

Appendix A

Technical Assistance Directory

This directory is provided as a starting point for your information and technical assistance needs. This listing is by no means comprehensive, but provides representative examples of organizations that can assist you in or provide information for your community ecosystem protection effort. The technical assistance directory is divided by topic into eight sections:

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GENERAL INFORMATION DIRECTORIES

In addition to the major organizations referenced in the rest of this appendix, the directories listed below can lead you to useful organizations and data resources.

- 1) **National Wildlife Federation, *1996 Conservation Directory, 1996***, phone: (800) 432-6564.
A list of organizations, agencies, and officials concerned with natural resource use and management. Published annually. Check your local public library.
- 2) **Balachandran, Sarojini, ed., *Encyclopedia of Environmental Information Sources***, Gale Research Inc., Washington, DC, 1993, available also from Gale Research Inc., 853 Penobscot Building, Detroit, MI 48226-4094. A subject guide to print and other sources of information on all aspects of the environment. Sources include government organizations, online databases, research centers, and trade organizations, among others. Check your local public library.
- 3) **U.S. EPA, *Access EPA***, U.S. Government Printing Office, Washington, DC 20402-9328, ISBN 0-16-037989-X, Internet Website: <http://www.epa.gov>. Developed for citizens and other U.S. EPA partners, this guide provides a roadmap to EPA information services, contacts, and products.
- 4) **Leadership Directories, Inc., *State, Federal, and Municipal Yellow Books***, phone: (212) 627-4140.
Listings of government agencies at the federal, state, and local levels. Includes addresses, telephone numbers, and names of administrative heads. Available at public libraries, or can be purchased by calling Leadership Directories.

ECOSYSTEM ASSESSMENT DATA (FEDERAL AGENCIES)

- 1) **U.S. EPA** — 401 M Street SW, Washington, DC 20460, phone: (202) 260-2080, Internet Website: <http://www.epa.gov>
 - ⁿ **CBEP Clearinghouse** — U.S. EPA Office of Sustainable Ecosystems and Communities, 401 M Street SW, Washington, DC 20460-2134, phone: (202) 260-5339. The Community-Based Ecosystem Protection Clearinghouse has a number of U.S. EPA documents pertaining to ecosystem protection.
 - ⁿ **Office of Water** — 401 M Street SW, Washington, DC 20460, phone: (202) 260-7018.
 - ⁿ **Office of Air Quality Planning and Standards (OAQPS)** — Research Triangle Park, NC 27111, phone: (919) 541-5616.
 - ⁿ **Office of Solid Waste and Emergency Response (OSWER)** — 401 M Street SW, Washington, DC 20460, phone: (202) 260-4610.
 - ⁿ **Regional Offices**
 - *Region 1*, John F. Kennedy Federal Building, 1 Congress Street, Boston, MA 02203-2211, phone: (617) 565-3400. CBEP Contacts: Deb Hartstedt and Rosemary Monahan (ME, NH, VT, MA, CT, RI)
 - *Region 2*, 290 Broadway, New York, NY 10007-1866, phone: (212) 637-3000. CBEP Contact: Rabi Kieber (NY, NJ, PR)
 - *Region 3*, 841 Chestnut Street, Philadelphia, PA 19107, phone: (215) 566-5000. CBEP Contacts: Dominique Lueckenhoff and Susan McDowell (PA, WV, VA, MD, DE)
 - *Region 4*, 100 Alabama Street SW, Atlanta, GA 30365, phone: (404) 562-8327. CBEP Contact: Grace Deatrick (KY, TN, NC, SC, MS, AL, GA, FL)
 - *Region 5*, Robert E. Metcalfe Federal Building, 77 West Jackson Boulevard, Chicago, IL 60604-3590, phone: (312) 353-2000. CBEP Contact: Marylou Martin (MI, OH, IN, IL, WI, MN)
 - *Region 6*, First Interstate Bank Tower at Fountain Place, 1445 Ross Avenue, 12th Floor, Suite 1200, Dallas, TX 75202-2733, phone: (214) 665-2100. CBEP Contacts: Shirley Bruce and Cindy Wolf (NM, TX, LA, AR, OK)
 - *Region 7*, 726 Minnesota Avenue, Kansas City, KS 66101, phone: (913) 551-7000. CBEP Contacts: Cathy Tortorici and John Houlihan (NE, KS, IA, MO)
 - *Region 8*, 999 Eighteenth Street, Suite 500, Denver, CO 80202-2466, phone: (303) 312-6308. CBEP Contacts: Karen Hamilton and Nat Miullo (MT, ND, SD, WY, UT, CO)
 - *Region 9*, 75 Hawthorne Street, San Francisco, CA 94105, phone: (415) 744-1305. CBEP Contacts: Denise Zvanovec, Debbie Schechter, and Stephanie Valentine (CA, NV, AZ, HI)
 - *Region 10*, 1200 Sixth Avenue, Seattle, WA 98101-1128, phone: (206) 553-1200. CBEP Contact: Eric Winiecki (WA, OR, ID, AK)

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- 2) **U.S. Fish and Wildlife Service**, 1849 C Street NW, Washington, DC 20240, phone: (202) 208-3171, Internet Website: <http://www.fws.gov>
 - ⁿ **National Contaminant Biomonitoring Program** — phone: (703) 358-2148. This group can provide information on contaminant concentrations in fish, waterfowl, and other wildlife.
 - ⁿ **National Wetlands Inventory** — Internet Website: <http://www.nwi.fws.gov>. The U.S. Fish and Wildlife Service began the National Wetlands Inventory in 1977 to systematically classify and map America's remaining wetlands. This website has information on where to find maps of wetlands, as well as contacts for regional wetlands coordinators.
 - 3) **Natural Resource Conservation Service** (formerly Soil Conservation Service) — U.S. Department of Agriculture, National Resources Inventory, phone: (202) 720-4530. The NRCS can provide information on soil quality and soil erosion control measures.
 - 4) **United States Geological Survey** — U.S. Geological Survey National Center, 12201 Sunrise Valley Drive, Reston, VA 22092. Public Information, phone: (703) 648-4000, National Mapping Division, phone: (800) USA-MAPS, Internet Website: <http://www-nmd.usgs.gov/>. The National Mapping Program Website contains information about land mapping programs throughout the country, as well as a guide to obtaining USGS earth science information and services.
 - 5) **U.S. Army Corps of Engineers** — Casimir Pulaski Building, 20 Massachusetts Avenue NW, Washington, DC 20314-1000, phone: (202) 761-0660.
 - 6) **National Oceanic and Atmospheric Administration** — U.S. Department of Commerce, Silver Spring Metro Center 3, 1315 East West Highway, Silver Spring, MD 20910-3282, phone: (202) 482-6090, Internet Website: <http://www.noaa.gov>
 - ⁿ **National Marine Fisheries Service** — Internet Website: <http://www.kingfish.ssp.nmfs.gov>
 - ⁿ **National Weather Service** — Internet Website: <http://www.nws.noaa.gov>
 - 7) **Federal Emergency Management Agency** — Center Plaza 500 Street SW, Washington, DC 20472, phone: (202) 646-4600.

EPA HOTLINES AND REGULATORY DOCKETS

U.S. Environmental Protection Agency hotlines provide information for voluntary action. Some of the most useful include:

- 1) Green Lights and Energy Stars Programs, phone: (800) 782-7937, Internet Website: <http://www.epa.gov/docs/gcdoar/energystar.html>, provide information and technical support on energy efficient lighting to U.S. businesses and governments.
- 2) Hazardous Waste Ombudsman, phone: (800) 262-7937 in U.S. except metropolitan Washington, DC (202) 260-9361 in metropolitan Washington, DC, assists the public and regulatory community in resolving hazardous waste issues. The ombudsman handles complaints from citizens, conducts investigations, undertakes site reviews, and issues reports relating to hazardous waste sites.
- 3) Office of Environmental Justice, phone: (800) 962-6215 in U.S. except metropolitan Washington, DC (202) 260-6359 in metropolitan Washington, DC, coordinates public communication and provides technical and financial assistance to outside groups on environmental justice issues.
- 4) Pollution Prevention Information Clearinghouse, phone: (202) 260-1023, provides answers and referrals in response to questions from the public concerning pollution prevention.
- 5) Resource Conservation and Recovery Act (RCRA) Hotline, phone: (415) 744-2074, responds to requests for information on hazardous-waste identification, generators, transporters, treatment, storage, and disposal facilities, and recycling sites.
- 6) RCRA/Underground Storage Tank, Superfund, and Emergency Planning and Community-Right-to-Know Hotline, phone: (800) 424-9346 in U.S. except metropolitan Washington, DC (703) 412-9810 in metropolitan Washington, DC, provides information about the title programs and referrals for obtaining documents about these programs. Translation is available for Spanish-speaking callers.
- 7) Small Business Ombudsman Clearinghouse/Hotline, phone: (800) 368-5888 in U.S. except metropolitan Washington, DC (703) 305-5938 in metropolitan Washington, DC, TDD: (703) 305-6824, disseminates regulatory and other environmental information to help small businesses enhance voluntary regulatory compliance and pollution abatement and control.
- 8) Toxic Substances Control Act (TSCA) Assistance Information Service, phone: (202) 544-1404, TDD: (202) 544-0551, furnishes TSCA regulation information.
- 9) WASTEWISE Helpline, phone: (800) EPA-WISE, provides information about EPA's voluntary program encouraging businesses to reduce solid waste.
- 10) Wetlands Information Hotline, phone: (800) 832-7828 in U.S. except metropolitan Washington, DC (703) 525-0985 in metropolitan Washington, DC, disseminates information about the Wetlands Protection Program; answers questions and provides referrals concerning the value, function, and protection of wetlands; and accepts requests for certain wetlands publications.

The EPA regulatory dockets provide information about regulations, permitting, and hazardous waste cleanup decisions.

- 1) Air Docket — Office of Air and Radiation (6102), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-7548
- 2) Water Docket — Office of Water (4101), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-3027

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- 3) Wetlands Docket — Office of Water (4101), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-1799
 - 4) Resource Conservation and Recovery Act Docket — Office of Solid Waste and Emergency Response (5305), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-9327
 - 5) Superfund Docket — Office of Solid Waste and Emergency Response (5201G), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (703) 603-8917
 - 6) Underground Storage Tank Docket — Office of Solid Waste and Emergency Response (5305), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-9720
 - 7) Pesticides Docket — Office of Pesticides (7506C), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (703) 305-5919
 - 8) Toxic Substances Control Act Docket — Office of Toxic Substances (7407), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-7099

ECOSYSTEM PROTECTION/LAND CONSERVATION

- 1) **U.S. Department of Interior** — 1849 C Street NW, Washington, DC 20240, phone: (202) 208-3171.
 - ⁿ **U.S. Bureau of Land Management**, phone: (202) 208-3171. The BLM manages 300 million acres of land, most of which is in the Midwest and western United States.
 - ⁿ **National Biological Service** — Ecosystem Monitoring Division, phone: (202) 482-3774, Internet Website: <http://www.nbs.gov/>. This agency seeks to enhance scientific understanding and sustainable management of our nation's biological resources. The website provides access to a range of data, as well as an excellent list of linked servers.
 - ⁿ **National Park Service** — phone: (202) 208-3171.
 - ⁿ **U.S. Fish and Wildlife Service** — phone: (202) 208-3171, Internet Website: <http://www.fws.gov/>. The FWS manages the National Wildlife Refuge System — over 100 million acres of land devoted to conservation of plant and wildlife species.
- 2) **U.S. Department of Agriculture** — Fourteenth Street and Independence Avenue SW, Washington, DC 20250, phone: (202) 720-2791.
 - ⁿ **The U.S. Forest Service**, phone: (202) 720-2791, Internet Website: <http://www.fs.fed.us/>. This agency manages approximately 200 million acres of forestland in the United States
- 3) **Trust for Public Land** — 116 New Montgomery Street, 4th Floor, San Francisco, CA 94105, phone: (415) 495-4014, Internet Website: <http://www.igc.apc.org/tpl/>. This national non-profit organization is dedicated to the conservation of land for parks, gardens, natural areas, and open space. The website includes information on the organization's Green Cities Initiative, as well as an excellent list of linked servers.
- 4) **American Farmland Trust** — 1920 N Street NW, Suite 400, Washington, DC 20036, phone: (202) 659-5170, Internet Website: <http://farm.fic.niu.edu/aft/aft/home.html>. This non-profit organization is dedicated to the conservation of land for agricultural use. AFT has also developed an economic model of urban sprawl and its fiscal impacts with the University of California-Berkeley. The website contains updates on federal, state, and local farm policies, extensive research material, and information on obtaining AFT publications.
- 5) **The Nature Conservancy** — 1815 N. Lynn Street, Arlington, VA 22209, phone: (703) 841-5300, Internet Website: <http://www.tnc.org>. This non-profit organization identifies ecologically significant lands and protects them through gifts, purchase, cooperative management agreements with governments or public agencies, or through voluntary arrangements with private landowners.
- 6) **The Conservation Fund** — 1800 N. Kent Street, Suite 1120, Arlington, VA 22209, phone: (703) 525-6300. This organization helps to protect ecosystems, develop greenways, develop economic assessments for conservation objectives, and promote other environmental protection activities.
- 7) **The Sierra Club** — 730 Polk Street, San Francisco, CA 94109, phone: (415) 776-2211, Internet Website: <http://www.sierraclub.org>. This environmental group was founded to explore, enjoy, and protect natural areas. Work includes lobbying, litigation, publishing, and arranging conferences.
- 8) **The National Audubon Society** — 700 Broadway, New York, NY 10003-9501, phone: (212) 979-3000, Internet Website: <http://www.igc.org/audubon/contents>. This environmental group's mission is to protect the air, water, land, and habitat that are critical to the health of the planet.

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- 9) **National Wildlife Federation** — 1400 Sixteenth Street NW, Washington, DC 20036-2266, phone (202) 797-6800, Internet Website: <http://www.nwf.org/nwf>. A non-profit organization whose mission is to educate, inspire, and assist individuals to conserve wildlife and other natural resources.
 - 10) **The Wilderness Society** — 900 Seventeenth Street NW, Washington, DC 20006, phone: (202) 833-2300. Promotes protection of public (especially federal) lands.
 - 11) **Natural Resources Defense Council** — 40 W. Twentieth Street, New York, NY 10011, phone: (212) 727-2700. Dedicated to sound management of natural resources through research, education, and development of public policies.
 - 12) **Environmental Defense Fund** — 257 Park Avenue S., New York, NY 10010. Dedicated to the improvement of environmental quality and public health through responsible reform of public policy.
 - 13) **Defenders of Wildlife** — 1244 Nineteenth Street NW, Washington, DC 20036, phone: (202) 659-9510. Promotes the preservation and protection of wildlife and habitat.
 - 14) **Native Ecology Initiative** — Lillian Wilmore, Director, P.O. Box 470829, Brookline Village, MA 02147-0829, phone: (617) 232-5742. This Native American organization is devoted to cultural and ecological preservation.
 - 15) **League of Women Voters** — 1730 M Street NW, Washington, DC 20036, phone: (202) 429-1965. The league has an educational branch that conducts research and publishes newsletters on topics such as safe drinking water, nuclear waste issues, and pesticides in food and water.
 - 16) The following religious organizations have ecological protection or environmental justice missions:
 - n **Episcopal Church Center, Peace and Justice Ministries** — 815 Second Avenue, New York, NY 10017, phone: (800) 334-7626.
 - n **Evangelical Lutheran Church in America, Environmental Stewardship and Hunger Education** — 8765 W. Higgins Road, Chicago, IL 60631, phone: (312) 380-1485.
 - n **Greek Orthodox Archdiocese of North and South America, Church and Society** — 8-10 E. Seventy-Ninth Street, New York, NY 10021, phone: (212) 570-3500.
 - n **Jewish Theological Seminary of America, Coalition on the Environment and Jewish Life** — 3080 Broadway, New York, NY 10027, phone: (212) 678-8996.
 - n **National Council of the Churches of Christ, USA, Environmental Justice** — 475 Riverside Drive, New York, NY 10115, phone: (212) 870-2141.
 - n **Presbyterian Church (USA), Office of Environmental Justice** — 100 Witherspoon Street, Room 3046, Louisville, KY 40202, phone: (502) 569-5809.
 - n **Progressive National Baptist Convention, Home Mission Office** — 601 Fiftieth Street NE, Washington, DC 20019, phone: (202) 396-0558.
 - n **Roman Catholic Church, U.S. Catholic Conference, Office of International Justice and Peace** — 3211 Fourteenth Street NE, Washington, DC 20017, phone: (202) 541-3140.
 - n **United Church of Christ, Office for Church Society** — 700 Prospect Avenue, Cleveland, OH 44115, phone: (216) 736-2174.
 - n **United Methodist Church, General Board of Church and Society Resources** — 100 Maryland Avenue NE, Washington, DC 20002, phone: (202) 488-5617.

SUSTAINABLE DEVELOPMENT/ECONOMICS

- 1) **U.S. Department of Commerce**, Bureau of Economic Analysis — 1441 L Street NW, Washington, DC 20230, phone: (202) 606-9900. Publishes regional economic data such as employment and revenues of various industries.
- 2) **U.S. Department of Energy**, Center of Excellence for Sustainable Development — 1617 Cole Boulevard, Golden, CO 80401, phone: (303) 275-4830, e-mail: sustainable.development@hq.doe.gov, Internet Website: <http://www.sustainable.doe.gov>.
- 3) **National Park Service**, Economics Clearinghouse, — 600 Harrison Street, Suite 600, San Francisco, CA 94107-1372, phone: (415) 744-3975. Encourages up-to-date information exchange on the economic impacts of rivers, trails, and greenways. Included are case studies, economic impact analyses, benefit and cost estimation techniques, and other reference materials.
- 4) **The Ecotourism Society** — P.O. Box 755, North Bennington, VT 05257, phone: (802) 447-2121. The Ecotourism Society is an international nonprofit organization dedicated to finding the resources and building the expertise to make tourism a viable tool for conservation and sustainable development.
- 5) **Lincoln Institute of Land Policy** — 113 Brattle Street, Cambridge, MA 02138-3400, phone: (617) 661-3016. Publishes reference materials on land use, public policy, and sustainable development.
- 6) **The Nature Conservancy**, Center for Compatible Economic Development — 7 East Market Street, Suite 210, Leesburg, VA 22075. This group within The Nature Conservancy evaluates and promotes opportunities for communities to pursue tourism and other businesses that are compatible with the conservation of biodiversity and environmental protection.
- 7) **Rocky Mountain Institute** — 1739 Snowmass Creek Road, Snowmass, CO 80164, phone: (970) 927-3851. Many publications and reference materials on sustainable economic development, energy efficiency, agricultural policy, and other community development issues.
- 8) **Corporation for Enterprise Development** — 777 North Capitol Street NE, Suite 410, Washington, DC 20002, phone: (202) 408-9788. Conducts economic assessments for communities and helps assemble community development plans. Variety of publications, including case studies.
- 9) **Heartland Center for Leadership Development** — 941 O Street, Suite 920, Lincoln, NE 68508, phone: (402) 474-7667. Programs and publications to help rural communities develop local leadership, including practical resources and policies for the survival of small towns.
- 10) **United States Tourist Council** — Drawer 175, Washington, DC 20013-1875. A non-profit association of conservation-concerned individuals, industries, and institutions who travel or cater to the traveler. Emphasis is on historic and scenic preservation, wilderness and roadside development, ecological protection through sound planning and education, and support of scientific studies of natural wilderness.

PROGRAM ORGANIZATION AND FUNDING

- 1) **U.S. Environmental Protection Agency**, Office of the Comptroller, Environmental Financing Information Network — 401 M Street SW, Washington, DC 20460, e-mail: efin.@epamail.epa.gov. This network can provide information on financing alternatives for state and local environmental protection.
- 2) **Foundation Center** — 79 Fifth Avenue, New York, NY 10003, phone: (212) 620-4230. This organization publishes summary information about charitable foundations and their grant-making policies and practices. There are regional offices in San Francisco, CA, Cleveland, OH, Washington, DC, and Atlanta, GA.
- 3) **The Grantsmanship Center** — P.O. Box 17220, Los Angeles, CA 90017, phone: (213) 482-9860. This organization publishes information on how to obtain grants and raise other funds.
- 4) **Land Trust Alliance** — 900 Seventeenth Street NW, Suite 410, Washington, DC 20006, phone: (202) 638-4725. The Land Trust Alliance provides a broad range of technical assistance and services to local and regional land trusts and land conservation groups.

STATE ENVIRONMENTAL PROTECTION AGENCIES

Alabama

Conservation and Natural Resources Department
P.O. Box 301450
Montgomery, AL 36130-1450
Phone: (800) 262-3151
Fax: (334) 242-1880

Environmental Management Department
1751 Cong. W.L. Dickinson Drive
P.O. Box 301463
Montgomery, AL 36130-1463
Phone: (334) 271-7700
Fax: (334) 271-7950

Alaska

Environmental Conservation Department
410 Willoughby Avenue, Suite 105
Juneau, AK 99801-1795
Phone: (907) 465-5010
Fax: (907) 465-5097
TTY: (907) 465-5010

Natural Resources Department
3601 C Street, Suite 858
Anchorage, AK 99503
Phone: (907) 269-8400
Fax: (907) 269-8901
TTY: (907) 269-8411
Agriculture Revolving Loan Fund: (907) 745-7200

Arizona

Environmental Quality Department
3033 N. Central Avenue
Phoenix, AZ 85012
Phone: (602) 207-2300
Fax: (602) 207-2218
TTY: (602) 207-4829

Arkansas

Pollution Control and Ecology Department
8001 National Drive
P.O. Box 8913
Little Rock, AR 72219-8913
Phone: (501) 682-0744
Fax: (501) 682-0798

California

Environmental Protection Agency
555 Capitol Mall, Suite 525
Sacramento, CA 95814
Phone: (916) 445-3846
Fax: (916) 445-6401

Resources Agency
Resources Building, Suite 1311
1416 Ninth Street
Sacramento, CA 95814
Phone: (916) 653-5656
Fax: (916) 653-8102

Colorado

Natural Resources Department
1313 Sherman Street, Room 718
Denver, CO 80203
Phone: (303) 866-3311
Fax: (303) 866-2115

Public Health and Environment Department
4300 Cherry Creek Drive, South
Denver, CO 80222
Phone: (303) 692-2000
Fax: (303) 782-0095
TTY: (303) 691-7700

Connecticut

Environmental Protection Department
79 Elm Street
Hartford, CT 06106
Phone: (860) 424-3000
Fax: (860) 424-4053

Delaware

Natural Resources and Environmental
Control Department
89 Kings Highway
P.O. Box 1401
Dover, DE 19903-1401
Phone: (302) 739-4506
Fax: (302) 739-6242

District of Columbia

Environmental Regulation Administration
 2100 Martin L. King Avenue SE
 Washington, DC 20020
 Phone: (202) 645-6617
 Fax: (202) 645-6622

Natural Resources Department
 Lincoln Tower Plaza
 524 S. Second Street
 Springfield, IL 62701-1787
 Phone: (217) 782-6302
 Fax: (217) 785-3150
 TTY: (217) 782-9175

Florida

Environmental Protection Department
 3900 Commonwealth Boulevard
 Tallahassee, FL 32399-3000
 Phone: (904) 488-1073
 Fax: (904) 921-6227

Indiana

Environmental Management Department
 105 S. Meridian Street
 P.O. Box 6015
 Indianapolis, IN 46206-6015
 Phone: (317) 233-6894
 Fax: (317) 232-5539
 TTY: (317) 233-6087

Georgia

Natural Resources Department
 205 Butler Street SE, Suite 1252
 Atlanta, GA 30334
 Phone: (404) 656-3500
 Fax: (404) 656-0770

Natural Resources Department
 402 W. Washington Street
 Indianapolis, IN 46204
 Phone: (317) 232-4200
 Fax: (317) 233-6811

Hawaii

Land and Natural Resources Department
 Kalanimoku Building
 1151 Punchbowl Street
 Honolulu, HI 96813
 Phone: (808) 587-0406
 Fax: (808) 587-0360

Iowa

Natural Resources Department
 Wallace Building
 Des Moines, IA 50319-0034
 Phone: (515) 281-5145
 Fax: (515) 281-6794
 TTY: (515) 242-5967

Idaho

Environmental Quality Division
 450 W. State Street
 P.O. Box 83720
 Boise, ID 83720
 Phone: (208) 373-0502
 Fax: (208) 373-0417

Kansas

Health and Environment Department
 Landon State Office Building
 900 S.W. Jackson Street
 Topeka, KS 66612-1290
 Phone: (913) 296-1500
 Fax: (913) 296-6247

Illinois

Environmental Protection Agency
 P.O. Box 19276
 Springfield, IL 62794
 Phone: (217) 782-2829
 Fax: (217) 782-9039
 TTY: (217) 782-9143

Kentucky

Natural Resources and Environmental
 Protection Cabinet
 Capital Plaza Tower, 5th Floor
 500 Mero Street
 Frankfort, KY 40601
 Phone: (502) 564-5525
 Fax: (502) 564-3354

Louisiana

Environmental Quality Department
P.O. Box 82231
Baton Rouge, LA 70884-2231
Phone: (504) 765-0741
Fax: (504) 765-0045

Natural Resources Department
P.O. Box 94396
Baton Rouge, LA 70804-9396
Phone: (504) 342-4500
Fax: (504) 342-2707

Maine

Conservation Department
22 State House Station
Augusta, ME 04333-0022
Phone: (207) 287-2211
Fax: (207) 287-2400
TTY: (207) 287-2213

Environmental Protection Department
17 State House Station
Augusta, ME 04333-0017
Phone: (207) 287-7688
Fax: (207) 287-2814

Maryland

Natural Resources Department
Tawes State Office Building
Annapolis, MD 21401
Phone: (410) 974-3195
Fax: (410) 974-5206
TTY: (410) 974-3683

Environment Department
2500 Broening Highway
Baltimore, MD 21224
Phone: (410) 631-3000
Fax: (410) 631-3888
TTY: (410) 631-3009

Massachusetts

Environmental Affairs Executive Office
100 Cambridge Street, Room 2000
Boston, MA 02202
Phone: (617) 727-9800
Fax: (617) 727-2754

Michigan

Environmental Quality Department
P.O. Box 30473
Lansing, MI 48909-7973
Phone: (800) 662-9278
Fax: (517) 241-7401
Pollution Emergency Alerting System:
(800) 292-4706

Natural Resources Department
P.O. Box 30028
Lansing, MI 48909
Phone: (517) 373-1214
Fax: (517) 335-4242
TTY: (517) 335-4623

Minnesota

Natural Resources Department
500 Lafayette Road
St. Paul, MN 55155-4001
Phone: (612) 296-6157
Fax: (612) 296-3500
TTY: (612) 296-5484

Environmental Assistance Office
520 Lafayette Road, 2nd Floor
St. Paul, MN 55155-4100
Phone: (612) 296-3417
Fax: (612) 297-8709

Mississippi

Environmental Quality Department
P.O. Box 20305
Jackson, MS 39289-1305
Phone: (601) 961-5650
Fax: (601) 354-6965

Missouri

Natural Resources Department
P.O. Box 176
Jefferson City, MO 65102
Phone: (573) 751-3443
Fax: (573) 751-7627

Montana

Environmental Quality Department
P.O. Box 200901
Helena, MT 59620-0901
Phone: (406) 444-2442
Fax: (406) 444-1804

Natural Resources and Conservation Department
1625 Eleventh Avenue
P.O. Box 201601
Helena, MT 59620-1601
Phone: (406) 444-2074
Fax: (406) 444-2684
TTY: (406) 444-2074

Nebraska

Environmental Quality Department
1200 N Street, Suite 400
P.O. Box 98922
Lincoln, NE 68509-8922
Phone: (402) 471-2186
Fax: (402) 471-2909

Nevada

Conservation and Natural Resources Department
123 W. Nye Lane
Carson City, NV 89710
Phone: (702) 687-4360
Fax: (702) 687-6122

New Hampshire

Environmental Services Department
6 Hazen Drive
Concord, NH 03301
Phone: (603) 271-3303
Fax: (603) 271-2867
TTY: (800) 735-2964

New Jersey

Environmental Protection Department
401 E. State Street, CN 402
Trenton, NJ 08625-0402
Phone: (609) 777-3373
Fax: (609) 292-7695

New Mexico

Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502
Phone: (505) 827-2855
Fax: (505) 827-2836

New York

Environmental Conservation Department
50 Wolf Road
Albany, NY 12233
Phone: (518) 457-5400
Fax: (518) 457-7744

North Carolina

Environment, Health and
Natural Resources Department
P.O. Box 27687
Raleigh, NC 27611
Phone: (919) 733-4984
Fax: (919) 715-3060

North Dakota

Environmental Health Section
1200 Missouri Avenue
P.O. Box 5520
Bismarck, ND 58506-5520
Phone: (701) 328-5150
Fax: (701) 328-5200

Ohio

Natural Resources Department
Fountain Square
Columbus, OH 43224-1387
Phone: (614) 265-6565
Fax: (614) 261-9601

Environmental Protection Agency
1800 WaterMark Drive
P.O. Box 1049
Columbus, OH 43216-0149
Phone: (614) 644-3020
Fax: (614) 644-2329
TTY: (614) 644-2110

Oklahoma

Environmental Quality Department
1000 NE Tenth Street
Oklahoma City, OK 73117-1212
Phone: (405) 271-8056
Fax: (405) 271-8425
Complaints Hotline: (800) 522-0206

Oregon

Environmental Quality Department
811 S.W. Sixth Avenue
Portland, OR 97204-1390
Phone: (503) 229-5696
Fax: (503) 229-6124
TTY: (503) 229-6993

Pennsylvania

Environmental Protection Department
P.O. Box 2063
Harrisburg, PA 17105-2063
Phone: (717) 783-2300
Fax: (717) 783-8926
TTY: (800) 654-5984

Rhode Island

Environmental Management Department
235 Promenade Street, Suite 425
Providence, RI 02908
Phone: (401) 277-6800
Fax: (401) 277-6802
TTY: (401) 831-5508
24-Hour Hotline: (401) 277-3070

South Carolina

Health and Environmental Control Department
2600 Bull Street
Columbia, SC 29201
Phone: (803) 734-5000
Fax: (803) 734-4777

Natural Resources Department
Rembert C. Dennis Building
P.O. Box 176
Columbia, SC 29202
Phone: (803) 734-3888
Fax: (803) 734-6310

South Dakota

Environment and Natural Resources Department
Joe Foss Building
523 E. Capitol Avenue
Pierre, SD 57501-3181
Phone: (605) 773-3151
Fax: (605) 773-6035

Tennessee

Environmental and Conservation Department
Life & Casualty Tower
401 Church Street, 21st Floor
Nashville, TN 37243-0435
Phone: (615) 532-0109
Fax: (615) 532-0120

Texas

Natural Resource Conservation Commission
12100 Park 35 Circle
P.O. Box 13087
Austin, TX 78711-3087
Phone: (512) 239-1000
Fax: (512) 239-5533

Utah

Environmental Quality Department
168 N. 1950 West
Salt Lake City, UT 84116
Phone: (801) 536-4400
Fax: (801) 536-4480
TTY: (801) 536-4414

Natural Resources Department
1594 W. North Temple, Suite 3710
Box 145610
Salt Lake City, UT 84116-5610
Phone: (801) 538-7200
Fax: (801) 538-7315
TTY: (801) 538-7458

Vermont

Natural Resources Agency
State Complex
103 S. Main Street
Waterbury, VT 05671
Phone: (802) 241-3600
TTY: (800) 253-0191

Virginia

Natural Resources Secretariat
733 Ninth Street Office Building
Richmond, VA 23219
Phone: (804) 786-0044
Fax: (804) 371-8333
TTY: (804) 786-7765

Washington

Ecology Department
P.O. Box 47600
Olympia, WA 98504-7600
Phone: (360) 407-6000
Fax: (360) 407-6989
TTY: (360) 407-7155

Natural Resources Department
1111 Washington Street SE
P.O. Box 47000
Olympia, WA 98504-7001
Phone: (360) 902-1000
Fax: (360) 902-1775
TTY: (360) 902-1125

West Virginia

Environment Bureau
10 McJunkin Road
Nitro, WV 25143-2506
Phone: (304) 759-0515
Fax: (304) 759-0526
TTY: (800) 637-5893

Wisconsin

Natural Resources Department
P.O. Box 7921
Madison, WI 53704
Phone: (608) 266-2621
Fax: (608) 267-3579
TTY: (608) 267-6897

Wyoming

Environmental Quality Department
Herschler Building, 4th Floor
122 W. Twenty-Fifth Street
Cheyenne, WY 82002
Phone: (307) 777-7937
Fax: (307) 777-7682

Puerto Rico

Natural and Environmental Resources Department
P.O. Box 9066600
San Juan, PR 00906-6600
Phone: (787) 723-3090
Fax: (787) 723-4255

Environmental Quality Board
P.O. Box 11488
San Juan, PR 00940-1119
Phone: (787) 723-6200
Fax: (787) 724-3270

NATURAL HERITAGE PROGRAMS AND RELATED DATA CENTERS

State Natural Heritage Programs

Alabama Natural Heritage Section

Department of Conservation & Natural Resources
Division of Lands
Folsom Administration Building
64 N. Union Street, Room 421
Montgomery, AL 36130
Phone: (334) 242-3484
Fax: (334) 242-0098
Director: vacant

Alaska Natural Heritage Program

707 A Street, Suite 208
Anchorage, AK 99501
Phone: (907) 257-2702
Fax: (907) 258-9139
Program Director: David Duffy

Arizona Heritage Data Management System

Habitat Branch
Arizona Game & Fish Department
2221 W. Greenway Road
Phoenix, AZ 85023
Phone: (602) 789-3612
Fax: (602) 789-3928
Coord. Data Mgmt. System: Barry Spicer

Arkansas Natural Heritage Commission

Suite 1500, Tower Building
323 Center Street
Little Rock, AR 72201
Phone: (501) 324-9150
Fax: (501) 324-9618
Chief of Research: Tom Foti

California Natural Heritage Division

Department of Fish & Game
1220 S Street
Sacramento, CA 95814
Phone: (916) 322-2493
Fax: (916) 324-0475
Director: Ken Hashagen

Colorado Natural Heritage Program

College of Natural Resources
Colorado State University
254 General Services Building
Fort Collins, CO 80523
Phone: (970) 491-1309
Fax: (970) 491-3349
Coordinator: Chris Pague

Connecticut Natural Diversity Database

Natural Resources Center
Department of Environmental Protection
79 Elm Street, Store Level
Hartford, CT 06106-5127
Phone: (860) 424-3540
Fax: (860) 424-4058
Coordinator: Nancy Murray

Delaware Natural Heritage Program

Division of Fish & Wildlife
Department of Natural Resources & Environmental Control
4876 Hay Point Landing Road
Smyrna, DE 19977
Phone: (302) 653-2880
Fax: (302) 653-3431
Coordinator: Lynn Broadus

District of Columbia Natural Heritage Program

13025 Riley's Lock Road
Poolesville, MD 20837
Phone: (301) 427-1354
Fax: (301) 427-1355
Coordinator: Olin Allen

Florida Natural Areas Inventory

1018 Thomasville Road
Suite 200-C
Tallahassee, FL 32303
Phone: (904) 224-8207
Fax: (904) 681-9364
Acting Coordinator: Gary Knight

Georgia Natural Heritage Program

Wildlife Resources Division
Georgia Department of Natural Resources
2117 U.S. Highway 278 SE
Social Circle, GA 30279
Phone: (706) 557-3032
Fax: (706) 557-3040
Coordinator: Jonathan Ambrose

Hawaii Natural Heritage Program

The Nature Conservancy of Hawaii
1116 Smith Street, Suite 201
Honolulu, HI 96817
Phone: (808) 537-4508
Fax: (808) 545-2019
Coordinator: Dan Orodener

Idaho Conservation Data Center

Department of Fish & Game
600 South Walnut Street, Box 25
Boise, ID 83707
Phone: (208) 334-3402
Fax: (208) 334-2114
Coordinator: Bob Moseley

Illinois Natural Heritage Division

Department of Resources
524 South Second Street
Springfield, IL 62701-1787
Phone: (217) 785-8774
Fax: (217) 785-8277
Division Chief: Carl Becker

Indiana Natural Heritage Data Center

Division of Nature Preserves
Department of Natural Resources
402 West Washington Street,
Room W267
Indianapolis, IN 46204
Phone: (317) 232-4052
Fax: (317) 233-0133
Coordinator: Cloyce Hedge



Iowa Natural Areas Inventory

Bureau of Preserves &
Ecological Services
Department of Natural Resources
Wallace State Office Building
Des Moines, IA 50319-0034
Phone: (515) 281-8524
Fax: (515) 281-6794
Coordinator: Daryl Howell

Kansas Natural Heritage Inventory

Kansas Biological Survey
2041 Constant Avenue
Lawrence, KS 66047-2906
Phone: (913) 864-3453
Fax: (913) 864-5093
Coordinator: Craig Freeman

Kentucky Natural Heritage Program

Kentucky State Nature Preserves
Commission
801 Schenkel Lane
Frankfort, KY 40601
Phone: (502) 573-2886
Fax: (502) 573-2355
Director: Robert McCance, Jr.

Louisiana Natural Heritage Program

Department of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898-9000
Phone: (504) 765-2821
Fax: (504) 765-2607
Coordinator: Gary Lester

Maine Natural Areas Program

Department of Conservation
(FedEx/UPS: 159 Hospital Street)
93 State House Station
Augusta, ME 04333-0093
Phone: (207) 287-8044
Fax: (207) 287-8040
Coordinator: Molly Docherty

Maryland Natural Heritage Program

Department of Natural Resources
Tawes State Office Building, E-1
Annapolis, MD 21401
Phone: (410) 974-2870
Fax: (410) 974-5590

Coordinator: Lynn Davidson

Massachusetts Natural Heritage & Endangered Species Program

Division of Fisheries & Wildlife
Route 135
Westborough, MA 01581
Phone: (508) 792-7270 ext. 200
Fax: (508) 792-7275
Coordinator: Henry Woolsey

Michigan Natural Features Inventory

(FedEx/UPS: 530 W. Allegan.
48933)
Mason Building, 5th Floor,
Box 30444
Lansing, MI 48909-7944
Phone: (517) 373-1552
Fax: (517) 373-6705
Director: Leni Wilsmann

Minnesota Natural Heritage & Nongame Research

Department of Natural Resources
500 Lafayette Road, Box 7
St. Paul, MN 55155
Phone: (612) 297-4964
Fax: (612) 297-4961
Coordinator: Bonita Eliason

Mississippi Natural Heritage Program

Museum of Natural Science
111 North Jefferson Street
Jackson, MS 39201-2897
Phone: (601) 354-7303
Fax: (601) 354-7227
Coordinator: Ken Gordon

Missouri Natural Heritage Database

Missouri Department of
Conservation
P.O. Box 180
(FedEx: 2901 West Truman
Boulevard)
Jefferson City, MO 65102
Phone: (314) 751-4115
Fax: (314) 526-5582
Database Coordinator:
Dorothy Butler

Montana Natural Heritage Program

State Library Building
1515 E. Sixth Avenue
Helena, MT 59620
Phone: (406) 444-3009
Fax: (406) 444-0581
Coordinator: David Genter

Nebraska Natural Heritage Program

Game and Parks Commission
2200 N. Thirty-Third Street
P.O. Box 30370
Lincoln, NE 68503
Phone: (402) 471-5421
Fax: (402) 471-5528
Co-coordinators: Mike Fritz and
Gerry Steinauer

Nevada Natural Heritage Program

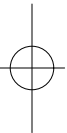
Department of Conservation &
Natural Resources
1550 E. College Parkway, Suite 145
Carson City, NV 89710
Phone: (702) 687-4245
Fax: (702) 885-0868
Coordinator: Glenn Clemmer

New Hampshire Natural Heritage Inventory

Department of Resources &
Economic Development
172 Pembroke Street
P.O. Box 1856
Concord, NH 03302
Phone: (603) 271-3623
Fax: (603) 271-2629
Coordinator: vacant

New Jersey Natural Heritage Program

Office of Natural Lands
Management
22 S. Clinton Avenue, CN404
Trenton, NJ 08625-0404
Phone: (609) 984-1339
Fax: (609) 984-1427
Coordinator: Tom Breden



New Mexico Natural Heritage Program

University of New Mexico
2500 Yale Boulevard SE, Suite 100
Albuquerque, NM 87131-1091
Phone: (505) 277-1991
Fax: (505) 277-7587
Director: Pat Mehlhop

New York Natural Heritage Program

Department of Environmental
Conservation
700 Troy-Schenectady Road
Latham, NY 12110-2400
Phone: (518) 783-3932
Fax: (518) 783-3946
Coordinator: Kathryn Schneider

North Carolina Heritage Program

NC Department of Environment,
Health & Natural Resources
Division of Parks & Recreation
P.O. Box 27687
Raleigh, NC 27611
Phone: (919) 733-7701
Fax: (919) 715-3085
Coordinator: Linda Pearsall

North Dakota Natural Heritage Inventory

North Dakota Parks & Recreation
Department
1835 Bismarck Expressway
Bismarck, ND 58504
Phone: (701) 328-5357
Fax: (701) 328-5363
Coordinator: Kathy Armstrong

Ohio Natural Heritage Program

Division of Natural Areas &
Preserves
Department of Natural Resources
Fountain Square, Building F-1
Columbus, OH 43224
Phone: (614) 265-6453
Fax: (614) 267-3096
Division Chief: Guy Denny

Oklahoma Natural Heritage Inventory

Oklahoma Biological Survey
111 East Chesapeake Street
University of Oklahoma
Norman, OK 73019-0575
Phone: (405) 325-1985
Fax: (405) 325-7702
Coordinator: Caryn Vaughn

Oregon Natural Heritage Program

Oregon Field Office
821 S.E. Fourteenth Avenue
Portland, OR 97214
Phone: (503) 731-3070, 230-1221
Fax: (503) 230-9639
Coordinator: Jimmy Kagan

Pennsylvania Natural Diversity Inventory - East

PNDI-East
The Nature Conservancy
34 Airport Drive
Middletown, PA 17057
Phone: (717) 948-3962
Fax: (717) 948-3957
Coordinator: Julie Lundgren

Pennsylvania Natural Diversity Inventory - West

Western Pennsylvania Conservancy
Natural Areas Program
316 Fourth Avenue
Pittsburgh, PA 15222
Phone: (412) 288-2777
Fax: (412) 281-1792
Coordinator: Paul Wiegman

Pennsylvania Natural Diversity Inventory - Central

Bureau of Forestry
P.O. Box 8552
Harrisburg, PA 17105-8552
Phone: (717) 783-0388
Fax: (717) 783-5109
State Coordinator: Kathy McKenna

Rhode Island Heritage Program

Department of Environmental
Management
Division of Planning &
Development
83 Park Street
Providence, RI 02903
Phone: (401) 277-2776 x 4308
Fax: (401) 277-2069

Coordinator: Rick Enser

South Carolina Heritage Trust
SC Wildlife & Marine Resources
Department

P.O. Box 167
Columbia, SC 29202
Phone: (803) 734-3893
Fax: (803) 734-6310 (call first)
Coordinator: Steve Bennett

South Dakota Natural Heritage Database

SD Department of Game,
Fish & Parks
Wildlife Division
523 E. Capitol Avenue
Pierre, SD 57501-3182
Phone: (605) 773-4227
Fax: (605) 773-6245
Coordinator: Dave Ode

Tennessee Division of Natural Heritage

Department of Environment &
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401 Church Street
Life and Casualty Tower, 8th Floor
Nashville, TN 37243-0447
Phone: (615) 532-0431
Fax: (615) 532-0614
Director: Reggie Reeves

Texas Parks and Wildlife Department

Endangered Resources Branch
3000 IH-35 South, Suite 100
Austin, TX 78704
Phone: (512) 912-7011
Fax: (512) 912-7058
Heritage Coordinator: vacant

Utah Natural Heritage Program

Division of Wildlife Resources
1596 West North Temple
Salt Lake City, UT 84116
Phone: (801) 538-4761
Fax: (801) 538-4709
Coordinator: Doug Stone



Vermont Nongame & Natural Heritage Program

Vermont Fish & Wildlife
Department
103 S. Main Street, 10 South
Waterbury, VT 05671-0501
Phone: (802) 241-3700
Fax: (802) 241-3295
Heritage Coordinator: Bob Popp

Virginia Division of Natural Heritage

Department of Conservation & Recreation
Main Street Station
1500 E. Main Street, Suite 312
Richmond, VA 23219
Phone: (804) 786-7951
Fax: (804) 371-2674
Division Director: Tom Smith

Washington Natural Heritage Program

Department of Natural Resources
(FedEx: 1111 Washington
Street SE)
P.O. Box 47016
Olympia, WA 98504-7016
Phone: (360) 902-1340
Fax: (360) 902-1783
Coordinator: Mark Sheehan

West Virginia Natural Heritage Program

Department of Natural Resources
Operations Center
Ward Road, P.O. Box 67
Elkins, WV 26241
Phone: (304) 637-0245
Fax: (304) 637-0250
Coordinator: Brian McDonald

Wisconsin Natural Heritage Program

Endangered Resources/4
Department of Natural Resources
101 S. Webster Street, Box 7921
Madison, WI 53707
Phone: (608) 266-7012
Fax: (608) 266-2925
Coordinator: Betty Les

Wyoming Natural Diversity Database

1604 Grand Avenue, Suite 2
Laramie, WY 82070
Phone: (307) 745-5026
Fax: (307) 745-5026 (call first)
Coordinator: George Jones

Regional Heritage Data Centers

Navajo Natural Heritage Program

Navajo Fish & Wildlife
P.O. Box 1480
Window Rock, AZ 86515-1480
Phone: (520) 871-6472
Fax: (520) 871-7069
Coordinator: Jack Meyer

TVA Regional Heritage

Division of Land Management
Tennessee Valley Authority
Norris, TN 37828
Phone: (423) 632-1593
Fax: (423) 632-1795
Coordinator: William H. Redmond

National Park Data Centers

National Park Service

75 Spring Street SW
Atlanta, GA 30303
Phone: (404) 331-4916
Regional Data Manager:
Teresa Leibfreid

Florida and Caribbean Marine Conservation Science Center

c/o Biology Department
P.O. Box 249118
University of Miami
Coral Gables, FL 33124-0421
Phone: (305) 284-3013
Fax: (305) 284-3039
Marine Ecologist: Kathleen Sullivan

Great Smoky Mountains National Park

c/o Janet Rock/Keith Langdon
1314 Cherokee Orchard Road
Twin Creeks Natural
Resources Center
Gatlinburg, TN 37738
Phone: (423) 436-1264
Fax: (423) 436-5598

Coordinator: Keith Langdon

Gulf Islands National Seashore

1801 Gulf Breeze Parkway
Gulf Breeze, FL 32561
Phone: (904) 934-2605
Research Mgmt. Specialist: vacant

Mammoth Cave National Park

Division of Science & Resource
Management
Mammoth Cave National Park
Mammoth Cave, KY 42259
Phone: (502) 758-2238
Chief, Science & Research Mgmt:
Jeff Bradybaugh

National Capital Region Conservation Data Center

District of Columbia Natural
Heritage Program
13025 Riley's Lock Road
Poolesville, MD 20837
Phone: (301) 427-1354
Fax: (301) 427-1355
Resource Biologist: Olin Allen

National Forest Data Centers

National Forest in Florida

Department of Agriculture
227 N. Bronough Street, Suite 4016
Tallahassee, FL 32301
Phone: (904) 681-7329
Fax: (904) 681-7144
Coordinator: Guy Anglin

National Forest in North Carolina

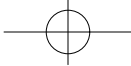
P.O. Box 2750
Asheville, NC 28802
Phone: (704) 257-4810
Forest Botanist: Steve Simon

Ouachita National Forest

P.O. Box 1270
Hot Springs, AR 71902
Phone: (501) 321-5323

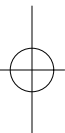
Virginia Coast Reserve

The Nature Conservancy
P.O. Box 158
Brownsville Road
Nassawadox, VA 23413
Phone: (804) 442-3049
Fax: (804) 442-5418
Director: John M. Hall



Appendix B

Glossary of Terms



GLOSSARY OF TERMS

Biodiversity: The number and variety of different species that populate a given place and contribute to the balance of ecological forces.

Biological Stressors: Organisms that are introduced (intentionally or accidentally) to habitats in which they do not evolve naturally. Examples include gypsy moths, certain tree diseases, certain types of algae, and some bacteria.

Chemical Stressors: Chemicals released to the environment through industrial waste, auto emissions, pesticides, and other human activity. These chemicals can cause illnesses and even death in plants and animals.

Consumers: Organisms such as people, other mammals, birds, and reptiles that take energy and materials from producers (plants) through the food web.

Decomposers: Microscopic organisms that break down matter such as fallen trees and dead animals into basic chemicals such as carbon dioxide, oxygen, water, and minerals.

Ecosystem: A community of plants and animals (including people) interacting with each other and their physical environment. Ecosystems include places as diverse as urban parks, wetland areas, lakes, prairie potholes, and major forests.

Food Web: The set of feeding relationships by which energy and materials are transferred from one species to another.

Ground Water: Underground water, often pumped and used for drinking, irrigation, and other purposes.

Habitat: The environment that supports plant or animal species. Examples include terrestrial (land) habitats such as forests and marine (ocean) environments.

Nutrients: Basic elements that plants and animals need to survive, including carbon, nitrogen, calcium, oxygen, phosphorus, sulfur, and magnesium.

Photosynthesis: The process by which plants combine sunlight, water, and carbon dioxide to make carbohydrates, proteins, and sugars necessary for all life.

Physical Stressors: Activities that directly remove or alter habitat, including logging, road construction, and land development.

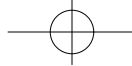
Producers: Plants that perform photosynthesis and provide food to consumers.

Stressors: Man-made factors that can undermine the proper functioning of ecosystems.

Surface Water: Ground-level water bodies such as rivers, lakes, reservoirs, bays, and oceans.

Watershed: An area where rain and other water drains to a common location such as a river or lake.

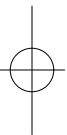
Wetlands: Areas between land-based and surface-water ecosystems, including swamps, bogs, and marshes. Wetlands help control floods, filter pollutants, and serve as spawning and nursery areas for fish.





Appendix C

Understanding Ecosystems — An Ecosystem Primer



Appendix C

Understanding Ecosystems — An Ecosystem Primer

From urban settings to rural land, the landscape is alive with the beauty and detail of nature. The ecosystems that you see support you with resources (timber, water, components of pharmaceuticals, and food, just to name a few) and services (water purification and erosion control, for example), making your survival possible and your life more enjoyable. While anyone can enjoy ecosystems for their resource value or essential beauty, knowledge of their underlying complexity yields a deeper appreciation for them. Being successful in protecting this life support system means understanding how ecosystems work and how they can be threatened. This appendix provides some basic information to help you succeed. Appendix B provides a glossary of ecosystem terms used in this appendix.

What Is An Ecosystem?

An ecosystem is a community of animals and plants interacting with one another and with their physical environment. Ecosystems include physical and chemical components, such as soils, water, and nutrients, that support the organisms living there. These organisms may range from large animals to microscopic bacteria. Ecosystems also can be thought of as the interactions between all organisms in a given habitat; for instance, one species may serve as food for another.

People are part of the ecosystems where they live and work. Human activities can harm or destroy local ecosystems unless actions such as land development for housing or businesses are carefully planned to conserve and sustain the ecology of the area. An important part of ecosystem management involves finding ways to protect and enhance economic and social well-being while protecting local ecosystems.

Ecosystem Structure and Function

Most ecosystems consist of four basic components: producers, consumers, decomposers, and non-living matter. Most producers are green plants that use light energy from the sun, carbon dioxide, and water to make simple sugars. These sugars are the building blocks for the other complex molecules necessary for life.

Consumers are organisms that consume producers (plants). Consumers include humans, other mammals, birds, fish, and insects. When consumers eat producers or other consumers, they break down, store, and use the food through the processes of digestion and respiration. When an animal eats a plant or another animal, it is obtaining not only the matter contained in that food source, but also the energy stored there. Producers also absorb mineral nutrients from soil and water. Animals that consume lower level plants or animals obtain the nutrients necessary for growing and reproducing. When plants and animals die or release organic material to the environment (for example, when leaves fall

from trees), bacteria and fungi in the soil decompose this material and return its original mineral components to the soil.

A “food web” or a “food chain” is one way, then, of describing how plants and animals interact in an ecosystem. An ecosystem also is described by cycles of component materials — minerals, energy or heat, carbon — that result in the interdependence of humans, other animals, plants, and the environment.

A variety of environmental problems result when the cycles are disrupted. For instance, farming and forestry operations can significantly deplete nutrients (nitrogen, phosphorus) in soil. Likewise, rain and soil erosion can wash nutrients away.

In the case of threatened and endangered plants or animals, loss of even a few individuals is significant, because the species is at or near the point of no return. When the population of a given plant or animal species dwindles, food chains may be broken and biodiversity is lost.

Types of Ecosystems

Living organisms interact with their environment to create many varieties of ecosystems. Understanding the different types of ecosystems helps to identify aspects of the local environment that need protection.

Some major types of natural ecosystems include the following:

- ⁿ **Surface Water Ecosystems** — These include rivers, lakes, reservoirs, ponds, and bays. These aquatic environments support fish and other organisms such as worms, crustaceans, aquatic plants, and microscopic organisms.
- ⁿ **Estuaries** — Estuaries are coastal areas where freshwater drains from the land and mixes with ocean saltwater in swamps, marshes, lakes, and bays. Examples include the Mississippi Delta, Chesapeake Bay, and San Francisco Bay. Estuaries are biologically diverse and provide spawning and nursery grounds for the majority of the nation’s fisheries.
- ⁿ **Wetlands** — Wetlands are transitional areas between land-based and aquatic ecosystems where ground water is at or near the surface or the land is covered by shallow water. This definition would include swamps, bogs, marshes, and a variety of other wet environments. Whether coastal (such as salt marshes) or inland (such as fresh water), wetlands are critical to water flow control, water supply, water quality, and wildlife habitat.
- ⁿ **Forests** — Forests are ecosystems dominated by large woody plants, particularly trees. In North America, forests are home to wildlife as diverse as bear, moose, deer, rabbits, birds, toads, and worms.
- ⁿ **Grasslands** — Grasslands cover much of the plains of the central and western United States and represent important feeding areas for wild animals and domestic livestock.

- ⁿ **Deserts** — Deserts are arid regions that support a unique system of plants (such as cacti), mammals, reptiles, and birds.

Sometimes local ecosystems will be part of a last remaining area that has many of its original and natural attributes. In other cases, ecosystems will be heavily influenced by humans. For example, a city is an urban area that combines elements of the “green” environment (such as parks) with the “built” environment (such as houses, skyscrapers, and roads). Cities are different from natural ecosystems because they need large imports of energy, water, and other materials; that is, they are not self-sustaining. Likewise, agricultural land, while cleared and planted by humans, must retain certain natural features (such as healthy topsoil) to be productive and may be bordered or interspersed with wooded or wetland habitat.

It may be difficult for a community to identify its ecosystems because:

- ⁿ The physical boundaries of ecosystems don’t always coincide with a community’s political boundaries or developed area.
- ⁿ The natural range for species of concern may move beyond one ecosystem. For example, songbirds that nest in your backyard may have a migratory range of thousands of miles.
- ⁿ “Natural” ecosystem boundaries (where one ecosystem begins and the next one ends) are often not easily identified.
- ⁿ Human activities that harm an ecosystem are sometimes located far from that ecosystem. For example, air pollutants from power plants in the Midwest may travel hundreds of miles and contribute to acid rain in the Northeast.

A specific community’s environment may contain several ecosystems. Both the relationships of components within ecosystems (such as water, plants, and animals) and the interactions among neighboring ecosystems are important. Communities concerned with ecosystem protection often consider both man-made and natural boundaries, including geographic and political boundaries of the neighborhood, village, or city. A community that manages the area in which it lives can be said to be taking a “place-based” approach to protecting its environment. A community that takes it one step further and looks toward managing the ecological structure and integrity of the place around it is taking an ecosystems approach.

Ecosystem Stress

Both natural and man-made factors can put the structure and healthy function of ecosystems under stress. Scientists refer to these influences collectively as “stressors”.

Even healthy ecosystems change over time. Ecologists refer to a process of ecosystem change as “ecological succession”. There are gradual successions where the aging of soils or changes in regional climate make the landscape inhospitable to some species but appropriate for others. Succession can also result from sudden, drastic change. For instance, soon after a forest fire, shoots of pioneering grasses and wildflowers sprout from the charred earth. Within a year or so, bushes begin to replace the pioneers. Over time, the first wave of trees becomes higher than the shrub layer and shades out some of the shrubs. Finally, decades after the fire has occurred, a for-

est community emerges that is virtually indistinguishable from nearby areas not affected by the fire.

Ecosystems may be able to absorb many natural processes such as forest fires and floods because these events usually occur infrequently or at a low level of intensity. Indeed, efforts to protect ecosystems from these natural processes have recently been found to be damaging rather than helpful. For example, preventing small, periodic forest fires can lead to a buildup of debris on the forest floor that fuels major, destructive fires. In fact, the smaller fires sometimes have a specific ecological purpose, as with Scotch Pines that require heat to drop their seeds.

In contrast, an ecosystem is less able to recover from stresses induced by humans when those stresses are constantly applied or occur at high levels of intensity. Human activity also may cause novel stresses that ecosystem processes are not adapted to handle, such as spills of synthetic chemicals that do not degrade over time. The ecosystem may have insufficient time to recover or adapt to the rapid changes imposed by human activities.

This section briefly reviews the types of ecosystem stressors — physical, biological, and chemical — and the problems they can cause.

- n **Physical Stressors** — Physical stressors include changes that remove or alter habitat. For instance, erosion of topsoil that results from land disturbance can result in loss of habitat for vegetation on land and accumulation of sediment in streams and lakes. In addition, physical stressors can undermine ecosystems by fragmenting habitats. Physical disturbance — such as the excessive destruction of nesting habitat for birds or the alteration of in-stream fish habitat such as swift water, pools, and rapids — can result in major losses of these organisms. Wildlife that need more space or access to multiple areas (such as lakes and forests) will disappear.

Because the sources of physical stress tend to be visible and well known in the community (for example, land development), they are often the object of community-based ecosystem protection efforts. However, obvious physical stressors are often not the only influences on the ecosystem.

- n **Biological Stressors** — Biological stressors are organisms or microorganisms that are introduced (released), intentionally or accidentally, to habitats in which they did not evolve naturally. These organisms are often called “exotics”, because they did not occur naturally along with the native plants or animals. They may be difficult to control if they reproduce rapidly in the new environment. Examples include infestations of insects such as the gypsy moth, plants such as kudzu, and tree diseases such as chestnut blight. Biological stressors become a concern when they compete against native species, replace them, and become pests. The result often can be loss of habitat or disruption of established food chains.

The bacteria, parasites, and viruses that occur in human sewage and animal waste are common biological stressors. These microscopic organisms are released to the environment by sewage treatment plants, farm runoff, or other means. The result can be contaminated drinking wells that cause illness in



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humans or contamination of rivers and lakes, sometimes resulting in fish kills and waterfowl deaths.

Chemical Stressors —

Technology and industrialization have resulted in the introduction of increasing quantities of chemicals into the environment. Chemical stressors include hazardous waste, industrial chemicals, pesticides, and fertilizers. Depending on the physical and chemical properties of contaminants, they can be incorporated into the cycles of the atmosphere, soil, and water, where plants and animals become exposed. Chemical stressors can hurt individual organisms in a variety of ways, ranging from rapid death to non-lethal effects (such as impairment of reproductive capability).

Table C-1 provides several examples

of stressors and their impacts.

Ecosystems Provide Key Services

Ecosystems Make the Human Environment Livable

One function of ecosystems can be described as “infrastructure services”. This refers to the ways that ecosystems, when properly functioning, can make the human environment more habitable. These services include the following:

- Water Supply** — Ecosystems provide fresh water for household uses (such as drinking and bathing) and for agricultural and industrial uses. Surface water sources (such as lakes, reservoirs, and rivers) and underground water sources both play a vital role in the maintenance of human and animal life.
- Control of Water Movement** — Wetlands control floods, serving as a sponge that absorbs water from heavy rains or snowmelt. Similarly, coastal dune systems and wetlands help protect against storms, absorbing the effect of waves and other storm surges. This storm protection limits flooding and reduces erosion of coastal areas. The salt marshes and barrier islands from Cape Cod to Florida, the delta system of Louisiana, and the mangroves of the Florida keys are all examples of coastal wetlands that provide protective services.
- Erosion Control** — Soil is held in place by the root systems of trees, grasses, and other vegetation, preventing erosion by rain, wind, and waves. All terres-

Table C-1

EXAMPLES OF STRESSORS			
Stressor Category	Stressor	Sources	How Ecosystems Are Affected
Physical	Erosion	Logging, agriculture, surface mining, construction	Loss of topsoil; siltation of rivers and lakes
	Habitat removal and fragmentation	Residential and commercial development, logging	Decline in animal abundance and diversity
Biological	Zebra mussels	Transported on hulls of foreign ships and spread by small boats	Crowding out of native species in affected surface waters
	Bacteria, parasites	Human sewage, animal waste	Illness in humans through drinking water; fish kills, waterfowl deaths
Chemical	Nutrients	Fertilizers, animal waste	Eutrophication of surface water
	Toxic Chemicals	Automobiles, factories, pesticides	Contamination of air, water, and soil; health and reproductive effects in humans and wildlife

trial plants, especially healthy forest and grassland ecosystems, promote soil formation, enrichment, and stabilization. Soil erosion can lead to increased sedimentation of streams, rivers, and lakes, which can harm or destroy aquatic habitats, such as trout streams, oyster beds, or salmon spawning grounds. Sedimentation also can impair water transportation, possibly requiring dredging or other expensive measures to correct the problem.

• **Pollution Control** — Soil and plant life are essential to the storage and control of toxics in the environment. For example, wetlands and soil ecosystems in rural areas are the first line of defense against pesticide runoff, breaking organic contaminants down before they reach sensitive areas and slowing the movement of inorganic pollutants. Organisms in water can break down sewage, oil, and other pollutants. Vegetation also plays a role in reducing air pollution. Trees can trap dust and dirt particles that transport pollutants. Their leaves also absorb gases like ozone and sulfur dioxide. Of course, ecosystems' ability to absorb pollutants is limited; humans must also control the release of pollutants to the environment.

• **Local Climate Control** — Trees and shrubs, particularly in densely forested areas, can affect local climate. They absorb and give off water to the atmosphere. Removing trees can make affected areas drier and hotter. In addition, trees cool by shading. Finally, trees and plants absorb carbon dioxide and release the oxygen needed by most living things.

Ecosystems Influence a Community's Economic and Social Well-Being

Ecosystems play a major role in economic life as well as the community's social well-

being. See Chapter 3 of this resource book for a detailed discussion of how ecosystems affect local economies and the quality of life.

Ecosystems Are Needed by Other Species

Humans are only one member of the ecosystem. Every ecosystem also includes a multitude of other plants and animals. Some species depend on more than one habitat. This is most obvious with amphibians and migratory birds. Frogs and salamanders develop in the water but spend much of their adult lives on land. A wood duck may winter in the Everglades, feed and rest in a Virginia pond, and nest in an upstate New York swamp. The survival of such species is dependent on the availability and environmental condition of all the required habitats — at the right time and place. Other species' reliance on local ecosystems is important when evaluating the benefits these ecosystems provide your community.

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