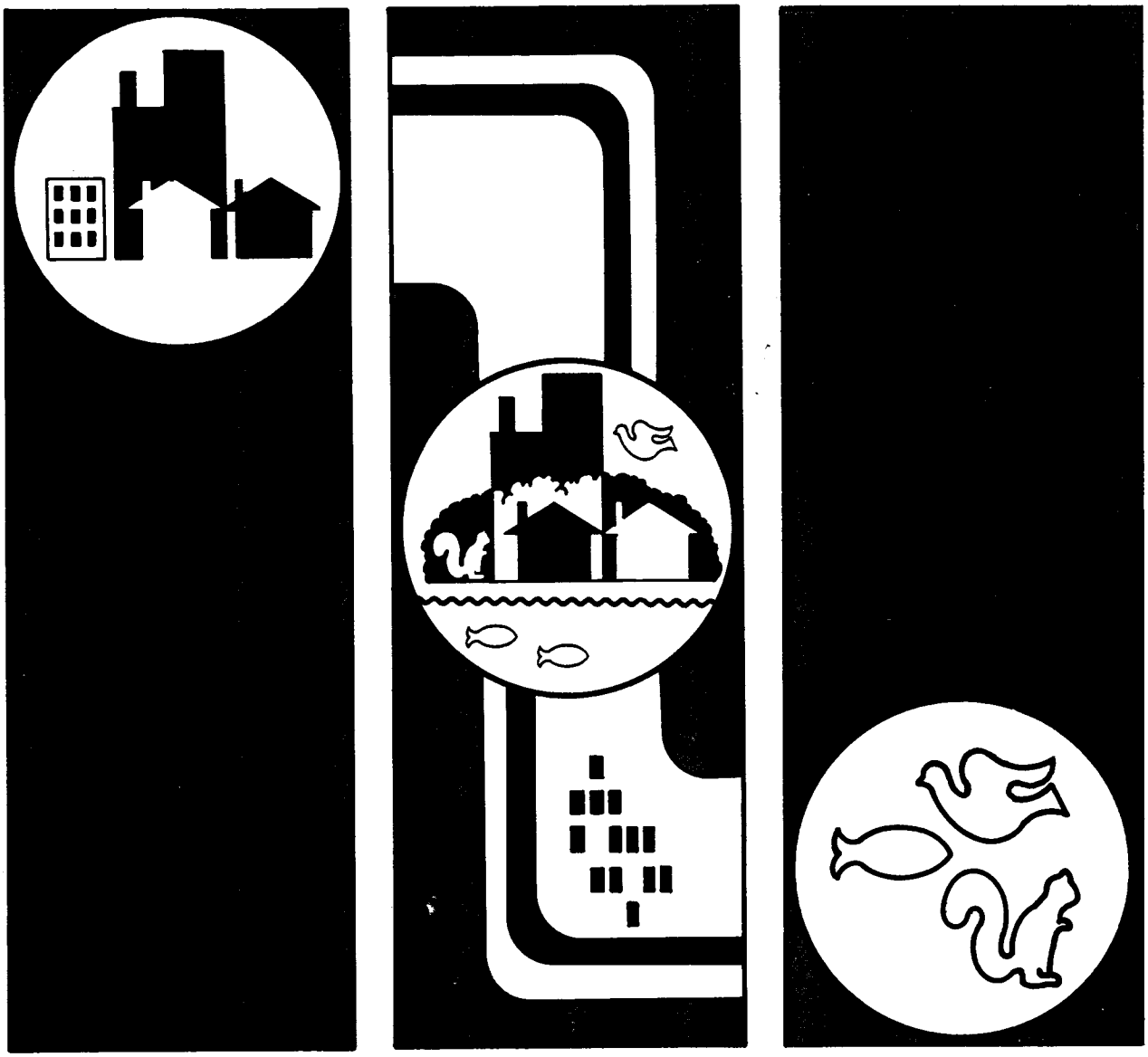
Biological Services Program

FWS/OBS-79/25
December 1979

An Annotated Bibliography on Planning and Management for Urban-Suburban Wildlife



Fish and Wildlife Service

U.S. Department of the Interior

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; mineral development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; environmental contaminants; National Wetland Inventory; habitat classification and evaluation; inventory and data management systems; and information management.

The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for development of information and technology by contracting with States, universities, consulting firms, and others; Regional Teams, which provide local expertise and are an important link between the National Teams and the problems at the operating level; and staff at certain Fish and Wildlife Service research facilities, who conduct in-house research studies.

FWS/OBS - 79/25

AN ANNOTATED BIBLIOGRAPHY ON PLANNING AND MANAGEMENT FOR URBAN-SUBURBAN WILDLIFE

by

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U.S. Fish and Wildlife Service
Purchase Order 98210-0235

Financial support provided by the
Wildlife Management Institute and
Missouri Department of Conservation

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Performed for

Office of Biological Services
Fish and Wildlife Service

U.S. DEPARTMENT OF THE INTERIOR

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INTRODUCTION AND BACKGROUND INFORMATION

BACKGROUND INFORMATION

This annotated bibliography was prepared with the financial support of the Office of Biological Services of the U.S. Fish and Wildlife Service, the Wildlife Management Institute, and the Missouri Department of Conservation. It may be considered as a follow-up volume to "Planning for Wildlife in Cities and Suburbs" by Daniel L. Leedy, Robert M. Maestro, and Thomas M. Franklin, all associated with the Urban Wildlife Research Center, Inc. The previous volume, a manual, was edited, printed and distributed by the American Society of Planning Officials as Report 133 of their Planning Advisory Service in 1978. It has been reprinted several times by the Office of Biological Services as publication FWS/OBS-77/66. This was to satisfy the demand for information on how urban planners and developers can incorporate into their plans and designs, features that can protect and enhance fish and wildlife in urban areas. The response to this manual has indicated that, not only urban planners and developers are interested in this subject, but State and Federal resource agency administrators, biologists, decision makers, and the public.

Until recently, urban wildlife was thought of primarily as pest or nuisance species such as rats, mice, house sparrows, pigeons, and starlings, and other birds and mammals that occasionally damage urban gardens or property. To a growing extent, however, recognition is being given to the positive values of wildlife in urban and suburban areas. Urban developers and real estate agencies are beginning to realize the added property values provided by trees, shrubbery, and a diversified, naturalistic environment. Recognition of the aesthetic and economic values of wetlands, unpolluted waters, open space, and the wildlife found in such areas is beginning to affect the planning process. More thought is being given to the rehabilitation of sand and gravel pits and quarries in urban areas for fish and wildlife purposes. Emphasis is beginning to include urban planning for the amelioration of the harmful effects of erosion, sedimentation, pollution, and waste disposal. The thoughtless elimination of habitat, whether by clearing off vegetation, draining wetlands, filling-in bays and wetland areas, or converting natural streams to concrete stormwater pipelines, is now being replaced by conscientious planning to maintain a diversified natural environment that is beneficial to wildlife.

PURPOSES OF THE BIBLIOGRAPHY

The major purposes of this bibliography are: (1) to identify some of the scattered publications dealing with these and other subjects and (2) to provide background information helpful to planners, biologists, and others in developing more effective policies and programs for the planning and management of wildlife

resources in urban and urbanizing areas. Expected readers and users of the bibliography include: regional and urban planners and developers; landscape architects; city and county officials, such as park superintendents and managers of open-space areas, parkways, and urban forests; university professors, students and research personnel; State agency personnel, such as conservation department directors and urban nongame biologists; Federal agency personnel concerned with fish and wildlife, outdoor recreation resources, and environmental quality in urban areas; members of private conservation organizations; and private citizens interested in furthering wildlife conservation as a community project, or, perhaps, in enhancing wildlife in their backyards for their personal enjoyment.

SOURCES OF MATERIAL

Although most of the references accumulated for the preparation of the above manual are used in this bibliography, many additional references are included, especially those concerned with fish and fishing in urban areas. The author makes no claim, however, that this is an exhaustive bibliography which documents the presence of all wildlife species known to occur in an urban environment; rather, it is a volume which focuses largely upon the urban environment, effects of urbanization, the responses of wildlife to urbanization, and implications for planning and management. Wildlife is viewed broadly to include--in addition to birds and mammals--fish, amphibians, and reptiles, and some of the invertebrates which share the urban ecosystem with man.

Locating pertinent articles in this area is not a simple matter. The references are scattered among professional and trade journals, government reports, and miscellaneous publications of various institutions and conservation organizations in which publication titles and indexes often show no relevance to urban areas. "Urban wildlife," "urban environment," and similar terms have not become well established as key words (or index terms) in computerized literature retrieval systems. They are rarely found in indexes to scientific journals or abstracting journals such as Wildlife Review, Wildlife Abstracts, and Sport Fishery Abstracts published by the U.S. Fish and Wildlife Service, all of which were examined in the preparation of this bibliography.

Among the resources consulted during the course of preparing the manual, "Planning for Wildlife in Cities and Suburbs," additional to the Fish and Wildlife Service abstracting periodicals, were the Fish and Wildlife Reference Service at the Denver Public Library, the Water Resources Information Center of the U.S. Department of the Interior, and the library of the U.S. Department of Agriculture at Beltsville, Maryland. A search was conducted by the Biosciences Information Service (Biological Abstracts), 2100 Arch Street, Philadelphia, Pennsylvania 19103 on the basis of 14 relevant "key words" or terms submitted to that organization. Index Volume I covering articles published in Limnology and

Oceanography for the 20-year period 1956-75 and published by the American Society of Limnology and Oceanography, Inc., January 1978 was reviewed. Other indexes reviewed to locate pertinent articles included those for Copeia and Herpetologica, these by the librarian at the Patuxent Wildlife Research Center of the U.S. Fish and Wildlife Service.

Although these searches led to the identification of some pertinent references, the examination, number by number, of the Transactions of the North American Wildlife and Natural Resources Conferences, and of scientific journals such as the Journal of Wildlife Management, Ecology, Wilson Bulletin, Auk, Journal of Wildlife Diseases, Transactions of the American Fisheries Society, Journal of Mammalogy, and the Wildlife Society Bulletin was more fruitful. Even more productive were reviews of the proceedings of several symposia oriented towards urban wildlife and of review-type papers which are identified in this bibliography, followed by examination of publications cited in these proceedings and papers. Some pertinent references were located, also, in a partial list prepared by the Urban Wildlife Working Group of the Pinchot Institute Consortium for Environmental Forestry Studies under the chairmanship of Dr. John L. George of Pennsylvania State University. The author was a member of that group. Finally, because of the known interests of the Urban Wildlife Research Center, miscellaneous publications relevant to the bibliography were mailed to the Center.

It should be emphasized that for the literature as a whole, given the present use of key words and indexing terms, one cannot depend upon existing computerized data systems, hurried scanning of journal indexes, or, for that matter, the titles of papers, to discover information relevant to urban wildlife planning and management. Very likely some pertinent publications have been missed in the compilation of this bibliography, especially those concerned with fish, amphibians, and various invertebrates for which the literature was not reviewed as thoroughly as for birds and mammals. It is hoped, however, that the bibliography will aid researchers, planners, and managers in their work by identifying publications of interest and by providing useful information to readers who may not have ready access to many of the references cited.

ORGANIZATION OF THE BIBLIOGRAPHY

Publications selected for this annotated bibliography have been listed alphabetically by author under each of seven major headings or subject matter categories according to the main thrust or relevance of the publication. These categories are further subdivided so the reader may be able to locate most of the papers on a given subject within the same section rather than turning from one part of the bibliography to another. References are numbered consecutively throughout the whole bibliography, however, and when a publication deals with several topics, cross references are given at the end of each section to the appropriate publication or reference

number.

In preparing the reference citations, the original publication was reviewed whenever possible. In some cases, the author's abstract or parts of the abstract, as quoted in the bibliography, were judged sufficient in the context of this document. Often, however, additional relevant material from the publication was excerpted or paraphrased for the benefit of the reader. Abstracts of a few publications not seen by the compiler were included, in which cases the source or abstracting journal is noted. For readers aware of the scientific interests of certain individuals or agencies in this field of activity an index of principal authors is provided.

AVAILABILITY OF PUBLICATIONS LISTED

It is expected that those readers who, after reviewing the material included in a particular section identified by the Table of Contents and, after following up on the cross references, wish to obtain more information, will attempt to secure copies of the original documents. Availability of all of the references cited could not be determined. Generally, Federal Government documents can be obtained from the issuing agency, the Government Printing Office, or the National Technical Information Service, Springfield, Virginia 22161. State and private conservation agency publications often can be obtained from the issuing agency, also, and reprints of articles in scientific journals, from the authors. Often, out-of-print documents can be located in libraries and some items such as graduate student theses and dissertations can be secured through interlibrary loans.

STATE-OF-THE-ART

Although not designed as a state-of-the-art publication, the brief commentary at the beginning of each major subject-matter category is indicative of the relative availability of literature and present knowledge of that subject.

ACKNOWLEDGEMENTS

Thanks and appreciation are extended to the U.S. Fish and Wildlife Service, Office of Biological Services for financial support of this document and to Debby Peck, Project Officer, for helpful suggestions; the Wildlife Management Institute and the Missouri Department of Conservation for financial support; Joyce Keifer of the Urban Wildlife Research Center (UWRC) for the painstaking and tedious task of typing drafts of this bibliography; and Louise Dove of UWRC for securing hard-to-get copies of publications for review. Linda Garrett of the Patuxent Wildlife Research Center, Laurel, Maryland, was most cooperative in providing

information and searching indexes for Copeia and Herpetologica. Abstracts quoted from Biological Abstracts as copyrighted material are indicated by an asterisk and those identified by two asterisks were included in a list of publications provided by BIOSIS and later reviewed by the author. Permission for use of other copyrighted material was obtained from the publisher or the author.

REFERENCES BY MAJOR SUBJECT CATEGORIES

I. URBAN ENVIRONMENT

Considerable information has been developed with respect to the urban environment, particularly related to vegetation, hydrology, waste disposal, pollution, erosion and sedimentation, use of pesticides, and transportation facilities. Some representative reports on these subjects are included in this bibliography. The implications of such aspects of the urban environment as alterations of temperature and precipitation patterns, and other physicochemical conditions for fish and wildlife, however, are not well known. For example, are the effects of increased temperatures and pollution in urban areas sufficient to warrant planting of plant species other than those native to the immediate city environs--perhaps those from a plant hardiness zone farther south--and what are the effects of noise, lights, and the disturbance of people on wildlife and their environment in urban areas?

A. General

Allee, D. C., D. Kelso, and P. L. Rosenblatt. (1)

1976. Impact of construction and urban development on the aquatic environment, pp. 38-45. In The Potomac Estuary: biological resources--trends and options. Interstate Commission on the Potomac River Basin, 4350 East West Highway, Bethesda, Md. 20014 and Maryland Power Plant Siting Program, Dept. of Natural Resources, Annapolis, Md. 20160. ICPRB Technical Publication 76-2. 140 pp.

The authors report on studies in Fairfax County, Virginia, a suburb of Washington, D.C., which is undergoing rapid development. They conclude, page 45: "Widespread construction and development have affected the aquatic environment in Fairfax County. Heavy silt loads from overland erosion have depleted the fauna during construction and, after development is complete, the streams, altered by increased flood flows and contaminated with nutrients in the urban runoff, allow for only partial recovery.

"Erosion can be controlled by a number of techniques, includig surface-stabilization treatments, runoff control measures, sediment-trapping devices, and limitations on the extent of ground exposure. Cost-effectiveness of alternative control practices for a given site can be assessed using sets of curves generated during studies for the Fairfax plan for flood control and drainage."

Allen, D. L. (2)

1974. Philosophical aspects of urban wildlife, pp. 9-12. In

Noyes and Progulske (eds.), A Symposium on Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author discusses problems of population and of the growth of technology as related to the current situation in cities. Also, he indicates that making green belts and parks good habitats for many species of wildlife is a challenge to wildlife managers and suggests that, with proper management, it is possible to have spectacular twice-a-year visitation of wild waterfowl in urban-suburban areas. He states that in addition to making the immediate environment of city people more pleasant, a greater challenge for wildlife managers is that of "using wildlife in the dooryard to remind urbanites that there still is a world of nature."

Banks, R. C. (3)

1976. Reflective plate glass--a hazard to migrating birds. BioScience 26(6):414.

Banks suggests that as many as 1.25 million birds a year may die as a result of flying into lighthouses, tall buildings, and television towers and possibly as many as 3.5 million may die from injuries received from flying into windows of homes and other buildings. He believes a new variant of the bird-strike phenomenon may result from the increasing use of reflective plate glass which, if placed on buildings in a wooded setting, gives the illusion of additional trees or woods where the buildings stand. Examples of bird mortality at the John S. Lehmann Building in St. Louis and at several buildings with reflective plate glass in Washington, D.C. are described. The presence of trees near the buildings, reflection of which can be seen by the birds, creates a potentially dangerous situation for birds. Banks states: "The aesthetic and economic values of reflective plate glass should be carefully weighed against the potential avian mortality at proposed construction sites."

Bauer, A. M. (4)

1965. Simultaneous excavation and rehabilitation of sand and gravel sites: a general survey and analysis of preoperational planning factors and procedures. Project No. 1, University of Illinois--National Sand and Gravel Association. The National Sand and Gravel Association, 900 Spring Street, Silver Spring, Md. 20910. 60 pp., illustrated.

This deals with problems, opportunities, and the role of the sand and gravel industry; describes the influencing features of sand and gravel deposits and their distribution or occurrence in the United States; discusses site location in relation to supply and demand, transportation, and plant size; discusses

operations and equipment; describes current rehabilitation practices and planning procedures; and presents two case studies for developing the use potential of a sand and gravel deposit.

Clement, R. C. (5)

1974. Symposium summary, pp. 179-182. In Noyes and Progulske (eds.), A Symposium on Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Remarks by Clement at the close of this symposium held 27-29 November, 1973, at the University of Massachusetts, Amherst. He indicates that the urbanization process is already over in the United States, i.e., all large American cities are experiencing population outflow because the city is becoming unlivable. Thus, he believes, the problem is a double one of analyzing the prospects of recreating the city as a place where a lot of people still prefer to live, and coping with the "spread city" syndrome which is homogenizing and destroying the megapolitan region's diversity and amenities. He states that "the ecological insights of wildlife ecologists are vital to survival and that an ecologist must be a citizen, not just a specialist, i.e., he must now tackle the enemies of civilization."

Dasmann, R. F. (6)

1968. An environment fit for people: the new meaning of conservation. The Public Affairs Committee, Inc. Public Affairs Pamphlet 421, published in cooperation with the Conservation Foundation. Washington, D.C. 28 pp.

Defines conservation as "the rational use of the environment to achieve the highest quality of living for mankind." Points out the need for conservationists to devote more attention to cities and use the environment rationally, taking the future into account. States that the disturbance of any natural environment should not exceed the minimum needed to accomplish its rational use for worthy human goals. Discusses conservation in the cities, including problems of air and water pollution, solid waste disposal, value of urban open space, and city planning. Discusses, also, conservation of rural lands, wildlife (including nongame species), the marine environment, and the need for the individual citizen to help maintain a high quality environment.

Davis, B. N. K. (7)

1976. Wildlife, urbanization and industry. Biological Conservation 10:249-291.

Author's abstract: "This paper reviews the impact of urban

growth, industrial expansion and mineral exploitation upon the countryside and their direct effects upon wildlife. It also considers the ways in which wildlife can adapt to and exploit man-made environments. Past and future trends in urbanisation and mineral extraction are given for the country as a whole and particular areas are singled out for special analysis. The immediate effects are described in terms of losses of species adapted to existing natural and semi-natural habitats. Except in the most highly disturbed or polluted areas, however, natural recolinisation by plants and animals takes place and a new equilibrium is established. Examples are given of the birds, mammals, invertebrates and plants which occur in urban and industrial areas, especially in parks, gardens and wasteland including disused pits and quarries. The efforts now being made to foster this wildlife for amenity, educational and scientific purposes are described and discussed."

Davis observes that despite increases in human population in England, planning controls introduced in 1946 have greatly limited ribbon development and urban sprawl in that country. Twenty-nine "new towns," excluding the region of Northern Ireland, had been designated under the New Towns Act of 1964, however, and most of the land taken for urban development was formerly in agriculture. It was estimated that parks, gardens, and other planned open space--where most urban wildlife is found--occupied from 15% to 20% of the total urban area of cities and large towns. Considerable biological information exists for London largely as the result of work by the London Natural History Society. The author points out that although fishing and wildfowl interests are developing expertise on habitat management, there is a lack of information on other groups, both in aquatic and terrestrial habitats, on which to base practical decisions. Some research needs are suggested.

Edmondson, W. T., and C. C. Anderson. (8)

1956. Artificial eutrophication of Lake Washington. Limnology and Oceanography 1(1):47-53.

Authors' abstract: "Lake Washington has been receiving increasing amounts of treated sewage and appears to be responding by changes in kind and quantity of biota. In 1933 and 1950 the dominant phytoplankton organisms were Anabaena and various diatoms and dinoflagellates, but in 1955, apparently for the first time, there was a large population of the blue-green alga, Oscillatoria rubescens, a species which makes nuisance blooms in a number of lakes. A great increase in the hypolimnetic oxygen deficit is taken as evidence of increased productivity; the deficit was 1.18 mg/cm^2/month in 1933, 2.00 in 1950, and 3.13 in 1955. There is a fairly close relation between the decrease in oxygen and increase in phosphate concentration in the hypolimnion between measurements, a much

less close relation with the chlorophyll concentration in the epilimnion."

The authors state, pages 52-53, "The most reasonable explanation of the increase in productivity is the great increase in treated sewage added to the lake with the growth of adjoining communities. Lake Washington seems to be fitting the pattern of abrupt change, as seen in other cases of polluted lakes which have been studied limnologically before pollution became serious."

Reviewer's note: It is my understanding that, with better pollution control in recent years, Lake Washington in the Seattle, Washington area, has regained some of its former oligotrophic condition.

Euler, D., F. Gilbert, and G. McKeating (Eds.). (9)

1975. Proceedings of the symposium--wildlife in urban Canada. Office of Continuing Education, University of Guelph, Guelph, Ontario and the Ontario Ministry of Natural Resources. 134 pp.

Proceedings of a symposium held at the University of Guelph, 26-30 May 1975, sponsored by the University of Guelph and the Ontario Ministry of Natural Resources with several cosponsors. As stated in the Foreword by Euler, this symposium dealt with problems created by the needs of wildlife and of people in urban areas, i.e., people need wildlife for recreation; for full development of their senses and to fulfill a basic primeval requirement for contact with the natural world; and wildlife need enlightened people to prevent habitat destruction, provide the opportunity for wildlife populations to exist, and to promote the benefits of natural ecosystems everywhere on earth. The theme paper, entitled "Wildlife and Human Settlements" by Constantinos A. Doxiadis, President, Athens Technological Organization, Athens Center of Ekistics, Athens, Greece, was reacted to by Alan Loughrey, James Hatter, Joseph Lucas, and John B. Sprague. Dr. Doxiadis gave a global perspective on problems of merging human settlements with nature. He pointed out that a large metropolis cannot be encircled by a green belt but should be merged with the natural elements into one unified system. Nature and wildlife must remain inside the cities as well as outside them.

Technical papers were presented as follows: Wildlife and People in an Urban Environment--Biology of Co-habitation by Valerius Geist; Wildlife Habitat in the City by Jack W. Thomas; Disease Problems of Urban Wildlife by Lars H. S. Karstad; Urban Planning and Urban Wildlife--a Case Study Near Washington, D.C. by Aelred Geis; and Urban Pets and Urban Wildlife--Crisis or Compatibility? by Bruce M. Feldman.

Workshops dealth with: wildlife, urbanization and the educator; special needs for special people--cultural, ethnic, and aged groups; Canadian cities in search of nature; birds and bees in the bedroom community; and industry and wildlife--symbiosis or antagonism? Three ancillary papers dealt with topics of these workshops.

The plenary session included reports of a reactor panel composed of Alan Loughrey, James Hatter, Joseph Lucas, and John Sprague and a summary by Max Dunbar.

Fisher, J. L. (10)

1969. Reflections on the conference theme: conservation in an urbanizing society--an appraisal of the program of the 34th North American Wildlife and Natural Resources Conference. Transactions of the 34th N. American Wildlife and Natural Resources Conference, pp. 485-492.

In an America that is becoming more urban, Fisher believes that needed developments in concept and action for conservation to reach its full stature include: (1) a clearer, more comprehensive statement of conservation goals attuned to the highly urban situation in which the country finds itself; (2) a broader, more inclusive, and more sophisticated concept of multiple use management of natural resources and natural resource areas that includes urban factors; (3) making urban waste disposal a part of the total concept of the process of production and use of resources and the environment, and not something extraneous and even irrelevant to these processes; (4) a better understanding, dependent upon psychological and sociological research, of why people do what they do with resources and to the environment, what they want from the environment, and how much effort and money they are willing to devote to maintaining its quality; (5) creation of some new institutions through which to do the job if conservation is to become more relevant to an urbanizing society, including acquisition of many more land and water areas for outdoor recreation and preservation of natural beauty; and (6) re-examination of the whole structure of concepts, attitudes, instrumentalities, and programs which go under the heading of conservation. In connection with the re-examining and re-structuring of conservation, he advocates having it based on people, their habits, desires, and modes of behavior, as much as on natural areas, wildlife, soil, and water, making full use of the insights of the behavioral and social sciences as well as the natural sciences; and having it foster new educational approaches at all levels and in all subject matter fields and disciplines so that coming generations, nearly all of whom will live mainly in cities and suburbs, will understand better what will be required of them if the good earth is to remain good.

1978. Toronto's Outer Harbour Eastern Headland: The Changing Role of a Transportation Facility. University of Toronto-York University Joint Program in Transportation Research Report 55. University of Toronto, Room 219, 150 St. George Street, Toronto, Ontario, Canada M5S 1A1. 86 pp.

This is an interesting account of the origins, development, and use of a man-made promontory, the Outer Harbour Eastern Headland on the edge of the Port of Toronto which shelters and partially encloses the Outer Harbour. The author provides an analysis of the origins, development and use of this transportation facility and a review of the past and present intentions of planners for the site. She compares these planning goals with past and present uses, as well as future needs, both of the port itself and of users of the site. She notes the complex inter-relationships between constantly changing goals and evolving uses from the time the Outer Harbour was conceived in the 1950s to the present. The report is based upon documentary materials pertaining to the origins, development, and use of the Headland and upon a questionnaire administered to a random sampling of users of the Headland during the summer of 1978.

Plans for development were never fully implemented and apparently the area is still considered to be "under construction"; however, after many years during which the Headland was closed to the public, increasing use of the area for various recreational purposes has occurred. The Headland, a breakwater created by landfill, shelters a new harbor and serves as a current-deflecting mass that protects the Eastern Gap of the harbor from siltation. Although not by design, the Headland has become a unique wildlife area in an urban setting. Among about 200 species of birds identified on the area are many ring-billed gulls, Canada geese, common and Caspian terns, and other species which nest there. Also, it is reported that approximately 200 species of plants have been identified on the area, including some rare ones and others not existing elsewhere in the Toronto region. The continued well-being of these resources depends in part upon whether the area is subjected to high-intensity usage and development or preserved. Some of the conflicts between boaters and other users are outlined and it is stated that the Headland would serve as a transportation facility in either case.

Based upon the questionnaire administered to users, considerable information is provided on outdoor recreation activities and preferences. In responding to a question about what they would like to see happen to the area in the future, 30% preferred that the area be left as is (no change) and 18% suggested it be used as a wildlife refuge. Other preferences

were recorded in lower percentages.

Gill, D., and P. Bonnett. (12)

1967. Nature in the Urban Landscape: A Study of City Ecosystems. York Press, Inc. Baltimore. 209 pp.

This book contains chapters entitled: The City Ecosystems; Characteristics of Urban Flora and Fauna; London: A City with Integrated Suburban Wildlife Habitat; Los Angeles: A City with Islands of Wild Landscape; Planning for Wildlife in the City; Management of Urban Wildlife Habitat; and Conclusions. There is a bibliography of over 27 pages and a glossary.

This is a well-written and informative book which combines findings from the United States, Canada, and Europe, particularly, England. Considerable attention is given to the management of green space, biological corridors, and the need for habitat diversity. In the treatment of Los Angeles, an interesting section is devoted to coyotes. Some suggestions are given on types of applied ecological research needed.

Holling, C. S., and G. Orians. (13)

1971. Toward an urban ecology. Bulletin of the Ecological Society of America 52(2)2-6.

The authors discuss similarities and differences between urban and ecological systems. Both systems have historical quality and spatial, systems, and structural properties. They point out, however, that as long as there is an "elsewhere" which can provide water, air, food, and others, the city is not a closed system but it does involve bringing in materials from a region. "It appears that we are quickly reaching the point where environmental limitations will inevitably impose constraints on urban systems.... As the density gets to the point where the psychological, physical and economic resources are insufficient, then indeed social behavior must change. A realistic analysis, therefore, of the effort of density on people must be as much economic and engineering as ecological." Ecologists can contribute to a synthesized view of all the components of an urban system.

Huff, F. A. (14)

1977. Effects of the urban environment on heavy rainfall distribution. Water Resources Bulletin 13(4):807-816.

Author's abstract: "A network of 225 recording raingages was operated over an area of 5,200 km^2 in the St. Louis region during 1971-1975, in conjunction with an extensive investigation of urban effects on precipitation. Study of urban-induced effects on the frequency of heavy rainstorms has revealed a

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pronounced increase in the occurrence of storms producing 25 mm (1 inch) or more of rain. The increase is greatest in an area that is frequently in the path of storms passing across two urban industrial regions. Analyses of raincells (rain intensity centers) within heavy convective storms shows a pronounced increase in the water yield from cells exposed to potential urban effects, compared with those exposed only to the surrounding rural environment. Naturally-occurring heavy cells tend to undergo the greatest enhancement from urban exposure. Other analyses indicate an above-average frequency of excessive rain rates for periods of five minutes to two hours downwind of the urban-industrial complex. It is concluded that urban-induced intensification of short-duration rainstorms is sufficient to merit inclusion in the design and operation of urban-area hydrologic systems that control the flow of surplus storm water."

Apparently the urban effect on heavy rainfall distribution is maximized during the summer in the St. Louis area. It involves intensification of storm units moving across the urban area and initiation of new raincells within the existing storm system as it crosses the city. Convective cells merge downwind of the city and mergers are recognized as a cause of storm intensification. The author states that a comparison of 138 urban and 174 rural cells having relatively heavy water yields showed a median output that was 55% greater in the urban cells. He points out that the designs for urban storm-sanitary sewer systems often are based upon long-term weather records frequently compiled at airports outside of the major metropolitan area and which do not reflect enhancement imposed by the urban environment. In this study, the frequency of heavy storms was greatest near Edwardsville which is frequently downwind of major urban-industrial complexes at St. Louis (25-30 km away) and Alton-Wood River (8-16 km away).

Hurcomb, Lord. (15)

1969. Protection of wildlife in London and its outskirts by public authorities. Biological Conservation 1(2):166-169, illus.

Author's summary: "The vast metropolis of London, with the River Thames running through its centre, and embracing numerous parks and other open spaces, attracts many birds and supports a wide variety of wildlife. The area considered in this paper is defined by a circle with a radius of 20 miles (32 km) from St. Paul's cathedral. Fine herds of Red and Fallow Deer are included, as are undisturbed enclosures for birds to shelter and nest, and for wild plants to flourish. The Committee on Bird Sanctuaries in the Royal Parks functions in close cooperation with the Ministry of Public Building and Works in administering these with the assistance of a number of Qualified Observers. Another Committee on Forestry, and the Greater London

Council and Metropolitan Water Board, also collaborate in maintaining biological diversity in the urban scene--with a special eye on arboreal grandeur. In 1965-66, 138 species of birds were identified in the areas of Greater London coming under the Ministry's care. Of these, 70 species bred--36 of them in the Inner Parks. From this example it seems clear that governmental and local authorities, accepting the encouragement of wildlife as an integral part of public policy, can enable it to hold its own and even extend in variety despite increasing human population."

Jackson, H. (16)

1975. Testimony presented by Senator Henry Jackson in connection with Senate Bill 984. Congressional Record 121(36) 6 March 1975.

In his testimony for S.984, the Land Resource Planning Assistance Act, Senator Jackson of Washington stated: "Over the next thirty years, an additional 19.7 million acres of undeveloped land will be consumed by urban sprawl--an area equivalent to the States of New Hampshire, Vermont, Massachusetts and Rhode Island.

"Each decade's new growth will absorb an area greater than the entire State of New Jersey.

"Each year the equivalent of 2½ times the Oakland-San Francisco metropolitan region must be built to meet the Nation's housing goals.

"By the year 2000, over 3.5 million acres may be paved over for highways and airports.

"By the end of the century, 5 million acres of valuable agricultural land may be lost to public facilities, second home development, and waste control projects, and another 7 million may be taken for recreation areas.

"Finally, in the next two decades, one industry alone--the energy industry--will require vast areas of land; new high voltage transmission lines will consume 3 million acres of new rights-of-way, while nearly four hundred new major generating stations will require hundreds of thousands of acres of prime industrial sites.

"...unlike air, water, and many minerals, land cannot be recycled. Mountains carved by strip mines, wetlands dredged and filled, or streams 'channelized' can seldom be returned to their former use or beauty."

Keys, D. L. (17)

1976. Land Development and the Natural Environment: Estimating Impacts. The Urban Institute, 2100 M Street, N.W., Washington, D.C. 20037. xiv + 128 pp. (Available from URI, $4.95.)

One of a series of reports by the Urban Institute's Land Use Center dealing with evaluation of land developments and their economic, environmental, and social impacts. This report treats impacts relating to the natural environment such as air quality, water quantity and quality, wildlife and vegetation, and noise. Various models relating to air quality and to water quantity and quality are described, methodological approaches are outlined, and considerable available information on standards and indices is provided. Information on effects of development on vegetation and wildlife is concise and somewhat limited in scope but should be helpful to planners and developers.

Kim, J. T., T. J. Grizzard, C. W. Randall, and R. C. Hoehn. (18)

1978. Urban runoff and the stream life of the Occoquan, pp. 155-160. In "The Freshwater Potomac: aquatic communities and environmental stresses." Interstate Commission on the Potomac River Basin, 1055 First Street, Rockville, Md. 20850. ICPRB Technical Publication 78-2. 194 pp. (Available from USDI Fish and Wildlife Service, Eastern Energy and Land Use Team, Kearneysville, West Virginia 25430.)

The authors report on an intensive data collection effort of runoff pollution from three sites located within the City of Manassas, Virginia representing typical suburban land use patterns. The impervious cover constituted by rooftops, sidewalks, roadways, parking lots, and the like varied from essentially 100% at the Manassas covered shopping mall to 60% at Irongate and 13% in the Stonewall Road sub-basin. The total runoff volumes varied according to differences in impervious area and sub-basin size. The yields of nitrogen and phosphorus in runoff from the sites monitored in this study exceeded by factors of over 25 and 100 for nitrogen and phosphorus respectively those lower levels considered necessary to limit nuisance algal growths in natural systems. They found that large fractions of observed heavy metals and algal nutrients were associated with particulate matter and pointed out that they may not be immediately available to the aquatic life as they enter lake or stream sediments but may, however, be released in time to the overlying water and become sources of water quality problems. They stated, also, that some heavy metals, noticeably zinc and copper, which may be tolerated by humans, are highly toxic to certain species of fish.

Kirkpatrick, C. M. (19)

1971. Urban ecology today. The Wildlife Society News 133:13-14.

Kirkpatrick as The Wildlife Society's representative to the American Association for the Advancement of Science (AAAS) reported on an AAAS symposium sponsored jointly by The Wildlife Society and The Ecological Society of America held at Chicago, Illinois, 30 December 1970. He quoted Forest Stearns, University of Wisconsin, as saying "American cities are physically complex systems in which the animal biomass is predominantly of one species and the plant biomass exists by chance or for esthetic considerations.... As they become increasingly devoid of species and habitat diversity, cities tend toward an encompassing monotony which, in other systems, ecologists recognize as leading to imbalance and disruption.... The implications of ecological concepts such as diversity, succession, energy and nutrient flow, population dynamics, and territoriality are pertinent to the management of older cities and the development of new ones."

One speaker, Alan M. Beck, The Johns Hopkins University, estimated a population of stray and feral dogs in Baltimore, Maryland, to be 600-800 dogs/square mile and indicated the top predators were "dog catchers."

The potential roles of ecologists in providing general design guidance to landscape architects and urban planners; in public and land use decision-making; and in predicting the consequences of urban development were discussed.

Among the research needs discussed were the need to: (1) develop alternatives to the widely-used cost-benefit analysis technique, and (2) develop a method for assessing for land developers the cost of environmental degradation caused by their actions.

Another need found was to establish the credibility of the wildlife profession with regional and urban planners.

Kirkpatrick, C. M. (Ed.). (20)

1978. Wildlife and People. Proceedings of the 1978 John S. Wright Forestry Conference sponsored by Department of Forestry and Natural Resources and the Indiana Coop. Ext. Service, Purdue University, 23 and 24 February 1978. 191 pp. Copyright, 1978, by Purdue Research Foundation, West Lafayette, Indiana 47907. Permission to republish granted for U.S. serial rights only at no fee. Copyright notice as it appears in the original publication required.

An informative and well-edited volume with a keynote address

by D. L. Allen, 15 papers under three major headings: Wildlife in Man's World, Wildlife and Man on Neutral Ground, Man's Invasion of Wildlife's World; and a conference summary, "The Interaction of Wildlife and People" by D. M. Knudson of Purdue University. The papers deal with such topics as birds, amphibians, reptiles, and mammals, e.g., deer in urban areas; highway-wildlife relationships; raptor research and management; blackbirds, starlings, and human disease and nuisance problems; off-road vehicles and wildlife; animal damage and control; and effects of man on marine birds. The Conference summarizer asks if we have the will, the good sense, and the skill to develop an attitude of sensitively sharing the world with other species, while keeping it reasonably comfortable, healthy, and productive for our own use and states that wildlife management success appears to be much more a function of politics and economics than it is of knowledge; yet, he states, knowledge is a prerequisite to successful policies.

Leopold, L. B. (21)

1968. Hydrology for Urban Land Planning--A guidebook on the Hydrologic Effects of Urban Land Use. USDI Geological Survey Circular 554. 18 pp. (Free on application to the U.S. Geological Survey, National Center, Reston, Va. 22092.)

An excellent publication which has been reprinted at least three times. The author attempted to summarize the then existing knowledge of the effects of urbanization on hydrologic factors and express this knowledge in terms the planner can use to test alternatives during the planning process. Findings from previous relevant studies were analyzed, interpreted, and presented and the data applied to a portion of the Brandywine Creek basin in Pennsylvania. The author states that because the available data are not yet adequate, this report can be considered as a compilation of tentative suggestions in the form of an explanatory, not a definitive, handbook. He states that of all land-use changes affecting the hydrology of an area, urbanization is by far the most forceful.

The author points out that the four interrelated but separable effects of land-use changes on the hydrology of an area are: changes in peak flow characteristics, changes in total runoff, changes in quality of water, and changes in the hydrologic amenities or the impression which the river, its channel, and its valleys, leaves with the observer. These effects are described and various examples are given.

Considerable information is provided in the form of tables and graphs which should be useful to the planner. Among the topics treated are: planning procedures and hydrologic variables, availability of data and the technique of analysis, effect of urbanization on increasing frequency of overbank flow, local storage to compensate for peak flow increase,

sediment production, effect of increased peak flows on sediment yield, and water quality. There is some discussion on water quality-biotic relationships. Twenty-eight selected references are listed.

Lewis, P. H. (22)

1968. Nature in our cities, pp. 23-27. In Man and Nature in the City, U.S. Department of the Interior. xii + 92 pp.

Lewis points out that we have a twin city problem of requiring rehabilitation within existing core-city areas and of landscape analysis and restraint in guiding new fringe (suburban) development so that outstanding natural and cultural features are preserved for the developing outer city. He observes that opportunities for contributions of environmental sciences are greater for the outer city ring with respect to above-surface, surface, and subsurface features such as ground water and building materials.

Linville, J., Jr., and R. Davis. (23)

1976. The Political Environment--An Ecosystems Approach to Urban Management. American Institute of Planners, 1776 Massachusetts Ave., N.W., Washington, D.C. 151 pp. $7.00, paperback.

A review of case studies of attempts in managing environmental problems in three distinctly different areas: Columbia, Maryland; Nashville-Davidson County, Tennessee; and San Diego County, California. Results of a workshop of more than 125 environmental scientists, engineers, social scientists, planners, private developers, elected and appointed urban officials, and architects from institutions across the nation. Held 12-17 January 1975 in San Diego.

Page 33: "An ecosystem is an organized unit of the natural world, containing plants and animals and nonliving components in sufficient diversity and interrelationship to be self-sustaining. It is an open system, with flexible boundaries defined by the needs and extent of a particular problem. Three elements are common to ecosystems: (1) flow of energy and cycling of materials; (2) self-regulatory mechanisms for population control with positive and negative feedbacks; (3) linked subsystems with spatial, structural and historical patterns. There is little waste--matter gained or lost--within such a cyclic system; it is a natural model of resource conservation."

"An ideal urban ecosystems approach to environmental planning and management, according to Stearns, is one which successfully considers not only man's sociocultural propensities but also his physiological and behavioral traits. In order for man to

influence and change his urban ecosystem to meet his needs, he must be able to 'intervene wisely and effectively' in the physical aspects, the material and energy flow systems of the urban environment" (after Stearns and Montag 1975, p. 173). Such an endeavor, however, is likely to be restricted by factors such as technology, availability of resources, and nature's limited capacity to absorb human effluence."

"The urban system has much in common with the natural ecosystem. Each is made up of many interacting components linked by flows of energy, matter and information. The urban ecosystems approach considers the set of inter-related systems within a city or region--transportation, housing, pollution, etc.--and establishes their interdependence. This approach requires a comprehensive organization of urban planning and management." (Page 34.)

Production of waste by urban society is greater than the natural environment in a given area is capable of absorbing and reusing.

Lull, H. W. (24)

1971. Effects of trees and forests on water relations, pp. 65-69. In Trees and Forests in an urbanizing environment. Proceedings of a symposium conducted by Cooperative Extension Service in cooperation with University of Massachusetts Department of Forestry and Wildlife Management and the Department of Landscape Architecture; the USDA Forest Service, Northeast Forest Experiment Station and Northeastern Area, State and Private Forestry; and the Massachusetts Department of Natural Resources.

Converting forest land to urban uses will increase water yield and storm runoff along with sedimentation from construction areas. Forested areas within the megalopolis may be useful for disposing of and renovating waste water, recharging groundwater, and stabilizing the soil.

Lull, H. W., and W. E. Sopper. (25)

1969. Hydrologic effects from urbanization of forested watersheds in the Northeast (USA). U.S. Forest Service Res. Pap. N.E. 146:1-29.*

"Urbanization of forest areas tends to reduce interception, reduce infiltration and increase overland flow, reduce soil-moisture storage, reduce evapotranspiration, increase runoff, increase peak flows, and reduce water quality. Annual maximum peak flows, annual hydrologic responses, and annual runoff were found (from actual streamflow records) to increase with progressive urbanization. The percentage of summer rainfall that appeared as runoff and the hydrologic responses were

greater for partially urbanized watersheds than for mostly forested ones."

New York State Department of Environmental Conservation. (26)

1975. Urban wildlife environments: policy statement. New York State Department of Environmental Conservation, Bureau of Wildlife. Final draft of policy statement, 25 pp., with appendices, 28 March 1975.

This final draft statement sets forth a 19-point policy; followed by a section on implementation; a conclusion that a successful wildlife program depends greatly upon the continued understanding, participation, and support of all the States' citizens; a 2-page bibliography and six appendices dealing with departmental objectives, a glossary of terms, descriptions of urban and suburban land areas for New York, distribution of $175 million provided by the 1972 Environmental Quality Bond Act, possible sources of funding for programs related to urban wildlife, and the Hudson River Wildlife Program respectively. Point 1 of the policy: "All land and water is considered wildlife habitat if it provides food, water, or protective cover to wildlife species"; point 10: "The variety and abundance of wildlife in urban and suburban environments should be preserved and enhanced."

Nichols, D. R. (27)

1975. Earth sciences and the urban environment, pp. 23-29. In United States Geological Survey Annual Report, Fiscal Year 1975. U.S.D.I. Geological Survey annual report, 194 pp. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock 024-001-02818-2.

Nichols points out that natural resources--construction materials, minerals, fuel, water, and others--are the basis for urbanization; describes some of the natural hazards to urban areas including earthquakes, land slides, volcanic eruptions, flooding and subsidence; outlines some of the constraints and opportunities in land use management afforded by earth sciences; and describes some of the information and services that can be provided by earth scientists in the Geological Survey and elsewhere. He states that earth-science information is useless, however, without effective communication and application and urges earth, natural, and social scientists to work diligently to communicate with one another, with decisionmakers, and with the public.

Noyes, J. H., and D. R. Progulske (Eds.). (28)

1974. A Symposium on Wildlife in an Urbanizing Environment. Sponsored by Cooperative Extension Service in cooperation with U.S. Department of Agriculture, Forest Service; Department of

Forestry and Wildlife Management; University of Massachusetts; Massachusetts Division of Fisheries and Game; Massachusetts Cooperative Wildlife Research Unit; Massachusetts Audubon Society; and The Wildlife Society. Planning and Resource Development Series 28, Holdsworth Natural Resources Center. 128 pp.

Included in this wildlife symposium are: a foreword, 33 individual papers, and a symposium summary. This is one of the more comprehensive single sources of information on urban wildlife.

Odum, E. P. (in collaboration with H. T. Odum) (29)

1959. Fundamentals of Ecology. Second edition. W. B. Saunders Company, Philadelphia and London, 546 pp.

A well-known work which describes basic ecological principles and concepts including organization at species and interspecies population levels and at the community level; provides an introduction to freshwater ecology, marine ecology and terrestrial ecology using the habitat approach; and provides information on and examples of applied ecology including applications to human society.

Odum, E. P. (30)

1969. The strategy of ecosystem development. Science 164(3877):262-270.

Discusses metabolism and production: respiration ratios as indices to the health of ecosystems. In early successional stages, the PR ratio is such that production tends to exceed respiration, i.e., the PR is greater than 1; in mature or "climax" conditions, the PR ratios approximate 1, and in senescent, degraded, or polluted environments, respiration tends to exceed production.

Odum, E. P., and H. T. Odum. (31)

1972. Natural areas as necessary components of man's total environment. Transactions of the 37th North American Wildlife and Natural Resources Conference, pp. 178-189.

"Natural environment" is that part of man's life support system that is essentially self-supporting because a minimum of human management is required for maintenance, i.e., the system runs on sun energy, including the energy of rain, wind, or water flow that are derived from sun power. "Developed environment" includes ecosystems that are structured and maintained by large auxiliary power flows from fossil or other concentrated fuels that supplement or replace the natural energy flow of the sun. "Specifically, cities need the protection of an adequate life

support system, many elements of which natural environment provides free of charge. Without natural recycling and other works of nature, the cost of maintaining quality life in cities would be prohibitive...." The authors calculate that the per capita cost of treating human wastes, which are only one small part of the pollution disorder generated by cities, would be more than doubled if there were no natural environment available and able to carry out the work of tertiary treatment of these wastes. They state, page 180 "...the true value of man's total environment is determined by the diversity interaction between the 'developed' and the 'natural' environment and not only by the worth of each as a separate component." They warn against overdevelopment and suggest there has to be some optimal proportion between the natural and developed environments.

Rumker, R. V., R. M. Matter, D. P. Clement, and F. K. Erickson. (32)

1972. The Use of Pesticides in Suburban Homes and Gardens and Their Impact on the Aquatic Environment. Pesticide Study Series-2, Office of Water Programs, Applied Technology Division, U.S. Environmental Protection Agency, Cincinnati, Ohio. xii + 61 pp. and five appendices.

This study, conducted for EPA by Ryckman, Edgerly, Tomlinson, and Associates, Inc., is concerned with the use of pesticides in suburban homes and gardens in three different metropolitan areas--Philadelphia, Dallas, and Lansing. The data, conclusions, and recommendations detailed in the summary report and appendices were developed through extensive personal field studies, telephone interviews, questionnaires, and literature surveys.

Four hundred and four million pounds of herbicides, 490 million pounds of insecticides, and 140 million pounds of fungicides were produced in the United States in 1970 excluding the amount exported. Of 525 respondents to a survey conducted uniformly in each of the three previously mentioned cities, 92.5% reported using pesticides with homeowners dispersing approximately 80% of the pesticides used. Although considerable information is presented on home and garden pesticide use, transport mechanisms, degradation of pesticides, and applicable laws and regulations, the 76-page appendix on aquatic impacts of pesticides apparently provides little new data on effects of pesticides on aquatic organisms; some of the available literature is reviewed and summarized, however, and research needs are pointed out.

Sartor, J. D., and G. B. Boyd. (33)

1972. Water Pollution Aspects of Street Surface Contaminant. A project (11034-FVJ) report prepared by the URS Research

Company, under Contract 14-12-921 for the Office of Research and Monitoring, U.S. Environmental Protection Agency, Washington, D.C. 20460. EPA-R2-72-081, pp. xii + 236. (Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. $3.00.)

Authors' abstract: "Materials which commonly reside on street surfaces have been found to contribute substantially to urban pollution when washed into receiving waters by storm runoff. In fact, runoff from street surfaces is similar in many respects to sanitary sewage. Calculations based on a hypothetical but typical U.S. city indicated that runoff from the first hour of a moderate-to-heavy storm would contribute considerably more pollutional load than would the same city's sanitary sewage during the same period of time.

"This study provides a basis for evaluating the significance of this source of water pollution relative to other pollution sources and provides information for communities having a broad range of sizes, geographical locales, and public works practices. Information was developed for major land-use areas within the cities (such as residential, commercial and industrial). Runoff was analyzed for the following pollutants: BOD, COD, total and volatile solids, Kjeldahl Nitrogen, Nitrates, Phosphates, and a range of pesticides and heavy metals."

This report pointed out that the major constituent of street surface contaminant material averaged on the order of 1,400 lb/curb mile of street for the cities tested. It indicated that a great portion of the overall pollutional potential is associated with the fine solids fraction of the street surface contaminants and that catch basins, as they are normally used, are reasonably effective in removing coarse inorganic solids from storm runoff, such as sand and gravel, but are ineffective in removing fine solids and most organic matter. Parked and abandoned vehicles were found to be one of the serious problems in street cleaning. The authors state, page 99, "Although many small animals and a few larger ones are killed on streets and highways in the course of a year (thereby creating a concentrated source of pollution) they are generally not dealt with as a part of the street cleaning program. Rather, some organization, either within the city government or under contract to the city, is responsible for removing such bodies and ultimately disposing of them...."

They reported, page 98, the use of sodium-chloride and abrasives in the United States for the winter of 1966-67 to be 6,320,000 tons of sodium chloride, 247,000 tons of calcium chloride, and 8,400,000 tons of abrasives.

With respect to heavy metals contained in the street pollutants, the authors indicated they were of special concern because of their high potential toxicity to various biological

forms and showed that from the standpoint of concentration alone, zinc and lead had the heaviest loadings, chromium and nickel the lightest. They pointed out, however, page 68, that these metals may not be the worst pollutants. Commercial land use was considered to be responsible for the heaviest loadings of zinc, copper, lead, and mercury, while most of the nickel stemmed from industry and the greatest amount of chromium was from industrial sources. In consideration of their effect on aquatic organisms, they reported recommended limits for copper for salt water organisms to be 0.05 ppm and for freshwater organisms, 0.02 ppm; for lead only slightly higher than 0.05 ppm, the USPH drinking water standard; indicated that nickel was moderately toxic to aquatic organisms and can be very toxic to plants, depending on the chemical form; that mercury can be expected to be detrimental to aquatic ecosystems at concentrations as low as 0.005 ppm; and that limits of 100 ppm of chromium for fisheries and 5 ppm for irrigation water have been recommended.

They attributed (page 28) to automobiles the following contributions to street surface contaminants but were unable to quantify them: leakage of fuel, lubricants, hydraulic fluids, and coolants; fine particles worn off of tires and clutch and brake linings; particulate exhaust emissions; dirt, rust, and decomposing coatings which drop off of fender linings and undercarriages; and vehicle components broken by vibration or impact (glass, plastic, metals).

Although this study focused on the contaminant materials on urban and suburban streets, the authors indicated these are common elements of freeways in most cities. And, parenthetically, one might add, many of them are common on rural highways as well.

Shaheen, D. G. (34)

1975. Contributions of Urban Roadway Usage to Water Pollution. Office of Research and Development, U.S. Environmental Protection Agency, Environmental Protection Technology Series, EPA-600/2-75-004, pp. ix-118 and 10 appendices comprising 228 pp.

From author's abstract: "...motor vehicular traffic is directly or indirectly responsible for deposition of substantial quantities of materials on roadways in urban areas. Significant levels of toxic heavy metals and asbestos and slowly biodegradable petroleum products and rubber are deposited directly from motor vehicles along with large quantities of particulate materials contributed indirectly by traffic. The particulates contributed indirectly by traffic are largely inorganic, but have associated with them solids and nutrients which represent a serious source of water pollutants in all metropolitan areas."

The author states that less than 5% by weight of the traffic-related deposits originate directly from motor vehicles; however, these pollutants are among the most important by virtue of their potential toxicity. He points out that much of the grease and all of the petroleum and n-paraffins result from spills or leaks of motor vehicle lubricants, antifreeze, and hydraulic fluids; traffic-related lead is deposited principally through the use of leaded fuels but that some results from the wear of tires in which lead oxide is used as filler material; zinc is also used as filler in tires and at high concentrations in motor oil as a stabilizing additive; copper, nickel, and chromium are wear materials from metal plating, bearings, bushings, and other moving parts within the engine, and considerable copper is deposited as a result of wear of brake linings which have copper added to increase mechanical strength and promote more rapid dissipation of heat; and that asbestos found along roads arises from wear of clutch and brake linings and traffic-related rubber from tire wear.

Considerable quantities of dust and dirt, i.e., particles smaller than 3.35 mm were found to become airborne and settle on areas adjacent to the roadways while litter (particles larger than 3.35 mm) was found to be more concentrated and less affected by curbs or road barriers which at a height of 15 to 20 inches tended to increase dirt and dust loadings on the roads.

The author states, pages 9 and 10, "Runoff from urban roadways induces shock effect upon receiving waters as the accumulated nutrients, toxic and oxygen demanding substances are abruptly introduced during storm events. Such events will occur several times over the course of a year and permanent changes in the downstream biota may result even though the chemical composition of the receiving water reverts to normal shortly after cessation of runoff. Chemical examinations of stream bottom samples taken from upstream and downstream of roadway runoff outfalls demonstrated that a permanent, dry weather sphere of influence exists near the roadway/receiving water interface.... Zinc compounds deposited on roadways were found to be more soluble than those of lead as evidenced by the higher dissolved zinc concentrations found in the runoff samples. It is believed that this higher solubility causes zinc to be removed from roadways by stormwater runoff at a faster rate than lead compounds."

The author points out that just as roadways are efficient collectors of particulate materials, they are also extremely effective in transporting them by virtue of their high runoff coefficients. He indicates that even without reduction of the amounts of materials deposited on urban roadways, it is possible to effect considerable improvements in the water quality situation by altering the kinetics of transport so that peak runoff rates are delayed or flattened out over a longer period

of time in order to reduce shock loads on the receiving waters. To this end several recommendations are given including selection of roadway sites in such a manner as to minimize the roadway areas drained directly into the receiving body of water; utilization of low curbs where the road is adjacent to unpaved areas which are flat or sloping away from the street surface to facilitate deposition of the dust and dirt into grass and gravel areas and reduce the rate of deposition in receiving water; continue research on use of porous pavement to determine its applicability in areas having clay or other impervious types of soils and in colder climates; intensify and improve street cleaning operations to reduce urban roadway runoff effects; design curbs and gutters to facilitate concentration of particulate material and collection of same and investigate various approaches to detention and storage of storm runoff and separation of solids from stormwater. Comments are made, also, on elimination of specific toxic materials, vehicle design changes for containment of nonexhaust vehicular emissions, litter collection and disposal, and antilitter campaigns. Additional studies are suggested.

Shoesmith, M. W. (35)

1978. Wildlife management conflicts in urban Winnipeg, pp. 49-57. In Wildlife and People. Proceedings of the 1978 John S. Wright Forestry Conference, Purdue University. (For complete citation see reference 20.)

The author states that in a list of the 100 best-loved things readers of the Winnipeg Tribune mentioned to the staff of this paper about their city of 600,000, "live deer and beaver within the city limits" was number 48 ahead of the Jets professional hockey team, the former mayor, the new premier, and cheap wine. Discusses public ignorance and apathy, overlap of provincial and city responsibilities with respect to wildlife, and the increasing pressures of urbanization in existing green areas. He cites some conflicts of people and wildlife such as deer being killed by cars, trains, poachers, and dogs; deer standing on runways of the Winnipeg International Airport delaying incoming and outgoing flights; beavers chewing down ornamental trees; deer eating and trampling garden vegetables; and a moose on the Niakwa Golf Course which kept golfers from going out on the course until it was driven away by provincial Renewable Resources staff. States that major parks and golf courses where most of the major wildlife habitat may be maintained or enhanced in some form comprises 2.2 percent of the total land area of Winnipeg and that a wildlife inventory of Assiniboine Forest revealed the presence of 9 species of small mammals and 23 species of breeding birds. The author points out that general legal jurisdiction for wildlife enforcement belongs to the city but most animal damage and nuisance complaints are handled by provincial employees. Among recommendations made by the author to make urban wildlife and people more compatible

were: acquiring or maintaining existing green areas rather than developing new ones; clarification of the roles of city and provincial government in urban wildlife management; enforcing existing city bylaws related to wildlife control and harassment; focusing attention on wildlife control, maintenance, or enhancement by creating a professional urban wildlife manager position; prohibiting urban sprawl into adjacent rural areas through strict rezoning bylaws and restricting additional development associated with green areas to low density housing or light industrial development; where possible, restricting human access to portions of existing green areas to provide some sanctuary for urban wildlife; restricting wildlife access to portions of the city to avoid mortality and human property damage; and educating the public in terms of ecological principles and wildlife use in urban environments.

Spaulding, B. W., and E. O. Heady. (36)

1977. Future use of agricultural land for nonagricultural purposes. Journal of Soil and Water Conservation 32(2):88-93.

Authors' abstract: "We developed a procedure to estimate the acreage of agricultural land needed for nonagricultural purposes in the continental United States to the year 2000. The acreage to be converted by the turn of the century represents a 2.2% reduction in the nation's existing agricultural land base. Overall, our Nation's productive capacity in agriculture will not be impaired significantly by this loss of land to nonagricultural purposes. However, the impacts will likely be significant at state and local levels."

In 1970, the land area of urban places with a population of 2,500 or more and a population density of 500 people or more per square mile in the 48 contiguous states totaled 28,950,000 acres (U.S. Dept. of Commerce, Bureau of the Census. 1972. 1970 census of population, number of inhabitants, United States summary. PC(1)-A-1, Washington, D.C.). The authors reported (after Otte, R. C. 1974, Farming in the city's shadow. Agr. Econ. Rpt. 250. Econ. Res. Serv., U.S. Dept. Agr., Washington, D.C.) that nearly 35% of the 1970 population in the 48 contiguous States was concentrated in the top 1% (in total population) of counties, while 86% was concentrated in the top 25%. They stated "the impact of converting 13 million acres of agricultural land to urban uses (assuming that 86% of this will occur in about 25% of the Nation's counties) will not be insignificant." This increase was projected for the period 1970 to 2000 when the projected population would be 262 million.

The authors state further: "Most U.S. cities need to improve management of land conversion. So-called leapfrog and ribbon developments frequently leave significant amounts of undeveloped land scattered in relatively small tracts. This

may not always be undesirable from the urban dweller's point of view. However, interior tracts of land are often difficult to develop and too small to be farmed efficiently. Frequently, more agricultural lands are idled from agricultural production by developers and speculators than is necessary for housing and commercial needs. The result is undeveloped or partially developed lands that remain idle for long periods of time. Often these lands become unsightly weed patches and sources of sediment."

We would observe, however, that these tracts offer good possibilities for management of urban wildlife.

Stearns, F. W. (37)

1967. Wildlife habitat in urban and suburban environments. Transactions of the 32nd North American Wildlife and Natural Resources Conference, pp. 61-69.

Stearns suggests that wildlife in an urban setting may provide the last major opportunity to bring the city dweller in contact with the realities of nature. He outlines the essentials of wildlife habitat and cites examples of wildlife occurring in Milwaukee, Wisconsin and elsewhere. He lists as limitations to habitat development in cities, the small size and discontinuity of habitat units (suggests corridors as a possible solution), people activity, absence of diversity, and air and water pollution. He suggests, as means of maintaining and improving habitat, provision of a variety of food sources, water in winter and summer, adequate cover and travel corridors, and protection from man, including the use of fences. He believes use should be made of members of the Boy Scouts, Girl Scouts, and 4-H Clubs and states that there is potential for a vast number of small but rewarding developments in cooperation with homeowners, industrial concerns, and private institutions.

Stearns, F. W. (38)

1978. Urban ecology--opportunity or tar pit? Bulletin of the Ecological Society of America 59(1):7-9.

Excerpts from the presidential address to ESA in August 1977. Dr. Stearns states, page 8, "to characterize the urban system briefly, it is one of: low species diversity; low habitat diversity; intensive land use; high labor and high fossil fuel inputs; and therefore, unstable and vulnerable to perturbation in the inflows; and a source of overloads and polluting output to other systems." Later he defines urban ecology as "an ecological holistic view of a specific system--an open system operating under a variety of constraints, energy intensive, and generally short on negative feedbacks and one where counter-intuitive results are the rule rather than the exception."

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Dr. Stearns recognizes that present ecological knowledge cannot revolutionize cities but ecologists may, however, (page 9):

"Provide leads for avoiding counter intuitive results of change;

provide a framework to use in examining urban size in respect to efficiency;

examine the potential in predator-prey concepts to alleviate human conflict;

provide some rationale for the maintenance of neighborhoods and affinity groups;

give some credence to the value of redundancy and diversity;

strengthen knowledge of urban support systems and efforts to preserve them;

examine the function of territoriality in respect to neighborhood stability;

remind the planner that age cohorts of the human population differ in their needs; and

encourage--even insist on--long range thinking that extends beyond the political 2-4 year framework."

He states, page 9, "Success in dealing with cities will come only with a broad view which must include the physical environment, the cultural-social milieu and the biological nature of the various populations as they relate to each other and as they influence the urban environment. Cities do indeed hold opportunities--as well as frustration--for the ecologist!"

Stearns, F. W., and T. Montag (Eds.). (39)

1974. The Urban Ecosystem: a Holistic Approach.

The Institute of Ecology for the National Science Foundation's Research Applied to National Needs. Dowden, Hutchinson, and Ross, Inc., Stroudsburg, Pennsylvania. Distribution by McGraw-Hill Book Co. 240 pp.

A report of a workshop involving approximately 90 scholars and practitioners, partially selected by an advisory council, held at the University of Texas, Austin, 29 March to 4 April 1973. Part Two of this publication is the complete workshop report, whereas Part One includes a brief introduction, general workshop recommendations, and a summary view of the urban system.

The authors would like to treat the city as a "system," or as a part of a larger, regional "ecosystem" emphasizing the fundamental biological nature of man interacting with the complex urban system.

It was pointed out that problems of crowding, housing, health care delivery, and antisocial behavior are intensified in the urban core and are influenced by population processes; and that nonhuman animals and various plant species, important components of urban populations, frequently are overlooked. They suggested that in the management of urban parks and green areas, plant communities more nearly self-sustaining than the present manicured areas of regularly mown grass could be used.

The carrying capacity of cities can be extended through technological innovations and a good supply of water, food, and energy, but shortages of water and food have been experienced due to strikes or riots and there are signs that carrying capacity may be exceeded. Hence, perhaps present trends in urban-rural population balance should be examined closely and a shift in direction of migration encouraged. Concentrations of wastes generated by urban populations swamp the processing capacities of adjacent systems, causing them to function inefficiently or not at all. "Almost any attempt to remove or recycle wastes involves environmental changes and economic adjustments...." (Page 23.)

Stearns, F., and J. E. Ross. (40)

1978. The pressures of urbanization and technology, pp. 199-217. In Wildlife and America. Council on Environmental Quality, Washington, D.C. (For complete citation see reference 229.)

Points out that nowhere is there a complete escape from the influence of modern urban civilization and that wildlife, in the broadest sense, is giving way to the human enterprise. The authors discuss human population trends and their significance to wildlife; waste disposal; problems of energy, including strip mining, arctic gas and oil, electrical generation and transmission lines; TV and telephone transmission towers needed for communications; and transportation facilities, such as highways, railroads, and airports.

The authors state, page 216: "It is clear that, considering the momentum of our economic growth, we will continue to manipulate, urbanize, and plan more and more of our environment. The task is to learn to do this in ways that minimize adverse effects on wildlife. As a result of the findings of scientists and the pressure of citizen organizations, we are slowly developing and applying the technological, political, legal, and economic mechanisms to control and direct this growth. The abundance and diversity of wildlife in the future depend upon the success and the pace of this process."

Sudia, T. W. (41)

1974a. Man. Nature. City--the urban ecosystem. USDI National Park Service, Urban Ecology Series, 1. 18 pp.

This pamphlet describes the city as a biological community; discusses the function of cities, vegetation, and climate, effects of urbanization on climate, and how climate affects distribution of plants; discusses edaphic factors and effects of urbanization on water and on environmental quality. The author points out that a 26-square mile section of the Rock Creek watershed in Maryland which as a rural area in 1913 had 64 miles of natural flowing stream, had only 27 miles of streams as a heavily populated Washington suburban area in 1966.

Teagle, W. G. (42)

1978. (2nd Edition.) The Endless Village: the wildlife of Birmingham, Dudley, Sandwell, Walsall and Wolverhampton. (C) Nature Conservancy Council, Attingham Park, Shrewsbury SY4 4TW, England. 58 pp.

A report of a 1975 wildlife survey made in the Birmingham, England Metropolitan area in which the investigator enlisted and received information and assistance from many local specialists in natural history largely through appeals published in the Birmingham Evening Mail and broadcast in the BBC program, "The Living World." R. E. Boote, Director, Nature Conservancy Council, states in the Foreword to the publication: "'The Endless Village' illustrates the potential value for wildlife conservation of a surprising variety of habitats--buildings, walls, gardens, parks and open spaces, road and railway banks, derelict land and industrial wasteland, streams, rivers, canals and reservoirs. The natural resource of wildlife in all these habitats can be enhanced by thoughtful planning and management, for instance, by planting native species of plants and trees rather than exotics; by leaving some overgrown patches with dead timber in our parks; by siting buildings away from river banks; by checking pollution in our streams and rivers."

This report is informative and written in a refreshing and delightful manner. After a description of the study area including its geology and physiography and land use history, there are numerous accounts of the presence of various plants and wildlife in different parts of the Birmingham region. These accounts describe not only the occurrence of birds, but of mammals, fish, amphibians, reptiles, and insects, and discusses their response to urbanization effects. Considerable emphasis if placed upon floral resources.

A five-page chapter entitled, "Away ahead" by C. M. A. Barker

and W. G. Teagle discusses how to protect the natural relics of the past which have survived by accident or design and how to make use of the available space, money, and time to create new places within the built-up area where attractive and interesting plants and animals can exist in safety.

The illustrated report includes a selected bibliography of 14 items, an appendix providing the scientific and common names of the plants and animals mentioned in the text, and an appendix which lists the names and addresses of the organizations, clubs, and museums in the survey area.

Thomas, J. W., and R. M. DeGraaf. (43)

1975. Wildlife habitats in the city, pp. 48-68. In Euler, Gilbert, and McKeating (Eds.) 1975. Wildlife in Urban Canada. Proceedings of a Symposium. The University of Guelph and the Ontario Ministry of Natural Resources. Guelph, Ontario. 134 pp.

A review paper in which over 160 references are cited many of which deal with urban vegetation and birds but including others of a philosophical nature or concerned with wildlife values, research needs, education, and management possibilities. The authors emphasize that cities, including the core city and suburbs are all wildlife habitat, but toward the suburbs, more and more vegetation is found and with it increasing diversity and numbers of native species. They conclude with the following paragraph (page 57): "We believe that there is a yearning in most men for life among some semblence of naturalness, including the attendant wildlife. The economic facts of life indicate that cities are here to stay--at least for the foreseeable future. The solution, it seems to us, is to purposefully pursue a course of nurturing nature in the cities and suburbs, with wildlife as a barometer of success. It won't be easy, but the process is underway."

United Nations Educational, Scientific and Cultural Organization. (44)

1977. The Man-Made Landscape. UNESCO, 7, Place de Fontenoy, 75700 Paris. Printed by Imprimeries Réunies S.A., Lausanne; available in the United States from Unipub, Box 433, Murray Hill Station, New York, NY 10016. 178 pp. $14.00.

This publication, prepared in cooperation with the International Federation of Landscape Architects, is of a cosmopolitan nature; the locales discussed are in many parts of the world and the contributing authors are from, or have had work experience in, many countries with varied man-made landscapes. The volume is well illustrated (black and white), interesting, and informative, especially from the viewpoint of history, culture, and landscape architecture. The introductory chapter traces some of the effects of man on the landscape from the

Pleistocene epoch to the present. Other chapters and two appendices deal with vegetation and its planning and management in cities, e.g., Amsterdam and elsewhere in Europe, England, and Japan; with man-made waterways and urban waterfronts; with reclamation of strip-mined areas as in the Federal Republic of Germany and in the United States; and with regional planning using the Tennessee Valley Authority program as an example. Appendix I by G. Parlevliet of the University of Wageningen, Netherlands, suggests that the effect of trees and shrubs on the environment in city areas is very exaggerated and that although they can have a positive influence, a great deal of research into their optimal use still needs to be conducted.

U.S. Department of the Interior
Bureau of Sport Fisheries and Wildlife. (45)

1968. Man and Nature in the City. Department of the Interior, Washington, D.C. (U.S. Government Printing Office.) xii + 92 pp.

Proceedings of a symposium to explore the role of nature in the urban environment. Sponsored by the Bureau of Sport Fisheries and Wildlife.

Wiken, E. B., and G. R. Ironside (Compilers and Eds.). (46)

1977. Ecological (Biophysical) Land Classification in Urban Areas. Lands Directorate (Fisheries and Environment Canada) and Central Mortgage and Housing Corp., Ecological Land Classification Series, no. 3. 167 pp. Available from Unipub, Box 433, Murray Hill Station, New York, NY 10016 ($7.50).

Proceedings of a workshop, Canada Committee on Ecological (Biophysical) Land Classification, 23 & 24 November 1976, Toronto, Ontario. Includes 16 papers--some in both English and French, and others in English with abstracts in French--plus reports of three study groups responding to the question, "Would it be desirable to have a biophysical survey program for urban or urbanizing areas in Canada?" and other selected questions relating to ways of providing planners with ecological information in a form useful for urban planning. Papers include much information on geology, soils, water, vegetation, and climate with respect to urban planning needs including suggestions on mapping and analysis of the resources and the terrain for urban suitability. Papers by P. B. Dean and Gerald McKeating deal specifically with wildlife needs and concerns in urban areas and a third paper by R. S. Dorney, Consulting Ecologist, describes in considerable detail a methodology for classification and mapping of cultural-historic, abiotic, and biotic features, and their associated ecosystem properties, for land already urbanized and land to be urbanized.

Wolman, M. G., and A. P. Schick. (47)

1967. Effects of construction on fluvial sediment, urban and suburban areas of Maryland. Water Resour. Res. 3(2): 451-464.*

"Sediment concentrations from areas undergoing construction ranged from 3,000 to over 150,000 ppm, whereas in natural or agricultural catchments the highest comparative concentration was 2,000 ppm. In terms of annual values, yields from construction areas range from several thousand to a maximum of 140,000 $t/mi^2/yr$ (i.e., up to 55,000 $t/km^2/yr$) from a small area. Total yield declines with increasing drainage area as a result of dilution from waters draining urban and other land not actually under construction. Observations demonstrate that sediment storage occurs on construction sites as well as in valley bottomlands. Actual yields from a given unit surface may be even larger than those derived from measurements in streams. Data on erosion from roadcuts in Georgia, when converted to soil loss per area, result in sediment yields similar to those from building sites: 50,000-150,000 $t/mi^2/yr$ (20,000-50,000 $t/km^2/yr$), and local measurements indicate depths of erosion on roadcuts of 0.1-0.2 ft (3-6 cm) over time intervals of generally less than one year. Imposition of large quantities of sediment on streams previously carrying relatively small quantities of primarily suspended material produced deposition of channel bars, erosion of channel banks as a result of deposition within the channel, obstruction of flow and increased flooding, shifting configuration of the channel bottom, blanketing of bottom-dwelling flora and fauna, alteration of the flora and fauna due to changes in light transmission and abrasive effects of sediment, and alteration of species of fish due to changes produced in the flora and fauna upon which fish depend."

(Additional information on the urban environment in relation to habitat for fish and wildlife is contained in many other references, particularly 73, 84, 88, 108, 123, 128, 138, 146, 147, 153, 160, 166, 168, 170, 178, 182, 186, 187, 191, 194, 200, 209, 220, 221, 245, 257, 276, 277, 298, 299, 301, 309, 310, 316, 321, 333, 342, 348, 357, 363, 368, 371, 382, 387, 389, 391, 392, 408, 413, 414, 415, 419, 432, 438, 441, 451, 453.)

II. EFFECTS OF URBANIZATION ON WILDLIFE: WILDLIFE RESPONSES

Within this major category are listed references documenting the occurrence in urban-suburban areas of a variety of wildlife species other than the rats, house mice, house sparrows, starlings, and pigeons or rock doves commonly thought of as urban wildlife. The fact that more articles deal with birds than with any other group probably is due largely to their mobility, diurnal habits, relative conspicuousness, and interest, not only to the public, but to

researchers as well. Thus, although more may be known about birds and their responses to environmental changes resulting from urbanization than about other wildlife populations, much remains to be learned for all groups or species. This is true especially from the standpoint of knowing more about the tolerance, requirements, and adaptability of wildlife populations to urban conditions, the interrelationships among the different groups of animals and their habitats, and what can be done through planning and management to enhance wildlife in keeping with public preferences and values.

A. Amphibians and Reptiles

Bara, M. O. (48)

1976. American alligator investigations. Final Study Report August 1970-December 1975, Division of Game and Freshwater Fisheries, South Carolina Wildlife and Marine Resources Department, Columbia. 40 pp.

This is a report on a part-time study of the American alligator (Alligator mississippiensis) in the Upper and Lower Coastal Plain physiographic regions of South Carolina involving 28 of the State's 46 counties. Two hundred and thirteen alligators were live-captured and released in 8 counties. These animals ranged in size up to 10½ feet. Altogether, 1,006 alligators were live-trapped at approximately 60 capture sites in 14 counties--108 in response to nuisance alligator complaints and 808 for research purposes. The nuisance animals were relocated. The largest concentrations of alligators were found in marsh impoundments and shallow ponds within the coastal counties.

Based upon recapture data the projected age to sexual maturity was judged to be nearly 11 years. Over half of the animals were males. Data on nesting habitat, nest construction, clutch size, hatching dates, and nesting success were obtained at 17 alligator nest sites. Locations preferred for nesting appeared to be slightly elevated above the marsh bed such as dikes, road or dike berms, island, or the shoreline.

The author removed 198 nuisance alligators and law enforcement personnel have removed approximately 331 alligators since 1970.

Recommendations are given for further research, management, and the handling of complaints of nuisance animals received as a result of incidents of depredations upon pets, domestic waterfowl and livestock, or due to fear, superstition, misinformation, and ignorance of people. Indiscriminate killing by thoughtless individuals is estimated to be a significant limiting factor throughout many portions of the alligator's range.

Although specific information on loss of habitat for alligators was not obtained in the study, it is thought that loss is being caused by clearing and drainage for urbanization, residential developments, agriculture, forestry and marsh filling. Residential development encroaching into existing alligator habitat or the movement of alligators into newly constructed ponds, ditches, and canals within new subdivisions, the author believes, could be expected to result in an increase in the number of nuisance complaints.

Burton, T. M., and G. E. Likens. (49)

1975. Energy flow and nutrient cycling in salamander populations in the Hubbard Brook Experimental Forest, New Hampshire. Ecology 56(5):1068-1080.

This study was conducted in the Hubbard Brook Ecosystem of New Hampshire where five species of salamanders are present in the predominantly beech-sugar maple-yellow birch mountainous forests. The authors concluded, page 1078: "Salamanders are unimportant as agents for nutrient input or output to the forest ecosystem. They are also insignificant sinks in the intra-ecosystem nutrient cycles for all nutrients with the possible exception of sodium. Their primary role in nutrient cycling may be in regulating invertebrate populations responsible for the mechanical breakdown of the litter. They are also insignificant in energy flow in the ecosystem and utilize only about 0.02% to 0.03% of the net primary production of the system. Surprisingly, however, salamanders are potentially a better source of energy for predators than are either birds or small mammals. They are more efficient in converting assimilated energy into new tissue and produce as much or more new tissue annually as do either birds or mammals. This new tissue has a higher protein content than bird or mammal tissue and represents a source of high-quality food for potential predators."

The authors point out that the biomass of salamanders at Hubbard Brook is larger than the biomass of birds during the birds' peak breeding season and represent a larger source of high quality prey for a tertiary consumer than do the birds or mice and shrews. Salamanders are one of the prime food sources of the snake Thamnophis s. sirtalis and form a small part of the diet of shrews and ground-feeding birds, such as thrushes.

Campbell, C. A. (50)

1974. Survival of reptiles and amphibians in urban environments, pp. 63-66. In Noyes and Progulske (eds.), A Symposium on Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author, Vice President, Canadian Society of Herpetologists and Ichthyologists, provides a fairly detailed literature review of reptiles and amphibians in urban areas and includes personal observations. He points out that the opposite of many urban land management practices such as the halting of burning of cover, drainage, and spraying would benefit herptiles which are now rare in many temperate zone cities. He concludes: "This is unfortunate, since they provide natural pest control and educational material, carry few diseases, and enliven the city with sounds and sights."

Garrick, L. D., and J. W. Lang. (51)

1977. The alligator revealed. Natural History 86(6):54-61.

An article illustrated in color which describes courtship, mating and other social behavior, and life history features of the American alligator (Alligator mississippiensis). Although supplemented by some references to other work (not cited in a bibliography), the authors base much of their description on observations made at an alligator farm in south-central Florida where 35 adult alligators inhabit a medium-sized lake.

With reference to urbanization, the authors indicate that the Florida Game and Fresh Water Fish Commission is swamped with complaints from residents, many of whom have moved into alligator habitat. Although the American alligator is now on the "threatened" species list rather than the endangered list as it was in 1967, wetland ecosystems essential to its existence are disappearing in some areas. The authors state (page 60) "For example, in 1972 biologist Jim Schartemeyer of the Florida Game and Fresh Water Fish Commission estimated that 23% of good alligator habitat was lost in the development of six south Florida counties." In northern Florida, the authors report that the State with Federal approval will license hunters to shoot "nuisance" alligators and to sell their hides with State cooperation.

On page 60, they state: "In order to regulate their body temperatures, alligators require a source of water deep enough to provide a temperature gradient and shelter from the sun, adequate vegetation on land and near the water for shade and shelter, and access to suitable land areas for basking."

Raccoons and black bears are major predators of alligator eggs in nests usually built above high water mark. The nests, however, may be flooded during severe storms and the authors report that release of water from canals into former parts of the Everglades during the rainy season regularly inundates and destroys many alligator nests.

Minton, S. A., Jr. (52)

1968. The fate of amphibians and reptiles in a suburban area. Journal of Herpetology 2(3-4):113-116.

Author's abstract: "Between 1949 and 1958, two species of salamanders, six species of anurans, six species of turtles and seven species of snakes were recorded from a suburban area on the edge of Indianapolis, Indiana. Most were terrestrial or semiaquatic species of broad ecological tolerance. At least 11 species bred within the area during this period. During 1963 and 1964 only two species of anurans, one species of turtle and four species of snakes were recorded, and there was no evidence of amphibian breeding. Modification of aquatic habitat appears to have been the most important factor in reducing the number of species inhabiting the area."

Orser, P. N., and D. J. Shure. (53)

1972. Effects of urbanization on the salamander Desmognathus fuscus fuscus. Ecology 53(6):1148-1154.

Authors' abstract: "Five spring-fed streams near Atlanta, Georgia, comprise an urbanization gradient ranging from severely disturbed to undisturbed conditions. Population densities of the dusky salamander, Desmognathus fuscus fuscus, were established within these streams and were inversely proportional to the degree of urbanization. Differences in the chemical parameters among the stations, while reflecting habitat disruption, were not considered limiting factors on salamander densities. Analysis of invertebrate prey availability indicated no significant difference among the stations. Salamander populations were significantly affected by scouring caused by increased runoff and soil erosion in disturbed areas. Differences in salamander densities were also attributed to relative stability of the bank soils and availability and dispersal of protective cover. More cohesive substrates and increased availability of ground cover at the less disturbed areas offered greater stability against erosion and better habitats for salamanders burrowing. Urbanization thus creates physical instability within stream habitats. Such instability results in a disruption of trophic structure by a reduction or loss of this major stream predator."

Schlauch, F. C. (54)

1976. City snakes, suburban salamanders. Natural History 85(5):46-53. With permission from Natural History, May 1976. Copyright the American Museum of Natural History, 1976.

Author's abstract: "The effects of urbanization on the amphibians and reptiles of Long Island are discussed. The majority of the 37 species of herpetozoans native to Long Island

have declined under urbanization pressures. However, for some species, urbanization may actually have caused population increases. Generally, species with the more specialized and complicated environmental requirements tend to be the most sensitive to urbanization. Showing a comparatively less complex life cycle and requiring less specialized habitats, Plethodon cinereus cinereus is certainly the most urban tolerant of the salamanders native to Long Island. Bufo woodhousei fowleri is probably the most urban tolerant of all the native amphibians. Key preadaptations enabling this toad to survive amidst urbanization include its ability to use almost any body of water as a breeding site, its comparatively short larval period, and its inhabitation of dry upland areas except during breeding. The dumping of debris in vacant lots within the New York City portion of Long Island apparently has provided artificial shelter that helps insure the survival of Storeria dekayi dekayi there. This snake persists in habitats too small and hostile for most other herpetozoans. The damming of streams for recreational and other purposes has probably resulted in the creation of more deep-water ponds than naturally existed on Long Island, and this has provided new habitats suitable for such aquatic chelonians as Chrysemys picta picta and Chelydra serpentina serpentina. The pet collecting activities of youngsters have adversely impacted the status of Terrapene carolina carolina. This turtle and a number of other terrestrial animals are threatened in county and state parklands by the existence of ground-level "nature" trails. Long Island may not possess any endemic species of herpetozoans, but preliminary studies suggest that populations of at least several species may harbor rare or noteworthy genetic traits. Even among urban tolerant species, there may exist preservation worthy genotypes that will disappear under the unnatural selection pressures wrought by humanity. To insure the preservation of such intraspecific genetic diversity, it is important that the notion of 'endangered species' be abandoned in favor of the concept of 'endangered local populations' or 'endangered local communities.'"

Schlauch, F. C. (55)

1978. Urban geographical ecology of the amphibians and reptiles of Long Island, pp. 25-41. In Charles M. Kirkpatrick, ed. Wildlife and people (John S. Wright Forestry Conference Proceedings 1978). Department of Forestry and Natural Resources, and the Indiana Cooperative Extension Service, Purdue University, West Lafayette, Indiana. Copyright, 1978, by Purdue Research Foundation, West Lafayette, Indiana 47907. (For complete citation see reference 20.)

Author's abstract: "Long Island is an excellent area for research in urban geographical ecology. A diversity of life forms, environmental requirements, behavioral characteristics, and urbanization sensitivities are evidenced by the 37 species

of amphibians and reptiles definitely native to Long Island.

"New terms are needed to give the science of urban geographical ecology a precise conceptual framework around which future research efforts may be undertaken. Negative, neutral, and positive urbanization sensitivities may be exhibited by organisms. Negative urbanization sensitivity is possessed by an organism that becomes extinct (absolute urbanization intolerance) or that declines but does not become extinct (partial urbanization intolerance). Positive urbanization sensitivity is held by an organism that needs an urbanized environment to survive in an area (dependent urbanization affinity) or that increases in abundance in an urbanized environment although it was capable of surviving at a lower density in the preurbanization environment of an area (nondependent urbanization affinity).

"Urban geographic barriers inhibit the migration of organisms to urban bioenclaves (sites surrounded by urban sprawl but conducive to biotic diversity). Urban dispersibility is the aptitude of an organism to cross unfavorable urbanized terrain and reach urban bioenclaves. Low urban dispersibilities apparently prevent a number of amphibians and reptiles from reaching suitable new urban bioenclaves on Long Island. Of the native members of the Long Island herpetofauna, the Fowler's Toad (Bufo woodhousei fowleri) shows the greatest ability to withstand the pressures of urbanization on a widespread basis, and the relatively high urban dispersibility of this salientian is undoubtedly an important aspect of its success.

"Although generally influencing population levels in an adverse manner, urbanization may create localized environmental conditions that allow certain amphibians and reptiles native to a site to attain densities higher than those possible under preurbanization pressures. Such localized population level increases occur on Long Island.

"The minimum number of individuals of a species necessary for a population to survive in a particular location is a necessary population level, and the acreage of a specified habitat needed to sustain an organism at a necessary population level is a necessary area. Once the size of an urban bioenclave is reduced below the necessary area of a resident species, the species will decline and eventually become extinct within the site. Among congeners, the species with smaller home ranges and less complicated habitat requirements tend to possess smaller necessary areas and to be more tolerant of urbanization.

"The behavior of an organism is an important aspect of its urbanization sensitivity. Selection pressures wrought by 'pet' collectors on Long Island seem to favor the survival of herpetozoans with secretive habits or rapid retreat responses.

"Much of the research in the so-called field of 'urban ecology' is concerned exclusively with the effects of urbanization on the socio-economic conditions of human populations, and a significant portion of the literature on plant and animal populations in urbanized areas lacks biological rigor and is excessively influenced by the superficial notions of anthropocentric planners. Clearly, a comprehensive framework, formed by extensive field research and sound ecological theory, is needed to stimulate the proper advancement of the science of urban geographical ecology."

Schlauch, F. C. (56)

1978. New methodologies for measuring species status and their application to the herpetofauna of a suburban region. Engelhardtia 6(3-4):30-41.

Author's abstract: "Five indices are proposed to aid in evaluating the status of animal species within urbanized regions. Each index has a potential range of 0 to 1, with 0 indicating the species with the poorest status within a region and 1 the species with the best status. One of the indices is based on a series of qualitative species status categories (extinct, extremely endangered, endangered, locally endangered, and not endangered). The indices are applied to evaluate the status of 35 species of amphibians and reptiles native to a suburban region on Long Island, New York. A four-stage model of faunal component status is presented: Stage I represents the theoretical distribution of the values of one of the species status indices for the earliest period of human settlement within a region and Stage IV the distribution for the most recent and most urbanized period. The herpetofauna of the suburban survey region on Long Island shows a distribution of index values most closely resembling that of Stage III, the later of the two intermediate stages of faunal component status. The quantitative methodology presented should prove helpful in biological conservation planning; however, it is doubtful that numerical indexing techniques will ever be sufficiently sophisticated for use as the only or primary criteria in determining sound conservation practices."

Schlauch, F. C. (57)

1975. Agonistic behavior in a suburban Long Island population of the smooth green snake (Opheodrys vernalis). Engelhardtia 6(2):25-26.

Author's abstract: "The Smooth Green Snake (Opheodrys vernalis) is generally regarded as an inoffensive species that rarely exhibits a threat display. During the period from 1970-1974, about 12 captures of this species were made within an enclave of abandoned farmland in suburbanized Central Islip, Suffolk County, Long Island, New York. Four of the captures

were of snakes that exhibited an agonistic behavior. These snakes gaped and feigned striking but did not bite. An apartment complex was built on approximately 10 of the estimated 50 acres comprising the enclave and may have severely affected the size of the O. vernalis population. If it is assumed that the agonistic behavioral pattern is genetically determined and occurs in the population in a higher frequency than elsewhere, at least two theoretical reasons may be given to explain its occurrence: (1) the pattern may occur naturally on Long Island in higher frequency than elsewhere; (2) the isolation of the snake population by suburban development may have resulted in selection pressure changes, genetic drift, and/or increased in breeding that brought about the high frequency."

U.S. Department of the Interior. (58)

1975. Sea turtles to be added to threatened list. USDI News Release (21 May 1975). 2 pp.

This news release states that three more species of sea turtle--the green (Chelonia mydas), loggerhead (Caretta caretta) and Pacific ridley (Lepidochelys olivacea), have been pushed closer to extinction by increased development of coastal shorelines and overuse for commercial purposes. These species have been proposed in the Federal Register to be added to the U.S. List of Threatened Wildlife.

The release states: "Sea turtles, which can grow to 1,500 pounds, rarely come on land except to lay eggs. Human development of coastal areas for industry and tourism has destroyed many of these nesting sites. Along shorelines, bright city and highway lights confuse hatchlings and attract them inland where they die."

(For further information on amphibians and reptiles, see references 42, 238, 285.)

B. Birds

Armstrong, J. T. (59)

1965. Breeding home range in the nighhawk and other birds; its evolutionary and ecological significance. Ecology 46(5):619-629.

Author's abstract: "Nighthawks, Chordeiles minor, lay their eggs on flat surfaces--in cities on flat roofs--roost in trees, and feed on flying insects which in turn presumably feed on vegetation. Thirteen neighboring nighthawk breeding home ranges in the center of Detroit, Michigan included on the average 10.4 ha total area, 97 small trees (including large shrubs), 70 large trees, and 38 flat roofs, representing 2.25 ha. More or less centrally in each home range and

preferentially over flat roofs, whether being used for nesting or not, resident males performed diving and booming displays. High, average and minimum distances between the centers of activity of the residents, together with observations of conflict between neighbors indicated that the home ranges were mostly defended and, since including feeding and breeding activities, constituted type A territories. Home range size which varied more than threefold, showed no significant correlation with the density of any environmental feature, including an index of photosynthesis, except for a negative correlation with number of flat roofs per ha. Six of the 13 home ranges bounded a 42 ha area unoccupied by nighthawks, which was, compared with the home ranges, deficient in trees and especially in flat roofs. These six home ranges tended to be larger than the remaining seven, though not to differ from them in density of trees and roofs, and in neither group was there correlation between size and density of these features. Thus, variation in home range size seems best explained by birds settling thickly where flat roofs are numerous, and through mutual aggressiveness having small home ranges, by birds not settling at all where flat roofs are scarce, and by home ranges next to such unoccupied areas expanding into them and/or at the expense of neighbors who must defend their entire boundaries.

"Although nighthawks do not always defend combined nesting and feeding areas, the apparently primary importance of aggressive interaction in determining home range size, in the present study, suggests that in nighthawks, as well as in other species having more strictly type A territories, aggressiveness at high population levels may reduce the proportion of individuals breeding and population natality rate below what resources would allow. A variety of evidence is reviewed on this point including the interspecific variation of home range size in relation to body mass which suggests that bird home ranges generally contain more food resources than required by the occupants."

Banks, R. C. (60)

1979. Human related mortality of birds in the United States. USDI Fish and Wildlife Service Special Sci. Report--Wildlife no. 215. 16 pp.

Author's abstract: "Modern man serves as both a direct and an indirect cause of the death of birds. In the early 1970's, human activity was responsible for the death of approximately 196 million birds per year, or about 1.9% of the wild birds of the continental United States that died each year.

"Hunting was the largest direct mortality factor and accounted for about 61% of human related bird deaths. Control or prevention of avian depredations took about 1% of the total, and all research and propagation about 0.5%. Collision with man-made

objects was the greatest indirect human cause of avian deaths, accounting for about 32% of the human related deaths. Pollution and poisoning caused the death of about 2% of the total.

"A relatively few species account for most of this mortality but continue to maintain large, harvestable populations, suggesting that the numbers of most bird species are essentially unaffected by the human activities discussed. Other activities of man that do not necessarily result in the death of birds but rather reduce reproductive potential are more likely to have long-term effects on avian populations."

The author cites a report of the American Ornithologists Union indicating a population estimate of nearly 10 billion breeding season birds in the United States exclusive of Alaska and Hawaii and perhaps 20 billion birds with the addition of young in the autumn which suggests that with a stable population of breeding birds from year to year, some 10 billion birds must die each year. The author recognizes that estimates on loss of birds particularly through indirect causes may be considerably in error but indicates he made an attempt to keep the figures realistic. Among the estimated numbers of birds killed annually are the following: highway mortality, 57.2 million; flying into TV towers, airport ceilometers, radio transmitting towers, and similar obstacles, 1,250,000; flying into windows and reflective glass type buildings, 3.5 million; lead poisoning of waterfowl, 2 million; oil spills and sumps, 1.5 million; and other indirect mortality resulting from electrocution by power transmission lines and electric fences, domestic pets, haying operations, accidental trapping, and others, 3.5 million.

Barger, N. R. (61)

1968. American redstart. Wisconsin Conservation Bulletin 33(6):28-29.**

The author states that the American redstart, the bird with the flashing wings and tail is one of our best known warblers. In Wisconsin this species arrives during spring migration and may remain to nest before leaving in October during the fall migration. Some information on their life history and habits is presented. With respect to nesting the author states, page 28, "Usually they resort to the deeper wooded areas near water for this purpose, but some appear to feel at home in the suburbs of cities and in areas devoid of water. A crotch in a small tree normally is selected to hold the nest, although various branch formations may be used."

Barnes, I. R. (62)

1966. Amid brick and asphalt, pp. 414 to 424. In Birds in Our Lives, USDI, Fish and Wildlife Service (Alfred Stefferud and Arnold L. Nelson, Eds.), USGPO. xiii + 561 pp.

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This book gives a wide perspective of birds as they affect and are affected by people, other birds, and other forms of life and activities. Irston Barnes reports on birds in urban areas.

Batten, L. A. (63)

1972. Breeding bird species diversity in relation to increasing urbanization. Bird Study 19(3):157-167.

The author describes urbanization and qualitative changes in bird life in a northwest London area surrounding Brent Reservoir over a period of 140 years (1830-1970).

Beer, J. R., L. D. Frenzel, and N. Hansen. (64)

1956. Minimum space requirements of some nesting passerine birds. Wilson Bulletin 68(3):200-209.

This study was conducted during six field seasons (1950-55) on small islands in Basswood Lake, Lake County, Minnesota. The islands, varying in size from a small fraction of one acre to about 15 acres in extent, are situated so that the birds resident thereon do not have ready access to the mainland or to other islands. The authors selected for study the song sparrow, yellow warbler, and red-eyed vireo. They pointed out that on islands where single pairs were found the physical and vegetational aspects were the factors determining minimum space needs and that social intolerance should have been of little or no importance. There was no chance to expand the area defended or utilized at the expense of other pairs.

Authors' conclusions: "The data gathered indicate that in some birds the minimum amount of space used by a pair to raise their young successfully may be much smaller when the boundaries are strictly physical barriers rather than invisible lines determined by intraspecific conflict. The three species observed reacted similarly to the situation of reduced space. The Song Sparrow on occasion successfully used islands less than one-tenth the size of the minimum area reportedly required on the mainland. The Red-eyed Vireo and the Yellow Warbler showed similar but less pronounced tendencies. The size of a territory is based upon a number of factors and not on single factors such as food."

The investigators found the minimum territory size for song sparrows to be as low at 0.04 acres compared with about one-half acre reported for central Ohio, a minimum of 0.08 acre for the yellow warbler when a single pair was present, and a minimum of 0.33 acre for the red-eyed vireo when a single pair was present. With additional pairs present on an island, the minimum territory sizes for yellow warblers and red-eyed vireos approached those reported on the mainland for these

latter two species--about 0.3 acre for yellow warblers and 2.3 vs. 2.6 acres for the red-eyed vireo.

One wonders whether various urban developments could create islands where similar reductions in size of minimum territory for breeding birds might occur. (Abstractor's comment.)

Bohlen, H. D., and J. W. Seets. (65)

1977. Comparative mortality of birds at television towers in central Illinois. Wilson Bulletin 89(3):422-433.

Losses of birds at television towers and other high structures, especially during periods of migration, have been recognized for a long time. The authors point out that kills of birds at televison towers offer one means of learning the timing and geographic patterns of migration and the physiological and population traits of the migrants; however, the potential to develop such information has not been fully realized because coverage of the towers has been too limited. In this article the authors report that on 13 dates between 2 September and 12 November 1972, 5,465 birds were collected (93.4% of them killed on four nights) at seven television towers in central Illinois. The birds were listed by species and date of collection. Birds killed at towers in central Illinois were compared with birds killed at towers and collected in eastern Illinois during September for the years 1958, 1962, and 1972. Data analysis showed no consistent relationship between tower height, terrain, or tower location but indicated that the number of birds killed at a given tower on a given night is related primarily to local weather conditions and to the number of birds flying. Generally, kills occurred following the passage of cold fronts, when conditions of low overcast (550 m or less) and reduced visibility (< km) prevailed. The kills occurred within 32 hours (usually within 6 hours) after the passage of cold fronts, when the winds were from the north.

Briggs, S. A., and J. H. Criswell. (66)

1978. Gradual Silencing of Spring in Washington: Comparison of population trends between migratory birds nesting in three Washington, D.C. study areas, and the birds that remain there all year--1947-1977. ii + 24 pp.

The first two pages of this paper are devoted largely to comments on migratory birds as indicators of the condition of the environment in our whole hemisphere and to lengthy quotations from an article by the scholar and writer, Louis J. Halle, in the Summer 1969 issue of Atlantic Naturalist. Halle comments on the changes in bird populations observed in his familiar

birding haunts in Washington in May 1969, compared with populations he was accustomed to seeing in the same areas 12 or more years previously.

The main part of the paper is based upon censuses done by standard U.S. Fish and Wildlife breeding bird population study methods. These censuses have been made for 30 years on Cabin John Island and a Rock Creek Park area and for 20 years in Glover-Archbold Park. Few sites have been studied so long and so consistently. A wealth of information is provided on changes in habitat and in the status of the principal bird species with respect, specifically, to summer residents and permanent residents. Generally, populations of summer residents have decreased in relation to those of permanent residents.

Changes in local habitat are discussed, and the authors consider in some detail the deterioration of the wintering habitat of migratory species through destruction of large areas of rain forest in Central and South America, high use of pesticides in these countries, and changes in land use. The deliberate destruction of rice-eating bobolinks in Venezuela is mentioned as are other hazards, such as television towers, encountered by migratory birds. The authors suggest the need for studies in some of the Central and South American countries to determine whether their all-year resident birds have population trends similar to those in Washington, D.C. or similar to those of the migrants that winter there.

Catchpole, C. K., and C. F. Tydeman. (67)

1975. Gravel pits as new wetland habitats for the conservation of breeding bird communities. Applied Science Biological Conservation 8:47-59.

Authors' abstract: "Gravel pit wetland habitats are a new and rapidly expanding feature of the contemporary environment in Britain. This paper investigates and emphasizes their value as potential conservation areas for breeding bird communities. Most gravel pits are characterized by close proximity to man in an urban-agricultural environment, but contain a variety of aquatic, marshland and terrestrial habitats. Their breeding bird communities contain a wide variety of species, often as high breeding densities. As natural wetlands come under increasing pressure, it is suggested that these new wetlands are important for the future conservation of marshland and aquatic species, and may also act as reservoirs of diversity and abundance in a rapidly changing environment. Conservation of some gravel pits should be based on their overall value as conservation, education and recreation areas near urban centres, and others could relieve the increasing public pressure on natural wetlands. Present trends in the utilization of gravel pits for recreation are discussed and ultimately it is hoped to show how

conservation and recreation may or may not co-exist in the new wetlands of the future."

The authors recognize that reservoirs provide important wintering areas for waterfowl use but lack the wide variety of terrestrial and marshland habitat provided by gravel pits. In Britain approximately 90% of gravel pits are wet and although formerly many of these pits were filled in, they are now being used increasingly by enterprising gravel companies as a permanent source of income and recreation if managed in the right way. Sometimes this may involve landscaping and planting. Often, in addition to open water, there are areas of marshes particularly along the margins of the pits composed of Phragmites, Typha, Glyceria, Juncus, and Carex and on the ungrazed uplands mixtures of grasses, shrubs, and trees. On 10 sites studied, from 21 to 35 breeding species of birds were identified, including both aquatic and passerine birds. On sites that were previously farmed, the authors point out that the possible loss of a few species from open farmland is more than compensated for by the addition of marshland and aquatic species to the community. They suggest that holding many bird species at high densities in these areas helps to buffer local populations against adverse factors operating in the surrounding urban-agricultural environment.

Choules, G. L., W. C. Russell, and D. A. Gauthier. (68)

1978. Duck mortality from detergent-polluted water. Journal of Wildlife Management 42(2):410-414.

The authors report on an investigation to find the cause of recurring waterfowl deaths--mostly during the spring and fall migration periods--on a 36 ha industrial waste basin located at Rocky Mountain Arsenal, Denver, Colorado. They observed that most waterfowl survived only a few hours after entrapment on the basin. Insecticides were present but not in concentrations sufficient to kill rapidly. Based upon examination of waterfowl removed from the basin and controlled experiments with yearling male mallards only two generations removed from the wild, the authors suggested that death resulted from chilling caused by detergent wetting of the birds. They hypothesize that the industrial wastes or conditions of the water caused by wastes contributed to detergent buildup by inhibiting the growth of bacteria. The water in the basin had less than 10 bacteria per ml. The amount of detergent in the water was 18.5 ppm. Ducks exposed to the detergent-laden water lost 10°C body temperature in 20 hours at 30°C (84°F). The authors found that the body temperature of ducks dropped rapidly after reaching a critical range of 30-35°C and that in washing oil-soaked birds with detergent in rescue operations the birds should be dried in a ventilated room warmed to 35-40°C rather than left to dry in the outside air. As a result of this investigation, 1,500 to 1,600 water birds have been rescued from the basin each year

for the past 3 years.

Crisley, F. D., V. R. Dowell, and R. Angelotti. (69)

1968. Avian botulism in a mixed population of resident ducks in an urban river setting. Bulletin of the Wildlife Disease Association 4(3):70-77.

Authors' abstract: "An outbreak of fatal duck sickness among a resident flock of mixed mallard, Peking white, and mallard-Peking white crossed ducks was investigated and proved to be caused by botulism type C intoxication. The incident was deemed unusual because it occurred on a flowing river in the apparent absence of the usual conditions associated with avian botulism. Furthermore, Clostridium botulinum could not be demonstrated in bottom samples from the shallow water at the site of the outbreak. Although a comprehensive scheme was followed for detection and isolation of C. botulinum type C, and ample evidence of the toxic anaerobe in enrichment cultures was obtained, examination of approximately 125 isolates failed to yield the toxic anaerobe in pure culture. A possible association between this outbreak of avian botulism and an alteration in the aquatic environment occasioned by the building of a high dam, with the attendant rise in water levels and decreased river flow rate, is suggested but cannot be definitely proved. Interested workers should be alert to the possibility of botulism in unusual or recently altered environments and the attractive hazard to migratory fowl posed by afflicted resident waterfowl."

This incidence of botulism occurred on the Kentucky shore of the Ohio River opposite Cincinnati, Ohio in August 1964. The resident ducks had been attracted to a yacht club and had been kept there for two years by feeding them.

Dambach, C. A., and E. E. Good. (70)

1940. The effect of certain land use practices on populations of breeding birds in southwestern Ohio. Journal of Wildlife Management 4(1):63-76.

A report on the effects on bird populations of soil and water conservation practices in the early days of the Soil Conservation Service, based on 3 years' observations in southwestern Ohio. Strip-cropped fields had a larger population of breeding birds than fields of the same crops not in strips, possibly due to (1) establishment of acceptable territories with smaller boundaries than would be likely in large fields and (2) continuity of habitat. Red-winged blackbirds, bobolinks, and dickcissels, however, were not found as abundantly in strips as in large meadows. Meadows had more pairs of breeding birds than small grains and corn. Woods protected from grazing had more than twice the population either in individuals or species

per unit of area than did grazed woods. Fifty percent of the bird species in grazed woods were hole-nesters compared with 31.25% in the protected woods.

Dean, P. B. (71)

1977. Wildlife needs and concerns in urban areas, pp. 43-47. In Ecological (Biophysical) Land Classification in Urban Areas. Proceedings of a Workshop, Canada Committee on Ecological (Biophysical) Land Classification, 23 & 24 November 1976, Toronto, Ontario. Comp. and ed. by E. Wiken and G. Ironside. Unipub, Box 433, Murray Hill Station, New York, N. Y. 10016. 167 pp.

Wildlife needs in urban areas are discussed with emphasis on importance of diversity of habitat. The author believes water seldom is a limiting factor for terrestrial wildlife in Canadian cities. He considers shelter and escape habitat to be less critical than food and nesting habitat but points out that habitat for wildlife in urban areas should be planned as a network rather than in isolated patches, e.g., a marsh preserved within a urban community is valuable for marsh-nesting birds but without sufficient surrounding habitat its attraction to certain wildlife species will be minimized. Some wildlife management and ecological principles are outlined and some discussion of home range and territorial requirements, predator-prey relationships, mortality factors, and the edge effect are provided. The author points out that artificial feeding can induce migratory birds to delay migration and result in possible starvation if the birds are caught by a sudden onslaught of bad weather or if they become dependent on artificial feeding and the food source is suddenly removed. Also mentions threats of introducing exotic species into an environment in which there are no biological controls of the mammals, birds, reptiles, and amphibians kept as pets escape or are released. He states that man is probably in more danger of contracting disease from domestic pets than from wildlife populations in urban areas and recognizes educational values of wildlife in such areas. Research needs are suggested, including predator-prey relationships such as effects of birds on bothersome mosquitoes and predation by cats and dogs on wildlife. Wildlife and wildlife habitat values in urban areas are discussed briefly.

DeGraaf, R. M. (72)

1975. Suburban habitat associations of birds. University of Massachusetts, Amherst, Mass. Ph.D. dissertation. 214 pp.

The author's dissertation reports on a study of the breeding birds of Amherst, Mass. during 1973 and 1974 in which vegetative volumes were considered by five-foot layers, i.e., height above ground. Multiple regression analysis was used to ordinate habitat variables associated with the various bird species. The relative tolerance of five common species to variation in

habitat components was determined.

DeGraaf, R. M. (73)

1978. Avian communities and habitat associations in cities and suburbs, pp. 7-24. In Wildlife and People. Proceedings of the 1978 John S. Wright Forestry Conference, Purdue University. (For complete citation see reference 20.)

Dr. DeGraaf reviews personal research on birds in suburban Amherst and in urban Springfield, Massachusetts and selected work of other authors dealing with birds in cities and suburbs. He points out that suburban habitat contains more species in the breeding season than urban habitat; that urban habitat has more wintering than breeding species. Density (numbers of individuals) of urban birds is greater than the bird density in suburbs due largely to the dominance of the urban avifauna by house sparrows in the breeding season and starlings in winter. Native cavity-nesting species such as the downy woodpecker, tufted titmouse, and black-capped chickadee are fewer in urban areas than in suburbs. He states that the quality of urban habitats for birds can probably be improved somewhat by addition of a diverse shrub understory and more trees but stresses the importance of allowing as many woodlots as possible to grow in a natural state, with dead or dying trees for cavity-nesting species and to allow a diverse shrub understory to develop. Analysis of habitat associations showed that various aspects of tree and shrub cover were especially important to breeding birds and that the distance to the nearest woodlot and the number of bird feeders were most important to wintering bird distribution. He states that growth of suburbs probably increases the variety of habitats regionally, but within habitats, especially inner urban residential areas, the bird communities are quite depauperate.

DeGraaf, R. M., and J. W. Thomas. (74)

1976. Wildlife habitat in or near human settlements, pp. 54-62. In Trees and Forests for Human Settlements. J. W. Andresen (Ed.), 417 pp. (For full citation see reference 415.)

The authors review some of the responses of urban bird populations to urbanization as revealed by their research and selected literature. They point out that with urbanization the number of species decreases, while the numbers of individuals of some species increase. Discussed briefly is a method developed to relate habitat components, including layers of vegetation volume, to bird species density in suburban habitats. The report also states that the mourning dove and robin are strongly related to low foliage; the blue jay is associated more with foliage of moderate height; and the cardinal requires both low and intermediate layers of foliage.

The authors state, page 59, "The importance of the low foliage layers to the four bird species is especially noteworthy in view of the common urban landscape practice of pruning the lower limbs from trees and shrubs for ease of mowing and visibility. If we want to have these and other species in areas of human habitation, many of these landscape maintenance practices will need to be modified."

Emlen, J. T., Jr. (75)

1956. A method for describing and comparing avian habitats. Ibis 98(4):565-576.

The author describes a scheme for habitat description based on the selection of a set of measurable features or dimensions, each of which is graduated for quantitative or qualitative evaluation. Deals with vegetation (canopy heights, screening efficiency, foliage type, twig type, coverage, and others) substrate and special features such as bodies of water, barren areas, and buildings.

Emlen, J. T., Jr. (76)

1970. Habitat selection by birds following a forest fire. Ecology 51(2):343-345.

Author's abstract: "In the light of current opinion that habitat selection by birds is determined largely by gross visual aspects of the vegetational physiognomy (Hilden, O. 1965. Habitat selection in birds. Ann. Zool. Fenn. 2:53-75), one might intuitively expect that drastic alteration of the ground and shrub strata of a forest would modify the composition and numerical status of resident bird populations. However, counts in a burned pine stand in southern Florida during the first few months after burning were essentially no different than counts in an immediate adjacent unburned stand. The lack of response to this habitat alteration may be attributed behaviorally to individual home range attachments by the resident birds. Its occurrence in this situation may be associated with the relatively brief duration of these severe habitat disruptions and the frequency of forest fires as a normal feature of slash pine ecology."

Emlen, J. T. (77)

1974. An urban bird community in Tucson, Arizona: derivation, structure, regulation. Condor 76(2):184-197.

The author studied the land bird population of a 24-block residential tract in the form of a rectangle covering 87.3 acres near the center of metropolitan Tucson and compared it with a tract of undeveloped desert 16 km (10 miles) to the south--a tract selected for its resemblance to predevelopment

conditions of the urban site some 70 years before. A well prepared, interesting and informative paper.

The urban tract contained 350 houses typically on 50 x 150 ft. lots fronted by 30 x 50 ft. irrigated lawns with built-in sprinkler systems and bordered by dense ornamental shrubs with a few scattered pines, Eucalyptus trees and palms, and rows of orange trees, oleander, and palms along some of the streets and property lines. Vegetation in the desert area was primarily a nearly uniform and evenly dispersed stand of creosotebush, 4 to 5 ft. high and covering 20-30% of the ground surface. A few shrubby acacias, cholla cactuses, mesquite shrubs, palo verde trees, and large sahuaro cactuses made up most of the remainder of the desert vegetation.

Studies revealed that 65% of the birds in the urban community belonged to exotic species already adapted to urban habitats when they arrived. These were the Inca dove, house sparrow and starling. Thirty percent belonged to five widely distributed North American species that favored the mesic conditions found in irrigated sections of Tucson: the mourning dove, mocking bird, cardinal, house finch, and black-chinned humming bird. The remaining 5% belonged to six southwestern desert species: the white-winged dove, which increased under the new conditions; the arboreal species--Gila woodpecker, ash-throated flycatcher, and verdin--which increased moderately; and two shrub-cactus species--cactus wren and curve-billed thrasher, which declined. Twelve local desert species were not found as residents in the urban habitat.

The urban community had lower diversity in numbers of species (14:21) than the desert community but a higher diversity of habitat according to a perch-height diversity index (0.85:0.55) and habitat feature index--including such features as telephone and power lines, and poles, fence lines, buildings, streets, bird feeding stations, and exposed garbage (2.13:0.80).

The total population density (all species) was 26 times higher in the city than in the desert (1,230:47 birds per 100 acres), and the total bird biomass was also 26 times greater in the city. Ninety percent of the biomass of urban birds were seed eaters. The author noted that, in addition to heavy production of seed by lawn grasses and weeds--the latter particularly on poorly tended and trampled lots--fed on extensively by house finches, house sparrows, and Inca doves, seeds supplied at feeding stations probably provided about half of the community's total needs for these and other seed-eating species. The presence of black-chinned humming birds was attributed at least in part to regularly serviced nectar (hummingbird) feeders. Insect-eaters increased between 2.5 to 7.0-fold or decreased by half in the case of foliage gleaners. Water-dependent species such as doves and house finches increased more strongly than water-independent species. Also, tree and

shrub nesters increased markedly but cactus and ground nesters declined. Most (95%) of the birds in the urban area were of weakly territorial types whereas strongly territorial type species dropped from 93% of the desert community population to 8% in the city.

The author pointed out that water, nearly absent in the desert area for much of the year was well distributed in the city; nesting sites were greatly increased for arboreal, cavity, and crevice nesters by plantings and concurrently reduced for cactus nesters and certain shrub nesters by plant removals; overhead wire and other high song perches presumably enhanced the value of the urban area for territorial species; and traffic hazards, cat predation, and disturbance or harassment by dogs and humans were selectively detrimental to ground nesting and low shrub-foraging birds.

Erz, W. (78)

1966. Ecological principles in the urbanization of birds. From Proceedings of the 2nd Pan-African Ornithological Congress, 1964. The Ostrich, Supplement 6, pages 357-363.

The author discusses ecological principles in the urbanization of birds, particularly in South Africa and Europe. The paper considers subhabitats in cities, climate, food, and origin of the bird species as related to the population of cities.

Figley, W. K., III. (79)

1974. The significance of suburban lagoon developments as waterfowl habitat. State University of New York College of Environmental Science and Forestry, Syracuse. M.Sc. thesis. 157 pp.

The importance of suburban lagoon developments, which now encompass over 14 square miles of former New Jersey saltmarsh, to mallards is examined.

Figley, W. K., and L. W. VanDruff. (80)

1974. The ecology of nesting and brood rearing by suburban mallards, pp. 87-93. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

This report is concerned, primarily, with results of a study of mallards at a lagoon housing development--Beach Haven West--in Ocean County, New Jersey. Development of coastal lagoon communities has resulted in almost complete loss of habitat for all species of waterfowl, except the mallard. Lagoons provide the mallard, a species more tolerant of urbanization than the black duck, with an abundant source of unnatural food and cover

which enables the species to maintain large year-round populations in association with adjacent marshlands where mallard pairs disperse and compete with black ducks for available nesting and brood-rearing habitat. Although production of yound mallards in the lagoon development of Beach Haven West is better than in the surrounding marsh, brood survival is poor due to insufficient cover to protect broods from gulls by day and cats at night; poor supplies of invertebrate foods needed by ducklings; man-made hazards, such as storm sewers; harassment of broods and hens by small groups of unpaired drakes; the capture and scattering of young broods by people; and possibly, the effects of night-lighting. Residents of Beach Haven West consider the numerous flocks of mallards as an asset to their community, bringing natural beauty and enjoyment, but high land values and homeowners' concern for the appearance of yards and homes precludes management activities designed to increase productivity.

See, also, Figley (1974).

Gavareski, C. A. (81)

1976. Relation of park size and vegetation to urban bird populations in Seattle, Washington. Condor 78(3):375-382.

The author used as study sites, six urban parks varying in size from 2 ha to 113 ha and the University of Washington's 61 ha Lee Forest as a control area well removed from urban areas. The hypotheses tested were that parks with large tracts of natural forest can support a diversity and abundance of birds comparable to those in natural forest areas and that modification of the forest and small size of parks are associated with reduced diversity and abundance of birds in urban parks. Bird populations were studied from 1 May through 2 July 1971, by a strip census method.

Author's conclusions: "My results show that a large forested park with a natural diversity of native vegetation was associated with a high diversity of native forest bird species, a diversity comparable to a forest tract outside the urban influence. While native diversity was preserved, there was no marked increase in number of species typical of the urban landscape. At the opposite extreme, the small or highly modified parks contained fewer species, a greater proportion of species typical of urban areas, few regularly occurring species, and most native forest species in reduced abundance or frequency.... This initial short-term study shows that a diverse avifauna characteristic of Pacific northwest lowland forests can be supported in urban areas as long as large park areas with native forest vegetation are maintained." Five tables subjected to various statistical treatment are used for presenting the data collected in the study.

Among the more specific findings or conclusions were that: the large forest park was most similar in the various measurements of species numbers and diversity to the control area, Lee Forest; as clearing and modification of vegetation increased and park size decreased, species such as chestnut-backed chickadee, bushtit, red-breasted nuthatch, winter wren, Bewick's wren, Swainson's thrush, black-throated gray warbler, purple finch, rufous-sided towhee, and song sparrow decreased; the winter wren and brown creeper, species usually found in dense forests with well developed forest floor vegetation, were seen only in the large forest park and the control area; the winter wren preferred nest sites at ground level among fallen logs and stumps; the presence of adequate natural brush cover evidently was a habitat requirement for the bushtit, winter wren, Bewick's wren, Swainson's thrush, black-throated gray warbler, rufous-sided towhee, and song sparrow; and ornamental shrubbery at least partially compensated for removed brush cover for all of these species (except wrens). The presence or absence of shrub-dwelling species is suggested as a useful indicator of the extent of vegetation change.

Geis, A. D. (82)

1974. Effects of urbanization and type of urban development on bird populations, pp. 97-105. In Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

This report indicates effects of development at Columbia, Maryland on bird populations. This includes effects of housing construction and design. Bird survey techniques used are described. Typical farmland species such as bobwhite and mourning dove showed a dramatic decline as the area was developed and there was a decline, also, of field-inhabiting species such as eastern meadowlarks, red-winged blackbirds, and grasshopper sparrows, and of woodland and woodland edge species such as the woodthrush and indigo bunting. House sparrows and starlings, on the other hand, had remarkable increases as housing developments with construction of the type that provides holes, cavities, and ledges suitable for nesting increased.

Geis, A. D. (83)

1976. Effects of building design and quality on nuisance bird problems. Proceedings of Vertebrate Pest Conference, Monterey, California, 9-11 March 1976, 7:51-53.

A resume of the general effects on bird populations of the development of Columbia, Maryland is followed by more detailed discussion of effects of building design and construction on starlings, house sparrows, and pigeons.

Giffin, J. G. (84)

1968. Plover census (Oahu). Hawaii Division of Fish and Game, Pittman Robertson Project W-5-R-19, Ecological Investigation of the Migratory Game Birds, Job Completion Report on Plover Census on Oahu, 11 pp.

This study was conducted to determine the abundance and distribution of the Pacific golden plover (Pluvialis dominica) on the island of Oahu and the effects of environment upon this species in terms of changes in their density and distribution.

Author's abstract: "Wintering plovers were censused for four months on all major habitats to determine the wintering populations on Oahu. The average density of plovers on each habitat type and the total number of acres of available habitat were determined to arrive at a total estimated population of 15,173 plovers on Oahu.

"Grazed grass lands supported the largest number of plovers, with harvested cane fields being next. Sugar cane roads, urban areas (parks, golf courses, cemeteries), and pineapple roads supported smaller numbers of plovers. Saline mud flats supported large numbers of plovers, but their numbers fluctuated greatly with the tide."

With respect to urban areas, school lawns, and suburban home lots were not censused, because of the large amount of foot work that would have been involved and the relatively small numbers of birds on them. The author stated, however, page 6, "Urban areas support large numbers of plovers because of excellent feeding opportunities offered by the closely cut grass as a result of constant mowing." The total acreage of cut grass areas and the estimated numbers of plovers using these areas were: for golf courses, 2,632 acres and 421 plovers; for parks, 797 acres and 414 plovers; and for cemeteries, 258 acres and 175 plovers.

The author noted that insect population explosions will attract large numbers of plover to areas where there are usually very few birds. He stated also, page 8, "Poisoning for army worms greatly affects the plover numbers on cut grass habitats. Plovers may be very common on one golf course and yet on another one mile away, there will be none at all. If the grass has been poisoned, plovers completely avoid the area."

Gill, J. D., R. M. DeGraaf, and J. W. Thomas. (85)

1974. Forest habitat management for nongame in central Appalachia. USDA Forest Service Research Note NE-192. 6 pp.

Authors' abstract: "To woodland owners or managers who are

interested in bird-habitat improvement, the authors suggest managing for: (1) people with slight to moderate knowledge of birds; (2) high numbers of both individual birds and bird species, particularly the conspicuous species; (3) seeing and hearing birds near trails and other human-activity areas; (4) bird nesting; and (5) natural-appearing habitat. The nesting-habitat preferences of 31 representative species are listed. Guidelines are offered for trails, sites, plants, growth stages, dimensions and lay-out, and treatments."

Goetz, E. J. (86)

1975. Habitat variables and urban songbird populations. West Virginia University, Morgantown, W. Va. M.Sc. thesis. 132 pp.

An urban bird habitat analysis study conducted in and around Morgantown, West Virginia with particular reference to 10 species--robin, gray catbird, song sparrow, Eastern house wren, Carolina wren, blue jay, chipping sparrow, house sparrow, cardinal, and mourning dove.

Graber, J. W., and R. R. Graber. (87)

1979. Severe winter weather and bird populations in southern Illinois. Wilson Bulletin 91(1):88-103.

Authors' summary: "A study was made of bird populations in 3 arboreal habitats--bottomland forests, upland forest, and urban, in southern Illinois, comparing the severe winter of 1976-77 with milder winters of the 3 previous years. Prolonged severe cold and snow cover caused massive population shifts and high mortality among several species of birds. Populations of certain species left their preferred winter habitats to use special food sources elsewhere. Mortality was particularly high among ground forages, but mortality rate was also related to body size, smaller species showing the greatest decline. Closely related species showed very similar patterns of population change. Some populations survived better in urban habitat than in natural habitats probably because of food provided by humans. Population declines in a habitat were related to: (1) the initial winter population density, and (2) the carrying capacity of the habitat as expressed in the average population density for the habitat during more normal winters. The higher the population was above average, the greater the loss."

The authors state that overall, the bird population declined sharply during the severe weather (winter of 1976-77), falling about 58% in bottomland and 66% in upland forest. In these habitats the early winter bird populations had been higher than average. In the urban habitat where the early winter population had been lower than average, the population had increased by February by 9.2%. The rather abrupt population changes are

ascribed as probably due to emigration, local movement, and-or mortality. Apparently there was 100% mortality in the case of the hermit thrush, two species of wren, two kinglets, and the field sparrow, and very high mortality in the flicker, brown thrasher, bluebird, cardinal, towhee, junco, and white-throated sparrow. The authors suggest that if a bird cannot survive where it knows the resources, moving to an unknown and probably already occupied area is not likely to improve the situation and involves an energy cost that increases with distance. They suggest, also, that birds near the northern limits of their winter range probably suffer the greatest losses when a severe winter occurs. They state that bird feeders and special plantings in town were part of the reason bird populations increased in urban habitat. There was an 8-fold increase in mockingbirds, for example, and ground foragers that survived--white-throats and juncos--survived mainly in the urban habitat. Also, urban cardinals apparently survived better than those in the natural habitats. The shifting of some birds from bottomland forests to upland forests where fruits of poison ivy, shining sumac, greenbrier, persimmons, and acorns were available above the snow is described.

Graber, R. R., and J. W. Graber. (88)

1963. A Comparative Study of Bird Populations in Illinois, 1906-1909 and 1956-1958. Illinois Natural History Survey Bulletin. Volume 28, article 3, pp. 378-528.

This well prepared, well edited bulletin contains a wealth of information on changes in land use, including crops grown, highways and urban development, and changes in bird populations from 1906-09, when strip censuses were made by Alfred O. Gross and Howard A. Ray, to 1956-58, when strip censuses were repeated. The Grabers estimated there were about 350,000 acres of urban areas in Illinois in 1909 with a population of about 3,269,000 birds compared with 820,000 acres and 7,657,000 birds in urban areas in 1959. Although commercial sections of urban areas have smaller bird populations than residential areas and contain mostly house sparrows, starlings, and rock doves (and some nighthawks), they point out that urban residential areas represent a modified forest habitat that can be an important reservoir for several species of native birds. They observe that the house sparrow and rock dove were adapted to residential habitat even before their introduction into Illinois and that two native species, the chimney swift and purple martin, were probably adapted to the urban situation long before 1900.

They state, page 511: "Urban residential areas, which now boast a higher bird population density than any other habitat except edge, occupied an almost inconsequential acreage only 100 years old...by 1958, the area exceed 800,000 acres, accounting for nearly 8,000,000 breeding birds (13 percent of the state population), and was growing at an ever-increasing

rate...."

They urge that some effort be made to study the possibilities of planned control of problem species (house sparrows and starlings) by building and landscape design.

Grobecker, D. B., and T. W. Pietsch. (89)

1978. Crows use automobiles as nutcrackers. Auk 95(4):760.

This brief note describes the authors' observations of a common crow (Corvus brachyrhynchos) hovering over a busy street in Long Beach, California dropping from its beak a palm fruit (Washingtonia sp.) from a height of about 10 m; immediately perching on a nearby lamppost; then recovering the shattered food within seconds after it had been run over by cars. This feeding sequence was repeated a second time in which it took seven minutes for a car to run over the fruit but the crow waited until the fruit was shattered and available. Other references are cited which indicate the resourcefulness and adaptability of the crow to diverse habitats including the following of milkmen on their routes and prying off the caps of bottles and sipping the milk when the bottles are left alone.

Hamilton, W. J. III, and W. M. Gilbert. (90)

1969. Starling dispersal from a winter roost. Ecology 50(5):886-898.

The authors describe observations of starling dispersal from a winter roost in thick marsh vegetation near the mouth of the Sacramento and San Joaquin Rivers in the Central Valley of California close to the towns of Pittsburg, Antioch, Travis, and Rio Vista. "At times there were more than two million starlings in residence and as many blackbirds--red-wings, Brewer's and tricolored, primarily." The authors' hypothesis is that dispersing starlings behave to maximize the efficiency and rate of energy gain and believe this hypothesis can explain much of the winter starling roosting behavior. "As the roost population grows, more distant resources are utilized. At maximum roost populations, individuals may disperse daily as much as 50 miles from the roost.... During dispersal, most individuals make in-transit stops to feed.... On foggy and overcast mornings, dispersing starlings do not extend as far from the roost and the flight is less accurately oriented."

The authors calculate that individuals from such a large roost may forage and affect a region of some 8,000 square miles, perhaps significantly reducing insect populations throughout this space. They reported that at Davis, California, some 34.5 miles from the roost, a small population of a few hundred starlings are permanent residents and roost in palm trees. Apparently these birds move only a few miles from their roosts.

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Heusmann, H. W., and R. G. Burrell. (91)

1974. Park mallards, pp. 77-86. In Noyes and Progulske (1974) --Wildlife in an Urbanizing Environment (a symposium). (For full citation see reference 28.)

The authors report on waterfowl use of a series of interconnected ponds in a 700-acre Forest Park just outside of downtown Springfield, Massachusetts where the flock fluctuates in size but normally consists of 10 to 20 domestic pekins, a few black ducks, and 200-600 mallards. Other ducks observed on the ponds include wood ducks, American widgeon, green-winged teal, and blue-winged teal. American coots and Wilson's snipe also use the parks. A majority of these birds stopped during fall migration. Also, many of the black ducks and mallards present on any one day during the migration season are there only temporarily and are replaced by other migrants of the same species. The authors believe that more than 10,000 mallards and 2,000 black ducks spend each winter in Massachusetts' parks and urban areas. Banding data indicate that mallards from Iowa, Illinois, and other midwestern states are not uncommon. Observations on other Massachusetts parks were included. Although viewers of park waterfowl populations were mostly local citizens, out-of-state guests also enjoy the opportunity of observing the waterfowl. The authors found that two-thirds of the parties they interviewed came to the park to feed the ducks; another 31.7% indicated they came to watch the birds. The amount fed per party weighed 1.05 pounds--mostly of bread. Unanswered questions, the authors indicated, include: "How will park mallard populations affect native black duck populations? How dependent is the mallard on artificial feeding? And, amusingly as it may sound, how will an increase in bread prices affect the availability of the mallards food supply?"

Hooper, R. G. (92)

1977. Nesting habitat of common ravens in Virginia. Wilson Bulletin 89(2):233-242.

Author's summary: "Common ravens in Virginia were primarily cliff nesters. The major factors apparent in selection of a nest site were cliff profile, determined by a suitable ledge with an overhang above and steep rock face below, and the distance to other active raven nests, the closest 2.2 km and the average 4.3 km. Nest cliffs average 19.7 m in height. No significant difference was found between heights of successful and unsuccessful sites. Nest cliffs close to human activity were not taller than those in remote areas. Observed proximity of roads and dwellings to nests had no significant effect on nest productivity. Nest sites were found between 335-1130 m above sea level, with 44% below 580 m. Successful nests below 580 m. fledged a mean of 3.08 yound compared to 2.37 at higher

elevations. Starvation of nestlings, due to a loss of feeding efficiency in adults nesting at higher elevations, was suspected."

From the standpoint of management the author stated, p. 240, "Human activity, in my judgment, should be curtailed near active nests, despite the tenacity of some nesting pairs. The actual distance to restrict activity depends on the terrain and type of activity. In general, pedestrians should not be permitted within 200 m of a nest if they are visible to birds on the nest cliff, or within 100 m if they are hidden from view. Vehicular traffic as close as 100 m to a nest would not create excessive disturbance if parking areas are not provided within 200 m. However, road construction within 200 m could cause desertion. Overlooks should not be built on top of nest cliffs. Rock climbing should be discouraged on active nest cliffs from 15 January until the nestlings fledge in late April or early May...."

Howard, D. V. (93)

1974. Urban robins: a population study, pp. 67-75. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author reports on robins in a residential section of West Newton, Middlesex County, Massachusetts--a section with a density of six people, two dwellings, one cat and one dog per acre. The buildings cover about 15% of the total area and there is an almost total lack of brushy ground cover, but spacious lawns and many trees are planted around the houses. In what appears to be good robin habitat, Howard found that the average annual production of young was too low to balance adult mortality. Apparently the area is surrounded by similar suburban and urban areas in which robin production does not offset mortality. She theorizes that robins can maintain populations in association with man only when there are areas interspersed with those inhabited by people which are refuges from domestic predators and perhaps sources of food. She points out that availability of earthworms and defoliating caterpillars used as primary sources of food by robins in West Newton decreases sharply in June and July as compared to April and May and that alternate food probably is less than in more rural areas because there is a lack of moist leaf litter among the carefully tended gardens and lawns.

Hunt, L. B. (94)

1960. Songbird breeding populations in DDT--sprayed Dutch elm disease communities. Journal of Wildlife Management 24(2): 139-146.

Author's summary: "In the spring of 1959, 11 quadrats (averaging 25.8 acres) in southeastern Wisconsin were censused to evaluate the possible adverse effects to birds of spraying all street elms with annual dormant applications of mist-blown DDT to control Dutch elm disease. In three unsprayed communities (Madison, Portage, and Stoughton), five residential plots averaged 409 songbird breeding pairs per 100 acres. In three sprayed communities where six quadrats were distributed, the total density of breeding was 31% lower in Janesville, 68% lower in Wauwatosa, and 90% lower in Shorewood. Robin populations in these sprayed communities were 69, 70 and 98% below that in the average unsprayed community. Densities of 13 other censused species were moderately to irregularly lower on the sprayed plots, or occurred normally in numbers too low for meaningful comparison."

Rock doves, chimney swifts, purple martins, cedar waxwings, and American goldfinches were not censused; house sparrows were incompletely censused.

Note by compiler: Use of DDT is now out-lawed or strictly controlled partially as a result of studies of this type.

Jackson, J. A. (95)

1970. A quantitative study of the foraging ecology of downy woodpeckers. Ecology 51(2):318-323.

Author's abstract: "Studies of the foraging ecology of Downy woodpeckers (Dendrocopos pubescens) at the University of Kansas Natural History Reservation indicate that there is intersexual partitioning of the foraging niche, seasonal variation in the relative frequency of the mode of foraging, variation in the mode of foraging on live versus dead trees, and seasonal variation in the use of live and dead trees.

"Partitioning of the foraging niche by the sexes is accomplished behaviorally by a differential use of the substratum according to the limb height and diameter. The degree to which these unisexual subniches are expressed varies on live versus dead trees. Males tend to forage on small branches, generally 5 cm in diameter or less; females tend to forage on the trunk and larger limbs. The mean foraging height of males in live trees (6.0 m) is significantly different from that of males in dead trees (8.9 m); the mean foraging height of females in dead trees (8.4 m) is not significantly different from that of females in live trees (8.1 m) or of males in dead trees. The mean foraging height of males in live trees is significantly different from that of females in live trees. A similar relationship exists among the heights of the trees in which Downy woodpeckers forage.

"Both male and female Downy woodpeckers use sub-surface

foraging techniques to a greater extent during the winter and superficial techniques during the warmer months. Greater use of dead trees during the winter is also indicated.

"Dead American elms (Ulmus americana) are used as foraging sites by both sexes to a greater extent than expected by chance. Some other tree species seem to be favored and some avoided by one or both sexes."

Johnsgard, P. A. (96)

1960. A quantitative study of sexual behavior of mallards and black ducks. Wilson Bulletin 72(2):133-155.

This is a report of observations made over a 2-year period on flocks of mallards and black ducks in the Cayuga Lake region of New York. A semitame flock of mallards at Stewart Park Ithaca was included. Johnsgard concluded:

"1. Male Mallards and Black Ducks tend to react independently and rather specifically to female stimuli.

2. Thresholds of male Mallard and Black Duck display responses vary seasonally, as apparently also do female stimulus thresholds.

3. The three major male sexual displays studied have the same hierarchy of reaction intensities in both the Mallard and the Black Duck.

4. No qualitative differences between male Mallard and male Black Duck displays were found.

5. Male Black Ducks have a distinctly lower threshold of display response, and apparently a somewhat more specific response, than do male Mallards.

6. These last two quantitative differences in two forms are believed to be related to lack of male plumage dimorphism in the Black Duck, which probably must be compensated for by a more sensitive and specific sexual- and species-recognition mechanism than is needed by the Mallard, where male plumage characteristics alone can effect sexual and species recognition."

Johnsgard points out that wild hybrids between mallards and black ducks are relatively common in the Ithaca area and repeated counts of wild black duck flocks suggest that roughly 3% of the males exhibit rather obvious hybrid ancestry. On the basis of his observations, he concluded that females were selecting normal plumaged male mallards in preference to the mallard males which, due to mutations in domesticated mallard flocks, had plumage that deviated markedly from normal plumaged drakes.

Kale, H. W. II, and W. L. Jennings. (97)

1966. Movements of immature mockingbirds between swamp and residential areas of Pinellas County, Florida. Bird-Banding 37(2):113-120.

Movements of post-fledgling mockingbirds into swamps and their subsequent dispersal to residential areas suggests a possible transport mechanism of arboviruses from swamp reservoirs to areas of human habitation during periods of high arbovirus activity.

Lay, D. W. (98)

1938. How valuable are woodland clearings to birdlife? Wilson Bulletin 50(4):254-256.

Based on 14 30-minute counts in Walker County, Texas, Lay found that the margins of woodland clearings had 95% more birds representing 41% more species than the interiors of corresponding woodland.

Leopold, A.(with drawings by A. Brooks) (99)

1933. (1936, copyright 1933.) Game management. Charles Scribner's Sons, New York. xxi + 481 pp.

This classical book, although it focuses on the conservation of game by management, sets forth and discusses principles of general importance to all fields of conservation. The central thesis is that game can be restored by the creative use of the same tools which have hithertofore destroyed it--axe, plow, cow, fire, and gun. The author states (p. 404): "A pair of wood thrushes is more valuable to a village than a Saturday evening band concert, and costs less."

"Environments can, by the judicious use of those tools employed in gardening or landscaping or farming, be built to order with assurance of attracting the desired bird. In short, by deliberately and intelligently reversing the processes which are destroying bird environments, we can restore not only birds in general, but those particular birds in which the landowner may have a special interest.

"This is the substance of game management, and can likewise become the means whereby each community creates its own dearth or abundance of nongame birds. Is it not probable that landowners who now proudly exhibit their bird baths or feeding stations will be equally enthusiastic about the diversity of bird environments which they can build up? Should not public parks be 'landscaped' with an eye to the variety of their birdlife, as well as to the beauty of their scenery?" (p. 405)

Leopold, A. S. (100)

1977. The California Quail. University of California Press, Berkeley, Los Angeles, London. 281 pp.

This is an authoritative account of the California quail, Lophortyx californicus, written in an easy-to-read style to serve as a stimulus and a guide to the preservation and management of this fine game bird. The book contains 15 chapters, 3 appendices, a prologue by Ian McMillan, an epilogue by the author, a 12-page bibliography, and a 3-page index. The volume is divided into three parts dealing with the bird and its distribution and history, its biology or natural history, and its management. Much of what is known of this species is presented including discussion of its sociality and behaviour, nesting, growth and development of the young, rainfall as a factor affecting reproductive success, quail mortality, habitat, land use relationships, and management approaches. Human-social values of the bird are discussed in chapters on hunting and on "Backyard Quail" and in Appendix A. "Quail in Aboriginal California," an independent contribution of much interest by Karen M. Nissen, a graduate student in Anthropology. Detailed information on foods of the California quail is included in Appendix B by Bruce M. Browning. Appendix C, a contribution by Michael J. Erwin, a graduate student, deals with physiological and behavioral differences in quail during two breeding seasons of contrasting precipitation.

Leopold begins Chapter 15, "Backyard Quail," with the statement, "There is no more delightful bird to have around the yard than the California Quail" and ends the chapter with: "In my judgement, the creation of living space for a covey of California Quail would represent the gold standard of successful backyard management. What more pleasant sound could there be to awaken a jaded suburbanite than the morning call of the quail--'cu-ca-cow'?" In this chapter, he points out that habitat requirements of quail in a suburban situation are identical with those on the open range. These requirements are well described in preceding chapters but suggestions are made about how they can be met in suburban areas. Shrub cover, dense at ground level, is needed for protection from predators and a place where the covey can loaf in mid-day. He suggests that pyracantha, holly, and other decorative berry plants may form satisfactory thickets and that, in more arid situations, Atriplex, or salt bush, and juniper can meet this cover requirement. Green food in the forms of sprouting annuals may be obtained on vacant lots or open ground and these same areas may furnish insects and seeds for the young birds. Quail come readily to feeding stations where small grains or mixed bird feed is offered either on bare ground adjacent to cover or on elevated feed trays. Although suburban quail can drink adequately from drops of water remaining on vegetation from the regular watering of plants, a permanent drinking pool is

recommended. A ground-level bird bath is preferable, apparently, to meet the needs of young quail. Problems of providing adequate nesting cover, predation by cats and dogs, and damage to sprouting vegetables and flowers by quail are discussed.

Linehan, J. T., R. E. Jones, and J. R. Longcore. (101)

1967. Breeding-bird populations in Delaware's urban woodlots. Audubon Field Notes, December 1967, pp. 641-646.

Observations on role of urban woodlots in providing habitats for birds enjoyed by residents of suburban areas. The paper contains information useful as a basis for managing suburban open space areas.

Longcore, J. R., and R. E. Jones. (102)

1969. Reproductive success of the wood thrush in a Delaware woodlot. Wilson Bulletin 81(4):396-406.

The authors report on a segment of investigations carried out to determine wildlife effects of habitat changes stemming from increasing human populations and destruction of wooded areas in Delaware. This study of the wood thrush in a 35.6-acre, relatively undisturbed woodlot within the city limits of Newark, Delaware, is intended to provide base line data for comparative purposes with breeding bird success in greatly disturbed suburban woodlots. Research findings with possible implications for management of urban-suburban areas include the following: In general, the greatest nest success was associated with (1) late season nests (June and July), with (2) spicebush and black gum vegetation, and with (3) the lower heights of nests above ground level (below 8.5 feet); while low nest success was associated with May nesting, red maple, and heights above 9 feet. "Arrowwood, black gum, red maple, spicebush, and flowering dogwood were the most commonly used plant species of the 17 used to support active nests." (Page 406)

Lucid, V. J. (103)

1974. Bird utilization of habitat in residential areas. Virginia Polytechnic Institute and State University, Blacksburg, Va. Ph.D. thesis. 164 pp.

This describes the author's research on bird populations in seven residential areas of different types in Blacksburg, Virginia during the wintering and breeding periods, 1972-1974.

Lussenhop, J. (104)

1977. Urban cemeteries as bird refuges. Condor 79:456-461.

Author's summary: "Nests of birds breeding in 10 Chicago cemeteries were located in the spring of 1974. In addition strip censuses in urban sample areas associated with cemeteries were used to estimate species numbers and abundance of birds in the city surrounding nine of the cemeteries, as well as in portions of the cemetery neighborhood equal in area to the cemetery. Percent vegetation cover did not differ between cemeteries and neighboring areas in any height interval except at ground level.

"The number of bird species in cemeteries and neighboring areas increased with area; the rate of species addition was greater in cemeteries than in neighboring areas. Cemeteries larger than 25 ha supported more bird species than the surrounding city because of large-scale heterogeneity provided, in part, by ponds, ruderal vegetation, and undeveloped land. Complete development of the cemeteries would probably result in loss of about two bird species. Increased human disturbance would probably cause loss of three additional species. On the other hand, in cemeteries where suitable nesting sites were apparently limited, native species were found nesting in the adjacent city and foraging in the cemeteries. This suggests that urban bird refuges would attract more species than knowledge of their area alone would predict."

In his study, Lussenhop found rock doves, house sparrows, and mourning doves nesting in urban areas near cemeteries, but not in cemeteries; a second group of birds--starlings, cardinals, common grackles, American robins, blue jays, common flickers, chipping sparrows, and brown thrashers--which nested in both cemeteries and neighboring areas; and a third group which subsumed those species that nested almost exclusively in cemeteries. Among the latter species were: mallard, American kestrel, red-headed woodpecker, Eastern kingbird, great crested flycatcher, Eastern wood pewee, common crow, mocking bird, catbird, red-winged blackbird, Northern oriole, brown-headed cowbird, indigo bunting, and song sparrow. Instead of a spillover of urban birds into cemeteries the author found a spillover of species typical of cemeteries into the city. He suggested that human disturbance was responsible for fewer than expected species in some of the cemeteries and attributed some of the attractiveness of larger incompletely developed cemeteries to the coarse-grained patchiness of the cover. He believes human disturbance such as would occur with greater recreational use of cemeteries and cemetery development would limit the future value of urban cemeteries as bird refuges.

MacFarlane, A. E. (105)

1977. Roof-nesting by common terns. Wilson Bulletin 89(3):475-476.

The author reported the observation of a pair of common terns

(Sterna hirundo) nesting on the flat roof of a building on Great Gull Island, New York (at the eastern end of Long Island Sound) during the summer of 1975. She reported also (after Cooper et al., Proc. Linn. Soc. 71:108-118, 1970) that on Great Gull Island, common terns often nest on the crumbling concrete of the old fort which covers most of the Island and (after Fisk, Am. Birds, 29:15-16, 1975) that least terns (S. albifrons) nest on roofs in Florida. She concludes that roof-nesting, like the use of other man-made structures on Great Gull Island, demonstrates the adaptability of common terns in their choice of nest sites.

Nuorteva, P. (106)

1971. The synanthropy of birds as an expression of the ecological cycle disorder caused by urbanization. Annales Zoologici Fennici 8:547-553.

The author suggests that the large biomass of birds in urban areas, although of fewer species when compared with rural houses in agricultural areas and in an uninhabited forest in southern Finland, is an indication of the ecological cycle disorder caused by transport of biological material from forests and fields to the city.

Odum, E. P. (107)

1945. The concept of the biome as applied to the distribution of North American birds. Wilson Bulletin 57(3):191-200.

This paper, Part I of a symposium on Bird Distribution and Ecological Concepts held at Urbana, Illinois, 21 November 1941 and directed by V. E. Shelford, compared the life zone theory of classifying communities or the environment with the biome theory, especially in regards to bird distribution. Life zones, of which C. Hart Merriam described six as transcontinental along temperature isotherms, were based largely on temperature differences. These zones were later modified and divided into associations and still further into ecological niches with vegetation considered as the primary factor. The biome theory is based on the concept of an association of diverse, mutually dependent organisms in a natural ecological unit, i.e., biomes are major biotic communities characterized by the occurrence of certain plants and animals which are dominant and influent. The biome theory does not minimize the importance of climate but recognizes rainfall, humidity, wind, and solar radiation as well as the direct importance of cover (habitat or shelter) to animals.

Odum states that, in general, few species of birds are restricted to a particular species of plant, but many birds seem to be limited to a type or life form of vegetation.

Bird distribution is influenced by the dynamic nature of succession and, while perhaps occupying the climax of one biome, may also occur in the seral stages of other biomes. Comparatively few species occur in the climax of more than one biome.

As pointed out by Odum, man has perhaps changed the climate little, but he has greatly modified shelter, food supply, and other habitat factors.

Odum, E. P., and S. Davis. (108)

1971. More birds in the bushes from shrubs in the plans. Landscape Architecture. October 1969, page 36.

The present trend in campus and urban landscapes stresses tall trees scattered in expanses of grass or low ground cover with little medium height dense cover so valuable for a diversity of song birds especially when it occurs as massed shrubbery. Although architects make a case against massed shrubbery next to buildings on the basis that it hides the clean lines and patterns of modern buildings, the authors point out that shrubbery, to be attractive to man and useful to birds, need not be planted against or even near buildings. "It is time for building architects and landscape architects to work together with the whole environment in mind."

Power, D. M. (109)

1971. Warbler ecology: diversity, similarity, and seasonal differences in habitat segregation. Ecology 52(3):434-443.

From author's abstract: "...the species that are most broadly distributed within the habitat have indices of ecological diversity (H) or 'niche breadth' of from 3 to 5 times greater than the most narrowly distributed forms. There is no correlation between H in foliage types and H in habitat zones within seasons, but there are significant correlations for H between spring migration and post-migration samples within vegetational subdivisions. Average H is not significantly different between seasons for either foliage type or habitat zone data. The dominant component of H is the number of vegetational subdivisions occupied, rather than the equitability of distribution within subdivisions.

"...average ecological distance among species is greater in the reproductive season than during spring migration for both foliage type and habitat zone data. Increased segregation among species in the breeding season may be due to the reduction in the number of warbler species in the study area during that time, seasonal shifts in behavior as regards interaction of species, or simple population differences."

Roth, R. R. (110)

1976. Spatial heterogeneity and bird species diversity. Ecology 57(4):773-782.

Author's abstract: "A heterogeneity index, D, derived from the point-quarter technique was significantly correlated with bird species diversity (BSD) for several shrub and forest areas. It predicted BSD for a series of similar brushlands where other indices had failed. Species richness increased faster than species overlap in a series of increasingly complex habitats up to the forest stage. Species overlap was negatively correlated with patchiness. Additional species may be accommodated in preforest habitats primarily by horizontal spatial segregation facilitated by the presence of additional patches. New patches result from the addition of layers of vegetation. In late shrub or forest stages other birds of segregation such as vertical segregation become important to species packing.

"Patchiness, as measured here, has a proximate effect on avian diversity. The extent or existence of latitudinal gradients in habitat patchiness and the effect on bird species diversity is unknown. The need remains for a universal, simple, yet meaningful, heterogeneity index which incorporates both horizontal and vertical variability of vegetation.

"Key words: Avian community; Delaware; forest; heterogeneity; Illinois; shrubland; species diversity; species packing; Texas."

Four of the study areas were suburban forest communities in Delaware. Other study areas included a late shrub-tree seral stage (forest edge) in Illinois and four brush-grasslands in Texas. The greatest number of bird species was found in the Illinois forest edge habitat, the fewest in grassland.

Sayler, R. D., and J. A. Cooper. (111)

1975. Status and productivity of Canada geese breeding in the Twin Cities of Minnesota--a paper presented at the 36th Midwest Fish and Wildlife Conference, Indianapolis, Indiana, 16-19 Dec. 1974. 12 pp., typescript.

Twelve major breeding flocks now numbering about 1,800 of the giant Canada goose (Branta canadensis maxima) are distributed throughout a seven-county metropolitan area of nearly 3,000 square miles. The flocks were established by holding pinioned or wing-clipped birds until they nested and by allowing the young to fly freely. In general, according to the authors, each home flock area consists of a small refuge supporting a high density nesting population: Islands, both natural and man-made, and artificial platforms are common nest sites, accounting for 87% of the nests studied.

"Population pressures are sufficient in each home flock to force nesting birds to pioneer into surrounding areas. In the Hennepin County Park Reserve District, dispersing birds find ample nesting habitat within areas ranging from 1,200 to 3,000 acres. Birds from other flocks are moving into residential areas and nesting on lake shorelines, in city parks, and small marshes. Many geese nest in close proximity to sources of potential disturbances, such as nature trails, freeways, railroads, and houses." The authors point out that Twin Cities' Canada geese share their environment with more than two million people. In 73% of all nests, in 1973 and 1974, at least one egg hatched. In the Twin Cities area, Canada geese are as productive as geese nesting in rural and wild habitats. Among other reasons related to the reproductive success of these geese are that they are early nesters and the broods come off the nests before heavy recreational use of the Cities' lakes and marshes; private lands, nature centers, and park reserves serve as breeding refuges where human activities are restricted to nature trails, observation blinds, and tours conducted by naturalists; and "geese nesting in residential districts are often protected by neighborhood 'vigilantees' who keep a close eye on 'their geese'." A management objective is to increase the number of separate breeding flocks, rather than just the total population of geese, so that more people will have the opportunity to view the birds. Urban goose populations can cause problems such as traffic accidents--and, potentially, air collisions--and may become dependent on handouts of food if care is not exercised so they retain their migratory habits; however, surplus production can be used to build new flocks in other locations by trapping and releasing them.

Schinner, J. R. (112)

1974. An analysis of the interrelationship of habitat and avifauna in metropolitan Detroit. Michigan State University, East Lansing, Michigan. Ph.D. thesis. 201 pp.

The author reports on a study of birds in five areas of metropolitan Detroit each containing a residential and a park subsection. Thirty-three habitat variables were measured, and the interrelationships between these and bird species diversity and the population estimates for seven selected species were examined. A questionnaire was utilized to determine the attitudes of urban residents toward bird life.

Schoener, T. W. (113)

1968. Sizes of feeding territories among birds. Ecology 49(1):123-141.

Author's abstract: "This analysis deals with size variations in the breeding territories of land birds which obtain most or all of their food on the territory.

"For the species studied as a whole, territory size shows a strong positive relationship to body weight. Predators tend to have larger territories than omnivores or herbivores of the same weight, presumably due to the relatively denser food of the latter species. The home range of raptors inhabiting two areas were found to be significantly correlated with an index of the numerical density of their prey and in one area with raptor weight. Higher clutch size is not significantly associated with larger territories in any category of birds tested. The number of individuals defending the territory and the number feeding the young are probably not correlated with territory size.

"The exponential relationships between body weight of the consumer and three dependent variables--food biomass consumed per unit time, average prey weight and territory or home range size--are used to derive three predictions: a) Heavier predators take fewer individuals per unit time than lighter species; b) If certain restrictions are satisfied, the collective biomasses in a given large area increase as individual biomasses become larger for omnivorous species and decrease as individual biomasses increase for predators; c) For predators, the density of acceptable and accessible food in biomass per unit area decreases as the weight of the consumer increases.

"Territory or home range size increases more rapidly with body weight for predators than for omnivores or herbivores This relationship holds true for both birds and mammals and presumably reflects a rapidly decreasing food density for predators of increasing weight. Since smaller predators do not feed over a wider range of food size than larger species, and since there are less species or individuals feeding on large food than on small, the predators of the areas studied probably consume food whose distribution of biomass with food size is declining.

"The habit of feeding on exclusive areas is considerably more widespread among predators than among omnivores and herbivores. The smaller spatial needs for omnivorous and herbivorous birds of a given biomass and perhaps the greater patchiness of their food when compared to predators are used to explain the higher occurrence of gregarious nesting in the former group.

"Implications of this study for the functions of feeding territories maintained during the breeding season are discussed."

This study is based largely on a review of pertinent results from investigations presumably carried out primarily in nonurban areas. However, the deductions and the principles discussed may be helpful to ornithologists in understanding urban bird populations and for comparing sizes of urban bird feeding territories with those in nonurban areas.

The author found, in analyzing the data available for 23 families of North American land birds with respect to the habit of feeding on exclusive areas during the breeding season, that for birds which consume 90% or more animal food, 91.7% of the species sampled obtain most or all of their food on such areas, whereas only 16.7% of the omnivorous (30-70% animal food) species sampled did likewise. About 42.9% of the herbivores were territorial feeders. He hypothesized that acceptable animal food is more uniformly distributed than is acceptable plant food but pointed out that birds which feed on fruits and seeds which are produced nonuniformly at different times of the breeding season would not be expected to possess exclusive feeding ranges.

Schreiber, R. W., and E. A. Schreiber. (114)

1977. Observations of ospreys nesting on artificial structures in Charlotte Harbor, Florida. Florida Field Naturalist 5(1):5-7.

Currently, many nests of the osprey (Pandion haliaetus) are found on artificial structures such as waterway channel markers, signs, utility poles and other tall structures rather than in natural situations. In this brief paper, the Schreibers report on observations made of ospreys nesting on artificial structures in Charlotte Harbor, Florida in 1975-76. They state, page 6, "The seven nests which received eggs in 1976 thus produced 2.0 young per successful nest and 1.71 young per active nest." Several nesting attempts were unsuccessful. The observers were intrigued by the fact that they did not see ospreys nesting elsewhere on any of more than 300 markers in the intercoastal waterway channel between Clearwater, Pinellas County, and Sanibel Island, Lee County, that they had surveyed regularly for 8 years. They speculate that as human "development" has occurred along the coast the birds have been forced to nest on the channel markers but the authors are uncertain why they seem to do so in this part of Florida only in the Charlotte Harbor area. They wonder, also, if the ospreys are taking more readily to artificial sites now than in the past. Unfortunately, if the nests impair the visibility of the channel marker lights or numbers, the nests must be destroyed by the U.S. Coast Guard.

Smith, E. F., III. (115)

1971. Bird populations and habitat analysis in Reston, Virginia. Virginia Polytechnic Institute and State University, Blackburg, Va. M.Sc. thesis. 120 pp.

The author discusses problems and techniques in obtaining information on breeding bird densities and relationships to habitat in urban areas as illustrated by a study in the new city of Reston, Virginia.

Speirs, J. M., and R. G. Tozer. (116)

1970. Populations of birds in urban habitats, Ontario County, 1969. Ontario Field Biol. 24/70. 10 pp.

The author reports on bird censuses on 10 urban plots in Ontario County, Ontario, Canada in 1969--a part of a long-term project in which urban bird populations are being compared with those of forests and other habitats.

Stewart, R. E., and C. S. Robbins. (117)

1958. Birds of Maryland and the District of Columbia. USDI Fish and Wildlife Service. North American Fauna 62. 401 pp.

This publication constitutes a comprehensive and systematic treatment of the seasonal or year-round occurrence, distribution, and relative abundance of birds in Maryland and Washington, D.C. prior to 1958. The first 41-page section provides a historical sketch including a list of birds of the District of Columbia published in 1816 and other early observations of birds in Maryland and D.C.; discusses bird life and changes in land use; describes the geographical distribution of birds within the area treated along with physical and biotic features of the area; and states that a total of 333 species is included in the regular list of birds for Maryland and the District of Columbia. The authors point out that much of the information contained in the book, including population densities by habitat units, should permit comparison with data from similar studies that may be conducted in the future, thereby affording a measure of the responses of birds to changing environments.

In the systematic treatment of birds which constitutes most of the book, information is provided on status, habitat, occurrence during spring and fall migration, and maximum counts of birds during different seasons of the year. Many references are made to birds within Washington, D.C., Baltimore County, and other urban areas.

Sturman, W. A. (118)

1968. Description and analysis of breeding habitats of the chickadees, Parus atricapillus and P. rufescens. Ecology 49(3):418-431.

From author's abstract: "The breeding habitats of Parus rufescens and P. atricapillus are largely nonoverlapping. A multiple regression analysis was used to describe carefully their breeding habitats and to analyze the extent of their coexistence. The abundance of P. rufescens is most highly correlated with the percent of the upper story canopy volume which is coniferous and the average height of the upper story

conifers; taken together, these 2 variables account for more than 90% of the variability in the observed abundance. For P. atricapillus, the canopy volume of all trees, all bushes, and middle story trees together most accurately predict its abundance; the regression of these 3 variables on abundance accounts for over 90% of the variability in the observed abundance of P. atricapillus on the study areas. Evidence is presented which supports the view that it is these features of the habitat to which the chickadees respond in selecting a breeding habitat."

This study was conducted in western Washington. Sturman indicated that the black-capped chickadee was absent on the San Juan Islands, but the chestnut-backed chickadee (P. rufescens) was seen in a broadleafed area perhaps because such areas were "vacant" on the Islands in contrast to the mainland where this species did not breed in a comparable situation.

Swank, W. G. (119)

1955. Nesting and production of the mourning dove in Texas. Ecology 36(3):495-505.

This study was conducted on an 81-acre portion of the campus of the then Agricultural and Mechanical College of Texas (now Texas A&M University) from the spring of 1949 to June 1951. The area is described as park-like with streets lined with trees forming a canopy 25 to 45 feet high and grounds mostly in lawn. Of 1,137 trees on the area, 63% were live oak (Quercus virginiana), 18% eastern red cedar (Juniperus virginiana), 12% hackberry (Celtis occidentalis), and 2% chinaberry (Melia azedarach), and a small percent other species. The campus provided excellent nesting habitat for the mourning dove. The author stated that the first week in June, 1950, there were 89 active mourning dove nests on the 81-acre study area, and during the complete 1950 nesting season, 648 active nests. A decrease to 26 active nests found in the first week of June, 1951, was attributed, at least in part, to a heavy winter-kill of doves the preceding February.

With respect to nesting habitat, the author stated, page 495, "The campus seemed to provide an excellent nesting habitat for mourning doves. The area was clear for a height of eight to twelve feet under the tree canopy, providing an open view on all sides. This seemed to be one of the necessary requirements for ideal nesting habitat. Even doves observed in woodlands traveled to areas with sparse ground cover to gather nesting material. On the study area male doves preferred the gutters of paved streets over adjacent grass-covered sites for collecting nesting material.

"The tree canopy, primarily of live oaks, provided excellent supports and protection for nests. The horizontal limbs and

numerous diverging small twigs of this species served to anchor the nests in place. Also the live oak contained an abundance of green leaves the year round, which provided protection for early nests constructed before leaves came out on such species as hackberry, chinaberry, and pecan (Hicoria pecan)."

He pointed out that water was available because lawns were watered when rainfall was insufficient. Food, both natural and in the form of corn and wheat--probably from the feed yard of domestic stock--was available on, or to the west of, the study area. He stated that he had found no other area that equalled his study area on a nest-per-acre basis and that students from all over Texas commented on the high population of doves on the campus as compared with their home localities.

Although active nests were found in every month except November and December, nestings during May, June, and July produced 72% of the young successfully reared to the fledgling stage. Other information on mourning dove life history, mortality, and population dynamics is presented.

Taylor, W. K. (120)

1965. Nesting heights of some Louisiana birds. Wilson Bulletin 77(2):146-150.

Author's summary: "An investigation on the elevations of birds' nests was conducted during the breeding season of 1963 in northern Louisiana, primarily on the campus and farm of the Louisiana Polytechnic Institute, Ruston. A total of 522 nests representing twenty-eight species of birds was found. The 522 nests ranged from 0 to 50 feet above the ground, with more than three-fourths of the 522 nests ranging from the 0 to 12.5 foot level. More than one-half of the 522 nests were below 7.5 feet from the ground. The mean height for the 522 nests was 9.1 feet from the ground."

Thomas, J. W., R. M. DeGraaf, and J. C. Mawson. (121)

1974. A technique for evaluating bird habitat, pp. 159-162. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The components of bird habitat as indicated by counts of 10 selected bird species on 60 plots in the town of Amherst, Massachusetts, May-June, 1972, were identified by examining the relationships between the average bird counts and the plot characteristics through a combination stepwise regression and simple correlation. The authors believe the habitat components, particularly vegetative factors, will determine just what species and in what numbers birds will be present in our cities of the future. Their study suggests what the relationships are

between volume, height, and type of vegetation and bird species, but does not answer: why? For this they suggest studies on a species-by-species basis.

Thomas, J. W., R. M. DeGraaf, and J. C. Mawson. (122)

1977. The determination of habitat requirements for birds in suburban areas. USDA Forest Service. Research Paper NE-3357. 15 pp.

This paper presents a discussion of how songbird populations can be related to habitat components through correlation and multiple regression analysis. Habitat requirements for a variety of species can be determined simultaneously using as variables to account for bird distribution aspects of vegetation, human activities, and structures. Ten bird species were studied in Amherst, Massachusetts.

Thomas, J. W., and R. A. Dixon. (123)

1974. Cemetery ecology, pp. 107-110. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Cemeteries in Boston and its suburbs take up 35% (1,716 acres) of the 4,903 acres of open space remaining in the area and represent an extremely valuable resource. The authors found many wildlife species present in cemeteries and learned that, already, there was heavy human use of such areas for purposes other than deposition and honoring of the dead. They suggest that wildlife management on such areas could be a compatible use and pointed out that in one of 50 cemeteries studied--Auburn Cemetery in Cambridge--wildlife was considered whenever plantings were planned.

Thompson, L. (124)

1971. Behavior and ecology of burrowing owls on the Oakland Municipal Airport. Condor 73(2):177-192.

The burrowing owl (Speotyto cunicularia hypugaea), although eliminated by civilization in parts of the San Francisco Bay area, have moved into some sites created by bay-fill projects including older parts of the Oakland Airport and adjacent golf course filled with materials, mostly dredgings from the Bay, in 1928. The ground is vegetated with assorted grasses, mustard (Brassica), and some scattered coyote brush (Baccharis). The paper is an interesting account of this owl and treats such topics as the burrows it uses, population movements, general habits, food habits, sexual dimorphism, communications, courtship and pair formation, territoriality, selection of the nest site and nest building, nesting period, emergence of the young, reproductive performance, mortality and survival,

dispersal, and plumage and molt.

Burrows of the Beechey ground squirrel (Spermophilus beecheyi) provide most of the owls' burrows in this area. The owls, which use vacant dens and renovate and maintain them by digging, may sometimes move into burrows occupied by ground squirrels and apparently evict the squirrels. There is little other interaction between the owls and the squirrels, however, because the squirrels go into their dens before the owls become active and do not come out until the largely crepuscular and nocturnal owls have become quiescent in the morning. Dogs damage some of the owls' burrows but no interaction between cats and owls was observed. Based on owl pellet analysis, the meadow vole (Microtus californicus) is an important food of the owl, along with vegetation, presumably half or more of which was food of the consumed prey, insects (especially beetles and the Jerusalem cricket), and birds such as meadowlarks and blackbirds. Food items found at owl burrows included such species as meadow voles, young jackrabbits, meadowlarks, shore birds, toads (Bufo boreas), and Jerusalem crickets. The territory size of six pairs of owls was estimated to range from 0.1 to 4.0 acres and averaged 1.98 acres--considerably smaller than the home range. Nesting material, apparently gathered mostly by the male, consisted mostly of divots from the nearby golf course, but included, also, loose grass and miscellaneous items such as gum wrappers.

Thompson, W. L., and E. H. Coutlee. (125)

1963. The biology and population structure of starlings at an urban roost. Wilson Bulletin 75(4):358-372.

The authors report of a study of starlings roosting on the supporting beams below the Ambassador Bridge over the Detroit River connecting Detroit with Windsor, Canada and of starling use in lesser numbers of the attic and beams below the roof overhang of Mackenzie Hall on the campus of Wayne State University, Detroit. The authors point out that Detroit area starlings apparently are able to find an adequate food supply in winter, because they reach and maintain their peak body weight during the coldest months. The authors believe that the immediate stimulus for leaving their feeding areas and flying toward the roost probably involves light intensity but in the vicinity of the roost the birds seem to be responding more to social stimuli than to be seeking warmth and protection from the cold.

Tomoff, C. S. (126)

1974. Avian species diversity in desert scrub. Ecology 55(2):396-403.

Author's abstract: "Along a gradient of habitat complexity

in desert scrub communities of the Sonoran Desert in southern Arizona, nest sites and food niches become more diverse, and breeding bird population density and species diversity increase. Birds are highly specific in their selection of plants for nest placement; densities of most species are strongly related to densities of nest plants. The MacArthur foliage-height diversity model does not yield consistently accurate predictions of breeding bird species diversities in desert scrub communities.

"A significant relationship is found between physiognomic coverage diversity and breeding bird species diversity. This index, based on a system of plant life forms, quantifies critical environmental features used by birds in habitat selection. A model that combines aspects of foliage-height diversity and physiognomic coverage density may provide greater accuracy and wider applicability for predicting breeding bird species diversity."

Vicenty, J. A. III. (127)

1974. A study of factors affecting nesting raptor populations in urban areas, Sacramento County, California, 1974. State of California, Dept. of Fish and Game, Wildlife Management Branch Administrative Report 74-5 (supported by Fed. Aid to Wildlife Restoration Project W-54-R, Special Wildlife Investigations, Job III-61). Final report. 21 pp.

Author's abstract: "A study was undertaken during the 1974 raptor breeding season to determine factors that affect breeding raptor populations in urban areas. The study area covered 9,835 hectares (24,303 acres) along 48.3 kilometers (30 miles) from Folsom Dam to the mouth of the American River, Sacramento County, California. Seventy-one active raptor nests were located, consisting of 10 species. The American kestrel and the burrowing owl were the most numerous of the nesting raptors with 19 nests and 16 burrows respectively. Fledging success, disturbances, and nest failures were documented for 53 (75%) nests. Of the 53 nests, 43 (81%) were successful and 100 young fledged, averaging 2.3 young per successful nest. Of the 10 known nesting failures, 9 were attributed to human activities; 5 nest failures were caused by construction activities, 2 nests were robbed by humans, 1 nest was destroyed by high winds and young later taken, and 1 owl burrow was destroyed by motorcycle vandals. The remaining nest failure was caused by scrub jay predation."

Author's conclusion: "Raptors can exist in urban situations, providing adequate habitat is present. This includes nesting habitat as well as habitat able to support an adequate supply of prey species. An informed public which knows the value of raptors and present protective laws and is willing to support the proper enforcement of such laws is also necessary.

Intensive recreational activity is detrimental only when it is disruptive to the raptors' nesting habits and habitat. Land development and construction work is the greatest disruptive force within the study area. Therefore, immediate as well as long range planning of land development is necessary to insure the survival and welfare of raptors in urban areas."

Walcott, C. F. (128)

1974. Changes in bird life in Cambridge, Massachusetts from 1860 to 1964. Auk 91(1):151-160.

Documents nesting bird life in a residential section of Cambridge over the past 100 years and correlates changes in bird life with environmental changes associated with progressive urbanization. Birds nesting and transient during the summer on two comparative 6-acre tracts are listed. The amount of natural habitat on tract A was reduced from 95% in 1860 to 30% in 1900-04 and on tract B from 50% in 1943 to 15% in 1960. Also, the residential areas were subjected to insecticide spray from 1912 to 1964 and some of the marshes were filled and developed industrially in a nearby fresh pond-unsprayed reservation used for comparative purposes. In the course of the study, the bird life of the residential area changed from 26 nesting species, mostly residents and a few transients, to 9 nesting species, mostly permanent residents, which were outnumbered by transient species. In the fresh pond reservation a score of nesting species composed mostly of summer residents continued to outnumber the transients throughout the study.

The author notes that studies in tract B, in 1940-43, where considerable natural vegetation was still present and where thick border plantings of young hemlock, white pine, and arborvitae had been made, the increased habitat diversity in comparison with the orchard and field habitat existing 70 years previously resulted in a slight increase of nesting species. Interesting accounts are given on the invasion of Cambridge by the house sparrow and the starling.

Warbach, O. (129)

1958. Bird populations in relation to changes in land use. Journal of Wildlife Management 22(1):23-28.

From author's summary: "Changes in breeding-bird populations on a 210-acre farm area were observed from 1947 to 1952. During this period, clearing, drainage, and planting changed the area from a partially abandoned farm with only 34 acres in cultivation to a modern conservation farm. Number of bird species nesting in the area was about 10% lower in the last three years than in the first three years; number of nesting pairs declined about 40%.

"The greatest decline was in species characteristic of brushy habitat; these were the most abundant birds on the area at the start of the study. For these species, approximately eight acres of planted hedges and field borders did not serve as an adequate substitute for 63 acres of brushy fields...."

Weber, W. C. (130)

1972. Birds in cities: a study of populations, foraging ecology and nest-sites of urban birds. University of British Columbia. M.Sc. thesis. 269 pp. in two volumes.

This thesis is a report of an ecological, all-season, study of urban birds, 1968-70, conducted mostly in Vancouver, British Columbia, but including winter studies in two plots each in Sacramento, California and Ottawa, Canada. Bird densities decreased with increasing urbanization but were much higher than in nonurban habitats in winter; species diversity was low and there was almost a total absence of nests near the ground, probably due to cat predation and human disturbance.

Williamson, R. D. (131)

1972. The effects of a forested urban park on the distribution of selected song birds in adjacent neighborhoods. Howard University, Washington, D.C. M.Sc. dissertation. 99 pp.

The author discusses summer bird life in Rock Creek Park and for about 10 blocks west of the Park ("middle and upper class" neighborhood with considerable vegetation) and 10 blocks east of the Park into "lower class or ghetto" area with more pavement and less vegetation and where more residents live in high-rise apartments.

Williamson, R. D. (132)

1974. Birds in Washington, D.C., pp. 131-135. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The study of birds is discussed in relation to vegetation and to the quality of the human environment along transects running through Rock Creek Park in the District of Columbia westward into an area of homes surrounded by parks, flowers, and other dense vegetation and eastward into an area of highrise apartments and sparse vegetation. House sparrows, pigeons, and starlings were the most abundant, especially on the east side of the park. Numbers of starlings tended to increase with distance from the park, reflecting the species adaptation to occupied human areas. Robins, mockingbirds, catbirds, blue jays, song sparrows, and wood thrushes generally were more abundant west of the park. Williamson asks: "If songbirds do not find the east side areas suitable for existence, then why

should man believe otherwise?"

Willson, M. F. (133)

1974. Avian community organization and habitat structure. Ecology 55(5):1017-1029.

Author's abstract: "Bird species diversity was linearly correlated with foliage height diversity and curvilinearly with total percent vegetation cover. The addition of trees in a vegetational series has a disproportionate effect on the addition of species, primarily by the addition rather than the expansion of guilds. No basic relationship of species-packing within guilds is associated with bill or body size except frequently within two-member guilds. Estimated abundance and biomass of birds does not appear to be related to productivity of the habitats, in contrast to reports from the literature. Similarity of bird species composition is not related to similarity of foliage distribution, when like study areas are compared. Avifaunas of grasslands generally differed more among themselves than did those of forests. Bird species overlaps were correlated with foliage height overlaps only for part of the variational range for two- and three-layered habitats, and little if at all for grasslands. Width of 'habitat-niche' is not related to numerical dominance, taxonomic or ecological categories.

"Because many of these results do not coincide with previous attempts at ecological generalization, great care in such attempts seems strongly indicated. Studies should be made of meticulously delineated subcommunities, resource measurement, and reproductive success, as well as events in the nonbreeding season."

Woolfenden, G. E., and S. A. Rohever. (134)

1969. Breeding birds in a Florida suburb. Bulletin of the Florida State Museum, Biological Sciences, University of Florida, Gainesville 13(1):1-83.

The authors describe a study of bird population in the residential suburbs of St. Petersburg and Gulfport, Pinellas County, Florida based on observations made in three study plots totaling 100.5 acres during portions of 1963 and 1964.

Young, H. (135)

1949. A comparative study of nesting birds in a five-acre park. Wilson Bulletin 61(1):36-47.

Author's summary: "Nesting birds were studied in a five-acre park area with arbor vitae and bluegrass lawn as the main cover types.

"A total of at least 15 species (94 pairs) bred on the area during the period of study.

"May and June were the months of highest nest density. On May 19-20, there were 9.6 active nests per acre. The average number of nests per acre for the season was 4.3. The total density for the season was 32.8 nests per acre.

"The high density did not produce any noticeable interspecific strife.

"Catbirds were the most successful breeders, producing fledglings from 51% of their eggs: Mourning doves were the least successful, producing fledglings from 20% of their eggs.

"Those species suffering the greatest loss of eggs in the nest generally appeared to be the most successful in raising nestlings.

"Predation by an unknown avian form was the main cause of nest failures."

This study was made in the spring and summer of 1947 at Ho-Nee-Um Pond, a small portion of the University of Wisconsin Arboretum, in the vicinity of Madison, Wisconsin. Judging from the author's description it could be considered an open space area or park in a suburban area, and the high density of bird nests is indicative of breeding bird use possible in such areas.

A mowed lawn of bluegrass (Poa spp.) covered about 40% of the total area, and numerous plantings of closely spaced arbor vitae (Thuja occidentalis) arranged in irregular patterns, covered about 26% of the total area. The arbor vitae varied in height from 5 to 30 feet. Mixed with it were scattered patches of red osier dogwood (Cornus stolonifera) and staghorn sumac (Rhus typhina) and less amounts of white birch (Betula alba), elderberry (Sambucus canadensis), ninebark (Physocarpus opulifolius), box elder (Acer negundo), honeysuckle (Lonicera tatarica), hawthorne (Crataegus sp.), and highbush cranberry (Viburnum opulus). Ground cover under the plantings was mainly bluegrass, nettle (Urtica sp.), thistle (Cirsium sp.), and burdock (Arctium sp.). Vegetation beneath the arborvitae was cut once with scythes in May. Swamp milkweed (Asclepias incarnata) was found in solid beds along some of the edges in late summer. In addition, a small group of black locust trees (Robinia pseudo-acacia), a 0.3-acre swampy pond thickly grown to emergent aquatics, occasional cottonwoods (Populus deltoides) along the shore of Lake Wingra, and a thick clump of black willow saplings (Salix nigra) added diversity to the area. The author states that there were approximately 5,000 feet of arbor vitae-grass edge in the area and great interspersion of plant types (also shown by map).

Numbers of nests actually found on the area by species were: bronzed grackle, 26; robin, 36; catbird, 22; cedar waxwing, 14; yellow warbler, 12; goldfinch, 9; song sparrow, 2; mourning dove, 11; alder flycatcher, 5; mallard, 1; ringneck pheasant, 2; killdear, 1; rose-breasted grosbeak, 1; chipping sparrow, 1; warbling vireo, 0 (1 estimated); yellowthroat, 0 (1 estimated).

Zinkl, J. G., J. Rathert, and R. R. Hudson. (136)

1978. Diazinon poisoning in wild Canada geese. Journal of Wildlife Management 42(2):406-408.

Diazinon, a so-called "short-lived" pesticide, is suspected to have caused the death of 14 Canada geese found on a golf course near Ladue, Missouri, 25 November 1975. Diazinon was applied to the golf course in June and August and presumably no further application was made between August and November. Three or four geese, it was learned, had died on the golf course immediately after the diazinon application and the authors suggest that the particular area where the second die-off occurred received an accidental over-application, or a spill, or received high concentrations from rain or sprinkler water runoff. Grass found in the mouth of one bird showed a concentration of 20 ppm of diazinon. Determination of brain cholinesterase (ChE) activity for the 14 dead geese shipped to the Denver Wildlife Research Center revealed the average ChE activity to be about 69% less than their controls which consisted of 25 apparently normal (hunter killed) Canada geese shipped from Missouri to Denver. The authors suggest that when geese or other birds die under circumstances such as these, anticholinesterase pesticides should be considered as a possible cause of death and that so-called "short-lived" compounds may cause mortality of birds months after their last application.

(Additional information on birds in urban areas is contained in references 3, 15, 20, 35, 42, 142, 146, 150, 187, 194, 201, 223, 235, 281, 285, 315, 372, 382, 415, 428, 429, 432, 436, 438, 441, 451.)

C. Mammals

Barkalow, F. S. Jr., and Monica Shorten. (137)

1973. The world of the Gray Squirrel. J. B. Lippincott Company, Philadelphia and New York. 160 pp. Illustrated.

A popular but informative book on the gray squirrel, its life history, habits, habitat, and management. Certain comparisons are made with other squirrel species. Information is drawn from research in the United States and England. A chapter entitled Squirrel and Man provides some information on squirrels in urban areas.

Beck, A. M. (138)

1973. The Ecology of Stray Dogs: A Study of Free-Ranging Urban Animals. York Press, Baltimore. 98 pp. (Out of print.)

Beck estimated there were from 32,400 to 54,000 free-ranging dogs in Baltimore's 72 square-mile area in 1970-71 constituting about one-third to one-half the total estimated dog population of that city in which the human population was approximately 900,000. During summer, free-running dogs, including some house pets released by owners for only part of the day, were seen most frequently in the mornings and evenings and in alleyways. People who walked their dogs did so primarily on pedestrian pathways and tree areas adjacent to streets, which areas received a heavy fecal load from pet dogs. Some active predation apparently occurred on rats in city alleys and on birds in urban wooded areas but dogs found their food chiefly in garbage and human handouts. Overturned garbage cans make food easily available to rats and increase costs of garbage collection. Rats feed to some extent on dog feces calculated to be deposited at the rate of 3 to 11 tons daily per 100,000 dogs. Dog feces also attract roaches and flies and may be a source of Salmonella infection in man. Feces are a source of nematodes and other worms which can infect man. Rabid dogs can be a problem, also.

Beck states that residents of Baltimore fear rat bites more than they do dog bites although there were only 32 rat bite cases reported in 1970 and 54 in 1971 compared with 6,023 and 6,809 dog bites reported during those same 2 years. Many of the bites were by free-ranging dogs to children, particularly in the summer.

The author observed that most people found free-roaming dogs objectionable but that most regulations to control dogs are directed against dog owners who fail to meet responsibilities in caring for their dogs, rather than the dogs themselves. He suggested that urban animals provide insight into the effects of urbanization on man, i.e., as indicators of stress, pollution, and environmental deterioration and as models for behavioral adaptations to urban life.

Beck, A. M. (139)

1974. The ecology of urban dogs, pp. 57-59. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Beck reports (after Djerassi, C., A. Israel, and W. Jockle. 1973. Planned Parenthood for Pets? Bull. Atom. Sci. Jan:10-19) that there are an estimated more than half of the Nation's 34 million "owned" dogs residing in cities and that nearly 38% of all households own at least one dog (av. 1.4)

which is one dog for nearly every six people. Beck estimated the number of free-running dogs (strays and straying) in Baltimore, Maryland during the early morning hours to be 450-750 animals per square mile. Recently there has been an increase in the popularity of the larger breeds of dogs partly because of their use for protection. In 1972 over a billion dollars of dog food, mostly animal protein, was sold in the United States. If the leash law were strictly enforced, it would be the most beneficial policy for both man and dog. No mention made of dogs as predators in cities.

Brown, L. G., and L. E. Yeager. (140)

1945. Fox Squirrels and Gray Squirrels in Illinois. Bulletin of the Illinois Natural History Survey, Vol. 23, (5):449-536.

A substantial report is given of a 4-year, statewide study of squirrels in Illinois. Compares habitat characteristics, population densities, movements, breeding biology, rearing of young, foods and feeding, nesting, hunting and management of the fox and gray squirrels and makes brief observations on squirrels in urban habitats where usually only one species is found in a municipality. The authors conclude that the gray squirrel is more exacting in its water requirements than the fox squirrel.

Cauley, D. L. (141)

1970. The effects of urbanization on raccoon (Procyon lotor) populations. The University of Cincinnati, Cincinnati, Ohio. M.Sc. 55 pp.

Cauley, D. L. (142)

1974. Urban habitat requirements of four wildlife species, pp. 143-147. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author gives a brief report on results of an urban wildlife study at Taylor, Michigan, a suburb of Detroit, with particular reference to the habitat used by the cardinal, blue jay, fox squirrel, and raccoon. Territories for cardinals ranged from 0.96 to 7.27 acres and for blue jays the average territory was 15.9 acres. A yearling female raccoon had a home range estimated to be 21 acres with den sites in a dead basswood tree and in a garage attic separated by a linear distance of about 1,050 feet. The home ranges of juvenile fox squirrels on the 159-acre study tract averaged slightly over 1.3 acres and for adults, about 5.3 acres. In more rural areas, a home range of 10 acres probably is more common. Squirrels were seen frequently moving between feeding areas along telephone cables; one animal denned in a chimney and another chewed through the eaves of a building to den in an attic. Seventy-six percent of

the people interviewed stated they liked and enjoyed having wildlife on their property.

Coman, B. J., and H. Brunner (Victoria, Australia). (143)

1972. Food habits of the feral house cat in Victoria. Journal of Wildlife Management 36(3):848-853.

From authors' abstract: "A total of 128 feral domestic cats (Felis catus) were collected from two different habitat types in Victoria. The stomachs of 80 of these cats contained food. Mammals, chiefly rabbits (Oryctolagus cuniculus), small murids, and phalangers, comprised some 88%, by volume, of the total dietary intake. Birds, cold-blooded vertebrates, and invertebrates were of secondary importance in the diet, accounting for 5.2%, by volume, of the total intake.... It appears that feral cats are opportunist predators and scavengers and that the level of predation on any one prey type will depend largely on its relative availability...."

Constantine, D. G., G. L. Humphrey, and T. B. Herbenick. (144)

1979. "Rabies in Myotis thysanodes, Lasiurus ega, Euderma maculatum, and Eumops perotis in California." Journal of Wildlife Diseases 15(2):343-345.

Authors' abstract: "Rabies is reported for the first time in bats of the species Myotis thysanodes, Lasiurus ega and Eumops perotis from California, and a second infected spotted bat, Euderma maculatum, is reported."

Bats submitted to public health laboratories to be tested for rabies viral infection are reported from Appel Hill, El Dorado County; Forks of Salmon, Siskiyou County; Thermal, San Jacinto, Indian Wells, and Palm Desert, Riverside County; El Centro and Calexico, Imperial County; Redlands and San Bernardo, San Bernardino County; Holtville, Imperial County; Spring Valley and Vista, San Diego County; Bishop, Inyo County; Sherman Oaks, Los Angeles County; and Porterville, Tulare County.

The authors state that there is a marked tendency to restrict laboratory testing to bats that have contacted persons or pets and that many of the bats tested are ill or dead when found. Although such samples contain a relatively high proportion of rabies-positive bats--about 10% in California--the prevalence of infection in unbiased samples is usually one-half of one percent or far less, with few exceptions. Most of the infected bats are characterized by a lack of aggressive behavior.

No mention is made of rabies infections in humans. Some of the bats submitted for testing were taken from cats and dogs. A southern yellow bat, a species not detected in the United

States until 1945, but now apparently relatively common and widespread in southern California, was removed from a swimming pool by a dog at Indio.

Davids, R. C. (145)

1978. Polar bears aren't pets, but this town is learning how to live with them. Smithsonian 8(11):70-79.

A good popularized account of the life history, physical characteristics, and behavior of polar bears with particular reference to their presence in and near Churchill, Manitoba, is given in this report. The author, who reports, in part, on scientific studies by Dr. Charles J. Jonkel of the University of Montana, states that despite the very real dangers of polar bears in a town like Churchill where they appear frequently, "Churchill residents wouldn't have it otherwise.... Churchill simply likes its bears." He states, page 77, that "Churchill is determined that bears and people coexist, and to that end there are slide shows and lectures at school, and next year a bear patrol of pupils who will check for the presence of bears before school dismisses. Phone directories list bear-alert numbers. At Halloween, to safeguard trick-or-treaters, volunteers ring the town in cars with shortwave radios. Garbage remains the major problem. Bears love its smorgasbord of smells and tastes."

Apparently, at present, bears that keep returning to town and refuse to be scared away are being killed, but plans are underway to confine the troublemakers in a Quonset hut next year until freeze-up at which time it is hoped they will take to the ice and feed on seals and other natural fare. Attempts to incinerate the garbage in Churchill were disrupted by bears climbing over the trucks and scaring the drivers away.

The author reports (page 77) that last fall the first polar bear tour flew along the coast (Hudson Bay) in helicopters and their enthusiasm for what they saw may prompt Canada to create one or more bear-watching towers expressly for tourists.

Some of the investigating scientists (Jonkel and Dr. Ian Stirling, the latter of the Canadian Wildlife Service) are reported to favor hunting where bear populations grow too dense for human safety or the bears' own food supply.

Eberhard, T. (146)

1954. Food habits of Pennsylvania house cats. Journal of Wildlife Management 18(2):284-286.

The author provides results of an analysis of 154 cat stomachs collected in Pennsylvania and classified as field cats and non-field cats. Thirty-two fecal samples from cats also were

analyzed. "Analyses of stomach contents and feces revealed that rodents, table foods and garbage, and possibly cottontail rabbits were the primary foods of field-hunting cats and that birds, shrews, insects, and other forms were secondary in volume and occurrence. Nonfield cats took very few birds and cottontails; their diet consisted mainly of table foods and garbage."

Feldman, B. M. (147)

1974. The problem of urban dogs. Science 185(4155):903.

This is an editorial by the Director, Pet Clinic, University of California, Berkeley. Feldman states that there are about 40 million owned dogs and that 46% of all American households have at least one dog, but the most serious urban dog problems are caused by dogs allowed to roam free. Costs of capturing and killing these dogs, plus costs of leash law enforcement, animal shelter services, and other related public and private activities come to about $450 million annually. In addition, free-roaming dogs, Feldman states, constitute an ecological and public health menace by (1) spreading disease, (2) biting, (3) causing road accidents, (4) creating nuisances and pollution, (5) causing property damage, and (6) destroying livestock and wildlife. He states the 500,000 owned dogs in New York City deposit about 150,000 pounds of feces and 90,000 gallons of urine each day on the streets. Relief from these and other problems, he believes, will require public education, leash law enforcement, and canine birth control.

Flyger, V. (148)

1970. Urban gray squirrels--problems, management, and comparisons with forest populations. Transactions of Northeast Fish and Wildlife Conference 27:107-113.

Author's abstract: "Urban squirrels (as other wild mammals) have advantages but often become numerous enough to be a nuisance. At present, the complaints of damage by wild animals is handled in a happenstance manner and an administrative machinery is needed to handle the situation. Urban squirrel populations may exceed those in the wild and they are characterized by many coat colors which are the result of genetic drift."

Flyger, V. (149)

1974. Tree squirrels in urbanizing environments, pp. 121-124. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Tree squirrels are found in the forested portions of urban communities throughout much of the United States--the gray

squirrels, especially in the southeastern States where they may attain densities of 5 or 6 animals per acre; red squirrels in the north, especially where conifers predominate; and fox squirrels in the west, midwest, and the south. Flyger points out that mature, uncrowded trees with large canopies provide excellent food and shelter and that forests in urban situations often are preserved in a near climax condition. He suggests that squirrel watching can be as interesting and absorbing as bird watching, and that one may have as many as 15 to 20 animals at one time at a squirrel feeding station.

Problems of squirrel damage are described. Flyger states that currently no agency wants to be responsible for urban wildlife problems, and he feels that urban wildlife management should properly include a person or agency to whom citizens can turn for advice on how to handle control and other management problems. He suggests that the fox squirrel might well be re-established in suitable habitat within its former range. He points out that squirrels in urban areas near universities provide teaching and research material for wildlife students.

Gysel, L. W. (150)

1961. An ecological study of tree cavities and ground burrows in forest stands. Journal of Wildlife Management 25(1):12-20.

Author's summary: "Measurements and observations of cavities in trees and logs, of ground burrows, and counts of leaf nests were made in four stands in the beech-maple type forest and in two stands in the oak-hickory type near East Lansing, Michigan.

"A large proportion of the cavities originated from limb scars in the tree crowns; others were caused by rot, lightning scars, and frost cracks. The most cavities occurred in unmanaged stands of the beech-maple type. A large proportion of cavity entrances in boles above the bases were 2 to 4 in. in diameter. The size of cavities in tree boles as indicated by horizontal cross-section diameters was larger in the unmanaged than in the managed stands. The vertical extent of a cavity was generally proportional to the horizontal diameter. Cavities at bases of trees were common only in beech-maple stands, generally in enlarged bases of large trees.

"Cavities in boles above the bases were most commonly used by fox squirrels and hole-nesting birds. Approximately half of the small number of large cavities were used by raccoons which were present in all beech-maple stands. Cavities in bases of trees were used primarily for temporary refuge by fox squirrels, raccoons, and mice. Burrows were most commonly used by red foxes and raccoons."

The author stated that starlings, nuthatches, and titmice nested in some of the cavities and that starlings were most

numerous in the unmanaged stands where there was the greatest number of cavities. Also, raccoons were most numerous in the stands having the largest number of suitable cavities, most of which occurred in sugar maple, beech and basswood trees over 20 inches d.b.h.

Improvement cuts in 1938 and 1948 had removed most of the trees classed as poor growing stock or cull in the "managed" woodlots so there was little rot or crown deterioration in the remaining trees.

Hoffmann, C. O., and J. L. Gottschang. (151)

1977. Numbers, distribution, and movements of a raccoon population in a suburban residential community. Journal of Mammalogy 58(4):623-636.

Authors' abstract: "A population of raccoons (Procyon lotor lotor) was studied in the village of Glendale, a suburban residential community near Cincinnati, Ohio. The 234.1-hectare (ha) study area is approximately 64 percent residential and 1 percent business district, with the remainder being woods and fields. There are approximately 1.1 people and 0.6 housing units/ha. Although Glendale is surrounded by other residential and industrial areas, it was an excellent habitat for raccoons.

"During the two-year study, 150 raccoons were live-trapped a total of 237 times. In addition, five raccoons were radio-tracked an average of 13.2 nights each. One hundred and sixty raccoons were estimated present on the study area in 1973-74, a density of one raccoon per 1.46 ha. Raccoon density was higher in the northern section of the study area than in the south due to (1) the character of the surrounding areas, and (2) the better habitat offered by wooded areas, garden plots, and available water. The average trap-determined 'minimum home range' for 46 raccoons was 5.1 ha and the mean greatest distance traveled for 94 raccoons was 391.5 meters (m). The 'minimum home ranges' averaged 5.5 times as long as wide. Radio telemetry showed that animals used linear travel routes going to and from the feeding areas. The comparatively small and narrow home ranges are attributed to high population density, an abundance of food, and the linear components of an urban habitat."

Raccoons released from live-traps used seven different types of refuge sites: sewer systems or drainage tiles; abandoned houses, garages, garage-barns, and greenhouses; ground dens; hollow trees; churches; open trees; and residential homes. The 10 seeds found most abundantly in fecal samples were cherries (black, pin, and sour); hackberries; grapes; bumelia; woodbine; rose; firethorn; dogwood (two types); plum; and buckthorn. Animal remains included many small mammal parts,

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e.g., eastern cottontail rabbit and Norway rat; snail shells; beetle parts; crayfish parts; bird egg shells; fur; and feathers. Cellophane wrappers, string, paper, aluminum foil, bits of plastic, and other material, in the droppings indicated that the raccoons were eating garbage also. The home range diameters were shorter and the home range areas smaller for the Glendale raccoons than found in a population of wild raccoons in Michigan. The authors found that generally adult and yearling males had larger home ranges and moved greater distances than the other components of the population. However, yearling raccoons traveled farther than adult animals and yearling females had larger home ranges than adult females. The authors hypothesize that range size difference is because yearling animals, newly independent from their mothers, must move to less densely populated areas to find a suitable range and females may mate and rear young their yearling year, whereas males do not. The estimated population density of one raccoon per 1.46 ha in the study area is one of the highest raccoon densities published.

Lay, D. W. (152)

1942. Ecology of the opossum. Journal of Mammalogy 23(2):147-158.

Lay reports on an ecological-life history study of the opossum (Didelphis virginiana L.) in an undisturbed part of Tyrrell Park, 5 miles southwest of Beaumont, Texas. Live-trapping in 86 acres of flat coastal pine-hardwood with 26 traps for 24 months revealed 117 opossums which were taken 378 times. Twenty-nine of the opossums visited three or more stations and had an average home range of 11.5 acres. A population density of one opossum to 4 acres was estimated for the 86-acre study plot. Stomachs from 16 opossums collected in September contained, by volume, insects and worms, 45%; fruit, 11.8%; green leaves, 11%; trash, 10.6%; mammals, 7%; acorns, 4.7%; birds, 4.3%; crayfish, 3.3%; snails, 0.75%; and traces of grasses and cellophane.

McKinnon, J. G., G. L. Hoff, W. J. Bigler, and E. C. Prather. (153)

1976. Heavy metal concentrations in kidneys of urban gray squirrels. Journal of Wildlife Disease 12(3):367-371.

Authors' abstract: "Concentrations of lead and zinc in the kidneys of 180 urban gray squirrels were determined by spectrophotometry and found similar for all age groups; however, concentrations of cadmium increased up to two years of age. Values for 12 rural squirrels were significantly lower than those of the urban animals. There were no differences in mean concentrations of the metals when urban squirrels were grouped by the land usage pattern of the sites in which they were

captured. Grouping squirrels by human socioeconomic strata for the city revealed that squirrels in low socioeconomic areas have significantly higher levels of lead than animals residing in middle or high socioeconomic areas."

McMurry, F. B., and C. C. Sperry. (154)

1941. Food of feral house cats in Oklahoma, a progress report. Journal of Mammalogy 22(2):185-190.

From authors' summary: "Laboratory analyses of 84 Oklahoma house cat stomachs revealed three main foods; namely, insects, mammals, and garbage. Reptiles and birds were minor items.

"Insects contributed 17 and 25 percent, respectively, to the food of cats collected on the Wichita Mountains Wildlife Refuge and in the residential section of the Fort Sill Military Reservation, but much less to the diet of cats from other sections.

"Mammals, chiefly rodents, composed from a half to four-fifths of the food of the cats in each habitat group except those collected in the residential areas on Fort Sill where they made up only 10 percent of the diet.

"Garbage formed two-thirds of the food of cats collected in the residential areas of Fort Sill. In other environments, it was from 10 to 16 percent of the food....

"Birds comprised 6.5 and 6 percent, respectively, of the food of cats taken in the residential district of Fort Sill and of those obtained here and there along highways of the State.... Cats of residential areas and those frequenting roadsides appear to be a greater menace to birds than cats hunting in open fields or woods. The data at hand, however, indicate that the prey of cats consists largely of the most abundant and available forms and do not justify the common belief that every roadside or field-roaming cat is in search of avian food."

The authors concluded that amphibians, apparently, are rarely devoured by cats but lizards are frequently consumed.

Parmalee, P. W. (155)

1953. Food habits of the feral house cat in east-central Texas. Journal of Wildlife Management 17(3):375-376.

The author reports on the qualitative analysis of 31 stomachs of feral house cats collected in the central post oak region of east-central Texas. Based upon frequency of occurrence within the stomachs of these cats, the cotton rat was found most frequently--13 stomachs, followed by insects, principally

grasshoppers and black crickets--9; cottontail rabbit--4; house mice--4; hispid pocket mouse--3; white-footed mouse--2; domestic chicken--2; little brown skink--2; grass--2; and bobwhite quail, red-winged blackbird, rough green snake, fence lizard, and racerunner (Cnemidophorus sp.)--one each. One stomach contained bread. The cats were collected in a rural area, presumably.

Ryan, D. A., and J. S. Larson. (156)

1976. Chipmunks in residential environments. Urban Ecology 2:173-178.

Authors' abstract: Chipmunks (Tamias striatus) were observed at residential houselots near Amherst, Massachusetts. Activity was highest in spring and fall, and lower in midsummer. This summer lull was absent where man-supplied food sources were available. Chipmunks were observed in wooded areas, as expected, but mown lawn and other open areas, such as driveways, were seldom used unless broken by trees and shrubs. Chipmunks were frequently observed at houses, in home roof and drainage systems and around man-made physical structures such as stone walls and debris piles. Man-supplied food sources were heavily utilized at several houses, greatly increasing the number of sightings. The horizontal visibility of commonly used perches was found to be relatively unobstructed but not completely open."

This publication apparently was based in large part upon a M.Sc. thesis by D. A. Ryan entitled Chipmunks (Tamias striatus) In Selected Residential Environments, University of Massachusetts, 1974, 37 pages. The thesis is said to contain more discussion of potential management approaches but it appears that stone walls, debris piles, wood and brush piles, fallen logs, stumps, the presence of trees and shrubs on lawns, and feeding by man are means of attracting chipmunks to and increasing the sightings of these animals in residential areas.

Schinner, J. R. (157)

1969. Ecology and life history of the raccoon (Procyon lotor) within the Clifton suburb of Cincinnati. University of Cincinnati, Cincinnati, Ohio. M.Sc. thesis. 60 pp.

Schinner, J. R., and D. L. Cauley. (158)

1974. The ecology of urban raccoons in Cincinnati, Ohio, pp. 125-130. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Results of a study of raccoons within the Clifton suburb of Cincinnati, Ohio, 1967-70, are discussed. Home ranges are less than those for nonurban raccoons and are calculated to be

20.7 acres for juveniles and 11.5 acres for adults. Urban raccoons which have a readily available and permanent food supply (garbage) do not have to alter their activity patterns as much as nonurban raccoons. Population levels of raccoons in the Clifton suburb varied from one raccoon per 1.4 acres to one raccoon per 23 acres. The wooded area had an adequate number of natural dens but the animals also used attics, garages, and sewers for denning. Although dogs accounted for the death of eight raccoons during the study, and may be a constant drain on the urban raccoon population, the authors doubt that dogs have a controlling effect. Canine distemper reduced the population in the fall of 1968.

Sharp. W. M., and L. H. Sharp. (159)

1956. Nocturnal movements and behavior of wild raccoons at a winter feeding station. Journal of Mammalogy 37(2):170-177.

From authors' summary: "A study of the nocturnal activities of a wild population of raccoons was conducted during the winter months of 1940-41; 1941-42; and 1942-43....

"Raccoons demonstrated acute senses for detecting approaching danger on calm nights. Windy nights appeared to impair this ability.

"The majority of the population had fed and departed prior to midnight. A wary segment of the population arrived between 1:30 and 3:30 AM....

"A form of social order existed in the population. This behavior enabled the various segments of the society to share the same source of food (corn at winter bird feeding station). Threatening or intimidating gestures were displayed when necessary to gain acceptance to feed grounds.

"The population was active throughout the winter months during mild weather.

"Temperatures and winds were controlling factors limiting nocturnal activity. Thermometer readings at 24°F. or below caused the adult population to 'lay up' in semi-hibernation. Cub coons were inclined to be abroad on nights when the cold was too great to be tolerated by adults. Winds affected movements noticeably. Warm winds approaching 8 to 10 m.p.h. caused the population to become erratic. Stronger winds curtailed early-night visitors and eliminated the after-midnight visitors.

"The population possessed an acute ability to foretell storms. Approaching cold fronts were detected by the adults at least 48 hours in advance."

Thus, raccoons, as well as squirrels, may share corn and other food at bird feeding stations, especially if placed on the ground for such species as pheasants. People who may enjoy observing the feeding raccoons can do so by using the beam from a three-cell flashlight.

Shoesmith, M. W., and W. H. Koonz. (160)

1977. The maintenance of an urban deer herd in Winnipeg, Manitoba. Transactions of North American Wildlife and Natural Resources Conference 42:278-285.

The authors state that over one-half million people and 200 white-tailed deer cohabit the greater Winnepeg area on what is largely private land but that only careful city planning and management of green areas will insure that some free-ranging deer, as well as many other species of wildlife, will continue to exist in urban Winnepeg. Primary attention in the paper is given to the largest concentration of deer in the Tuxedo-Charleswood area of southwest Winnepeg. The deer population in this area was about 100 from 1971-73. The herd was reduced by 33% during the severe winter of 1973-74 but, after two successive years of mild winter weather, had built up to at least 150 deer or 30 deer/km^2. Immigration-emigration of individuals is thought to occur along the Assiniboine River which runs through the northern part of this portion of Winnepeg but man-made barriers such as fences, buildings, and heavily used streets probably prevent much exchange of deer, i.e., the Charleswood deer herd is largely sedentary.

The city deer densities are as high or higher than densities anywhere in Manitoba, due in part to close association of winter cover to readily accessible food sources. In addition to native foods such as snowberry, red-osier dogwood, chokecherry, rose, and bur oak, the deer have access to sugar beet tailings left in fields, waste hay and grain around riding stables, waste hay at a garbage dump, and concentrated alfalfa pellets and powder near a processing plant where they feed in winter.

During the periods October to early December and in March-April, especially, vehicles on city streets constitute the greatest single mortality factor. Although dogs cause the loss of several deer annually, they are not considered to be a significant mortality factor. Harassment by people and some illegal shooting occur.

The authors state that providing habitat requirements for song birds in a city is much more easily done than providing the same for deer. They believe, however, that despite plans for more commercial development, street, highway and railway construction, a herd of 25-30 free-ranging deer can be retained in the Assiniboine Forest alone. They state: "On-site management of Assiniboine Forest will include: (1) maintaining a

major portion of the forest from visitor use; (2) fencing to restrict people and dogs but to allow access to deer and other animals; (3) fencing to prevent deer-vehicle accidents on major streets and freeways; (4) developing existing habitat to provide a stable natural food supply; (5) creating an Assiniboine Forest Advisory Committee composed in part of wildlife managers to advise the city on specific wildlife management problems; and (6) providing for removal of surplus deer through line-trapping and transplanting whenever deemed necessary."

The authors point out that deer have persisted in Winnipeg despite a 90% loss of habitat and that the deer herd can be used by resource managers to illustrate to decision makers the use of this resource and to the general public the effects of various ecological and biological factors operating on any deer herd in the province.

Sonenshine, D. E., and E. L. Winslow. (161)

1972. Contrasts in distribution of raccoons in two Virginia communities. Journal of Wildlife Management 36(3):838-847.

From authors' abstract: "A study was undertaken comparing populations of raccoons (Procyon lotor) in two natural areas of Virginia, one at Montpelier in the Piedmont physiographic province near Richmond and the other in the coastal plain at Newport News.... Density estimates suggested that the Montpelier study area was only average raccoon habitat (one raccoon per 14.3 acres). Although a mathematical estimate of density was impossible for the Newport News study area, a comparison of other factors suggested a higher density than at Montpelier. Trap-reflected distribution in both areas was found to be nonrandom. At Newport News, the animals were concentrated along the shoreline with few upland captures during all seasons. At Montpelier, two concentrations of raccoons were observed, one along the water's edge, the other 800 to 1,000 feet upland. The data suggested that these are two behaviorally distinct groups. A comparison of food consumption in the two areas revealed that raccoons at Newport News were consuming mostly native foods; namely, insects found in the water and rotten logs in lowland areas adjacent to the shorelines. At Montpelier, the main food consumed was found in upland fields."

Stapanian, M. A., and C. C. Smith. (162)

1978. A model for seed scatterhoarding: coevolution of fox squirrels and black walnuts. Ecology 59(5):884-896. Copyright (1978) by Duke University Press.

From authors' abstract, p. 884: "Granivores are likely to store food in numerous, widely scattered, small caches if they are unable to defend concentrated large caches against

interspecific competitors. This scatterhoarding of seeds makes it impossible for individuals to defend all their scattered caches against intraspecific competitors as well. Optimum spacing of scattered caches should result from a balance between decreasing loss of caches to naive competitors with decreasing density and increasing cost of storage with decreasing density. A mathematical model predicting optimal density is presented." Note: this constitutes less than one-third of the authors' abstract.

This reference is included here because field observations of the scatterhoarding of black walnuts by fox squirrels in a relatively open Manhattan, Kansas cemetery were described as being easier to make than in a woodlot; it documents use of urban cemeteries by fox squirrels and the potential use of cemeteries for research; and it presents interesting facts and hypotheses concerning squirrels. For example, it points out that rather than larderhoarding or storing seeds in a large cache as is done by the red squirrel (Tamiasciurus sp.) with conifer cones, the fox squirrel's system of burying individual nuts probably reduces the squirrels' competition from other animals. The authors' studies suggest that fox squirrels maintain an optimum density of buried nuts which balances increasing costs of carrying nuts against decreasing probability of losing the nuts to competitors such as deer, wild turkeys, raccoons, jays, and woodpeckers. The authors observe that squirrels are both predators and dispersal agents for walnuts and that before starting to bury nuts they eat a large fraction of the crop while it is ripening on the tree. They note also that the five squirrels observed in the cemetery buried nuts in areas that were nearly mutually exclusive for the burial. The apparent optimum caching density of nuts for squirrels and the spacing of black walnut trees in orchards as suggested in the literature for maximum nut production were in surprisingly close agreement.

Sunquist, M. E. (163)

1967. Effects of fire on raccoon behavior. Journal of Mammalogy 48(4):673-674.

An automatic radio tracking system was used to obtain quantitative data on movements and behavior of four raccoons (adult female and three yearling male offspring) at 15-minute intervals for 4 days before a controlled burn, the day of the burn, and the four days following. Twenty-four acres of savanna habitat common to the home ranges of the raccoons in east-central Minnesota were burned. The entire family traveled together 1% of the time; three animals traveled together about 8% of the time; two animals traveled together about 23% of the time; and four animals traveled alone about 68% of the time. Young animals made up the traveling groups of two and three. Each animal spent the diurnal resting

period alone except for 1 day when two young rested together. The four animals used a common area of approximately 110 acres in this 9-day period. Individual home ranges varied from 158 to 236 acres. Although there was a reduction in use of the area for hunting food following the burn, raccoons continued to travel through the burned area.

Toner, G. C. (164)

1956. House cat predation on small mammals. Journal of Mammology 37(1):119.

The author reported on small mammals brought to his house on a farm in Haliburton County, Ontario by an emasculated male and a female (while nursing young) cat. The cats were fed one and one-half ounces of canned food each daily but preferred to catch their own food. Meadow-mice were the mainstay of the cats from late April to early December; the male cat brought in two or three each day. Chipmunks were abundant on the farm and Toner reported counting 148 which were brought to the house between late August and early December 1952. Other mammals taken included the shrew (Sorex cinereus), star-nosed mole, northern flying squirrel, red-backed mice, meadow jumping mice, and woodland jumping mice. Although Toner indicated that birds were numerous in the summer and easily caught when learning to fly, the cats did not bring them in and Toner believed few were taken.

Tyson, E. L. (165)

1950, Summer food habits of the raccoon in southwest Washington. Journal of Mammology 31(4):448-449.

Stomachs of 20 adult and 9 young raccoons (Procyon lotor psora) collected on the Willapa Harbor National Wildlife Refuge in Pacific County, Washington, except for milk contained in some still suckling young, and except for some traces of grass taken perhaps adventitiously, contained, almost entirely, tidewater and mudflat animals--molluscs, crustaceans, fish, and worms. This is in contrast to the food of raccoons in other parts of the country where usually much plant material is consumed.

(For more information on mammals see references 12, 15, 20, 35, 42, 124, 285, 427.)

D. Fish

Brocksieper, I. (166)

1977. The ecology of the Rhine: Expert opinion on the Rhine by the Council of Specialists on Environmental Problems. Decheniana 130:266-267. (In Ger.) *

"In this densely populated and economically important area, the river is polluted by traffic, recreational activities and industry. Noise and air pollution were discussed. The present day ecological situation was compared with that of 1800, especially the effects of building operations and river navigation. Comparison of the fauna lists between 1915-1971 shows that indicator organisms for strongly and excessively polluted water have continuously increased. There were substantial decreases in migratory fish populations (salmon, shad, etc.). In their place, whitefish, eels and other small species still inhabit the stream."

Carl, L. M., J. R. Ryckman, and W. C. Latta. (167)

1976. Management of Trout Fishing in a Metropolitan Area. Michigan Dept. of Natural Resources, Fisheries Division. Fisheries Research Report 1836. 29 pp.

Authors abstract: "Rainbow trout of legal size or larger were stocked in a 5-mile length of the Huron River, Oakland County, Michigan, where conditions of flow and temperature are favorable for trout only during the spring months. Special fishing regulations were enacted. For April and May only artificial flies could be used and all trout caught had to be released. In June, bait was restricted to flies or other artificial lures, the creel limit was two trout, and the minimum legal size was 10.0 inches. Between July 1 and September 30, natural bait or artificial lures could be used, the creel limit was five trout and the minimum size was 10.0 inches (normal state-wide trout regulations). From April through September trout anglers fished 10,411 hours in 3,297 trips. Sixty-four percent of the fishing took place in April and May. A total of 5,706 trout were caught. Each fish was caught approximately 2.35 times. Fishermen spent an average of $10.92 per trip. Total benefits for the program were $37,375 and the total expenses were $3,708, giving a benefit-to-cost ratio of 10.1 to 1. The mean personal income of the anglers was $14,570, well above the average. Fishermen traveled an average of 50.4 miles for each fishing trip. The program was successful in utilizing hatchery trout efficiently to provide fishing in an urbanized area."

It should be noted that trout fishing in the seven-county metropolitan area of southeastern Michigan, which contains 54% of the 9 million people in the State, is scarce. Currently, only three or four small streams are considered capable of sustaining trout the year around and the closest streams that can provide quality trout fishing are 150 to 200 miles north of the metropolitan area. Hence, utilization of the nearby Huron River in Oakland County, where conditions are suitable for trout in the spring and early summer, in the manner described, seems commendable.

Dietemann, A., and A. Sanderson, Jr. (168)

1978. The fishery of the Piedmont Potomac, pp. 70-75. In The Freshwater Potomac: aquatic communities and environmental stresses. (For complete citation see reference 330.)

The authors provide a brief review of the diverse fish life found in the Piedmont Potomac, including a list of species reported in the River and tributaries from Washington, D.C. to the Monocacy River. They comment on fish habitat and harvest. They state that municipal water supply withdrawals have already exceeded the low river flow on record of 388 million gallons per day (16.8 m^3/sec) for the Potomac River. They observe that preservation of the present diverse fish life will depend largely upon increased environmental awareness by public officials, enforcement of existing laws, careful regional planning, and stricter programs for control on nonpoint sources of water pollution. Among problems of water quality control associated with urbanizing areas and agricultural runoff which must be resolved, they list: continuing contamination of streams by sediments, pesticides, herbicides, fertilizers, heavy metals, petroleum residues, litter, road runoff and other toxic wastes in stormwater runoff. They note the flash flooding effects in small streams caused by storm drains, channel improvements, and others, and state that local detention or retention of storm water is needed in many Washington area storm water drainage systems. They suggest that government agencies should encourage on-site use of storm water wherever possible and that collection of rainwater from roofs and parking lots and infiltration-recharge of the groundwater by using seepage basins, dry wells, and porous pavements is both economically and environmentally desirable.

Dillon, O. W., Jr., W. W. Neely, V. E. Davison, and L. V. Compton. (169)

1971. Warm-water fishponds. U.S. Department of Agriculture, Farmers' Bulletin 2250. 14 pp. U.S. Government Printing Office, Washington, D.C.

This bulletin discusses the temperature ranges for warm-water, cool-water, and cold-water fishponds then proceeds to give suggestions and recommendations for warm-water fishponds including selection of site, with comments on size of pond, water supply, and water depth; building the pond; stocking the pond; water quality; fertilizing; controlling waterweeds; fish die-offs; and fishing the pond.

Duttweiler, M. W. (170)

1975. Urban Sport Fishing: a review of literature and programs. New York Cooperative Fishery Research Unit--Cornell

University, U.S. Fish and Wildlife Service and N.Y. State Dept. of Environmental Conservation cooperating. 52 pp.

From author's Summary and Conclusion (p. 40): "Many center-city residents lack opportunity for outdoor recreation. Sport fishing is one outdoor recreation activity that can be adapted to the urban setting.

"The Bureau of Sport Fisheries and Wildlife (now U.S. Fish and Wildlife Service) and 43 states have been involved with some form of urban fishing. However, the bulk of urban fishing programs to date have had local sponsorship.

"Urban fishing programs include stocking urban waters, urban access programs, fishing piers, kids only fishing, fishing derbies, fishing day camps, swimming pool fisheries, senior citizen's fishing, fishermen's clinics, fisheries interpretive services, fee fishing, and more.

"Careful consideration should be given to fishing experience provided, economic limitations, site location, species selection, and the sociological characteristics of the target population. Key problems with past urban fishing programs centered on funding, planning, coordination, failure to use appropriate personnel, program publicity, and program evaluation.

"Urban fishing programs are increasing rapidly and should continue to do so in the near future. A large share of the support and operation of urban fishing will be from local sources, but, state and federal agencies should provide technical, personnel, and financial assistance whenever possible...."

Points out that most of America's large cities are located on some form of waterways that offer much potential recreational opportunity but lack of public access and extensive pollution often destroy this potential.

This report is a useful review of urban fishing literature and programs in which 95 references are cited. Among the various types of urban fishing programs, a survey by the New York Cooperative Fishery Research Unit indicated 74% of the States participated in stocking urban waters; 59% in park-pond fisheries; 41% in "kids-only" fishing; 39% in urban-area access programs; 33% in fishing derbies; and 26% in fishermen's clinics.

Duttweiler, M. W. (171)

1975. Analysis of demand for sport fishing: past approaches and their applicability to urban fishing. Report 1 of 3 reports dealing with Methodology for evaluating urban fishing programs. New York Cooperative Fishery Research Unit, Cornell University, Ithaca, N.Y. 19 pp.

Author's abstract: "Currently available research methods for assessing sport fishing participation, financial benefits, intangible benefits, and angler motivations were reviewed to determine their applicability to urban fishing programs. Serious limitations existed for directly adapting most such methodology to urban sport fishing. Existing research provided general program evaluation guidelines, but specific techniques for urban programs need to be developed independently." Fifty eight references were cited.

The author suggested that direct evaluation of current participation in the urban center, conducted over periods of time with subsequent trend extension, may be the most suitable means for predicting participation levels in urban fishing programs. He pointed out that few studies have assessed fishing participation in individual urban areas and that accurate assessment of participation, including detailed information on frequency and duration of visits, site selection, travel involved, and others, should be a primary component of any urban fishing program evaluation. He observed that fishery managers are being called upon, increasingly, to manage sport fishing recreation rather than simply to manage sport fisheries. In the past, recreation specialists, apparently like fisheries managers, have not often considered urban areas as prime sites for outdoor recreation.

Duttweiler, M. W. (172)

1975. General applications of recreational analysis techniques to urban sport fishing. Report 2 of 3 reports dealing with Methodology for evaluating urban fishing programs. New York Cooperative Fishery Research Unit, Cornell University, Ithaca, N.Y. 21 pp.

Author's abstract: "General advantages and disadvantages of mail questionnaires, personal interviews, direct observation, telephone surveys, and self registration were reviewed and possible applications to urban fishing programs were outlined. It was concluded that no single technique could provide all information required for extensive program evaluation. Combinations of techniques appeared to be necessary to evaluate thoroughly component elements of an urban program."

The author stated that an evaluation should include assessment of reactions to what is currently being provided in an urban fishing program, such as fish species, numbers of fish, access and fishing information, and assessment of angler preferences. He suggested that a mail questionnaire based on a general population sample might be used to assess preprogram participation and to gain insights to the preferences of both participants and potential participants, allowing adaptation of the program to the urban residents under consideration. He felt that a postfacto population survey would be useful not only for assessing direct effects of an urban program but could also

yield information from persons who were not reached on the initial survey. Examples of creel census applied to urban sport fishing were cited. He believed a combination of personal interview and creel census might provide on-going feedback while an urban program is in operation. Direct observations, he believed, would provide additional channels of instant feedback during the operation of urban programs and he suggested that information useful in identifying problems or highpoints of a program could be obtained by providing the recreationist with an opportunity to provide voluntarily information about himself and his fishing experience through a "suggestion box." He stressed the importance of reporting findings of the evaluations regardless of the evaluative techniques used. Fifty three references are cited, many of which deal with techniques but some with descriptions of programs.

Duttweiler, M. W. (173)

1975. Recommendations for evaluation of key elements of urban sport fishing programs. Report 3 of 3 reports dealing with Methodology for evaluating urban fishing programs. New York Cooperative Fishery Research Unit, Cornell University, Ithaca, N.Y. 21 pp.

Author's abstract: "Evaluative approaches were outlined for key elements of urban sport fishing programs including: participation, limiting factors on participation, transference of recreational effort, angler motivations, benefits to anglers, success of program components and others. It was concluded that the purposes and resources of individual fishing projects largely determine what aspects actually are evaluated and in what manner."

Part 3 was more closely related to possible approaches and strategies for evaluating specific aspects of urban sport fisheries than Parts 1 and 2. All three parts dealt with methodologies for evaluating urban sport fishing rather than with the management of the fisheries. Many suggestions included in Part 3 should be of value to fish managers and others interested in preparing questionnaires or taking other approaches to measure participation in fishing programs and learn about the benefits, strengths, and weaknesses of such programs. For example, the author cautioned that evaluation procedures should allow for time lag in effects and that simple measurement of participation will not yield an indicator of new fishing activity generated unless there is a measurement, also, of participation transferred from other nonurban sites as a result of the urban program. In obtaining information on fishing he stated that input was needed from children, elderly people, and potential fishermen in addition to licensed fishermen.

Among the factors he listed as having an influence on the

recreational appeal of urban fishing sites were: ease of access, convenience of location, public safety, information available, use by others, level of pollution, fish species present, size of fish present, scenery, supplemental facilities present, fishing success, calmness of water, publicity, times available, competition from alternative fishing sites, and competition from alternative leisure activities. There was some discussion of program benefit assessment from the standpoints of benefits to the individual angler and of cost: benefit analysis. Fifty one references were cited including some listed in Parts 1 and 2 of this very useful report.

Edwards, G. B. (174)

1977. Evaluation of management alternatives for small desert lakes. Arizona Statewide Investigations Project F-14-R-11. Final Report, 4 pp.

Author's abstract: "Two subspecies of largemouth bass, Micropterus salmoides salmoides and Micropterus salmoides floridanus were evaluated to determine their suitability for utilization in an urban fishing program. Both subspecies were stocked in a 4-acre urban park lake. They received fishing pressure from a restricted group of anglers and were monitored through electrofishing.

"M. s. salmoides exhibited greater growth potential and was more vulnerable to angling than M. s. floridanus. If either of these two subspecies were to be used in an urban fishing program, M. s. salmoides would be the more desirable."

The author reports that angling was permitted in the lake located in Papago Park--a public park administered by the City of Phoenix--only during the periods when the Phoenix Zoo was closed to the public. During the 9 months that angler use was recorded, 133 angling man days totaling 471 fishing hours were expended. The author states that the offer of a $25 savings bond to the angler catching the bass bearing a selected tag number failed to stimulate additional usage, presumably due to the restricted hours for fishing. Participating anglers caught 233 bass, for a bass-per-hour rate of 0.49.

Edwards points out that the goal of urban fishing is not just to provide fishing opportunity but also an acceptable degree of fishing success. From the standpoint of catchability he believes the northern subspecies of largemouth bass, being more susceptible to angling, would be preferable to the Florida subspecies. However, he questions whether even M. s. salmoides is suitable for stocking the typical small urban impoundment because such waters would have to be stocked regularly and using current fish culture practices, largemouth bass cannot economically be raised for this purpose.

Hammond, D. L., and D. M. Cupka. (175)

1977. An Economic and Biological Evaluation of the South Carolina Pier Fishery. South Carolina Marine Resources Center, P.O. Box 12559, Charleston, S.C. 29412. Technical Report 20, 14 pp.

The authors state that the South Carolina pier fishing industry is located mainly along the Grand Strand area which extends from the North Carolina line southward to Georgetown, South Carolina, and includes Myrtle Beach and Murrells Inlet; thousands of anglers visit the 11 or more piers weekly, many from out-of-state and noncoastal areas of South Carolina; and easy access to a fishing site and "the usual willingness of the spot (Leiostomus xanthurus) to bite a baited hook are the chief contributors to the popularity of the South Carolina piers." Business closely follows the pulse of the area's tourism; during the summer many piers remain open all night; there is a wide selection of baits and fishing equipment available; and snack bars or restaurants are usually available at the piers.

At four piers surveyed, out-of-state people accounted for 57.2% of the anglers, in-state people 26.3%, and local residents 16.5%. Information is provided for these three groups on length of stay, number of trips, expenditures, and other data. Of 1,751 anglers interviewed, 72% caught at least one fish and 39% of the fish were either thrown back or given away. With respect to expenditures of the anglers, of every dollar, approximately 75 cents went to lodging and food establishments, 7 cents to the petroleum industry, and 18 cents to the fishing industry for pier admission fees, and the sale of bait and tackle.

A total of 58 species representing 28 families were documented as entering the landings of the pier fishery. Twenty-five of the species were noted food fish. Four families of fish--the drums (Sciaenidae), the jacks (Carangidae), the bluefishes (Pomatomidae), and the sea catfishes (Ariidae)--accounted for over 96% of the fish harvested, with the drums constituting 85.8%.

The authors state, page 13, "Pier anglers injected $2.4 million directly into the local business economy. Of this amount, $1.3 million can be directly attributed to the presence of the pier fishing industry."

Hammond, D. L., D. O. Myatt, and D. M. Cupka. (176)

1977. Evaluation of Midwater Structures as a Potential Tool in the Management of the Fisheries Resources of South Carolina's Artificial Fishing Reefs. South Carolina Marine Resources Center, P.O. Box 12559, Charleston, S.C. 29412.

Technical Report Series 15, 19 pp.

The authors report on the attractiveness to fish of midwater structures located in the immediate vicinity of a benthic (bottom) artificial reef composed of three steel hull vessels off the coast of South Carolina. The midwater structures each consisted of six automobile tires lashed together and suspended one above the other from a galvanized steel cable. The uppermost tire was attached to a hollow steel floatation element and the lower end of the cable to a block of concrete which served as an anchor. Specifications for the assembly are given.

The authors state that use of midwater structures in conjunction with an existing benthic reef proved a definite value in increasing the concentration and availability of baitfish and pelagic gamefish in the reef area. They suggest that use of such structures adjacent to a benthic reef allows an angler the opportunity to sample either or both the ground-fish and the pelagic species without one type of angling interfering with the other. Further studies into the design of midwater structures, their deployment and the feasibility and productivity of reefs composed entirely of these structures are recommended.

Ikeda, A. Y. (177)

1971. A study of the 1970 urban fishing program in the city of St. Louis, Missouri. University of Missouri, Columbia, Missouri. M.Sc. thesis. 93 pp.

A report on the Urban Fishing Program in St. Louis, Missouri--a cooperative project of the USDI Bureau of Sport Fisheries and wildlife, the Missouri Department of Conservation, and the St. Louis Department of Parks, Recreation, and Forestry, with some financial support from the St. Louis Sports Council. The program was initiated to provide outdoor recreational fishing experience for dwellers in the "inner" city of St. Louis. Five lakes in city parks were selected for study. The lakes, previously stocked annually with carp, black bullhead, channel catfish, and green sunfish, were stocked in 1970 with carp and bullheads only. A total of 140,487 fishing hours at the lakes was estimated, indicative of considerable interest on the part of inner city residents; 77.1% of the fishermen ate the fish they caught; about one-half walked to the lake; many of the fishermen were under 16 or over 60 years of age. Although there was no definite correlation between the Urban Fishing Program and the incidence of crime in the fishing lake areas, many local residents thought the program was socially helpful.

Klein, R. D. (178)

1979. Urbanization and stream quality impairment. American

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Water Resources Association. Water Resources Bulletin 15(3). 16 pp. (In press.)

Author's abstract: "A study was conducted in the Piedmont province of Maryland to determine if a relationship exists between stream quality and the extent of watershed urbanization. During the first phase of the study 27 small watersheds, having similar characteristics but varied according to land use, were investigated. Using these controlled conditions, eliminating as many interferences as possible, this first phase was intended to determine if a definite relationship did exist between the two factors. Finding that the first phase was successful, the second was initiated which consisted of a comparison of biological sampling data, from other studies, with degree of watershed urbanization. The purpose of this second phase was to ascertain if the relationship between degrees of urbanization and decline in stream quality was linear as watershed area increased and in streams spread throughout the Maryland Piedmont. The principal finding of this study was that stream quality impairment is first evidenced when watershed imperviousness reaches 12%, but does not become severe until imperviousness reaches 30%. (KEY TERMS: urbanization; impervious surfacings; benthos; fish; toxic substances; stream quality impairment; sediment; migration barriers; baseflow; storm water; temperature.)"

The author found that the greatest species diversity for benthic organisms was in streams in wooded control areas and that of 11 streams in which fish collections were made, Buffalo Creek, draining an agricultural watershed, had the greatest number of fish species. Five of the nine urban streams sampled were completely devoid of fish life and in three of the four urban streams where fish were collected the dominant species was the blacknose dace (Rhinichthys atralatus), a species that can tolerate a wide range of environmental conditions. He reported, also, that debris dams--accumulations of logs, brush, and litter, limit the extent of a stream available to spawning fish and interfere with the movement of migrating fish. Debris dams apparently are more common in urban streams than in streams draining natural watersheds.

Also discussed are sedimentation, runoff, baseflow, nutrients, and toxic substances in urban and nonurban streams. He suggested as options for reducing adverse effects of urbanization on stream quality: detention-retention systems, infiltration systems, treatment of storm water, and limiting of watershed development.

Klima, E. F., and D. A. Wickham. (179)

1971. Attraction of coastal pelagic fishes with artificial structures. Transactions of the American Fisheries Society 100(1):86-99.

Authors' abstract: "Artificial structures positioned off Panama City, Florida, during July 1969 proved effective in attracting commercial quantities of round-scad, Spanish sardines, and scaled sardines.

"The structures' position in the water column and their design were important in attracting fish. Midwater structures which resembled a small pup tent were effective in attracting up to 25 metric tons of fish and consistently attracted from 1/2 to 5 metric tons daily. SCUBA divers made visual estimates of the number of each species present at the structures. We discuss the behavior of the fish and present a possible explanation of why fish are associated with submerged structures."

Although this paper deals with coastal pelagic waters in the Gulf of Mexico off Panama City, Florida, it demonstrates the effects of floating and midwater objects (cover) in attracting fish. Apparently attraction was dependent upon the visibility of the objects and simple structures were more effective than complex structures. "Jacks," including amberjack (Seriola sp.), rainbow runner (Elagatis bipinnulatis), and blue runner (Caraux crysos) preferred surface structures. "Bait fish," including round scad (Decapterus punctatus), Spanish sardine (Sardinella anchovia), and scaled sardine (Harengula pensacolae) preferred midwater structures.

The authors point out the need for further study to determine the significance of a structure's vertical position and whether improving its visibility by changing size, color, or design would increase its attraction and holding ability.

Marcy, B. C., Jr., and R. C. Galvin. (180)

1973. Winter-spring sport fishery in the heated discharge of a nuclear power plant. J. Fish Biol. 5(4):541-547.

A substantial winter-spring sport fishery had developed along the 1.83-km heated discharge canal of a nuclear power plant. An estimated 3,166 fishermen caught an estimated 11,090 fish, representing 18 species, during a creel survey conducted from January through June, 1972. Of the canal fishermen, 87% were successful in catching one or more fish, and averaged 2.07 fish per rod-hour of effort. Fishermen averaged 1.08 fish per rod-hour and had a 61% success rate at other areas in the vicinity of the plant from April through November, 1965-1969. There was a correlation between the water temperature of the canal and the number of fish caught per rod-hour of effort."

Oates, D. (181)

1976. The effects of boating upon lead concentrations in fish. Trans. Kans. Acad. Sci. 79(3/4):149-154. *

"The concentration of Pb in fish (Micropterus salmoides, Lepomis macrochirus, Pomoxis nigromaculatus) muscle tissue from lakes where boating is heavy and where it is prohibited was measured. The Pb levels ranged from less than 0.05-1.35 ppm but did not differ significantly between those in the controlled and noncontrolled boating lakes. Pb levels apparently pose no public health hazard."

Sasaki, S., et al. (182)

1977. Recovery Plan for Unarmored Threespine Stickleback, Gasterosteus aculeatus williamsoni an Endangered Fish. California Dept. of Fish and Game, 49 pp. + appendices.

This report was prepared by the Unarmored Threespine Stickleback Recovery Team composed of S. Sasaki, J. N. Baskin, Ben Beall, J. A. St. Amant, and C. Swift assisted by M. A. Bell, Team Advisor, Natural History Museum of Los Angeles County, Los Angeles. It is a plan for the recovery of the unarmored threespine stickleback from the status of an endangered species to a nonendangered status. It involved input from the California Department of Fish and Game, California State Polytechnic University, the Natural History Museum of Los Angeles County, the U.S. Forest Service, U.S. Fish and Wildlife Service, and other agencies.

The authors state, page 5, "At present the only recognized G. a. williamsoni populations are confined to the headwaters of the Santa Clara River and its tributaries, in northern Los Angeles County. The areas in the Los Angeles basin, which formerly contained them now contain no sticklebacks, and few or no other native fishes." Apparently another population of this subspecies was found more recently in San Antonia Creek.

Urbanization with stream channelization destroying the quiet backwaters and side streams required by sticklebacks is one of the causes listed for the decline of this fish.

Detailed suggestions given for the recovery of this endangered subspecies include schedules of priorities, responsibilities, and estimated costs.

Stroud, R. H. (183)

1966. Recreational use of watersheds--panel discussion Conservationist's View. Journal of American Water Works Association 58(10):1263-1270.

An informative review of the status of water-oriented recreational uses of domestic water supply resources in the United States in the 1960s. Points out the public needs for such recreational use, the key role of fishing, and the multiple uses of water supply reservoirs sanctioned by various municipalities.

Also cites some examples of fish management applied to domestic water supplies to improve fishing, e.g., removal of carp and other rough fish populations and restocking with species such as largemouth bass, crappies, bluegill, and channel catfish. He states that most progressive operators of public water supply now recognize that there are important public benefits in the recreational uses of their facilities and that they have a dual responsibility to permit such use, wherever it appears feasible, in the interest of maximum environmental public health.

The author suggests as requirements for successful recreational multiple-use management of domestic water supplies that:

* The water must be filtered and chlorinated before domestic use;

* Sanitary facilities must be provided, safety regulations must be imposed in terms of adequacy of boating equipment and limitations on engine horsepower;

* Regulations must be reasonable yet adequate, and strictly enforced to assure compliance;

* Daily or season fees should be imposed to cover all the added costs involved, including those of managing the fish and game resource to provide satisfactory recreation experiences;

* Certain fishery management procedures can sometimes substantially reduce normal costs of water management treatment and help produce water of improved potability; and

* When recreational use conflicts arise, as between anglers and boaters, some kind of activity zoning may be used to resolve them.

Stroud, R. H. (184)

1978. Recreational fishing, pp. 53-66. In Wildlife and America Council on Environmental Quality, Washington, D.C. (For complete citation see reference 229.)

In this chapter of Wildlife and America, Stroud discusses numbers of recreational fishermen and fishing trends, making some comparisons with commercial fishing with respect to catch and expenditures. Points out that fishing is a preferred outdoor recreational activity and discusses some of the elements of fishing satisfaction. States that the collective inland (fresh) fishing waters in the 48 contiguous States total about 72 million acres and that there is an overall potential for recreational fishing in the estuaries and readily available nearshore waters along the coasts of the contiguous United

States amounting to about 2.6 billion angler days annually. Suggests that except for some of the larger, less abundant, predator game fishes, the low levels of catch for many of the panfishes by recreational fishermen have negligible effects on the populations in comparison with environmental degradation resulting from overriding external resource use factors. Suggests that one of the most damaging effects by fishermen is their release of the unused, but live, contents of minnow buckets and the occasional deliberate transplanting of selected species into the fishing waters. Indicates that seldome or lightly-fished freshwater species like carp and suckers may have considerable recreational potential.

As possible means of accommodating future fishing, he lists: multiple-use management of large reservoirs; building community fishing lakes and farm ponds; constructing artificial fishing reefs and piers; adding angler outwalks to bridges spanning coastal waters as well as the capping and railing of coastal jetties; and opening to fishing inaccessible or poorly accessible estuaries, coastal lagoons, bays, beaches, streams and rivers, lakes and reservoirs.

Stroud suggests that as urbanization increases, recreational fishery agencies need to identify, in advance of other development, and reserve for future fishing use all the feasible artificial lake sites. He suggests these sites would provide for lakes from 50 to 1,000 surface acres (or more) with depths of not less than about 10 feet and up to about 50 feet maximum and with drainage area-surface ratios ranging from at least 10 to not more than 25. Research needs are discussed including investigation of environmental effects of industrial, commercial, and residential developments.

Stroud, R. H., and R. C. Martin. (185)

1968. Fish conservation highlights 1963-67. Sport Fishing Institute, Suite 801, 608 13th Street, N.W., Washington, D.C. 20005 ($2.00 post-paid). 147 pp.

This publication, which discusses trends in angling, resource management by State agencies, Federal agency resource activities, sport fishery programs in Canada, and the American Fisheries Society's role, contains a brief section entitled Creating Community Fishing Lakes by State conservation agencies. By 1965 the total lake area created since 1932 for recreation (principally fishing) amounted to 317,241 acres distributed among 1,545 units and including 18 impoundments (103,190 acres) built by local jurisdictions in Louisiana. The authors point out that fishing areas near large population centers are increasingly needed even in water-rich States and that the North-Central States, collectively, began in 1960 to spend substantially more money on this activity than any other region.

Tsai, Chu-fa. (186)

1973. Water quality and fish life below sewage outfalls. Transactions of the American Fisheries Society 102(2):281-292.

Author's abstract: "Comparative studies of water quality and fish species diversity in stream locations immediately above and below the outfalls of 149 secondary sewage treatment plants were made in Virginia, Maryland, and Pennsylvania. Sewage chlorine and turbidity increment resulting from sludge were found to be major causative factors for fish species diversity reduction below the outfalls."

Three types of domestic sewage treatment plants are briefly described: Type I with engineering facilities for sludge activation, aeration, sedimentation, and filtration, and with effluent chlorination; Type II with engineering facilities, chlorination, and an effluent holding lagoon; and Type III with engineering facilities, a lagoon, and effluent chlorination at the lagoon outlet. Four types of outfalls among these plants included: Type I, located at a stream bank in which the effluent takes a longer time and a greater length of stream before completely mixing with water across the stream; Type II in the center and at the bottom of a stream; Type III in the middle of a stream between two concrete barriers, each extending from one side of the stream; and Type IV, which had multiple outlets across a stream.

The author points out that with the Type II sewage treatment plant which has a lagoon providing necessary space and allowing for the holding of chlorinated effluent long enough for dechlorination and natural purification, the double objectives of sanitation and fish protection (downstream) can be achieved. He states, also, that, although the more complicated outfalls (Types III and IV) produce a quick mixing of sewage and stream water, the zone of concentrated sewage formed across the stream causes heavy fish depletion and an ecological barrier adversely affecting fish movement. From the standpoint of fish protection, the primitive Type I outfall is described as being more effective.

Tsai, Chu-fa. (187)

1978. Impact of wastewater treatment plant discharges, pp. 147-150. In The Freshwater Potomac: aquatic communities and environmental stresses. (For complete citation see reference 330.)

The author discusses, briefly, various components of sewage treatment plant effluents and their impacts on fish and other aquatic organisms. He points out damaging effects of sludges and of toxic substances including residual chlorine from treatment plants and that sewage nutrients such as nitrate

and phosphate may be either damaging or beneficial depending upon the eutrophic state of the receiving water. Types of sewage treatment plants and outfalls in relation to fish life are described. He suggests, also, that inasmuch as soil has a tremendous capacity to absorb organic wastes and break them down into compounds that can re-enter the natural cycle of plant and animal life, more consideration might be given to the application of sewage effluents as fertilizer and water supply on cropland as has been done in Europe for up to 100 years. Mentions that some sewage lagoons receiving chlorinated sewage treatment plant effluents have been found to be good sanctuaries for waterfowl.

White, D. S., F. C. Hill, and K. H. Haag. (188)

1977. The fishes of Goose Creek, Jefferson County, Kentucky: a stream under the influence of urban development. Transactions, Kentucky Academy of Sciences 38(1-2):45-55. (From Sport Fishery Abstracts 22(3):206-207.)

"Goose Creek is a small, spring-fed stream beginning to show the influence of urban development along its banks. During the study, 63 species of fishes were collected in Goose Creek and annotations are given for each. Although sedimentation and discharges from sewage treatment plants are beginning to affect the distribution of fishes, the populations were extensive and possibly even enhanced by the additional nutrients that entered the stream during the study period. At present, Goose Creek not only has an assemblage of fishes that inhabit small streams, but is utilized by many species from the Ohio River as a breeding and foraging ground."

Wickham, D. A., J. W. Watson, Jr., and L. H. Ogren. (189)

1973. The efficacy of midwater artificial structures for attracting pelagic sport fish. Transactions of the American Fisheries Society 102(3):563-572.

Authors' abstract: "Field experiments were conducted in the northeastern Gulf of Mexico off Panama City, Florida to evaluate the feasibility of using man-made midwater structures for attracting pelagic game fish to improve sportfishing catch rates. Significantly greater catches of little tunny (Euthynnus alletteratus), king mackerel (Scomberomorus cavalla), and dolphin (Coryphaena hippurus) were made around experimental structure sites than in adjacent control areas when equal experimental fishing effort was used.

"Multiple structures attracted larger numbers of coastal pelagic bait fish and produced larger catches of pelagic game fish than single-structure units. The distance offshore or water depth of structure locations affected both the species of fish attracted and the number of fish caught.

"Charter fleet vessels fished around one of the experimental structures for several hours and reported total numbers of pelagic game fish caught and catch rates at least double those in 'other areas' for that day."

The midwater structures and method of deployment are described. The authors state that the simple economical design of the structures (white vinyl cloth attached to frames) and their relative ease of deployment and retrieval make this technique usable by individual weekend sport fishermen as well as fishing clubs and charter fishing fleets. Presumably the subsurface deployment of these structures--some of them in the form of inverted cones--prevents them from interference with other boating interests. The authors state, also, that if the structures are snared by a commercial fisherman's trawl, they would cause little damage to his nets.

Wilbur, R. L. (190)

1976. Urban lakes. Final report on Arizona Game and Fish Department's Project F-14-R-11 on Statewide Investigations, Work Plan 3, Job 01. 20 pp.

Author's abstract: "Existing urban lakes (public and private) in the Phoenix and Tucson metropolitan areas were studied to gather base data for making recommendations and isolating specific management requirements applicable to future urban lakes.

"Accurate cost benefit estimates were not obtained. The figures available were either obscured by economic and social factors or considered too antiquated for contemporary cost analysis.

"Soil samples taken from lake bottoms provided limited data on effect of nutrient elements on lake productivity.

"The effects of fountains and waterfalls on oxygen and temperature levels are significant. They promote a slight cooling of summer waters and even more so increase water circulation, assisting to eliminate summer stratification.

"Angler interviews placed the urban angler in the inexperienced fish-for-anything category. While the majority of anglers were interested in catching 'anything they could catch', they expressed a preference for catfish (Ictalurus punctatus) and bluegills (Lepomis machrochirus). Success of anglers fishing for a specific species was generally superior to those fishing 'for anything'."

The author stated that there were 30 or more private or public reservoirs in the Phoenix and Tucson metropolitan areas, ranging in size from 0.4 to 34.4 surface ha. He indicated that

the private lakes are real estate oriented, with fishing a low priority benefit, and that the public lakes are located in municipal parks, providing recreation that ranges from "come and feed the ducks" reflection pools and angling, to those allowing limited-size sail boating.

(Additional references to fish or fishing in urban areas are made in reference citations 18, 42, 47, 279, 285, 322, 325, 330, 342, 405.)

E. Invertebrates

Dindal, D. L. (191)

1976. Ecology of Compost: a public involvement project. State Univ. of N.Y., College of Environmental Science and Forestry, New York State Council of Environmental Advisers, Syracuse, N.Y. 12 pp.

The author describes soil micro-organisms as part of the backyard ecological community and explains their role as decomposers of organic matter. He encourages and describes construction of compost piles as a measure individuals can take in helping solve the solid waste problem and in improving soils for gardens or potted plants. An illustrated center-spread in the publication shows interrelationships of soil organisms constituting the food web of compost piles. A useful and informative publication for the backyard gardener interested in disposing of waste materials by following the recycle-reuse principle which occurs naturally in fields and forests.

Dindal, D. L., D. P. Schwert, J. Moreau, and L. Theoret. (192)

1977. Earthworm communities and soil nutrient levels as affected by municipal wastewater irrigation, pp. 284-290. In Lohm, V. and T. Persson (Eds.) Soil Organisms as Components of Ecosystems. Proceedings, VI. International Soil Zoology Colloquim. Ecol. Bull. (Stockholm). Vol. 25.

The authors discuss research done at University Park, Pennsylvania on effects on soil invertebrates of spray irrigation of municipal sewage wastewater within a variety of plant communities. They state that spray irrigation of reed canary grass, old field and mixed oak forest communities with municipal wastewater effluent causes an increase in number of individuals, biomass, and number of species of earthworms.

Note: Wildlife biologists concerned with urban areas may wish to explore the contributions of municipal wastewater irrigation programs to the enhancement of woodcock populations in view of the importance of earthworms as food for woodcocks.

Fales, J. H. (193)

1977. Butterfly counts in Rock Creek Park, Washington, D.C. Typewritten manuscript, dated 31 October 1977. 12 pp.

The author reports on an initial census of butterflies started at the request of the National Park Service in seven of the meadow areas in Rock Creek Park, Washington, D.C.

Author's summary and conclusions: "In summation, 26 species of butterflies were found in the seven meadows studied near the end of the season from August 26 through September 26, 1977. The commonest species found were those formerly known to be abundant at this time of the year in this region. Several less common species were found.

"A minimum of a full season of butterfly counts would be necessary to give a nearly complete picture of the butterflies that may find their habitats in the meadows under study and in the Park as a whole.

"In addition to assisting the meadows studies this effort will produce a list and collection of the butterflies now occurring in Rock Creek Park as needed information for the present and as a reference for the future."

More specifically, Fales found the following six families of butterflies to be represented:

Hesperiidae (Skippers)
Papilionidae (Swallowtails)
Pieridae (Whites and Sulfurs)
Lycaenidae (Gossamer-winged Butterflies)
Nymphalidae (Brush-footed Butterflies)
Danaidae (Monarchs)

Species recorded on each of the six counts were:

Palites coras (Peck's Skipper)
Ancyloxypha numitor (Least Skipper)
Pieris rapae (Cabbage Butterfly)
Everes comyntas comyntas (Eastern-Tailed Blue)
Phycoiodes tharos tharos (Pearl Crescent)

And on five of the six counts, he found:

Colias philodice philodice (Clouded Surfur)
Danaus plexippus plexippus (Monarch)

Larval food plants of butterflies recorded from Rock Creek Park are listed in Table 6 of the manuscript. For example, Tiger Swallowtail larvae feed on cherry, birch, apple, mountain ash, basswood, poplar, maple, and magnolia; Spicebush Swallow-

tails feed on spicebush, sassafras, sweet bay, and prickly ash; Black Swallowtails feed on many species of Umbelliferae including cultivated and wild caraway, carrot, parsley, celery, dill, wild carrot, and poison hemlock; Peck's Skipper feeds on grasses; Least Skipper feeds on grasses (Poa sp.) and marsh millet; Cabbage Butterflies feed on nearly all of the cabbage and mustard family (Cruciferae) and also watercress; Pearl Crescent feeds on asters and crownbeard (Verbesina helianthoides); Eastern-tailed blues feed on bush clovers, trefoils, milk pea, everlasting pea, clovers, false indigo and bean; and Monarch butterflies on milkweeds and nightshades.

Falk, J. H. (194)

1976. Energetics of a suburban lawn ecosystem. Ecology 57(1):141-150.

Author's abstract: "A study of the energetics of a suburban lawn was conducted in 1972-73 in Walnut Creek, California, USA. Several major components of the annual primary and secondary production were measured, including man's role as manager and experimenter in the system.

"The system was extremely productive with net productivity of 1,020 g/m^2 per yr. compared with cornfields with productivity of 1,066 g/m^2 per yr. and exceeding tall grass prairie values of around 1,000 g/m^2 per yr. Homopterans, with maximal values of 19 mg/m^2 were plentiful; other typical grassland species like Araneida, were scarce, representing only 1% by weight of the total invertebrate population. Food utilization per unit area by suburban birds considerably exceeded natural grassland bird utilization (46 kcal/m^2 per yr. vs. 1.01-2.33 kcal/m^2 per yr.); lawns are ideal foraging sites for open area adapted, flock-feeding species.

"Man was the dominant consumer in the community, accounting for 10% of the herbivory and nearly 100% of the scavenging. Energy inputs (labor, gasoline, fertilizer, etc.) amounted to 578 kcal/m^2 per yr., equalling or exceeding corn production for a comparable net productivity, but not necessarily utilitarian return."

The author states that an increasing percentage of terrestrial sites throughout the United States are being converted into lawns and turfs, the area now estimated to be 16.5 million acres nationally (after Hawkes, G. R., ed. 1969. Turfgrass fertilization. California Fertilizer Association, Soil Improvement Committee, Sacramento and Nutter, G. C. and J. R. Watson, Jr. 1969. The turfgrass industry, pp. 9-26. In A. A. Hanson and F. V. Juska [Ed.] Turfgrass science. Agronomy 14 Am. Agron. Soc.).

Broadleaf weeds, clovers, and invertebrates commonly are

associated with various varieties of blue grasses and fescues which constitute most of the lawns or turf in much of the United States.

This study was done with considerable care and provides much information on productivity of lawns and their use by invertebrates and some vertebrates. On the lawn studied, live biomass was greater than dead biomass throughout the year due to the constant removal of older aerial parts. In natural grasslands, dead standing crops normally exceed or equal those of living crops over an entire year.

Vertebrates were considered nonresidents of this small lawn and the scrub jay (Aphelocoma coerulescens Swarth) was the only species that used the lawn continuously throughout the year. Use by Brewer's blackbird (Euphagus cyanocephalus) far exceeded that of other birds which included red-winged blackbirds, starlings, and house sparrows--birds which usually fed in mixed flocks. Mammals (unidentified) used the lawn mostly during the spring and summer months. The author indicated that mammalian influence was minimal and that more energy was put into the system by mammals in the form of cached walnuts and excreta than was removed. Man's input of energy was in the form of irrigation, lawn mowing, raking (dethatching), fertilizing, and reseeding. The author states that for roughly the same energetic effort expended on suburban lawns, every home owner could raise vegetables and suggests that as vegetables become increasingly expensive perhaps the future will see a reversal in the trends towards ever-increasing turf coverage.

Falk, J. H. (195)

1977. The frenetic life forms that flourish in suburban lawns. Smithsonian 8(1):90-96, illustrated.

The author states that more than 20 million acres of lawn exist in the United States. This represents between one and two percent of the land area in the form of short grasslands maintained by lawn mowers in city parks, golf courses, and front yards, and more lawns are being created every day as forests succumb to housing tracts. The author compares lawns with an East African savanna which is maintained by herds of zebras, wildebeests, and gazelles and by periodic fires instead of gas-driven lawnmowers. He states that an average lawn contains perhaps 30 to 50 different kinds of grasses and broadleaf plants (weeds), well over 100 species of insects and many other animals such as snails, spider mites, isopods (pill bugs), spiders, and earthworms. On his lawn near Edgewater, Maryland, a dozen species of birds ranging from mourning doves to towhees to starlings and house sparrows feed and consume, on a 30-by-40 foot area, more than 500 kilocalories of food, 87% consisting of insects, during a year's time. He estimates that this level of utilization (energy extracted per square meter per year) is

20 to 40 times greater than that recorded for natural grassland birds. He believes this is true because lawns are islands of food resources in suburban areas 80 to 90% of which are occupied by roads, driveways, and rooftops all of which support few insects and, secondly, because the more common city birds--starlings, house sparrows, pigeons, and black birds--are gregarious and after a food-rich area is found, the birds flock to it in contrast to more uniformly distributed food in prairie areas where vigorous territorial defense systems among birds lead to more solitary feeding rather than flock feeding.

The author estimated that his front lawn produced more new plant material in a year than a tall grass prairie or a coniferous forest of comparable size; that the total energy cost of human inputs in a year was more than 22,500,000 kcal most of which were expended for irrigation or gasoline for the mower and 2.5% for physical labor; and that despite the addition of manure and inorganic fertilizer, his lawn suffered a net loss of 1,580 grams of N, 530 grams of P, and 990 grams of K. The manager-scavenger "consumed" in excess of 98% of the dead plant material with his grass bag and rake. Herbivorous animals consumed less than 1% of all grass clippings and tree leaves that fell on the lawn. He suggested that our present day love affair with lawns may stem from a desire to recreate our primeval environment.

Knudsen, G. J. (196)

1968. Field cricket. Wisconsin Conservation Bulletin 33(6): 28-29. **

Knudsen suggests tht most people like the rhythmic chirping song of the big, shiny-black cricket (Gryllus assimilis) which is one of Wisconsin's best known insects, its song being heard by everyone from the city dweller to the farmer and camper. He describes how "music" is made by the males by rubbing a file-like area on the underside of one forewing against a roughened spot on the upper surface of the other and he states that the wing membranes act as resonance boards and amplify the sound.

The author describes briefly the life history and habits of this common insect, stating that they are most abundant in fields and other grassy areas where they live in holes they have dug, or under rocks, boards, and other ground debris. When abundant, these crickets can damage gardens and will also chew holes in clothing, rugs, or drapes that might be left lying on the lawn overnight. Many Chinese and Japanese households keep crickets as pets in small cages and tend to them as carefully as they would look after pet songbirds. Some suggestions are given about keeping crickets as pets.

Kulman, H. M. (197)

1977. Butterfly production management, pp. 39-47. In Kulman, H. M. and H. C. Chiang, eds. 1977. Insect Ecology. Papers Presented in the A. C. Hodson Lectures. Univ. Minn. Agr. Expt. Sta. Tech. Bul. 310. 107 pp.

Author's abstract: "A speculative overview of butterfly production management is presented which includes manipulation of habitats to enhance larval and adult food plants, accessibility and longevity of adults, early season introduction of migrants, and use of exotic butterflies and larval host plants.

"Concentration and accessibility of butterfly adults for viewing and collecting may be influenced by adult longevity, adult food sources, larval host plant odors, and other factors. Dangers to butterflies and their host plants by concentrating adults are discussed. Production management opportunities by manipulation of larval host plants appears to be much greater for expansion of the local and regional range of butterflies than for increasing butterfly density. The paucity of the literature does not permit general conclusions concerning population regulating factors, carrying capacity concepts, etc. However, there is sufficient observational data to guide experimental production management studies. Migratory species are considered for management although the carry-over from management inputs are lower than with resident butterflies. Introduction of exotic species is limited mainly to butterflies useful in weed control programs.

"Speculative production research possibilities are given for the Pipevine Swallowtail, Battus philenor (L.); Black Swallowtail, Papilio polyxenes asterius Stoll; Giant Swallowtail, Papilio cresphontes Cramer; Little Sulphur, Eurema lisa (Boisduval and LeConte); Dainty Sulphur, Nathalis iole Boisduval; Baltimore, Euphydryas phaeton (Drury); and Monarch, Danaus plexippus (L.)."

In Kulman's view, butterfly production management selects candidate species on the basis of their (1) likelihood to respond to management, (2) viewing potential, (3) aesthetic qualities, and (4) insignificant pest potential--without reference to their natural rarity or endangered status.

Habitats or sites suggested as offering management potential include botanical conservatories, nature centers, parks, private yards, vacant urban land, railroad and power line rights-of-way, fence rows, and managed and unmanaged lands of all categories.

Among the aesthetic qualities of butterflies suggested or identified by Kulman are color, pattern, and size; commonness; behavioral properties; freedom and ephemerality; and

desirability, i.e., the beauty of butterflies probably can be appreciated best in pleasant surroundings.

Among plants mentioned that are attractive to or utilized by butterflies were butterfly weed, Asclepias tuberosa (L.); dill, Anethum graveolens (L.); pipevine, Aristolochia dureor Hill; turtlehead (in wet, peaty meadows), Chelone glabra (L.); and prickly ash, Xanthoxylum americanum (Mill).

Although, except for extremely weak, depleted local and environmentally stressed butterfly populations, collecting is not considered particularly damaging, protection may be needed under certain circumstances. The author reports after Urquhart (Urquhart, F. A. 1960. The Monarch Butterfly. Univ. of Toronto Press, Ontario. 361 pp.) that Pacific Grove, California, has a city law protecting the Monarch Butterflies that overwinter there in such great numbers that they provide a tourist attraction.

The author provides considerable information on the biology of selected butterflies, identifies research needs and suggests several intriguing experiments that might be made to promote butterfly production or to concentrate them for the increased enjoyment of humans.

Spoon, D. M. (198)

1976. Microbial communities of the upper Potomac estuary: the aufwuchs, pp. 63-68. In The Potomac Estuary. (For complete citation see reference 342.)

The author discusses periphyton, or the microbial organisms that live attached to underwater surfaces, in a section of the Potomac estuary in the Metropolitan Washington, D.C. area extending from Key Bridge in D.C. to Piscataway Creek several kilometers below the major Blue Plains water treatment plant for the District. Considerable information is provided on microbial communities and their roles in food chains upon which higher organisms are dependent. Comparison of survey data collected in 1971 and 1974 showed a doubling of the total microfauna (number of species) in 1974, presumably indicative of better water quality--more dissolved oxygen, and lower levels of phosphorus and nitrogenous compounds.

(See references 42, 285, 342, and 458 for further mention of invertebrates in urban areas.)

III. Wildlife and Related Environmental Values

Publications included under this category suggest that wildlife

values to humans are difficult to assess but that the urban public, generally, is favorably disposed to, and benefits from, having wildlife in urban areas. How best to handle problems of wildlife damage to gardens and property or potential dangers to human health and safety remains largely unsolved, but involves education and further research. Increased property values resulting from maintaining trees and other vegetation, beneficial to wildlife, on urban properties are documented, but hard, factual evidence of the benefits of urban wildlife populations to people and their health and well-being is needed.

A. Animal Damage and Control

Aldrich, J. W., C. S. Robbins, and W. W. Dykstra. (199)

1961. Bird hazard to aircraft. USDI Fish and Wildlife Service, Wildlife Leaflet 429. 10 pp., illustrated.

This leaflet provides a brief history of bird hazards to aircraft, pointing out the increased problems associated with jet and turbo-jet engine aircraft and longer runways; discusses flight habits and patterns of birds; describes conditions that attract birds to airports and the vicinity of airports and bird use of these areas for food, roosting, resting or loafing, nesting, and migration; suggests remedial measures, including habitat manipulation by eliminating dumps and other unsanitary conditions, destructing roosting sites and removing berry or seed-producing shrubs, and the use of scare devices; and outlines research approaches.

Andresen, J. W. (200)

1974. Dog control. (Letter to editor.) Science 186:394.

The author comments on a previous editorial by B. M. Feldman, 1974. (Science 185:903) on the problem of urban dogs, adding that before the advent of contemporary urban pollution, including copious amounts of dog urine being sprayed on the lower trunks of sidewalk trees and eroding the cortical and suberized layers of juvenile bark, urban trees persisted for 40 to 50 years; currently their life expectancy is 10 to 20 years. The author states that attempts to alleviate urine damage by placing cylindrical metal shields around tree bases have increased the cost of planting a tree in New York City by $5 to $10. Andresen agrees with Feldman that one solution to the urine problem would be to reduce the total number and size of urban dogs.

Anonymous. (201)

1979. Bird pest control by trimming favorite trees shown effective. Weeds Trees and Turf, May issue, pp. 28-30.

317-774 O - 80 - 9

This article, based on an article entitled Nonlethal Blackbird Roost Control in Pest Control magazine, September 1978, reports on work done by Heidi Good of Rice University and Dan Johnson of Tennessee State University (see also reference 205). It is suggested that the roosting blackbirds have favorite trees in a grove and that removal or trimming of these trees discourages roosting of the birds in these and in nearby associated trees. In this trade magazine article, there are illustrations of a tree before trimming, the same tree after heavy trimming, and a tree in which, by means of heavy black lines, branches suggested for removal are indicated.

Carlton, R. L. (202)

1975. Building out unwelcome guests. Leaflet 211, Cooperative Extension Service/University of Georgia, College of Agriculture. 3 pp.

This brief leaflet states that although there are many ways to get rid of animals such as bats, opossums, rats, mice, skunks, lizards, snakes, and squirrels which may get into homes, the best solution is to prevent them from entering in the first place. Based on information provided by the Fish and Wildlife Service and from other State extension services, the author outlines criteria for construction design and steps that may be taken to discourage unwelcome animals. For example, he recommends that trees should not hang over roofs because they provide travel routes for squirrels and other climbing animals, and vents should be screened with insect screening and with one quarter-inch mesh hardware cloth, stops should be installed in double-wall construction to prevent travel between walls, and guards should be installed on pipes, wiring, or guttering if they are used by climbing animals to gain entry into buildings.

Courtsal, F. R. (203)

1978. Wildlife problems and people, pp. 63-65. In Wildlife and People. Proceedings of the 1978 John S. Wright Forestry Conference, Purdue University. (For complete citation see reference 20.)

The author states that the Norway rat (Rattus norvegicus) is the wild mammal causing the greatest problem to humans throughout the world through competition with man for food and fiber; contamination with urine, fecal matter, and hair of much more food than it consumes; damaging of structures; and spreading of diseases. Emphasizes the importance of habitat management or sanitation as the most permanent method of control, i.e., removal of trash piles, cutting of weeds close to buildings, placing tight-fitting lids on garbage cans, and using sheet metal, hardware cloth, and reinforced concrete to

plug holes, to encase door edges, and to prevent burrowing under foundations. The author comments briefly on approaches to control of pine voles and meadow voles which damage fruit trees, nursery stock, and ornamentals by trunk and root girdling and root pruning. He suggests use of tree guards for newly planted stock.

Gilman, R. M. (204)

1978. Vertebrate pest control in urban/suburban areas, pp. 63-66. In Proceedings, Eight Vertebrate Pest Conference, Sacramento, California, 7-9 March 1978. (Available from Vertebrate Pest Conference, California Dept. of Food and Agriculture, 1220 N Street, Room A-357, Sacramento, California 95814. $15.00.)

Author's abstract: "Urban/suburban vertebrate pest control problems present unique challenges because of the people-afflicted environment in which they occur. People are a major consideration in effective urban/suburban vertebrate pest control because of their emotions and changing values. Those responsible for today's vertebrate pest control must anticipate and consider this element of increasing importance and use it to their advantage rather than let it become a liability."

The author identifies several types of damage, nuisance, or concerns caused by wildlife in urban and suburban areas; describes measures effective in controlling some species of wildlife and the constraints or limitations in applying, in developed areas, measures that are effective elsewhere; and points out that one person's vertebrate pest may be another person's pet. Pigeons, which many people enjoy feeding, may be bothersome to others where they roost and defecate. Trapping, when done discretely, is a relatively effective pigeon control method. Use of toxic bait, however, which results in dead birds where people can see them, causes much repercussion. Use of acoustic devices to scare starlings or other birds from a nuisance roost is unacceptable to many urban residents because of noise pollution. The final solution may be expensive and drastic alteration of the landscaping sufficient to make the site unattractive to the starlings. In one case where waterfowl fed on a lush lawn developed in a mobile home park adjacent to a natural lagoon, the residents' views were polarized into two camps: "producers" and "anti-duckers." The answer to this problem, according to the author, was to replace the strip of natural grass with artificial grass which was not as attractive to the waterfowl and could be hosed clean of droppings. Other examples and approaches to control were cited for various mammals. The importance of explaining to the public: the values of wildlife; the complications and difficulties involved in control; and, in some instances, alerting residents

to control programs so they would understand what the strange noises resulting from acoustic devices were, for example, was stressed.

Good, H. G., and D. M. Johnson. (205)

1977. Experimental tree trimming to control an urban winter blackbird roost, pp. 54-64. In Proceedings, Seventh Bird Control Seminar. Bowling Green State University, Bowling Green, Ohio, 1976.

The authors have studied roosting blackbird biology and experimented with habitat alteration as a method of controlling the roosting of birds on the campus of Rice University in Houston, Texas. The birds involved are primarily brown-headed cowbirds, starlings, common and great-tailed grackles, red-winged blackbirds, and robins. This report focuses on results of a tree-trimming program initiated in August 1974. The campus comprises 121 ha and was planted with live oaks (Quercus virginiana) in 1912. In January 1970, U.S. Fish and Wildlife Service biologists estimated there were one million birds in a 64-ha woodlot 10 km north of the campus. Much of this roost area was developed into apartments in 1972 and the number of birds roosting on campus increased dramatically so that almost every available tree in a 5-6 ha section of woods with a closed canopy to individual groves between the buildings was used. University records indicated that the trees had not been regularly trimmed since 1965. Inasmuch as there was some indication that cowbirds did not roost in properly pruned live oaks, certain groves were selected and one-third of the canopy was removed to determine the number of roosting birds in comparison with untrimmed groves of trees. Roost populations of birds were estimated from the weight of bird droppings collected on filter papers mounted on pizza boards elevated 15 cm above the ground. Dropping weight was converted to net dropping density measurements of g/m^2. Numbers of birds were calculated on the basis that a male cowbird deposits 1 g of fecal material (dry weight) per night.

The trimming experiments showed that trimmed groves were not occupied while the untrimmed pair-member (control) was occupied as usual. Other experiments are described indicating that it may be necessary to eliminate only a portion of roosting space in a grove for adequate control. Apparently in dense roosts of birds a crowding threshold can be reached after which birds spill over into other areas. The investigators suggest that a group of birds apparently select the best roosting spots or foci and other birds follow suit until a maximum or threshold level of occupation is reached. When these foci are eliminated as through construction (or trimming), the birds choose to roost elsewhere. This, they believe, suggests a social structure that determines the roosting place of birds within a roost and the possibility of exploiting such

a structure to induce birds to move the roost.

Guarino, J. L. (206)

1975. An overview of problem bird management--rural and urban, pp. 129-146. In Proceedings of the Second Great Plains Wildlife Damage Control Workshop, Kansas State University, Manhattan.

Author's summary: "The economic impact of birds on agricultural crops in the U.S. is quite substantial--perhaps as much as $100 million dollars. Methods for reducing this damage can be categorized as biological, mechanical, and chemical. The chemical approach appears to have the most potential. An avian repellent, methiocarb, has proven to be effective for reducing damage by a variety of species of birds to many sprouting and ripening crops, and ripening fruits. An avian chemical frightening agent, 4-aminopyridine (Avitrol), is federally registered for use for protecting ripening field corn and sweet corn and was shown to be effective for reducing damage in sunflowers and sorghum. An avian toxicant, 3-chloro-para-toluidine hydrochloride (DRC-1339) (Starlicide) is federally registered for reducing populations of starlings in cattle and poultry feedlots."

Despite the title, bird problems in urban areas are not mentioned specifically in this overview-type paper. However, some of the control methods described could be used in urban areas where there are objectionable bird roosts or bird damage to garden crops and fruit trees.

Examples of biological control methods cited include: decoy crops; changes in cultural practices, such as harvesting early or changing crop types; habitat manipulations, e.g., burning roosting vegetation or thinning branches and trees in large roosts; and development of bird-resistant varieties of crops, e.g., thick-husked corn or sorghum with a high tannin content.

Examples of mechanical means for reducing damage include the use of propane or acetylene exploders, shell crackers, traps, and alarm and distress calls of birds broadcast through mobile or stationary units or played on record players.

The authors emphasize that chemicals used as repellents, stressing agents, toxicants, chemosterilants, and frightening agents must be species selective, effective, economically practical, and environmentally safe.

Mitchell, B. (207)

1977. Wildlife impacts on telephone and electrical services

in Waterloo, Ontario. Journal of Soil and Water Conservation 32(3):133-135.

A well-prepared article referencing 20 additional publications dealing with conflicting views and activities of residents with respect to squirrels and other wildlife in urban areas. Mitchell found that urban wildlife, especially squirrels, causes substantial damage to telephone equipment but relatively minor damage to electrical facilities. In the Regional Municipality of Waterloo, Ontario, Bell Telephone personnel estimated squirrel damage to telephone facilities to average $25,300 annually; each squirrel bite through the insulation of a telephone line costing between $80 and $100 to repair. When aerial lead-covered cables are gnawed and the insulation perforated, water enters during rainstorms and the moisture causes a buzzing sound that often makes use of telephones impossible. If the squirrel bites into the telephone line itself, service is stopped until repairs are made. Preventive strategies all of which have their strengths and weaknesses have included use of squirrel guards to prevent squirrels from reaching the telephone cables, use of polyethylene insulated cables instead of lead cables, attaching salt to cables on the supposition that squirrels chew lead-covered cables for salt, use of "Tanglefoot," a sticky substance on the cables to discourage squirrels from traveling on them, warning devices to alert telephone officials of possible damage, and burial of the cables. With respect to electrical services, both squirrels and birds occasionally short-out aerial equipment by touching two phases simultaneously. The author concludes by suggesting there are still opportunities for developing ways to make aerial equipment more inaccessible or resistant to urban fauna.

National Research Council of Canada. (208)

1969. Proceedings of the World Conference on Bird Hazards to Aircraft. National Research Council of Canada through the Associate Committee of Bird Hazards to Aircraft. 542 pp.

This book contains the proceedings of a world conference on bird hazards to aircraft held at Queen's University, Kingston, Ontario, Canada, 2-5 September 1969. It deals with a review of the bird-aircraft problem in various contries of the world, airport surveys, ground cover and earthworms, dispersal of birds as a means of reducing collisions with birds, bird migration studies, airworthiness of planes following ingestion of birds, identification of bird remains, population control, and need for national and international exchange of information on the bird hazard to aircraft problem.

Olkowski, W., H. Olkowski, R. van den Bosch, and R. Hom. (209)

1976. Ecosystem management: a framework for urban pest control. BioScience 26(6):384-389.

This paper briefly describes a pest management program developed during 1970-1975 for Berkeley, California's 30,000 street trees (123 species) and points out the advantages of biological control for urban areas where high human densities require the employment of control methods that are of low risk to mammals and other animals. The authors report that pesticide use within urban areas--about equal to that used in agriculture, or 500 million actual pounds--represents a worrisome, largely unassessed hazard, a source of environmental contamination, a consumption of nonrenewable raw materials, and an erosion of manpower. They report that since 1888 biological control has resulted in complete or substantial control of 120 pest species in 253 separate importation projects throughout the world. Examples of importation of parasites to successfully control the linden aphid (Eucallipterus tiliae L.) and the elm aphid (Tinocallis platani Kaltenbach) are described. A plea is made for more inclusive ecosystem views in pest control and for a new professional role for ecologically trained pest managers in urban areas.

Seubert, J. L. (210)

1963. Biological studies of the problem of bird hazard to aircraft, pp. 143-171 In Colloque--Le Probleme des Oiseaux sur les Aerodromes. Compte rendu des Reunions tenues a Nice, les 25,26 et 27 Novembre, 1963, par Rene-Guy Busnel et Jacques Giban. Institut National de la Recherche Agronomique, 149, rue de Grennelle--Paris (7). 326 pp.

A resume of bird-aircraft problem research by the U.S. Fish and Wildlife Service for the period 1 April 1962, through 30 June 1963. Included are a problem analysis, report of airport inspections and advice given to aerodrome managers, comments on gull population studies in New England and of blackbird-starling roosts in the vicinity of Dulles International Airport, maps of migration routes of six species of larger birds considered potentially hazardous to aircraft operation, discussion of possible control methods, and suggested areas of emphasis for future research.

Seubert, J. L. (211)

1971. Birds and airport safety. A paper presented at an Environmental Planning Conference sponsored by the Airport Operators' Council International, New Orleans, Louisiana, 24 March 1971. 6 pp.

The author discusses the bird problem at airports; gives examples of bird strikes on aircraft and types of birds causing accidents; suggests remedies to the problem, with emphasis on

the garbage-gull problem, and describes types of assistance available to State, interstate, intermunicipal, and municipal agencies, including demonstration grants, planning grants, and technical assistance.

Seubert, J. L., and B. Meanley. (212)

1974. Relationships of blackbird/starling roosts to bird hazards at airports, pp. 209-219. In Proceedings of A Conference on the Biological Aspects of the Bird-Aircraft Problem, Dept. of Zoology, Clemson University, Clemson, South Carolina, 5-7 Feb. 1974, Sidney A. Gauthreaux, Jr., Ed. 535 pp.

From authors' abstract: "Blackbirds and starlings pose serious hazard to aviation when they roost on or near airports. Damage and loss of aircraft and personnel may ensue when bird flightlines cross runways and approach areas and when birds are ingested into turbine engines.

"About 500 million blackbirds and starlings are found in the United States, three-fourths of them in the East.... Roosts usually are established in dense deciduous or pine vegetation, swamp thickets, cane, and marshes. Selection of roosting areas probably is determined by the availability of suitable food and habitat. Dense cover apparently is a primary requirement....

"Blackbird/starling airport hazards have occurred at Moody Air Force Base, Winston-Salem Airport, Dekalb-Peachtree Airport (Atlanta), and elsewhere. Alleviating hazards requires environmental management, effective programs of bird harassment and dispersal, timely warnings to pilots of hazardous bird flights or concentrations, and adjustment in flying schedules where appropriate."

Smith, R. N. (213)

1974. Problems with urban wildlife, pp. 113-115. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Wildlife in an urban area can cause problems and the planners and the public must understand this fact before promoting programs that will result in unwanted wildlife neighbors. Problems caused by wildlife include structural damage to dwellings, telephone cables, wooden telephone and electric line poles, and others; crop destruction and ornamental plant damage, including girdling of trees and clipping of roots of ornamentals by mice; aesthetic degradation such as caused by roosting birds; human safety including bird hazards at airports or the packs of feral or semi-wild dogs that may live in large green corridors and metropolitan parks; and disease transmission. The author believes the most acceptable way to avoid these conflicts is to prevent their happening through correct planning.

Solman, V. E. F. (214)

1969. Airport design and management to reduce bird problems, pp. 143-147. In Proceedings of the World Conference on Bird Hazards to Aircraft. National Research Council of Canada (1969). 542 pp.

The author states that airport location and design must be planned to minimize the hazards from birds and suggests ways of accomplishing this, including avoidance of areas habitually used by birds for airport locations; use of sandy well-drained soil for airports; use of a fire-resistant ground cover not attractive to birds such as Potentilla tridentata; elimination of vegetation attractive to birds for food, shelter, or roosting; keeping earthworms and snails off paved runway areas; avoiding crop production or grazing on airport areas, if possible; and designing buildings and landscaping to minimize attractiveness to birds.

Solman, V. E. F. (215)

1973. Influence of garbage dumps near airports on the bird hazard to aircraft problem. A paper presented at the National Conference on Urban Engineering Terrain Problems, Montreal, Canada, 7 May 1973. 8 pp.

From author's abstract: "Between 1960 and 1972, bird strikes on aircraft cost more than 100 lives and property damage of more than one hundred million dollars in North America.... Birds at and near airports come into collision with aircraft. They are usually attracted by one or more of food, shelter and water. At some airports studied in 15 countries disposal of edible material in open garbage dumps was a major attraction to birds which were involved in collisions with aircraft. The problem was most severe when the disposal areas were near the airports and when bird flight routes between disposal areas and other areas used crossed runways or their approaches."

Solman, V. E. F. (216)

1974a. Aircraft and wildlife, pp. 137-141. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

This is a brief account of the bird aircraft problem with comments on differences of prop- and turbine-powered aircraft in relation to collisions with birds, bird migration and aircraft, and the need for utilizing land capability data and biological knowledge in locating airfields.

Transport Canada. (217)

1971. Wildlife control--birds. Field Maintenance, Technical Circular FMTC No. 4-13-1. 6 pp. + 5 pp. of appendices or annexes.

This circular provides technical guidance with respect to the reduction of bird hazards to aircraft safety at airports. It outlines standards and policies of the Ministry of Transport regarding bird hazards to aircraft; identifies bird attractants on airports; suggests control measures including environmental management, economic land management, and bird scaring devices; outlines implementation procedures; and appends list of bird dispersal equipment, bird strike reporting procedures, a form for bird strike-near-miss reporting, Canadian Wildlife Service assistance information, and regulations pertaining to control of migratory birds on airports.

U.S. Department of Transportation, Federal Aviation Div. (218)

1974. FAA guidance concerning sanitary landfills on or near airports. Order 5200.5, dated 16 October 1974, signed by William V. Vitale, Acting Director, Airports Service, AAS-1. 3 pp.

This order provides guidance concerning the elimination or monitoring of open dumps, waste disposal sites, and sanitary landfills on or in the vicinity of airports. Garbage dumps, sanitary landfills, and similar areas, attract rodents and birds, erode the airport environment, and where the dump is ignited, create smoke--all of which are undesirable and are potential hazards to aviation. The order provides criteria for sanitary landfills considered to be incompatible for airports.

(For additional information on animal damage and control see references 20, 32, 35, 48, 51, 77, 83, 84, 88, 94, 100, 130, 137, 139, 147, 148, 149, 154, 158, 160, 164, 196, 221, 222, 223, 240, 242, 296, 317, 320, 327, 334, 361, 426, 427.)

B. Human Health, Safety, and Well-Being

Claudon, D. G., D. I. Thompson, E. H. Christenson, G. W. Lawton, and E. C. Dick. * (219)

1971. Prolonged Salmonella contamination of a recreational lake by runoff waters. Appl. Microbiol. 21(5):875-877.

"In the summer and fall of 1968, various Salmonella serotypes were isolated from a portion of Lake Mendota, the major recreational lake for Madison, Wisconsin. The apparent source of these organisms was a residential storm sewer and a University of Wisconsin Experimental Farms' washwater drain.

Salmonellae were isolated with regularity from a swimming beach located approximately 0.5 mi. (0.8 km) from these sources."

Geist, V. (220)

1975. Wildlife and people in an urban environment--the biology of cohabitation, pp. 36-47. In Euler, Gilbert and McKeating (editors) of Proceedings of the Symposium--wildlife in urban Canada. (For full citation see reference 9.)

This is a thought-provoking article which deals with the values of wildlife in cities, possibilities for ecosystem management of diseases of wildlife of concern to man and of degrading garbage by wildlife, and other approaches to managing wildlife in urban areas.

Geist argues that the management and support of wildlife in urban areas is, in the final analysis, an exercise in preventive medicine and that there is circumstantial evidence that an investment in wildlife and essential supportive ecosystems has long-term economic benefits in that it reduces the health costs to society. He states, page 36:

"Wildlife in the city has three potential values. It has aesthetic and inspirational appeal, it has educational significance, and it has a number of functional benefits which have been almost entirely neglected. It can, of course, also cause damage and inconveniences. We must note that wildlife depends on supporting ecosystems, and cannot exist without them. Thus, if wildlife is to flourish so are plants, insects and microorganisms. A diversity of wildlife, therefore, implies a diversity of organisms living in complex ecosystems." He continues, page 37, "The very availability of diverse wildlife and plants is the prerequisite to intellectual stimulation, leading to curiosity and exploration. This leads to developing familiarity with natural processes and the development of simple skills in natural environments. It leads to analogy formation which can be used in daily conversation, and hence leads to increased communication skills, to an easier and quicker comprehension of our cultural heritage since much of it is rooted in natural events and our language is filled with terms describing natural processes. A close contact with nature, therefore, can lead to a more sophisticated appreciation of our culture as well as aid a person in the development of physical and social competence, the very kind modern outdoor education in such programmes as 'Outward Bound' aims for." He reports on a study that demonstrated that urban residents differed significantly from indians in the James Bay region with the indians having visual acuity not found in the urban residents who had been constantly exposed to a visual environment dominated by vertical and horizontal straight lines.

Geist suggests that the availability of nature is an excellent prerequisite to high intellectual and physical development of humans during ontogeny, therefore it is important to retain natural environments for the benefit of children during their development. Retention of such islands of environment also helps to create a citizenry aware of the values of the land and who can help with decision making and conservation.

Karstad, L. (221)

1975. Disease problems of urban wildlife, pp. 69-78. In Euler, et al. (Eds.). 1975. Wildlife in Urban Canada. Proceedings of a Symposium. (For full citation see reference 9.)

Karstad classified diseases of wild animals into those diseases of importance to the wild animals themselves; those that are important because they are shared by domestic animals; and those of public health importance. Among the latter diseases are rabies, tularemia, encephalitis, erysipelas, leptospirosis, and histoplasmosis. He concludes by stating, page 74: "I don't think any present day urban community has seriously considered eliminating wildlife. We prefer to keep the wildlife, but we are wise to learn the risks and, however possible, try to deal with them in an intelligent manner. We have already considered several good examples of minimizing the hazards. We don't destroy the wild birds because they carry encephalitis viruses. Instead we try to control the mosquito vectors, by means that will not injure the birds. When salmonellosis shows up in urban wildlife, we look for the primary source of exposure. It may be a slaughter house, or it may be raw sewage entering a stream. Wildlife, in the city or elsewhere, can be a useful indicator of problems in the environment."

Locke, L. N. (222)

1974. Diseases and parasites in urban wildlife, p. 111. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Locke points out that infectious diseases in urban wildlife are of two types: (1) those primarily or solely affecting the wildlife species such as pox, trichomoniasis and salmonellosis which cause losses among birds concentrated at bird-feeding stations, canine distemper, which causes losses among raccoons and shunks, and type C botulism which is a frequent cause of waterfowl deaths on city and suburban park ponds; and (2) those that have public health implications such as histoplasmosis and cryptococcosis associated with accumulations of guano at blackbird roosts, bat colonies or pigeon nests in or near human residences, and arboviruses seasonally present in bird populations and which, on occasion, can be spread by mosquitoes to man or his horse. Rabies also occurs in skunks, foxes, bats

and raccoons. Bat-transmitted rabies has been responsible for at least four human deaths in the United States.

Locke states: "The public needs to be made aware of the causes of mortality among wildlife living in close proximity to human habitation so that fears based on ignorance can be eliminated and, when necessary, control or sanitation procedures can be undertaken to prevent human infection."

Monroe, B. L., Jr., and L. S. Cronholm. (223)

1978. Health and management problems of starling-blackbird roosts, pp. 58-62. In Wildlife and People. Proceedings of the 1978 John S. Wright, Forestry Conf. Purdue University. Copyright, 1978, by Purdue Research Foundation, West Lafayette, Indiana 47907. (For complete citation see reference 20.)

The authors state that some 500 million or more birds fill winter roosts in North America, particularly in S.E. United States and that most of these birds consist of various species of blackbirds (Icteridae) plus the starling. In urban areas starlings may compose essentially all of the birds in a roost. The birds may cause depredation problems at feedlots and in winter wheat sprout pulling; or problems may be at the roost site in the forms of nuisance--droppings, smell, noise--, tree destruction as a result of the droppings, and human health matters such as histoplasmosis produced by the organism Histoplasma capsulatum. Although means are available to kill most of the birds in a roost, unless the roost site itself is destroyed or altered, the roost tends to be repopulated and depredation problems are not effectively solved except at the site of depredation. From their studies and a review of the literature the authors conclude that the fungal organism will grow in bird roosts but is not routinely present in the majority of roosts; the birds themselves are not responsible as vectors of the organism, which is apparently airborne in the infective state; and birds roosts, even the positive ones, are health hazards only under a specific set of circumstances that can be managed. Apparently the threat of symptomatic histoplasmosis to humans is greatest in locations where persons are likely to enter the site itself or with sites that are cleared and where the soil surface is disturbed. They state that sites to be cleared need to be decontaminated, an expensive process, or at least handled so as to produce a minimum of spore dispersal. They suggest as a means of dispersing birds from a roost--or of keeping birds from roosting on a site--the organization of a properly managed bird disturbance project involving the use of shotguns, birdbombs, and the like by organized groups of people stationed on incoming flight lines.

Moore, R. M., Jr., R. B. Zehmer, J. I. Moulthrop, and R. L. Parker. (224)

1977. Surveillance of animal-bite cases in the United States, 1971-1972. Archives Environmental Health 32(6):267-270.

"The type of biting animal was reported for 196,117 persons bitten: 84 percent were bitten by dogs, 10 percent by cats, 4 percent by rodents, less than 1 percent by foxes or skunks, and 2 percent by other animals." Based upon abstract contained in Wildlife Review No. 169, p. 27.

Rosebery, D. A. (225)

1964. Relationship of recreational use of Forrest Lake and bacterial densities. Journal American Water Works Association 56(1):43-59.

The author discusses densities of coliform organisms and enterococcus bacteria in the 702-acre Forrest Lake which supplied water for Kirksville, Missouri and drains from 11,000 acres, including the suburbs of Kirksville. Sightseeing, picknicking, swimming, and fishing are preferred recreational activities on the lake and in the 3,152-acre Thousand Hills State Park where the lake is located. After evaluating the compatability of the recreational use of water and the watershed for human consumption, the author concluded that high recreational use was not reflected by bacterial counts at the lake's intake tower. The pollution of Forrest Lake would need to increase considerably before there would be additional costs for filtration and treatment of the waters for the municipal water supply.

Stainbrook, E. (226)

1968. Human needs and the natural environment, pp. 1-6. In Man and Nature in the City, U.S. Department of the Interior. (For full citation see reference 45.)

The author states that to a progressively accelerating extent the widespread applications of science and technology are contributing directly to the denaturalization of man and of the rest of nature, yet the return and longing to return to "Mother Nature" is present in all of us. He states also that just to be in frequent perceptual contact with the reassuring, enduring earth is a psychological security factor of considerable importance. He implies that nature, instead of being perceived as an opponent to be conquered, controlled, or "malleably used and changed" in the service of man, should be "perceived more as a possible ally, to be identified with, understood, joined, sought for and lived with in harmonious collaboration."

Stamm, D. D. (227)

1966. Relationships of birds and arboviruses, The Auk, 83(1): 84-97.

Arboviruses are viruses that infect blood-ingesting arthropods such as mosquitoes and which multiply in the tissues of the arthropod and are transmitted by bite to susceptible vertebrates. Stamm states that about 50 different arboviruses are known to produce disease in man or domestic animals and eight of these have been isolated from wild birds. He describes the transmission cycle of the causative organism, including the course of infection in birds; treats tick-borne arboviruses briefly; and cites several epidemics of encephalitis in which birds and mosquitoes presumably were involved. Among the latter were outbreaks of encephalitis in the Atlantic City, New Jersey area in 1959, which resulted in some human deaths and a reduction in resort and recreation business; and in St. Petersburg, Florida, where the news media, circulating opinions that concentrations of birds at feeding stations were responsible for the epidemic, probably were responsible for the passing of a city ordinance prohibiting the feeding of wild birds. Stamm points out that the critical causative mechanisms for such epidemics is juxtaposition of donor (e.g. birds) and vector (e.g. mosquitoes), and later of vector and recipient (e.g. man) and is not the absolute numbers of any of the three entities. He suggests that much is to be learned about these relationships and that ornithologists can provide much information needed by virologists in developing efficient methods of predicting, preventing or controlling these epidemics. He states that epidemics produced by arboviruses have an important and complex emotional, political, and economic impact on affected human communities but the impact is much greater than consideration of actual mortality would suggest.

(Other references relating, in part, to human health, safety, and well-being include: 51, 71, 97, 111, 138, 144, 145, 183, 199, 210, 211, 212, 213, 215, 228, 238, 297, 314, 415.)

C. Human Preferences

Baumann, D. D. (228)

1969. Perception and public policy in the recreational use of domestic water supply reservoirs. Water Resour. Res. 5(3): 543-554. *

"Recreational activities are more restricted on domestic water supply reservoirs in the Northeast and Far West than in the remainder of the USA. In the Northeast and Far West, recreational activities are usually prohibited from domestic water supply reservoirs, especially bodily contact activities; the water managers view recreation as incompatible with the production of safe potable water, and consumer opinion opposes such reservoir use. In the remainder of the country, recreational activities are not only allowed on domestic water supply reservoirs, but the water managers do not consider reservoir recreation as inimical to the hygienic and aesthetic qualities of the drinking water, and the public favors such reservoir use. From a literature review, it is concluded that

all recreational activities can be permitted on domestic water supply reservoirs without any measurable increase in the risk of water-borne disease if the water is properly treated."

Brokaw, H. P. (Ed.). (229)

1978. Wildlife and America. Council on Environmental Quality, Washington, D.C. Cosponsored by U.S. Fish and Wildlife Service, Forest Service, and National Oceanic and Atmospheric Administration. 532 pp. (For sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, stock number 041-011-00043-2.)

There are 33 chapters (by 40 authors) in this book arranged in seven major sections dealing with: values and uses of wildlife, modification of wildlife habitat, stress from human activities, legal and political authority, wildlife management, protection of wildlife habitat, and the support of wildlife conservation. The book, resulting from a national symposium held in 1976, is intended as a source for fact and philosophy about wild animals and man in a broad sense; it discusses what has happened to wildlife and wildlife habitat; and it serves as a critical analysis of the adequacy of present conservation efforts so as to provoke thought and action on how to improve these efforts.

Although the influence of urbanization, abetted by technology, on fish and wildlife is addressed specifically in only one chapter (see reference 40 of this bibliography), the subject is treated in chapters on inland waters, the seashore, and elsewhere. Chapters on funding wildlife conservation programs, environmental education, wildlife training and research, reforming private land use practices, and the role of private organizations have application to wildlife in urban areas. Durward L. Allen, in Chapter 3 of the book, discusses the values of wildlife including the benefits and enjoyment derived from urban wildlife and nongame species. Recreational fishing is discussed in Chapter 5 by Richard H. Stroud. He states that recreational fishermen have done more than any other group of Americans to create awareness of the need for nationwide water pollution control.

Burger, G. V. (230)

1971. Some other thoughts on wildlife research and management objectives. The Wildlife Society News. No. 137, pp. 69-70.

This is a response to observations on the same subject by Crissey (see reference 231). Burger points out that competition--with others, with one's own previous marks, or with a preset goal--and the ego-satisfaction derived therefrom, is a major feature in wildlife-oriented recreation, just as in other aspects of life, and feels that few hunters, unless they

are presented with the sight of and chance to bag game at reasonably frequent intervals, will continue hunting. He thinks that competition and the self-satisfaction so derived, through the largest daily list motivate the average bird-watcher the same as competition motivates the hunter. He urges that wildlifers not lose sight of the research goal to "show how to produce two ducks where one was produced before" and he makes a plea for increased attention to habitat management needed to assure there will be wildlife--both game and nongame--to use.

Crissey, W. F. (231)

1971. Some thoughts on wildlife research and management objectives. The Wildlife Society News. No. 134, pp. 27-28.

The author suggests there is need for clarification of objectives for wildlife management before wildlife research priorities can be established. Crissey believes that wildlife programs should be developed to benefit people and that one of the primary end products of the efforts of wildlife personnel is recreation, but he indicates that there should be a better understanding of what the recreation benefits are. Others, he states, believe that wildlife management is primarily for the purpose of maintaining wildlife populations and their environments. Crissey believes that doubling of the wildlife population will not double the benefits received from the resource, but the benefits can be doubled if programs are developed to induce people to make more use of birds and animals that exist. Although Crissey indicates more benefits might be derived from hunting by methods such as bow hunting which requires more time or skill than hunting deer with a gun, for example, more attention to nonconsumptive forms of wildlife in urban and suburban areas might provide greater recreational benefits.

Dagg, A. I. (232)

1974. Reactions of people to urban wildlife, pp. 163-165. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Author's summary: "Most urban dwellers liked seeing birds in the city, with the exception of starlings and pigeons which have become pests. Both are exotic species. Most people liked chipmunks, squirrels and cottontail rabbits in the city too, but other mammals were unpopular because of the damage they caused. Despite their acceptance of many wildlife species in the city, a large number of people were unable to identify many of the animals sometimes present in Waterloo, Ontario. The ability to recognize animals was a function to some extent of education as well as of age."

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Davey, S. P. (233)

1967. The role of wildlife in an urban environment. Transactions of the 32nd North American Wildlife and Natural Resources Conference, pp. 50-60.

This is a plea for wildlife managers to become more active in the enhancement of wildlife in the urban environment. Values of wildlife to people are discussed and statistics are provided to show increasing public interest in wildlife, outdoor recreation and conservation. Funding possibilities, including the Land and Water Conservation Fund, are mentioned and opportunities for participation of wildlife managers operating in the urban area in cooperation with people from other disciplines are suggested.

Davis, J. D. (234)

1974. Wildlife in your backyard, pp. 175-177. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author states that the National Wildlife Federation has close to three and one-half million supporters and that the NWF uses the money they get from these people to make the other 207 million citizens in our land more aware of natural resources and of the mounting need for their sound management. Davis describes the NWF's Backyard Wildlife Program as a way of attracting public attention to the needs of urban wildlife. About one out of ten who receive an application form from the Federation fill it out and report on accomplishments including animals seen. Davis indicates that many backyard gardeners have rooted out flowers which have no particular value for wildlife and have replaced them with autumn olives, highbush cranberry and other producers of food and shelter; others have installed bird baths or built small pools in their yards.

Girard, G. L. (235)

1941. The mallard: its management in western Montana. Journal of Wildlife Management 5(3):233-259.

The author, previously with the U.S. Fish and Wildlife Service, reports on his observations as manager of five small wildlife refuges in Montana during 1937-39, particularly with respect to life history and management of the mallard (Anas platyrhynchos). Information is provided on nesting cover, nesting behavior and success, family life, survival of young, foods, the farming program, winter feedings, and hunting. The interest aroused by mallards in city parks is mentioned. The importance of cooperation among many agencies in the management of mallards was recognized and information gaps were listed.

Gray, G. G., J. S. Larson, and D. A. Braunhardt. (236)

1979. Urban conservation leadership and the wildlife resource. Urban Ecology 4(1):1-9.

Authors' abstract: "Municipal conservation leaders in one of the most densely populated of the United States were surveyed to determine their preferences for nonconsumptive wildlife-related activities and for wildlife species, and the extent to which wildlife considerations influenced the acquisition of conservation land. The preference among activities was highest for viewing wildlife and for hobby nature study. Wildlife species ranked highest were those that are common, visible, and well publicized. Much interest was expressed in rare and endangered species, but respondents were not able to identify those resident animals which are in this category. Wildlife played a minor role in the acquisition of conservation land by the municipalities surveyed."

The authors pointed out that Massachusetts was the first of the northeastern States to establish municipal conservation commissions--1958--in a region where there is a growing trend to authorize local units of government to acquire and manage land for a variety of conservation purposes. Such authorization has the advantage of involving the local citizen in environmental management but members of local unpaid boards are not professionally trained.

Massachusetts conservation commissions had acquired 43,756 acres of land, by 1975, of which, in 24 commissions sampled, 52.1% was for recreation, 15.7% for watershed protection, 15.4% for water resources, and 1.1% for survival of wildlife. The preferences indicated by municipal conservation commissioners in 1974, among taxonomic classes of animals, showed mammals to rank slightly higher than birds, while scores for reptiles and amphibians were very low. Preferences among all wildlife by these commissioners showed that white-tailed deer and moose rank highest, followed by eagles, hawks and owls, upland game birds, waterfowl, song birds (Passeriformes), beavers, whales and seals, and various other water and shore birds; bats, mice, moles and shrews were at the bottom of the list. The commissioners indicated support for management programs oriented toward nongame species, but not at the expense of game animals.

The authors suggest that public agencies concerned with nongame urban wildlife programs will encounter a receptive local audience but effective translation of this interest, via habitat acquisition to benefit wildlife is not occurring in Massachusetts. They recommend that several means be examined for increased effectiveness, including: special training for commissioners, provision of expert technical assistance, and new selection criteria for selection of commissioners.

Heidman, M. L., Jr. (237)

1975. Tapiola: model, myth, or happenstance--a personal investigation. Urban Ecology 1(1):5-47.

In this new city north of Helsinki, Finland, a survey was made of the citizens to determine the main reasons for living there. "Those reasons given most often were as follows: green natural beauty, uniquely blended with town living, and the pleasure of walking around in these surroundings; Tapiola's quality as a good place for children--happy, safe, easy, full of things to do; a variety of good services close by; community spirit and the quality of being a good place for all kinds of people; peace and quiet."

The author stated, page 15, "It has been the consensus of planners, journalists, environmentalists, etc. actually visiting it that Tapiola stands at the top of existing urban communities for quality of physical environment, judged both objectively and negatively (low levels of air pollution, noise, etc.) and subjectively and positively (natural quality, beauty convenience, etc.)."

Heidman reported, page 17, "Tapiola has over 50% of its land as public, common, natural, open space (after VonHertzen and Spreiregen, 1973, pages 158-159). This is much higher than has been achieved in any other planned town, much less usual development. It also has a unique variety of sizes and types of open space areas, both around and throughout the built-up areas."

Reviewer's comment: Current new towns and other large-scale planned development in the United States run about 20% bona fide community open space.

Hines, T. C., and R. Schaeffer. (238)

1977. Public opinion and alligators in Florida. Proceedings Annual Conference, Southeast Association Fish and Wildlife Agencies 31:84-89.

Authors' abstract: "A public opinion survey designed to measure human attitudes toward wild alligators (Alligator mississippiensis) and alligator management was carried out. Most (92%) Florida residents view the alligator as a valuable species, but 72% felt that large alligators are dangerous. There was variation in the degree of danger attributed to alligators by various socioeconomic groups. Opinions about management strategies were more variable than for the other topics examined. In urban areas, 52% felt that wildlife officers should capture large alligators, a sizable group (50%) favored commercial harvest and sport hunting in wild areas, and 25% favored complete protection in wild areas."

The authors stated, page 84, that more than 10,000 persons called Game and Fresh Water Fish Commission offices during 1976 to request that live alligators be removed but others felt that conflicts between humans and alligators were not serious and that further expansion of the wild alligator population in Florida was justified.

This study was conducted through the use of questionnaires sent to samples of the general public in different regions of Florida and to a sample of persons who had purchased Florida hunting licenses in 1976.

Eighteen percent of the respondents with urban backgrounds regarded small gators (less than 1.3 m) as either occasionally dangerous or usually dangerous as compared with 10% of those people with rural background. There is little factual evidence that the small alligators are a threat to humans. Only 6% of the respondents favored complete protection of large alligators in urban settings, while 16% felt that small alligators should be offered complete protection.

Hinkle, L. E. (239)

1968. Response to address on human needs and the natural environment, pp. 7-9. In Man and Nature in the City, U.S. Department of the Interior. (For full citation see reference 45.)

Hinkle, in commenting on the address by Stainbrook (1968) regarding human needs and the natural environment, recognized man's dependence upon plant and animal life and that fish and wildlife and related resources are a valuable part of our heritage. He pointed out, however, that we have little hard, reproducible scientific information on how much and what kind of parklands and recreational areas are required in our cities and how men can best relate to nature in these areas. He recommended research and experimentation to learn more about the problem.

Howard, W. E. (240)

1974. Why wildlife in an urban society?, pp. 13-18. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Howard raises the question of wildlife values pro and con in urban areas and suggests that before encouraging any species of wildlife in such areas we should: (1) identify the animal and plant species involved; (2) determine the size of suitable habitat that will be required; (3) consider the effect the target species may have on other species; (4) determine if there are any likely irreversible consequences; (5) consider all possible alternative species and habitat developments; (6) examine thoroughly the human relationships involved; (7)

establish priorities and spell out precise objectives for each species being considered; (8) determine if the species might become a nuisance, serious pest, or health problem; (9) capitalize on the rapidly growing social and recreational values that the public is placing on all wildlife; and (10) involve the widest range of other disciplines such as sociologists, planners, landscape architects, and educators in this problem solving effort, for wildlife and other problems will be solved only if a multidisciplinary approach is used."

He states "...it is desirable to preserve natural areas, but there is no reason why we should not also construct highly unnatural but manageable habitats that may have far more needed niches available than would a natural habitat occupying the same amount of space. We have not yet learned how to most effectively utilize railroad rights-of-way, roadsides, drainage ditches, and the like for wildlife. With few exceptions, city parks, school yards, and public buildings are not landscaped with the enhancement of wildlife being considered. These public areas could be used to demonstrate what is possible on a massive scale. Readily adaptable species like the house sparrow, pigeon, starling, and rat, become difficult to manage; so when attracting new kinds of wildlife, it is important to be certain that, if things do not work out, the species can be easily discouraged from its new niche."

Jahn, L. R. (241)

1978. Report of nongame wildlife committee. Proceedings of the Sixty-Seventh Convention, International Association of Fish and Wildlife Agencies, 12-14 September 1977, pp. 264-272.

In this report of the International Association's nongame wildlife committee, Committee Chairman Jahn reviewed the status of the proposed Federal Aid in Nongame Fish and Wildlife Conservation Act, discussed public interest and demands for strengthening nongame fish and wildlife programs, and reviewed some of the needs for nongame programs. He pointed out that in a survey of households conducted in southeastern United States (see reference 261), nonconsumptive values of fish and wildlife were found to be greater--($12.3 billion) than combined hunting and fishing values--$11.8 billion. As an indication of the increasing numbers of participants in nature-oriented outdoor recreation and growing interest in related activities, he stated that membership in the National Audubon Society expanded from 41,000 in 1963 to 321,000 in 1975 and that subscriptions to the National Wildlife Federation's National Wildlife magazine went from 60,000 in 1963 to 600,000 in 1977. Although as Jahn observed, habitat management for game species also benefits nongame species, more funds are needed for nongame planning, management and research. He estimated that of the 3,699 U.S. vertebrate species, probably less than 10% receive specific management attention. An

important objective, he stated, is to enhance understanding, appreciation and enjoyment of fish and wildlife populations, the natural and man-dominated units of the landscape they use, and the management actions required to insure their production and survival.

Leach, H. R., and E. G. Hunt. (242)

1974. Coyotes and people, pp. 117-119. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The authors give a brief account of the past and current status of the coyote in California including efforts at control and the different values placed on the coyote by people. "With the continuing expansion of urban developments in southern California, inhabited now by 13 million people, comes an increasing clamor to do something about the coyote and other wildlife that are being displaced.... From the same community comes an outcry for coyote control...."

Leonard, J. W. (243)

1972. Hunter vs. protectionist: can the wildlife manager serve both? Proceedings, 62nd Convention of the International Association of Game, Fish and Conservation Commissioners, pp. 34-38.

Dr. Leonard mentioned the increasing anti-hunting sentiment and public awareness of environmental quality and observed that the nonconsuming participant in outdoor recreation is better educated, on balance, than the average citizen. He suggested that a taste for nonconsuming outdoor recreation appears to be largely an urban-based phenomenon. Although the sportsman has done much through hunting and fishing license fees to provide funds for acquiring and maintaining land and water for recreational use which also benefits the nonconsumptive and often noncontributing user, they could take a more active role in matters affecting the quality of the environment generally and thereby attract more support from today's new environmentalists.

Lumsden, H. G. (244)

1957. The problem of changing beliefs and attitudes. Journal of Wildlife Management 21(4):463-465.

Author's summary: "Opinions remote from reality held by sportsmen and other groups have prevented game departments from adopting sound deer management programs. Written material used in information campaigns is not effective in changing strongly held beliefs. Group discussions are more effective than lectures or individual instruction because opinions are

a part of the group and its situation. The social support of groups subscribing to progressive views should be used to make converts."

McKeating, G. (245)

1977. Wildlife studies in urban areas, pp. 133-137. In Ecological (Biophysical) Land Classification in Urban Areas. Proceedings of a Workshop, Canada Committee on Ecological (Biophysical) Land Classification. (For full citation see reference 46.)

Author's abstract: "Evidence exists to suggest that urban dwellers value natural areas in their community, but an education process for residents, developers and planners among others is clearly needed. A number of wildlife studies have been undertaken in cities but little application of the data has occurred."

The author reports that in a series of public meetings with residents of a Toronto suburban community, residents strongly supported preservation of a natural ravine. He states that data from the Tourism and Outdoor Recreation Planning Study (TORPS) indicated that the number of days people participated in activities related to nature appreciation averaged 18.6 days for the Toronto area and 12.9 days in a large nonurban area of southwestern Ontario. He reviews some of the research done in urban areas on wildlife by Geis, Erskine, Thomas and DeGraaf, Dorney and others and suggests that studies should be undertaken that would attempt to justify in economic terms the advantages of natural environments in urban areas. Identification and quantification of the perceptions and attitudes of urban people toward nature in their communities as a fundamental need is also indicated.

More, T. A. (246)

1979. The demand for nonconsumptive wildlife uses: a review of the literature. USDA Forest Service, Northeastern Forest Experiment Station, 370 Reed Road, Broomall, Pa. 19008. Forest Service General Technical Report NE-52, 16 pp.

Author's abstract: "Nonconsumptive wildlife use is a generic term for a variety of recreational activities related to wildlife. Primary nonconsumptive uses include general wildlife observation, birdwatching, birdfeeding, and wildlife and bird photography. Secondary activities include nature walks, membership in animal-related organizations, ownership of wildlife pets, and zoo visitation. This report reviews the literature about the demand for nonconsumptive wildlife, based on surveys of the attitudes, preferences, participation, and expenditures for related activities."

Sixty-one references are cited in this report. In his summary and conclusion, page 13, the author states: "Based upon the series of recent surveys examined here, approximately 27 percent of the U.S. population participates in wildlife observation, 5 percent enjoy birdwatching, 2 percent are wildlife photographers, and 20 to 30 percent of U.S. households feed birds. Most of these activities appeal to people from all walks of life--there are few socioeconomic or demographic differences between participants and the general population. Overall, participation appears to be highest in the West, the north-central and northeastern regions, and lowest in the South."

Reed, D. J. (247)

1976. The San Antonio River walk: a user and environmental analysis. Journal of Soil and Water Conservation 31(1):28-30.

The author describes, briefly, the history and nature of this well-known combination park-and-business river walk in San Antonio, Texas, where, rather than taking the alternative of covering the San Antonio River for a storm sewer, a flood prevention program was undertaken along with riverfront enhancement and over four million visits are made annually. A survey indicated that even though taxes might have to be raised, over 73% of the users would favor a bond issue to support development in their own city (if a nonresident) or in another city (if a resident). The study indicated that a small amount of water in an urban area can be a powerful social and economic force and can provide a stimulus for tourism and civic pride.

Reilly, W. K. (Ed.). (248)

1973. The Use of the Land: a Citizens' Policy Guide to Urban Growth. Thomas Y. Crowell Company, New York. 318 pp.

This is a report of the Task Force on Land Use and Urban Growth, a private organization, then under the chairmanship of Laurence S. Rockefeller reporting to the Presidential Citizens' Advisory Committee on Environmental Quality. The Task Force conducted studies in New York, Colorado, and Florida where citizens' environmental groups have been active in questioning traditional assumptions about the desirability of continued urban growth coupled with demands to know how proposed new developments will improve lives and communities. The Task Force concluded that environmental concerns must be tempered by social concern and suggested ways for improving the methods used to urbanize land.

Schmid, J. A. (249)

1975. Urban Vegetation. Research paper no. 161, Department of Geography, University of Chicago, 5828 S. University Avenue,

Chicago, Illinois 60637. 266 pp. $6.00 paperback book.

As stated in the Introduction this study seeks to forge a new synthesis, and it draws on insights from many disciplines to initiate a systematic understanding of plants in the urban landscape. It focuses in detail on Chicago and examines the landscape into which that city and urban region expanded and still expands at present. The native plant communities are described in summary form and characteristic ecosystem changes are reviewed as they affect the survival of pre-urban vegetation into the built environment. Patterns of vegetation in contemporary Chicago are examined in the results of a census of plants that grew in the front yards of 800 houses which differed greatly in age and socioeconomic class. Findings of the study are then compared with the scattered literature on urban vegetation elsewhere.

The author points out that the Chicago region's legacy from the Glacial Period is a complex array of landforms and soil-forming materials which once governed the distribution of its plant communities. He indicates that floristic homogeneity is increasing, but the landscape still retains a perceptible visual differentiation based in large part on wild vegetation. However, he points out that the chief habitat factor in residential Chicago now is landscape taste, a social characteristic just beginning to receive its proper recognition by geographers and other scholars in the social sciences.

Schmid states that the use of vegetation for traditional purposes appears to restrict possibilities for individual homeowners to derive environmental benefits from their plants and that virtually no effort has been made by individuals in Chicago to utilize vegetation to reduce noise levels from automobile traffic. He suggests that the appearance of large masses of border plants is a sign of certain gardening fashions among particular social strata. Apparently the common native upland species almost never were planted by residents after settlement and the native understory that consists of shrubs and herbaceous plants is allowed to persist only where lot size is great enough to provide excess space, after all the requirements for structures and for lawns and other cultivated ornamental plants have been met viz. on lots usually larger than 0.5 acre.

Scant reference is made to wildlife but the importance of vegetation, particularly native vegetation, to wildlife is recognized, pp. 102 and 103.

Shaw, W. W. (250)

1974. Meanings of wildlife for Americans: contemporary attitudes and social trends. Transactions of the 39th North American Wildlife and Natural Resources Conference, pp. 151-155.

There have been two important developments in American attitudes toward wildlife in recent years--(1) an increasing concern for nonconsumptive wildlife values, and (2) growing criticism of traditional consumptive wildlife uses, i.e. opposition to hunting and trapping. The author suggests that as human numbers and environmental impacts have continued to increase at the expense of wildlife habitat and hence wildlife numbers and as urbanization has concentrated people in metropolitan areas where only a few species of wildlife can exist, attitudes toward wildlife have changed. He suggests, further, that in the culture as a whole, the aesthetic and existence values of wildlife appear to be replacing consumptive recreation as the most important uses of wild animals. He concludes that values of wildlife to society must ultimately be measured in human, not biological terms and that the goal of wildlife management should be to maximize human benefits from wildlife within the framework of biological feasibility. These benefits are often abstract, intangible, and subject to change over time.

Shaw, W. M. (251)

1977. A survey of hunting opponents. Wildlife Society Bulletin 5(1):19-24.

Author's abstract: "Two hundred Michigan members of a nationally prominent anti-hunting organization were surveyed in 1974. The survey instrument dealt with sociodemographic characteristics and attitudes toward hunting, wildlife and related issues. As a group, respondents were middle-aged, well educated, mostly women, and from predominately urban backgrounds. Most of the respondents had always objected to hunting and their opposition was supported by a broad range of beliefs and attitudes. This group rated the ecological, aesthetic, and existence values as the most important values of wildlife and habitat destruction was considered wildlife's greatest threat. Implications of these findings for wildlife managers are discussed."

The group referred to, or surveyed, were supporters of the Fund for Animals, Inc. With respect to their attitude toward hunting, 69% of the respondents strongly disapproved, 25% disapproved, 2% were neutral or indifferent toward hunting, 3% indicated hunting was okay, and 1% strongly approved of sport hunting.

Reasons listed for considering wildlife important in descending value included (page 22):

1. They are a part of the ecological balance upon which we are all dependent.
2. People enjoy viewing wildlife.
3. People enjoy just knowing they exist.
4. They play an important part in our cultural heritage

(songs, legends, etc.).

5. Animals may have souls like humans.
6. They are of scientific value.
7. They help the economy by attracting tourism.
8. They are a source of food and furs.
9. They provide hunting recreation.

Possible threats to wildlife as seen by the group included (page 23):

1. Loss of habitat due to human developments.
2. Illegal hunting.
3. Pollution.
4. Commercial trapping.
5. Unsound wildlife management practices.
6. All terrain vehicles (snowmobiles, jeeps, etc.).
7. Legal sport hunting.
8. Predation by other animals.

The author pointed out the need for the wildlife management profession to broaden its base of public support regardless of the attitudes toward hunting.

Shaw, W. W., E. H. Carpenter, L. M. Arthur, R. L. Gum, and D. J. Witter. (252)

1978. The American disposition toward hunting in 1976. Wildlife Society Bulletin 6(1):33-35.

The authors report on results of telephone interviews conducted in May and June, 1976, using a representative probability sample of households in the 48 contiguous states and the District of Columbia. Completed interviews totaled 2,041 and an additional 419 cases in the sparsely settled Intermountain Region were interviewed for regional analyses but not included in the aggregate national statistics. Purpose of the survey was to determine peoples' attitude toward sport hunting. Of the respondents, 66% of the males and 43% of the females approved of hunting. Stratified by type of present residence, the percentage approval of hunting (combined sexes) was: 46 for cities, 51 for suburbs, 60 for towns, and 68 for farms and country. Approval was lowest (43%) among the youngest age category of 18-25, gradually increasing to a maximum of 64% for the 46-55 years group, and then decreasing for the older categories. The authors state, page 34 "Assuming that future cohorts (those less than 18 now) will follow similar trends, these results suggest a continuing erosion of public approval of hunting.... Wildlife and wildlife concerns are no longer solely the realm of select interest groups. They have become household issues with the American public and as a profession, wildlife managers must constantly assess their roles in serving the total public." The study indicated that although most

members of the general public are neither active hunters nor active members of anti-hunting organizations, many of the people interviewed had extremely strong views on their approval or disapproval of sport hunting. Regionally, disapproval of sport hunting was most prevalent in the New England and Middle Atlantic areas and the strongest support of hunting was in the South Central states.

Smith, L. C. (253)

1975. Urban wildlife--is it wanted and needed? Canadian Field Naturalist 89(4):351-353. Oct.-Dec. 1975. (From Wildlife Review 160, page 1.)

SRI Community Response of Colorado, Inc. (254)

1977. State Division of Wildlife, wildlife use survey: summary analysis. Colorado Dept. of Natural Resources, Division of Wildlife, Denver. 15 pp. + appendices.

This survey provides information regarding wildlife use throughout Colorado. It defines the type of wildlife activities the people of Colorado participate in, frequency of participation, kinds of wildlife preferred and potential use of an established wildlife preserve; and explores various means to finance such a natural preserve, including peoples' willingness to pay for a program to protect wildlife. It indicates that where differences existed in responses to this telephone survey of heads of households, men are more likely than women to participate, express interest in, and be willing to finance wildlife-related activities, and that, age-wise, people 25-40 years old are most active and supportive. The greatest number of people, in descending order, participated in observing wildlife, feeding/observing wildlife in their own backyards, fishing, feeding wildlife, hunting, and photographing wildlife. Almost two-thirds of the sample reported that time had been taken to observe wild animals during the last two years; almost half of the sample reported feeding and observing wild animals in their own yard; and 44% of the sample had fished at least once during the past two years. For other than hunting, fishing, trapping, and feeding and observing animals in their own yards, the respondents indicated they were most interested in big game (63%), small mammals (36%), song and garden birds (21%), birds of prey (10%), upland game birds (10%), and waterfowl (9%). Fish, shore birds, reptiles, and amphibians were at the lower end of the list in which interest was expressed. When asked about expenditure of public tax money in support of various activities, preserving endangered species rated top priority (85%--higher, 98%, for people aged 16 to 24), followed by wildlife observation areas (68%), wildlife educational brochures (61%), and studies of numbers of animals (56%).

Strange, J. D. (255)

1969. The urbanite's interest in rural land use planning. Journal of Soil and Water Conservation 24(5):176-178.

The author points out that although 70% of the people in the United States live in urban areas on 1% of the land, and their conception of a quality environment relates to rural land values such as outdoor recreation, wildlife, clear water, scenic beauty, fresh air and open space for relief from the constraints of urban life, the average urbanite exercises little interest in the development of land use policies and resource management program. Education and motivation are needed.

Szot, T. R. (256)

1975. Perception of urban wildlife by selected Tucson residents. University of Arizona, Tucson, M.A. thesis (geography). 121 pp.

Residents living in different parts of Tucson perceived urban wildlife differently. People living on the edge of town generally were aware of more species than residents toward the center of town. One-half or more of the correspondents felt there was already enough (or perhaps too many) animals present within the city and less than half would be willing to support a wildlife management program to provide more wildlife.

(Additional references which deal, in part, with human preferences and attitudes are: 5, 12, 43, 80, 91, 112, 138, 142, 145, 149, 159, 172, 173, 177, 183, 184, 190, 196, 197, 204, 207, 225, 260, 264, 273, 280, 299, 339, 344, 374, 376, 389, 404, 415, 448, 457.)

D. Economic-Recreational-Tourism Values

Andresen, J. W. (257)

1975. New York's urban forests. University of the State of New York, the State Education Department, NAHO 8(1):6-9.

Although the term "urban forest" sounds contradictory, the older residential and business section of Syracuse, Rochester, Albany, Binghamton or Queens County have mature tree crowns that now occupy 50% or more of available airspace. "All trees, especially those in the city, have a positive monetary value. In addition to the current standard rate between $10 and $12 per cross-sectional square inch (measured at 4.5 feet above ground level) for healthy shade trees, specimen and historic trees in sound condition have premium monetary value. A vigorous 30-inch diameter Norway maple growing in Brooklyn will be worth over $7,000. In aggregate, the value of publicly owned trees in a typical city of about 200,000 people is over

$100 million. Add to this the value of privately owned trees on front lawns and back lots and the figure becomes astonishing. The monetary value of shade trees decreases as one travels away from the city."

DeGraaf, R. M., and B. R. Payne. (258)

1975. Economic values of nongame birds and some urban wildlife research needs. Transactions of the 40th North American Wildlife and Natural Resources Conference, pp. 281-287.

The authors suggest that perhaps the greatest opportunity for human enjoyment of wildlife exists for urban man in the observation of non-game birds. They state, "By the measure of economic value, the enjoyment of non-game birds is already a big business, and that business is growing. We estimated the total direct expenditures associated with the enjoyment of non-game birds. Included in our estimate were retail sales of birdseed, birdhouses and feeders, field guides, gift books, a portion of total retail sales of binoculars and cameras, and dues paid to representative professional societies.

"We believe our estimate is conservative and that it represents a minimum value of the economic importance of non-game birds. We have not attempted to measure willingness to pay for bird watching; we have estimated only what has actually been spent for the activity. Actual expenditures obviously must always be less than or equal to willingness to pay."

Indirect expenditures such as transportation, lodging, food and alcoholic beverages during bird watching expeditions and the value of clothing worn by participants were not included.

After discussing various expenditures for nongame bird enjoyment, they state, page 284, "Thus the total direct expenditures attributable to the enjoyment of non-game wildlife in 1974 appeared to be about $500 million. Photographic equipment and services, birdseed, and binoculars account for 95 percent of this total. An additional three percent is contributed by birdhouses and feeders, with minor contributions from membership dues, gift books and field guides."

The authors conclude that about 20% of U.S. households purchase an average of 60 pounds of birdseed per year, an amount that has remained constant for several years despite increasing prices. For 15 million households feeding birds in 1974 the retail sales were estimated at $170 million.

Among the suggested research needs listed are: (1) determination of habitat requirements of non-game species; (2) inventories of urban and suburban wildlife populations and sites which have potential for habitat management; (3) identification of who the constituents are, i.e., who enjoys wildlife, when

and how; (4) determination of what benefits, either mental or physical, are derived from experiences which include wildlife; and (5) research on laws that would help protect habitat and allow tax deductions for backyard habitat improvement.

DeGraaf, R. M., and J. W. Thomas. (259)

1973. Songbirds bring joy to cities. USDA Forest Service, Northeastern Forest Experiment Station Forestry Service in the Service of Man No. 16. 4 pp.

Based upon 367 questionnaire returns out of 538 randomly selected householders contacted in Amherst, Massachusetts, 43% of the Amherst householders regularly feed birds at an average cost of $8.80 per year on bird feed. Ninety one percent of those who feed birds do so between December and March but 16% of those who feed birds continue doing so in July. An independent market research agency determined that 23.8% of Boston's 861,024 households reported feeding birds regularly at an average cost of $8.20 per year. Using the 23.8% figure and applying it to Massachusetts' 1,762,140 households indicates that householders in the State are voluntarily spending $3,439,000 each year to foster bird populations. Food, water, cover, and reproductive areas are discussed briefly in relation to bird enhancement in residential areas.

DeGraaf, R. M., and J. W. Thomas. (260)

1974. A banquet for the birds. Natural History, January 1974 issue, pp. 40-45. With permission from Natural History, January 1974. Copyright the American Museum of Natural History, 1974.

The authors give a popular account of a random survey of households in Amherst, Massachusetts, to determine the extent of bird feeding in the area.

Of 538 households queried, 43% indicated that they fed wild birds. The average bird-feeding household maintained 1.7 feeders and spent $8.80 annually on bird food. Market research has revealed that 23.8% of the 861,024 households in metropolitan Boston fed birds in 1972, and that each household purchased an average of 69.6 pounds of birdseed during the year. Using the Boston figure of 23.8% of 1,762,140 Massachusetts households, about 419,000 in the State engaged in this activity and spent $3,439,000 in 1972 for bird feed.

The authors state in conclusion: "Now that feeding wild birds has become the basis of an estimated fifty million dollar a year industry, perhaps more thought and effort will be expended on protecting wild birds and their habitat."

Horvath, J. C. (261)

1974. Detailed Analysis Economic Survey of Wildlife Recreation--Southeastern. Economic Research Group, Georgia State University, Atlanta. 183 pp. in five separately numbered chapters.

One of a multi-volume work funded in part by Federal funds under the provisions of the Federal Aid in Wildlife Restoration Act and the Federal Aid in Sport Fishing Restoration Act. This volume consists mostly of computer output tables and their analyses based upon information derived from household interviews and responses to 62 major questions regarding participation in wildlife-oriented activities including hunting, fishing, and nonconsumptive activity such as watching and/or photographing birds, mammals and fish. In the Southeast the households sampled spent almost $36,000 on wildlife-enjoyment activities and the estimated total for the region was $53.7 million. This included an estimated $26.6 million for attractants, such as birds and animal feeders, $13.7 million for cost of visits to zoos and aquariums, and about $13 million for wildlife-enjoyment services and equipment such as guides, and hunting and fishing supplies and equipment. More households spent money on feeders than anything else.

Langford, W. A., and D. J. Cocheba. (262)

1978. The Wildlife Valuation Problem: a critical review of economic approaches. Canadian Wildlife Service. Occasional Paper No. 37. 35 pp.

As stated by the authors, page 31, "This report assesses the legitimacy and effectiveness of existing wildlife valuation techniques. A critical review of the literature found no single valuation approach to be wholly satisfactory. In an attempt to develop an improved conceptualization of the wildlife valuation problem, all major sources of wildlife value were identified and a new theoretical consideration was introduced. The estimate of hunting benefits was considered first, followed by consideration of a method for estimating nonhunting benefits. Finally, an attempt was made to explain how the true separate approaches can be combined." They identify four types of benefits associated with wildlife: recreational hunting benefits, nonhunting recreational benefits, existence value, and option value which is considered to be a future period value. They state that separation of benefits into their private- and collective-good components is required for aggregating wildlife values and that, while hunting benefits have both a private and collective dimension, all other sources of value can be viewed exclusively as collective goods. The nature of a collective good, they state, is such that under some circumstances relatively small collective-good values can result in very large aggregate values. They point out that in the absence of information on the costs and benefits of alternative courses of action, decision making becomes a matter of

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random choices which may or may not be influenced by personal biases. They state that wildlife management decisions are too important to be left to chance and efforts aimed at improving the data base for making these crucial resource allocation decisions should be encouraged. Fifty-four references are cited.

Lewis, H. F. (263)

1951. Wildlife in today's economy: aesthetic and recreational values of wildlife. Transactions of the 16th North American Wildlife Conference, pp. 13-16.

This publication is a brief but perceptive article by the then Chief, Canadian Wildlife Service. He observed that economic values are the kind by means of which people make a living. On the other hand, he stated, page 13, "Aesthetic and recreational values are primarily concerned with living a life. In one form or another, they are essential to real living. They upbuild the persons who assimilate them. Rightly used, they increase ability to perceive and to comprehend. In the long run, they are essential to the sound development of society. In comparison with economic values they take no second place." He observed further that aesthetic and recreational values from wildlife are varied as well as the kinds of wildlife on which such values are based, i.e., the greater the variety of existing wildlife, the greater its capacity to provide opportunities for obtaining aesthetic and recreational values. He suggested that these values are reduced to two principal categories: personal pleasure and heightened ability to see the environment with understanding. He indicated that the increased values resulting from a combination of wildlife species and recreational experiences is greater than in direct ratio, for in many cases combinations that involve two or more kinds of wildlife originate or heighten values obtained.

Manning, R. E., L. W. Moncrief, and J. Hawrelak. (264)

1977. Influence of recreation and amenity values on land use and management: a Michigan case study. Journal of Soil and Water Conservation 32(6):285-288.

Authors' abstract: "We investigated the nature and extent to which recreation and amenity values influence land use and management in the rural/urban fringe of Grand Rapids, Michigan. These values accounted for the ownership objectives of nearly half of all landowners surveyed. Ownership objectives significantly affected land use with respect to land cover types, land tenure, land value, and human activity on the land. In addition, we found significant effects with respect to land management practices involving physical alterations to land, wildlife resources, outdoor recreation, and economic production."

Landowners whose motives for owning land were primarily for recreation and amenity purposes were grouped in a noneconomic category and those whose motives were most financially oriented were grouped under economic objectives. On this basis about 50% of all sample parcels of land were held for noneconomic reasons such as the benefits of living close to nature and enjoying recreation opportunities. Less of the land held by noneconomic owners was in crops; more was in open fields, marsh and brush. Noneconomic land parcels tended to be somewhat smaller and held for a shorter period by the owner than the so-called economic land parcels. The assessed land values for noneconomic lands averaged $337.27 per acre or more than one-third higher than the $219.19 per acre of economic land parcels. The authors concluded that a part of this difference in value was due to the fact that more of the owners lived on, i.e., had buildings on their noneconomic land and were more likely to build fences, roads and nature trails and plant trees thereon. The owners of the noneconomic land parcels also maintained or provided more bird feeders, and nest boxes than the other owners, the percentages being 48 and about 20% respectively. There was no significant difference, however, in the two groups of landowners in planting special food crops or shrubs for wildlife. Several questions of a research nature were raised during the study such as will such land uses increase or reduce demands for public recreation facilities and what are the implications for a region's tax base of such land use changes, including the possibilities of assessment criteria and standards?

Payne, B. R., and R. M. DeGraaf. (265)

1975. Economic values and recreational trends associated with human enjoyment of nongame birds, pp. 6-10. In Proceedings of the Symposium on Management of Forest and Range Habitats for Nongame Birds--a meeting held at Tucson, Arizona, 6-9 May 1975. Dixie R. Smith, Technical Coordinator, Forest Service, U.S. Department of Agriculture General Technical Report WO-1. 343 pp.

Authors' abstract: "Total direct expenditures for the enjoyment of nongame birds in 1974 were estimated to be $500 million. Expenditures for birdseed, binoculars, and camera equipment constituted 95% of the total. Continued moderate growth is predicted."

The authors pointed out that sales of birdseed rose from $50 million in 1969 to $80 million in 1972, to $170 million in 1974, the latter increase being attributable almost entirely to a doubling of the price of birdseed from 1972 to 1974.

Payne, B. R., and S. Strom. (266)

1975. The contribution of trees to the appraised value of

unimproved residential land. Valuation--the Journal of the American Society of Appraisers 22(2):36-45.

Authors' abstract: "Professional appraisers estimated the value of seven simulated combinations of amount and distribution of tree cover for a 12-acre parcel of unimproved residential land in Amherst, Massachusetts. Arrangements with trees were valued higher than arrangements without trees and scattered arrangements of trees were valued higher than concentrated arrangements for a fixed percentage of tree cover."

The authors state, page 40, "Presumably the combined value of large houses on wooded lots is high enough to cover a developer's higher cost in buying and developing wooded land."

Pickels, G. (267)

1970. Realizing the recreation potential of sand and gravel sites. National Sand and Gravel Association, 900 Spring Street, Silver Spring, Maryland 20910. 75 pp.

Sand and gravel operations are generally located close to urban areas where the greatest demand exists for recreational sites and activities; sand and gravel sites often provide topographic relief and water areas useful for a variety of recreational activities; and, with wise land use and progressive rehabilitation practices, recreational uses can occur on sand and gravel sites prior to, concurrent with, or subsequent to, site excavations over extended periods of operation with multiple benefits. The author believes the producer may decide to reclaim a site because: recreation development may offer the producer the greatest economic return for the expense involved; a plan to provide for recreational use may create a favorable impression on local authorities and secure necessary zoning for site operations; recreation rehabilitation is good publicity for the producer and such good will may be beneficial for subsequent operations; and recreation may be the only practical after-use for the site at that particular time. The author states that recreation planners may look to sand and gravel sites as potential recreation sites because: in many cases it is possible to acquire a very unique recreation feature at considerably less cost than if one had to construct a similar facility elsewhere; sand and gravel sites may be the only available potential recreation sites in the vicinity; the long term duration of sand and gravel operations may allow for long-term purchase agreements by public or private concerns; and sand and gravel sites are a valuable asset as open space in a community, before, during, and after excavation.

"The successful transformation of a sand and gravel site into a potentially valuable recreational resource is achieved through the application of a comprehensive and systematic planning process based on a thorough understanding of the

characteristics of the area and requirements of the people, including basic resource inventories and identification of alternative development possibilities."

Shafer, E. L., and G. H. Moeller. (268)

1974. Wildlife priorities and benefits: now, 2000, and beyond. Transactions of the 39th North American Wildlife and Natural Resources Conference, pp. 208-215.

Based on a personal interview survey of 47 decision makers in four public agencies to determine the priority that recreation planners assign to wildlife values in comparison to values they assign to physical features of the resource and to social needs and conditions associated with the development of recreation facilities, wildlife values rate high in the recreation environment planning process only for wildland management situations. In these situations, wildlife is prominent already or is likely to occur. In the city, the planners assigned low or negligible priorities to wildlife. The authors ask, page 211, "If we continue to place heavy emphasis on wildlife values only where wildlife presently exists in abundance, will the eight out of ten Americans who will be living in cities by 1980 become less concerned with wildlife--as well as with policies and programs designed to maintain, perpetuate, and protect wildlife?" They indicate that, while wildlife management's future prospects and directions appear to be determined by ties to the past and to old ideas, there are challenges to meet in the future. They suggest that although hunting will continue for some time in the future as an important use of wildlife resources, by the year 2000 nonconsumptive uses of wildlife, such as photography and observation, will be the primary social values; and with the shrinking acreage of land resources available for people-wildlife interaction, particularly near urban areas, cemeteries and other open space in urban areas will need to be managed intensively for wildlife habitat and for observation of wildlife.

USDA Agriculture Research Service. (269)

1965 (slightly revised, 1975). Protecting Shade Trees During Home Construction. USDA Agricultural Research Service, Home and Garden Bulletin No. 104, available Superintendent of Documents, U.S. Govt. Printing Office, Washington, D.C. 20402. 8 pp.

"Shade trees can add thousands of dollars to the value of residential property--yet homebuilding contractors often remove them before starting construction. Many trees can be saved with little effort or expense; many are valuable enough to justify considerable effort and expense in protecting them. But some trees are worth less than their owners realize."

This bulletin provides criteria to determine from information as to their location, species, size, age and vigor whether trees are worth saving and discusses approaches and methods of protecting or of moving trees on building sites. For greatest success and safety in moving trees, it is suggested that an arborist or tree surgeon be engaged. They indicate that elm, poplar, willow, plantree, and locust adapt well to environmental changes in moving whereas beech, birch, hickory, tulip trees, some oaks, most maples, and most conifers are less adaptable. The protection suggested as desirable to save trees left in place includes protection from mechanical injuries by fences or other barriers; protection from grade changes; protection from excavation; and protection during cleanup.

USDA Forest Service. (270)

Undated. Trees could make a difference in the selling price of your home. Northeastern Forest Experiment Station, Upper Darby, Pennsylvania 19082. Photo Story No. 26. 4 pp.

Researcher Bryan R. Payne of Amherst, Massachusetts found that the presence of trees around a house appears to have a tangible effect on its marketability, enhancing the value of a property by as much as 20%, with an average increase of 5 to 10% for architecturally similar houses. Trees offer beauty, shade and habitat for birds and, at the same time, leaves to rake, damage to pipes and paving.

(Some mention of economic and recreation values of fish and wildlife is made, also, in references 20, 67, 100, 159, 167, 170, 171, 172, 173, 174, 175, 220, 227, 229, 231, 233, 241, 243, 245, 246, 247, 251, 280, 348, 356, 363, 369, 396, 401, 409, 448.)

IV. PLANNING ASPECTS

References included in this subject matter category deal with formulation of plans and designs for sites designated for development as new towns or suburban areas, for rehabilitation of developed urban areas, and for regional and special areas such as open space and coastal areas, airports, flood plains, surface-mined sites, and municipal parkways and streets. Brought out are the facts that, often unwittingly, city planners and urban designers function as wildlife managers in that their plans for open space, recreation areas, urban vegetation management, storm water management, and waste disposal have a direct bearing on fish and wildlife habitats and that qualified wildlife biologists should have a voice in the decision-making process.

A. Site

Allen, P. (271)

1974. To preserve a heritage: conservation easements. The Maryland Environmental Trust, 8 East Mulberry Street, Baltimore, Maryland 21202. 24 pp. with illustrations by Kathy Polland.

A nicely-prepared booklet which points out needs and opportunities, through conservation easements, to preserve open space in Maryland. Such an easement is described and questions that might be raised by a donor interested in selling or giving an easement are answered. Considerable attention is given to tax consequences of easement donations, both Federal and State. Concerned individuals are encouraged to participate in the program for the benefit of future generations and the Maryland law concerning conservation easements and a sample easement are provided in Appendices I and II.

Bernatzky, A. (272)

1975. Gardens for stepped terrace housing. Urban Ecology 1:49-62.

The author, of the German Academy of Town and Country Planning, Frankfurt/Main, recognizing that ground for gardens and green spaces is becoming increasingly scarce, suggests that one way out of the situation is construction of stepped terrace housing blocks, where each dwelling is allotted a very small garden.

Burby, R. J., III, and S. F. Weiss (with others). (273)

1976. New Communities USA. Lexington Books, D. C. Heath and Company, Lexington, Mass. xxxiii + 593 pp.

A good reference book on new communities or new towns, their concept, development since 1947, who lives in them, why people move in and why they move out, planning, governing, components of the community, residents' responses to new communities, and an assessment of the future of new communities in USA. The investigation, supported by the National Science Foundation, included studies of 36 communities including federally and non-federally assisted new communities. Information gathered is compared with information from a sample of conventional communities. Interviews were conducted with 577 professional personnel.

The authors concluded that advantages in favor of new communities included (page 7): (1) better land use planning and access to community facilities; (2) reduction in automobile travel; (3) superior recreational facilities; (4) enhanced community livability; and (5) improved living environments for low- and moderate-income households, blacks, and the elderly. "Key factors attracting residents to new communities (mentioned by 20 percent or more of the respondents) were: (1) perceptions of the community as a good place to raise children; (2) layout

and space of the dwelling and lot; (3) appearance of the immediate neighborhood; (4) nearness to the outdoors and natural environment; and (5) community planning," page 19. "Three fourths of the new community respondents, versus just over one half of the conventional community respondents, rated the planning of their communities as better than that of the communities from which they had moved. Planning was rated highest in those new communities and conventional communities characterized by landscaping of public and common areas, preservation of environmental corridors, existence of architectural controls, and the grouping of all commercial facilities in centers. Planning was also rated better in communities that provided walking paths, a greater degree of pedestrian-vehicular separation, and greater accessibility of community facilities and services," page 21. Among the factors contributing to their quality of life, living in an attractive physical environment ranked fifth according to new community respondents, page 30.

"Private new communities had an average of 406 acres per 10,000 population in open space and recreational land uses versus an average of 216 acres per 10,000 population in the paired conventional communities...." Page 223.

With respect to adults' favorite out-of-home activities, 11 activities accounted for 71 percent of the responses of new and conventional community residents--golf, swimming, gardening, walking and hiking, bowling, tennis, boating, fishing, bicycling, arts and crafts, and playing cards, page 234.

Caldwell, L. K. (274)

1974. Moving from talk to action, pp. 47-50. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author points out that effects of urbanization on wildlife have been largely destructive. In order to preserve wildlife in an urbanizing environment, Caldwell suggests action as follows: (1) education of the public in an appreciation of wildlife; (2) planned growth either by limited and selective economic growth carefully directed to safeguard environmental amenities, or limited population growth and carefully controlled geographical distribution of human settlement; (3) landscape management and design including buffering areas to protect wildlife from completely incompatible human uses and restoration of "wasteland" often found on the periphery of large cities; and (4) preservation of high quality agricultural land near cities made possible by rewriting of laws pertaining to the assessment and taxation of land.

1975. Industry and wildlife--symbiosis or antagonism?, pp. 117-121. In Euler, Gilbert and McKeating, editors of Proceedings of the Symposium--Wildlife in Urban Canada. (For full citation see reference 9.)

The author discusses some of his experiences in the development of Meadowvale, a new community for 40,000 people in an environmentally sensitive region of southern Florida and the influence an ecologist (Dr. George Cornwall of the University of Florida) had had upon him in the development industry. Comyns states that the development industry is not opposed to environmentalists, "but that there must be a balance between the economy and the ecology because if we lost this balance we may end up with no economy." He regards as the first law of ecology "...that everything is connected with something else." He states: "We must be sure that in the name of progress we don't ignore this first law of Ecology. We should consider progress as those acts of man that enhance the quality of the human experience without impairing the earth's life support system.

"We must evaluate each of these acts of man in terms of its cost in energy, resources consumed, and environmental degradation, but we must not limit each act to those considerations. When the environmental price tag appears too high, the action must be reconsidered in light of the adverse long-lasting effects. The public must be prepared to pay the price of our past abuses and mistakes, even if it means abandoning many of the basic precepts of private enterprise, such as the right of the owner to do with his lands as he wishes, without regard to the effects of his action on the health of the ecosystem. This must apply right across the board including governments, and not just be limited to the private land developer or those involved in the urbanization process. We must identify environmental abuse as antisocial, even when profitable. We must be prepared to lower our own individual consumption of resources and the affluence that this consumption makes possible. Each of us, as responsible citizens, must be prepared to do all that is necessary to restore the environment to at least a functional level of health."

He describes planning as the process whereby those making decisions or those affected by the decisions are aware of the consequences before the decisions are made, not afterwards. He states that, in the urban planning and development process, the ecologist has an important role of identifying the ecological elements and ensuring that this knowledge is taken into account while urban design and engineering decisions are still in the fluid state.

DeChiara, J., and L. Koppelman. (276)

1975. Urban Planning and Design Criteria, 2nd ed. (C) 1975 by Litton Educational Publishing, Inc. Reprinted by permission of Van Nostrand Reinhold Company.

This is a treatise on planning principles and practices applicable in the United States which are in use today. It provides information on master plan studies and special studies, elements of urban design, physical and climatic characteristics, land use, population, housing, subdivision and land development vehicular circulation, air and rail transportation, educational facilities, neighborhood and community facilities, parks and recreation, commercial development, industrial development, neighborhood and new town concepts, public and private utilities, zoning codes and regulatory controls, and other basic data. Well illustrated.

Dorney, R. S. (277)

1977. Biophysical and cultural-historic land classification and mapping for Canadian urban and urbanizing land, pp. 57-71. In Ecological (Biophysical) Land Classification in Urban Areas. (For full citation see reference 46.)

Author's abstract: "A methodology for the mapping and classification of the cultural-historic, abiotic and biotic land features at scales of 1:500 to 1:25,000 is proposed. It is oriented toward encouraging a land-use planning process which addresses issues of environmental quality and environmental assessment. Opportunities and constraints are identified as well as ecological processes. The biotic mapping uses a three-tier system based on description, function and value of the resource area mapped."

In addition to building on published vegetation and biogeographical classification systems, the methodology is based on 90 practical planning problems of land use and resource management encountered by the author and his colleagues in Ontario during a 10-year period. The author points out that although planners and other design professionals, economists, engineers, and lawyers have been primarily involved in planning and land-use decision-making traditionally, recent requirements for environmental assessment at Federal and Provincial levels will require more involvement by environmental managers and increasing interprofessional teamwork. Examples of various types of maps used in the Townsend Community Development Program are presented as well as tables showing the aquatic and terrestrial biotic components of the proposed urban-rural land unit classification system. Suggestions for implementation of the system are proposed. One suggestion is to involve local universities in the work to facilitate a two-way technology transfer, thereby facilitating diffusion of ideas to students by professorial

staff who would be familiar with the evolving approach and production of graduates who would generate demand for such mapping in the agency where they work.

Ferguson, B. (278)

1978. Erosion and sedimentation control in site master planning. Journal of Soil and Water Conservation 33(4):167-172.

This is a well-illustrated and informative article, using Surrey Village near Pittsburgh as a model in describing how accelerated erosion resulting from construction activities which may increase sediment yields as much as 40,000 times may be reduced by timely and proper site planning and installation of erosion and sedimentation control measures. The author states that site master planning is primarily concerned with those temporary erosion and sediment control measures for which space must be reserved viz. sediment traps and diversions, and that identification of these needed sites for control should be made early in the master planning stage rather than late in the process as is common currently. His proposed solution is to combine the general characteristics of space-consuming erosion and sedimentation control measures with site planning to produce an explicit, rational planning procedure. Twenty-one references are cited.

Fisheries and Oceans Canada. (279)

1978. Guidelines for Land Development and Protection of the Aquatic Environment. Fisheries and Oceans Canada, Pacific Region, 1090 West Pender Street, Vancouver, British Columbia V6E 2PL. Fisheries and Marine Service Technical Report 807. 55 pp.

These guidelines were prepared by the Land Use Unit, Habitat Protection Division, Resource Services Branch of the Fisheries and Marine Service. The purpose and scope of this publication which, in the opinion of this reviewer are well achieved, are described in the Introduction as follows: "These Guidelines identify the problems and concerns associated with land development and present feasible solutions or measures to prevent its potential deleterious effect upon the freshwater environment of rivers and streams. An awareness of the environmental concerns and protective measures by all people involved in residential, commercial and industrial land development is essential to safeguard existing and future fish populations."

Although the guidelines pertain primarily to the preservation of salmon populations which are a Federal resource in Canada, they are applicable in a wide range of situations.

The specific guidelines related to land development which are

presented are based on the experience and knowledge of Fisheries and Marine Service technical staff dealing with these problems in land development and from a review of pertinent literature. The guidelines are divided into three main categories: Green Strips, Water Quantity and Quality, and General Construction Guidelines. The authors suggest that readers systematically proceed through each of the three categories--all of which are well illustrated by drawings--and apply the guidelines most applicable to their own development situation. They state: "Incorporation of appropriate guidelines in point form onto the Contractor's copy of the final design plans will ensure that the environmental concerns are known by those persons actually doing the work."

With respect to Green Strips, attention is given to residential development criteria based on water course definition and topography and to such details as width of vegetated buffer strips needed for different situations. Various approaches to managing and preserving these strips are discussed. Storm water quantity and quality problems are treated in some detail, including the use of detention and settling basins, natural swales, preservation of trees during site preparation and clearing activities, permanent methods to retain and discharge runoff to ground water, and pollution control. The General Construction Guidelines are concerned mainly with activities associated with instream and streamside construction with particular reference to minimizing damaging effects on salmon habitat or interference with fish passage requirements.

Also included in this very ueful publication are: a list of Federal Fisheries and Marine Service District Offices, a copy of the British Columbia Gravel Removal Order, a glossary of terminology, technical appendices, and a bibliography.

French, A. W., P. Seitz, D. Thorbeck, S. Kahne, and R. B. Martin. (280)

Undated. Minnesota Zoological Garden--mirror to the environment. InterDesign, Inc., 1409 Willow Street, Minneapolis, Minn. 55403. 64 pp.

This is a report of a study completed by the firm of InterDesign, Inc., for the State of Minnesota under the direction of the Minnesota Zoological Board. This well-prepared and nicely illustrated report includes an introduction that outlines zoos and man, the need for a Minnesota zoo, evolvement of the project and a discussion of the zoo experience. It then provides considerable detail on the development process, including objectives and guidelines, programming, site selection, site analysis, and design criteria; elements of the plan; elements of design; and suggested phasing and implementation. The master land use plan provides guidelines for implementing the overall site plan over a period of years. The plan calls for optimum

use of the unique topographical, hydrological and vegetative patterns of the site selected for the zoological garden. The animals are to be exhibited in a facsimile of their natural environment, i.e., they will be displayed in their correct ecological and geographic environment. The master plan for landscaping was developed to show areas of existing vegetation to be retained, those to be replaced, and those to be selectively pruned and supplemented by other types of plants. As much of the existing vegetation of the site will be retained as possible, and plant materials and landscaping for any existing exhibit should be ecologically consistent with the habitat of the animal being exhibited. The report points out that in 1967 professional football, baseball, basketball and hockey drew 39 million persons compared with 85 million persons who attended American zoos. The report indicates that, although recreation is intimately related to education, most people who visit zoos do so for "solely recreation purposes."

Geis, A. D. (281)

1975. Urban planning and urban wildlife--a case study of a planned city near Washington, D.C., pp. 79-84. In Euler et al. (Eds.) Wildlife in Urban Canada. Proceedings of a Symposium. (For full citation see reference 9.)

The author discusses the planning and development of the "new-town" of Columbia, Maryland with particular reference to urbanization effects on birds and bird habitat. He points out some failures to achieve stated goals due to ecological unawareness during early stages of development but mentions that maintenance of remnants of the original forest floor in some areas and use of many trees and shrubs in landscaping efforts helped retain wood thrushes in some areas and resulted in large increases of mockingbirds and song sparrows in other areas. By proper design and high quality workmanship in building, starling and house sparrow populations can be minimized. Research needs are suggested.

Gentile, J., and M. J. Lavine (Eds.). (282)

1974. Owego environmental study. Landscape Architecture Graduate Program, College of Architecture, Art and Planning, Cornell University. Project A-045-NY, OWRT, USDI. 103 pp.

The authors write of a project conducted with support of USDI through the Water Resources and Marine Sciences Center at Cornell University. They describe existing conditions of natural systems at Owego, New York, natural processes, land use and natural systems compatibilities and develop information on these aspects in addition to project review methodologies and environmental management tools in a form that Owego decision makers and planners can use. Considerable reference material is provided.

Kaiser, E. J., K. Elfers, S. Cohn, P. A. Reichert, M. M. Hufschmidt, R. E. Stanland, Jr. (283)

1974. Promoting environmental quality through urban planning and controls. Socioeconomic Environmental Study Series, U.S. Environmental Protection Agency EPA-600/5-73-015. 441 pp.

The authors focus on changing awareness and current practices in promoting environmental quality through urban planning and controls in local and metropolitan planning agencies. Principal areas of concern are land use and comprehensive urban planning, water resource management and urban land-water interfaces, urban design, and the management of air quality and noise. The key concept of integration for the study is the urban guidance system approach which includes various planning activities, decision guides such as plans and policy statements, and action instruments such as ordinances, taxes and public investments.

LaNier, R. (284)

1976. Input of wildlifers expected by urban and regional planners: views of the American Institute of Planners. Transactions of the 41st North American Wildlife and Natural Resources Conference, pp. 555-560.

Wildlifers need to provide information defining a vital function for wildlife and natural areas as indicators of health within an urban ecosystem. Until such information is available, no major reordering of urban development priorities is likely.

Leedy, D. L., R. M. Maestro, and T. M. Franklin. (285)

1978. Planning for Wildlife in Cities and Suburbs. American Society of Planning Officials, 1313 East Sixtieth Street, Chicago, Ill. and U.S. Fish and Wildlife Service, Washington, D.C. FWS/OBS-77/66. 64 pp.

This manual brings together two disciplines--wildlife management and urban planning--that have had little to do with each other. Although planners and developers, with guidance from the manual alone, can provide an urban environment more favorable to both wildlife and humans, the authors encourage direct input from wildlife biologists in the planning-management process. Opportunities for wildlife enhancement are discussed in relation to site design, urban core areas, suburbs and new towns. The importance of habitat diversity is stressed. Sources of additional information and assistance, lists of plants valuable to wildlife, and recommended reading materials are provided in appendices. Examples of wildlife species responses to the effects of urbanization are cited.

Love, S. (286)

1975. Houses designed with nature: their future is at hand. Smithsonian 6(9):46-53.

The author discusses simple ways of using solar heat for buildings; utilizing deciduous trees on the south side of houses to cool the house during the summer and let sun shine on the house in winter; of using greensward roofs or of using water on roofs for cooling and heating; compost toilets; appropriate insulation; air circulation vents; minimum water appliances; working towards a closed system by integrating waste; vegetable and livestock production functions; overhangs to help heat a structure in winter and cool it in summer; and other approaches.

Lynch, K. (287)

1971. Site Planning (Revised Edition). The MIT Press, Cambridge, Mass., and London, England. 384 pp. ($12.95).

The author provides information on site selection, planning, methodologies, etc., including a checklist of useful site data. He treats site form and site ecology and special types of site planning including open space.

Maestro, R. M. (288)

1974. The incorporation of wildlife into the new town planning process, pp. 155-157. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author points out that papers on urban wildlife have dealt largely with existing urban areas rather than proposed urban areas and that if we are to be successful in having wildlife incorporated into the planning process for developing new communities, wildlifers must alter their approach and relate more effectively with developers and urban designers. The urban designer functions as liaison between wildlife consultants and developers. Maestro states that the main concern of developers is profit; the main concern of the designer is with spatial distribution of program elements so the whole development is aesthetically pleasing. He suggests that in dealing with the developer, emphasis should be given to flood plains, steep slopes, wetlands and other areas intrinsically unsuitable for development, but valuable for wildlife. He suggests also that it is important to have the developer realize that without spending a lot of additional money, many wildlife benefits can be obtained simply by proper selection of landscaping plants and the type of management program selected for the open-space program. In working with the urban designer, it is desirable to identify those parts of the building site most

valuable to wildlife and to demonstrate the need for retention of a diversity of habitat types. Maestro suggests, also, that the value of a corridor configuration which hooks-up the different habitat components into one contiguous system be explained to the urban designer in connection with open space development. Research needs are outlined. Maestro states that wildlife managers must stop talking to each other and begin talking to planners and developers.

Mason, R. (289)

1976. Underground architecture: what lies ahead may be beneath us. The Futurist--a journal of forecasts, trends, and ideas about the future 10(1):16-20.

The author discusses an innovative architectural movement focusing on structures that lie partially or fully beneath the surface of the earth. Advantages mentioned include: Saves up to 60% energy and is cheaper to construct. Silence. Stability of floor loads. Protection from the elements. No roofs need replacing. Constant temperature of 12.2°C in ground needs to be raised only to comfortable temperature. Underground architecture is easy on the environment. Space above ground is conserved. Unsightly surface buildings can be razed and open areas treated where none existed previously. Sun can be brought in by skylights, lightwells and open courtyards or by having an open side for the building. Especially desirable in extreme climates. Highways, railroads, factories, warehouses, parking lots, power stations, etc., may be the first to go underground.

McDowell, E. (290)

1975. Planning environmental controls for operation and for after-mining use of a new sand and gravel property. A paper presented at a meeting of the Joint National Sand and Gravel Association--NRMCA Environmental Session, January 28, 1975, New Orleans, Louisiana. 5 pp. typescript.

The author reports on steps taken by the Flatiron Companies to obtain approval for, and render environmentally sound, the White Rocks Project--a project involving the mining of sand and gravel next to a part of Boulder, Colorado known as White Rocks on sites which contain unique flora and fauna, but are not an economical mining resource in themselves. Background work involved preparation of a summary of environmental impact reports 233 pages long and an expenditure of approximately $100,000 on design and approval of the plan. Another $150,000 will be spent on reclamation and monitoring of impacts. This amounts to about $1 for every ton of gravel hauled from the site to date. White Rocks are home "to a rare fern not presently growing elsewhere in the United States, the Asplenium, and five rare species of bees and ants."

McHarg, I. L. (291)

1969. (Paperback edition: 1971.) Design with Nature. Published for The American Museum of Natural History, Doubleday/ Natural History Press, Doubleday and Company, Inc., Garden City, New York. 198 pp.

The author suggests how man-made structures and urban development can be accommodated within the natural order of things by planners and developers by applying ecological principles and by taking cognizance of geology, soils, physiography, water, vegetation, wildlife and other components of the ecosystem.

Real Estate Research Corporation. (292)

1974. The costs of sprawl: environmental and economic costs of alternative residential development patterns at the urban fringe. (A report prepared for the Council on Environmental Quality; the Office of Policy Development and Research, Department of Housing and Urban Development; and the Office of Planning and Management, Environmental Protection Agency, U.S. Government Printing Office, 1975. $3.45.) 278 pp.

The report develops a comprehensive and consistent set of quantitative and qualitative estimates of the environmental, economic, natural resource, psychic, and other personal and community costs associated with alternative patterns of residential land development at the neighborhood and community levels. The analysis covers a range of typical development patterns from the traditional "unplanned" single-family subdivision to high-density "new communities."

Sargent, F. O., and J. H. Brande. (293)

1976. Classifying and evaluating unique natural areas for planning purposes. Journal of Soil and Water Conservation 31(3):113-116.

Unique natural areas found in rural towns, such as a bog, a stand of virgin trees, an area of rare wildflowers, a blue heron rookery, etc., can be preserved or protected by designating these sites as unique natural areas and including them in the comprehensive town plan. The authors describe a natural area classification and evaluation system understandable to town planners and officials who use it, based on the judgement of natural scientists and local citizens and planning officials, and sufficiently reasonable and objective as to withstand legal challenges. Natural science categories in the classification include land forms, geologic, hydrologic, biologic-flora, and biologic-fauna with emphasis on unique features. Ratings of from 1 to 5, 5 being highest, consider areas in acres, elevation above mean sea level, frequency of occurrence, diversity, established significance, i.e., whether

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national, regional, local, etc., and fragility. Planners also rate the areas according to numbers of recreation and education-research uses, integrity of the area in its present status, i.e., according to danger of its misuse or destruction, present management status, planning status, i.e., whether the area has been designated in the New England Natural Areas Project (higher rating if it is), and finally the degree to which an area functions in natural cycles, food chains, or aesthetically, e.g. a marsh is important in filtering water before the water reaches a lake (high rating). The natural science rating and the planning rating are combined and a total score of 60 is possible for a given area. This makes it possible to determine the priorities to be recommended in a town, regional or state plan for the acquisition and protection of the natural areas. Thus, the rating system is based on the judgments of scientists, augmented by the judgments of planners to accommodate requirements of the municipal planning process. The procedure is designed to help planners and decision-makers decide where to act first. Twelve factors are involved in the combined rating.

Schellie, K. L. (Ed.). (294)

1977. Sand and Gravel Operations: a transitional land use. National Sand and Gravel Association, 900 Spring Street, Silver Spring, Md. 20910. 211 pp.

This is a compendium of publications by the National Sand and Gravel Association, papers presented at Association meetings, and selected material concerning land use associated with the mining of sand and gravel. The five chapters in part 1 of the report deal with sand and gravel as a valuable resource, planning for resource utilization, basic land use controls, environmental impact statements, and land development as illustrated by selected case studies. Part 2 of the report, entitled "The Transitional Use and Development of Sand and Gravel Lands," treats preplanning resource removal and land forms, operational procedures, utilization of lands including recreational use, such as hunting and fishing, and site improvement practices.

In the last chapter on site improvement practices, much useful information is provided on the reclamation of areas mined for gravel and sand--many of which are in urban areas--with respect to: grading, stockpiling of topsoil, use of tailings and spoils, handling and use of water areas, soils and their potential use, planning for re-use of sites in floodplain areas, and planting designs for various purposes.

In connection with plantings, consideration is given to ecology, plant hardiness zones are mapped for the continental United States, and lists of plants--shrubs, grass, and trees, deciduous and evergreen--are recommended, by region, together

with illustrated planting procedures, seeding operations, and suggested maintenance operations for the reclamation of mined areas.

Schellie, K. L., and D. A. Rogier. (295)

1963. Site Utilization and Rehabilitation Practices for Sand and Gravel Operations. National Sand and Gravel Association, 900 Spring Street, Silver Spring, Md 20910. 80 pp., illustrated. ($20.00.)

Sand and gravel are indispensable to modern industrial, commercial and residential development. An estimated 35,000 acres of land are being consumed annually in commercial production of sand and gravel. Reuse of extracted (mined) areas is essential and economically feasible. Sand and gravel deposits should be identified and those best situated reserved to serve future use demands. Undesirable influences associated with the removal process should be ameliorated by screening, barriers, etc., and noise and dust controlled to the extent possible. Extracted areas should be rehabilitated. The industry has been working with planning officials to these ends which involves community acceptance. Planning procedures are described with respect to land use plans, zoning and statutory controls, site plans and neighborhood relationships; potential uses of mined areas are described including fishing camps, hunting resorts, water reservoirs, sewage lagoons, game preserves, and open space; correlation of site redevelopment with community plan elements such as regional parks and highrise residential complexes; and the timing of redevelopment. Part III of the publication, entitled site improvement practices, is concerned with the handling, shaping, and improvement of the land and discusses grading, stockpiling of topsoil, use of tailings and spoils, handling and use of water areas, soils and their capabilities for use. Considerable attention is given in Part III to revegetation of the mined areas including planting design, plant materials, planting procedures, seedbed preparation, seeding operations, pruning, etc. Growth habits of plants are discussed. A map showing 10 regions or "coimatic provinces" is shown and plant species considered suitable for planting in these 10 regions are listed according to various heights of trees, both deciduous and evergreen, and shrubs. A similar map of four regions is included for grasses and species of grass considered appropriate for each region are listed. Part IV describes five major types of services which a planner is qualified to perform; discusses the roles of landscape architects and civil engineers with respect to site utilization and rehabilitation of extracted areas; and describes services or assistance available from the Agricultural Extension Service, the Soil Conservation Service, and state conservation departments. Part V describes services provided by the Public Relations Committee of the National Sand and Gravel Association to sand and gravel producers in their rehabilitation programs.

A two-page bibliography lists references under the headings: Zoning and Land Use Planning, Site Planning, Grading, Soils, Planting Design, Plant Materials, and Planting Procedures.

Solman, V. E. F. (296)

1974. Aircraft and wildlife, pp. 137-140. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author gives a brief account of the mounting problem of bird-aircraft hazards since the first reported human fatality from a crash caused by a bird in 1912. He considers ecological modification of an airport to make it unattractive to birds to be basic and suggests that an earlier step--that of choosing a site for a new airfield, preferably a well-drained site with low agricultural and wildlife production capability is very important.

Stauffer, D. B. (297)

1976. Kingwood: a nonassisted private suburban development. American Society of Civil Engineers, Preprint 2656 of a presentation made at the ASCE National Water Resources and Ocean Engineering Convention, San Diego, California, 5-8 April 1976 ($1.00). 26 pp.

The author describes Kingwood, a new suburban community being developed on the outskirts of Houston, Texas, with funding by Friendswood Development Company and King Ranch, Inc. Five thousand people lived in Kingwood at the end of 1975; 80,000 residents are expected at build-out in 1990 on a 14,000-acre tract, 11,000 of which will be developed. Tract has about 14 miles of shoreline on Lake Houston, a principal water supply reservoir also used for fishing, boating, and contact water sports. Land and initial improvements in greenbelts, parks and recreational areas are given by the developer to nonprofit community associations free of debt. Most community associations are managed by the developer until the residents are able to take over. Approximately 27% of the project area lies below the 100-year flood plain, much of which is used for parks and recreation including one children's fishing pond stocked with bass and catfish.

Stearns, F. (298)

1974. Wildlife habitats in the urbanizing environment, pp. 151-153. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Stearns states that vegetation is the key to habitat quality for bird, beast, and man and suggests five ideas important to the preservation and development of habitat: (1) the holistic

or ecosystem view in habitat development; (2) plans for preservation or development of habitat should be based on ecological principles; (3) every plan should be aimed toward improved human habitat, not at wildlife habitat alone; (4) we must keep in mind the basic needs of man in planning and providing quality habitat; and (5) all plans need direction and a list of priorities.

As guidelines for habitat development, he lists the following: (1) provide or retain natural plant biologic communities as unsubsidized systems working for man, such as urban forests that process ozone and SO_2 as well as cooling and filtering the air, and natural communities that routinely process animal wastes; (2) attempt to retain alternatives for future decisions, e.g., wetlands and urban open spaces; (3) use natural boundaries and gradients provided by water bodies and topography to aid in habitat creation; (4) link wildlife and human habitat in both aims and needs; (5) base plans and actions on ecological principles, not on intuition alone; (6) cross societal lines to work with planners, politicians, bankers and other useful groups--educate them and learn from them; (7) be opportunistic but not reckless and don't oversell. An over-abundance of wildlife or a predicted population which does not materialize, can both result in embarrassment; and (8) use demonstration areas to "test" as well as demonstrate ideas.

Thomas, J. W., and R. M. DeGraaf. (299)

1975. Wildlife habitats in the city, pp. 48-68. In Proceedings of the Symposium--Wildlife in Urban Canada, University of Guelph, Ontario, Canada. (For full citation see reference 9.)

This is a review type of article in which 169 articles are cited. It points out that until recently, attention to wildlife management in urban areas was largely devoted to the negative aspects and elsewhere largely to game production. The authors suggest that the time may have come for a change in emphasis in which urban areas are considered wildlife habitat and that there is a place for urban wildlife management. An article by the authors and co-author R. O. Brush entitled "Invite Wildlife to Your Backyard," published in National Wildlife Magazine (April-May issue 1973), is indicative of the interest in this subject. In this first seven months of the Federation's "backyard wildlife" program one-quarter million reprints of the original article were requested.

The authors state that designs that include open space, green belts, etc., are simultaneously including wildlife habitat with each and every decision and they urge that knowledgeable people help make the decisions on what and where habitats are left undeveloped and how those habitats are then managed to benefit wildlife and to put man and wildlife into pleasing contact.

Thurow, C., W. Toner, and D. Erley. (300)

1975. Performance Controls for Sensitive Lands: a practical guide for local administrators, Parts 1 and 2. American Society of Planning Officials, 1313 East Sixtieth Street, Chicago, Ill. 60637. 146 pp.

This guide was prepared by ASPO for the Office of Research and Development, U.S. Environmental Protection Agency, under Contract No. R802-443, Program Element 1 HA098. The manual identifies the key natural processes of five environmentally sensitive areas--streams and creeks, aquifers, wetlands, woodlands, and hillsides--which provide important public benefits and suggests means by which these benefits can be maintained by using the basic police powers and zoning powers of local government. The authors indicate that although the number of communities which have adopted ordinances for environmentally sensitive areas is relatatively small, these ordinances are an important development in local land-use control. The design and implementation of these ordinances is said to be well within the capabilities of municipal and county governments and do not require special state enabling legislation. The critical factors in developing good ordinances are (1) analyzing the natural processes associated with the environmentally sensitive area so that the regulatory mechanisms can be designed to protect the specific functions that are important, for example the importance of plant communities to local hydrology; (2) identifying and mapping the critical areas to be protected; and (3) developing the necessary legal language for writing the ordinance.

Untermann, R., and R. Small. (301)

1977. Site Planning for Cluster Housing. (C) 1977 by Litton Educational Publishing, Inc. Reprinted by permission of Van Nostrand Reinhold Company. 306 pp.

This book deals with the process of physically designing cluster housing developments and their potential for serving as an alternate to urban crowding and at the same time conserving the land and its natural systems, open space, and the capability of the land to yield sufficient material and energy resources. Emphasis is on the development of lowrise, medium-density, cluster environments that optimize the interrelationship of land form and house form.

Part 1 of the book focuses on approaches and methods of site analysis, concept development and planning for small sites. Part 2 deals with large-scale site analysis and natural processes--geology, soils, climate, hydrology, vegetation, and wildlife--as design determinants. It deals, also, with ways of implementing the site plan including the delivery of site services, how to deal with zoning and ownership regulations,

how to comply with environmental impact assessments, and how to reduce the cost of housing.

Considerable attention is given to the design and routing of roadways in housing developments, and it is pointed out, page 83, that public roadways consume approximately 30% of our total metropolitan land. The need for the site planner to assure adequate and proper food sources, shelter, and water to enhance wildlife is recognized (page 196), as is the importance of species diversity.

USDI Bureau of Outdoor Recreation. (302)

1974. Preplanning: surface mining for outdoor recreation. USDI Bureau of Outdoor Recreation, Washington, D.C. 20240. For sale by U.S. Government Printing Office, Stock No. 2416-00068, 40 cents. 22 pp.

As of 1 January 1974, land in the United States disturbed by surface mining for coal, sand and gravel and other commodities totaled over 4.4 million acres, and, of this, at least 2.5 million acres are in need of reclamation. The leaflet stresses that by preplanning and by carrying on some reclamation during the time deposits are being extracted many sites can be reclaimed economically for various types of recreation, fish and wildlife areas and for other purposes. Friendship Park, a 1,100-acre area in one of Ohio's most densely populated Appalachian counties (Jefferson), is described as a case study for preplanning.

Wells, M. (303)

1976. Why I went underground. The Futurist 10(1):21-24.

The author discusses how underground architecture offers silence and freedom from vibrations; living land instead of roofing materials to the sun (natural vegetation on roof); wildlife habitat and green areas in place of rats and asphalt; weather modification and temperature buffering; long-lasting buildings; and an end to lawn and shrub maintenance. It offers use of rainwater normally wasted, percolation and slow runoff instead of erosion and fast floods; it offers oxygen production--even food production in place of blistering heat of lifeless roofs; and it offers a convenient place to recycle largely organic wastes generated in most buildings.

(For further information on site planning see references 3, 4, 9, 35, 38, 42, 44, 46, 67, 71, 82, 83, 85, 108, 160, 199, 214, 215, 216, 218, 237, 240, 243, 281, 369, 371, 374, 419, 423, 429, 444.)

B. Developed Areas

Andresen, J. W. (304)

1974. Community and urban forestry--a selected and annotated bibliography. U.S. Department of Agriculture, Forest Service/ State and Private Forestry, Southeastern Area, viii + 195 pp.

Andresen, J. W., and P. R. Dolberg. (305)

1974. Shade trees for cities--a community forestry program. Weeds, Trees, and Turf 13(5):26,28,30,65,68-69.

The authors point out that an increasing number of state forestry commissions, forestry divisions, and extension services are developing new and innovative community and urban forestry programs and assistance measures dealing with public values and benefits offered by trees, shrubs and associated vegetation within an urbanizing environment. The authors describe a state forestry division-state extension service program which has been organized in Kansas to encourage maximum participation by local community tree boards or commissions. Helpful suggestions are provided on how to organize and implement such programs. Programs developed in Florida, Georgia, Kansas, Maryland, Michigan, and Missouri were listed as notable.

Doig, H. H. (306)

1978. Managing wildlife in an urbanized society. Proceedings of the Sixty-Seventh Convention, International Association of Fish and Wildlife Agencies, 12-14 September 1977, pp. 114-123.

This article does not deal wholly with fish and wildlife in urban areas but rather with the diversity of utilization of environments in an urbanizing society including urban, residential, suburban, and central city developments, expansion of transportation systems, multiple uses of waterways, need for agricultural and timber products, waste disposal, absentee land ownership, land banking where there is essentially no management, personal values that are not necessarily economically oriented, energy needs, passive recreation, changing social values, population growth, and other factors that have to be coped with in fish and wildlife resource programs.

In facing these challenges, the author states that the response in the policy area has got to take on more sociological aspects than biological and the general focus must be towards managing ecosystems rather than acres. He believes it is necessary to have input from the different users of land in decision making and that the users of the resource must be brought together and work towards a common objective. He recognizes the need to develop urban programs that focus on bringing fish and wildlife resources to those people who cannot get out of the core of cities and utilize fish and wildlife resources. It is necessary, he believes, to learn more about resource users and the needs and desires of these users. He

believes that by seeking diversity of opportunities, focusing on new and different species, and providing a variety of experiences, the quality of recreational experiences and the experiences people associate with fish and wildlife resources can be increased. He states, page 119, "We must work with local organizations and work with people such as lake associations and sportsmen and landowner groups to help them find ways to resolve the dilemmas and the conflicts that evolve over various land and water uses." He feels that we must encourage a broader use of underutilized species, such as warm water species frequently referred to as trash species. He sees the need to disperse user pressure through application of controlled use management, for participation at the local level to assure fish and wildlife considerations are part of the broader land and water use planning, and to focus on all significant habitats for all species, utilizing such tools as law, land use regulations, planting, land acquisition, media support, and impact assessments to perpetuate the valued significant habitats we have. Also, he sees the need to inject fish and wildlife resources in local assistance programs where money is being made available through increased emphasis on social programs to place emphasis on staff training and development, and to have programs developed and ready for implementation when funds are made available.

Friedberg, M. P. (307)

1970. Projects for urban spaces. Design Quarterly 77, Walker Art Center, 807 Hennepin Avenue, Minneapolis, Minn. 55403. $1.60. 32 pp.

This issue (77) of Design Quarterly discusses the need for and the components of physical planning in urban areas including the need for the planner to work with political and governmental institutions to help establish priorities for dollar expenditures and design programs with social, economic and educational orientation; then it deals with private space for public use, quasi-public spaces, public space for total use, new priorities for public use, art for public use, and planning for communities. It would appear that although trees and shrubs are suggested for areas where there are none now, many are planted in concrete containers.

Jackson, B. (308)

Undated. Open space plan--Harlem: Open space development plan for Harlem-East Harlem Model Cities Area. Barry Jackson, Architect, A.I.A., M. Paul Friedberg & Associates, Landscape Architecture, Urban Design, New York. 53 pp.

This is an open-space development plan for Harlem-East Harlem Model Cities Area. Open space is considered to include, in addition to green space and tot-lots, streets, parking,

alleyways, vacant lots, roof-tops, backyards, stoops, avenues, markets, shopping streets, decks, school grounds, overpasses, parks, campuses, squares, plazas, and walls. In Harlem, there is approximately one acre of public park space for every 7,000 inhabitants while national standards call for one acre per 1,000 inhabitants. The plan suggests ways of making more efficient use of existing open space.

Peirce, N. R. (309)

1976. Seattle celebrates a freeway burial. The Washington Post, No. 298. The Washington Post Co., Washington, D.C., 28 September 1976. Page A-15.

An interesting article in which Mr. Peirce describes how, through local leadership, perserverance, and cooperative effort, the City of Seattle created a Freeway Park over a freeway (Interstate 5). He points out that the six-acre urban park with trees and grass and cascading water masks the roar of traffic only a few feet below and creates pedestrian access between parts of the City cut off from each other when the interstate highway was built. He states that the total public cost of $14 million amounted to only $45 a square foot in an area where raw land normally costs $63 a square foot. The project required ingenious planning and financing and eight years of teamwork between city, county, state and Federal governments and private citizens.

"The City acquired the property and paid for the parking garage; the state highway department, using federal and state funds built the bridge across the freeway to support the park. Close to $1 million in community development block grants, open space funds and recreation monies were made available for the work."

James R. Ellis, civic leader, who apparently had much to do with accomplishing this task, was reported as saying that reclaiming the air space over freeways--space already in public ownership--should be considered by at least 50 other major U.S. cities.

Sudia, T. W. (310)

1974b. The vegetation of the city--the urban ecosystem. USDI National Park Service, Urban Ecology Series, No. 2. 17 pp.

The author points out the importance of vegetation in a city and that a mature biological community, characterized by diversity requires little outside maintenance and is less subject to epidemic diseases. The author suggests that trees in street vegetation should be at many stages of growth so when a tree is lost its replacement will be at the site. He also states that trees do not have to be removed from building sites except

for those actually on the spot where the building is to go. As an example, he states that in the new city of Tapiola, Finland, clauses have been written into the building contracts which place a monetary value on each tree at the site. "Except for those trees which the plans specify must be removed in order to accommodate the building, the contractors are fined for any tree damaged or destroyed." Engineering plans for a city should include the needs of plants.

(Other references dealing to some extent with planning in developed areas include 27, 35, 38, 40, 145, 249, 257, 268, 276, 277, 279, 282, 285, 311, 312, 371, 379, 419, 424, 428, 444.)

C. Regional and Special Area Considerations

American Aggregates Corporation. (311)

Undated. "Project/Parklands." American Aggregates Corporation, Greenville City Park, Greenville, Ohio. 15 pp.

Suggests that real estate needs of the area be studied, sand and gravel excavation sites be carefully surveyed, and aerial maps be consulted to create a master plan for developing parklands out of exploited sites long before the first shovel is turned. Steps to be taken include planning location of main plant as remote from all adjacent property owners as possible; taking advantage of "natural" screens to isolate main plant; planting multiflora rose hedge and/or constructing safety fence around perimeter of excavation site; grading back overburden around perimeter of excavation site to create sloping "planting berm" sight and sound barrier, and sowing grass seed and starting first stage of landscaping with trees and shrubs; removing overburden from main plant site to create low-profile plant area and planting trees around immediate main plant area; landscaping main entrance and building of a modest, attractive office building/weighing station, and constructing a solid, dust-free entrance drive-way with gate enclosures; and backfilling excavation face with overburden, creating gently sloping lake banks concurrently as the excavation progresses--covering with top soil, grading smooth and accomplishing final seeding and landscaping.

Aspen Systems Corporation. (312)

1979. Land and Natural Resources Management: An Analysis of Selected Federal Policies, Programs, and Planning Mechanisms. Report to the President's Interagency Task Force on Environmental Data and Monitoring Programs. Council on Environmental Quality and Resource and Land Investigation Program, U.S. Geological Survey, U.S. Department of Interior, Sponsors. 124 pp. + appendices. (Available from NTIS, U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, Va. 22161.)

This report identifies approximately 25 Federal agencies and over 70 legislative acts that influence land and natural resources policy. It analyzes representative policy conflicts. Also, it identifies: the impact of Federal policy on State and local land and natural resource activities; the types of land and natural resource planning mechanisms in existence; and requirements and implications for data and monitoring collection. Among the planning mechanisms incorporated piecemeal into Federal legislation are: financial assistance, agency coordination, "comprehensive" planning, fact finding and information sharing, delegation to State and local authorities, tax incentives, technical assistance, regulation, acquisition, and enforcement.

Planners will find much useful information in this report, including the many Federal laws and executive orders listed together with their primary purposes and provisions, and possible sources of assistance to State, regional, and local agencies for planning and development.

Baker, J. P., and J. J. Magnuson. (313)

1976. Limnological responses of Crystal Lake (Vilas County, Wisconsin) to intensive recreational use, 1924-1973. Trans. Wis. Acad. Sci. Arts Lett. 64:47-61. *

"Crystal Lake, in northeastern Wisconsin (USA), has approximately 70% of its shoreline developed into camping sites and swimming beaches. Results of a 1973 limnological survey of the lake were compared with measurements taken by Birge, Juday and associates (1924-1942) to assess physical, chemical and biological changes. Secchi disc readings declined from 10.8-8.8 m. This decrease probably resulted from mechanical disturbances of human activity and increased rates of erosion and run-off from shoreline use. Standing crops of phytoplankton and zooplankton did not change, but bacterial concentrations in the water rose by 90%. The slight decrease in total P (13.5-5 µg/l) probably resulted from regrowth of the vegetation in the drainage basin after the lumbering and clearing in the 1st decade of the 1900's. The CO_2 equilibrium has apparently shifted as evidenced by slight increases in alkalinity (1.0-2.6 mg/l), specific conductance (10.0-13.2 µmhos) and pH (5.8-6.2) and a decrease in free CO_2 (1.7-1.3 mg/l). The small magnitude of these changes could be accounted for by natural eutrophication processes."

Bishop, A. B., H. H. Fullerton, A. B. Crawford, M. D. Chambers, and M. McKee. (314)

1974. Carrying Capacity in Regional Environmental Management. U.S. Environmental Protection Agency (Washington, D.C. 20460), Socioeconomic Studies Series (EPA 600/5-74-021). 170 pp.

This report examines the concept of carrying capacity in the context of regional environmental management. The authors concluded that the concept in this light must be broadened to include the complex relations among resources, infrastructure and productive activities, residuals, and societal preferences for quality of life within both the natural and human environments.

Bystrak, D., C. S. Robbins, S. R. Drennan, and R. Arbib (Eds.). (315)

1974. Wintering areas of bird species potentially hazardous to aircraft. Special report jointly prepared by the National Audubon Society, New York, N.Y., and the U.S. Fish and Wildlife Service. 156 pp.

This report was prepared to make available winter bird distribution maps for 143 species using data collected and published by the National Audubon Society in their journal, American Birds, and to interpret these maps in terms of potential hazard to low-flying aircraft. The maps are based largely on counts of birds made in the National Audubon Society's Christmas Bird Counts. It is stated in the Foreword that the maps tend to be more accurate in the East because of the greater number of counts. The information provided on the general characteristics of flight of the birds by family or species, including altitude, etc., should give some indication of where bird-aircraft collisions would be most likely, both at airports and during flight of aircrafts.

Campbell, H. W. (316)

1973. The problems of the preservation of geographic variability. A contribution to the American Society of Zoologists' Symposium Toward a System of National Ecological Preserves, Houston, Texas, 27 Dec. 1973. 11 pp.

The author defines "geographic variability" as the sum total of all between and within habitat variation in species composition and all taxonomic and sub-taxonomic variation in the component species over the face of the earth. He indicates that loss of patterns of geographic variability are due to absolute loss of natural habitats, as through urbanization, and to selective elimination of species from the habitats. Also, he cautions against introduction of exotic species; points out that 16.4% of the land in the lower 48 states may be urbanized by the year 2000 and that some of the 13% of the country's land underlain by coal and shale oil reserves will be modified and that when agricultural lands and heavy recreational-use areas are added, perhaps 60 to 70% of the Nation's land area will be severely modified. The author points out that ecological preserves of fairly large size (1,000 square miles) are mandatory for an adequate program; that they, in themselves,

are not likely to be adequate; and suggests that every acre purchased for wildlife or other natural uses be evaluated for its significance to the preservation of ecosystem variability. He suggests, further, that use of ornamental plant species in suburban landscaping be de-emphasized and that 50% of our lawns be converted from grass to the use of native plant species. Similarly, he asks, to what extent, safety factors considered, could, in the case of cloverleafs and interchanges and interstate highways, the shoulder design and landscaping be altered to create "greenbelts" of native vegetation and associated animals. He believes it may be possible in urban areas, to avoid some of the problems of insularization of preserves, and the inevitable loss of geographic variability by the creation of a continuum of mini-parks and that a system of greenbelts and "naturalized" suburbs might support a proportion of the original plant and animal inhabitants of each area, perhaps serving as bridges or corridors between preserves and parks.

Canadian Air Transportation Administration. (317)

1972 (Revised). Land use in the vicinity of airports: planning guidelines for the use of land outside the airport boundary. Canadian Air Transport Administration, Civil Aeronautics Branch, Aviation Planning and Research Division S-72-8. 46 pp. + 8 pp. appendices.

Author's abstract: "This publication describes the operational characteristics of airports which may influence land uses outside the airport property boundary and recommends, where applicable, guidelines for land uses which would be compatible with airport operations."

The publication is intended, basically, to assist planners and legislators at all levels of government in becoming familiar with problems related to land use which are associated with airport development.

Clark, J. (318)

1974. Rookery Bay: Ecological constraints on coastal development. The Conservation Foundation, 1717 Massachusetts Avenue, N.W., Washington, D.C. (Price $4.00.) 91 pp.

This is a summary report of investigations by the Conservation Foundation in cooperation with the University of Miami, the National Audubon Society, the Collier County Conservancy and other organizations of coastal developments in the vicinity of Rookery Bay, Florida. In addition to the summary report, 10 background study reports were issued by the Conservation Foundation with support of the Office of Water Resources Research, U.S. Department of the Interior to provide information on hydrology, biology, land use, and socio-economic aspects of the area which was used for the decision-making process and

as a basis for recommendations on coastal management with a view towards maintaining environmental quality in development of a mangrove shoreline. The Conservation Foundation assisted Collier County in interpreting the research results by meeting with local officials and public interest groups. Collier County moved to initiate a strong program to protect its water systems and estuarine resources through establishment of county ordinances.

Clark, J. (319)

1976. The Sanibel Report: Formulation of a Comprehensive Plan Based on Natural Systems. The Conservation Foundation, 1717 Massachusetts Avenue, N.W., Washington, D.C. 20036. 305 pp.

The people of Sanibel Island, Florida, voted to incorporate the island as a city in 1974. In the introduction by W. K. Reilly, President, Conservation Foundation, it is pointed out that each year a million people visit Sanibel to collect shells, walk the beach or enjoy the other natural values of the island. The J. N. "Ding" Darling National Wildlife Refuge located on Sanibel lures more than 800,000 visitors annually. Reilly states, page vi, "The Sanibel Plan provides for long-term conservation of natural resources as well a reasonable amount of growth. The planning methods adopted: (1) set a future limit on population consistent with natural limits, notably those imposed by water resources and the imperative of evacuation before hurricanes; (2) distribute the permitted number of new structures (about 2,000) over the developable land in accordance with the carrying capacity of the natural systems; (3) establish a strong set of performance standards for all development; (4) develop a scientific plan for restoration of past ecologic damage (particularly to the water systems); and (5) provide for the highest level of continuing public participation."

The Conservation Foundation studied Sanibel's natural systems to determine their carrying capacity, discussed the findings and recommendations with the Sanibel-Captiva Conservation Foundation and then with the City Council. Many of the recommendations were reflected in the plan as approved in 1976.

This report describes how the carrying capacity of a natural system can be determined and then used in developing a comprehensive land-use plan. Reilly believes that lessons learned on Sanibel apply to many small communities whose ecology imposes natural limits to growth. Part 1 of the report deals with the history of the island and with development problems; Part 2 with the natural systems study; and Part 3 with the Sanibel Plan and methods of formulating the Plan including total community effort required and the interactions among citizens, government officials and consultants. Six appendices

provide detailed information on hydrology, vegetation, beach geology, wildlife ecology, estuarine ecology, and natural energy systems of the area.

Davidson, G. R., Jr., T. V. Degeare, Jr., T. J. Sorg, and R. M. Clark. (320)

1971. Land disposal sites near airports reporting bird/aircraft hazards--a survey for the Inter-Agency Bird Hazard Committee. U.S. Environmental Protection Agency, Solid Waste Management Office, Div. of Technical Operations, Open-File Report (TSR 1.6.004/0). 33 pp.

The authors report on findings from a survey of 32 airports out of 70 airports designated by the Inter-Agency Hazard Committee as airports with bird-aircraft hazards resulting in part from the proximity of the airports to solid waste disposal sites. The bird-aircraft hazard was considered to be extremely serious at 19 airports in the sample. Closing all existing disposal sites around airports will reduce the risk of bird-aircraft collisions at the airports. The government and a land disposal site owner could be liable for a bird-aircraft collision if the site is known to contribute to the bird hazard.

Darling, F. F., and J. P. Milton (Eds.). (321)

1966. Future Environments of North America: Transformation of a Continent. Natural History Press. Doubleday and Co., Inc., 501 Franklin Ave., Garden City, N.Y. 11530. 767 pp.

This book constitutes the record of a conference convened by the Conservation Foundation to ponder the influence of man upon his own environment. Several of the papers presented by scientists and authorities participating in the Conference deal with the urbanization process and its effect upon the environment. Various papers are concerned with preservation of endangered species and their habitats, economics vs. ecology, regional planning and development, and organization and implementation of environmental programs.

Deardorff, H. (322)

1977. The Public Benefits of Cleaned Water: emerging greenway opportunities. Office of Land Use Coordination (A-101), U.S. Environmental Protection Agency, Washington, D.C. 20460. 32 pp.

This illustrated booklet was prepared for EPA by Deardorff, Environmental Design and Research Communication consultant, 367 Tiverton Way, Lexington, Kentucky as one of a series of publications and audiovisual materials on securing the public benefits from Federal, State and local water clean-up efforts.

It highlights opportunities for greenway development and protection, encourages careful management in the use of waterfront land, early planning for public access and enjoyment of cleaned rivers, streams and harbors, and efforts to ensure that these water bodies are not repolluted by new, indiscriminate development attracted to their shores.

More specifically, the booklet outlines what can be done under Sections 201, 208, and 402 of Public Law 92-500 to attain the clean water goal of 1983 for water resources which are fishable and swimmable. It is pointed out that with the cleaning of the water, waterside land values will rise sharply and that now is the time to acquire greenway water frontage, negotiate use easements, and establish land development performance controls to assure the water-oriented greenway potential of a community. It discusses how present day waterfront uses came into being over the past 250 years and makes a plea to recognize that water is a resource shared by industry and commerce so a flexible approach is needed in the implementation of greenway development. It lists as general benefits derived from development of water-oriented greenways: protection of the natural environment; increased public awareness of the importance of water quality and overall environmental quality; protection of health and safety; and improved cultural environment.

Shown by illustrations and concise text are ways of attaining the above benefits and of implementing programs with public involvement in the decision-making process and with support of EPA and BOR (now the Heritage Conservation and Recreation Service). Examples of what various cities or communities have done to create water-oriented greenways are given, including: San Antonio's river walk, Ann Arbor's Huron River greenway, and Maine's Saco River corridor.

This is a very informative and useful publication for planners and decision makers.

Department of the Army, Corps of Engineers, Civil Works Directorate. (323)

1974. Flood plain--handle with care! Dept. of the Army, Corps of Engineers, Civil Works Directorate EP 1105-2-4, U.S. Government Printing Office 1974 0-551-674. 33 pp., with foreword by J. W. Morris, Major General, USA, Director of Civil Works.

This booklet, in nontechnical language, describes some of the fundamentals of wise flood plain management and stresses aspects of flood plain management that can be undertaken by a community itself as illustrated by an account of the experiences of the residents in the Pennypack Creek area of Pennsylvania. Directions are included on how to apply to the Corps for a flood pain information study; services available are described,

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including flood insurance program; services provided by other Federal agencies are outlined; addresses of state coordinators for U.S. Army Corps of Engineers Flood Plain Management Services are listed by states; and addresses of Corps offices are provided.

Dietemann, A. J., and A. E. Giraldi (with major contributions by M. Donnald, C. Wirths, and A. App). (324)

1974. A provisional inventory of the flora and fauna of Seneca Creek, Muddy Branch, and Watts Branch Watersheds, Montgomery County, Maryland. The Maryland National Capital Park and Planning Commission, 8787 Georgia Avenue, Silver Spring, Md. 20907. Environmental Planning Document. 87 pp.

Authors' conclusions:

"1. Several areas of Seneca Creek, Muddy Branch, and Watts Branch watersheds contain species found nowhere else in Montgomery County. The protection of these areas is important in order to preserve the diversity of the county's flora and fauna.

"2. A number of plants have been practically eliminated in the County. Repetition of this tragic mistake could be prevented by documentation of the location of rare plants.

"3. The watersheds studied contain an abundant and diverse flora and fauna. The protection of this natural heritage will depend upon skillful planning of future land use policies.

"4. Urbanization in these watersheds is proceeding along the major roads as corridor development occurs in a general westward director. In addition, a detectable pattern of urbanization from north to south is evident."

The authors recommend that a comprehensive flora and fauna survey be made to prevent the unknowing extirpation of species rare in the County and suggest that the Park and Planning Commission establish a priority list for unique areas in the County which need protection. They recommend that parkland acquisition should proceed in a general western and southern direction ahead of advancing urbanization.

Dorney, R. S., and S. G. Rich. (325)

1976. Urban design in the context of achieving environmental quality through ecosystems analysis. Contact 8(2):28-48.

This paper traces four approaches or levels of urban design found in North American cities and indicates there has been substantial evolution in the past two decades in the design to include more consideration of ecology. The flat earth planning approach assumes the earth is flat and featureless

and that man is free to impose his design on it without consideration of environmental consequences; the contour planning approach gives consideration to topography; the third approach--feature or constraint planning--identifies physical and symbolic landscape features and integrates them into the urban design along with historic buildings, etc.; and the fourth approach--ecosystem planning--is a multi-disciplinary systems approach which considers cultural, historical, abiotic and biotic features. These four approaches or levels of urban designing are described and compared. The advantages of the fourth approach are set forth and problems of implementation are described.

Dougal, M. D. (326)

1976. Floodplain management: the Iowa experience. Journal of Soil and Water Conservation 31(2):60-62.

The author mentions that floods have plagued the residents of Iowa since the first settlements appeared along the rivers; describes enactment of Iowa's first comprehensive water resources and flood control legislation in 1949 and amendments in 1957; traces the development of the State's first successful floodplain zoning ordinance at Iowa City in 1962; and outlines how the Iowa floodplain management program could be strengthened.

Drury, W. H., Jr. (327)

1963. Results of a study of herring gull populations and movements in southeastern New England, pp. 207-209. In Colloque--Le Problème des Oiseaux sur les Aérodromes. Compte rendu des Réunions tenues a Nice, les 25,26 et 27 Novembre, 1963, par René-Guy Busnel et Jacques Giban. Institute National de la Recherche Agronomique, 149 rue de Grenelle--Paris(7). 326 pp.

This is a report on Fish and Wildlife Service-supported research on gull populations, movement and behavior in southeastern New England. The author pointed out that large numbers of gulls have been directly attracted to metropolitan areas by refuse--dumps and fish wastes from fish handling and from fish-processing plants--and that removal of the food supply causes rapid shifts in gull populations. He stated: "As long as gulls are attracted to metropolitan areas, they will seek loafing grounds and hence will congregate at the relatively undisturbed areas of airports. Airports often are close to dumps because both are placed on marginal land, especially marshland; i.e., Logan International Airport at Boston, Massachusetts; MacArthur Airport at Bridgeport, Connecticut; Kennedy and LaGuardia Airports at New York; and Washington National Airport at Washington, D.C."

Fairey, D. A. (328)

1975. Flood plain management in South Carolina. South Carolina Land Resources Conservation Commission. 95 pp.

This report was written to partially fulfill the responsibility of the Land Resources Conservation Commission to coordinate development of a statewide flood plain lands area inventory and formulate guidelines for the conservation, protection and use of flood plain lands, excluding tidelands and marshlands. It provides information on various aspects of flood plain management and encourages application of flood plain management information and principles. Emphasis is on flood plain regulations and need for a legislative study in South Carolina. Recommendations for limitations on use of flood-prone lands and for prohibition or discouraging the extension of streets and utilities into such areas are made. Increased attention to value of flood plains for fish and wildlife and recreation is recommended and the forest types associated with the secondary features of river bottomlands are noted.

Fairfax County (Virginia) Planning Division. (329)

1961. A natural resources development plan. Commonwealth of Virginia, Fairfax County Planning Division. A report to the Director of Planning. 45 pp.

This is a report, with recommendations, concerning the gravel deposits in Fairfax County, future needs for gravel, and suggestions for development of sand and gravel operations in the County. The suggested ordinance set forth in the study was adopted by the Fairfax County Board of Supervisors on 15 November 1961.

Flynn, K. C., and Mason, W. T. (Eds.). (330)

1978. The Freshwater Potomac: aquatic communities and environmental stresses. Interstate Commission on the Potomac River Basin, 1055 First Street, Rockville, Md. 20850. ICPRB Technical Publication 78-2. 194 pp. (Available from USDI Fish and Wildlife Service, Eastern Energy and Land Use Team, Kearneysville, W.V. 25430.)

This document, published by ICPRB in cooperation with the Virginia State Water Control Board, Maryland Power Plant Siting Program, and the U.S. Fish and Wildlife Service, represents the proceedings of a symposium held in January 1977 on the biological resources of the freshwater streams of the Potomac River basin which was cosponsored by the above agencies and organizations and by Avtex Fibers, Inc. and Westvaco Corporation. The book is divided into two major sections: Aquatic Communities and Biological Monitoring, which includes

scientific reports on the biological life of the Potomac's streams, and Environmental Stresses concerning effects of man's activities on the freshwater streams. It is a companion volume to "The Potomac Estuary: Biological Resources, Trends and Options"published by ICPRB in April 1976.

Many of the 38 papers or presentations made at the symposium and included in this document relate to urbanization effects on fisheries or other resources, research needs, pollution, legal aspects, and what the layman can do to protect aquatic life--all of which are pertinent to the subjects treated in this bibliography and some of which are included as separate entries with reference to this book.

Ford Foundation. (331)

1974. Ford Foundation experiments in regional environmental management. (A symposium of the American Association for the Advancement of Science.) A.A.A.S., Washington, D.C. 48 pp.

This collection of five papers presented at the A.A.A.S. meetings on 25 February 1974, San Francisco, California, reviews some of the principal results of Ford Foundation-assisted experiments in regional environmental management.

Fuhriman, J. W., and E. S. Crozier. (332)

1975. Planning for wildlife and man. USDI Fish and Wildlife Service, U.S. Government Printing Office. 56 pp.

The authors provide information useful to wildlife area managers and others concerned with enhancing the pleasure and education of man while minimizing his impact on wildlife and wildlands. Considerable emphasis is placed on design principles as related to man's reaction to visual aspects of wildlife areas.

Ginzbarg, H. (333)

1975. Recreation in the coastal zone and the urban crunch, p. 22. In USDI, Bureau of Outdoor Recreation and U.S. Dept. of Commerce, Office of Coastal Zone Management, conference proceedings. (For full citation see reference 404.)

The author discusses how winding tree-lined bayous in Houston and Harris Counties, Texas that used to exist in the Houston metropolitan area have been dredged, ditched and reactified or filled so that few suitable for parksites remain. He describes how, through local support and enthusiasm generated in part by those who attended monthly nature hikes along Armand Bayou, nearly $800,000 was raised and cooperation was obtained from the Federal Government to purchase, cooperatively, the Armand Bayou for parkland, preserving it from development.

Goddard, J. E. (334)

1976. The nation's increasing vulnerability to flood catastrophe. Journal of Soil and Water Conservation 31(2):48-52.

Seven percent of the United States, excluding Alaska, is subject to the 100-year flood. More than half (53%) of the Nation's flood plains in urban areas had been developed by 1973. Flood control structures are economically justified on the basis of benefits (flood damages prevented) but many benefits from flood control reservoirs are being nullified. Developments are permitted to move lower and lower into the downstream floodplains and have resulted in increased flood damage potential that is greater than that prior to the flood control project.

"Planning the use of floodplain lands should recognize flood hazards. Master plans for cities must consider these hazards as well as the recreational value of floodplains. Such planning will lead to wise and fruitful use of this natural resource."

Hook, R. A. (335)

1975. Planning for urban greenspace, pp. 8-14. In Andresen The urban forest: its management under environmental and economic stress. (For full citation see reference 371.)

The author discusses various approaches to preserving greenspace in the face of urbanization, including the greenbelt as used in London to control urban sprawl; the lineal city as proposed by C. A. Doxiadis for growth of Copenhagen into the heart of Denmark characterized by a lineal central business area on either side of which are zoned suburban strips, outside of which are greenbelt and agricultural areas to which urbanites can bicycle or walk; and the Victor Gruen approach in which neighborhoods of several hundred homes are located in cul-de-sacs around a town commercial center and surrounded by greenspace. The author points out that highway and utility rights-of-way, reclaimed quarries, roadways, schools, institutional lands and commercial properties and lands controlled by conservation authorities and government are also all available for greenspace development.

Howard County (Maryland) Farm Bureau and Howard County Soil Conservation District Supervisors. (336)

1972. Senator Mathias' Conference on Preserving Open Space and Natural Resources in the Developing Areas. Proceedings of a Conference at the Urban Life Center, Columbia, Maryland, 16 March 1972. 35 pp. (Dale Z. Maisel Conference Chairman.)

The conference proceedings, first published in the

Congressional Record of 18 September 1977 (Vol. 118, No. 145), were reproduced in part for convenience of conference participants and other interested persons. Recommendations and brief discussions of five workshops dealing respectively with preservation of water resources; wildlife, forests, and natural areas; agricultural land; future parks and recreation areas; and esthetics and historic sites were included. Also included were remarks by Senator Mathias of Maryland; copy of S.2554, a bill to establish a systematic and comprehensive National land-use policy; and a luncheon presentation by Professor Ian McHarg of the Graduate School of Fine Arts, University of Pennsylvania.

INTASA (N. V. Arvanitidis, supervisor, and S. Davenport, ed.). (337)

1973. Multiobjective planning for multiple purpose water resource systems: a structure for regional water resource development. INTASA, 1120 Crane Street, Menlo Park, California 94025. A report prepared for the Office of Water Resources Research, USDI. 158 pp. + 7 appendices.

This report supports the idea that land use and water resource development should be investigated in close relationship with each other and suggests research needs.

Isberg, G., and R. Diedrick. (338)

1976. Metro-area environmental planning: the Twin Cities experience. Journal of Soil and Water Conservation 31(1):10-13.

The authors indicate that natural resources data are playing an important role in developing an innovative approach to regional planning in the Minneapolis-St. Paul metropolitan area. The twin cities approach to planning, including the creation of the Metropolitan Planning Commission, the adoption of a Metropolitan Development Guide, and creation of a Metropolitan Council with significant authority to implement its policies, is described. The Council, composed of 17 members appointed by the Governor, is authorized to levy .23 mill on all taxable property in the metropolitan area and the power to review the long-term comprehensive plans of other commissions and agencies for conformance with plans of the Council, i.e. it is more than an advisory body such as most councils of government are. A consulting firm was hired to study the natural resources of the area as a basis for development of goods, policies and plans for future development and to identify some of the limitations that wetlands, steep slopes, etc., place on urban development. Such areas were utilized for recreation and open space. However, much of the basic information was not available or was not in a standardized form for ready use of local government units and some of it was too generalized to be of much value. To remedy this situation, the Metropolitan Council

entered into an intergovernmental personnel agreement (IPA) with the Soil Conservation Service to help get information on soils incorporated into the planning process. A map was prepared of the entire seven-county area showing soil limitations for all land uses. Agriculture was recognized as a legitimate land use to be protected from indiscriminate urban encroachment. Model ordinances for regulating urban development are being drafted. The needs and opportunities for planners and soil scientists to work together are emphasized.

Kasimov, M. S. (339)

1977. Organization of rural recreation for the population of the city of Baku. Gig. Sanit. (5):89-91. (In Russ.) *

"The plan for suburban development of Baku (Azerbaijan SSR, USSR) includes short-term and long-term rest and recreational facilities, public beaches and parks along a narrow strip of the northern shore of the Apsheron Peninsula. While climatological factors favor utilization of the area for short vacations, there is objection to longer-term rehabilitation use because of the prevalence of a sharp, dry, north wind which blows for 2-10 days without interruption. Substitution of the Khudat-Khachmas shoreline 100-200 km to the north is proposed. This area shares the favorable features of the Apsheron Peninsula, without the wind."

Libby, W. (340)

1975. Acquisition of land in the coastal zone, p. 25. In USDI, Bureau of Outdoor Recreation and U.S. Dept. of Commerce, Office of Coastal Zone Management Conference proceedings. (For full citation see reference 404.)

The author discusses the use of Conservation Easements as a means nonresident property owners have of controlling the use and development of real property. He describes how the Maine Coast Heritage Trust was organized and how it negotiates and assigns Conservation Easements.

Los Angeles, California (Dept. of City Planning). (341)

1973. Conservation plan. City Plan Case No. 24578 (Adopted by City Council, 20 December 1973, Dept. of City Planning, Los Angeles, California. 31 pp. + 4 plates or maps.)

"The Plan is designed to serve as an official guide for the conservation, development, and utilization of the natural resources located within the boundaries of the City of Los Angeles for the use of the City Council, the Mayor, and the City Planning Commission; other concerned governmental agencies; individual citizens and businessmen; and private organizations concerned with conservation. For the Council, the Mayor, and

the Planning Commission, the Plan provides a reference to be used in connection with their actions on various City development matters as required by law."

Mason, W. T., and K. C. Flynn (Eds.) (342)

1976. The Potomac Estuary: biological resources--trends and options. Interstate Commission on the Potomac River Basin, 4350 East West Highway, Bethesda, Md. 20014 and Maryland Power Plant Siting Program, Dept. of Natural Resources, Annapolis, Md. 20160. ICPRB Technical Publication 76-2. 140 pp.

This publication, based on a symposium held June 1975, has three major sections: Environmental Stresses on the Estuary, Biological Responses to Stresses, and Managerial Options. Among the 30 or more presentations, several involved urbanization effects, planning, and management options. It was pointed out that if managerial decisions are to be proper and timely to protect the biological resources of the estuary, the biota must be better characterized, qualitatively and quantitatively, including both their interdependency within the plant and animal ecosystem and their economic, recreational, and aesthetic role in the human ecosystem.

Maisel, D. Z. (343)

1972. Special planned agricultural and conservation elective--the space plan. Howard County, Maryland, Farm Bureau. 5-page typescript.

This proposal by the Howard County Farm Bureau is an optional plan for the preservation of farmland, forests, conservation land, and wildlife in an urbanizing area. It is not intended to replace any existing permitted uses but to be used where applicable and under strict county and state regulations as to gross population densities, water, sewer, roads, schools, and others. The proposal would allow the owner of agricultural land to sell the development rights of his land to a developer who could develop only about one-third of the land on a cluster concept; the farmer would continue to own the other two-thirds of the land which could not be developed but would remain in agricultural production or open space. As seen by Maisel, "The farmer would receive the development value of the land (e.g. the so-called unearned increment); the developer would realize the economics of clustering; the county and state would realize the economics of more meaningful forms of development and the value of an agricultural economy, as well as an increased tax base. The urban dwellers would realize the advantages of living in a community that would be a community in the toal sense of the word." Open space would be dedicated under county laws to protect this portion of our valuable conservation land remaining.

Monahan, D. H. (344)

1974. The small city role, pp. 37-39. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author discusses how an agricultural community, the town of Concord, Massachusetts, during the process of urbanization has, through cooperation of the citizenry and the town government, coped with the stewardship of its environment. This has included the setting aside of hundreds of acres of prime habitat for wildlife and the carrying out of many wildlife management measures. A department of natural resources was created under the general supervision and direction of the town manager to assume responsibility for the town-owned natural resources which responsibility, prior to 1967, was split among many boards, committees and operating departments.

New York State Office of Planning Coordination. (345)

1970. Long Island sand and gravel mining. Metropolitan New York District Office, 1841 Broadway, New York, N.Y. 36 pp.

The report summarizes the extent and potential of the sand and gravel industry on Long Island and proposes ways for applying sound planning principles to the use of this valuable natural resource. Included in the report are sections dealing with demands for sand and gravel, land requirements and competition for other uses, transportation needs, existing operations on Long Island, regulations for mining, recommendations, and two appendices--one providing suggested model standards, and the other a brief bibliography. The sand and gravel resource should be identified on the basis of competent geologic surveys and included as part of a long-term land use plan which considers regional needs and such environmental values or resources as wetlands, prime agricultural lands and areas with unique flora and fauna.

Noren, C. R. (346)

1978. Additional funds for resource management. Transactions of the 43rd North American Wildlife and Natural Resources Conference, pp. 42-52.

The author describes the history of and steps taken in Missouri to develop the "Design for Conservation" which provides a new source of revenue--an earmarked one-eighth of one percent sales tax--dedicated to fish, wildlife and forest conservation. "Design" is considered to be a basic program for Missouri's outdoor future--a long-range plan to help mitigate the adverse impacts of modern development. Proposed uses of the general sales tax add-on estimated to yield about $20 million annually include acquisition of high-quality uplands,

wetlands, prairies, forests and natural areas; construction of community lakes; acquisition of stream access sites, development of interpretive centers; and expansion of all the public services of the Missouri Conservation Department including management, law enforcement, educational services and research involving nongame as well as game programs.

People for Open Space. (347)

1975. Regional Exchange: an information service. People for Open Space, 46 Kearney Street, San Francisco, Calif. 94108. September 1975 issue. 4 pp.

This issue is devoted primarily to the need for, and ways of, preserving agricultural land to supply food for a growing world population as complicated by a doubling of the demand for energy every 10 years. All but two states have enacted, or are considering enactment of, new land-use planning and control laws. The report points out that Hawaii established a Land Commission with authority for State zoning and has designated all land as Urban, Rural, Agricultural and Conservation; West Virginia has invited all farmers with prime agricultural land to give their "Development Rights" to the State in return for reduction of taxes so great that this reduction can be regarded as payment for these Rights (17,000 acres saved in this way to date); the Governor's Task Force for the Preservation of Connecticut Agricultural Land recommended in 1974 purchasing Development Rights for the difference between value of land for growing food and its value for urban development and also suggested establishment of Agricultural Reserves with the idea that every town should have the opportunity to designate a Reserve to fit its Town Plan; a similar committee in Maryland recommended Purchase Easements or Development Rights; Suffolk County on Long Island, New York, with a 30-year $60 million bond issue is purchasing Development Rights to some 17,000 acres of farmland (Development Rights are pegged at 80% of the Market value); and in British Columbia, where only 5% of the land is suitable for food crops and is rapidly disappearing into urban sprawl, a moritorium was placed on all farmland until a study could be made and a plan developed. Consideration is being given in British Columbia to establishment of greenbelts around the Vancouver area and to use flood plains for both production and recreation. In California the Williamson Act of 1965 allows local county governments to tax farms and ranches according to the income they produce rather than the price a developer might pay for the land if the owner keeps his land in agriculture. This amounts to a lease of Development Rights by the government but has not been effective in stopping urban sprawl.

Reed, N. P. (348)

1975. Remarks at Conference on Recreation in the Coastal Zone,

pp. 26-27. In USDI Bureau of Outdoor Recreation, and U.S. Department of Commerce, Office of Coastal Zone Management Conference Proceedings. (For full citation see reference 404.)

The author points out that the coastal zone represents a resource base that provides opportunities for both the public and private sectors, that the burden of developing land management systems for this zone is on the States and that regardless of what jurisdiction does the planning, recreation, and public access must be among the allowable uses of the coastal zone.

Richards, N. A., and A. D. Bradshaw. (349)

1976. Interim greenspace in the recycling of urban wastelands, pp. 38-50. In Trees and Forests for Human Settlements--J. W. Andresen (Ed.). 417 pp. (For full citation see reference 415.)

Authors' abstract: "This paper, based on experience in the United States and United Kingdom, discusses potentials and problems involved in making urban wastelands useful as interim greenspace until their redevelopment comes about. The typical kinds of wastelands over the urban gradient are outlined and factors to be considered in their revegetation as interim greenspace are discussed, including time scales, relations with the urban physical and social environment, soil conditions and their modification, expected uses of the areas and the vegetation required to serve these uses. The argument is advanced that much more useful interim greenspace could be produced at reasonable cost through use of minimal treatments designed to achieve particular effects. This involves translating ecological research on derelict lands into practice to assure that results are both achieved and maintained."

Rickert, D. A., and A. M. Spieker. (350)

1971. Real-estate lakes--water in the urban environment. USDI Geological Survey Circular 601-G. 19 pp. Available free on application to the U.S. Geological Survey, Washington, D.C. 20242.

The authors point out that a real-estate lake can be either an asset or a liability; that management of such lakes can be truly successful only if preceded by proper planning; and that even well-planned lakes require constant management to be maintained at a desirable level of physical, chemical, and esthetic quality. The Circular provides sound advice and information on the planning and siting of urban man-made lakes, discusses pollution and sedimentation problems, opportunities for reclaiming abandoned quarries and pits through preplanning and sequential development, describes eutrophication, and presents a brief model for real-estate lake planning and management.

Sabatier, P. A. (351)

1976. Regulating development along the California coast: a review and evaluation of the coastal commissions. J. of Soil and Water Conservation 31(4):146-151.

The author discusses the California Coastal Zone Conservation Act of 1972 and the review authority of California coastal zone commissions over local land use decisions in the coastal zone. The Act mandated that the state commission present a coastal plan to the legislature consistent with the following objectives, page 150: The maintenance, restoration and enhancement of the overall quality of the coastal zone environment, including, but not limited to, its amenity and aesthetic values; the continued existence of optimum populations of all species of living organisms; the orderly, balanced utilization and preservation, consistent with sound conservation principles, of all living and nonliving coastal zone resources; and avoidance of irreversible and irretrievable commitments of coastal zone resources. Interrelationships of state and regional planning and policy formulation are discussed.

Sharp, J. M., Jr. (352)

1976. Application of Missouri River floodplain hydrogeology in land use planning. Journal of Soil and Water Conservation 31(2):73-75.

The author discusses the hydrogeology of the Missouri River floodplain in the St. Louis and Kansas City metropolitan areas and mentions some of the conflicts in use of the floodplain area for groundwater resources and for liquid and solid waste disposal and for other purposes.

Shimazu, Y., and R. Harashima. (353)

1977. Environmental assessment-management system for local developmental project: Cases in Japan. J. Environ. Manage. 5(3):243-258. *

"Developmental projects in Japan are classified into 2 types: coastal types at a national-regional level and inland types at a regional-local level. Deforestation and engineering works are major causes of environmental disruption in inland-type developmental projects, destroying the nature and culture of less-developed villages. A comprehensive environmental assessment system for a local, inland-type project was developed and applied to several situations with success. This system consists of the following: main sub-systems which cover legislative procedure, document retrieval, grid analysis, wildlife survey, vegetation, microbiological diversity, landslide monitoring, watershed, flood monitoring,water quality, irrigation and drainage, traffic monitoring, landscape, community, social

response, conflict resolving, land use, finance, cost/benefit analysis and an information channel; a monitoring system to check progress and provide early warning to prevent disasters and a coordinating system to provide a link between the inhabitants and the developer. The total system is interdisciplinary, but does not require a large project team."

Solmsdorf, H., W. Lohmeyer, and W. Mrass. (354)

1975. Schriftenreihe fuer Landschaftspflege und Naturschutz, Heft 11. Ermittlung und Untersuchung der schutzwuerdigen und naturnahen Bereiche entlang des Rheins (Schutzwuerdige Bereiche im Rheintal). (Series on Landscape Architecture and Nature Conservation, Vol. 11. Delineation and analysis of the undeveloped areas along the Rhine and those requiring protection (areas in the Rhine Valley requiring protection). (In Ger.) 163 pp. Bundesanstalt fuer Vegetationskunde, Naturschutz and Landschaftspflege: Bonn-Bad Godesberg, West Germany. *

"The cartographic research on the areas along the Rhine River, from the Netherlands to the Lake of Constance in Switzerland, is described, and an historical survey of these regions is included. The lowland vegetation, its zonation and succession, the hydraulic work done, the geology and topography of the areas and the aquatic and avian fauna are examined with respect to anthropogenic influences. Distinctions are made between moist areas, nature preserves, recreation areas and especially large zones and those under bilateral protection. Addenda containing photographs and maps of existing and proposed protected areas, aquatic bird biotopes and areas modified by industrial development, and maps illustrating the naturalness of the landscape and topography of the various areas, their conservation and recreational functions, indexes of the tables and illustrations are presented. A Bibliography, and German, English and French abstracts and summaries are included."

Twiss, R. H. (355)

1967. Wildlife in the metropolitan landscape. Transactions of the 32nd North American Wildlife and Natural Resources Conference, pp. 69-74.

The author discusses the need for greater collaboration of resources personnel with urban designers and planners. He suggests four principles of regional landscape design which might facilitate collaboration: (1) Both natural and social laws must determine the form of the regional landscape; (2) Landscape is significant not in its superficial appearance, but in its deeper meaning; (3) Resource development should consider not only internal natural processes and production functions, but spatial arrangement and visual form; and (4) Visual perception of the environment is complex, but measurable.

The author also encourages the training of regional land planners with a background in both natural ecology and design.

USDI, Bureau of Outdoor Recreation and National Park Service. (356)

1975. Nationwide Symposium on Urban Recreation. Proceedings of a symposium sponsored by the USDI at Reston, Virginia, 23-25 June 1975.

Proceedings of the symposium held to exchange information and viewpoints among professionals with a recognized expertise in the field of outdoor recreation. Discussions focused on two questions: (1) What are the urban recreation needs?; and (2) Who should supply urban and urban-related recreation needs? Great support was expressed for continuing and strengthening the Land and Water Conservation Fund. Most State and city park officials expressed a strong desire to continue maintaining control of those areas they consider as possessing local significance but, at the same time, several admitted they needed help to keep these areas open and meeting community needs.

Weaver, R. C. (357)

1968. Natural resources and tomorrow's cities. Trans. 33rd North American Wildlife and Natural Resources Conference, pp. 8-14.

This article discusses urbanization trends including estimates that although 80% of all Americans will be living in urban areas by the year 2000, cities, and their suburbs, will occupy no more than 2% of the total land area. It states that 60 to 70% of the area of some cities is given over to the needs of the automobile. The author stresses the need for a national land use policy with building blocks encompassing efficiency and economy of development; control and elimnation of pollution, a use of natural resources that respects their basic capabilities, and the traditional conservation ethic. Among the measures that can be taken to harmonize urban settlement with the natural world around it, Weaver suggests, are: (1) preserving stream valleys and flood plains from permanent development, thus preventing costly flood damage to public and private facilities; (2) using ridge lines and other natural barriers to shape metropolitan form in such a way as to produce attractive as well as efficient land use patterns; and (3) maintaining natural sump areas to recharge underground aquifers and help assure adequate water supplies. He states that the challenge is to find a means for making an urban land use policy operative on a basis that is politically acceptable, and that takes into account the property rights of the individual that have such a special place in our traditions. He suggests that if public concern is to see that lands are not developed for incompatible uses, easements, development rights, and leasehold

arrangements can be negotiated which accurately describe the extent of the public interest and the cost of protecting it and that other useful arrangements might include long-term leases, sale and lease-back provisions, tax incentives and special zoning.

Whipple, W., Jr., N. S. Grigg, and R. Lanyon. (358)

1979. Water Problems of Urban Areas. American Society of Civil Engineers, 345 E. 47th Street, New York, N.Y. 10017. 348 pp. (Price $18.00.)

This volume constitutes the proceedings of a research conference held at New England College, Henniker, New Hampshire, 16-21 July 1978. The conference was organized by the Universities Council on Water Resources and the ASCE Urban Water Resources Research Council; cosponsored by the Office of Water Research and Technology, U.S. Department of the Interior, U.S. Water Resources Council, U.S. Environmental Protection Agency, U.S. Soil Conservation Service, and by the Engineering Foundation.

The conference focused on water problems of metropolitan regions; on planning and management for urbanizing areas including broad water quality aspects and interfaces with, or relations to, various land uses and environmental quality; and on carefully considered research needs. For readers interested in planning and management for fish and wildlife in urban areas, probably several papers and discussions dealing with control of urban runoff and nonpoint source pollution, effects of pollutants on biota, maintenance of instream flows, eutrophication and lake management, protection of lakes and wetlands, and effects of urbanization on streams are most relevant.

Following termination of the conference proper, general conclusions and recommendations based on the conference were developed by a representative group of conference attendees. These are presented, pages 313-322, under the major headings: A Proposed Ten Year Plan of Research in Water Problems of Urbanizing Areas, Priorities for Immediate Research, and Policy, Planning and Management.

The proceedings include subject matter and author indexes.

Whyte, W. H., Jr. (359)

1959. Securing open space for urban America: conservation easements. Urban Land Institute, 1200 18th Street, N.W., Washington, D.C. Technical Bulletin 36. 67 pp. (Third printing, September 1968.)

As land is absorbed for urban purposes, open land areas

disappear with finality. "Open space is not the absence of something harmful," the author states; "it is a public benefit in its own right, now, and should be primarily justified on this basis.... Let's save the best land as soon as we can, and then, at our leisure, rationalize with further studies how right we were to have done it." He urges as one means of securing open space, short of actual purchase, conservation easements in which a public agency (or municipality?) purchases away from landowners their right to develop it, or to develop it with restrictions, and as an alternative, buying the land outright and then leasing it back to the owner, or a new owner, subject to open space restrictions. Details on open space conservation easements are provided.

(For further information related to regional and special area considerations in planning see references 6, 11, 21, 23, 27, 36, 42, 44, 46, 67, 127, 168, 183, 184, 237, 271, 274, 276, 279, 281, 285, 287, 288, 291, 294, 295, 300, 301, 307, 308, 325, 334, 371, 373, 387, 403, 409, 411, 412, 450, 464.)

V. Management

References on projects specifically designed for management of fish and wildlife management in urban-suburban areas are limited. Some references with general application to urban areas are included under this category. Recognizing that wildlife management is primarily a matter of manipulating the environment to satisfy wildlife requirements, many of the references deal with the management of vegetation and water, and some with special areas such as airports, streets and parkways, and gravel pits.

A. Urban-Suburban--General

Burger, G. V. (360)

1973. Practical Wildlife Management. Winchester Press, 205 East 42nd Street, New York, N.Y. 10017 (second printing, 1975). 218 pp.

The title of this book is appropriate in that the author, who has had much first-hand experience in managing land and water areas for wildlife at Remington Farms near Chestertown, Maryland, and at the Max McGraw Wildlife Foundation in Dundee, Illinois, does, indeed, provide practical suggestions for wildlife management in easily understood language. After discussing some of the basic interrelationships of soil, water, plants and animals, wildlife requirements, and the principles of wildlife management, he deals with problems of assessing and inventorying wildlife habitats and their potential, and how to get help in planning realistic improvements. He then discusses more specific management techniques for producing or attracting various types of wildlife including small game, waterfowl, upland birds, forest wildlife, and song birds.

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Although the emphasis is on vegetation management, he discusses other measures, such as artificial feeding, the erection of nest boxes, and predator control, and gives a frank appraisal of what is worth doing and what is not. The human element is not neglected in his treatment of wildlife conservation. He suggests what people can do to aid in conservation and he lists valuable sources in information and technical assistance available for promoting wildlife management.

Greenwalt, L. A. (361)

1974. The Federal role in urban wildlife management, pp. 25-28. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author points out that although a community may provide for and preserve that portion of wildlife living in a particular urban environment, wildlife is being protected and preserved for the citizenry of the world. Also indicated is that the Federal Government has a role in: (1) educating the citizenry to the positive values of wildlife and wildlife habitat in urban situations; (2) research to show what can and cannot, what should and should not, be done in providing wildlife habitat in urban environments, etc.; (3) providing encouragement and incentives to communities wishing to develop urban wildlife programs; and (4) assisting in providing the means to prevent the degradation of urban wildlife habitats once they are established and in advising on the control of undesirable or noxious wildlife species that invade urban habitats, and in preventing accidental introduction of exotic species that might be detrimental.

Grieb, J. R., and W. D. Graul. (362)

1975. The current status of state nongame bird programs, pp. 300-304. In Proceedings of the Symposium on Management of Forest and Range Habitats for Nongame Birds--Dixie R. Smith, Technical Coordinator, Forest Service, U.S. Dept. of Agriculture General Technical Report WO-1. 343 pp.

Authors' abstract: "Thirty states presently have nongame programs dealing in part with birds, but only 17 have a program that includes at least one full-time nongame employee. Most states are restricted by shortages of money and manpower. As they try to alleviate these problems, they are proceeding with active nongame bird programs which include the following: (1) seeking legislation needed for management, (2) passing specific regulations, (3) conducting literature surveys, (4) documenting distributions and monitoring population levels, (5) enhancement and protection of habitat, (6) direct management activities, (7) programs to enhance the nonconsumptive use of nongame birds, and (8) public education programs."

LeMonnier, Jeanne (Ed.). (363)

1978. The Time-Life Gardening Yearbook 1978 edition. 160 pp.

This book, with beautiful illustrations in color, index, photo credits and copious acknowledgments, contains 12 chapters, many of which deal with aspects of gardening of particular interest to biologists and others concerned with enhancement of wildlife and environmental quality in urban areas.

Chapter 1, for example, "The quirky weather of 1977" (pp. 6-17) by George Alexander and John Pekkanen warns gardeners to be prepared for such weather and gives suggestions on how to avoid losing plants as a result of unusually cold or dry periods including use of species adapted to the region, taking advantage of beneficial microclimates, use of mulch, proper watering, etc.

Chapter 5, "Home lawns gone native" (pp. 48-59) by Curt Prendergast, describes the growing interest, as evidenced by law suits in different parts of the country, to develop natural vegetation in homeowners' yards despite current American standards which require cutting of weeds and maintenance of evergreen grass and neatly-trimmed hedges. Court cases upholding the right of urban residents to permit their lawns to go natural are cited as well as numerous cases where the resident has developed yards not requiring expensive mowing of grass, fertilization and irrigation. The author points out that nearly 3 million tons of commercial fertilizer now go onto American home lawns, golf courses, parks and cemeteries (p. 52); establishment of turf grass over large areas costs $600 an acre in contrast with prairie grasses in suitable locations which cost less than half that amount and require much less maintenance; and lawn-seed sales run about 150 million pounds at an average retail price of $2 a pound. Examples of how native, or natural, yards have been developed in different parts of the country are described.

Chapter 8, "The ultimate city garden" (pp. 82-93) describes an effort, sponsored by the Farallones Institute, on how urbanites can create self-sufficient environments on small city lots through the design, selection, and integration of living systems that promote diversity and stability. The system involves recycling of wastes, bee-keeping and a form of aquaculture in addition to gardening.

Chapter 9, "Lo the mighty lousewort" by Peter Wood (pp. 94-107) includes an interesting account of the Furbish lousewort in Maine and the possible role of gardeners and botanical societies in helping in the implementation of the Endangered Species Act of 1973 by identifying threatened or endangered species. Methods of rescuing wild plants which would be destroyed by development are given on pp. 105-107.

Chapter 11, "The year in brief" (pp. 116-129) provides a review of gardening news and developments including use of windbreaks as energy savers, how to develop public lands in urban areas for community gardens, and comments on rooftop hydroponics.

Mohr, C. E. (364)

1953. How to build a nature trail. Published by the National Audubon Society, 950 Third Avenue, New York, N.Y. 10022, but available only from Encyclopedia Britannica Educational Corporation, 425 North Michigan Avenue, Chicago, Ill. 60611, catalog number 73061. Audubon Nature Bulletin, a part of set on Good Teaching, Audubon Aids. 6 pp.

The author gives us a concise bulletin on the role of nature trails, what they teach us, and how to lay out the trail, prepare signs, and construct the trail. Examples of good nature interpretation information are given.

Nature Conservancy (The). (365)

1975. The preservation of natural diversity: A survey and recommendations. Final report prepared for U.S. Department of the Interior (Contract No. CX0001-5-0110). 212 pp. and appendices.

This is a report concerned with natural areas, natural diversity and what is being done and what is needed to preserve such areas. Recommendations are given for Federal and State agencies and a summary of a working conference on a natural system of natural areas is presented.

President's Council on Recreation and Natural Beauty. (366)

1968. From sea to shining sea: a report on the American environment--our natural heritage. The President's Council on Recreation and Natural Beauty, Washington, D.C. U.S. Government Printing Office. 304 pp.

Pages 29 to 123 describe environmental problems and opportunities in urban areas and provide many examples of what Federal, State and local agencies and private citizens are doing to enhance the environment. Pages 269-295 provide information on publications and films, and on organizations--local, State and Federal which can provide assistance.

Shomon, J. J., B. L. Ashbaugh, and C. D. Tolman. (367)

1969. Wildlife Habitat Improvement for nature centers, parks and natural areas, schools and college lands, camp and recreation properties, refuges and sanctuaries, arboretums and forest preserves, rural life centers, botanical gardens, homesites

and special areas. National Audubon Society, Environmental Information and Education Dept., 950 Third Avenue, New York, N.Y. 10022. 97 pp.

This popular guide or manual indicates what groups or individuals can do to enhance wildlife in the areas mentioned in the title. Some elementary principles of wildlife management are discussed followed by ways of upgrading habitat for wildlife with special consideration given to birds and mammals.

USDA Soil Conservation Service. (368)

1970. Controlling Erosion on Construction Sites. USDA Soil Conservation Service, Agriculture Information Bulletin 347. U.S. Government Printing Office, Washington, D.C. 32 pp.

"Each year more than a million acres of land in the United States are converted from agricultural use to urban use.... Studies show that erosion on land going into use for highways, houses or shopping centers is about 10 times greater than on land in cultivated row crops, 200 times greater than on land .n pasture, and 2,000 times greater than on land in timber."

This bulletin suggests ways of controlling erosion on construction sites after outlining various types of damage caused by accelerated erosion. The author stresses principles of erosion and sediment control including use of soils suited for development, leaving the soil bare for the shortest time possible, detaining runoff on the site to trap sediment, and releasing runoff safely to downstream areas. He points out that with cluster type housing, houses can be built on the more level areas and the steep, more erodible land left undisturbed. He suggests selection of plants, such as Sericea lespedeza, crownvetch and honeysuckle, that require little or no maintenance for steep slopes and other inaccessible areas and points out advantages of using native plants for erosion control.

USDI National Park Service. (369)

1976. Gateway National Recreation Area, New York/New Jersey: statement for management and environmental assessment, Kay Roush, Sandra Roberts and Greg Sorensen, Editors. Gateway National Recreation Area, Headquarters Bldg., No. 69, Floyd Bennett Field, Brooklyn, N.Y. 11234. 346 pp.

The publication contains two National Park Service planning documents; a statement for management which identifies park purpose, significance, objectives, and influences; and an environmental assessment which provides a more detailed description of the park and its regional setting and sets forth three planning alternatives that reflect the objectives and other factors discussed in the statement for management. These documents are intended to provide a vehicle for evaluation of and comment

on Gateway planning that will aid in the subsequent selection of a general management plan for the park. Although this Recreation Area is only two seasons old, more than 12,000,000 people have visited it and 10,000,000 visitors are expected in 1976.

Wildlife Management Institute. (370)

1975. Current investments, projected needs and potential new sources of income for nongame fish and wildlife programs in the United States. (A study done by WMI in cooperation with Public Affairs Information Service, the University of Missouri, Columbia, for the Council on Environmental quality and the U.S. Fish and Wildlife Service, USDI.) 112 pp. including appendices.

This report describes current programs and investments in the nongame area (management, research, law enforcement, teaching, and others); estimated needs for broadening programs; potential sources of funds for broadening programs; discussion.

(Management in urban and suburban areas is treated generally, also, in references 2, 42, 44, 51, 69, 70, 71, 73, 77, 80, 85, 92, 98, 99, 100, 101, 108, 111, 135, 137, 148, 149, 150, 160, 169, 170, 187, 197, 205, 236, 240, 277, 279, 285, 292, 299, 304, 331, 372, 398, 425, 429, 431, 432, 437, 438, 441.)

B. Vegetation

Andresen, J. W. (Ed.). (371)

1975. The Urban Forest: Its Management Under Environmental and Economic Stress. Proceedings of the 26th annual meeting, International Shade Tree Conference, Canada, Inc. 57 pp. (Single copies $1.50, from Ernie Henson, Secretary-Treasurer, ISTC-C, 293 Dun Forest Ave., Willowdale, Ontario M2N 4K1.)

The proceedings include nine brief papers by university personnel and representatives from Federal and Provincial agencies and the private sector, with introductory remarks and conference summary by John W. Andresen, Proceedings Editor. The papers deal with planning for urban greenspace and different approaches, used in London, Copenhagen and elsewhere; the role of remote sensing in urban forest management as illustrated by Ottawa's greenbelt; climatic change and urban environment; designing the urban forestscape with emphasis on street trees and vegetation for multistoried, commercial buildings; trees under urban stress; the impact enlightened businessmen can have on beautification of commercial and shopping areas of cities; approaches to improving the aesthetics of highway corridors; the arboretum as a component of the urban forest, including development of a list of trees best suited to resist metropolitan environmental stresses; and air pollution effects on vegetation within the urban environment.

Burr, R. M., and R. E. Jones. (372)

1968. The influence of parkland habitat management on birds in Delaware. Transactions of the 33rd North American Wildlife and Natural Resources Conference, pp. 299-306.

The authors discuss increasing urbanization in New Castle County in northernmost Delaware with accompanying reduction of woodland and agricultural land and the fact that some woodland areas are being retained by the County as parks. Studies indicate that parkland management coupled with heavy human use affects breeding bird populations by: (1) decreasing the diversity of bird species and (2) increasing the nesting height of those species nesting in shrubbery. They suggest that, when possible, rather than removing shrubs in the parks, areas of brush should be left to encourage bird nesting and the presence of birds for the enjoyment of persons using parkland areas. Apparently bird feeders in residential areas are an important factor in increasing numbers and diversity of wintering birds in adjacent managed woodlots but a greater diversity of breeding birds is found in the larger, unmanaged woodlots.

Chavooshian, B. B., G. H. Nieswand, and M. E. Singley. (373)

1977. Land for vegetative use in an urban eivironment. J. Environ. Manage. 5(1):37-46. *

"The competition for land for development often leads to the elimination of appropriate spaces for the vegetative component to be included in the urban landscape. Methods have been developed to incorporate various sized parcels in new developments including purchase of land, zoning of green belts on the periphery of urban areas, clustering of development to accumulate residual parcels, and planned unit development where green spaces are designed into the development itself. None of these is completely satisfactory where the preservation of land for large scale use such as farming and forestry is desired. For these a new method has been devised called the transfer of development rights (TDR)...."

Dorney, R. S. (374)

1975. Recreating the early Ontario landscape in a front yard. Landscape Architecture, October 1975, pp. 420-423 (as reprinted with some changes from "Trellis," March 1975).

This is a most interesting account of how the author, an ecologist, is attempting to recreate on 1/100th acre of his front lawn a miniature forest or "heritage garden" with some of the original variety and richness of forests in the Waterloo, Ontario area where the Appalachian hardwood forest, the hemlock--yellow birch transition forest and prairie elements from the west met. Many of the plants used were obtained from areas being bull-dozed. The concept of a forest potentially able to

undergo dynamic change due to internal competition is designed into this miniature forest ecosystem. Observations on wildlife utilization of the area are made and the reaction of neighbors generally satisfied with lawns of grass, birch trees and petunias is described.

Hilton, R. J. (375)

1975. The arboretum as a component of the urban forest, pp. 41-45. In Andresen--The urban forest: its management under environmental and economic stress. (For full citation see reference 371.)

The author discusses the University of Guelph Arboretum and its roles in research and education, technical assistance, and others, as related to urban vegetation management in a broad sense--for example, determining the adaptability of plants not only in a climatic sense, but also in aesthetic and sociological aspects and in resistance to urban stresses. He points out that excessive early losses of planted trees are often due to neglect and pollution and that roots need O_2 as well as H_2O and gravel-filled tubes should be provided for aeration and H_2O penetration.

Presumably for Canada Plant Hardiness Zone 6, in which Guelph is located: "Trees best suited to resist metropolitan stresses are:

Ailanthus altissima----------Tree of Heaven
Celtis occidentalis----------Hackberry
Crataegus in var.----------Hawthorne
Fraxinus pennsylvanica subitegerrima--Green Ash
Ginko biloba----------Maidenhair Tree
Gleditsia triacanthos in var.---------Honey-Locust
Phellodendron amurense----------Amur Cork-Tree
Platanus acerifolia----------London Plane
Pyrus in var.----------Pear
Robinia pseudoacacia----------Black Locust
Tilia cordata----------Littleleaf Linden
Ulmus pumila----------Chinese Elm"

Some research problems suitable for attention by arboreta are listed.

Holscher, C. E. (376)

1971. European experience in integrated management of urban and suburban woodlands, pp. 133-137. In Trees and Forests in an Urbanizing Environment. (For full citation see reference 419.)

The author discusses European forests and forestry with particular reference to management by communities for both

recreational and economic purposes. European foresters are said to place less emphasis on economic returns and more value on forest recreation than we do in the United States.

Larson, J. S. (377)

1971. Managing woodland and wildlife habitat in and near cities, pp. 125-127. In Trees and Forests in an Urbanizing Environment (see Little and Noyes, 1971, reference 419.)

The author points out that most wildlife management to date in citieshas meant control of undesirable species, primarily exotics, but there is a challenge to foresters and wildlife biologists to promote more biological stability in urban areas through habitat management for native species. He suggests more attention be given to conservation and management of wetlands in urban areas.

Lindsay, D. J. (378)

1971. Protecting and managing trees and wooded areas subjected to heavy recreational use, pp. 111 to 114. In Trees and Forests in an Urbanizing Environment. (For full citation see reference 419.)

The author discusses problems and solutions for wooded areas subjected to urban and heavy recreational use, including problems of vandalism.

Meulen, E. van der. (379)

1975. Designing the urban forestscape, pp. 28-30. In Andresen (1975b)--the urban forest: Its management under environmental and economic stress. (For full citation see reference 371.)

The author states that there is emerging evidence that the private sector is willing to implement urban forestry in the areas of roof, street and courtyard tree installations. In many downtown city blocks, large scale developments for office towers, shopping malls and apartments, trees and shrubs are planted today, but the quality and size is still minimal in comparison to expenditures for artificial amenities within the buildings. He believes the Austrian pine would be a good species for Canadian streets and describes experimentation underway in Toronto in which special care will be given in planting and growing this species. He points out that oak, ash, linden and locust are among the species more hardy, popular, and available for planting in Toronto currently.

Monson, G. (380)

1941. The effect of revegetation on the small bird population in Arizona. Journal of Wildlife Management 5(4):395-397.

Only two years after a portion of the heavily grazed and eroded Navajo Indian Reservation in northeastern Arizona was protected from grazing and placed under improved management in the Steamboat Demonstration Area, vegetation was showing good recovery and numbers of birds (individuals) were double those on control plots. The western meadowlark, in particular, responded to the increased grassy cover within the managed area.

Niering, W. A., and R. H. Goodwin. (381)

1974. Creation of relatively stable shrublands with herbicides: arresting "succession" rights-of-way and pastureland. Ecology 55(4):784-795.

This paper deals, in part, with a description of the Connecticut Arboretum Right-of-Way Demonstration Area (established in 1953) and of shrub communities elsewhere in the Arboretum where the objective was to employ ecologically sound techniques in right-of-way vegetation management and where selective applications of herbicides were used to create shrub communities with high stability and wildlife values. "As a result of the selective use of herbicides, more than 48 different species of shrubs and vines have been preserved along this limited section of right-of-way. In addition, four species of lowgrowing trees and over 80 species of herbaceous perennials (10 ferns, 15 grasses, sedges and rushes, and 59 forbs) add to the floristic diversity of the demonstration area...." Clones of several shrubs, once established, have high stability with virtually no tree invasion; among these are huckleberry (Gaylussacia baccata), greenbrier (Similax rotundifolia), low blueberry (Vaccinium vacillans), witchhazel (Hamamelis virginiana), speckled alder (Alnus rugosa), sheeplaurel (Kalmia augustifolia), gray dogwood (Cornus racemosa), and nannyberry (Viburnum lentago).

Pure stands of little bluestem (Andropogon scoparius) exhibit remarkable stability also. The authors point out that in view of the stability of shrub communities and of the possibility of encouraging them through the selective removal of tree growth, the potential of creating shrub cover in vegetation management is great. They believe the selective approach in the application of herbicides, in contrast to blanket spraying, will minimize undesirable effects and maximize environmental quality while maintaining lowest costs. They indicate that this approach has application in right-of-way and wildlife habitat management, naturalistic landscaping and maintenance of habitat diversity.

Odum, E. P. (382)

1971. Ecological principles and the urban forest, pp 78-81. In Proceedings, Symposium on Role of Trees in the South's

Urban Environment. Georgia Center of Continuing Education, Athens, Georgia.

From the broad ecological point of view, the commercial forest represents a low diversity, rapid growth, oscillating (cut and regrowth cycles) ecosystem of an early successional type. In contrast, an urban forest should be a diverse, highly structured, mature and stable type of ecosystem if it is to best perform its protective, aesthetic, pollution abatement, and life support functions. The importance of retaining shrubbery and understory vegetation in urban forests is stressed for enhancement of soil moisture, self-fertilization and nutrient exchange; effectiveness as noise barriers; and cover for songbirds.

USDA Forest Service. (383)

1974. Your Tree's Trouble May Be You! USDA Forest Service. Agriculture Information Bulletin No. 372. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price: 70 cents. Stock No. 0100-03305. 21 pp.

This popular bulletin is well illustrated with colored drawings showing how man may injure trees by building and road construction, flooding, soil compaction, air pollution, lawn and garden equipment, lawn and garden chemicals, deicing salt, wounds, improper pruning, and improper planting. Ways of preventing injuries are suggested. Lists of trees tolerant to and intolerant of flooding, common air pollutants, and deicing salt spray are given.

Wilm, H. G. (384)

1971. Managing trees and woodlands to protect and improve water supplies, pp. 121-125. In Trees and Forests in an Urbanizing Environment (see Little and Noyes, 1971, reference 419.)

The author points out that optimum management of a forest for wood is not likely to be optimum management for water or other single purposes. True multiple-use management may be best attained by education, technical assistance, subsidy, public regulation of land use, and public acquisition of forest land.

(Additional references to vegetation management in urban, suburban, and urbanizing areas in reference citations 3, 35, 42, 44, 71, 73, 77, 108, 145, 220, 234, 272, 285, 294, 299, 304, 306, 309, 363, 368, 412, 413, 424, 428, 431, 435, 436, 437.)

C. Water, Including Flood Plain and Coastal Areas

Curtis, R. L., and T. H. Ripley. (385)

1975. Water management practices and their effect on nongame

bird habitat values in a deciduous forest community, pp. 128-141. In USDA Forest Service General Technical Report WO-1.

This paper was presented at the Symposium on Management of Forest and Range Habitats for Nongame Birds, Tucson, Arizona, 6-9 May 1975. A synthesis of available information concerning the effects of water management practices in deciduous forests on nongame birds is presented and research needs in this area are outlined.

Garrison, W. E., and R. P. Miele. (386)

1977. Current trends in water reclamation technology. Am. Water Works Assoc. J. 69(7):364-369. *

"In arid southern California (USA), both economic and energy-conservation incentives exist for water re-use. The re-use mode that would result in greatest cost savings is groundwater re-charge. Certain unknowns are associated with water re-use via groundwater re-charge; the need for investigation of health-related aspects of water re-use is clear. Presently constructed water-reclamation systems allow recreational water re-use and provide an excellent quality effluent for industrial, irrigation and groundwater-re-charge re-uses."

Hackett, J. E. (387)

1969. Water resources and the urban environment. Ground Water 7(2):11-14. *

"Approximately 2/3 of the present population live in the urban environment; by the year 2000, it is anticipated that 5/6 of the population will be urban. The trend of metropolitan growth is not the continued growth of major cities, but rather the expansion in population and size of the smaller suburban communities. The urbanization of the country is reflected in the emphasis on comprehensive water resources development - area-wide and basin-wide planning and management. In some areas of intense urban development the problems of water quality control, recreational use of water, and water for cooling and waste transport have become more significant than problems of adequate supplies for withdrawal. A major share of future water resource investigations will necessarily be directed to the urban environment, where geologic and hydrologic data is needed in urban planning. The general pattern associated with community development - the initial use of ground-water resources by individual systems, to the use of a community well and distribution system, and finally the use of surface-water sources far removed from the urban center - has contributed to the development of the 'commodity concept' of water use. By this attitude the water resource is viewed only in terms of its adequacy as a water supply: waste discharge and recreation uses are being ignored or considered a 'downstream' problem.

This concept is particularly inappropriate when applied in the multicommunity complexes of the metropolitan areas where there is little in the way of a 'downstream.' Water problems must be dealt with at the metropolitan level rather than at the individual community level; and not by a proliferation of smaller units of government and public agencies that often overlap and duplicate effort. The nature of the metropolitan complex requires that we think in terms of closed systems involving reclamation and re-use rather than in terms of the open systems of withdrawal, use and discharge."

Jahn, L. R., and J. B. Trefethen. (388)

1974. Recommended initiatives: Federal actions needed to improve flood plain management, pp. 177-201. In Sabol (1974) Proceedings of National Conference on Flood Plain Management. (For full citation see reference 399.)

The authors discuss trends in managing floods and flood plains, the increase in flood damages, despite expenditures of more than $500 million annually for flood control, and reasons for changes in management. They list 12 recommended actions to achieve a unified flood plain management program.

Keller, E. A., and E. K. Hoffman. (389)

1977. Urban streams: sensual blight or amenity? Journal of Soil and Water Conservation 32(5):237-240.

The authors point out that while urban streams tend to be straightened, deepened, paved over, or lined with concrete and filled with every imaginable type of urban trash, urbanites flock to the countryside to enjoy the "natural environment" characterized by free-flowing streams and clean water. They observe too that not all urbanites are mobile and, hence, exist in a sensually substandard environment. As an example of how an urban stream channel can be "restored" in contrast to "channelized" in the conventional sense, they cite Brian Creek in Charlotte, Mecklenburg County, North Carolina. The design philosophy was to reproduce a meandering stream that appeared as a country stream wandering through an urban area.

The work, conducted by engineers with the cooperation of property owners in collecting trash and providing rights-of-way, was a compromise between neglect of the stream and complete structural control or standard channelization. Such stream channel restoration can provide some flood control and at the same time provide for a more aesthetically pleasing environment.

In the course of the work an attempt was made to induce the stream to deposit a sandbar on the inside of the bend, as in natural stream channels by sloping the stream bank on the inside of a meander to an inclination of 3:1 or less. An

idealized diagram is presented which shows channel-restoration design criteria using a variable cross-channel profile to induce convergent and divergent flow at desired locations.

In the example cited, it seemed to this reviewer that more of the brush, logs and other cover in the stream channel and along the banks were removed than would be desirable from the standpoint of fish management and that the parklike environment produced was too parklike for wildlife; yet the concept is good.

Lindh, G. (390)

1972. Urbanization: A hydrological headache. Ambio 1(6): 185-201. *

"Urbanization disrupts the natural hydrological cycle and creates problems concerning the quality, quantity and distribution of water. Urbanization causes changes in the microclimate, the ground's hydrological response, the quality and quantity of groundwater, and the water balance. Urbanization often makes it necessary to transfer water from other regions. There is presently a great need for research on urban hydrology. The use of statistical and mathematical methods, especially systems analysis, has spurred progress in certain areas of hydrology."

Maddox, T., Jr. (391)

1974. Background summary of basic information (on flood plains), pp. 1-18. In Sabol (1974) Proceedings of National Conference on Flood Plain Management. (For full citation see reference 399.)

The author defines and delineates flood plains, indicates the extent of the problem in flood plain management and the extent of urban and built-up areas in flood plains (95,302 sq. mi.), discusses flood damages and the need for flood plain management.

Maddox, T., Jr. (392)

1976. A primer on floodplain dynamics. Journal of Soil and Water Conservation 31(2):44-47.

Characteristics of an alluvial channel are established by variations in the discharge of water and sediment, as modified by the growth of vegetation along the stream bank. Neither engineers nor biologists are fully aware of how alluvial channels behave. If floodplains are defined as the area covered by a flood with an average recurrence interval of 100 years, an estimated one acre in 10 or 12 and an average of one acre in six of all urban land falls in this category.

Mallory, C. W. (393)

1973. The beneficial use of storm water. U.S. Environmental Protection Agency report number EPA-R2-73-139. Office of Research and Monitoring, U.S. Environmental Protection Agency, Washington, D.C. 20460.

Author's abstract: "This report covers work originally performed by Hittman Associates in 1968 under Contract 14-12-20. Only a limited number of reports were prepared and this report makes this information available for general distribution.

"A system study was conducted to determine the technical and economic feasibility of using small storage reservoirs throughout an urban community as a means of storm water pollution control. Facilities were provided to treat the water prior to release or to provide sub-potable or potable water for use in the community. A conventional approach to controlling storm water pollution was defined for comparative purposes.

"Computerized system analysis was used to select the optimal combinations of reservoir locations, type of treatment and type of reuse on a least cost per day basis. Alternatives were ranked and the optimal practical solution determined considering the constraints. It was determined that the use of local storage and treatment does represent a feasible and economical method for storm water pollution control. Further, the use of the treated water can supply a large portion of the fresh water demands of a typical urban residential community.

"A demonstration program was planned and subsequently implemented to evaluate erosion and sediment control practices which includes a three-and-one-half-acre lake, evaluation of cleaning and sediment handling methods, and sampling and gaging stations to monitor changes in water quality and hydrology during urban development."

Note: The study considered an 1140-acre watershed located in the new city of Columbia, Maryland. Regression analysis techniques were used to develop hydrologic models for predicting runoff following development.

Merrell, J. C., Jr., and A. Katko. (394)

1966. Reclaimed wastewater for Santee recreational lakes. J. Water Pollut. Contr. Fed. 38(8):1310-1318. *

"The Santee County Water District in southern California operates a system of recreational lakes for which treated wastewater is the principal supply. After activated sludge

treatment and detention in an oxidation pond, effluent percolated through a shallow natural aquifer is chlorinated before entering the lake system. Bacteriological and virological quality of the lakes has been satisfactory. Recreational uses of the reclaimed water include boating, fishing, and swimming. The lakes have developed a reasonably well-balanced ecological system, although eutrophication has become a problem. The area appears to have great aesthetic appeal."

Muckleston, K. W. (395)

1976. The evolution of approaches to flood damage reduction. Journal of Soil and Water Conservation 31(2):53-59.

This is a brief but well documented paper dealing with the history and evaluation of approaches to reduce flood damage by structural and nonstructural measures and pointing out need for coordination and implementation and for a reordering of research priorities to place more emphasis on land use management, flood warnings, and flood proofing, and so forth.

Odum, E. P. (396)

1973. A description and value assessment of South Atlantic and Gulf Coast marshes and estuaries, pp. 23-31. In Proceedings, Fish and Wildlife Values of the Estuarine Habitat, a seminar for the petroleum industry. Bureau of Sport Fisheries and Wildlife, Atlanta, Georgia.

The author discusses the high productivity and values of coastal salt marshes, particularly Georgia marshes, which have an annual productivity equal to or exceeding man's best agricultural crops. This is due in part to the ability of Spartina alternifolia to cope with and benefit by tidal energy. Houses, apartments, condominiums, or what not, if they are to be built in coastal areas at all, should be built only on stabilized land, and preferably up on pilings so storm water can flow under them without harm to anything. "In this way, the beach and dunes are preserved for all to enjoy and the view from the houses is better anyway."

Phippen, G. R. (397)

1974. On a flood plain can a right go wrong? Water Spectrum published by U.S. Army Corps of Engineers 6(1):7 pp.

The author discusses the individual's legal relationship to the community when he occupies a flood plain and the fact that there may be flood losses not only to himself but also costs to others, such as loss of fish and game habitats; comments on the states' application of police power to land use; discusses the constitutionality of flood plain regulations enacted into state statutes or local ordinances; reviews principal regulatory rules;

indicates the need to bring taxing policies into harmony with the purpose of flood plain regulations; mentions Federal involvement under Executive Order 11296; and points out the changing attitudes about land and land use including the increasing urban-suburban interest in flood plain management and the recognition of need for new regulations in the management process.

Poertner, H. G. (398)

1974. Practices in detention of urban stormwater runoff-an investigation of concepts, techniques, applications, costs, problems, legislation, legal aspects and opinions. Special Report No. 43, American Public Works Association based on OWRR Project No. C-3380, USDI. 231 pp.

The author describes an investigation of on-site detention of runoff as an alternative to other methods of urban stormwater runoff management such as sediment basins, sedimentation ponds, detention ponds, storage on roofs, parking lots, porous pavement, use of storm water for augmenting water supplies for recreation, and so forth, i.e., permanent ponds. Disadvantages include nuisance problems of algae growths, mosquito breeding, and poor aesthetics of empty detention basins and spreading fields.

Sabol, K. J. (Ed.). (399)

1974. National Conference on Flood Plain Management Proceedings of conference, 24-25 July 1974, Statler Hilton Hotel, Washington, D.C. Co-sponsored by the American Forestry Association, American Society of Planning Officials, Council of State Governments, Keep America Beautiful, National Association of Conservation Districts, Soil Conservation Society of America, the Sport Fishing Institute, and Wildlife Management Institute. 261 pp.

The proceedings of the Conference including background summary of basic information prepared by Thomas Maddock, Jr., of USDI Geological Survey; four papers on uses of flood plains; four papers describing experiences in flood plain management in Minnesota, Connecticut, New Jersey, and Arkansas; five papers suggesting avenues to improved flood plain management; four papers recommending initiatives at the Federal, State and interstate, intrastate and county and city levels to improve flood plain management; conference summary by Gilbert F. White; and luncheon and keynote address by Senator Jennings Randolph, Chairman Senate Committee on Public Works.

Sperry, C. C. (400)

1947. Botulism control by water manipulation. Transactions of

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the 12th North American Wildlife Conference, pp. 228-233.

On the basis of studies at Bear River Refuge, Utah, 1942-46, Sperry concluded that: (1) botulism rarely kills ducks on an impoundment with steep banks; (2) duck sickness (botulism) is directly related to the production of toxin in shallow alkaline impoundments with an exposed, nearly flat, lake bottom as a shore line; (3) an abundance of water coming into and going out of a lake has little beneficial effect on sickness if extensive shore lines remain on the flat terrain of an exposed lake bottom; (4) water can safely be put over a thoroughly dried lake bottom provided the flooding does not create stable shore lines during the process; and (5) the theory linking major botulism outbreaks with changes in water levels and movements of shore lines should be given a severe test. The theory is that stabilization of a shore line on a gently sloping old lake bottom is favorable to toxin production and that the fringe area from the water's edge to dry land is a danger zone whenever shallow inundation makes it a feeding ground for ducks. Sperry believed that fluctuation in water level is a key factor in decreasing a botulism trend and that one way of avoiding waterfowl loss to botulism is to keep water levels low during the growing and nesting seasons and later to raise the water level so the water is against banks or on non-lake bottom soils.

Tourbier, J., and R. Westmacott. (401)

1976. Lakes and ponds. Technical Bulletin 72, Urban Land Institute, 1200 18th Street, N.W., Washington, D.C. 20036. 73 pp.

As stated by the authors: "This book has attempted to provide an overview of the possibilities for lake use and development. It is hoped that it will provide those persons who are involved in lake or lakeshore community development with an understanding of the basic concepts and unique problems of such development, an understanding which will help them make intelligent decisions in striving to create the best possible environment for the lake resident, the lake user, and the community at large."

The publication discusses the transitory nature of lakes and ponds, aesthetic and property values, problems associated with maintaining lakes and ponds, uses, criteria for design, and legal and management consideration. The authors point out that the developer's first step should be to consult professionals for advice in the development of lakes and lakesides.

USDA, Soil Conservation Service. (402)

1971. Ponds for Water Supply and Recreation. Soil Conservation Service, U.S. Dept. of Agriculture. Agriculture Handbook

No. 387. 55 pp., 26 figures. U.S. Government Printing Office, $1.25.

This handbook outlines requirements for developing a pond for water supply in areas where failure of the structure will not result in loss of life, damage to homes or commercial or other buildings, or to railroads, main highways and public utilities. Criteria and recommendations are for dams less than 25 feet high.

Private landowners had built more than 2.2 million ponds in the United States by 1969. Generalized maps of the country show approximate acreage of drainage area required for each acre-foot of storage in a pond and the recommended minimum depth of water for ponds. Other maps show the amount of rainfall expected in a 24-hour period at 10, 25 and 50-year average frequencies. Usually the spillway for a farm pond should be large enough to pass the runoff from a 25-year frequency storm but designing for a 50-year frequency is recommended where failure of the dam would cause damage to property. Information on rates of discharge for various size watersheds on flat, moderate and steep slopes is given as an aid in estimating the needed capacity of the dam and spillway. Instructions are given for constructing ponds, protecting against erosion, installing the trickle tube, riser, antiseep collars, trash rack, and other mechanical components of the dam. The sealing of ponds by compaction, clay blankets, bentonite, chemical additives or waterproof linings is discussed.

USDI, Bureau of Ourdoor Recreation. (403)

1976. Flood plains for open space and recreation. Outdoor Recreation Action. Report No. 39, pp. 3-16.

This report points out that the Federal Government has invested over $9 billion in flood control projects since 1936 and that State and local governments have invested large sums also. It cites several examples of how communities are dealing with the problem across the country and describes some major sources of assistance from the Federal Government. Also, encourages use of flood plains for compatible open space purposes such as recreation, agriculture and other low density uses.

USDI, Bureau of Outdoor Recreation and U.S. Department of Commerce, Office of Coastal Zone Management. Selected Proceedings of a Conference. (404)

1975. Recreation in the coastal zone. 28 pp.

Selected proceedings are given consisting of excerpts from papers presented at a conference sponsored by the Departments of The Interior and of Commerce, held 25-26 March 1975, at St. Petersburg, Florida. Remarks are also included on

recreation needs, problems and people preferences in coastal areas, approaches used to make additional shoreline available to the public, and needs for coordination and balance in the use of coastal resources.

USDI, Bureau of Sport Fisheries and Wildlife. (405)

1970. Report to the fish farmers--the status of warm water fish farming and progress in fish farming research. Resources Publication 83, Bureau of Sport Fisheries and Wildlife, Washington, D.C. 20240. 124 pp.

This report brings together the essentials of fish farming with emphasis on the culture and management of channel catfish and bait fishes. It takes stock of the situation in 1968 and indicates what the potential for warmwater fish farming may be in the future. There were an estimated 68,000 acres in the United States under intensive warmwater fish culture at the date the publication was prepared in comparison with 16,870 acres in 1963. Fish farming can be profitable, sometimes yielding gross income and net profits exceeding those in rice farming. An 11-page section deals with pond management.

U.S. Water Resources Council. (406)

1975. National conference on water: executive summary U.S. Water Resources Council, Washington, D.C. 10 pp.

This executive summary describes the proceedings and results of the National Conference on Water, 22-24 April 1975.

Whitman, W. R. (407)

1976. Impoundments for waterfowl. Canadian Wildlife Service, Ottawa, Canada. Occasional Paper No. 22. 22 pp.

The author reports on studies initiated in New Brunswick and Nova Scotia to: (1) identify factors involved in the aging of freshwater impoundments which affect waterfowl use; (2) evaluate the effect of impoundment upon the nutrient export-import balance within a tidal marsh; and (3) consider undesirable side-effects of parasitism caused by the concentration of waterfowl. On the basis of his study, the author recommends water-level drawdown and habitat manipulation every five to seven years in freshwater impoundments. He found conditions most suitable for waterfowl 1.5 to 4 years after impoundment. Tidal marsh impoundments were found to be potentially damaging to the coastal zone by reducing plant diversity and preventing the export of fertilizing nitrogen compounds and organic detritus in suspension; also waterfowl production was, perhaps, competitive with fish production in the use of salt marshes. Waterfowl impoundments may result in increased parasitism and increase numbers of biting flies at campgrounds, parks and

urban recreational areas, if located nearby such areas.

(Other references dealing, in part, with water management in urban areas, include: 4, 8, 12, 24, 25, 33, 34, 42, 44, 67, 70, 92, 104, 123, 135, 149, 150, 166, 168, 169, 170, 178, 180, 181, 183, 184, 199, 211, 212, 214, 215, 217, 219, 228, 235, 240, 241, 267, 279, 285, 290, 293, 294, 295, 297, 301, 302, 313, 315, 316, 317, 320, 322, 323, 335, 342, 349, 358.)

D. Special Area Concerns or Needs

Leedy, D. L. (408)

1975. Highway-Wildlife Relationships. Vol. 1. A State-of-the-Art Report. Federal Highway Administration, Offices of Research and Development. Washington, D.C. 20590. Report No. FHWA-RD-76-4. 183 pp.

This report assesses what is known about highway-wildlife relationships and suggests research and management approaches to protect and enhance fish, wildlife, and environmental quality. It points out that the Nation's four million miles of streets and highways often create "edges" conducive to wildlife. The mileage of municipal roads and streets was estimated to total over .6 million at the end of 1973. Some information is provided on management of roadside vegetation for wildlife in Volume 1 of this report. Additional information and references are available in Volume 2, "An Annotated Bibliography" by Leedy, T. M. Franklin, and E. C. Hekimian. Report No. FHWA-RD-76-5. 417 pp. Both volumes are available from the Federal Highway Administration and National Technical Information Center.

National Sand and Gravel Association. (409)

1961. Case Histories: Rehabilitation of Worked-Out Sand and Gravel Deposits. With foreword by E. K. Davidson, then President NSGA. National Sand and Gravel Association, 900 Spring Street, Silver Spring, Md. 20910. 32 pp.

Brief case histories are given describing for 10 sites, in different geographic areas, some of the ways in which sand and gravel deposits have been used after the deposit was exhausted. Among the uses for rehabilitated areas were: recreational lakes, permanent homes and cottages, lakeside residences, church and school sites, swimming beach, fishing lake, yacht club, recreational park, commercial, and sewage disposal plant. Land value of rehabilitated sites far exceeded the land values before mining.

Stortenbeker, C. W. (410)

1969. Ground cover at Schiphol Airport, pp. 163-166. In Proceedings of the World Conference on Bird Hazards to Aircraft.

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Natural Research Council of Canada (1969). 542 pp.

Gulls, partridge, and lapwing together form more than 80% of the bird problem at Schiphol Airport southwest of Amsterdam, Holland, with gulls being more accident-prone than any other species. Grassland is, in general, more attractive to birds than arable land but when the grass is mown at a minimum length of 10 cm. there is a noticeable shift towards arable land. Arable land is especially attractive to birds when in stubble or just after cultivation. When crop rotation necessitates growing of grains, a green fertilizer crop is sown with it in order to keep stubbles unattractive to gulls and lapwing until fall.

Talbot, L. M. (411)

1974. Nongame wildlife: a federal perspective. Transactions of the 39th North American Wildlife and Natural Resources Conference, pp. 81-86.

The author discusses the need for a strong federal-state program funded from nonhunting sources and focused on nongame species which can complement the existing game-related federal-state programs. He states that in 1969, $142 million was spent by all sources--Federal, State, and private--for wildlife management, research, and habitat acquisition but, of this amount, only $6 million, about 4%, was spent for clearly nongame purposes. And yet, Talbot observes, in the United States and its adjacent waters, there are about 400 species and subspecies of native mammals and just under 800 species of birds, plus the reptiles, amphibians, and invertebrates. The hunted forms of native wild birds and mammals constitute only a small percentage of the total.

(For further information on management problems and approaches see, also, references 42, 44, 74, 183, 233, 262, 294, 308, 330, 348, 372.)

VI. PLANTS FOR WILDLIFE AND OTHER PURPOSES; ATTRACTING AND ENHANCING WILDLIFE

Included in this category are publications which provide information on plants and plantings useful for wildlife and other purposes such as trees for city streets and landscaping. Representative publications on methods of attracting birds and other wildlife to backyards in residential areas are listed. No attempt was made to list them all because leaflets and bulletins on bird feeders, nest boxes, watering devices, and the like are widely available from the Audubon Society, the National Wildlife Federation, government agencies, and local nature clubs.

A. Plants for Wildlife and Other Purposes

American Horticultural Society. (412)

Undated. Transit Planting: a Manual for the Horticultural Development of Public Transportation Environments. American Horticultural Society, Mount Vernon, Virginia 22121 (Urban Mass Transportation Demonstration Project No. VA-06-0006). 65 pp.

This manual was prepared for the Urban Mass Transportation Administration, U.S. Department of Transportation. It is designed to illustrate how urban transportation facilities can be developed practically and esthetically, using plant material designated by the American Horticultural Society as particularly suitable for use in specific kinds of public transportation facilities. Judgments on such suitability are made from the standpoint of ecological adapability, taking into account climatic factors along with the plants' capability of resisting the various types of pollution in the urban environment. Trees, shrubs and ground cover plants are listed alphabetically by botanical names according to 10 hardiness zones based primarily on temperature and located throughout the conterminous United States and into Canada. Plants are listed also by botanical name in tabular form in the categories of trees, shrubs, ground covers and for interior plantings. These tables or charts indicate the size, relative growth rate, form of growth--rounded, spreading, weeping, or upright--, the features i.e. whether ornamental, good shade, flowering, seasonal or of interest, and other characteristics i.e. whether the plant trains to a large shrub, whether it tolerates dry soil, or whether it tolerates moist soil.

Andresen, J. W. (413)

1973. Forestry thrives in Chicago. American Forests, April 1973 issue. (Magazine of the American Forestry Association), pp. 12-15, 58.

The author gives an account of the multi-use forestry program of the City of Chicago administered by its Forestry Bureau. He points out the role of Frederick Law Olmsted in relandscaping Chicago after the holocaust of 1871, the losses of elm trees caused by the Dutch elm disease, and the introduction of a new assemblage of native and exotic shade trees accompanied by improved standards and techniques of culture. Chicago grows its own trees. "Propagating space in the Bureau's greenhouses not only serves arboreal demands but floricultural needs as well. In a typical year over 200,000 bedding plants are produced for hundredsof flower beds, beautification projects and window boxes that perk up municipal offices...."

'Beautification is further enhanced by the maintenance of

455 acres of landscaped grounds adjacent to 45 major boulevards and 41 greenbelt parkways. Lawn areas totalling more than 1,320,000 square feet are periodically fertilized and reseeded to create turf, the envy of many a golf course."

Andresen, J. W. (414)

1976b. Selection of trees for endurance of high temperatures and artificial lights in urban areas, pp. 67-75. In Better Trees for Metropolitan Landscape Symposium Proceedings. USDA Forest Service Gen. Tech. Report NE-22.

Author's abstract: "In urban areas, high temperatures and artificial lights may adversely affect the growth and survival of trees already under various forms of stress. Trees close to radiation surfaces such as pavements, walls and heat vents are especially susceptible to heat damage. However, harmful effects, if any, by prolonged illumination upon urban-grown trees are yet to be experimentally determined. Specific selection or breeding programs to identify species or cultivars with resistance to thermal and light pollution are not economically warranted. However, some research on heat resistance could be combined with drought studies, and light influences could be included in studies of low-temperature effects on trees."

The author points out that urban conditions of mid-and high latitudes produce a consistently higher temperature by 2 to 5 degrees C than that of rural areas, but in the center of large cities where buildings are dense and tall, local outdoor summer climates are several degrees cooler near ground level than in surrounding neighborhoods of dense but low-storied (1- to 5-floor) structures. Suburban fringes that include dispersed green space, however, are several degrees cooler than the city center. He points out, further, that current clonal-monocultural practices still evident in the arboriculture of most North American cities portend disasters similar to that due to Dutch Elm disease and that future problems resulting from overly uniform planting materials are predictable from observing the contemporary decline of large, widespread urban populations of even-aged and overmature exotic trees such as Acer platanoides, Aesculus hippocastanum, and Platanus acerifolia.

The author states, page 73, "...is an educational challenge to convince urban foresters that, even though clonal uniformity may have maintenance advantages, it might result in inordinate costs as diseases or insects strike or when large blocks of trees approach physiological maturity. Planting a variety of species in numerous responsive ecotypes, and spread through a sequence of age classes, holds the answer to low maintenance expenditures."

He concludes that urban trees should be resistant to low and high temperatures, drought, pollution and biologic pests and provide varying esthetic and amenity values. This reviewer notes that it is with these latter values, specifically related to wildlife, that ecologists and wildlife biologists can render assistance in the selection and maintenance of tree species.

Andresen, J. W. (Ed.). (415)

1976c. Trees and Forests for Human Settlements. Proceedings of papers presented during Pl.05-00 Symposia in Vancouver, British Columbia, Canada 11-12 June 1976 at the United Nations Habitat Forum and in Oslo, Norway, 22 June 1976 at the XVIth IUFRO World Congress. University of Toronto, Ontario, Canada MSS IAI. 417 pp.

This is a collection of 38 papers presented in Vancouver and Oslo with a brief epilogue commenting upon the effectiveness of the two symposia, summarizing organization details and recommending future activities for Pl.05. Notes relating to the origin and development of Pl.05 are included in one of the proceedings' papers, "Urban forestry research system" by editor Andresen. The volume provides much information on urban forests, their values and management based upon observations and investigations in the United States, Canada, the United Kingdom, and elsewhere, including continental Europe, Australia, Africa, Pakistan and China. Several of the articles consider wildlife values.

Dupont, E. N. (416)

1978. Landscaping with Native Plants in the Middle-Atlantic Region. Technical illlustrations by Stephan Kuter, native plant drawings by Jane H. Scott and photography by Susan Andreen. Brandywine Conservancy, Box 141, Chadds Ford, Pa. 19317. 72 pp.

A nicely-prepared book or manual which should be useful to private individuals in using native plants in their own landscape planning rather than depending primarily on exotic or imported plants and closely cropped grasses. Titles of the four chapters--"Gardening with Native Plants," "What Can Happen Where," "Designing with Nature," and "Planting and Maintenance" are indicative of the contents of the book. The author states, page 1, "Using a naturalistic style of gardening requires working with the land to bring out its own natural beauty and productivity. It can be done on any scale from a quarter-acre subdivision lot to a major land holding, but it will always require a basic understanding of how the natural forces work together, an awareness of why certain species fit with others, and a readiness to copy some of nature's own principles and techniques."

Attention is given in the text and in Appendix A to the wildlife values of plants and chapter two discusses plants and/or plantings for grassland or meadow, various types of wetland areas, dry areas, and forest areas. Chapter four provides useful guides concerning planting and maintenance. Appendices B, C, and D give information on characteristics of flowering plants in bloom, native tree and shrub characteristics, and plants found in various soil and water conditions. Appendix E lists arboreta and botanical gardens that may serve as sources for those seeking information and examples of native plants for use in or near the Middle-Atlantic Region. A glossary and bibliography complete the volume.

Gill, J. D., and W. M. Healy. (417)

1974. Shrubs and Vines for Northeastern Wildlife. USDA Northeast Forest Experiment Station, Upper Darby, Pa. in cooperation with N.E. Deer Study Group and Association of N.E. Game, Fish, and Conservation Commissioners. USDA Forest Service General Technical Report NE-9. 180 pp., illus.

Authors' abstract: "A non-technical handbook in which 34 authors discuss management of 97 native and 3 naturalized shrubs or woody vines most important to wildlife in the Northeast--Kentucky to Maryland to Newfoundland to Ontario. Topics include range, habitat, life history, uses, propagation, and management." Bibliography of 15 pages, a glossary of scientific terms, and an index of scientific and common plant names.

Halls, L. K. (Ed.). (418)

1977. Southern Fruit-Producing Woody Plants Used by Wildlife. Southern Forest Expt. Sta., Southeastern Area, State and Private Forestry Southern Region Forest Service, USDA, in coop. with Forest Game Committee, S.E. Sec. of The Wildlife Society. USDA Forest Service General Technical Report SO-16. 235 pp.

This publication describes and illustrates, in black and white photographs, 106 woody plant species that provide food used by wildlife in 200,000 acres of forests in an area extending from eastern Texas and Oklahoma eastward to Virginia and south to Florida. Primary attention is given to trees, shrubs, and vines that produce fleshy fruits or nuts. A general distribution map is included in each species account. These brief accounts prepared by Forest Service, U.S. Fish and Wildlife, State Wildlife Commission, and university personnel provide considerable information about the various species and their use by wildlife and, in some cases, suggestions on propagation. An appendix presents chemical composition values of fruits and seeds for species about which data are available. A bibliography of 20 references and a 3-page index are included.

Little, S., and J. H. Noyes (Eds.). (419)

1971. Trees and forests in an urbanizing environment. Proceedings of a symposium conducted by Cooperative Extension Service in cooperation with University of Massachusetts Department of Forestry and Wildlife Management and the Department of Landscape Architecture; the USDA Forest Service, Northeast Forest Experiment Station and Northeastern Area, State and Private Forestry; and the Massachusetts Department of Natural Resources.

This monograph is comprised of papers presented at the symposium held at the University of Massachusetts, 18-21 August 1970.

Martin, A. C., H. S. Zim, and A. L. Nelson (420)

1951. American Wildlife and Plants. McGraw-Hill Book Co., Inc., New York. 500 pp.

This is a guide to wildlife food habitats--the use of trees, shrubs, weeds and herbs by birds and mammals of the United States. Part one deals generally with the importance of plants to wildlife, farm crops and wildlife, wildlife food-habits studies, and how to interpret the data in the book. Part two describes the food of different kinds of wildlife and provides range maps of many of the wildlife species treated, and indicates the number of specimens examined, and the relative extent to which various food items are included in the diet. Part three deals with the wildlife plants of the United States--herbaceous and woody, wild and cultivated; upland and aquatic--that furnish food of wildlife in significant amounts. The plants are presented in family sequence. The final chapter provides a national list of plant groups ranked according to their use by wildlife as food and it provides regional lists of wildlife plants indicating the extent to which particular kinds of plants have been used by seven types of wildlife; water birds, marsh and shore birds, upland game birds, song birds, fur and game mammals, small mammals, and browsers.

National Wildlife Federation. (421)

1974. Gardening With Wildlife--a complete guide to attracting and enjoying the fascinating creatures in your backyard. The National Wildlife Federation, 1412 16th Street, N.W., Washington, D.C. 20036. 190 pp.

This book, with an introduction by Thomas L. Kimball, contains articles by Roger Tory Peterson, George Reiger, Len Buckwalter and George H. Harrison, Donald O. Cunnion, and Jack Ward Thomas and Richard M. DeGraaf. It has 118 full-color photographs and 129 "how-to" drawings. The chapters provide plans and suggestions on various types of plantings, how to

build pools and waterfalls, bird feeders, baths and houses to attract birds, and other information designed to increase one's appreciation of wildlife in the backyard.

Reiger, G. (422)

1974. Planting an oasis for wildlife, pp. 49-72, and Appendix, pp. 117-183. In "Gardening with Wildlife," National Wildlife Federation. (For full citation see reference 421.)

This chapter of the multi-authored book gives helpful suggestions on plantings for wildlife including a listing of plants by regions and categorized into flowers and grasses, low shrubs and vines, large shrubs, small trees, and large trees. The appendix provides scientific names, height of plant, brief description of flowers and flowering period, date of fruiting, value for wildlife, and brief comments on sites where plants will grow.

Robinette, G. O. (423)

1972. Plants/People/and Environmental quality. A Study of Plants and Their Environmental Functions published by the U.S. Department of the Interior, National Park Service, Washington, D.C. in collaboration with the American Society of Landscape Architects Foundation. 140 pp.

The author indicates that the functions of plants should be the basis for their use in environmental design. He illustrates, by sketches, uses of plants for architecture, engineering, climate control and esthetics. He mentions other uses, not elaborated on in the book, including appreciation and identification of plants, recreational use such as climbing in or playing on, conservation to supplement organic materials in the soil and provide food and cover for birds and other animals, and supplying food for humans.

Santamour, F. S., Jr., H. D. Gerhold, and S. Little (Eds.). (424)

1976. Better Trees for Metropolitan Landscapes, USDA Forest Service General Technical Report NE-22, Northeastern Forest Experimental Station, 6816 Market Street, Upper Darby, Pa. 19082. ($3.25 per copy, available from the Government Printing Office--Stock #001-001-00421-9). 256 pp.

This publication represents the proceedings of the symposium held at the U.S. National Arboretum, Washington, D.C. which was sponsored by the Agricultural Research Service and the Forest Service of USDA, and the Pennsylvania State University in conjunction with the Pinchot Institute Consortium for Environmental Forestry Studies. Twenty-nine papers were presented at this symposium including 14 dealing with selection

of trees for metropolitan environments; 10 dealing with selection strategies of planners, growers and breeders; and 5 with putting new cultivars into use. Although mention is made in the Foreword to the proceedings of the value of urban forest vegetation as habitat and sanctuary for wildlife, the 29 papers do not deal specifically with such values. They do, however, deal with other values including esthetics, climate modifications, noise and pollution abatement, and with the selection of species or development of cultivars for use in urban areas for various purposes. Planners and landscape architects could get guidance on selection of species of trees for use in urban areas by referring to this document but will find it necessary to go to wildlife biologists to ascertain the value of these trees for wildlife management purposes.

Sharp, W. C. (425)

1977. Conservation plants for the Northeast. Soil Conservation Service, USDA Program Aid No. 1134. 40 pp. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 001-000-03605-0/Catalog No. A1.68:1154.

This booklet describes plants suited to specific conservation uses under different site conditions from Maine through Virginia. The plants are listed by common and scientific name in five categories according to their main conservation use, but many of the plants may be suited to several uses. A generalized map of 8 plant hardiness zones based on average annual minimum temperatures appears in color on the inside front cover. For each plant listed, information is provided on zones for which the plant is suited. Uses of the plant, growth rate and site conditions--soil type, acidity, drought and shade tolerance, soil moisture--are described. The plants are illustrated in color photographs. Pages 38-39 are devoted to a section on "How to establish plants" by direct seeding; ground cover cuttings and divisions; planting bare-root woody plants; planting balled, burlapped, or container-grown plants; and planting vegetation on sand dunes. An index to plants listed appears on page 40. Cultivar names are given in the text. Plants suggested for specific uses include the following: Disturbed areas--crown vetch, birdsfoot trefoil, weeping love grass, Tioga deertongue (Panicum clandestinum), "Lathco" flatpea (Lathrus sylvestris), Sericea lespedeza, tall fescue, red fescue, perennial ryegrass, Bermudagrass, redtop, "Arnot" bristly locust (Robinia fertilis), sweetfern, staghorn/smooth sumac, European black elder and "Streamco purpleosier willow" (Salix purpurea). Ornamental ground covers--bugleweed, periwinkle, Japanese spurge, lily-of-the-valley, St. Johnswort, English ivy, Halls Japanese honeysuckle (Lonicera japonica hallina), small-leaved cotoneaster, lily-turf, bearberry, and ground juniper. Plants for coastal dunes and sandy inland areas--American beachgrass, bayberry, Virginia creeper, beach

plum, dusty-miller (beach wormwood), Rugosa rose, "Emerald Sea" shore juniper (Juniperus conferta) and Japanese black pine (Pinus thunbergii). Wildlife food and cover plants--"Blackwell" switchgrass (Panicum virgata), chokecherry, flowering dogwood, graystem and silky dogwood, "Natob" bicolor lespedeza, sawtooth oak (Quercus acutissima), American holly, crabapple, elderberry, American and European Mountain ash, winterberry, "Cardinal" autumn olive (Elaeagnus umbellata), firethorn (Pyracantha coccinea), and American cranberrybush (Viburnum trilobum). Plants for screens, hedges, and windbreaks--Amur privet, California privet, tall hedge (Rhamnus frangula), eastern redcedar, "Rem Red" amur honeysuckle (Lonicera maackii), Japanese yew (Taxus cuspidata), eastern arbovitae, and Tatarian honeysuckle.

Smith, R. H. (426)

1964. Some experimental shrub plantings--20 years later. New York Fish and Game Journal 11(2):91-105.

Author's abstract: "Experimental plantings of various shrubs, made in the early 1940s on two sites representative of the submarginal and abandoned uplands of southern New York, have provided valuable information on their survival, hardiness, adaptability to adverse sites, fruiting, susceptibility to weather and disease, damage by wildlife, and usefulness to wildlife for food. Many species were found unsuitable for one reason or another, others succeeded where their original value was doubtful, certain species have shown enough promise to call for further trial, and six species are now being regularly produced in quantity for erosion control, wildlife use, or both."

Note: The six species were: autumn olive, Tartarian honeysuckle, Toringo crab apple, multiflora rose, purple-osier willow, and American highbush cranberry.

Smith, R. H. (427)

1973. Crab apples for wildlife food. New York Fish and Game Journal 20(1):1-24.

A report summarizing observations begun in 1956 and continuing to date of writing on the fruit persistence of crab apple trees, mainly in horticultural collections, to determine which had fruit regularly persisting until mid- or late winter, and to observe wildlife use of the fruit for food. After several years of observations, 25 clones or individual kinds of trees that must be propagated by grafting were selected on the basis of adaptability, consistent fruit production, persistence of fruit and use by wildlife for establishing scion-wood orchards in the various game management regions of New York State. Among the species or clones of crab apples with demonstrated wildlife value and, at the same

time, of ornamental value and available from commercial sources are: Almey, Bob White, Dorothea, Eleyi, Hopa, Ormiston Roy, and Profusion.

The author states, page 22, "The budded varieties obtainable from commercial nurseries are suitable for the home lawn, shrub border, or garden where cultivation or close mowing discourages the mice, rabbits and woodchucks that could damage or destroy them. If these animals, or deer, will be a hazard, then the usual precautions must be taken: hardware cloth or roofing paper guards on the trunks or deer-proof fencing."

(For further information on plants for wildlife and other purposes see references 39, 102, 249, 285, 294, 298, 305, 310, 348, 360, 368, 375, 379, 381, 383, 408, 433.)

B. Attracting and Enhancing Wildlife

Baker, J. H. (Ed.). (428)

1941. The Audubon Guide to Attracting Birds. Halcyon House, Garden City, New York. 268 pp.

Briggs, S. A. (Ed.). (429)

1973. Landscaping for Birds. Audubon Naturalist Society of the Central Atlantic States, Inc., Washington, D.C. 62 pp.

This booklet is comprised, primarily, of a collection of seven brief papers which appeared in Atlantic Naturalist originally, a foreword by George Watson, a brief list of suggested source books on plants and birds, and a four-page index. In addition to chapters by American ornithologists--Irston R. Barnes, Gilbert Gude, Edward Mullins and Chris A. Mathisen--concerning ways to landscape the grounds around one's home and attract birds, an article combining two previous articles by the Englishman, P. H. T. Hartley, is included on bird gardens. The booklet is illustrated by Shirley A. Briggs, the editor.

Buckwalter, L., and G. H. Harrison. (430)

1974. Helping nature out, pp. 89-120. In the National Wildlife Federation's book, "Gardening with Wildlife." (For full citation see reference 421.)

Buckwalter and Harrison discuss bird feeders and feeding, how to attract mammals other than squirrels, and the ways of installing, and the benefits from, pools established in residential yards. Included are descriptions and drawings of various types of bird and other types of animal feeders, cover, and pools or ponds and suggestions as to where additional information can be obtained.

Davison, V. E. (431)

1967. Attracting Birds: From the Prairies to the Atlantic. Thomas Y. Crowell Co., New York, N.Y. 256 pp.

Dennis, J. V. (432)

1949. A wildlife sanctuary for everyone. Part I. Urban and suburban wildlife sanctuaries. Bulletin of the Massachusetts Audubon Society 33(3):93-96, illustrated.

The author gives examples of what is being done in Massachusetts' many home and community sanctuaries. He outlines the conditions needed for good wildlife sanctuaries.

(From Wildlife Review 57:3, Sept. 1949.) See references 438 and 441 for Parts II and III of this report.

Garrett, B. (433)

1979. Welcome wildlife to your backyard. Better Homes and Gardens 59(6):112-115, 212, 214.

This is a popular article, beautifically illustrated in color, which outlines what was done by Alice and Cliff Grant as participants in the National Wildlife Federation's backyard habitat program to beautify their yard and make it more attractive to birds and other wildlife. Food, shelter, space, and water needs for wildlife were addressed and lists of trees, shrubs, vines, and various herbs, meadow plants and annual and perennial flowers valuable to wildlife and for beautification were suggested for use.

Gellner, S., C. Russell, and P. Edinger. (434)

1975. Attracting Birds to Your Garden. Sunset Books, Lane Publishing Co., Menlo Park, Cal. 94025. 96 pp. ($2.45, paperback.)

The authors discuss 33 popular garden birds and their habits and how to attract them through supplemental feeding, bird houses, and plantings. The latter 47-page section on plants provides information on plants and their growth habits and on the birds attracted by them. This section, in particular, would be of interest to landscape architects, planners, and builders.

Harrison, G. H. (435)

1976. Backyard habitats. Virginia Wildlife, March 1976, pp. 13-16.

The author describes how to attract birds and other wildlife

to your yard and illustrates several easy-to-make types of bird feeders and watering devices. He provides some sources of additional information.

Kalmbach, E. R., and W. L. McAtee. (As revised by F. R. Courtsal and R. E. Ivers.) (436)

1969. Homes for Birds. Conservation Bulletin 14 (revised in 1969). USDI Fish and Wildlife Service, Washington, D.C. 20240. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price 30 cents. 18 pp.

This bulletin describes how to construct, erect and maintain many types of bird houses. Information is provided on dimensions of the floor of the nest box cavity, depth of cavity, height of entrance above floor, diameter of entrance, and height above ground for installation of bird boxes suitable for 26 different bird species. Protection from enemies and sanitation of bird houses are treated.

Marriage, D. L. (437)

1975. Invite Birds to Your Home: Conservation plantings for the Northwest. USDA Soil Conservation Service Program Aid (PA)-1094. 20 pp., illustrated. With bird paintings in color by Lee LeBlanc.

The author presents a popular account of ways of attracting birds to your home. Water areas, screens and fences, open areas, windbreaks and feeders, bird boxes and baths are discussed in consideration of birds' needs. Marriage points out that many common shade trees and landscape shrubs yield little food for birds and that yards with only deciduous species can be improved by adding conifers and by selecting species with staggered flowering and fruiting periods. Eight familiar birds of the Northwest are shown in color on typical perches, usually on a branch of a favorite plant species. Sixteen plant species or groups of plants are shown in a chart with the extent to which familiar birds use them as food. Fourteen plants are shown in color in fruiting stage and six additional species are listed and information is given as to their use by birds, ornamental value, adaptation to soil and moisture and sun, blooming and fruiting periods, and sources or means of propagating.

Mason, E. A. (438)

1949. A wildlife sanctuary for everyone. Part III. Management on the home sanctuary. Bulletin of the Massachusetts Audubon Society 33(5):185-188, illustated.

The author tells how to grow food and cover, with emphasis

on hedges. (From Wildlife Review 57:4, Sept. 1949. See references 432 and 441 for Parts I and II of this report.)

McAtee, W. L. (439)

1940. A venture in songbird management. Journal of Wildlife Management 4(1):85-89.

Forty-six nest boxes in 1926 and 1927, and 98 nest boxes from 1928-1931 located on grounds of the Bureau of Plant Industry in Prince Georges County, Maryland were examined for occupancy in a project intended to increase bird numbers as a possible means of controlling nut weevils in an experimental chestnut orchard. Net occupancy of the bird boxes varied from 32.6% to 71.4%. The success, on a broad basis according to size of the entrance to the nest box, was recorded. Starlings and the flicker used only boxes with a two and one-half inch diameter entrance; the crested flycatcher seemed to favor the two and two and one-half inch entrance; a titmouse used a box with a one and one-quarter inch entrance, and the English sparrow seemed to favor this size, although some used one and one-eight inch hole boxes; bluebirds used boxes with holes of one and one-quarter to two-inch diameter; and the house wren nested in boxes of all sizes of entrances except the largest which had two and one-half inch diameter holes. In this experiment, nest boxes at a height of five to seven feet appeared to be most productive of broods, although starlings nested higher, also. Nest houses in from 80 to 100% sun seemed to be more productive than those shaded most of the time. White-footed mice occasionally appropriated the nest boxes, but paper wasps, in various years, made nest in from 27.5 to 45.9% of the boxes. Other "intruders" were bumblebees, honeybees, yellow jackets, mud daubers, and ants.

McElroy, T. P., Jr. (440)

1951. Handbook of Attracting Birds. Alfred A. Knopf, Publisher, New York, N.Y. 163 pp.

Sanborn, A. W. (441)

1949. A Wildlife sanctuary for everyone. Part II. The effect of environment of wildlife populations. Bulletin of the Massachusetts Audubon Society 33(4):147-150, illustrated.

Following a discussion of the essentials of food, cover, water, and home site, the author describes the distribution of different birds in the wooded and open areas of Pleasant Valley Sanctuary in Lenox, Massachusetts.

(From Wildlife Review 57(4), Sept. 1949.) See references 432 and 438 for Parts I and III of this report.

Terres, J. K. (442)

1953. Songbirds in Your Garden. Thomas Y. Crowell Company: New York. 274 pp. (With introduction by Edwin Way Teale and illustrations by H. B. Kane.)

A book written "...for every man, woman, and child who has a back yard or a garden." Deals with "garden birds," how to attract them by feeding and water, ornamental plantings, bird houses, and care and feeding of young birds. Includes a discussion of some problems and how to meet them.

USDA Soil Conservation Service. (443)

1969. Invite Birds to Your Home: conservation plantings for the northeast. USDA Soil Conservation Service PA-940 U.S. Government Printing Office, Washington, D.C. 20402. 16-page folder (1 sheet when spread out).

Lists 19 species of shrubs and trees with colored illustrations for nine and the growth form for 15 and includes information on number of species of birds known to use each species, ornamental values, adaptation, i.e. for soil moisture and sun or shade, periods for blooming and fruiting, and sources or means of propagating. Shows, by sketch, possible planting treatment for a suburban lot and illustrates, by black and white photographs, food plots, cutback woods borders and clearings, ponds, living fences and windbreak plantings.

(Additional references which deal in part with attracting and enhancing wildlife include numbers 99, 156, 190, and 421.)

VII. RESEARCH AND EDUCATION

This category contains a few references dealing with needs for research and education. Readers interested in these subjects with respect to urban wildlife planning and management are advised to examine selected publications listed under other categories but which relate in part to research and education needs. No papers were located which discuss these needs in a systematic and truly comprehensive manner or from a broad and inclusive viewpoint. Included here, however, are publications suggesting needs and opportunities for training, beginning at the elementary school level and extending to the university training of wildlife biologists capable of working with urban planners and developers. Public information and education needs are treated, also.

A. Research Needs

Brush, R. O. (444)

1976. Wildlife research needed by landscape architects.

Transactions of the 41st North American Wildlife and Natural Resources Conference, pp. 561-563.

Whether they realize it or not, landscape architects are practicing wildlife management when they shape and reorder the outdoor environment to accommodate human activities. Three problem areas are noted where wildlife research is needed to provide information useful to landscape architects.

1. Identify patterns of open space in urban areas that might benefit wildlife;
2. Describe the form and structure of vegetation edge; and
3. Develop guidelines for managing urban open space for wildlife.

DeGraaf, R. M., and J. W. Thomas. (445)

1974. A strategy for wildlife research in urban areas, pp. 53-56. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The authors point out that, until recently, wildlife management in cities dealt mainly with the control of pest species but, now, wildlife biologists recognize the need to provide wildlife for enjoyment of people in urban areas. The authors suggest that urban wildlife research needs generally fall into three problem components: human preferences for wildlife, habitat requirements of selected species, and human-wildlife interactions evaluated in terms of contributions to the welfare of man.

Galli, J. (Ed.). (446)

1978. Proceedings of Meeting on Nongame/Urban Wildlife/Endangered Species Program Concerns. New Jersey Division of Fish, Game and Shellfisheries Endangered and Nongame Species Project and the Northeast Section, The Wildlife Society. The Wetlands Institute, Middle Twp., N.J. 83 pp.

The proceedings of this meeting, held 5 October 1978, include six brief papers each (18 papers total) describing nongame, endangered and urban wildlife programs being conducted by Federal, State, and university and private conservation organizations. State agencies reporting were Maryland, Massachusetts, New Jersey, New York, and Pennsylvania; Federal agency reports were by Fish and Wildlife Service and Forest Service employees. More was said concerning needs and plans for wildlife research, management and education in these areas than about accomplishments which may be indicative of the newness and low funding levels of many of the programs. The list of names, affiliations, and addresses of the people attending the meeting provides valuable potential contacts for readers desiring to

obtain additional information.

Geis, A. D. (447)

1978. Urban wildlife research program--U.S. Fish and Wildlife Service, pp. 16-17. In Proceedings of Meeting of Nongame/ Urban Wildlife/Endangered Species Program Concerns--Joan Galli (Ed.). (For full citation see reference 446.)

Dr. Geis discusses a new field procedure for measuring bird habitat in urban areas which permits quantification of habitat characteristics in a biologically meaningful way without the need to secure permission of property owners to sample their property. Also discusses current research on bird feeding experiments which suggests that seeds of sunflowers grown for oil production are superior to the conventional striped sunflower seed for such birds as goldfinches and mourning doves. He points out needs to determine why, despite current laws, floodplains valuable for wildlife continue to be developed and what the implications of bird feeding are on bird populations.

Hendee, J. C, and D. R. Potter. (448)

1971. Human behavior and wildlife management: needed research. Transactions of the 36th North American Wildlife and Natural Resources Conference, pp. 383-396.

The authors state that in reviewing the literature on human behavior and wildlife they found nearly 600 popular articles or published conference talks on people-wildlife topics but relatively few publications based on solid research data; they found only 190 scientific journal articles, 32 doctoral dissertations, 39 master's theses and 36 Federal or State research bulletins devoted to human behavior and attitudes toward wildlife. They report that of 698 total articles published in the Journal of Wildlife Management from 1960 through 1969, six were on human behavior, 108 on administration and management, 580 on biological topics, and four on "other" subjects. Issues for research discussed and suggested by Hendee and Potter were listed under: hunting satisfaction; nonconsumptive use of wildlife with some consideration being given to urbanization and what would "...contribute wildlife satisfactions to the 85 percent nonhunters in the population"; characteristics and preferences of hunters; access and hunting opportunity; wildlife economics; political-legal issues; and problems of implementing research on human behavior aspects of wildlife. Seventy references are cited.

Thomas J. W., and R. M. DeGraaf. (449)

1973. Nongame wildlife research in megalopolis: the Forest Service Program. USDA Forest Service General Technical Report

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NE-4, Northeastern Forest Experiment Station, Upper Darby, Pa. 12 pp.

The authors give a suggested generalized framework for research by the Forest Service on management of city habitats for wildlife production for enjoyment in forms other than hunting.

Walker, C. R. (450)

1969. Some views on research needed for providing urban sport fishing opportunities. Remarks at the Annual Coordination Meeting of the Cooperative Research Units, Washington Hilton Hotel, 1 March 1969. 3 pp.

The author discusses some of the parameters and problems involved in providing sport fishing opportunities for the urban dweller. The author sees the need for interdisciplinary effort for planning and manufacturing "natural" habitat in the city and in planning new cities. Problems needing to be researched include socio-economic and aesthetic values, the role of fishing for the well-being of man, problems caused by pollution and competition for the use of water, weed control, how to control and culture basic food chain organisms and regulate species composition and fish populations, how to treat fish diseases and detoxify metabolites and control agents, and how to develop new and better fish for urban water situations.

(For other publications cited which include mention of research needs, see references 7, 9, 10, 12, 19, 32, 34, 39, 44, 48, 66, 71, 88, 91, 110, 121, 149, 162, 171, 172, 173, 175, 176, 179, 184, 192, 197, 207, 210, 227, 229, 230, 231, 235, 239, 240, 245, 258, 262, 264, 281, 284, 288, 306, 330, 337, 342, 355, 358, 361, 370, 375, 385, 395, 400, 408.)

B. Education

Andrle, R. F. (451)

1976. Times Beach: Buffalo's harbor for wildlife. Science on the March 55(4):48-50.

The author describes the use by wildlife--particularly birds--of a 55-acre diked area on the Lake Erie face of Buffalo's waterfront. He points out that here, during the last few years, the U.S. Army Corps of Engineers has partially filled a portion of the harbor with silt dredged from the Buffalo River and, in so doing, created a combination of habitats used by an abundance of wildlife, especially waterfowl and shorebirds. He states that at least 186 species of birds have been identified at Times Beach and a comparable number at the nearby Tifft Farm Nature Preserve in Buffalo. Included among the birds visiting Times Beach are several rare or spectacular

ones for this region. Andrele asks whether this unique wildlife area in the heart of Buffalo can be preserved and tentatively answers yes, because of an agreement the Corps of Engineers has with the City of Buffalo and cooperation with the Buffalo Ornithological Society and the Buffalo Audubon Society in the disposition of dredged material and the management of vegetation in the area including elimination of herbaceous plants at the silt flat periphery. The author suggests some of the management objectives can be accomplished by the efforts of youths in municipal summer programs or by volunteer workers from local conservation groups. He suggest further that study of plant succession on the site could be incorporated in the education program for visitors as well as explanations of the rationale for management procedures.

Andresen, J. W. (452)

1976a. Legislation to enhance and protect Canada's trees and forests, pp. 99-104. In Proceedings of a Workshop on Ecological Land Classification in Urban Areas. Canadian Committee on Ecological Land Classification, 23 and 24 November 1976, Toronto, Ontario.

Author's abstract: "Canada's urban trees and forests lack comprehensive protection under contemporary legislation and regulation. As an example, the Ontario Municipal Act enables any municipality to compose and enforce tree bylaws, but only the larger municipal governments have enacted tree protective legislation. In general, municipal trees are more subject to removal than conservation. If violations of legislation do occur, the culprits are seldom prosecuted and punished. Increased civic activism, however, has alerted municipal officials to investigate more adequate tree protection legislation. In response to this need, a model tree bylaw and urban tree information brochure are discussed." The author notes that, in England, tree preservation orders extend to the protection of individual trees registered as having amenity value to the community at large. (See reference 46.)

Dasmann, R. F. (453)

1966. Wildlife and the new conservation. The Wildlife Society News, No. 105, pp. 48-49.

A reprint of a paper presented at U.S. Fish and Wildlife Service's Wildlife Division Seminar, Bowie College, Maryland, 13 June 1966. Dasmann pointed out that although old conservation problems of producing enough food and fiber and wildlife to meet our needs still exist, the "new" conservation is concerned more with the quality of the human environment. He urged that the wildlife profession become more involved with nonconsumptive forms of wildlife and with wildlife and environmental quality in urban areas. He stated that more wildlifers

should "...get out of the woods and into the cities. They must work with city and metropolitan regional planners, with landscape architects and all others concerned with the urban environment to make the cities and metropolitan regions, the places where people live, into environments where each person's everyday life will be enriched to the maximum extent possible by contact with living things and natural beauty. Only by such efforts will the wildlife conservationists regain the leadership that they once had in the conservation movement."

Etter, A. G. (454)

1960. Keeping the child in touch with the earth. Transactions of the 25th North American Wildlife and Natural Resources Conference, pp. 465-471.

The author discusses some of the competition in urban areas for space in which to maintain contact with nature and the earth versus space for playgrounds and intensive recreational use areas. He emphasizes the importance of getting children, especially, in touch with something besides smog and asphalt and suggests some approaches for attaining this objective including involvement in land use planning.

George, J. L., and S. S. Dubin. (455)

1971. Continuing Education Needs of Natural Resource Managers and Scientists: a comparative study of the self-perceived updating requirements of professional personnel in fisheries, forestry, range, recreation and parks, soil and water, and wildlife. Department of Planning Studies in Continuing Education, the Pennsylvania State University, University Park, Pa. 126 pp.

The authors discuss the needs and opportunities for continuing education of professional personnel in these areas to keep up to date with recent developments and improve their capabilities for effective work, including planning and management for wildlife in urban areas.

MacMullan, R. A. (456)

1968. Meeting urban wildlife needs, pp. 31-37. In Man and Nature in the City, U.S. Department of the Interior. (For full citation see reference 45.)

Dr. MacMullan, then director of the Michigan Department of Conservation, stated, page 36, "Our one best hope for wildlife and the opportunity for enjoying wildlife in the metropolitan area is educational programs to create an electorate who insist on keeping contact with our wild heritage. If we do that, they will see to it that we have the proper areas." He believed that the place to start was to develop teachers

capable of bringing an appreciation of wildlife into the elementary grades. He encouraged, also, devising means of getting children to fringe areas and zoos where opportunities exist for a closer contact with nature. He pointed out that some Michigan teachers received training and an indoctrination in ecological concepts by attending his department's conservation school for a week during the summer.

Miller, R. (457)

1978. New York's urban wildlife program, pp. 27-30. In Proceedings of Meeting on Nongame/Urban Wildlife/Endangered Species Program Concerns--Joan Galli (Ed.). (For full citation see reference 446.)

Miller describes briefly New York State's urban wildlife program including its inventory of urban and suburban lands as wildlife habitat through use of aerial photography, census and land use data; determination of the interests, needs and attitudes of the urban public with respect to wildlife; establishment of a pilot "urban wildlife park" to encourage use of existing undeveloped urban open space; distribution of an urban wildlife shrub packet at nominal cost to improve habitat in backyards for songbirds and small mammals; preservation of valuable wildlife habitat in urban areas; development of guidelines to assist developers, zoning and planning boards, urban planners, and others wishing to enhance urban wildlife; and providing informational and educational materials to assist teachers and group leaders in teaching conservation principles and promoting public appreciation of wildlife. Based upon responses to a questionnaire, residents of urban and suburban neighborhoods indicated a strong interest in several potential wildlife programs including those concerned with the attraction of wildlife to backyards, use of cemeteries for nature observation, and interpretive programs.

Milne, L., and M. Milne. (458)

1974. Urban wildlife as a tool in education, pp. 167-169. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The Milnes report on conversion of a local mill pond and its surroundings at Durham, New Hampshire into a "Valley Nature Area" following the closing down of a laundry which had polluted the pond and purchase of the area by the Milnes. Observations on wildlife species which found and used the area include comments on butterflies, bird life, squirrels and beaver and the importance of a pair of mute swans in whetting the interest of the town's citizens in learning more about wildlife. The interest generated by this "natural area" has resulted in development of additional parkland and waterfront areas for enjoyment of the citizens and has convinced many citizens that

they should and can do things intentionally to enrich the environment.

Mohr, C. E. (459)

1961. Environmental study areas: Wildlife preserves. Published by the National Audubon Society, 950 Third Arenue., New York, N.Y. 10022, but available only from Encyclopedia Britannica Educational Corporation, 425 N. Michigan Ave., Chicago, Ill. 60611, catalog number 73065. Audubon Nature Bulletin, a part of set on Conservation, 6 pp.

This is a general, but informative, account of environmental study areas, their value for education and conservation, how to develop plans for action, ways of acquiring land, how to maintain and safeguard sanctuary lands, and where additional information can be obtained.

Rettie, D. F. (460)

1968. Let's urbanize conservation education. Transactions of the 33rd North American Wildlife and Natural Resources Conference, pp. 465-470.

The author states that our metropolitan areas account for less than 1% of the land area of the United States and "for almost no percent of the focus of conservation education efforts." He makes a plea for extending conservation education to bring to the American people a new sense of urban land values and a new conservation ethic which includes consideration of soil erosion and sedimentation brought about by urbanization; more attention to urban geology, hydrology and land use; better planning for public open space; better pollution control; preservation of a viable segment of agricultural land use at the periphery of cities or intermingled with other forms of urban development; and enhancement of natural beauty, cultural and humane values of cities.

Roth, C. E. (461)

1974. An effective education program, pp. 171-174. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

Most wildlife education programs are geared to people already committed to wildlife; we need to reach the uncommitted. Roth believes that effective urban wildlife education programs will: (1) have their base in valuing--valuing that includes both factual and feeling components; (2) include an understanding of the urban ecosystem and the ecology of urban man; (3) have as a goal an empathy for other living things beyond mankind, along with an understanding that man shares his planet with other life forms in a mutually interdependent fashion; (4)

utilize, where possible, more than one component of the total educational system in order to reinforce their messages; (5) be based on a firm recognition of developmental growth--both cognitive and moral; and (6) be correlated to the efforts of others.

Sedgwick, C. J. (462)

1974. Wildlife in the urban San Diego community, pp. 41-42. In Noyes and Progulske (1974)--Wildlife in an Urbanizing Environment. (For full citation see reference 28.)

The author discusses the San Diego Zoo, a 150-acre zoological garden located in San Diego's Balboa Park with respect to its scientific and educational roles, its public relations efforts, and its research. Sedgwick states, page 42, "Our zoos represent a unique experiment in the marriage of a municipally-oriented interest and free enterprise." Speaking of the San Diego Zoo, he comments: "It has been a community resource in which the local public takes great pride, and hopefully, it has served the best interests of wildlife through its abilities to interest, educate and provide sources for research."

Shomon, J. J. (463)

1962. Resource use education in urban areas: a case for community nature and conservation centers. Transactions of the 27th North American Wildlife and Natural Resources Conference, pp. 445-450.

The author discusses need for and role of nature/conservation centers in urban areas to make conservation meaningful to the great majority of our citizenry who are losing ties with the land. Shomon states, page 448, "A nature and conservation center is an institutional device which brings land and people together on intimate terms, where the young people as well as the old--under the inspiration and guidance of trained interpreters--are taught to see, hear and feel something of the natural world about them, where they can develop the kind of personal values and conscience they need in order to live as better citizens." Requirements for a nature and conservation center are listed and the work of the National Audubon Society in establishing or helping to establish nature centers is briefly described.

Thillmann, J. H., and W. J. Manasch. (464)

1976. Wildlife as inputs to comprehensive planning. Transactions of the 41st North American Wildlife and Natural Resources Conference, pp. 548-560.

Wildlife biologists need to educate themselves in the comprehensive planning process and the goals of community

planning, to provide urban planners with needed information on wildlife and exert pressure on local jurisdictions, to ensure that wildlife preservation is an element of the planning process.

(For further information on education and education needs, see, also, references 6, 9, 10, 20, 35, 42, 71, 145, 160, 170, 209, 222, 229, 232, 233, 234, 240, 244, 245, 251, 255, 268, 274, 277, 280, 284, 288, 292, 306, 307, 332, 361, 362, 366, 370, 375, 384.)

INDEX OF PRINCIPAL AUTHORS-AGENCIES-SOCIETIES

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U.S. GOVERNMENT PRINTING OFFICE : 1980 O - 317-774

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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