



United States
Environmental
Protection

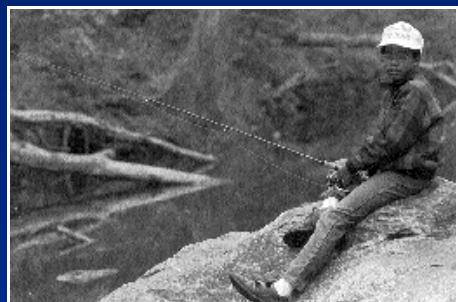
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Community-Based Environmental

A Resource Book For Protecting Ecosystems and Communities



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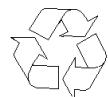
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The Environmental Protection Agency's (EPA's) Community-Based Environmental Protection (CBEP) initiative is designed to help people become effective partners in protecting the environment, including the ecosystems that support the physical and economic health of the places where they live and work. The EPA Office of Sustainable Ecosystems and Communities has compiled this book to identify practical approaches and tools to help communities carry out their own ecosystem protection efforts. Mention of organizations or products in this resource book does not constitute an endorsement by EPA, but is intended to point communities to places where they may look to find information, resources, or assistance and then evaluate for themselves the appropriateness of the resource for their own situations.



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Community-Based Environmental Protection: A Resource Book For Protecting Ecosystems and Communities

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Chapter

1 An Overview of Community-Based Environmental Protection

Over the last twenty-five years, federal and state anti-pollution laws have achieved many notable environmental successes. Local communities often play a prominent role in addressing many of the most pressing environmental concerns. Central to these concerns is the need for clean and vital ecosystems. Healthy ecosystems support human health, plants, and animals. They also provide recreational opportunities and support local economies dependent upon fish, game, forests, and other resources. Full protection of our nation's ecosystems requires communities and individuals to conserve or restore habitats and solve other environmental problems not specifically addressed by traditional regulatory approaches.

Over many years, a number of communities in the country have initiated their own successful community-based environmental efforts. Indeed, the first anti-pollution laws around the turn of the century were local ones. This publication draws on the experiences of many different communities to provide examples of community-based environmental programs and key approaches, information, and other tools that communities are using.

1.1 *What Is Community-Based Environmental Protection and How Does It Support Ecosystem Protection?*

Community-based environmental protection is action that local individuals and groups take to address their own environmental concerns. Ecosystem protection carries such activity beyond localized environmental issues, such as pollution from a particular factory or lead poisoning from paint in older housing, to consider the ecological health of the total local environment. This environment often extends beyond municipal borders.

People who work, live, and have businesses in the community (“stakeholders”) have a common interest in protecting their shared environment and quality of life. The defining element of community-based ecosystem protection is that these people work together to develop plans and goals. Ecosystem protection plans developed in this way can be very effective because:

- They take into account local social, economic, and environmental conditions as well as community values.
- They create a sense of local ownership of issues and solutions and encourage long-term community support and accountability.

Because most community-based efforts are initiated locally, they consider the views, interests, and values of local stakeholders. The *Malpai Borderlands Group in Arizona and New Mexico* (see across), is an instructive example of how a core group of local stakeholders undertook cooperative efforts to preserve local and regional ecological resources. In some cases, communities launch ecosystem protection efforts in response to specific concerns of states and federal agencies; this document also reviews several such programs.

Human activities may create a number of different types of stressors for ecosystems and the species that live within them. These stressors can be physical, such as erosion or habitat destruction; chemical, such as toxic chemicals or excessive nutrients; or biological, such as the introduction of an exotic species or the removal of a predator that controls pest species. Community initiatives that focus on protecting local ecosystems take into consideration the complexity of natural systems and the nature of human relationships with them. It may be difficult for a community to identify its ecosystems and their natural boundaries (where one ecosystem ends and the next one begins). Often, ecosystems' physical boundaries don't coincide with a community's political boundaries or the natural range for species, such as a migratory bird. Additionally, human activities that harm an ecosystem may be located some distance away, or may be difficult to change. A community also may contain several ecosystems. Both the relationships among components of an ecosystem, such as water, plants, animals, and topography, and the interactions among neighboring ecosystems are important.

1.2 *Community-Based Environmental Protection Goals Can Address Ecosystem Protection*

A major goal of many community-based environmental protection efforts is to ensure that local ecosystems are healthy enough to provide a range of valuable benefits, both now and in the future. Ecosystem services that benefit humans include:

- **Moderating Natural Events and Human Activities** — Healthy ecosystems can make communities safer and more livable by tempering the effects of natural events and human activity. For example, wetlands can absorb water and thereby help control flooding; they may also remove pollutants from wastewater.
- **Enhancing Social Well-Being** — Healthy ecosystems provide services that make communities more enjoyable and rewarding. For example, a healthy ecosystem provides opportunities for outdoor recreation. To many people, it also provides a sense of civic pride and spiritual well-being.
- **Supporting Local Economies** — In a sustainable economy, people meet the needs of the present without compromising the ability of future generations to meet their own needs. Maintaining healthy ecosystems can help ensure future generations the economic opportunities enjoyed by current residents. The interaction between ecosystems and the economy is often the most prominent issue for local decisionmakers because:

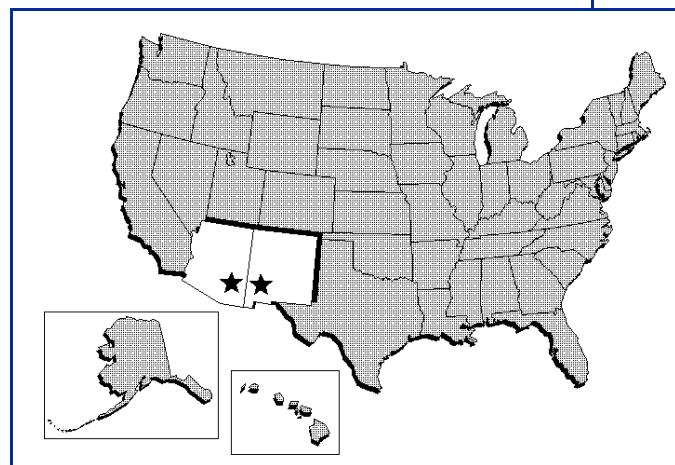
Arizona and New Mexico: The Malpai Borderlands Group's Community-Based Ecosystem Protection in

The Malpai Borderlands Group is a non-profit coalition of private landowners and ranchers in the border region of Arizona and New Mexico. The group provides a good illustration of community-based ecosystem protection. The group established a clear ecosystem-oriented goal: "To restore and maintain the natural processes that create and protect a healthy, unfragmented landscape; to support a diverse, flourishing community of human, plant and animal life...." To pursue this goal, the group developed a 5-year plan for management of the grasslands, desert scrub, and mountain forest ecosystem in the region. The plan targeted three major issues: conservation and land protection, low- impact economic development, and science and education.

The group employs an open, participatory process to choose individual ecosystem protection projects. Members explore options, consider available resources, and maintain open communication with ranchers and agencies. Their guiding principle is always to consider how a project will lead them toward their objective of restoring and maintaining their ecosystem and community.

The group members are aware that many options exist for achieving their goals. They adopted a clear 10-step methodology for identifying those options and developing new projects. Board members, staff members, and volunteers are invited to introduce new ideas. A point person discusses each new idea with the president or executive director and forms a project committee to explore its feasibility.

The planning process has resulted in successful initiation of projects in three major issue areas. "Conservation and land protection" projects include conducting prescribed burns, allowing natural fires to burn, and reintroducing natural grasses in conservation and land protection areas. In the area of "science and education", the group funded field research to determine the effects of fire, grazing, and climate change on lands. "Low-impact economic development" is addressed through cooperative investigations with local ranchers of ways to market local products. The group also focuses on endangered species protection by supporting ranchers' efforts to sustain Chiricahua leopard frog populations on their properties. Many of these successes can be attributed to the group's inclusive planning process. In the words of its executive director, "The Malpai Borderlands Group will never do something to someone — it will be done with them or it won't be done at all."



"The Malpai Borderlands Group will never do something to someone – it will be done with them or it won't be done at all."

Malpai Borderland Group

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- Many local economies depend on outdoor recreation and tourism.
- Many communities rely on resources extracted from the environment. Examples include timber, minerals, building materials, and seafood.
- Ecosystem quality affects the value of property and may influence local finances.

The importance of ecosystem quality to sustainability is illustrated by considering how community members' economic lives are made possible by healthy ecosystems. While modern technology has provided many substitutes and supplements to goods produced by healthy ecosystems, such as farm-grown fish rather than wild fish, the economy is still dependent upon the environment for basic raw materials like water, wood, and minerals. For the economy to grow, communities must protect the underlying natural systems on which they are built. For example, if a community harvests timber in a given region faster than the timber can grow back, or if a local shellfish bed is over harvested, the industries that depend on these resources will fail. Careful management of ecosystems such as forests and estuaries can help avoid this outcome and provide a continuing supply of products, services, and jobs for the next generation.

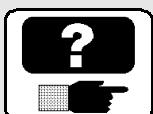
Throughout the book you will find special text sections intended to make community-based ecosystem protection more understandable. These include:



Community Stories — A state border symbol identifies summaries of real community ecosystem protection efforts throughout the United States. Each one demonstrates a key principle or tool discussed in the text. The descriptions list a contact person from whom you can obtain additional information.



Information Boxes — These text boxes are designed to enhance your understanding of key technical concepts.



"To Learn More" Sections — These sections provide suggestions for further reading, in case you want more detail on a particular topic.



Tool Boxes — These sections describe specific databases, models, or techniques that may prove useful in your ecosystem protection efforts.

This publication is intended to help you understand how healthy ecosystems benefit your community and how recreational, economic, and other activities affect the quality of your ecosystems. It will show you how other communities have assessed the interrelationships between their community goals, such as residential development, and ecosystem quality. As well, it will show you how those assessments helped communities decide how to focus their efforts and resources more successfully.

1.3 Basic Approaches For Developing A Local Ecosystem Protection Project — How To Use This Book

This publication contains four major sections:

▪ **Getting Started** — Getting an ecosystem protection project off the ground involves setting goals for the project and establishing an organizational structure for the effort. Chapter 2 of this book discusses effective approaches to these tasks.

▪ **Assessing the Conditions of Local Ecosystems and Their Effects on Communities** — Chapter 3 discusses assessment of the current conditions of

local ecosystems. The chapter lists data sources and techniques for identifying ecosystem problems and ways to trace these problems back to their root causes. In addition, Chapter 3 discusses assessing the linkages among ecosystems, the local economy, and the quality of life.

- **Strategies to Consider for Ecosystem Protection** — Chapter 4 explains local, state, and federal resources that may be useful to ecosystem protection projects.
- **Evaluating and Choosing Strategies for Ecosystem Protection Efforts** — Chapter 5 discusses how communities have evaluated potential ecosystem protection activities by weighing the potential impacts that they may have on local business, the local government, and the residents of the community. The chapter also discusses options for adapting projects as new information becomes available.

The bibliography at the end of certain chapters lists resources we used in preparing this book.

Additionally, the book contains three appendices. Appendix A lists sources of technical assistance within the U.S. EPA as well as within nonprofit organizations, other federal government agencies, and state governments. Appendix B provides a brief glossary of ecosystem-related terms that may be unfamiliar to some readers. Finally, Appendix C provides an introduction to how ecosystems work, and how human activity can affect them. This information may prove useful in interactions with environmental professionals in government, academia, and other organizations.

Chapter

2 Getting Started: Goal-Setting and Developing An Organization

2.1 *Getting Everyone Involved*

Community ecosystem protection initiatives often begin at the grassroots level, when friends and neighbors share a common interest in protecting or restoring the local environment. These initiatives may be spurred by noticeable air or water pollution, a development that causes ecosystem damage, some obvious ecological effect such as a fish kill, the gradual loss of desired species such as songbirds, or some other symptom of an underlying ecological problem. Alternatively, a community might come together to protect local ecosystems before they become threatened.

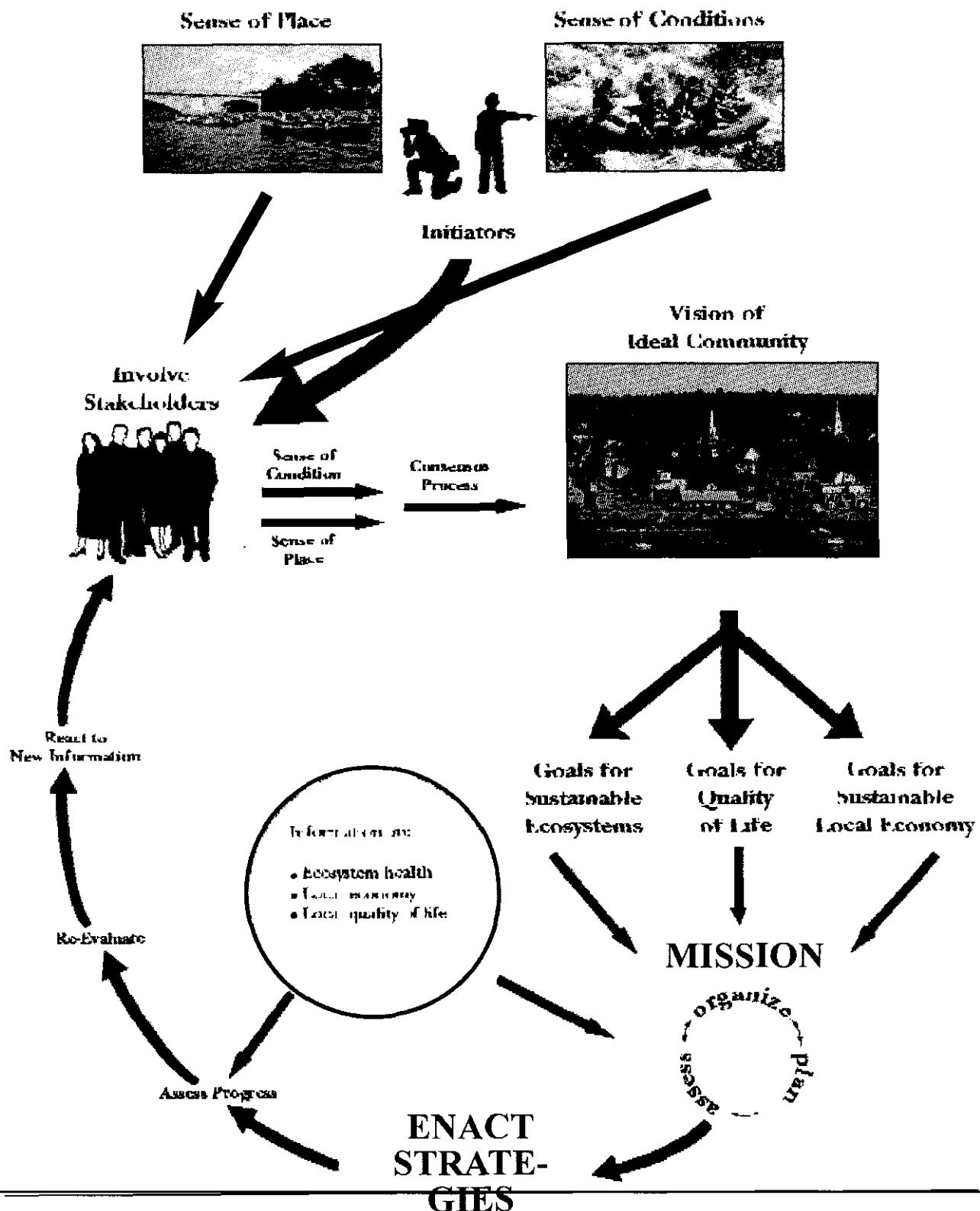
A concerned citizen, local official, or other project initiator may have some idea of desired outcomes, or may have identified ecosystems or ecosystem components to improve or protect. Project initiators in other communities have found it useful to reach out early to other *stakeholders* -- meaning, literally, people who have a stake (or at least an interest) in what the initiator is thinking about -- to begin an exchange of ideas about the desired outcomes or conditions that sparked their interest. Identifying possible stakeholders and sharing information stimulates their thoughts and desire to participate. Ultimately, stakeholders develop partnerships by coming to agreement on issues, vision, and information, leading to the development of a set of community goals and actions.

The figure on the next page shows one potential progression of a community ecosystem protection effort. The illustration begins with the topics found in this chapter -- that is, when a small group in the community alerts potential stakeholders to their concerns and begins to organize. Next, the community as a whole might develop its vision of the ideal community and, from this vision, develop goals. Finally, the community might assess the current problems facing ecosystems (discussed in Chapter 3) and identify and implement strategies to achieve those goals (discussed in Chapters 4 and 5).

Who are possible stakeholders? They include anyone in the community who takes a natural interest in environmental protection. Groups that might be affected by changes in commercial activity resulting from ecosystem protection strategies are also potential stakeholders. Examples may include businesses or labor unions. Local elected officials and community leaders can help identify potential stakeholders, in addition to participating themselves.

Figure 2-1.

Protection of Local Ecosystems Is An Inclusive and Evolving Process



Potential stakeholders might include the following organizations and individuals.

- Members of existing organizations that use or are concerned with the environment or land-use issues, such as:
 - Local environmental interest groups such as Audubon Society and the Sierra Club
 - Hiking, bicycling, and walking groups
 - Boating, canoeing, and white-water rafting organizations
 - Fishing or hunting clubs such as Trout Unlimited and the Izaak Walton League
 - Local community service organizations such as service clubs, garden clubs, 4-H Clubs, and Scouts
 - Public health organizations
 - Land trust organizations such as The Nature Conservancy or local land trusts
 - Condominium or housing development associations
 - Church organizations
 - Parent-teacher organizations
 - Neighborhood community economic development organizations
 - Student groups at local schools and universities
 - Local historical societies
 - Environmental justice activist groups
- Private landowners whose property includes habitat areas that the community wants to protect, including farmers, ranchers, timber companies, and private residents
- Businesses whose livelihoods depend on local environmental resources, directly or indirectly, including:
 - Canoe rental
 - Fishing and hunting guides
 - Nature tour guides
 - Horseback riding stables
 - Resorts, local hotels, bed and breakfasts, hunting lodges
 - Commercial fishing or other industries dependent on renewable resources
 - Landscaping businesses
 - Real estate agents
 - Developers' and builders' associations
 - Utility companies
 - Businesses that require clean water for manufacturing
 - Local industries with environmental discharges
 - Insurers
- Lenders
- Local chapters of relevant national professional organizations, including:
 - Ecologists, biologists, and other natural scientists
 - Physicians (e.g., the American) or state and county medical associations)
 - Landscape architects (e.g., American Institute of Architecture)
 - Attorneys (e.g., American Bar Association) and mediators (e.g., Society for Professionals in Dispute Resolution)

-
- Land use, natural resource, and other planners (e.g., American Planning Association or International City/County Management Association)
 - Offices of state, local, tribal, and federal governments, including:
 - Local watershed organizations and conservation districts
 - Local parks and recreation departments
 - Local planning boards
 - Local and state tourism offices
 - County or municipal water districts and health departments
 - State departments of environmental protection, agriculture, fish and game, transportation, and commerce
 - State economic development, coastal zone management, planning, and community and urban affairs commissions
 - U.S. Environmental Protection Agency
 - U.S. Department of Agriculture (especially the Extension Service and the Natural Resource Conservation Service)
 - U.S. Forest Service
 - U.S. Department of the Interior (especially the National Park Service, the Fish and Wildlife Service, and the Bureau of Land Management)



Ways to raise community awareness include:

- Using **Existing Forums for Public Participation-Communities** often have regular public meetings in which community members can place items for discussion on the agenda.
- **Publishing Information in the Newspaper or Running an Ad on a Local Radio Station or on Community Access TV** — Local newspapers can publish notices about ecosystem protection ideas and include either a date for an open meeting or a telephone number people can call for further information Alternatively, local radio stations or local cable TV channels can run similar notices.
- **Handing Out Leaflets**-A booth at a local store, shopping mall, library, or other well-traveled location can be an outlet for distributing leaflets about the local ecosystem and why people might be interested in joining an effort to protect it.
- **Sending Out Mailings** -Participants can drop off leaflets to people directly at their homes or send brochures via mail.
- **Writing Op-Ed Articles** Letters to the editor of the local newspaper, or op-ed articles, can efficiently publicize a project.
- **Calling Local Talk Shows**-Calling radio shows discussing environmental or community themes can raise awareness about local ecosystem protection.
- **Posting a Bulletin Board Notice or Developing a Home Page on the Internet** The Internet can be a direct and very effective way of getting information to certain segments of the community, especially interest group members (e.g., environmental activists and academics). Developing a home page that explains the project is a good way to get exposure.

-
- U.S. Department of Commerce (especially the National Oceanic and Atmospheric Administration and the Economic Development Administration)
 - U.S. Department of Transportation
 - Military bases administered by the U.S. Department of Defense or the Coast Guard
- Faculty at local schools and universities, especially those in environmental studies, biology, ecology, geology, and other natural sciences as well as economics, urban planning, public policy, and other social sciences
 - Labor unions and other workers' organizations
 - Senior citizens' organizations such as local councils on the aging or the Environmental Alliance for Senior Involvement (EASI).

Many diverse ethnic, religious, or other groups might be interested in sharing their points of view and participating. In some cases, communities must actively seek the involvement of key groups. Stakeholders may exist outside the immediate geographic area. Often, a community's ecosystem protection effort will interest people who live in distant places. For example, a land conservation effort in a rural resort area may capture the interest of city-dwellers who spend summers there. Similarly, a river restoration effort may affect many downstream communities. The economic interests of people in other areas also may greatly affect communities' efforts. The following stories about *Flagstaff's Open Spaces and Greenways Committee* and the *Anacostia Watershed Restoration Committee* illustrate efforts to include new members.

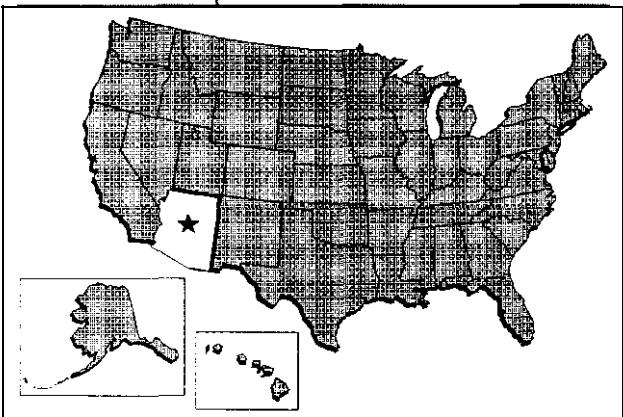
Engaging people from all key stakeholder groups as soon as possible produces many benefits. People are much more likely to work together successfully if they are involved from the beginning rather than after decisions are made. For example, developers may be more willing to discuss alternative development schemes if they are invited to help plan ecosystem protection strategies. Many community members gain a sense of well-being from volunteering their time to create a better community; involvement in the effort can be a source of personal enrichment.

Most communities have found that communication is vital in getting stakeholder involvement. For example, visiting some of the groups noted above at one of their meetings and speaking for five minutes might successfully draw stakeholder participation. Likewise, developing a newsletter to document decisions made and activities undertaken keeps everyone engaged and abreast of the latest developments.



Environmental Justice Advisory recently developed a public participation model that addresses **how** to include historically **disenfranchised** groups in community **efforts**. The description of the model is two pages long and can be obtained from Marva King at the U.S. Environmental Protection Agency's Office of Environmental Justice, phone: (202) 5644599.

Flagstaff, Arizona: Soliciting Flagstaff Citizen Involvement



This community-based planning initiative illustrates how an effort can expand and evolve as a result of the concerns of new members. What began as a one-issue, one-agency project expanded to an effective multi-agency coalition with extensive citizen involvement.

The project began with the City of Flagstaff's update of its general plan, Growth Management Guide 2000. The city brought the U.S. Forest Service and the State Land Department (which manage properties within the city boundaries) and the National Park Service (which was slated to expand its boundaries) to the table to discuss the interface of open space and urban areas. One of the city's major problems concerned the movement

of elk and other large mammals across highways and through residential areas. This concern brought the Arizona Department of Game and Fish into the process.

From this one concern over one area of land sprang a host of new issues: development pressures, quality-of-life concerns, and floodplain protection, among others. As new voices came forward and problems were clarified, the core group evolved into the Open Spaces and Greenways Committee to better address the new and original issues.

Although local, state, and federal agencies did much of the preliminary work, the group quickly opened the process to citizens, encouraged increased city and county representation, and sought the opinions of under-represented but affected groups, such as the Native American population.

Ultimately, the committee consisted of six agency representatives and seven local community members. City planners approached a limited number of organizations to encourage representatives to participate on the committee, including the Board of Realtors, the Sierra Club, the Chamber of Commerce, Northern Arizona University, the Parks and Recreation Commission, and the Beautification Commission. The final slot was offered to a representative of East Flagstaff. As the group grew and opinions were voiced, the actual goals of the group evolved, incorporating a more complete set of concerns from the community.

2.2 Identifying Goals and Defining An Approach

Other communities have found that when they first embark on an ecosystem protection project, they do not have a clear idea of goals, other than a general concern about protecting local ecosystems. Various methods of goal-setting, such as *visioning* -- forming a concept of what the ideal state of the community's ecosystems should be -- can help a community develop goals (see following tool box).

Setting Versatile Goals

When thinking about goals, many communities have considered not only ecological protection, but also the ways in which the environment interacts with quality of life and the local economy. These three endpoints can guide goal setting. For example, your primary ecological protection goal might be protecting streamside or woodland habitat. An associated "sustainable economy" goal might be working with landowners to pre-

The committee employed a diverse set of tools to find new members and to engage local and regional input, including:

- Open houses in elementary schools, fire stations, and other community meeting places to review resource maps
- Newsletters
- Free fact sheets on greenways initiatives
- Open plan-review sessions
- Videos to be used for community meeting outreach and local cable access
- Project posters made available through participating groups and agencies
- Trivia quizzes published on the op-ed page of the city newspaper
- Issue presentations on a statewide game and fish television show
- Outreach to populations who are not residents of Flagstaff, but who use and highly value many of the natural features of the Flagstaff area
- Maps of the open-space categories, with their descriptions and applications, posted in places of high public traffic for review and comment

When the Hopi Tribe heard about the Flagstaff Open Spaces and Greenways Committee's mapping project, they became concerned. The committee was mapping significant natural, historical, and cultural resources to classify priority areas for protection. The Hopis, however, did not want their sacred places identified precisely. The committee therefore simply flagged a region as culturally important without identifying specific locations that would have attracted attention to the Hopi sacred sites.

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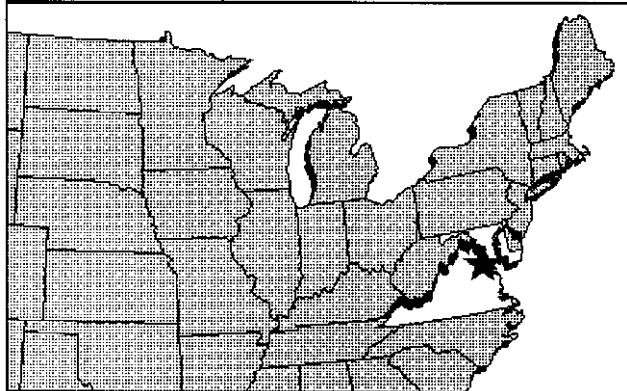
serve their woodlands by carefully planning and selecting the timber harvest to protect tree age, size, and species diversity, and replanting species native to the area.

Improving the quality of life might combine protecting wildlife habitat with construction of nature trails to provide hiking and walking benefits. Goals to improve ecosystems can include both present and future generations -- that is, the ecological legacy the community wants to leave its children and grandchildren.

Using indicators to Measure Progress Toward Goals

Tying goals to *indicators*, or specific measures of how well the community is achieving its goals, is a concrete way to determine progress. For example, measuring community progress in protecting aquatic species might involve counting the number of wading birds in the area. Specifically, the community could seek to double the wading bird population by the year 2000. Measuring the economic health of the community might involve tracking employment in eco-tourism businesses with a goal such as 50 percent growth in local eco-tourist business by the year 2000.

Metropolitan Washington Region: Building Community Support Through the Anacostia Watershed Restoration Effort



The sub-basin coordinators have gained an intimate familiarity with the streams, and have taken this knowledge to civic and environmental, town officials, and individual residents.

As the Anacostia restoration effort found, the most successful way to build community partnerships is by reaching out to the entire community, publicizing goals and efforts, recruiting project volunteers, and involving citizens in the decision making process.

The Potomac River cleanup in the 1970s drew much attention, but the Anacostia River (the “other” major river running through the nation’s capitol) remained largely ignored. Some residents used the Anacostia for recreation and appreciated the beauty of the watershed, but others ignored it, neither feeling any connection to the river nor realizing its potential as an urban treasure. In 1987, a regional partnership, the Anacostia Watershed Restoration Committee (AWRC), joined the District of Columbia, two Maryland counties (Prince George’s and Montgomery), and the State of Maryland in a coalition to address the basin’s declining health. Partnership goals included pollution reduction, watershed restoration, outreach, education, and stewardship.

The AWRC, representing local and state government, wanted to develop a new awareness of the Anacostia River among the 804,500 residents of the basin. In turn, these residents could serve as “stream stewards”. The AWRC chose a range of education and participation opportunities, including:

- Newsletters
- Subwatershed information brochures
- Sub-basin coordinators
- Volunteer restoration projects
- A citizen advisory committee

By stating goals in concrete, measurable terms, the community ensures that it can objectively assess the project’s progress. The use of indicators is discussed in more detail in Chapters 3 and 5.

Adapting Goals

As more and more stakeholders join the effort, the community may need to go through the goal development process more than once. As Figure 2-1 illustrates, the period after the assessment, planning, and execution of a particular ecosystem protection project provides an opportunity to reevaluate whether the community is meeting goals, using indicators, and whether these goals indeed represent the priorities of the community. If not, then the strategies chosen may not be effective and the underlying

To support these efforts, the Interstate Commission of the Potomac River Basin (ICPRB) publishes a quarterly newsletter and subwatershed publications to inspire residents to get involved. ICPRB packs these publications with local history, information on resources, easy-to-understand explanations of the restoration effort, and tips for household participation. ICPRB also supports part-time paid sub-basin coordinators recruited through local newspaper job advertisements. These people are the eyes and ears of the river, spending 10 hours a week walking the streams, talking with neighbors, distributing newsletters, producing stream-walk videos for local access cable channels, and making community presentations. Some take on special projects, such as watching for illegal dumping. Coordinators also promote citizen participation in many private and governmental stewardship efforts.

Many organizations have helped work toward the citizen stewardship goal. For instance, the Metropolitan Washington Council of Governments (MWCOG) provided staff to publish a handbook that provides step-by-step instructions for planning and conducting community restoration projects. The Maryland Department of Natural Resources Forest Service, MWCOG, the Anacostia Watershed Society, the Earth Conservation Corps, an Americorps group, and others have planted trees along basin tributaries and throughout the watershed. Citizens have also planted new wetlands and picked up countless pieces of trash floating in the waterways.

Most recently, the AWRC formed a citizen advisory committee to provide input on restoration and to ensure interactive community involvement in the restoration efforts.

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goals may not be relevant and realistic. Ultimately, the community may want to undertake another goals development session.

Making Sure the Goal-Setting Process Involves the Whole Community

Unless key community members participate in setting goals, the goals produced will not legitimately reflect the wishes of the community as a whole. Goal-setting works best when participants are an inclusive group.



Tools For Group Decision-Making

The Visioning Process - The visioning process involves all interested community members from the start. In the process, community members gather in a meeting place and openly discuss plans for the future, similar to the New England town meeting. Using visioning as a means to develop community goals takes advantage of the breadth and depth of ideas within the community and ensures that the initial proposals are shaped by all affected members.

Many communities have begun this process by scheduling a meeting that is open to all segments of the community. The same techniques used to interest others in the concept of environmental protection can be used to publicize the meeting: newspaper advertisements, radio announcements, flyers, leaflets, and word of mouth through existing organizations such as civic, church, environmental, and other community groups, and business organizations such as the Chamber of Commerce. Holding the meetings in schools or other accessible locations enables people to attend more easily, as does choosing a time that will be convenient to many people, such as a weekday evening or a weekend morning. Similarly, providing childcare and transportation enables parents, the elderly, and those without cars to attend.

The meetings can have two phases:

1 Generating Ideas -- First, in a group, all of the stakeholders brainstorm and share ideas of what the community ideally would look like. This discussion incorporates a diverse set of ideas about the desire for specific resource uses (such as using a meadow for development of songbird habitat) as well as personal values (for example, ensuring that development is environmentally friendly). In addition to brainstorming, the group can use role-playing exercises or other techniques to encourage participation.

2 Organizing Ideas Into Goals -- Members refine the ideas generated in the first phase into feasible goals using a consensus process, keeping in mind that these goals must be measurable and will be assigned indicators later. The outcome of this phase is a list of goals, both short- and long-term, and the specific activities necessary to achieve them. Goals produced in *Chattanooga, Tennessee's* visioning process are described on the opposite page (Figure 2-2). You'll notice that in the Chattanooga initiative, the community built very diverse goals including cleanup of distressed areas, creation of environmental enterprise zones, protection of wilderness areas, commitment to waste minimization, and fostering of public awareness and education.

Clearly, this process may not be completed in one meeting or even several meetings. Based on the number of members involved and the complexity of problems, communities have found that they need to schedule several meetings before completing the first round of goal-setting. A skilled facilitator can reduce conflict and ensure the best outcome (see discussion of facilitation below). The community of *Red Lodge, Montana*, as discussed below, used an outside group both to start the goal-setting process and to ensure that it ran smoothly.

Delphi Technique - The Delphi Technique involves multiple rounds of mail surveys. The first round asks stakeholders to describe their goals for the community's ecosystems. The second and later rounds describe the results of the earlier rounds and ask residents to respond to them in writing. Residents' views may change as they react to new information about others' goals. An appointed coordinator oversees the process and summarizes the information in each survey round.

Community Dispute Resolution - Differences of opinion may emerge among participants as they begin discussing visions and goals for local ecosystems. A variety of techniques exist for managing conflict. Other communities have found these techniques useful to encourage people to listen with open minds and understand each other's positions. In this way, communities

creative solutions that satisfy multiple goals, even when such solutions are not apparent to begin with.

Shared Values-Although stakeholders' goals may appear to differ on the surface, they in fact may share some common ground. For example, an industry that uses water from a river or discharges permitted effluents into the river would appear to have potentially competing goals with a community conservation group that wants to protect or improve the ecological quality of the stream. But the industry also values the clean water as a resource for their industrial processes. The group (including representatives from the industries) can start working out goals by focusing on this shared value.

Facilitators - Facilitators are neutral parties who help run meetings by calling on participants, limiting speaking time, recording points made on a whiteboard, easel, or notepad, and summarizing the discussion periodically. Facilitators help create an atmosphere of trust and fairness by ensuring that all groups have equal weight in the discussions. They keep the discussion focused on the topic at hand and moving forward. Finally, in tense situations, a facilitator can maintain civility and remind participants that a possible solution is to agree to disagree. Facilitators include clergy, college faculty or teachers, judges or magistrates, attorneys, and organizations with a facilitation mission, such as the League of Women Voters. Experienced mediators also can serve as facilitators. Although anyone can serve as a facilitator, a trained, experienced facilitator will likely bring out the best in the participants, produce the best outcome, and do the most to minimize conflict.

Mediators or Conciliators - Mediation or conciliation can be useful if a group arrives at a point where disagreements seem unresolvable. In mediation, an expert mediator or panel of mediators assists the disputing parties by helping them identify and discuss issues of mutual concern, explore solutions, and develop mutually acceptable settlements. The disputing parties are responsible for devising their own solution to the conflict with the help of a structured process established by the mediator. Mediators are often listed on court rosters. In conciliation, a neutral conciliator assists the parties to resolve their conflict by serving as a conduit for information, either by telephone or by alternating meetings with each side. Community members generally do not negotiate face-to-face. Similar to mediation, the conciliator provides a structured process for coming to a negotiated solution.

Arbitrators-Arbitration is a last resort after the disputants have tried other, more consensus-oriented procedures. In arbitration, the disputants present their sides and the arbitrator imposes a settlement, which may be binding or nonbinding depending on prior agreement. The community can give a mediator the authority to arbitrate if the mediator believes that the disputants have reached a true impasse.

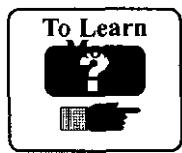
The *Back to the River* effort in Omaha, Nebraska, illustrates how one community used both facilitators and surveys to obtain input from the community.

Figure 2-2.

Sample Goal From the Revision 2000 Plan for Chattanooga,

GOAL: Develop and maintain the greater Chattanooga area as a world class environmental center.

- Promote the cleanup of environmentally distressed areas through the creation of environmental enterprise zones where public and private funds are used to create innovative solutions.
- Strengthen commitment to clean up our waterways. Establish a task force to lead, prioritize, and enforce mandatory clean-up of all polluted creeks and other areas.
- Protect the natural wilderness areas in the Chattanooga vicinity, such as North Chickamauga Creek Gorge. Establish a task force to protect and maintain environmentally significant areas.
- Require area-wide (residential, business, and industrial) recycling and waste minimization programs. Establish and maintain convenient curbside recycling and centers for disposal of household hazardous wastes.
- Foster professional education programs in environmental technology and engineering. Strengthen Chattanooga State's and the University of Tennessee — Chattanooga's solution-oriented programs.



Visioning

Books and Videos -The following materials on visioning are available from the American Planning Association at Planners Bookstore, 1313 E. Sixtieth Street, Chicago, IL, 60637-2891, phone: (312) 955-9100:

- Ames, Stephen C., ed., *A Guide to Visioning*, 1993, price: \$25.
- Chandler, Michael, *Meeting Management: A Mock Commission Hearing, 1994*, price: \$59.95. 90-minute VBS video and workshop materials.
- Klein, William, *Community Visioning*, 1994, price: \$94.95. 120-minute VHS video and workshop materials.
- Nelessen, Anton C., *Visions for a New American Dream*, 1994, price: \$50 (paperback); \$65 (library edition).

Internet -The following World Wide Web sites provide information on the visioning process, specific case studies, and organizations involved in the process:

- The Atlanta Project:
http://web.cc.emory.edu/BUSINESS/Carter_Center/TAPHistory.html
- public Access Network, Seattle, WA: <http://www.pan.ci.seattle.wa.us/>
- The Grandnet Visioning Process: <http://iserv.net:80/grandnet/>
- The Millennium Report to the Rockefeller Foundation:
<http://www.cdninet.com/millennium/Resource/master.html>
- Chattanooga Venture and the Community Vision Project:
http://www.chattanooga.net/SUSTAIN/pcsd_briefing_book/participating_venture

Local Universities – The environmental management, planning, or public policy departments of local universities may have information on visioning.

Dispute Resolution

Fisher, Roger and William Ury, *Getting to Yes*, Houghton Mifflin Company, Boston, MA, ISBN 0-14-00-6534-2, 1981. This book has many tips on negotiating and obtaining the best solution to a negotiation.

Miller, Sandra, Craig Shinn, and William Bentley, *Rural Resource Management*, Iowa State University Press, Ames, IA, 1994.

Northwest Renewable Resources Center, Seattle, WA. This organization assists in conflict resolution specifically in communities in which tribal and non-tribal peoples have trouble working together. For more information, contact Betsy Reynolds, phone: (206) 623-7361.

Patrick Flanigan, ed., *Community Dispute Resolution Manual*, National Institute for Dispute Resolution, Washington, DC, 1991, phone: (202) 466-4764. The institute also has a number of additional publications that deal with dispute resolution.

Saint, Steven and James R. Lawson, *Rules for Reaching Consensus*, Pfeiffer & Company, San Diego, CA, 1994.

Red Lodge, Montana: Small Jurisdiction Enlists Outside Help and Input from Other Small Communities to Develop a Plan for Sustainable Community Development

When Red Lodge, Montana, decided to become proactive in its development strategy for the future, it realized it faced a special challenge to be successful. Small jurisdictions, such as Red Lodge, often have neither the local expertise nor the budget and staff to support a community effort aimed at maintaining jobs and economic growth without sacrificing the environment. They realized that any initiative would likely result from the efforts of only a few people in the community. Recognizing their scarcity of resources, Red Lodge residents decided to draw on the experiences of other small communities and experts to guide their efforts.

The Red Lodge community began with a workshop led by the Sonoran Institute, which provided a forum to help residents develop a vision of the future. The workshops attracted 160 of the town's 2,000 residents and a broad cross-section of the inhabitants of the area: ranchers, developers, business people, educators, and senior citizens.

This workshop was the first step in identifying residents' shared vision and in creating committees to further explore and implement programs to make their vision a reality. Ultimately the workshop led to the development of the Beartooth Front Community Forum (BFCF), a non-partisan, locally-based citizens' organization that serves as an excellent demonstration of a far-reaching, inclusive, and long-term process for sustainable community development.

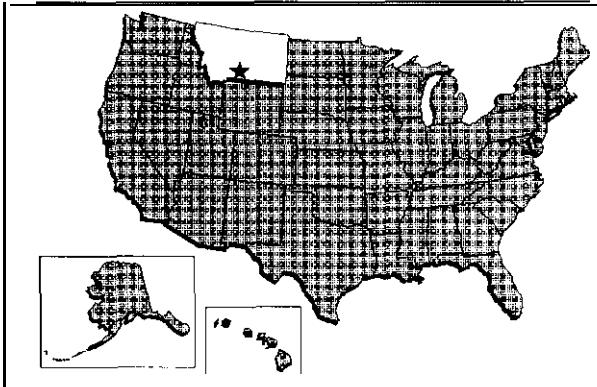
The BFCF represents the community's diversity and brings people together to find common ground and develop a vision of the future. The BFCF works to develop and maintain a plan to preserve and enhance the quality of life in Red Lodge. The early efforts and successes of the BFCF include development of a youth center, preservation of the post office, development of a land-use master plan, and implementation of water quality monitoring.

In addition to forming the BFCF, Red Lodge communicated with other small communities around the country that had taken on similar land planning efforts. After compiling information on others' experiences, the BFCF held a public meeting to share options with Red Lodge residents as well as catalyze fundraising to hire a professional land-use planner to guide their ongoing efforts. Ultimately, the BFCF came up with 40 percent of the cost of a land-use planner through fundraising, and the City Council provided the other 60 percent.

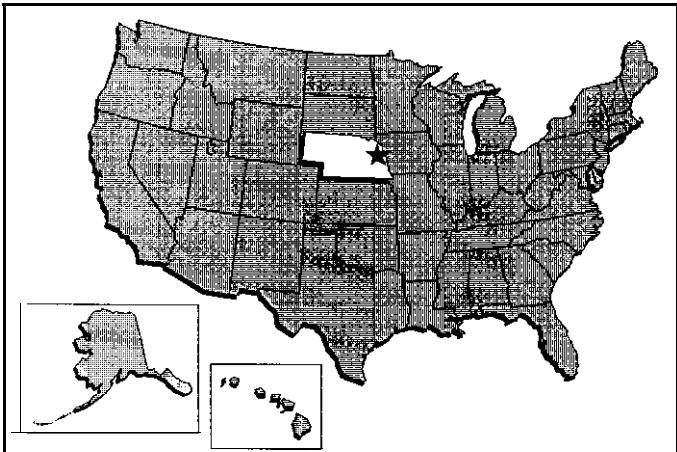
The BFCF's success is rooted in its ability to draw on all segments of the Red Lodge citizenry, the experience of similar communities, and the resources of other organizations in forming and implementing its vision.

The Sonoran Institute has helped extensively with the planning process and was a sponsor of workshops on sustainable jobs. In addition, the institute has been instrumental in linking this effort with the efforts of the Corporation for the Northern Rockies. The corporation brings people together to work toward collaborative problem-solving and to search for ways to meet economic needs while sustaining the environment.

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Missouri River, Omaha, Nebraska: “Back to the River” Taps Stakeholder Opinions



dams, and channelization of the river have changed the river's hydrology and resulted in the loss of wetlands and diverse fishery habitat. Conversion of forests and wetlands to cropland and residential uses has led to accelerated habitat loss, and industrial pollution has led to human health concerns. Back to the River is trying to reverse these trends.

The Back to the River Steering Committee, made up of seven formal partners including representatives of cities, local, state, and federal natural resource agencies, and a forest association, established broad restoration and education goals. At the outset, the steering committee determined that community input and support were crucial to success. How would citizens like to use the river? Would the community support increased property or sales taxes to fund projects? Would citizens be willing to donate time through volunteering?

To gauge community perceptions and values regarding the river, the committee used two methods: surveys and guided discussion groups or focus groups. They also hired independent professionals who were key to the success of both techniques. Selecting a neutral party with no stake in the outcomes lent credibility to inquiries and encouraged more honest responses.

The steering committee conducted over 1,200 telephone surveys inquiring about the communities' use of the river, their concerns, and their interest in enhancing the river corridor. The committee then organized four professionally facilitated discussion groups held in different communities. Each session included an ethnically, economically, and culturally diverse set of 12 citizens with no professional or personal link to the groups cooperating in the restoration effort. Attendees were unaware of the nature of the discussions before they arrived, though the facilitator had prepared a predetermined set of questions and topics to be discussed.

While the results of the focus groups are still being compiled, community members currently are enjoying a unique opportunity to express their opinions and provide a realistic basis for assessing their willingness to contribute to the restoration effort.

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The communities along the Omaha stretch of the Missouri River faced some difficult questions when organizing their ecosystem protection effort. How do you repair a damaged river? What initiatives are top priority? Who is going to take part? And most difficult of all, how much are you willing to pay for a healthy river? Through Back to the River, a cooperative campaign to restore one section of the Missouri, citizens are getting an opportunity to voice their opinions.

The Missouri River corridor, running north and south through Council Bluffs, Iowa, and a highly industrialized area of Omaha, Nebraska, has seriously deteriorated. Levees,

2.3 Defining Geographic Boundaries

of outlining to of commu-
to protect. Determining is
In particular, it

Starting Small

The is complicated by the are
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ural system of rivers and a lake may be
affected pollutant spills, flooding, and
water bodies. are so complicated that it may be difficult to address
system.
and rivers an example of such
as forests often cross town, even state boundaries.

These from ecosys-
tem protection plans. its ecosystems are so intercon-
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overwhelmed by in states.
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that it will need to to

it useful in the
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a scope may feasible
scope can help

- **A Critical Locale** – For example, a be if it covers an a crucial nesting site for birds.
- **A Critical Stakeholder** – For example, make a to of local to land
- **Special Skills or Resources** – The example, to to a to expand bound-
that to a of federal agencies.
- **Special Constituencies** – The an to groups to expand boundaries in overburdened by been been systematically left out of

The Big Sandy Lake Association, discussed on the next page, shows how one community expanded its ecosystem protection effort.

- A community can use the boundary-drawing exercise to help in thinking about other towns, counties, or even states with which to cooperate. If a community is considering making a river swimmable, for example, the effort will be affected by what goes on upstream. For this reason, communities often work closely with the watershed association and state entities, and may also involve other towns.



Obtaining Maps

Organizations from which you can obtain current maps of a particular area include the following:

■ Local Town Hall, County Office, or Planning Board

Local land-use maps that show whether land is used for housing, commercial enterprises, agriculture, or open space

- Tax maps that show private or public ownership of land
- Flood insurance maps

■ State Environmental Agency

Wetland delineation maps that show wetland boundaries

- Watershed maps that show the water bodies, wetlands, and other components of a local watershed
 - Land-use maps
- Aerial photo maps that show the location of different ecosystems
Aquifer delineation maps

■ State Conservation or Land Acquisition Group (within the state department of natural resources or environmental protection)

- Land-use maps

■ State Wildlife and Fisheries Department or Department of Natural Resources

Maps of state and local recreation areas

Maps showing the distribution of different plants and animals throughout the state, including rare and endangered species, non-native species, and crucial habitats

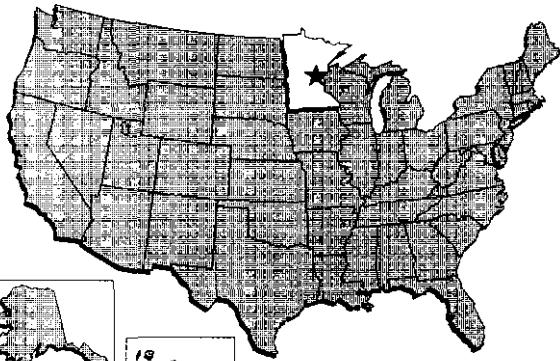
■ Federal Government (Appendix A of this handbook lists the telephone numbers and addresses of these agencies)

- U.S. Geological Survey (part of the US. Department of the Interior) has maps showing natural features of all parts of the United States.
- The National Oceanic and Atmospheric Administration (NOAA, part of the U.S. Department of Commerce) has maps of coastlines and ocean waters.
- The Federal Emergency Management Agency (FEMA) has maps of floodways and flood hazard areas

■ Geographic Information Systems (GIS)

At a greater level of sophistication, GIS software packages are available that allow you to model ecosystems on a personal computer. These computerized maps can show the political and geographic features of your ecosystems. As discussed in Chapter 3, GIS is also a powerful tool for evaluating ecosystem health and identifying sources of stress on the ecosystem, although in most instances citizen groups will have to rely on a state or local agency or academic institution to help with the analysis.

Big Sandy Lake, Minnesota: Broadening the Stakeholder Base and Focusing Attention on a Problem



Begun as a small organization of citizens, the Big Sandy Lake Association has been remarkably successful in identifying and working with stakeholders. In a relatively short time, the organization formed a partnership with federal, state, and local agencies that works to improve and maintain the Big Sandy Lake Watershed.

In the late 1980s, local residents began to see increasing development, ditching, wetlands alterations, poor timber harvesting practices, and livestock grazing along lakes and streams as a serious threat to water quality in the 400-square-mile watershed. Recognizing the need to protect the ecosystem and its

important fishery and tourism benefits, they formed the Big Sandy Lake Association and approached county and state agencies for help.

The Minnesota Pollution Control Agency (MPCA), responsible for the state's surface-water quality, in cooperation with the lake association, conducted a study of Big Sandy Lake's water quality. MPCA's report confirmed citizens' concerns and identified the expanded scale of the problem at the watershed level. Approaching the problem at the watershed level necessitated the participation of a variety of additional stakeholders: private landowners; the Army Corps of Engineers, which manages water levels on Big Sandy Lake; and the State Department of Natural Resources, which has large, local landholdings and manages fisheries and wildlife.

The Army, concerned about water quality and interested in forming local partnerships, began monthly water quality testing in 1990. Concerns about timber harvest, livestock practices, and compatible development attracted the attention of the Soil and Water Conservation Districts. Additionally, state agency personnel from several different departments became involved in the project when wetlands and erosion control became part of the lake's management plan. Soon county-level planning and zoning offices became the subject of scrutiny for not enforcing the state shoreland development standards.

The combined effort of interested state agencies, county departments, and citizens' groups led county planners to address declining watershed health as they realized its potential negative effects on tourism. Similarly, these organizations' concerns focused attention on the need for alternative lakeshore landscaping. In response, a local agent of the University of Minnesota is seeking the involvement of landscape architecture students to design ecologically sound lakeshore lawns.

The Big Sandy Lake Association has been remarkably successful in attracting the attention and resources of government agencies. It also has identified support from the McKnight Foundation, an organization that funds Mississippi Corridor environmental projects. Yet another measure of its success is that the State Department of Natural Resources offered a project coordinator to the steering committee and designated the watershed as one of five ecosystem management pilot projects.

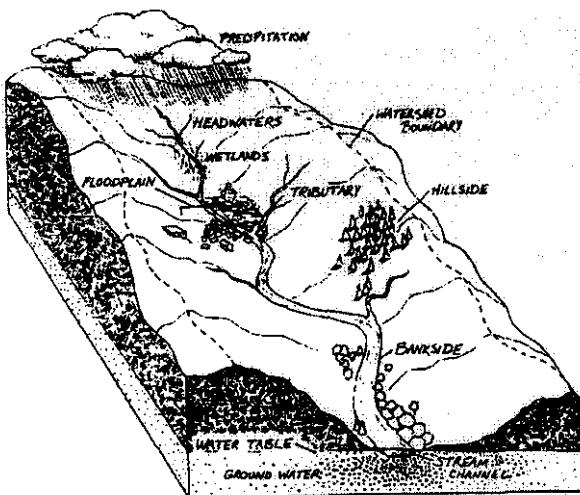
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Phone: (218) 327-4353
Fax: (218) 327.4263



A Watershed Is One Boundaries

A watershed is an area where **rain** and other water drains to a common location such as a river, lake, or wetland (see figure). This collection of water may occur naturally (as with rain running down a hillside) or with the influence of drainage infrastructure such as ditches and **storm** sewers. Watersheds range in size from a few acres that **drain** to a farm sands of square miles. Landscapes such as watersheds may contain many different and **interrelated** ecosystems (such as forests, streams, **wetlands**).

Ecosystem managers often use watersheds as a meaningful way to **define** areas of concern. Watersheds typically cut **across** political boundaries like neighborhoods, subdivisions, town lines, and even state lines. Thus, watershed management **often** requires coordination among different governments and organizations. While such coordination can **prove** challenging, watershed-based efforts can ultimately establish a seamless network of environmental **protection** across large regions, a result that is **difficult** for traditional government organizations to achieve.



Deciding What to Include

Communities often start with the most obvious ecosystem unit and enlarge the area of interest by considering related ecosystems. If a community is focusing on a small pond, for example, it may also consider including wetlands, marsh, or wooded areas around the pond. Outlining the area on maps clearly shows topography (for example, elevation, water bodies, and other features) as well as political features (for example, roads and state, county, and city boundary lines). The *California Natural Communities and Conservation Planning Program* illustrates one group's efforts to define the boundaries of a local ecosystem (see across).

In drawing boundaries, many projects have considered whether to include a buffer zone around the ecosystem. Such a zone absorbs the effects of human activity around the core of the ecosystem, preventing damage to the system itself. For example, for a seacoast, a zone of non-marsh, non-sandy terrain between the water's edge and development can prevent erosion and protect delicate tidal ecosystems. A project conducted by a citizens' group in *The Berkshires of New England* (see below) is an example of the successful implementation of a buffer zone around a river.

2.4 Choosing The Best Organizational Structure

Many communities function well as an ad hoc collection of members with shared responsibilities, each participating in tasks or responsible for implementing a part of the plan. Other communities decide to implement a formal organizational structure. Elements of such a structure might include:

- **Steering Committee** – The steering committee assumes the day-to-day responsibilities of the organization, delegates tasks, and may be responsible for outreach to other organizations. *The Blackjoot Challenge* and *Tensas River Basin* stories, on the following pages, provide examples of groups that exchanged ad-hoc structures for steering committees.

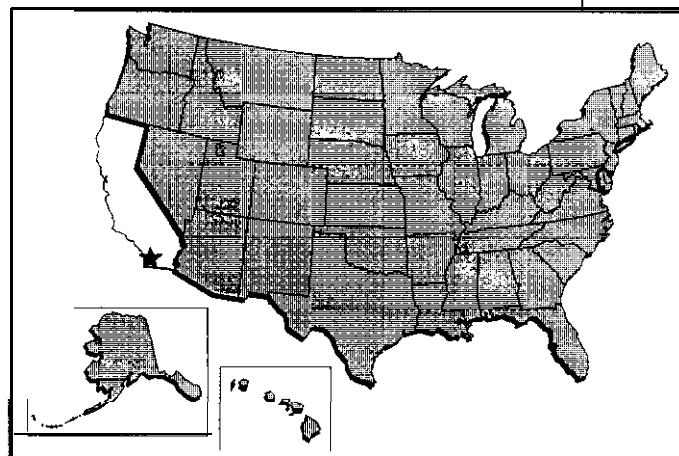
Southern California: Defining Geographic Boundaries Through the California Natural Communities and Conservation Planning Program

The Natural Communities and Conservation Planning Program (NCCP) has worked to delineate the geographic boundaries of critical lands within Southern California's coastal sage scrub ecosystem. The NCCP is a voluntary, collaborative effort among landowners, local governments, and state and federal agencies to preserve endangered habitats. The program's first goal is the preservation of the coastal sage scrub habitat in the 1.5 million acre planning area south of Los Angeles.

The range of California's coastal sage scrub habitat, home of the threatened California gnatcatcher and approximately 90 other potentially threatened or endangered species, has declined to 18 percent of its historical acreage. This fragmented habitat is scattered over more than 6,000 square miles and encompasses large parts of three counties (Orange, San Diego, and Riverside) and smaller portions of two others (Los Angeles and San Bernardino).

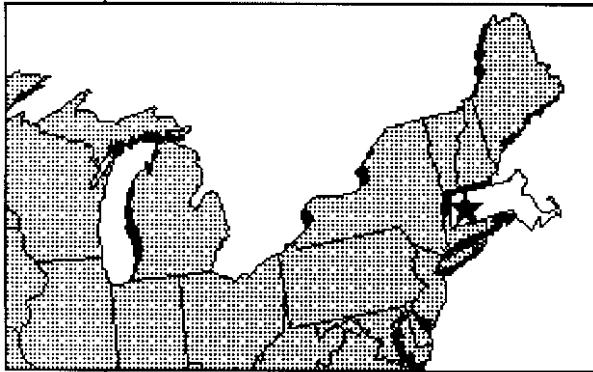
Designing a reserve system in the midst of this vast and substantially urbanized area required a systematic approach that focused on four specific tasks. First, project scientists identified the remaining undisturbed habitat areas needed to ensure the existence of two birds, the California gnat catcher and cactus wren, and one reptile, the orange-throated whiptail lizard. These three animals are considered to be the coastal sage scrub ecosystem's most endangered organisms. Second, project scientists identified landscape areas within the urbanized zones that can provide connections between the critical habitat areas. These "corridors" allow populations to interact with each other, increasing their chances for survival. Third, scientists identified plant species that are endangered but not yet protected in the reserve areas and corridor zones. The habitat of these plant species also was incorporated into the reserve's design. Lastly, the scientists made sure to include a range of soils, terrain, slopes, and other landscape features to accommodate a wide variety of species. They did so by dividing the landscape areas into subunits defined by elevation, slope, latitude, distance from the coast, and soils. Subunits that were under-represented in the reserve were incorporated by adjusting the boundaries of the reserve and corridors.

These guidelines have allowed for the design of a viable ecosystem management area that lies in the midst of a highly urbanized region. Over one million acres have been voluntarily enrolled in the NCCP. This land includes 31 local jurisdictions, 37 private landowners/developers, and 53 percent of the known coastal sage scrub habitat within the planning area. Enrolled landowners have guaranteed that they will not disturb the scrub habitat and, under the guidance of the NCCP, the entire planning region has effectively begun work on a habitat conservation plan.



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The Berkshires of New England: Protective Buffer Zones Along the Westfield River



***"The primary objective...
is the establishment of a
protective river corridor or
'greenway'..."***

— Westfield River Greenway Plan

Rushing through the foothills of the Berkshire Mountains in western Massachusetts, the Westfield River traverses one of New England's most pristine wildernesses. Encroaching development catalyzed local citizens to initiate a grassroots river protection effort that delineated 100-foot "buffer" zones to preserve the natural character of the river. The land within the buffer zones would be protected by restrictions on the development of new structures, septic systems, sand and gravel removal, and commercial timber removal.

The Westfield River Greenway Plan's buffer zones are designed to:

- Preserve the aesthetic appeal of the river environment for the enjoyment of current and future generations
- Provide feeding, nesting, and cover for a wide variety of wildlife
- Protect the river's water quality by maintaining a natural vegetative filter to prevent erosion, sedimentation, and nutrient and pollutant runoff into the river and by shading the river to prevent water temperatures from rising to higher than optimal for fish survival and reproduction
- Help protect the free-flowing condition of the river
- Help protect human life and property from flood damage.

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- **Task Forces and Work Groups**-Task forces within the organization each address a and forces each implement an aspect of that goal.
- **Fundraising** - the to to avoid of form of obtaining grants from governments fairs as Way.
- **Budgeting** - to develop a funds, organizations some and effectively.

-
- **Legal Incorporation** – Becoming a legal non-profit entity has advantages for some organizations. They include tax exempt status, access to certain grants, and protection from personal liability for group members. Incorporation involves establishing a board of directors and organization bylaws; an attorney generally handles the incorporation process.

To summarize, the following story about *the Neponset River Watershed Association* illustrates many of the elements involved in initiating a community ecosystem protection plan.

To Learn



Other Local, State, or National Environmental Organizations – Many of these groups have been through some or all of these procedures and can provide valuable information on incorporation, budgeting, and funding sources.

Attorneys Familiar With Nonprofit Tax Law – An attorney develops bylaws and may be **able** to assist with other legal issues. Some attorneys donate their time for free to non-profit groups.

Grants From Private Philanthropies: Foundation Clearinghouses – The Foundation Center, located in New York, New York, phone: (212) 620-4230, and the Grantsmanship Center, located in Los Angeles, California, phone: (213) 482-9860, both provide information on how to **find** and obtain grants from **private** philanthropies, as well as a listing of **thousands of grant-providing** organizations.

Environmental Financing Information Network (EFIN) – EFIN provides **information** on government and private **financing sources** for environmental programs **run** by **community** groups, states, and **municipal** governments. The EFIN **Center** maintains an online **database containing abstracts of publications**, case studies, and contacts and operates a hotline. EFIN is managed by **Vera Hannigan** of the U.S. Environmental Protection Agency, and is located in Room 3304, 401 M Street SW, Washington, DC 20460, phone: (202) 260-0420, e-mail: efin@epamail.epa.gov.

The Catalogue of Federal Domestic Assistance – This publication, put out by the federal government, lists sources of grants from federal agencies and programs.

Publications – Many books **dealing with** running a non-profit corporation and navigating the tax laws are available at local libraries.

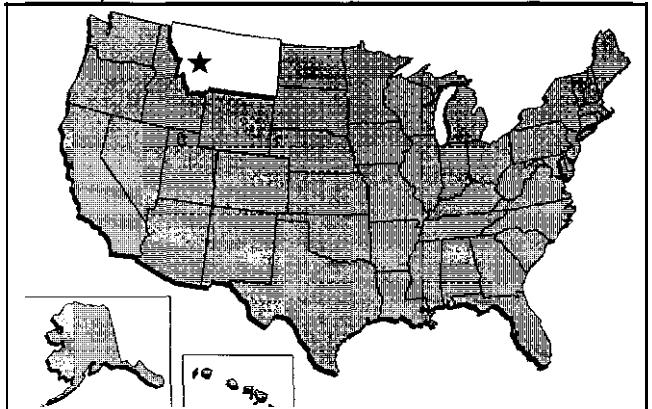
■ **Formalizing an Organization**

- Balling, David M., *How to Save a River: A Handbook for Citizen Action*, Island Press, Washington, DC, 1994. This book has a number of suggestions on fundraising and organizing yr effort.
- Cook, Christine M., *C(3) or C(4)? Choosing a Tax-Exempt Status*, River Network, Portland, OR, 1991.
- Hummel, Joan, *Starting and Running a Non-Profit Organization*, University of Minnesota Press, Minneapolis, MN, 1980.
- Mancuso, Anthony, *How to Form a Nonprofit Corporation*, Nolo Press, Berkeley, CA, 1990.

■ **Fundraising**

- Flanagan, Joan, *The Grassroots Fundraising Book: How to Raise Money in Your Community*, VOLUNTEER: The Citizen Involvement, Boulder, CO
- G., *What Volunteers Should Know for Successful Fundraising*, VOLUNTEER The National Center for Citizen Involvement, Boulder, CO.

Blackfoot River Valley, Montana: Using Existing Groups as a Springboard for Organization



The Blackfoot Challenge, a cooperative resource management initiative in the Blackfoot River Valley of Montana, has made the transition from a group of concerned individuals to a formalized, community-based working group focused on long-term ecosystem and economic viability in the valley. A key step in this transition was the development of a formal organizational structure that allows for and promotes representation of all interests in the valley.

The Blackfoot Challenge traces its roots to a meeting sponsored by the Big Blackfoot Chapter of Trout Unlimited. The meeting brought together government agencies, industry, conser-

vation groups, and landowners to discuss concerns and ideas for the future of the Blackfoot River Valley. Many local citizens concerned with the long-term environmental and economic health of the area were interested in finding a forum in which they could address these issues. Response to the initial meeting was overwhelmingly positive, and attendees decided that a formal organization should be created. At a follow-up meeting, the group formed the Blackfoot Challenge, and in the subsequent year the group reached consensus on a mission statement, goals, and an organizational structure.

Members of the Blackfoot Challenge designed the group to involve all stakeholder groups at all levels of decision making. The community group established bylaws that mandated a balanced representation of stakeholders on all committees. Prescribing equity in interest group representation on the committees gave the Blackfoot Challenge the credibility needed to attract diverse interests in the valley and ensure that no group was excluded from the process. Members of the Blackfoot Challenge note that during the early periods of the initiative, it was especially important to communicate to valley residents that the initiative included all stakeholders in the valley and was not led purely by environmental or industry groups.

The Blackfoot Challenge's organizational structure includes an executive committee that sets policies for the group and a steering committee that makes decisions on projects. Other committees address specific issue areas such as private lands, information, public relations, and funding.

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Tensas River Basin, Northeastern Louisiana: Ensuring the Sustainability of the Basin

In the Tensas (pronounced "ten-saw") River Basin, a group of citizens and agencies has analyzed the sources of environmental conflicts between farmers and conservationists and identified potential solutions. The resulting strategy addresses how to improve water quality, restore wetlands and wildlife habitats, and implement agricultural and forestry best management practices. The study also provides a detailed analysis of how proposed solutions affect the costs and profitability of farming in the region.

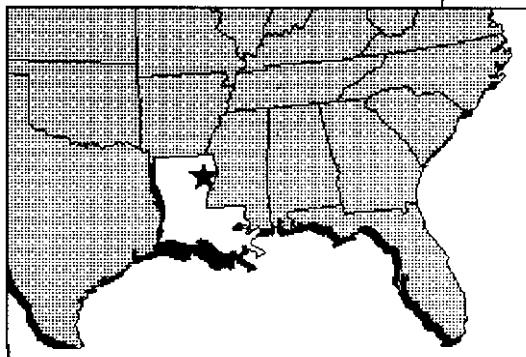
Spreading through the northeast corner of Louisiana, the bottomland hardwoods of the Tensas River Basin support some of the richest, most diverse, and most productive ecosystems in the country. This resource also creates conflicts between traditional row crop agriculture and resource conservation goals.

In 1991, the Tensas Basin Technical Steering Committee formed at a meeting of local, state, and federal officials, landowners, and conservation organizations to discuss a Soil Conservation Service river basin study. At the meeting, a core group decided to establish a model demonstration project to remedy the conflicts between traditional row crop farmers and resource conservationists through ecosystem restoration that considers economic viability.

Working by consensus so that any one member holds veto power, the 19-member committee (made up of a true cross-section of basin interests, including the U.S. Army Corps of Engineers, the local Levee District, The Nature Conservancy, six farmers, the Louisiana Department of Agriculture and Forestry, and many others) identified seven major watershed problems. Each major problem was broken down into component problems. These served as the driving forces behind the three recommended treatment options: best management practices, engineering methods, and bottomland hardwood restoration.

Best management practices refer to a set of land-use practices that reduce off-site damages while maintaining or improving productivity on cropland or forestland. According to one representative, "Only those [practices] deemed to be effective, efficient and acceptable to residents of the basin were considered."

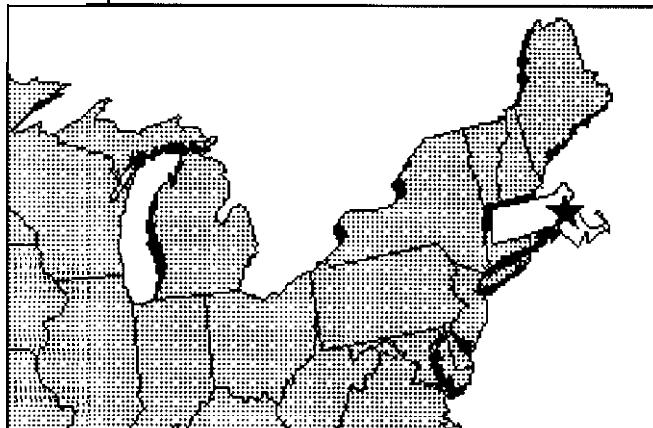
The Tensas Basin Technical Steering Committee developed a list of seven best management practices and their effectiveness in solving the watershed's problems (see sample below). Implementation of the options presented in the study depends heavily on voluntary efforts of local landowners, and technical and financial assistance.



Selected Best Management Practices	Recovery From Loss or Fragmentation of Habitats	Improvement of Water Quality, Impairment	Mitigation of Reduced Species Diversity
Conservation Cropping Sequence	.	.	.
Crop Residue Use	.	.	.
Filter Strip	.	.	.
Grade Stabilization Structure	.	.	.
Grassed Waterway	.	.	.
Structure for Water Control	.	.	.
Tree Planting	.	.	.

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Neponset River Watershed, Massachusetts: Citizen Action Charts a Path for Massachusetts River Restoration



Working to protect natural resources in a watershed that covers parts of 14 different Massachusetts cities and towns, including Boston, may seem like a huge task for a community-based effort. But that is exactly what the Neponset River Watershed Association (NepRWA) is doing and, by most accounts, doing very well. The association's efforts demonstrate how clear goals and inclusive, cooperative management and planning can bring together individuals, businesses, and government to support ecosystem restoration and preservation.

To collect data and monitor conditions in the 123-square-mile watershed, NepRWA depends on volunteer "stream teams". These local citizen groups document both the problem areas and positive aspects of streams and stretches of river within their own communities. Based on the information they gather, stream teams develop realistic action plans with both short- and long-term goals. Stream teams bring problems to the attention of officials within their cities and towns and work with them to address issues such as degraded habitat, illegal sewer hookups, erosion, dumping, and lack of access to the river for recreational use. NepRWA combines the observations of the stream teams with those of state and federal agencies to help develop overall management plans that are consistent with concerns throughout the watershed.

Although the stream teams work independently, NepRWA supports them by providing training and forums for communication with experts and with each other. NepRWA trains all the teams to use shoreline survey techniques developed by the state Department of Fisheries and Environmental Law Enforcement. When teams encounter especially difficult problems, they can turn to technical advisory groups (made up of industry experts and government officials) and members of other stream teams.

NepRWA also works at a broader level to make municipal governments and businesses aware of the value of restoring and preserving the watershed. The greater the awareness of watershed restoration and protection benefits, the greater the willingness to support the effort. Benefits include protection of a local aquifer that provides 150,000 area residents with drinking water, preservation of wetlands that slow and disperse the flow of flood waters and protect private property, and improvement of local property values resulting from maintaining a healthy river system.

NepRWA is piloting a process of community-based watershed management that will be replicated in 27 other river systems throughout Massachusetts. By including residents and businesses at the local level, and governments at the state, regional, and local levels, NepRWA achieves consensus in developing management plans while attracting resources and volunteers. The community focus of the watershed initiative is helping its residents learn their "ecological address" and increase their awareness that they are all connected by the waterways around them.

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Chapter

3 Assessing the Conditions of Local Ecosystems and Their Effects on Communities: Tools and Techniques

A doctor uses blood pressure, body temperature, and other data to monitor a person's health. In the same way, communities can assess and monitor the health of their ecosystems by collecting and analyzing various kinds of "indicator" data. A wide variety of indicators might be used. The kinds of indicators that are important depend on the characteristics of a community and its priorities.

This chapter describes what indicators are and explains their relevance to community ecosystem protection. Most communities have considered three types of baseline assessments:

- Assessing the health of local ecosystems and identifying factors ("stressors") affecting their quality
- Assessing links between local ecosystems and the local economy
- Assessing links between local ecosystems and the community's quality of life.

Note that while this chapter is divided into three types of assessments to simplify the presentation, there is substantial overlap among the three types. Ecosystem stressors discussed in the first section may be directly related to economic or quality-of-life indicators discussed later. The boundary between economic and non-economic quality-of-life measures is often fuzzy.

3.1 *Using Indicators*

What Are Indicators?

Indicators are measures that help you assess the health of local ecosystems, understand what factors are affecting ecosystem quality, and assess the effects of ecosystem quality on life in your community. Indicators provide insights into the condition, qualities, interrelationships, or problems of a complex system, such as an ecosystem or the local economy. Over time, tracking an indicator helps to measure progress toward a desired goal.

Most indicators are *quantitative*: they are numeric data based on actual measurement of the factor being monitored. *Qualitative* indicators generally attempt to describe a factor of interest, rather than measure it with precision. An example of a qualitative indicator would be a description of a local lakefront as “moderately polluted” or “very polluted”. Qualitative indicators are valuable because they can describe situations that cannot be measured with a single data series.

The accuracy and reliability of qualitative indicators depends on the knowledge and biases of the people providing information. Qualitative indicators can be difficult to interpret and may mean different things to different people. In contrast, quantitative indicators are less subject to conflicting interpretations.

Three general kinds of indicators are discussed in this chapter:



Why is species biodiversity important?

Ecologists often emphasize the concept of species biodiversity — that is, the number and variety of different species of plants and animals that naturally populate a given place. Because of the interdependence among these organisms, the loss of natural diversity can throw an ecosystem out of balance. For example, destruction of bat colonies can result in huge increases of insect-caused crop damage. Bats are one of nature’s most efficient insect predators. When bat populations are eliminated, insect populations soar and often overrun crops, forests, and other types of groundcover (such as suburban vegetable gardens). Natural biodiversity is often considered as a measure of an ecosystem’s sustainability, as well as its current health. In addition, species diversity is important because of the potential commercial value of rare species, such as drugs derived from rainforest plants. Finally, many people agree that biodiversity is intrinsically valuable, regardless of human uses for the species.

Indicators That Characterize Environmental Health

— For example, the number and variety of grass species is an indicator of a prairie’s ecological health. Because people are part of the ecosystem too, indicators of their health and safety are also useful.

Indicators That Reflect the State of the Local Economy

— These indicators track the economy as it is affected by the quality of ecosystem resources and services; for example, the number of people employed in commercial fishing or in industries that depend on a clean water supply (such as breweries and food processing).

Indicators That Reflect the Community’s Quality of Life

— These indicators track quality of life as it depends on ecosystem quality, such as the number of visitors to a public beach or levels of traffic congestion and vehicle miles traveled.

Why Use Indicators?

Using indicators is a shorthand method for obtaining representative information on the overall system. Each single indicator reflects only a part of the complex system. When indicators that measure key aspects of the system are looked at as a set, however, they reveal trends and interrelationships that might

not otherwise be apparent. For example, declines in bird populations on a lake shoreline in combination with data showing increased boating activity on the lake might suggest a cause for the reduced bird counts. Note, however, that comparing two data series does not *prove* a cause-and-effect relationship between them.

Indicators provide a relatively objective basis for discussion, planning, setting goals, and measuring progress. They help avoid the misdirected effort that might result

from simply reacting to the most obvious trends or relying on a few people's untested opinions about what actions should be taken.

Choosing Indicators

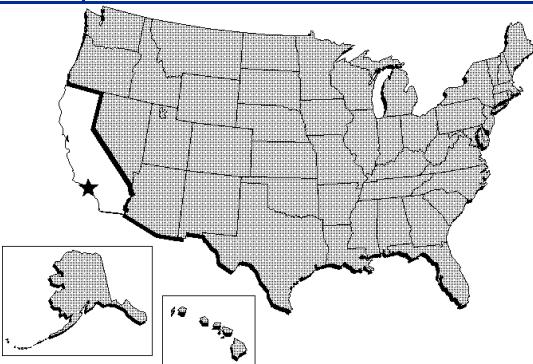
Some indicators address the community as a whole system — ecological, social, and economic. For example, while the amount of fish taken by a commercial or sports fishery may be of interest, this indicator may say little about the health of the aquatic ecosystem. Some more targeted indicators would include information on the presence of tumors in fish, the numbers of fish within age classes in the population, and the availability of their food resources — as overall indicators of the fishery's health. These indicators help to measure the sustainability of the local fishery, thus measuring both economic security and ecosystem stability and quality. For the *Santa Monica Bay Restoration Program* (see story on following page), citizens developed a list of potential indicators when evaluating what types of data were needed to create a comprehensive monitoring system for the bay. Their list illustrates the many characteristics different people considered when they thought about the health of one specific ecosystem.

Often, indicators need to be understandable and useful to a range of audiences, including the general public, public officials, and scientists. In communicating with the general public, less technical measures are often preferable. On the other hand, communications with public officials or scientists, perhaps when seeking future funding, often benefit from the use of more technical language. The difference may simply be in the wording of the indicator. For example, scientists wanting to protect water quality might find it useful to know specific bacteria levels in water. The general public, however, may find more useful the percentage and location of rivers and streams considered unsafe for swimming because of high bacteria levels.

One way to select indicators is by brainstorming with all interested parties to identify an ideal set, keeping in mind what is being measured. Ways to narrow down a list of possible indicators include looking at data sources, investigating sources of help, and deciding what information is most useful. Generally, monitoring a few key indicators well provides more useful information than monitoring a wide variety of indicators poorly. For example, a community may want to measure the recovery of an aquatic ecosystem by sampling the number of different types of benthic organisms (bottom-dwelling species such as worms and shellfish). Such a field survey may require a large budget, however. Instead, the community could track fish abundance or water quality as a proxy for ecosystem recovery. Also, data may already be available for developing certain indicators but not others; a less than perfect indicator supported by available data may be more practical than an ideal one that requires extensive data gathering.

In summary, good indicators will reflect stakeholder concerns, be readily understandable to their audience, be responsive to change in the ecosystem or community, and be appropriate for highlighting emerging ecosystem problems before they become irreversible. The *Sustainable Seattle Program* below provides a good example of effective community involvement in indicator development and selection.

Santa Monica Bay, California: Monitoring Ecological



The power of humans to destroy an ecosystem is awesome, but it is matched by the power of humans to protect and restore it.

Natural Stressors and Processes

- Chlorophyll a
- Salinity and temperature
- Water clarity
- Currents and hydrology
- Precipitation
- Storm duration, location, severity
- Regional sediment characteristics
- Site-specific sediment characteristics

Human Stressors and Processes

- Outfall effluent characteristics
- Storm-drain/river effluent characteristics
- Contaminant mass loadings
- Regional sediment contamination
- Site-specific sediment contamination
- Regional water quality
- Dredging location, timing, characteristics
- Shoreline habitat loss and modification
- Sport fishing locations and catch
- Kelp harvesting
- Oil spill location, timing, characteristics
- Human swimming patterns
- Human seafood consumption patterns
- Beach warnings and closings
- Sewage spills

The Santa Monica Bay Restoration Program (SMBRP) proposes a comprehensive monitoring system to measure the ecological effects on the bay and its human, wildlife, and plant populations. In 1988, concerned about the condition of the bay, local citizens joined with state and federal agencies to form the SMBRP. This coalition took on the responsibility of assessing the bay's problems, developing solutions, and putting them into action. The SMBRP has developed a plan of action that involves a diverse group of citizens and members of the government, scientific, and industrial communities.

One component of the SMBRP's activities is coordinating and integrating the existing monitoring programs in the bay and its watershed. As part of this program, the SMBRP has prepared a "Comprehensive Monitoring Framework" that suggests what types of data should be compiled. The following list groups SMBRP's potential measurements under headings that correspond to the three main public concerns:

Human and Biotic Response Indicators

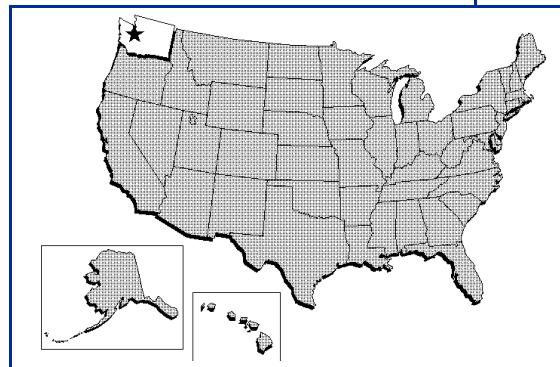
- Catch per unit of effort (by species)
- Fish abundance (by species)
- Fish egg and larval abundance (by species)
- Fish contaminant burdens (by species)
- Fish diseases
- Benthic invertebrate contaminant burdens
- Beached bird survey
- Bird survey in coastal habitats
- Bird counts and nesting success
- Migrant bird counts
- Bird birth defects
- Return of one-year-old birds and fish
- Wetland habitat type maps
- Exotic vs. native species
- Kelp bed location and extent
- Mammal abundance (by species)
- Number and cause of mammal beachings

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Seattle, Washington: Involving the Public in Selecting

Sustainable Seattle began in 1990 as a multiyear effort to make the greater Seattle region into a more ecologically and economically sustainable community. Project organizers recognized that the well-being of Seattle residents would play a key role in making sound policy choices. Therefore, the organizers placed a major emphasis on development of indicators that could measure community well-being.

The Sustainable Seattle group used a multistep process that emphasized community involvement to develop indicators. A core group of 25 trustees defined the scope of the project and served as advisors in the indicator-development process. A task team then was formed to generate an initial set of draft indicators in preparation for community participation. A final set of indicators was chosen at a series of civic forums where over 250 members of the community participated. At the first meeting, community members were introduced to the project, reviewed the task team's initial indicator suggestions, and identified additional indicators. Four more meetings were held over a period of five months, leading to the identification of nearly 100 sustainability indicators. Of these, 40 have been selected for publication in two groups. The first set of 20 indicators, published in *Indicators of Sustainable Community* (1993), included:



Environment

- Wild salmon runs through local streams
- Number of good air quality days per year
- Percentage of streets meeting "pedestrian-friendly" criteria

Population and Resources

- Total population of King County
- Gallons of water consumed per capita
- Tons of solid waste generated and recycled per capita
- Vehicle miles traveled and gasoline consumption per capita
- Renewable and nonrenewable energy (Btus) consumed per capita

Economy

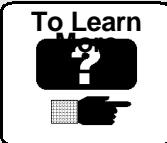
- Percentage of employment by top 10 employers
- Percentage of children living in poverty
- Housing affordability for medium- and low-income households
- Per capita health expenditures

Culture and Society

- Percentage of infants born with low birth weight
- Juvenile crime rate
- Percent of youths participating in some form of community service
- Percent of population voting in local primary elections
- Adult literacy rate
- Library and community center usage rates
- Participation in the arts

Each indicator was classified as moving toward, away from, or neither toward nor away from sustainability. Sustainable Seattle is now using the indicators and the development process to influence urban planning and implement programs that promote sustainable homes and businesses.

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Florida State University, *State Environmental Goals and Indicators Project*, in cooperative agreement with U.S. EPA, Washington, DC, August 1995, available from the U.S. EPA Community-Based Ecosystem Protection Clearinghouse, phone: (202) 260-5339 (see Appendix A). This report describes prospective environmental indicators that could be used in agreements that U.S. EPA negotiates with state environmental agencies. It is written for a technical audience, but contains a large number of indicators (with data sources) that could be useful for communities interested in assessing local environmental conditions.

Hart, Maureen, *Guide to Sustainable Community Indicators*, QLF/Atlantic Center for the Environment, Ipswich, MA 01938, May 1995, phone: (508) 356-0038, fax: (508) 356-7322, e-mail: atlanticr@igc.apc.org, price: \$12.50 (includes postage). This user-friendly guidebook is an excellent resource for those interested in assessing the ecological/environmental and socioeconomic quality of their community. The guidebook describes the process of developing, evaluating, and using indicators at the community level in a step-by-step approach. It contains a set of sample indicators, evaluated by the author, as well as a list of other community sustainability projects, potential data sources, and references.

Hren, Ben, Nick Bartolomeo, and Michael Singer, *Monitoring Sustainability in Your Community*, The Carrying Capacity Project, The Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878, 1995, phone: (301) 548-0150, e-mail: general@iwl.org, price: \$2.00 (includes postage). This brief, easy-to-

3.2 Assessing Conditions and Trends in Local Ecosystems

Your community may have begun its ecosystem protection effort in response to some actual or potential threat. Perhaps you have observed a decline in the number or diversity of birds that inhabit a local forest, or have grown concerned that open space in your town is disappearing due to sprawling residential development. This section describes some processes and tools for understanding and communicating information on the health of ecosystems.

Indicators of ecosystem health serve two purposes. First, they define the problems you are trying to address. Second, they track progress over time from a starting point or “baseline”. Collecting consistent data over time and comparing them to the baseline data enables an evaluation of whether the actions taken to protect ecosystems are actually working.

Specific Indicators of Ecosystem Health

Community characteristics (such as urban vs. rural, coastal vs. inland) and environmental problems affect the choice of ecosystem health measures. For example, a community may be interested in determining the degree of biodiversity in local ecosystems. A specific indicator would be the number of bird species found in an annual bird count. This number could be compared to counts from previous years to evaluate the trend in biodiversity. The first two columns in Table 3-1 provide several examples of broad ecosystem assessment objectives and some specific indicators that could be used to address these objectives.

use handbook presents 12 indicators, compiled from projects across the nation, to assess a community's quality of life, consumption of natural resources, and the condition of local ecosystems. Each indicator is described, including reasons for selection and ways to obtain and use source data.

MacLaren, Virginia, *Developing Indicators of Urban Sustainability*, Intergovernmental Committee in Urban and Regional Research (ICURR), 150 Eglinton Avenue East, Suite 301, Toronto, ON M4P 1E8, Canada, May 1995, phone: (416) 973-1376, fax: (416) 973-1375, price: \$31.75 Canadian (approx. \$25.00 US). This report is a comprehensive review of indicator characteristics, frameworks (including state-of-the-environment, quality of life, and healthy city reporting), and selection criteria. It is well-illustrated with examples of community indicators used throughout the United States and Canada.

U.S. Environmental Protection Agency, *Process for Selecting Indicators and Data and Filling Information Gaps - Final Report*, Washington, DC, July 1994, available from the U.S. EPA Community-Based Ecosystem Protection Clearinghouse, phone: (202) 260-5339 (see Appendix A). This report presents a process for selecting indicators and data sets to measure the current status, patterns, or trends of environmental quality. It is written for technical managers within EPA who are responsible for specifying and quantifying such indicators.

To start defining ecosystem assessment objectives, it might be useful to consider the physical, biological, or chemical changes the system has undergone. Relevant questions may include:

▪ **Physical Changes to the Ecosystem** — How has the structure of the system changed? Has the number and/or kind of habitat types in the area changed? Has the size of a forest area declined? Has the amount of water flowing through a river changed? Are wetland areas shrinking? How much low-density development of "greenfields" (such as farmland, forests, meadows, open space) is occurring? How much development is occurring on parcels of land not adjacent to existing urban areas? How much habitat remains of the original area? Is the remaining habitat fragmented?

▪ **Presence of Harmful Chemicals** — Are toxic chemicals, excessive nutrients, or other pollutants present in the soil, air, or water, or in the plants and animals living in the ecosystem?

▪ **Biological Damage to the Ecosystem** — Physical and chemical changes to the ecosystem are likely to produce changes in the plants and animals that are



Habitat Fragmentation

Many species of wildlife require habitat of certain minimum size to survive. Residential or commercial development, forestry, farming, road building, and other land use practices can break up continuous habitat into smaller sections less capable of supporting the species. For example, if patches of unharvested natural forest are small or isolated, some species may disappear, threatening the long-term sustainability of the overall forest ecosystem (Freedman, 1995). Many land conservation efforts attempt to protect large areas, avoiding fragmentation, or to provide corridors connecting separate areas to allow wildlife to move among them.

Table 3-1

Information Sources For Assessing Ecosystem Health		
Overall Assessment Objective	Sample Indicators	Possible Sources of Information
Measure changes in species biodiversity	Number of species in an annual bird count Ratio of abundant species to those classified as endangered	<ul style="list-style-type: none"> ▫ Local chapter of National Audubon Society ▫ The Nature Conservancy and state governments have developed Natural Heritage Programs that collect and record site-specific information on the location of rare, endangered, and threatened species (see Appendix A) ▫ State fish and wildlife agencies (see Appendix A) ▫ Biology/ecology departments at state colleges and universities ▫ Gordon, Rue E., ed., 1996 <i>Conservation Directory</i>, National Wildlife Federation, 1400 Sixteenth Street NW, Washington, DC, 1996, ISBN 0-945051-60-3, phone: (202) 797-6800, Internet Website: http://www.nwf.org.nwf
Assess trends in abundance of various ecosystem components and habitat areas	Acreage of grassland	<ul style="list-style-type: none"> ▫ State environmental agencies (see Appendix A), conservation division ▫ Agencies with photomaps and computerized land-use data include the U.S. Department of Agriculture, phone: (202) 720-2791, and the U.S. Geological Survey, phone: (703) 648-4000
	Acreage of wetlands	<ul style="list-style-type: none"> ▫ U.S. Fish and Wildlife Service, <i>National Wetlands Inventory</i>, documents developed for each state; see Internet Website: http://www.nwi.fws.gov/ for more information ▫ U.S. Army Corps of Engineers, <i>Federal Manual for Identifying and Delineating Jurisdictional Wetlands</i>, Washington, DC, 1989 ▫ The Association of State Floodplain Managers, Madison, WI, phone: (608) 274-0123
Assess air quality (current and trends)	Number of days each year that air quality standards are met	<ul style="list-style-type: none"> ▫ State environmental and public health agencies (see Appendix A) ▫ EPA's Aerometric Information Retrieval System (AIRS) contains data from stations across the country. U.S. EPA, Office of Air and Radiation, AIRS Database, Internet Website: http://www.epa.gov/airs/airs.html
Investigate presence of toxic pollutants in various media (current and trends)	Soil: Percentage of samples above U.S. EPA/state standards for health and ecological risk	<ul style="list-style-type: none"> ▫ Property Inspections: Many states require that commercial property owners perform environmental assessments before selling property. These assessments generally include sampling for toxic chemicals in soil and ground water. Contacts include state environmental agencies (see Appendix A) and local real estate boards. - Natural Resource Conservation Service (formerly the Soil Conservation Service), <i>National Resources Inventory</i>, phone: (202) 720-4530
	Ground water: Percentage of samples above U.S. EPA/state standards for health risk	<ul style="list-style-type: none"> ▫ State and local municipal public works departments ▫ U.S. Geological Survey, phone: (703) 648-4000 and state geological surveys ▫ Regional water supply authority ▫ U.S. EPA, Office of Ground Water and Drinking Water, Federal Reporting Database System, phone: (202) 260-7276 ▫ Property inspections (see above)
	Drinking water: Location and condition of drinking water wells	<ul style="list-style-type: none"> ▫ State office responsible for wellhead protection programs
Assess trends in surface water quality	Percentage of samples from surface waters meeting U.S. EPA/ state water quality standards	<ul style="list-style-type: none"> ▫ <i>State 305(b) Reports on Water Quality</i> - U.S. Geological Survey, <i>National Water Information Clearinghouse</i> ▫ U.S. Department of Agriculture, Water Quality Information, phone: (202) 426-9000 ▫ EPA's Storage and Retrieval database (STORET) contains information on surface water, ground water, soil, and fish tissue quality. U.S. EPA, STORET, phone: (202) 260-7030 ▫ U.S. Geological Survey maintains the National Stream Quality Accounting Network (NASQAN), collecting data at specified sites across the country. U.S. Geological Survey, NASQAN, phone: (703) 648-6870 ▫ Citizens' monitoring program (see text); U.S. EPA, Office of Water, <i>National Directory of Voluntary Environmental Programs</i>, phone: (202) 260-7018; listing of citizen-based water monitoring programs by state at Internet Website: http://www.epa.gov/OWOW/sec5/dir.html
	Percentage of tissue samples from fish or shellfish showing unsafe toxics concentrations	<ul style="list-style-type: none"> ▫ State public health agencies - State fish and wildlife agencies ▫ National Oceanic and Atmospheric Administration, <i>National Shellfish Register</i>, phone: (703) 487-4650 ▫ U.S. Fish and Wildlife Service, National Contaminant Biomonitoring Program, phone: (703) 358-2148
	Number of health warnings issued to anglers and swimmers	<ul style="list-style-type: none"> ▫ U.S. EPA, Office of Water, <i>National Listing of Fish and Wildlife Consumption Advisories</i>, phone: (513) 489-8190, Internet Website: http://www.epa.gov/OW/OST/Tools ▫ Consumption advisories and data on beach closures from state fish and wildlife agencies ▫ Swimming advisories from state public health agencies

part of the ecosystem. Among the questions these changes raise are: Has the number or type of species inhabiting the ecosystem changed? Are the species present healthy and flourishing? Are the types of species present typical of a healthy ecosystem? Are there any rare or endangered species present and at risk? Are there any invader or exotic species present? The ecosystem survey conducted by the *Owl Mountain Partnership in North Park, Colorado* (see following page) is a good example of how resources can be pooled to develop an inventory of species present in a given ecosystem.

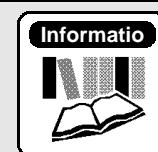
Developing an Historical Perspective

Analyzing the historical condition of an ecosystem helps assess its current health. Identifying man-made and naturally occurring forces that have affected the ecosystem also can help set sensible project goals, providing reference points for measuring progress.

For example, publicizing that a severely degraded local ecosystem once supported a large number and variety of birds and other wildlife can act as an incentive for local officials, business people, environmentalists, and the general public to restore it. Moreover, by understanding the system's history and the ways in which it was exposed to different stressors, communities can help evaluate the relative impact posed by these stressors. For example, a decline in wildlife populations may be caused more by a dam placed on a major river than by pollution associated with industrial activity. Understanding how events led to the current condition helps communities weigh alternative actions for restoring and protecting the ecosystem.

Other communities have found the following information sources useful in seeking out historical information on local ecosystems:

- **Surveys of the Community and Anecdotal Information** — Other communities have found a survey of the community to be very valuable. A survey not only will gather the public's ideas on how the quality of the ecosystem has declined, but will help publicize your project. In addition, informal conversations with older residents can be an excellent source of anecdotal historical information.
- **Local Historical Information** — Depending on the size and location of the community, a number of institutions may be able to provide information on the community's history and the evolution of the ecosystem. Possible examples include the local library, town or regional historical societies, colleges and universities, and local non-profit organizations such as land trusts. If useful local histories do not already exist, a local high school or college student may be able to develop a project on ecosystem history. Deeds and maps from the county registry of deeds or municipal offices also may provide historical information.

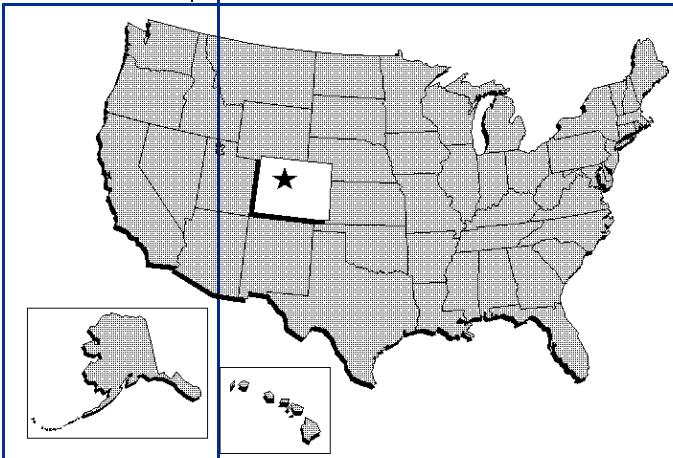


Erosion and Its Effects

Agriculture, timber harvesting, real estate or other land development, and other land-clearing activities are often the source of physical stress on ecosystems. The most visible consequence is often erosion, which occurs when trees and other vegetation that hold soil in place are removed, letting wind, waves, rainfall, and other forces eat away at the topsoil. Erosion may prevent regrowth of plants and may threaten the stability of houses, roads, and other construction.

One of the major ecological problems associated with erosion is siltation. Siltation results when excess soil is deposited in slow moving streams and rivers, smothering plants and bottom-dwelling organisms and covering important fish habitat. Some fish, such as salmon, require clean gravel streambeds in which to spawn. For these fish, siltation could result in the loss of critical breeding habitat.

North Park, Colorado: The Owl Mountain Partnership's Ecosystem Survey



The Owl Mountain Partnership in north-central Colorado has undertaken a comprehensive survey of the area's natural resources. The inventory is being used to define the desired future condition of the area and to support the establishment of resource management plans in the region.

Local citizens formed the Owl Mountain Partnership to address natural resource management issues in the North Park area of north-central Colorado. The partnership is composed of local citizens, landowners, associations, and federal, state, and local government agencies. Its goal is to serve the economic, cultural, and social needs of the community while developing adaptive long-term landscape management programs, policies,

and practices that ensure ecosystem sustainability.

During the first three years of the partnership, the partners conducted a comprehensive inventory of the area. An inventory of vegetation, soils, wildlife (including large mammals and neotropical birds), and aquatic systems began in 1994. Members of the Partnership, including the U.S. Forest Service, the Bureau of Land Management, and other interested groups and agencies, conducted the inventory. The Partnership relied on grants, in-kind services, and borrowed materials, such as vehicles and equipment, to complete portions of the survey. Before the inventory began, existing information from all agencies in the area was

- **Newspaper Archives** — Old newspaper articles, often accessible through microfiche or online services available at the local library, can provide a great deal of historical information about an ecosystem.
- **Local, State, and Federal Land Management Agencies** — Agriculture, forestry, mining, fish and wildlife, grazing (such as the U.S. Bureau of Land Management), and biological agencies (such as the U.S. Biological Service) may have historical maps or other descriptions of the numbers, types, and range of native flora and fauna for the area. For other sources of information (for example, hunting/fishing records, homestead records), you can contact the U.S. Bureau of Indian Affairs, railroad archives, the Library of Congress, the U.S. National Archives, and the Smithsonian Institution.
- **Natural Heritage Programs** — The Natural Heritage Programs operated by the states may have information on the characteristics of unspoiled natural areas in your region; these areas may serve as useful "reference points" that show the former condition of the ecosystem. Appendix A provides a phone listing for the Natural Heritage Programs.
- **GIS Maps** — A geographic information system (GIS) is a computer technology that develops maps of a specific geographic area. These maps can depict a

compiled and analyzed for gaps in data. These gaps became the focus of the inventory, so that the result would be a comprehensive inventory of the area.

A major challenge of the project was to have the different agencies adopt a standard method of surveying vegetation. The Forest Service and the Bureau of Land Management typically use different methods, yet it was important to survey the region employing a common technique so that data would be consistent and easily shared. Several meetings with the involved parties were held and a single vegetation inventory method was developed.

The survey provided a comprehensive inventory of federal, state, and private lands. While some land owners remain wary of the project, several ranchers realized a benefit from opening their gates to the survey. As part of their participation, they received assistance from the partnership to improve their land management practices.

The survey is now complete, and the partners are using the results to develop individual and small-group management plans that integrate the partnership's landscape approach to managing the area's resources on a sustainable basis.

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range of both man-made and natural features. The information box on the next page provides information on GIS analysis.

Gathering Technical Data

Once you have a good idea of how the ecosystem arrived at its current state, you can assemble a more detailed and rigorous evaluation of current conditions. This assessment will allow your community to identify those components of local ecosystems that currently are degraded or at risk and evaluate the extent of the problem. This will provide a baseline "snapshot" of ecosystem health against which protection measures can be evaluated.

Local, state, and national agencies collect an enormous amount of environmental data. The information ranges from observations about the general appearance of an ecosystem to detailed analyses of emissions of toxic compounds from industrial sources. Table 3-1 (on a preceding page) presents suggestions for data sources that may help in assessing the health of an ecosystem. Appendix A to this resource book provides additional phone and Internet listings for many relevant organizations. The information in Table 3-1 and Appendix A is by no means intended as an exhaustive list; rather, the sources identified are provided as potential starting points for your data search.

Many of the data sources suggested in Table 3-1 can be difficult to use and understand without proper training. Many databases require special technical knowledge and are not especially “user-friendly”. A private consultant or a faculty member or student volunteer from a local college or university can provide expertise needed to help identify, collect, and interpret the desired information.

Many of the information sources will fall into one of several categories: government agencies; non-governmental organizations; local resources; and reports, databases, and computer models.

Government Agencies

State or federal environmental agencies can help locate data to assess ecosystem health. While the workings of the agencies devoted to environmental protection may be unfa-



Geographic Information Systems

A geographic information system (GIS) is a technology that stores, analyzes, visually displays, and maps data about a geographic area. GIS can be used to define ecosystem boundaries, assess ecosystem health, and identify sources of ecosystem stress. A GIS analysis can graphically display different types of information, such as soils and habitat types, locations and concentrations of different species, roads, industrial facilities, and other man-made features. For example, a GIS analysis might show where industrial facilities discharging toxic compounds are located relative to contaminated sections of streams and rivers. In this way, a GIS can help link sources of ecosystem stress with observed impacts, and help develop strategies to alleviate those impacts. Some commercial GIS programs are simple enough to run on a personal computer; however, their use often requires special training and expertise. GIS consultants or GIS services available through state or local planning authorities can provide assistance. The most expensive and difficult part of a GIS analysis is obtaining data in “digitized” form so it can be used with GIS software; therefore, it’s helpful to locate data before embarking on an analysis.

For more information, you may want to consult the following sources of GIS information:

- U.S. Geological Survey, National Mapping Program, phone: (800) USA-MAPS, Internet Website: <http://www-nmd.usgs.gov>
- URISA, *GIS: World Source Book*, 1996, phone: (800) 447-9753
- American Planners Association, *GIS: Assessing Your Needs and Choosing a System*, APA No. 433
- U.S. EPA, Office of Research and Development, National Conference on Problem Solving with Geographic Information Systems, Cincinnati, Ohio, September 21-23, 1994, EPA/625/R-95/004, September 1995
- U.S. EPA, National GIS Program, Internet Website: <http://www.epa.gov/ngispr/>
- Federal Geographic Data Committee (FGDC), Internet Website: <http://fgdc.er.usgs.gov>
- Your state department of environmental protection (see Appendix A) or planning agency.

miliar, a few strategic phone calls may take you far. State environmental agencies often have published reports on statewide environmental conditions. These “environmental indicators” or “state of the environment” reports provide a useful overview of trends in the state and may point to other data sources. The state agency is also likely to be familiar with the local area and should be able to offer guidance on other regulatory agencies (such as federal organizations or other state and local agencies) that can help further.

As reflected in Table 3-1, the choice of other governmental agencies to contact depends on the type of ecosystems you are assessing. For example, for investigating pollution effects on waterfowl, state or federal departments of fish and wildlife may be helpful. Likewise, surface water quality issues are addressed by a variety of organizations, including state environmental protection agencies, the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, and the U.S. Geological Survey. Addresses and phone numbers for many of the major federal organizations are included in Appendix A.

Non-Governmental Organizations

In addition to government agencies, a large number of non-government organizations provide information to assess ecosystem quality. For example, conservation groups such as The Nature Conservancy and the National Audubon Society and state Audubon societies may be useful in assessing the quantity and quality of local wildlife habitat. Grant programs administered through universities may also be an important source of information.

While Table 3-1 offers a few examples of relevant non-governmental organizations, the general information directories in the “To Learn More” listings provided at the end of this section give more general listings.

Local Resources

A variety of local resources also may prove helpful in searching for ecosystem assessment information. For example, local public health agencies may have information on swimming advisories associated with local beaches, and may even keep more detailed water quality data. Data on soil and/or ground-water quality may be available through real estate transaction records that require environmental inspections prior to property sales. The results of such inspections may be available from the local registrar of deeds or real estate board. Likewise, the local Audubon chapter may conduct bird counts.

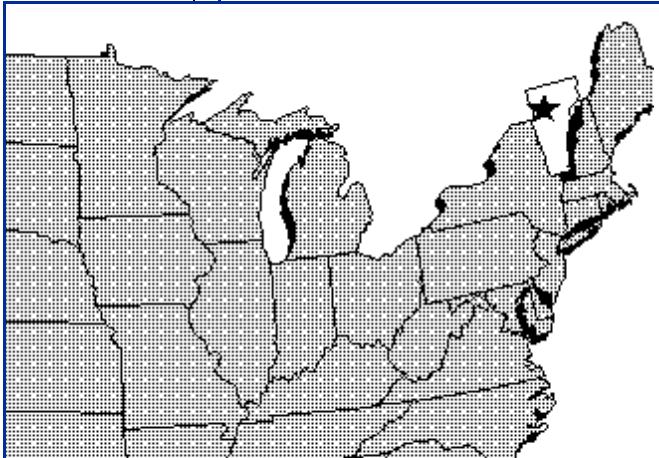
In addition, the community can gather its own data. Numerous citizen-based monitoring programs exist throughout the United States. For example, some groups gather water samples and submit them to centralized testing facilities operated by the state or federal government. As discussed in the story, *Keeping Track in*



Monitor Your Own Ecosystem

Communities can collect data to evaluate their own ecosystems. Many volunteer organizations monitor physical, biological, or chemical conditions in the environment. Many of these groups also provide assistance to others who want to learn how to conduct their own ecosystem monitoring programs. For example, communities monitor water quality through programs such as the Izaak Walton League of America’s Save Our Streams Program, phone: (301) 548-0150. Likewise, you can contact EPA’s Office of Water and ask for the *National Directory of Voluntary Environmental Monitoring Programs*, phone: (202) 260-7011. EPA’s Internet home page also lists existing citizen monitoring programs by state; for information see Internet Website <http://www.epa.gov/OWOW/sec5/dir.html>.

Keeping Track in Northern Vermont: A Community Effort to Protect Wildlife Habitat



of land through which the animals travel from one large block of habitat to another.

To ensure that the volunteers possess all the required skills and knowledge to do the job, the eight townships involved in the process have called on Keeping Track, a Vermont-based, non-profit organization that provides training and support. Volunteers must complete a training program that consists of six days of instruction in the field and two evening "classroom" sessions. After completing the training program, citizen-volunteers perform track and sign

If you find yourself hiking in northern Vermont, don't be surprised if you see teams of curious people searching the countryside for clues. They're citizen volunteers, dispatched by community conservation groups to look for tracks, fecal matter, and other evidence (referred to collectively as "sign") of wild animals in the area.

By gathering data on where animals live and the routes along which they travel, these trackers are helping their communities make informed decisions about ecosystem protection, land-use planning, and development. Trackers report their findings back to local conservation commissions that analyze the data to determine habitat areas that require protection — especially narrow corridors

Northern Vermont, citizens there and elsewhere track wildlife populations and other aspects of environmental quality.

In addition to formal monitoring organizations, communities have assembled information on ecosystem quality by enlisting the help of local schools or youth programs such as AmeriCorps.

Reports, Databases, and Computer Models

All of the organizations discussed above may have materials that can be of use in a community's ecosystem assessment effort. These materials may include reports, databases, or computer models that already contain information on the ecosystems you are trying to evaluate. For example, the U.S. EPA requires that each state develop a biannual report on water quality. These reports — referred to as "305(b)" reports for the section of the federal Clean Water Act which mandates them — characterize water quality statewide and classify individual water bodies according various use categories such as "swimmable" and "fishable". You can obtain your state's 305(b) report through the water quality office in the state environmental protection agency.

Numerous environmental assessment databases are available on diskette and often via the Internet. Table 3-1 provides just a few examples. For instance, environmental agencies have developed numerous databases reporting the results of environmental monitoring for various media (air, water, soil). Likewise, the Natural Heritage Programs have compiled data on the location of rare and endangered species. The "To Learn More" references at the end of this section provide listings of available

surveys — a scientific observation method that ensures accurate data collection.

Part of the Keeping Track program is helping community groups choose which species to track. In northern Vermont, the program gathers data on five area-sensitive species: bobcat, black bear, fisher, river otter, and mink. Protecting these animals is important because they are particularly susceptible to habitat loss and degradation. Furthermore, safeguarding the habitat of these species ensures that habitat is protected for myriad plant and animal species within the ecosystem.

Citizen involvement in the process has brought together people from diverse backgrounds, including birders, hunters, anglers, farmers, and foresters. The diversity within these volunteer groups has helped to build a broad base of support for ecosystem protection among northern Vermonters.

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KeepingTrack
Wolfrun, RFD 1 Box 263
Jericho, VT 05465
Phone: (802) 899-2023

Keeping Track is active across the United States in consulting and advocating for community-based habitat protection. It currently is working on projects in Arizona, California, and throughout northern New England.

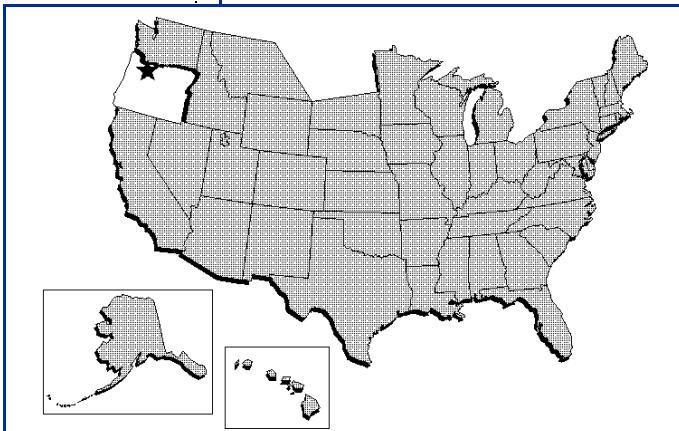
databases. An Internet search on concepts relevant to your ecosystems (for example, “Alabama wetlands”) may also provide information on databases.

Geographic information may be especially helpful in ecosystem assessment. Many state and county governments collect information and aggregate it by ecosystem or other geographic indicator. In addition, many federal agencies, including the U.S. EPA, U.S. Forest Service, and the U.S. Geological Survey, have developed computerized geographic information systems to display various types of information (including ecological information) on electronic maps. *The Metropolitan Greenspaces Program in Portland, Oregon* used aerial photography and GIS technology to inventory open space in and around the city (see following page).

Finally, more sophisticated tools are available for assessing ecosystem health. Government officials and academic researchers have developed computer models that evaluate whether ecosystems are functioning properly. Local university researchers can help in performing these types of analyses. Examples include:

- **Habitat Evaluation Procedure (HEP)** — This model, designed by the U.S. Fish and Wildlife Service (FWS), allows the user to assess habitat quality based on the habitat’s ability to support a specific species or group of species. The model typically is used to evaluate proposed projects and determine mitigation steps needed following oil spills or other pollution events. For more information, contact FWS’s National Ecology Center, 2627 Redwing Road, Fort Collins, CO 80526-2899.

Portland, Oregon: Analytical Tools Protect Greenspace



"The analysis relied heavily on... geographic information system technology... to determine which [lands] are already protected and constitute potential components of a larger interconnected system."

The Metropolitan Greenspaces Program (encompassing the Portland, Oregon, and Vancouver, Washington, metropolitan region) has a well-defined vision: "To maintain the urban region as a place where nature is valued as an important element of livability." The program planners (non-profit organizations and local agencies working on greenspace and wildlife protection) joined together to address a critical next step in translating that vision into a visual analytical tool — a single greenspace map covering the four-county, bi-state metropolitan region. Making the map required a thorough inventory and analysis of natural areas that could be woven together to form a single greenspace portrayal.

Just what are natural areas? The inventory team had to define "natural areas" before making the maps. They recognized that a natural area may be viewed as a self-sustaining area that would not change dramatically if all human influences were removed. For this inventory, however, they needed a clearer definition and decided on the following: "a landscape unit (a) composed of plant and animal communities, water bodies, soil, and rock, (b) largely devoid of man-made structures, and (c) maintained and managed in such a way as to promote or enhance populations of wildlife." This eliminated landscapes such as golf courses and agricultural land.

The geography department of Portland State University carried out the inventory, which involved:

- **Wetland Evaluation Technique (WET)** — The WET model provides a broad assessment of ecosystem health and can be applied to a wide variety of wetland assessment needs. It provides replicable, consistent results describing the ecological functions supported by a wetlands area. This information can be used to inform planners about the local, regional, and national significance of the area. For more information, contact the U.S. Army Corps of Engineers, phone: (202) 761-0660.
- **Gap Analysis** — Gap analysis is a method for identifying high priority areas for conservation efforts. It uses maps to compare ecosystem types with current land ownership and management status. Where important landscape types or species habitats currently are not included in protected areas (such as parks, refuges, or preserves), areas representing those landscapes or species might be selected as targets for conservation efforts. The U.S. Fish and Wildlife Service is conducting a large-scale state-by-state Gap Analysis Project using satellite imagery, other data on vegetation, and GIS mapping. This project is described

- Obtaining aerial photographs at a cost of \$109,000, paid for by contributors who received discounts when purchasing aerial photos
- Using color infrared aerial photographs to identify and map natural areas, and collecting onsite data through field surveys for a sample cross-section of natural areas
- Digitizing maps and entering field data into a geographic information system (GIS) spatial database.

Once the maps were complete, analysis of the data established criteria for evaluating the ecological functions of, and connections between, these natural areas. Human values (such as access or distance from residential populations), as well as wildlife values (such as the interconnectedness of sites by stream or ridge line corridors), were considered in developing criteria. The analysis relied heavily on the GIS as a tool to relate natural area patterns to land uses, zoning, utility rights-of-way, and soil and slope information. This type of evaluation helped to focus the program on priority land acquisition sites.

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in Noss, Reed F. and Allen Y. Cooperrider, *Saving Nature's Legacy*, Defenders of Wildlife and Island Press, Washington, DC, 1994.

Linking Stressors With Impacts

After characterizing the current state of the system and noting areas of concern (such as wetland loss, decline in plant or wildlife species), it is possible to identify the sources of those problems. For example, natural fish populations may be in decline, but why? Is it due to chemicals from industrial dischargers, over-fishing, or the damming or channelization of the river? Stress on an ecosystem can come from a wide range of sources, including industrial and municipal sources discharging toxic chemicals, agriculture and livestock feedlots, petroleum and chemical storage tanks, mining (for instance, acid mine drainage), recreational activities (such as stream bank erosion caused by boats and jet skis), water withdrawal by industry and utilities, septic tanks and other development impacts, and waste management. Appendix C of this resource book discusses stressors in more detail.



Gale Research, Inc., *Encyclopedia of Environmental Information Sources*, Gale Environmental Library, Detroit, MI, ISBN 0-8103-8568-6, price: \$125. Arranged by subject matter, this reference guide provides listings of relevant agencies, online databases, and research centers.

Gordon, Rue, E., ed., *1996 Conservation Directory*, National Wildlife Federation, 1400 Sixteenth Street NW, Washington, DC 20036-2266, ISBN 0-945051-60-3, 1996, phone: (202) 797-6800, Internet Website: <http://www.nwf.org.nwf>.

Harker, Donald, and Elizabeth Ungar Natter, *Where We Live: A Citizen's Guide to Conducting a Community Environmental Inventory*, Island Press, Covelo, CA, ISBN 1-55963-377-8, 1994. This guide describes sources and effects of contamination in simple terms, and suggests methods for collecting and mapping local environmental information. It includes definitions of technical terms and useful worksheets for organizing your data.

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 EPA partners, this guide provides a roadmap to EPA information services, contacts, and products.

Proving precise cause-and-effect relationships can be difficult when identifying stressors and their sources. You can identify stressors using scientific data or even computer modeling techniques, but these options may be beyond your resources or technical capabilities. Often, careful observation of local land-use conditions, and interviews

with experts or those in other communities that have faced problems similar to yours, are all that's needed. You can then verify your initial hypotheses using more precise data.



Fertilizers and Eutrophication

Fertilizers used on residential lawns in agriculture, home gardening, and golf course maintenance are often washed by rain to rivers and lakes. Once in the water, the fertilizer can cause algae to grow quickly. This growth can prevent sun from reaching water plants that are an important part of the aquatic ecosystem. Furthermore, the algae can use up the available oxygen in the river or lake, causing unpleasant odors and killing animals that need oxygen to live. Ultimately, the ecosystem will be undermined and the population of fish and other species will dwindle. This entire process is called eutrophication. For example, runoff to Chesapeake Bay has caused eutrophication, damaging shellfish beds and eelgrass meadows that young fish use as nurseries. In turn, commercial fin-fishing and shellfishing revenues have declined.

Both localized sources (e.g., a specific pollution source or local activity) and broader area- or region-wide trends may affect local ecosystems. Some stressors come from outside the local area — such as long-range transport of air pollutants. State officials involved in the voluntary Ozone Transport Assessment Group can provide information about these sources. In addition, data on regional and local trends in population, vehicle use, business activity, home construction, and power gen-

eration provide useful background that may point to stressors, which then might be investigated through more direct data sources such as those identified in Table 3-2.

Reviewing the stressors identified by other community efforts gives an idea of what stressors might exist in your community. General publications on environmental protection programs also provide useful lists of potential stressors. (See, for example, U.S. EPA Office of Water, *Wellhead Protection Program: Tools for Local Governments*, EPA 440/6-89-002, April 1989.)

U.S. EPA, National Center for Environmental Publications and Information, 11029 Kenwood Road, Cincinnati, OH 45242, phone: (513) 489-8190.

U.S. EPA also has developed outreach and assistance materials designed to help communities learn about and analyze the local environment. In conjunction with Purdue University, EPA Region 5 has developed software packages for use on personal computers. These software packages allow users to analyze a variety of topics. For example, one program helps users understand and assess water pollution risks from local livestock management. Another program discusses how toxic pollutants affect fish and explains fish collection and survey methods. In all, a total of 43 programs are offered on disk from Karen Reshkin, U.S. EPA Region 5, 77 W. Jackson Boulevard, Chicago, IL 60604-3590, phone: (312) 353-6353, e-mail: reshkin.karen@epamail.epa.gov, Internet Website: <http://www.epa.gov/grtlakes/seahome>.

Two communities that have performed comprehensive stressor evaluations are discussed in the stories on the *Upper Great Lakes* and *West Virginia* (see following pages).

3.3 Assessing Links Between Ecosystems and the Local Economy

Local Economies Depend on Ecosystems

The Federal Interagency Ecosystem Management Task Force has said that sustaining the health, productivity, and biological diversity of ecosystems, “is essential to maintain the air we breathe, the water we drink, the food we eat, and to sustain natural resources for future populations.” As this quote indicates, our lives are greatly influenced by the healthy functioning of ecosystems.

Ecosystem Components May Have Direct Commercial Value

Much of our country’s wealth is the result of an abundant supply of natural resources and the ecosystems that sustain them. The link between ecosystems and the economy is clearest in communities that extract renewable resources from the environment. For example, the economy of many communities in southeast Louisiana is highly dependent upon shellfish beds and the larger system of wetlands that surrounds and protects them.

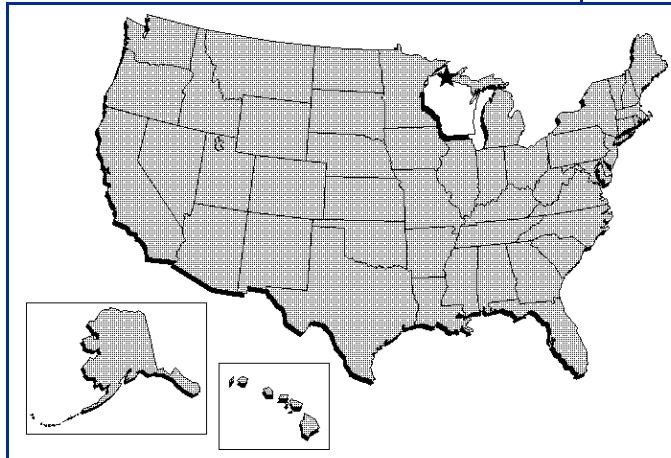
The issue of “jobs versus the environment” often arises when discussing ecosystem protection. Controversies such as limiting forestry to protect endangered species have led many people to believe that black-and-white choices must be made between resource extraction or land development and ecosystem protection. In fact, ecosystem protection is often pursued when a community is looking for ways to manage its resources and sustain local industries. While this may sometimes result in short-term reductions in economic activity (such as limitations on the commercial fishing catch), the resource may be maintained for the long run, making the local economy more

Table 3-2**Data For Identifying Stressors**

Data Item	Explanation/Use	Potential Information Source
Data on septic tanks and other underground tanks	Information on location and failure of septic and other underground storage tanks can help identify sources of nutrients and toxic pollutants.	<ul style="list-style-type: none"> ▫ Local land-use planning offices and health departments ▫ State underground storage tank offices
Residential and commercial development trends	Development can have direct impacts on an ecosystem, such as eliminating or fragmenting habitat, but can also have less obvious effects, such as contributing to non-point source pollution.	<ul style="list-style-type: none"> ▫ Local land-use planning office ▫ U.S. Census of Population and County Business Patterns data
Water discharges from industrial and municipal point sources	Data on volume and characteristics of discharges from local treatment facilities can provide information on discharges of metals or other toxic pollutants, nutrients, biological oxygen demand, pH, and pathogens that pose risks to humans, plants, and animals and affect surface water quality.	<ul style="list-style-type: none"> ▫ Municipal public works departments ▫ State department of environmental protection (water office) ▫ U.S. EPA's Office of Water Enforcement and Permits, Permit Compliance System Database, phone: (202) 475-8323
Data on pesticide use	Pesticide use data can help pinpoint the causes of non-point source pollution and ground-water contamination.	<ul style="list-style-type: none"> ▫ Agricultural Extension Service, U.S. Department of Agriculture ▫ U.S. EPA Drinking Water Hotline, <i>National Pesticide Survey</i>, phone: (800) 426-7491 ▫ U.S. Department of Agriculture, Economic Research Service, Agricultural Chemical Usage Database, phone: (800) 999-6779 ▫ State department of agriculture, state management plans
Industrial releases of toxic compounds	EPA maintains a database containing information on toxic emissions from certain industrial facilities to air, land, and water.	<ul style="list-style-type: none"> ▫ U.S. EPA, <i>Toxics Release Inventory Database</i>, available through National Library of Medicines TOXNET System, phone: (301) 496-6531 or the Emergency Planning and Community Right-to-Know Information Hotline, phone: (800) 535-0202, Internet Website: http://www.epa.gov/enviro/html/ef_home.html ▫ State department of environmental protection
Land-use and other geographic information	Maps enable you to get a comprehensive look at the ecosystem. A geographic information system can generate these maps. Data available from remote sensing operations and other sources can also help provide an overview of the ecosystem and the stressors affecting it.	<ul style="list-style-type: none"> ▫ State department of environmental protection ▫ U.S. Geological Survey, National Mapping Program, phone: (800) USA-MAPS, Internet Website: http://www-nmd.usgs.gov/ ▫ Local planning/zoning departments
Data on solid and hazardous waste	Waste storage, treatment, and disposal sites (active or inactive) may fragment habitat and contaminate local wildlife, air, soil, surface water, or ground water.	<ul style="list-style-type: none"> ▫ U.S. EPA, RCRA/Superfund Hotline, phone: (800) 424-9346 ▫ State agencies in charge of permitting hazardous waste management facilities (branch of environmental protection department) ▫ U.S. EPA's Envirofacts website provides access to data on abandoned and active hazardous waste sites, Internet Website: http://www.epa.gov/enviro/html/ef_home.html
Data on mine location and operation status	Acid mine drainage from active or abandoned mines can be transported to surface water and harm aquatic ecosystems.	<ul style="list-style-type: none"> ▫ U.S. Department of Interior, Office of Surface Mining, phone: (202) 208-2553, Internet Website: http://www.osmre.gov/osmhome.html

Upper Great Lakes: Evaluating Ecosystem Stress in the Kakagon and Bad River Sloughs

The Wisconsin Chapter of The Nature Conservancy (TNC) and the Bad River Band of the Lake Superior Tribe of Chippewa Indians are cooperating on a watershed project funded by the U.S. EPA. The Kakagon and Bad River Sloughs are the largest, healthiest, fully-functioning estuarine systems remaining in the upper Great Lakes Basin. The sloughs (swamps or stagnant waters along the river) are located on the Bad River Reservation in northwestern Wisconsin and are the ancestral home and cultural base of the Bad River Band of Lake Superior Chippewa. The Bad River watershed and its swamp lands are home to rare species such as lake sturgeon, wood turtle, bald eagles, nesting goshawks, ram's-head lady slippers, and black tern. They also support significant wild rice beds, which produce 20,000 pounds of green rice annually. The tribe is committed to maintaining the nearly pristine nature of these freshwater wetlands.



The health of the area has been affected by environmental stresses throughout the 1,421-square-mile watershed. The stressors include logging, farming, mining, and recreational activities. Effects in the watershed include excessive erosion and sedimentation, hydrologic changes, toxic contamination, habitat loss and fragmentation, excessive nutrient runoff, and displacement of native species by exotic species. The decline in upstream water quality could eventually degrade the downstream wetlands.

The cooperative watershed project focuses on identifying ecological stressors and working with a variety of stakeholders to mitigate and prevent negative impacts. Activities include conducting inventories to determine the current level of knowledge about the ecosystem, setting future research priorities, developing management and protection plans, promoting sustainable economic activity that is compatible with the natural environment through education and public relations, and building partnerships for cooperation on all these activities.

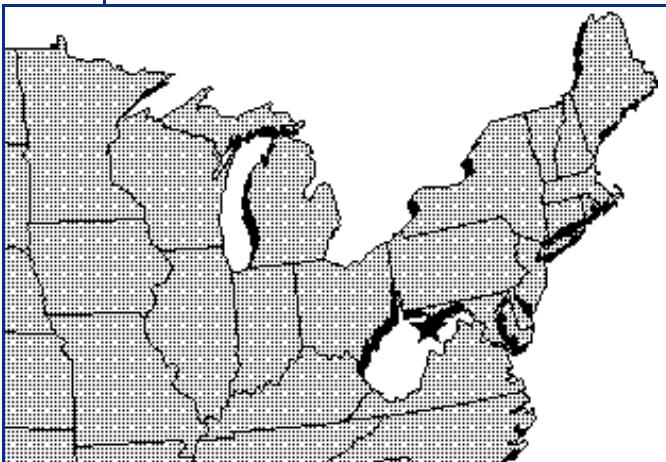
The Bad River Band and the Wisconsin Chapter of TNC are cooperating to address the health of the entire Bad River watershed and wetland ecosystem, with help from the Great Lakes National Program Office of the U.S. EPA.

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Canaan Valley, West Virginia: Identification of Environmental Stressors Helps Preserve Ecosystem



An early inventory of environmental stressors in Canaan Valley jump-started efforts to preserve the integrity of this ecosystem.

Canaan Valley, in West Virginia, is a popular destination for Washington, DC, and Baltimore vacationers. The valley, approximately 14 miles long and five miles wide, is one of the best examples of a northern, coniferous ecosystem in the United States.

The Canaan Valley Task Force, a private sector-government partnership created by EPA Region 3 in July 1990, promotes long-term environmental protection of the valley while allowing for reasonable and sustainable economic vitality. As a first step in guiding

protection efforts, the partnership produced an inventory of environmental stressors (see the table below) by identifying ecosystem problems and their associated causes, determining whether the problems are getting worse, and developing solutions.

The task force identified two priorities: advancing the delineation of wetlands, and developing a geographic information system (GIS) of land use/land cover and property boundaries. As a result of this early identification of stressors, three Department of the Army permits were suspended and the surveillance of illegal wetland fills was increased. The task force also produced and disseminated a series of fact sheets and informational brochures; completed a study of off-road vehicle impacts; studied ground-water, surface-water, and wildlife habitats; and initiated the first phase of an economic impact analysis of a proposed wildlife refuge.

Canaan Valley Environmental Stressors

AFFECTED FEATURE	EVALUATION TOOL	TREND	SOURCES OF STRESS
Wetlands	GIS, Observed land-use change, Photo	Loss of acreage	Power generation, Second home development, Recreation, Highway, Off-road vehicles
Unique vegetation	GIS, Photo	Loss of diversity	Off-road vehicles, Recreation, Second home development, Power generation
Brook trout	West Virginia, USGS	Decreased population	Off-road vehicles, Septic, Acid mine drainage
Woodcock	GIS, Habitat survey	Decreased population	Second home development, Power generation, Off-road vehicles, Recreation
Aesthetics	Observation	Loss of natural views	Wind power, Second home development, Recreation

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Northampton County, Virginia: Ecosystem Protection Can Benefit Recreation and Nature-Based Local Economies

Citizens in Northampton County, Virginia, recognize the value of their natural assets to their economic future. Northampton County is located at the southern tip of the Delmarva peninsula and occupies the southern half of Virginia's Eastern Shore. The county is bounded by 225 miles of shoreline, enclosing some 134,000 acres of prime cropland, saltmarsh, and forest.

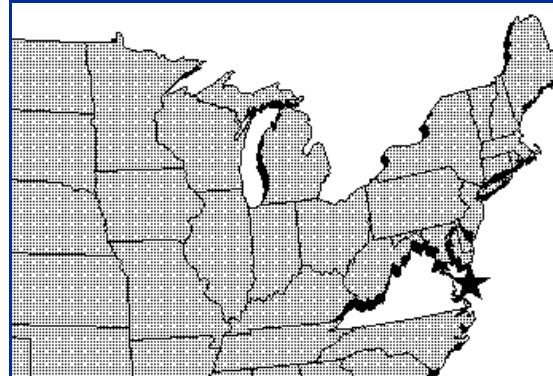
Despite its natural gifts, Northampton has severe problems. Historically, it has been the poorest county in the Commonwealth of Virginia, with a declining population and steep job losses resulting from reversals in its dominant seafood and agricultural industries. In 1993, Northampton County formed a Sustainable Development Task Force composed of Northampton citizens to address these challenges. Development of "heritage tourism" is a direct expression of the community's collective determination to ensure a more prosperous and hopeful future for all its citizens.

Promising opportunities exist for Northampton County to develop new industries and reinvigorate existing industries, such as heritage tourism, which provide well-paying jobs and a diversified tax base, improve the quality of life of the county's people, and retain its young people as they enter the work force. Heritage tourism is defined as "recreation travel activities which depend on the appreciation, interpretation and protection of the community's authentic natural, scenic, recreation, historical, and cultural assets." Fishing and boating on the Chesapeake Bay are the primary attractions for tourists and recreationists visiting Northampton County.

The First Annual Eastern Shore Birding Festival, held in October 1993 during the peak of fall migration, demonstrated the potential of birding tourism to the county. Heritage trails are also being planned to meet the sustainability objectives of the community.

In the past, Northampton industries have failed when they chose an unsustainable course. In the most notable instance several years ago, Northampton's fishing and canning industry collapsed as a result of overfishing. Citizens of Northampton recognize that no industry or development activity can be considered sustainable in and of itself. Even heritage tourism must account for long-term preservation goals along with near-term financial reward. Citizens of Northampton are convinced they can achieve both.

Ultimately, the community is taking responsibility for wise development and stewardship of its assets. County leaders are committed to sustainable development, but the community's dedication to active participation through town meetings, community task forces, and non-profit grassroots organizations ensures continued success.



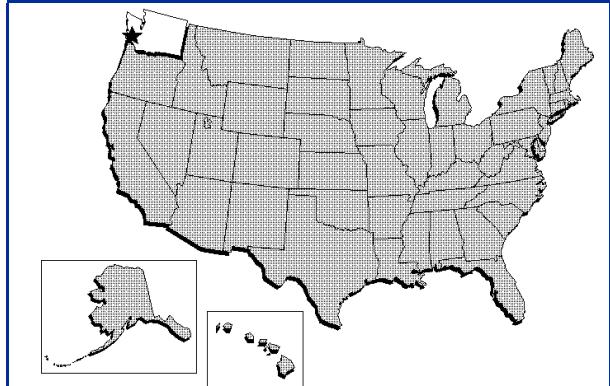
"...the true value of the [birding] festival is clearly its potential for generating future tourism and related economic benefits."

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sustainable. *Northampton County, Virginia* provides one example of how ecosystem protection can support nature-based business as a source of jobs and economic activity in an economically depressed area. Ecosystem management efforts in *Willapa Bay, Washington* (see below) focus on coordinating ecological and economic goals where the regional economy depends heavily on natural resource extraction. Similarly, the *Great Lakes Indian Fish and Wildlife Commission* (see following pages) helps Native Americans in the Midwest preserve resources that support commercial fishing and wild rice harvesting.

If properly managed, ecosystems may support recreation-based businesses. Many local economies in the United States, particularly those in more rural areas, depend on the commercial activity generated by outdoor recreation. Expenditures by tourists, anglers, hunters, birdwatchers, boaters, hikers, and other recreational enthusiasts contribute significantly to the regional economy and support jobs in the community. These expenditures include not only the purchase of recreational equipment and

Southwestern Washington: Innovation in Willapa Bay Helps Community Integrate Ecological and Economic



"It would only be ourselves we would be hurting if we lose the bay."

Willapa Bay, in the southwestern corner of Washington State, has long been considered one of the cleanest coastal ecosystems in the nation. The natural richness of the bay is maintained through the creativity of local businesses, citizens, and government officials. Communities and businesses in Willapa Bay know that their ecological and economic goals are interdependent. Ecosystem management efforts have engaged local and county governments, private non-profit organizations, and regional public agencies.

One collaborative effort, spearheaded by a non-profit conservation organization called Ecotrust, was established to address troubling new issues, including declining timber yields, fish populations, and job opportunities. In a unique partnership, Ecotrust and a development bank in Chicago began to offer capital and technical assistance to environmentally responsible businesses that integrate ecological and economic goals.

To begin, Ecotrust went to the local community. Members convened a small group of residents to discuss environmental protection through economic development. The group — farmers, oyster growers, fishermen, Native Americans, and small business owners — formed

the Willapa Alliance. One of the alliance's activities is to sponsor studies examining the region's natural resources and economic opportunities. Right away, the group discovered that some of its economic problems were based on a pattern of exporting unprocessed natural resources. In addition, ecologically friendly businesses were not familiar with how to reach expanding and profitable "green markets". The trick was providing resources and expertise to this community in need.

Ecotrust approached the Shore Bank Corporation of Chicago for help, and the two groups decided to collaborate. The partnership evolved into the locally based ShoreTrust Trading Group, which provides management services, marketing strategies, and financial support to local businesses focusing on sustainable practices such as the following:

supplies (such as boats, fishing rods, bait), but also spending at local hotels and restaurants. If ecosystems break down and populations of key wildlife species dwindle, many local economies would be undermined.

Ecosystems May Influence Property Values and Local Finance

Well-functioning ecosystems also help communities avoid expenditures on projects needed to replace the services that the ecosystems naturally provide. Examples include the following:

▫ **Storm Protection** — Wetlands may reduce wave action, slow winds, and absorb water. Preservation of wetlands can help communities avoid spending money on such expensive structural protection as levees and sea walls.

▫ **Filtration and Purification** — Wetlands and forested areas are capable of

- 
- Owners of a family-owned lumber mill business knew there was a demand for timber grown from sustainably managed forests. The local North American red alder is a hardwood species that regenerates rapidly on its own and can easily be managed as a renewable resource. Nevertheless, many landowners kill the plants with herbicides to grow conifers instead. The ShoreTrust Trading Group helped the family develop a market for the alder and expand its business.
 - The Trading Group introduced a local oyster fisherman to a natural foods grocery chain with strict health and environmental standards. These stores are willing to pay a premium for oysters harvested in the clean Willapa Bay. This has provided an incentive to protect the local environment that sustains the oysters. In the fisherman's words, "It would only be ourselves we would be hurting if we lose the bay."
 - A cranberry farmer runs a small business that processes local cranberries into relishes, mustards, and scone mixes. The Trading Group introduced the owner to new markets and helped her redesign her jars to emphasize the products' natural qualities.

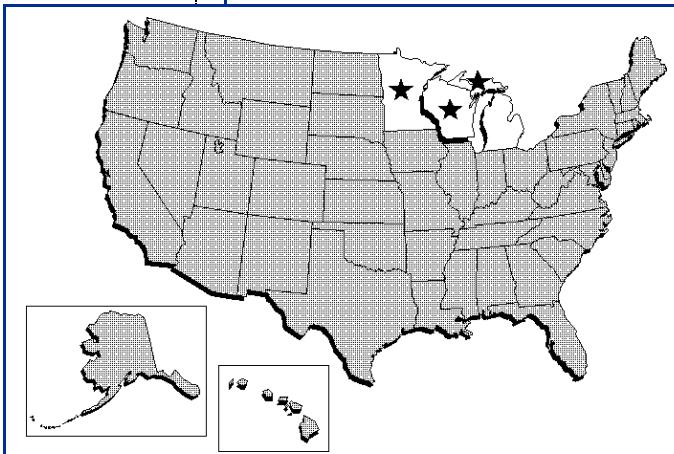
By helping resource managers meet their economic goals, local groups are ensuring that ecologically responsible businesses can continue to thrive and protect Willapa Bay. Further analysis of the bay may be needed to monitor environmental change.

In addition, the collaboration with Shore Bank has entered a new phase, with creation of ShoreTrust Bank, the first commercial bank in the country designed to focus primarily on loans to environmentally responsible businesses.

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Great Lakes: Native American Perspectives in Great Lakes



The natural resources of primary concern to the member bands include fisheries, wildlife, wild rice, and waterfowl. Jon Gilbert, a GLIFWC wildlife biologist, was involved in a project with state and federal agencies to study the survival rate and habitat use of re-introduced pine martens and fishers. According to Gilbert, "These are animals that are part of the natural

Historically, the tribes of the Great Lakes area depended on fishing, hunting, and harvesting wild rice for their subsistence. Currently, these activities are still economically significant because the tribes engage in commercial fishing and the sale of wild rice.

The Great Lakes Indian Fish and Wildlife Commission (GLIFWC), formed in 1984, is an intertribal, natural resource management organization representing the concepts and interests of 11 Chippewa Bands in Michigan, Minnesota, and Wisconsin. GLIFWC's primary mission is to assist members in implementing treaty rights and in managing resources in the off-reservation, ceded territories.

treating municipal or industrial wastewater and filtering runoff from city streets and farmland. Plants absorb nutrients that might otherwise stimulate

algal blooms, while toxic pollutants settle to the bottom of wetland areas where some may decompose. While not a replacement for man-made wastewater treatment capacity, these filtration services may, to a limited degree, reduce the need for towns to build additional treatment capacity.

Wetlands and forests may also help protect drinking water supplies. Many communities have instituted wellhead or watershed protection programs that avoid the costs of additional water treatment and the cost of cleaning up contaminated ground water by protecting the areas around water sources.

Finally, open space may create economic benefits in urban and suburban communities. For example, research shows that real estate values increase if property is near open spaces, waterways, and other



Practical Benefits From Open Space Preservation

Economic studies have shown that some kinds of development impose greater costs on local communities than others. An analysis of the costs of sprawl (Frank, 1989) revealed that lower-density developments built on former farms, forests, wetlands, or unoccupied lands away from existing urban areas cost considerably more in local taxes than higher-density developments built within or adjacent to existing urban areas. For instance, each house built in a medium-density development (seven to eight residences per acre) will cost an average of \$12,000 more in local government expenditures than it will contribute, while each house built in a low-density development (one residence for every four to five acres) will cost \$92,000 more in local government expenditures.

In contrast, another study showed that for every dollar of tax revenue collected from residential land, \$1.25 is spent on public services. For each dollar generated from an open space tax, 19 cents is spent on services (Vance, 1988).

Of course, these are examples only. Cost and tax differences for low- and high-density development will depend on the unique service costs and tax structure of your community, and on how development is designed.

ecosystem. The tribes are interested in seeing that the ecosystems are preserved, protected, and enhanced.” GLIFWC also works on conservation enforcement in cooperation with Wisconsin wardens

The Chippewa Bands rely on the fish resources of Lake Superior, as they have for generations. Therefore, GLIFWC undertakes numerous activities to protect and enhance this resource. These activities include harvest management, controlling foreign species that threaten the ecosystem, research and development, enhancement of resources, and technical assistance to members.

The participation of GLIFWC in state and federal ecosystem management projects ensures that tribal members’ historical perspectives and values about land are represented and that important economic resources are sustained.

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natural areas. This is illustrated in the story about *New York City’s Central Park* (see below). These increases bring more property tax revenues to municipalities. In addition, both real estate developers and local governments have found that the costs of clustered housing, including land clearing, road building, providing water and sewer service, and other costs, are significantly less than those of sprawling developments.

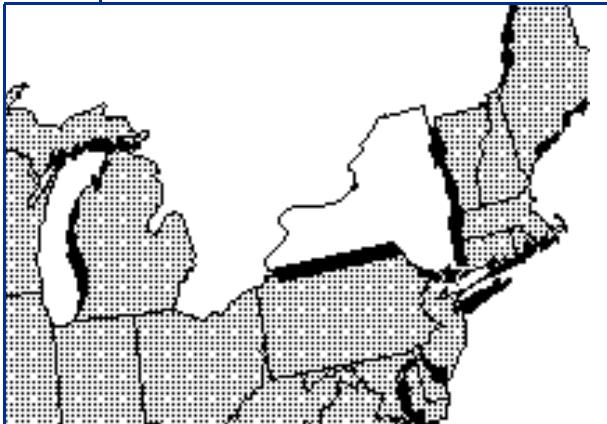
Evaluating the Links Between Ecosystems and Local Economies

As with ecosystem assessment, specific indicators can track the relationship between ecosystems and the economy. Table 3-3 provides several examples of specific economic indicators. For instance, a local economy may be dependent upon a resource-based industry such as commercial fishing. A relevant indicator in this case would be employment in each of these economic sectors as a percentage of employment in all local industries. Alternatively, a community that wants to assess how ecosystems influence tax revenues could investigate total tax collections through park and beach admission fees.

The following sources may be able to provide information on how ecosystems influence the local economy:

- **State and Community Planning Documents** — Many states have published statewide plans or growth strategy documents that address a range of economic and environmental issues. Some states (such as Florida) require that communities prepare comprehensive planning documents, as well. These sources provide useful background on the major economic trends in your area that may be affecting or affected by local ecosystems.

New York City: Recognizing the Value of Central Park's Open Space



Developers and city governments have discovered that urban open-space preservation can have a positive effect on property values, urban economies, and the general quality of life. As a result, cities around the country have initiated open-space preservation programs. One of the earliest and most dramatic examples of the economic benefits of urban parks and open space is New York City's famous Central Park.

An 1860 census of New York City's population indicated an increase from 4,302 to 814,524 inhabitants in 60 years. In response to this rapid urbanization, Frederick Law Olmsted and Calvert Vaux prepared a design for Central Park and attached a report

which suggested that, "The whole of the island of New York would, but for such a reservation, before many years be occupied by buildings and paved streets...[and] all its inhabitants would assuredly suffer, in greater or less degree, according to their occupations and the degree of their confinement to it, from influences engendered by these conditions."

Much of the park was purchased by 1859, but the Board of Commissioners, worried about excess valuation, was reluctant to purchase additional acres. Olmsted responded to cost concerns by tracking the increase in the value of properties adjacent to the park. In an 1875 report to the board, he detailed the total cost of Central Park and then calculated the increase in tax revenue from the surrounding properties.

Olmsted's report noted that property not directly adjacent to the park had appreciated only 100 percent over the previous 20 years. However the three wards adjacent to the park had appreciated 500 percent. While the City had spent \$13.9 million to acquire and build the park, the land surrounding the park was worth \$180 million more because of the purchase. In 1873 alone, the city's property tax income was \$3,746,880 more than the tax that the city would have received if the park had not been established. In effect, New York City's Central Park paid for itself just three years after park construction was completed.

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- **Local Merchants** — Local business owners may be able to provide information on the importance of certain ecosystem-based activities to their business. For example, recreational fishing may be critical to a local boat rental business.
- **Local Parks and Recreation Departments** — These local agencies may have information on the revenue collected from parks, beaches, and other city- or county-operated areas.
- **Chamber of Commerce** — The local Chamber of Commerce may be able to provide information about economic uses of ecosystems, whether for recreation, research, commercial fishing, forestry, or other uses.

Table 3-3

Overall Assessment Objective	Sample Indicators	Possible Sources of Information
Assess dependence of local tax revenues on ecosystems	n Annual revenue from fees for use of parks and beaches	n Local parks and recreation department, local revenue department
Assess dependence of local economy on nature-based recreation	n Annual revenues and/or employment in local outdoor recreational businesses (e.g., boat rentals, nature tour guides, birdwatching, and cross-country ski centers)	n Local merchants n Local Chamber of Commerce
	n Annual number of fishing or hunting licenses issued in the county	n State fish and wildlife department
	n Annual number of "activity days" for various categories of outdoor recreation (e.g., fishing, hunting)	n State Comprehensive Outdoor Recreation Plans (contact state tourism and recreation agency) n U.S. Fish and Wildlife Service, <i>National Survey of Fishing, Hunting, and Wildlife Associated Recreation</i> , published every six years n Local Chamber of Commerce
Assess need for clean water for industrial use	n Use of water by food processors, breweries, etc.	n Local water authority n Local Chamber of Commerce n Local business leaders or representatives of relevant companies
Assess impact of ecosystem health on residential property values	n Relative cost of otherwise similar houses located near and several blocks away from a local park n Qualitative indicator based on home buyer and realtor opinions on premium paid for properties located near environmental amenities (e.g., clean rivers, parks)	n Local registry of deeds n Survey of recent home buyers in the area n Local realtors
Assess trends in commercial and residential development	n Urban Sprawl Index: rate of conversion of open land to suburban/urban development	n Municipal/county/state land-use planning offices
	n Percentage of building permits in downtown/urban core vs. non-urban or suburban areas	n Local building and permits office
Assess local dependence on "extractive" natural resource-based industries	n Revenues of local forest products industry relative to revenue in all industries n Employment in local forest products industry relative to employment in all industries	n U.S. Department of Commerce, Bureau of the Census, <i>County Business Patterns</i> , phone: (301) 457-4100 n U.S. Department of Commerce, Bureau of Economic Analysis, <i>Regional Economic Information System</i> , phone: (202) 606-9900 n U.S. Department of Agriculture, Forest Service, <i>Forest Statistics</i> , by state
	n Revenues of local commercial fishery relative to revenue in all industries n Employment in local commercial fishery relative to employment in all industries	n U.S. Department of Commerce, Bureau of the Census, <i>County Business Patterns</i> , phone: (301) 457-4100 n U.S. Department of Commerce, Bureau of Economic Analysis, <i>Regional Economic Information System</i> , phone: (202) 606-9900 n National Marine Fisheries Service (NMFS) in the U.S. Department of Commerce maintains county-level data on landings and value of catch n Local Chamber of Commerce
	n Ratio of the amount, health, and diversity of timber regrowth to timber cut n Stability in numbers of juvenile and young-of-year in fish population over time.	n U.S. Department of Agriculture, Forest Service, <i>Forest Statistics</i> , by state n NMFS data (see above)



The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies, Report of the Interagency Ecosystem Management Task Force, June 1995. Prepared by representatives of several federal agencies, this report uses information from several case studies to define the “ecosystem approach” for protecting the environment and how this approach helps ensure healthy, sustainable economies.

Fox, Tom, *Urban Open Space: An Investment That Pays*, Neighborhood Open Space Coalition, 72 Reade Street, New York, NY 10007, 1990. This report describes the contribution that open space makes to the economies of large cities, highlighting impacts on real estate values, public health, city image, and other factors.

Hustedde, Ronald, et al., *Community Economic Analysis: A How To Manual*, North Central Regional Center for Rural Development, Iowa State University, Iowa State University Printing Services, Ames, IA, August 1995, phone: (515) 294-8321.

National Park Service, *Economic Impact of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book*, National Park Service, Department of the Interior, Washington, DC, 1995. This resource book provides

- **Local Realtors** — Realtors often understand what people value about a community and can help you understand how healthy ecosystems influence home prices.

Sources of Technical Information

Apart from local sources, more general data sources may prove useful in characterizing how the local economy is tied to ecosystem quality. One set of resources includes economic data gathered by economic research organizations in the federal government, including:

- **County Business Patterns Data** — Compiled by the U.S. Department of Commerce, Bureau of the Census, these data cover revenues and employment associated with various industries in each county. The data are summarized in a series of documents (one for each state), but also can be obtained in electronic form. Contact the Bureau of the Census, County Business Patterns Branch, phone: (301) 457-4100, or check the library at a local university.
- **Regional Economic Information System** — This data system contains county-based employment and income information similar to the County Business Patterns, but at a greater level of detail and across multiple years. Therefore, the data may be useful for assessing trends in various resource-dependent industries. The data are available on CD-ROM and can be obtained through the Bureau of Economic Analysis in the U.S. Department of Commerce, phone: (202) 606-9900.

While technical in nature, these data sources may prove helpful in characterizing the amount of commercial activity dependent upon ecosystem quality. These data are the basis for more sophisticated regional economic modeling that you may explore when you implement ecosystem protection strategies (see Chapter 5). An economist in the community or at a local university can help acquire and analyze these data.

In addition to general economic information, numerous databases and reports exist for assessing the local importance of specific industries. For example, detailed infor-

examples of how greenways and parks benefit local economies and gives practical guidance on how to estimate these benefits in your community.

The Nature Conservancy Center for Compatible Economic Development, *A Citizen's Guide to Achieving a Healthy Community, Economy and Environment*, The Nature Conservancy, Leesburg, VA, May 1996. This guidebook provides a comprehensive framework for understanding links among community, economy, and the environment, and illustrates the concepts using Virginia's Eastern Shore as an example.

Niemi, E. and E. Whitelaw, *Integrating Economics and Resource Conservation Strategies*, ECONorthwest, Eugene, OR, May 1995.

The Wilderness Society, *Measuring Change in Rural Communities: A Workbook for Determining Demographic, Economic, and Fiscal Trends*, The Wilderness Society, 900 Seventeenth Street NW, Washington, DC 20006-2596.

mation on commercial fishing activity is available from both state and federal agencies. Typically, state natural resource agencies maintain records on shellfishing in local estuaries. These data may include information on annual shellfish harvests by location as well as information on the number of commercial shellfishing licenses issued to area residents. Similarly, the National Marine Fisheries Service (NMFS) maintains data on annual finfish landings by county and by major port.

The economic development agency in your state government may be able to assist you in locating key data, and may also know of regional studies that already have been performed for ecosystem-related sectors of the economy.

3.4 Assessing Links Between Ecosystems and Quality of Life

Healthy Ecosystems Make Life More Fulfilling

Healthy ecosystems make our communities more rewarding places to live in ways that are unrelated to economic conditions. Many of these benefits are subtle, and different communities may emphasize different aspects of well-functioning ecosystems depending on their values. They include:

- **Natural Beauty** — Natural areas provide a sense of well-being for the community. In particular, protecting habitats in urban areas gives citizens an opportunity to “leave the city behind”, view local animal and plant life without having to travel, and gain a sense of inspiration and renewal.
- **Protection of Human Health and Safety** — Clean air and water and healthy ecosystems ensure that the community is free from health problems associated with pollution. In addition, community members have the peace of mind of knowing that they are safe from these threats.

-
- **Sense of Community** — A healthy natural environment enhances feelings of civic pride and may instill a stronger sense of kinship among residents.
-



Community Gardens

Community gardens are an effective and sustainable way of building community involvement while at the same time transforming unused space into something productive. More than 300 vacant, and in some cases littered and desolate, spaces in Newark, New Jersey, have been converted into 2,000 lively and productive neighborhood gardens through the Rutgers Urban Gardening Program. The program is a state and federally funded project of Rutgers University Cooperative Extension. Gardeners benefit in many ways, such as improved nutrition, savings on grocery bills, increased sense of self-reliance, and relaxation. Gardens also can become settings for social interaction and discussion of local problems.

Natural spaces can be used for community gatherings such as annual festivals, picnics, graduation ceremonies, and community gardens. The collective action necessary to protect ecosystems can itself be a bonding force and source of pride to residents who share a common goal and work together to make their community a better place to live.

- **Spiritual Value** — Many people feel spiritually connected with the ecosystems around them. The beauty of nature gives them an opportunity to contemplate their relationship with the world. Many religious denominations have organizations (see Appendix A) that promote environmental stewardship because of the belief that humans have a special responsibility to protect and pass on a healthy world. Many of these groups see the principle of sustaining the health and benefits of the natural world for future generations as a moral obligation. Native American cultures have often been identified as placing a particular spiritual and religious significance on nature and the harmony in natural systems. Many people in the United States share these values.

-
- **Educational Value** — Rivers, wetlands, forests, and other elements of community ecosystems all provide learning opportunities. Certain areas may be designated public learning centers by the town or by conservation groups. Local colleges and universities also may use ecosystems for teaching and scientific research. For schoolchildren, healthy ecosystems may provide a sense of wonder and encourage further learning. Many parks and forests make learning easy by posting illustrations and names of local plants and animals at park entrances or on placards along trails.
 - **Recreational Opportunities** — Healthy ecosystems support wildlife and other natural resources that are often central to outdoor recreational activity. For example, wetlands may provide breeding and spawning areas for fish sought by recreational anglers and may support bird species popular with birdwatchers or hunters. In addition to the commercial value of recreational resources, the intrinsic value of the recreational experience is an important part of life in many communities.

Evaluating the Links Between Ecosystems and Quality of Life

Table 3-4 provides some examples of indicators that characterize the link between ecosystems and quality of life. For example, your community may be interested in measuring the extent to which development has reduced the availability of open land.

Alternatively, you may want to characterize the importance of ecosystems to education by reporting the number of visitors to a local arboretum or the number of school field trips to local nature areas.

Local sources are often most relevant in assessing the link between ecosystems and quality of life. Table 3-4 provides several examples of information sources that may prove useful. These information sources include local, state, and federal governments.

Community members often have opinions about the value of different ecological resources. Surveys can be conducted to ask community members what resources are important to them. They can serve as a way to set priorities among different resources that need attention. However, surveys sometimes do not indicate why people care about one ecological resource or other community characteristic more than

Table 3-4

Information Sources For Assessing the Linkages Between Ecosystems and Local Quality of Life

Overall Assessment Objective	Sample Indicators	Possible Sources of Information
Characterize importance of ecosystem to local education	▫ Number of school field trips to natural areas	▫ Local schoolteachers
	▫ Number of visitors to local arboretum, bird sanctuary, or state and national parks	▫ Management office of relevant organization (e.g., arboretum)
Assess flood control services provided by local wetlands	▫ Qualitative indicator based on flooding history of area with wetlands and similar areas where wetlands have been lost to development	▫ Newspaper archives ▫ Local land-use officials ▫ Local emergency management officials
Characterize dependence of town on local surface and ground water	▫ Percent of household water supply from local sources	▫ Local public works department ▫ Regional water supply authority
Assess availability of land for recreation	▫ Acres of land/open space available for recreation per 1,000 people in the community	▫ Local land use officials ▫ Local or state parks and recreation officials
Characterize level of recreational activity dependent upon ecosystems	▫ Annual number of “activity days” for various categories of outdoor recreation (e.g., rafting and kayaking, fishing, hunting, and visitor days to local resorts and campgrounds) ▫ Trends in beach closures or fishing advisories ▫ Fate and effects of sanitary waste and refuse on ecosystems	▫ U.S. Fish and Wildlife Service, <i>National Survey of Fishing, Hunting, and Wildlife Associated Recreation</i> , published every six years ▫ State Comprehensive Outdoor Recreation Plans, contact state tourism and recreation agency ▫ County or municipal records for sanitary treatment and waste removal from recreation site

another. Reasons may include concerns about effects on the local economy, desire to preserve one's own recreational resources, or a desire to be a good steward of the earth's resources for the benefit of future generations. While not precise and perhaps difficult to interpret, surveys do provide insight into what issues are most important to the community.



Corson, Walter H., *Defining Progress: An Inventory of Programs Using Goals and Indicators to Assess Quality of Life, Performance, and Sustainability at the Community and Regional Level*, George Washington University, Washington, DC, October 1995, phone: (703) 683-5730. This report provides a useful overview of quality of life indicators, some of which are related to local ecosystem characteristics, as well as descriptions of community efforts to compile and track these indicators.

Engel, J.R. and P. Bakken, *Ecology, Justice and the Christian Faith: A Guide to Literature 1960-1990*, Center for the Scientific Study of Religion, Chicago, IL, 1990.

Kempton, Willett, et al., *Environmental Values in American Culture*, The MIT Press, Cambridge, MA, ISBN 0-262-11191-8, 1995. Written by a team of anthropologists, this book relies on surveys of American citizens to help people understand how Americans view environmental issues.

Salant, Priscilla and Don A. Dillman, *How to Conduct Your Own Survey*, John Wiley & Sons, Inc., New York, NY, 1994.

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- Community Environmental Council, *Sustainable Community Indicators: Guideposts for Local Planning*, CEC, 1995.
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- Frank, James E., *The Costs of Alternative Development Patterns: A Review of the Literature*, the Urban Land Institute, ISBN 0-87420-695-2, 1989.
- Freedman, Bill, *Environmental Ecology: The Ecological Effects of Pollution, Disturbance, and Other Stresses*, Academic Press, San Diego, CA, ISBN 0-12-266542-2, 1995.
- Hart, Maureen, *Guide to Sustainable Community Indicators*, QLF/ Atlantic Center for the Environment, Ipswich, MA, May 1995.
- Interagency Ecosystem Management Task Force, *The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies*, Report of The Interagency Ecosystem Management Task Force, Volume 1, June 1995.

Kempton, Willett, et al. *Environmental Values in American Culture*, The MIT Press, Cambridge, MA, ISBN 0-262-11191-8, 1995.

Kline, Elizabeth, *Sustainable Community Characteristics*, Consortium for Regional Sustainability, Tufts University, Medford, MA, 1993.

U.S. Environmental Protection Agency, *Environmental Planning for Small Communities: A Guide for Local Decisionmakers*, EPA/625/R-94/009, Washington, DC, September 1994.

U.S. Fish and Wildlife Service, *Guidance on Use of Habitat Evaluation Procedures and Suitability Index Models for CERCLA Application*, Report Number PB88-100151, June 1987.

Vance, Tamara A. and Arthur B. Larson, *Fiscal Impact of Major Land Uses in Culpeper County, Virginia*, Piedmont Environmental Council, 1988.

Wilson, E.O., *Biodiversity*, National Academy Press, Washington, DC, ISBN 0-309-03739-5, 1994.

Chapter

4 Strategies To Consider For Ecosystem Protection

Strategies for protecting the ecosystem likely will affect all other segments of the community — businesses, residents, tourists, and others. As a result, the strategies produce positive results not only for the ecosystem, but also for the local economy and the community's quality of life. For most communities, a wide range of ecosystem protection strategies is available. For example, should a local effort to protect endangered plant species proceed by regulating development? Buying conservation easements? Curbing off-road vehicles? Encouraging better land management practices?

Because it is likely that most of the projects the community undertakes will concentrate on local activities, strategies that call upon volunteers to protect or restore the ecosystems are potentially useful. Working through the laws and programs that affect the ecosystem and are administered by the city, town, county, or other local government is another option. Finally, certain programs and laws administered by the state and federal governments provide ecosystem protection and may provide a basis for a local protection effort.

4.1 *Strategies Using Voluntary Activities*

Many communities have found voluntary non-regulatory ecosystem protection strategies, including volunteer cleanups, land acquisition, and public education efforts, to be useful. Other voluntary strategies involving financial incentives require changes in tax policies, and are discussed in Section 4.2.

Low Cost, Immediate-Result Voluntary Strategies

A number of simple voluntary activities are available to achieve ecosystem protection goals (Greenfield and LeCouteur, 1994). These activities encourage community pride and may produce immediate, visible results. These activities include:

- n Tree, Grassland, or Wetland Planting or Reforestation** — These activities involve planting trees, shrubs, or flowers in urban areas to improve aesthetics, or undertaking a reforestation or wetland planting program in more rural areas to improve forests that have been clear-cut or wetlands that have been damaged. These activities produce additional benefits such as lowering urban temperatures, purifying air, and controlling storm-water runoff.

-
- **Stream, Beach, or River Cleanups** — Many communities have organized efforts to pick up trash and debris from rivers, beaches, or streams, either once or on an ongoing basis.
 - **Storm Drain Stenciling** — Many people do not realize that runoff collected by storm drains may pass untreated into a river or harbor. Stenciling “Do Not Dump” or other instructions on storm drains alerts community members that they should not use storm drains to dispose of used oil or other hazardous liquids.
 - **Pollution Prevention** — Recycling programs, car pooling networks, and public transportation improvements all reduce pollution at its source.
 - **Education** — Seminars at local schools can educate students about their local environment and encourage stewardship. Pamphlets encouraging recycling and explaining proper disposal of household hazardous materials or showing maps of local greenways and bike paths can increase interest in local natural resources. Some groups, such as farmers, may benefit from information on ecosystem issues specific to their occupations (for example, the importance of not filling in wetlands or benefits from reducing pesticide runoff). Community organizations and individuals also can find out more about the presence of hazardous materials in their neighborhoods through the community-right-to-know provisions that are part of the Superfund remediation program.
 - **Amending Covenants Governing Condominium and Homeowners’ Associations** — Covenants governing condominium or homeowners’ associations can address items like reducing the use of fertilizer and pesticides on lawns or prohibiting the removal of native vegetation.
 - **Instituting Integrated Pest Management (IPM) on Farms and in Gardens** — IPM minimizes pesticide use in favor of natural forms of pest control. These include introducing insects and animals that prey on the pests, rotating crops, planting two or more crops in the same field (making it harder for pests to find their targets), and many other techniques.
 - **Encouraging and Assisting Businesses to Conduct Environmental Audits** — Audits involve examining business practices to see if they are environmentally friendly (for instance, does the business recycle paper and other waste products). Often, programs to reduce waste also improve business efficiency and cost effectiveness. Small businesses may be able to get assistance through the EPA Information Hotlines listed at the end of this section or through their EPA regional office.

Land Acquisition

Land acquisition, which involves the purchase of land or a land easement, can be one of the most effective ways to preserve an ecosystem. Land conservation encompasses a number of activities, not all of which involve purchasing property outright.

Who Is Involved in Land Purchases?

The state or local government can purchase land or easements (defined below) from

voluntary sellers (as opposed to exercising eminent domain) to be set aside for conservation purposes. However, many communities also have formed land trusts for this purpose. Land trusts are private non-profit corporations that acquire land or easements. They often can move more quickly than governments, and also can interact more freely with private landowners who might be wary of working with a government agency. Large land trusts that already are established, such as The Nature Conservancy, usually focus their efforts on acquiring land with rare or highly valued species and habitat.

Local governments and land trusts may have programs to make local landowners aware of these options. Landowners may not realize that they can sell some of their property rights as easements without forfeiting the land itself. Similarly, developers may not be aware of land banking (see below) or other tools for mitigating ecosystem damage.

Tools for Land Acquisition

One way to ensure that land is protected or developed according to conservation principles is to purchase it outright (called fee simple acquisition). However, this is often very expensive. There are a number of other ways to acquire an interest in or influence over the management of a tract of land without making an outright purchase (Mantell, et al., 1990).

- **Easements** — Through an easement, a landowner voluntarily gives up or sells specific land-use or development rights but continues to hold title to the land. The easement “runs with the land”, meaning that it remains in force even when the property changes hands. Generally, the local, state, or federal government or private land trust buys the right to build on the land, which it will never exercise, thereby preventing development. Purchases of development rights are often made in areas adjacent to urban areas, where the pressure to develop land is greatest. The government or land trust also can purchase the rights to use the land for a conservation-related purpose, such as for hiking trails. In both cases, the owner retains the rights to use the land for other purposes consistent with the easement, such as for agriculture.
- **Options and Rights-of-First-Refusal** — Both of these tools allow a purchaser to gain time before buying land or an easement. A potential buyer can purchase an option that allows the purchase of land for a specific price within a specified period of time, during which the current landholder cannot accept any other offers to buy. Similarly, a buyer can purchase a right-of-first-refusal to a tract of land, which requires the current landholder to notify the rights-holder of any other offers made. The potential buyer then has the option of matching that offer and buying the land.



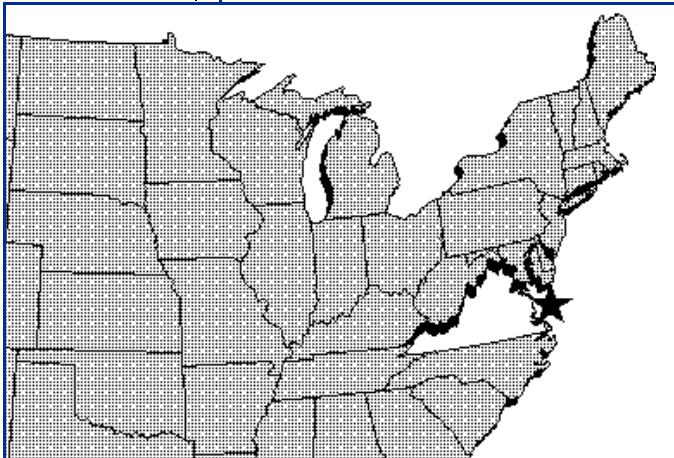
Virginia Beach's Agricultural Reserve Program

The economy of the coastal community of Virginia Beach, Virginia is based on tourism, agriculture, and military installations. As a result of recent urban growth, farms in the area face increased pressure to sell land for development. To protect the agricultural base of the area against urban sprawl, the municipality developed the Agricultural Reserve Program (ARP). Under the ARP, the municipal government purchases the development rights to working farms and holds them in a public trust. Not only do the proceeds from the sale of development rights enable farmers to reinvest in their farms, the purchase ensures that the farm is no longer a potential development site. In addition, the program provides for resale of the development rights back to the farmer after a minimum period of 25 years, if circumstances at that time indicate that the land should no longer be held back from development.
(Southern Watersheds Committee, 1994)

n Leases and Cooperative Management Agreements — These tools allow a government or land trust to exercise control over the land without purchasing anything. Landowners either lease the land for a specified time and purpose or manage it under certain terms and conditions. The federal Conservation Reserve Program and the Wetland Reserve Program use this technique to allow farmlands to lie fallow for a period of years (usually five).

Landowners may also donate easements, options, and rights-of-first-refusal to land trusts or federal, state, or municipal governments. Such donations can improve a landowner's tax position and can be a good estate planning strategy. The *Virginia Coast Reserve* illustrates the use of land acquisition and conservation easements in protecting ecosystems (see below).

Eastern Shore, Virginia: Using Easements and Other Compatible Development Approaches to Protect Virginia's Barrier Islands



"Protecting the watershed protects economically important species such as hardshell clams."

— The Nature Conservancy

port viable businesses compatible with the area's resources. The corporation consists of three companies with specific missions:

n Eastern Shore Products — This company develops, licenses, and markets a range of products. The company develops and markets nature-based tourism programs, local crafts, and specialty agricultural products grown through sustainable means.

Working with current and future landowners, The Nature Conservancy (TNC) has successfully combined conservation easements with other ecosystem preservation tools to protect part of Virginia's Eastern Shore and the Virginia Coast Reserve, the last intact coastal wilderness on the Atlantic coastline. Although federal and state agencies and TNC protect the barrier islands of Virginia's eastern shore themselves, they have concerns about the effects of development on surrounding lands. In response, they have begun to use several innovative methods for protecting the traditional resource-based economy, thus meeting the goals of this small community struggling through an economic recession while also preserving a valuable and distinct ecosystem. Two of the most innovative approaches developed are the creation of the Virginia Eastern Shore Corporation and the use of a community-based conservation easements program.

With \$2.7 million, a variety of investors including foundations, private companies, local businesses, and individuals founded the corporation. Focusing on meeting sustainable development goals, the corporation is helping identify and support viable businesses compatible with the area's resources. The corporation consists of three companies with specific missions:

Funding for Land Trusts

Acquiring easements or fee simple land is usually expensive. Land trusts often seek grants and donations from private charities. Some land trusts have found other funding sources, including (Mantell, et al., 1990):

- **Limited Development** — The land trust can borrow to finance a purchase, and then sell off a small portion of the land for development to repay the loan. The trust can impose requirements, such as clustering or open-space allotments, to ensure that the development is appropriate.
- **Conservation Investment** — Trusts can sell a part of the land to a buyer who is willing to build an ecologically friendly vacation home as an investment. The trust also can seek investors who want to purchase an interest in a working farm or fishery, from which they get a percentage of profits. This enables land to be kept in open-space uses.

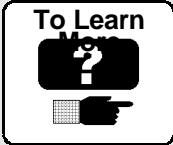
ible

- **Eastern Shore Venture Fund** — This company provides short-term business loans, guarantees, and venture capital to local, emerging, and ongoing enterprises that are ecologically sound.
- **Eastern Shore Lands** — This company helps implement sustainable development of the shore's landscape, just as the other two companies will help develop a sustainable economy. Eastern Shore Lands acquires and leases seaside farm and village properties, applies conservation easements and development restrictions, and then resells the land. It also provides farmland for sustainable agriculture and works to ensure that affordable housing and commercial facilities are available for local families and workers.

In the Virginia Coast Reserve region of the islands, conservation easements are used in cooperation with landowners to protect the watersheds adjoining the reserve.

Easements are valuable community tools because they bring value not only to the conservationists but also the landowner. As a result, they often allow for land uses that yield financial returns (such as agriculture, forestry, and limited residential development) consistent with the long-term health of the watershed. TNC is working with existing landowners and with future seaside farmers who are interested in purchasing TNC lands that already have conservation easements attached.

Contact: John M. Hall
Director
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Virginia Coast Reserve
P.O. Box 158
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Phone: (804) 442-3049
Fax: (804) 442-3050



Greenfield, Jennifer and Brian M. LeCouteur, *Chesapeake Bay Community Action Guide*, Metropolitan Washington Council of Governments, Washington, DC, May 1994. This book contains step-by-step instructions on how to organize and carry out voluntary activities.

The National Wildlife Federation, Backyard Habitat Program, 1400 Sixteenth Street NW, Washington, DC, phone: (202) 797-6800, can provide information on how individuals can create and improve local habitat.

The Land Trust Alliance, 900 Seventeenth Street NW, Washington, DC, phone: (202) 638-4725, provides technical assistance and services to local and regional land trusts and conservation groups. Some documents published by this group include:

- *Starting a Land Trust: A Guide to Forming a Land Conservation Organization*, 1990.
- *National Directory of Conservation Land Trusts*, 1989.
- *National Directory of Local and Regional Land Conservation Organizations*, Annual Report.

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

- 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.
- Hazardous Waste Ombudsman, phone: (800) 262-7937 in U.S. except metropolitan Washington, DC and (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.
- Office of Environmental Justice, phone: (800) 962-6215 in U.S. except metropolitan Washington, DC and (202) 260-6359 in metropolitan Washington, DC, coordinates public communication and provides technical and financial assistance to outside groups on environmental justice issues.
- Pollution Prevention Information Clearinghouse, phone: (202) 260-1023, provides answers and referrals in response to questions from the public concerning pollution prevention.
- 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.

4.2 Strategies Using Local Laws

Some communities have found that achieving their goals requires more than volunteer strategies. Communities often turn to local laws as a means of ecosystem protection.

Zoning Ordinances

A zoning ordinance describes the ways in which a parcel of land may be used and the intensity of that use (such as the density of development). Land is zoned for industrial, commercial, or residential development or can be set aside as farmland, forest, pas-

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- 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 and (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.
 - Small Business Ombudsman Clearinghouse/Hotline, phone: (800) 368-5888 in U.S. except metropolitan Washington, DC and (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.
 - Toxic Substances Control Act (TSCA) Assistance Information Service, phone: (202) 544-1404, TDD: (202) 544-0551, furnishes TSCA regulation information.
 - WASTEWI\$E Helpline, phone: (800) EPA-WISE, provides information about EPA's voluntary program encouraging businesses to reduce solid waste.
 - Wetlands Information Hotline, phone: (800) 832-7828 in U.S. except metropolitan Washington, DC and (703) 525-0985 in metropolitan Washington, DC, disseminates information about the Wetlands Protection Program; answers questions; provides referrals concerning the value, function, and protection of wetlands; and accepts requests for certain wetlands publications.

Other useful publications include:

Diehl, Janet, *The Conservation Easement Handbook*, American Planning Association, Chicago, IL, 1988.

Mantell, Michael A., Stephen F. Harper, and Luther Propst, *Creating Successful Communities*, The Conservation Foundation, Washington, DC, ISBN 1-55963-014-0, 1990. In particular, Appendix A contains a primer on land acquisition.

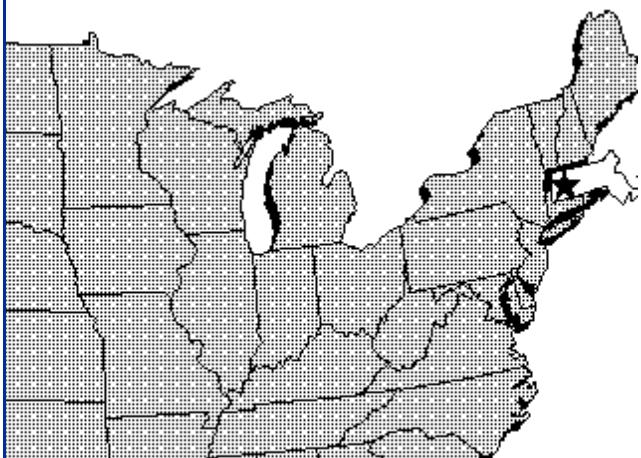
Porter, Douglas R., ed., *Growth Management: Keeping on Target?*, Urban Land Institute, in association with the Lincoln Institute of Land Policy, Washington, DC, 1986. In particular, this book discusses land acquisition for conservation by the City of Boulder, CO.

Small, Stephen, *Preserving Family Lands*, Landowner Planning Institute, Boston, MA, ISBN 9624557-1-7, 1992.

ture, open space, or habitat for wildlife and recreation. Zones can encompass a small parcel of land, such as a shoreline, or can be extended to an entire watershed.

Many zoning techniques are available for protecting an ecosystem. Bonus and incentive zoning award developers supplemental development rights, such as allowing construction of more buildings, in exchange for public benefits, such as developing within urban areas instead of in outlying areas. Buffer zones restrict activities on areas surrounding key ecosystems to minimize damage. Floodplain protection districts, located near rivers or other flood-prone areas, generally prohibit residential and commercial development. The *Westfield River Greenway Plan in Massachusetts* presents

Western Massachusetts: Local River Protection Zoning Bylaws to Preserve the Westfield River



town meetings. The bylaws establish a river corridor to protect the river's natural and scenic values by prohibiting roads, public recreation facilities, and development inconsistent with the river's wilderness character.

Each municipality also has the option to tailor its conservation efforts through its zoning bylaws. Towns are encouraged to expand the buffer to include important natural features. The degree of restrictiveness of zoning within the protected corridor can be tailored to meet resource protection needs. This flexibility allows towns to implement more stringent measures if the community places a relatively higher value on a particular area.

Deciding on a 100-foot buffer required considerable research and investigation of other communities' experiences. Minimum septic system distance from the river, distances needed to filter out non-point source pollution, and buffer strips adopted by other communities were a few of the factors considered. All the communities adopted the bylaws over four years ago, and the buffer appears to be working well, with no legal challenges to date.



The Role of Wetlands in Flood Protection

Scientists have just begun to understand the role of wetlands in protecting developed areas from flooding. Floods occur in peaks; that is, they do not occur along the entire stretch of a river simultaneously. As high water moves downstream, it spills over the stream's original banks, flooding everything in its wake and often damaging property. Wetlands allow flood waters to spread out over a wide area, slow the flow of the water, and temporarily store it. This decreases the size of floodpeaks and slows their movement. If wetlands are filled in and the banks are altered (a process called channelization), developed areas can suffer more severe flood damage.

As described in Chapter 2, a citizen group in Massachusetts developed the Westfield River Greenway Plan to ensure a regional approach to river protection.

A 100-foot, no-development buffer zone along the river is the most critical part of the plan. The plan recommends that management of land use along the Westfield River remain primarily a local responsibility, and that the six communities along the upper river branches adopt river protection bylaws as the mechanism for protection. The Pioneer Valley Planning Commission, directed by 43 member communities, worked with the six communities along the river to pass these bylaws at

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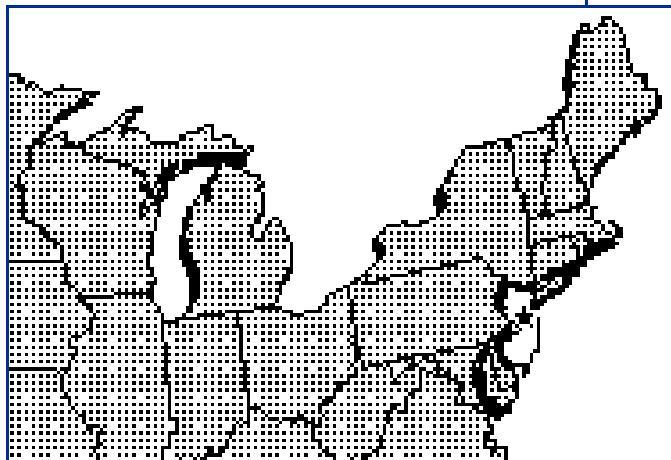
a good example of an ecosystem protection plan that uses floodplain (and buffer) zoning to preserve a river ecosystem (see across). Overlay, open-space, and conservation zones can be applied to a specific resource with defined boundaries, such as a wetland, that is already bound by a zoning ordinance. These zones apply additional restrictions on development and other activities, over and above those in the underlying ordinance, to ensure that a resource or ecosystem is protected from damage. The *Urban Forestry Demonstration Project in New Jersey* illustrates one New Jersey county's use of overlay zones.

Other zoning approaches include cluster zoning and interim development controls. Applied to a subdivided tract, cluster zoning ensures that development is concentrat-

New Jersey: Urban Forestry Improves Urban Living

An innovative demonstration project in New Jersey has allowed five communities to assess their unique environmental conditions and to involve citizens in improving the quality of city life through natural resource management.

The Urban Forestry Demonstration Project includes Mercer, Middlesex, and Passaic counties, and the urban communities of Newark and East Orange. Demonstration projects in the three counties focused on long-term resource protection, while in the urban areas, neighborhood revitalization and improved resource management are highlighted.



Mercer County's Green Links Project has inventoried the interconnected network of streams, wetlands, woodlands, and open spaces remaining in the county. The project has identified these resources as vulnerable to development and has targeted them for future protection as a component of the county's comprehensive natural resource map. Middlesex County has devised a strategy to protect a large percentage of the remaining forest land in the county through a model protection and management overlay zone covering 250 miles of continuous stream corridors. Passaic County has completed a comprehensive natural resource management plan to provide a framework to guide the open-space and development plans for the 16 municipalities that make up the county. These planning efforts have revealed a multitude of high-priority projects at the local level for ecological restoration and enhancement.

Newark and East Orange, as adjacent municipalities, share some common problems associated with neighborhood revitalization, restoration of vacant land, enhancement of riparian areas and city streets, and re-creation of neighborhood pride through community forestry activities.

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ed within a small portion of the tract, leaving large areas as open space. The *GreenSpace Alliance in metropolitan Philadelphia* is an example of a group using cluster zoning to encourage the preservation of green space (see below). Interim development controls include temporary ordinances, such as a moratorium on building permits or water and sewer connections, to slow growth in the short term.



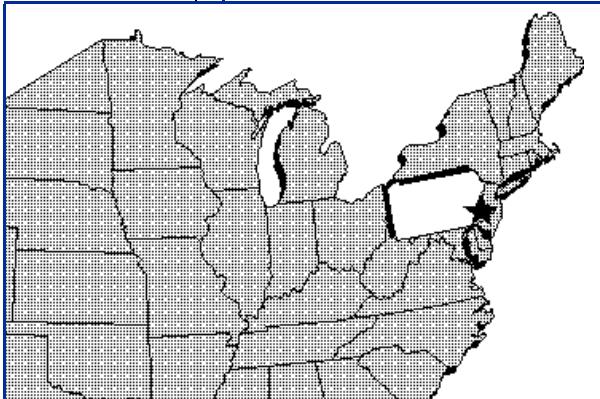
Pittsburgh's Split Tax

A highly successful example of a preferential assessment is Pittsburgh's "split tax", which taxes owner- or tenant-occupied downtown buildings, as well as buildings under active renovation, at lower rates than abandoned and deteriorating buildings. Pittsburgh's "split tax" has revitalized the city by reducing the number of abandoned or deteriorating buildings while increasing the city's overall property tax revenues. In addition, as abandoned or deteriorating buildings are renovated, they provide valuable new commercial and residential space within the city, thereby reducing pressure to build structures outside the downtown business district and community neighborhoods.

Property Taxes and Municipal Fees

Taxes or fees for services can affect the behavior of residents and developers in

The Philadelphia GreenSpace Alliance: Innovative Policy Tool Preserve Open Space and Concentrate Development



preserve key agricultural, natural, and historic resources in the region.

Land-use laws in the Philadelphia region require that individual townships zone to allow for all possible uses (such as industrial, residential, commercial) while also accepting a "fair share" of projected growth in the region. One method to achieve the GSA's goal is to use "zoning jointures" that allow neighboring municipalities to develop a single comprehensive plan and zoning ordinance. This allows participating communities to account for all necessary uses, and to control future development for combined territories, allowing communities to maximize open space by clustering development. Jointures are allowed under the metropolitan planning code (MPC) but are seldom used in southeastern Pennsylvania. The following figure compares typical development patterns under the MPC with land use under zoning jointures, where each square represents a township and each circle represents development.

One GSA pilot project with the Federation of Northern Chester County has developed a joint comprehensive plan with nine municipalities, laying the groundwork for joint zoning in the future. Other GSA projects include the Buckingham Township Project, which is using the transfer of development rights (TDR) to "transfer" the right to develop certain lots

ways that encourage ecosystem protection. For example, property tax breaks can be given in return for agreements from landowners to protect habitat on their property or to leave their property's shoreland in a natural state. Alternatively, localities can preferentially assess properties for taxes at a portion of their value if used in a manner consistent with conservation goals (such as farming) or if left in a natural state (such as a forestland). Increases in building permit processing fees can discourage building or help fund conservation activities.

Performance Standards

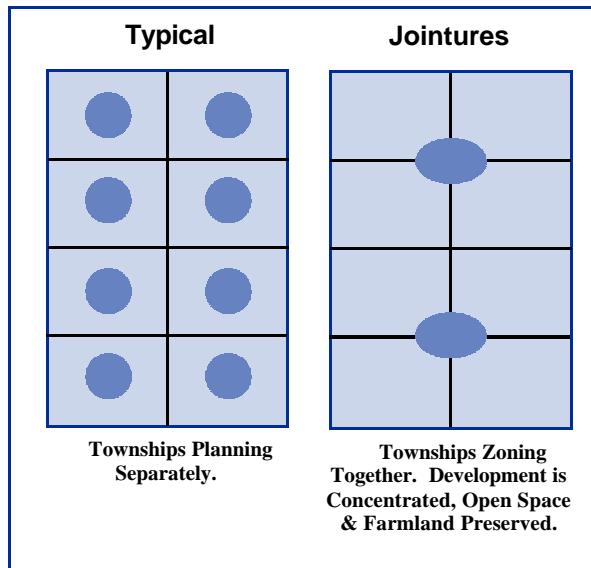
Some localities have begun to enact standards that not only control general uses, such as commercial or industrial development, but also establish strict guidelines for how tracts of land can be developed, regardless of use. For example, some towns regulate the placement or servicing of septic systems. Alternatively, localities can assign a tract of land with an impervious surface ratio that limits the amount of space that can be covered by roads, sidewalks, parking, and other impenetrable surfaces. This is intended to limit runoff and other environmental problems and to encourage the use of

in agricultural areas to areas more appropriate for development. Developers buy development rights from local farmers in an agricultural "sending area" and then build on land in a designated "receiving area" adjacent to existing development.

The alliance also works with the five counties in the region to promote open-space protection. In two counties, over \$150 million has been committed to the purchase of green spaces, but in Delaware County voters rejected a \$100-million proposed open-space program over the issue of taxes.

Recently, the GSA completed a comprehensive GreenPlan for southeastern Pennsylvania that describes its agenda for the creation of a linked regional system of green spaces and the building of green communities. The GSA now is seeking endorsement from a wide variety of organizations and interests to make this plan a reality.

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gravel driveways or reduce the size of parking lots. Finally, municipalities can require developers and other parties to purchase performance bonds, which insure the locality against damage caused to ecosystems. Developers, for example, would purchase these bonds from the local government. If ecosystems are damaged, the municipality can use those funds to repair the damage.

Transfers of Development Rights (TDRs)

TDRs involve transferring the rights to develop a site or building, or a portion of a site or building (including the “air rights” above it), to another site or building. The state or county separates the rights to build on a site from the deed, and allows the landowner to sell these rights to a developer looking to develop in a predesignated “receiving” area where the community wants to concentrate growth. This often allows the developer to exceed a zoning limit on the new site or building. TDRs can be used to protect farms, forests, and other areas by shifting development from one area and concentrating that development elsewhere. (See the earlier description of the *Philadelphia GreenSpace* initiative.)

Growth Planning in Local Communities

Many communities are developing comprehensive growth management plans that combine a number of land-use strategies in an effort to concentrate development within the city limits. Growth management techniques include:

- **Development of “Brownfields” Sites** — Using cluster or bonus zoning, communities can encourage re-development of “brownfields” sites, underutilized or abandoned areas such as railroad yards, warehouses, docks, or industrial sites. Because these areas are usually near or in the urban core of the community, this type of development both revitalizes urban areas and curbs sprawl by reducing pressure to develop industrial areas outside of town.
- **Infill and Minimum-Density Requirements** — Infill development targets existing but underused urban or suburban areas for development. If pockets of undeveloped or less developed land exist in these areas, communities can set infill or minimum-density requirements to increase development there. This reduces pressure to build in undeveloped areas.
- **Urban Service Limits and Urban Limit Lines** — These techniques mark the farthest reaches of city services as well as the edges of the city itself. To restrict development to city areas, planners can limit the degree to which utility extensions (such as sewer lines) are granted beyond the city boundaries.
- **Adequate Public Facilities Requirements** — These requirements limit development to levels that the infrastructure currently can support and mandate that future funding sources for infrastructure be identified in all plans for new development.
- **Increasing Public Transportation** — Primarily intended to mitigate air pollution, this technique involves increasing bus and subway service, implementation of high-occupancy-vehicle (HOV) designations for commuter traffic, installing bike lanes and paths, creating pedestrian walkways, and designing other measures to reduce the use of personal automobiles.



American Planning Association, 1313 E. Sixtieth Street, Chicago, IL 60637-2891, phone: (312) 955-9100, offers many services and publications. For example:

- **Planners Bookstore** sells hundreds of useful guides, books, reports, analytical tools, and bibliographies on a wide range of planning topics, including land use, growth management, transportation, zoning, geographic information systems, economic analysis and development, and habitat protection. The association can also provide you with model conservation zoning ordinances.
- **Planners Advisory Service** is a fee-based research service that can assist in developing strategies related to regional planning, land use, growth management, sustainable development, and most other planning topics.
- Recommended publications available through the American Planning Association include:
 - *Journal of the American Planning Association*, a scholarly journal published quarterly on a wide range of planning topics.
 - *Planning*, a monthly magazine published for a general audience and professional planners.
 - APA Planning Advisory Service, *Performance Controls for Sensitive Lands*, 1975.
 - Beatley, Timothy, *Habitat Conservation Planning*, University of Texas Press, 1994.
 - Butler, Kent, *Protecting Wildlife and Open Space*, 1992. 90-minute VHS video.
 - Endicott, Eve, *Land Conservation through Public/Private Partnerships*, Island Press, Washington, DC, 1993.
 - Nelessen, Anton, *Visions for a New American Dream*, 1994.
 - Smith, Herbert H., *A Citizen's Guide to Zoning*, American Planning Association Planners Press, Chicago, IL, 1993.
 - Steiner, Frederick, *The Living Landscape: An Ecological Approach to Landscape Planning*, McGraw Hill, 1990.

The following publications from other sources also might be useful:

- Arendt, Randall, *Designing Open Space Subdivisions - A Practical Step-by-Step Approach*, Natural Lands Trust, Media, PA, 1996.
- Beatley, Timothy and Greg Low, *Planning for Tomorrow*, The Nature Conservancy, Washington, DC, 1989.
- Collins, Beryl R. and Emily W. B. Russell, eds., *Protecting the New Jersey Pinelands*, Rutgers University Press, New Brunswick, NJ, ISBN 0-8135-1267-0, 1988. This book discusses the transfer-of-development-rights system set up to preserve the New Jersey Pinelands.

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- Diamond, Henry L. and Patrick F. Noonan, *Land Use in America: The Report of the Sustainable Use of Land Project*, Island Press, Washington, DC, 1996. This publication summarizes the major trends and controversies in land use, including the impact of urban sprawl on habitat.
- Einsweiler, Robert C. and Deborah Miness, *Managing Community Growth and Change, Volume I: Managing Growth and Change in Urban, Suburban, and Rural Settings*, Lincoln Institute of Land Policy, Cambridge, MA, October 1992.
- Ewing, Reid, et al., *Best Development Practices: Doing the Right Thing and Making Money at the Same Time*, Florida Department of Community Affairs, Tallahassee, FL, May 1995. This guidebook provides recommendations for growth management that take into account financial interests of developers and the general public. It also includes an excellent annotated bibliography.
- Little, Charles E., *Greenways for America*, The Johns Hopkins University Press, Baltimore, MD, 1990.
- Mantell, Michael A., Stephen F. Harper, and Luther Propst, *Creating Successful Communities*, The Conservation Foundation, Washington, DC, ISBN 1-55963-014-0, 1990. In particular, Chapter 1 discusses conservation of agricultural land, Chapter 2 discusses rivers and wetlands, and Chapter 5 discusses the value of open space.
- McHarg, Ian L., *Design with Nature*, John Wiley & Sons, Inc., New York, NY, ISBN 0-471-55797-8, 1992. This book discusses the effects of development on various ecosystems and offers suggestions about how to minimize ecosystem damage from development.
- Miness, Deborah and Robert C. Einsweiler, *Managing Community Growth and Change, Volume II: Bibliography of Academic and Professional Literature on Growth and Growth Management*, Lincoln Institute of Land Policy, Cambridge, MA, October 1992.
- Porter, Douglas R. and David A. Salvesen, *Collaborative Planning for Wetlands and Wildlife*, Island Press, Washington, DC, ISBN 1-55963-287-9, 1995. This book provides case studies in protecting sensitive lands from development.
- Templin, Elizabeth E., *Managing Community Growth and Change, Volume III: Bibliography of Educational Material for Local Officials on Growth Management*, Lincoln Institute of Land Policy, Cambridge, MA, October 1992.
- U.S. Environmental Protection Agency, Office of Water, *Protecting Coastal and Wetlands Resources: A Guide for Local Governments*, EPA 842-R-92-002, Washington, DC, 1992. In particular, Chapter 3 addresses zoning tools, Chapter 4 addresses land acquisition, and Chapter 5 addresses the use of taxes, fees, and other incentives.

4.3 Strategies Based On Federal and State Laws and Programs

Federal and state laws address a wide range of environmental issues. Regulations issued under federal and state laws set limits on releases of toxic substances, require cleanup of contaminated sites (sometimes with government funding), or control specific practices (such as the management of underground storage tanks). Many laws require public notice and comment, offering communities a way to participate in the regulatory process. Some laws provide for citizen law suits to enforce their provisions or impose penalties for violations. This section describes relevant federal and state laws and discusses how to work with them.

Federal and State Laws Affecting Ecosystems

Federal and state lawmakers have introduced an extensive set of laws designed to protect the environment. A complete discussion of these laws would be far too lengthy for this resource book. However, Table 4-1 presents a brief discussion of some federal laws that may be applicable to your ecosystem. Phone numbers for the suggested contact organizations are included in Appendix A.

State laws complement and expand upon many of the federal laws. They often are enacted when states want more stringent environmental requirements than those called for by the federal government, where the state has been delegated responsibility for implementation of a federal program, or when there is a specific, unique ecosystem or problem area that the state government wishes to regulate. For example, state laws may address coastal management issues, severe air pollution (California), or widespread hazardous waste contamination (New Jersey).

In addition, statewide growth management laws have been enacted by Florida, Georgia, Maine, Maryland, New Jersey, Oregon, Rhode Island, Vermont, and Washington. Of these, seven have policies for curbing urban sprawl that require or encourage contained development and strive to protect rural and natural areas (Maine, Maryland, New Jersey, Oregon, Rhode Island, Vermont, and Washington); two (Georgia and Vermont) provide for special review and approval of large-scale projects; and two (New Jersey and Washington) have criteria for assessing new community proposals (Ewing, et al., 1995).

Working With Federal and State Laws

The following are examples of how federal and state laws and regulations may interact with communities' ecosystem protection efforts:



EPA's Community XL Project

To give communities the opportunity to implement their own ideas for improving their ecosystems, the U.S. EPA has developed the Community XL program. Communities accepted into the program have developed innovative environmental protection plans that promise superior environmental protection to what would be achieved under the current regulatory system. EPA then works with state and local agencies to grant the community regulatory flexibility to try the plan.

To learn more about Community XL, contact the Information Line, phone: (703) 934-3241, fax: (202) 260-8590, Internet Website: http://www.epa.gov/Project_XL. To submit a proposal for your community, submit four copies of the proposal to Regulatory Reinvention Pilot Projects, FRL 5322-9, Water Docket, Mailcode 4101, U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC 20460.

Table 4-1

Federal Laws Relevant to Ecosystem Protection¹

Statute	Description	Contacts/Opportunities for Local
Clean Water Act (CWA) Section 402	The CWA covers a number of regulatory, funding, and education programs aimed at protecting and restoring the nation's surface waters. These include a permitting system that limits the amount and type of pollution that facilities and other individual sources can discharge. Dischargers must obey national discharge guidelines, as implemented to achieve state water quality standards.	Usually, the Office of Water within the U.S. Environmental Protection Agency delegates this program to the states. Communities can ask the state department of environmental protection for a review of how well local industries are complying with pollution discharge limits. Also, the CWA has a number of funding programs to help municipalities build wastewater facilities and control polluted runoff from farms, storm sewers, and other sources.
Coastal Zone Management Act of 1972	This statute helps coastal states manage and protect coastal resources from threats such as development, erosion, and pollution. States must develop programs to control polluted runoff from farms, storm sewers, and other sources that affect coastal waters.	Administered by the National Oceanic and Atmospheric Administration within the U.S. Department of Commerce, this program provides technical assistance and grants to states in developing coastal management plans. Communities can ask their state for an evaluation of whether development in coastal areas is consistent with their state's plan, and can seek state funding for projects in the community.
Coastal Barrier Resources Act	This statute provides federal funding for protection of barrier islands.	Administered by the National Oceanic and Atmospheric Administration within the U.S. Department of Commerce.
National Environmental Policy Act (NEPA)	All federally funded projects and activities as well as projects built on federal property (including highways, ports, dams, power plants, airports, drinking water plants and pipes, and sewage treatment plants and pipes) must comply with NEPA, which requires the submission of an Environmental Impact Statement (EIS) describing the project's effect on the local ecosystem as compared to other alternatives.	This program is administered by the U.S. Environmental Protection Agency. The community can examine previous EISs to determine the effects of similar projects on its ecosystems and can participate in public hearings on proposed development projects.
National Flood Insurance Program	This statute provides federally subsidized flood insurance for those communities that have adopted floodplain management regulations (e.g., wetlands protection) that will minimize future flood damage. Generally, flood insurance is required before federally guaranteed mortgages or loans can be issued.	This program is administered by the Federal Emergency Management Agency (FEMA). By incorporating floodplain management regulations into local zoning ordinances and building codes, communities can become eligible for floodplain insurance.
Endangered Species Act (ESA)	This statute provides for the protection of endangered wild plants and animals.	The U.S. Fish and Wildlife Service administers the ESA. As part of the process of determining which plants and animals should be considered endangered, the FWS conducts hearings to obtain public input. Communities also can participate in the development of Habitat Conservation Plans, which developers must design if their proposed development affects an endangered or threatened species.
National Wild and Scenic Rivers Act (NWSRA)	This statute protects extraordinary rivers from damming and other forms of development.	The National Park Service, which administers the NWSRA, manages all rivers that are protected. Through its Rivers and Trails Assistance Program, the Park Service also provides technical assistance to states and localities in developing conservation plans for rivers and river segments.
North American Waterfowl Management Plan Conservation	This program was started in 1986 to enhance waterfowl populations and habitats. The plan stipulates the use of subsidies, financial incentives, and tax adjustments favorable to landowners to promote conservation.	Management of the plan is delegated to state and regional levels, which work with the U.S. Fish and Wildlife Service as well as over 40 conservation organizations. Communities can get involved by asking authorities to assess whether local habitat is eligible for protection under the plan.

Table 4-1 (continued)**Federal Laws Relevant to Ecosystem Protection¹**

Statute	Description	Contacts/Opportunities for Local
Reserve Program/Wetlands Reserve Program	The Conservation Reserve Program uses financial incentives to encourage farmers to leave sensitive lands, such as riparian zones and steep slopes, out of agricultural production. The Wetland Reserve Program is similar, focusing on wetlands.	The programs are administered by the Natural Resource Conservation Service within the U.S. Department of Agriculture. Local farmers can enroll in the grant program, which involves signing 10-year agreements with the government for the receipt of grant funds.
Clean Water Act (CWA) Section 404	This section of the CWA regulates the discharge of dredged material (silt excavated from the bottom of a waterway) and fill into U.S. waters, including wetlands, and establishes a permit program to ensure compliance with environmental requirements.	This program is administered by the U.S. Environmental Protection Agency Office of Water and the U.S. Army Corps of Engineers. As a part of the permitting process, the Corps holds hearings on proposed dredge or fill discharge permits. Communities can use these hearings as a forum for expressing concerns about potential projects.
Swampbuster Program	This statute discourages the conversion of wetlands into farmland by making persons who raise crops on wetlands ineligible for most federal farm benefits.	This program is administered by the U.S. Department of Agriculture.
Resource Conservation and Recovery Act (RCRA)	RCRA regulates the design, location, operation, and monitoring of new and old municipal landfills and facilities that manage hazardous waste (e.g., landfills, recyclers, and incinerators). It also regulates the generation and transport of hazardous waste, requires cleanup of contaminated hazardous waste facilities, and requires inspection and cleanup of underground storage tanks at gas stations and other sites.	This program is administered by the Office of Solid Waste and Emergency Response within the U.S. Environmental Protection Agency, in conjunction with state waste management agencies. Permitting of hazardous waste management facilities includes provisions for public participation; communities may wish to take part in these forums.
Clean Air Act (CAA)	CAA regulations include permits to businesses and industries to limit the amount of pollution they emit to the air. Development that would increase air pollution is limited in areas that do not meet federal air quality standards.	The CAA requires that states develop plans for maintaining air quality and reducing air pollution. Emissions permitting includes provisions for public participation; communities may wish to take part.
Congestion Mitigation and Air Quality Program under the Intermodal Surface Transportation and Efficiency Act (ISTEA)	ISTEA promotes mass transit, rails-to-trails programs, and regional transportation land-use planning. The Congestion Mitigation and Air Quality Program provides grants for projects aimed at reducing transportation-induced congestion, safety hazards, and pollution.	This program is administered by the Federal Highway Administration and Federal Transit Administration under the Department of Transportation. Communities can apply for grants for projects that reduce traffic congestion and improve air quality.
Cooperative Forestry Assistance Act	This Act provides technical and financial assistance for both urban and rural forest management and community development activities that protect and restore ecosystems.	This program is administered by the USDA Forest Service in cooperation with the state forester in each of the 50 states.
Emergency Preparedness and Community Right-To-Know Act (EPCRA)	EPCRA requires facilities using hazardous chemicals to notify the community of chemical spills or leaks. It also requires facilities to publish lists of the hazardous chemicals used or stored on site and to develop spill response plans.	At the local level, EPCRA is administered by a Local Emergency Planning Committee (LEPC). Through the LEPC, communities can find out what hazardous chemicals are present in the area and can participate in developing spill response plans.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	This statute regulates the application of pesticides and other pest control substances to crops.	Through a system of review and permitting, FIFRA provisions can ban the application of substances that may harm sensitive ecosystems. Communities can take part in this permitting process.

¹ Federal statutes not discussed here include a number of laws that regulate federal lands managed by the U.S. Forest Service, the Bureau of Land Management, the Fish and Wildlife Service, and the National Park Service.

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- **Public Disclosure and Community Involvement Laws** — Many laws have been enacted in recent years to promote the public disclosure of information. These include, for example, the Toxic Release Inventory, the Environmental Impact Statement (EIS) process described above, the Freedom of Information Act, which provides citizens the right to access to all types of federal government information (except national security or confidential business information), and requirements under the Intermodel Surface Transportation and Efficiency Act (ISTEA) and the Clean Air Act (CAA) for government evaluation of the impacts of development.
 - **Land-Use Planning** — The many land-use requirements and grant programs in federal laws (e.g., the Clean Air Act, the Coastal Zone Management Act, and the Flood Insurance Act) support growth management and protection and restoration of habitats, farms, forests, wetlands, and open space.
 - **Supplemental Enforcement Program** — The U.S. EPA's Supplemental Enforcement Program (SEP) is a compliance agreement program whereby the EPA requires public or private groups that have violated an EPA-administered law to restore or protect habitats or to modify their operations in an environmentally beneficial way, rather than paying a fine. Communities can be involved in negotiating a SEP agreement.

You can contact federal and state governments through their public information offices, or you can contact the office in the relevant state agency that administers the program you're interested in. The offices can provide you with information on the specific requirements and resources of their programs, information on how to obtain



Diamant, Rolf, J. Glenn Eugster, and Christopher J. Duerksen, *A Citizen's Guide to River Conservation*, The Conservation Foundation, Washington, DC, ISBN 0-89164-082-7, 1984. Pages 27-68 address laws and economic tools that apply to conservation efforts.

Eugster, J. Glenn, *Riverwork Book*, Mid-Atlantic Regional Office, Division of Parks and Resource Planning, National Park Service, U.S. Department of Interior, Washington, DC, 1988.

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Stevenson, Jane H., *Managing Community Growth and Change, Volume IV: Directory of Federal Data Sources and Overview of State Data Needs and Activities in Growth Management*, Lincoln Institute of Land Policy, Cambridge, MA, October 1992.

U.S. Environmental Protection Agency, *Environmental Planning for Small Communities, Appendix B: What Environmental Regulations Affect Your Community?*, Office of Regional Operations and State/Local Relations, Washington, DC, September 1994. This appendix contains a summary of federal laws applicable to ecosystems and describes how you can work with these laws to protect your ecosystem.

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Collins, Beryl R. and Emily W. B. Russell, eds., *Protecting the New Jersey Pinelands*, Rutgers University Press, New Brunswick, NJ, ISBN 0-8135-1267-0, 1988.

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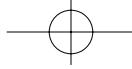
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Porter, Douglas R., ed., *Growth Management: Keeping on Target?*, Urban Land Institute, in association with the Lincoln Institute of Land Policy, Washington, DC, 1986.

Southern Watersheds Committee, *Proposal for Virginia Beach Agricultural Reserve Program*, 1994.

U.S. Environmental Protection Agency, *Environmental Planning for Small Communities*, Office of Regional Operations and State/Local Relations, Washington, DC, September 1994.

U.S. Environmental Protection Agency, Office of Water, *Protecting Coastal and Wetlands Resources: A Guide for Local Governments*, Washington, DC, 1992.



Chapter

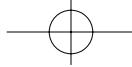
5 Evaluating And Choosing Strategies For Ecosystem Protection Efforts

An understanding of the interaction between community life and ecosystems, coupled with knowledge of ecosystem protection strategies, provides the foundation for selecting ecosystem protection strategies appropriate for a given community. This chapter discusses this selection process.

5.1 *Initial Considerations*

The following criteria can be used to narrow down the choices of strategies and identify the best ones for addressing specific ecosystem problems.

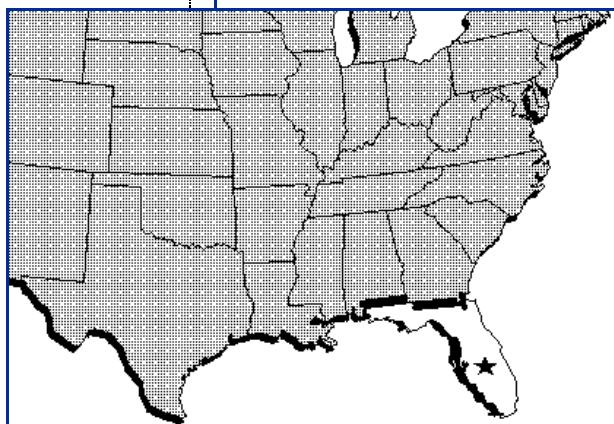
- **The Advantages of Voluntary Strategies and Local Activities** — Projects based on voluntary action and local activities may be easier to control and implement, and may achieve results faster.
- **Environmental Justice** — The benefits and burden of ecosystem management decisions may or may not be distributed equitably among community members. Certainly, you would want to avoid a decision that might put the bulk of the burdens on an area or group that is poorly equipped to shoulder them, particularly if the majority of the benefits would go somewhere else in the community. Therefore, principles of fairness say that “environmental justice” be considered in community-based projects and goals. The broadest possible stakeholder participation will ensure that all groups within a community are treated fairly regardless of race, religion, gender, or economic position.
- **Addressing Stressors and Achieving Community Goals** — In some cases, preventing a detrimental activity from occurring is not by itself enough to enable an ecosystem to recover. The affected resource may have to be restored. For example, reducing or stopping development near a nesting site may not necessarily cause birds to repopulate; the community may need to plant certain trees or build nesting sites as well. In this case, multiple strategies may be appropriate.
- **The Legal Feasibility of the Strategies** — Local, state, and federal officials are a good source of advice on how to create protection strategies that will work within the requirements and restrictions of all applicable laws, ordinances, and regulations.
- **Monetary Expense and Time Commitments** — The best strategies are those



that cost the least money to achieve a given goal. However, some strategies that seem less costly may cost participants a lot of time. For example, acquiring land initially may seem too expensive, yet finding a donor may require less effort than trying to change a land-use ordinance. Both the initial level of effort to get a program in place and the continuing effort required to run it are potential considerations.

- **Cosmetic or Temporary Solutions or the Big Picture** — Often communities find it helpful to combine short-term projects with efforts to find longer term solutions to environmental problems — such as encouraging recycling and composting while working with other local communities to find additional space for the disposal of materials that can't be recycled. The *Kissimmee River Basin restoration initiative* in Florida is an example of an ecosystem protection effort in which participants focused on reversing fundamental problems rather than making superficial changes (see below).
- **Stakeholders Outside the Community** — A community's ecosystem may have significance to people living in other parts of the country or world, especially if it is home to rare and endangered species or extraordinary habitat

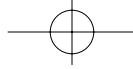
South-Central Florida: Bringing the Kissimmee River Basin Back to Life



The Kissimmee River restoration highlights the importance of focusing on the root causes of ecosystem degradation. Historically, a 103-mile stretch of the Kissimmee River meandered along its natural path through south-central Florida without the constraints of man-made levees, channels, and dams controlling its flow. In the 1960s, the river was channelized by the U.S. Army Corps of Engineers. Areas that periodically had received the floodwaters of the Kissimmee in the past (approximately 40,000 acres of wetlands) were drained to allow massive commercial, residential, and resort development in the Orlando area and surrounding agricultural regions.

The broadleaf marsh and wet prairie communities of the floodplain were converted to pasture lands, resulting in significant loss of fish and wildlife habitat and destruction of the wetlands' food webs and hydrologic cycles. Waterfowl use of the lower basin decreased by over 90 percent. Suitable habitats for wading birds, forage fish, and larger riverine fish also were sharply reduced. Since channelization, the river has lower dissolved oxygen levels and poorer water quality due to nutrient loading from agricultural and urban runoff and discharges. Consequently, these nutrients are reaching Lake Okeechobee and increasing the rate of eutrophication.

In the early 1970s, soon after the river was channelized, public concern and support increased for restoration of lost environmental benefits associated with the river and its former natural floodplain. By the early 1980s, fast-paced development and greater understanding of adverse environmental impacts led to the creation of the Kissimmee River Resource Planning and Management Committee (KRRPMC) in 1984. The committee was comprised of 35 constituencies, including landowners as well as agricultural, environmental, municipal,



(such as estuaries or marshes). These resources may have value beyond what that community assigns to them directly. Similarly, communities may be stakeholders in areas down stream or down wind if their actions have impacts in those places.

- n **Existing Institutions and Programs** — Rather than starting from scratch, communities often can build on the efforts of other local, state, or federal programs. Some of the stakeholders already participating in a community's effort may be members of these organizations and can provide firsthand information on relevant projects already under way. Examples of some types of organizations that may have similar programs include:
 - *Watershed Associations* – These work to ensure water quality in a region.
 - *Cooperative Extension Services* – These are sponsored by the U.S. Department of Agriculture and assist farmers in protecting their land and preventing pesticide runoff and erosion.
 - *Land Trusts* – These organizations purchase land to be preserved in its

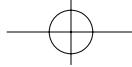


county, state, and federal authorities. Restoration of the Kissimmee River has hinged largely upon the support and strength of the KRRPMC, with funding coming largely from federal and state sources.

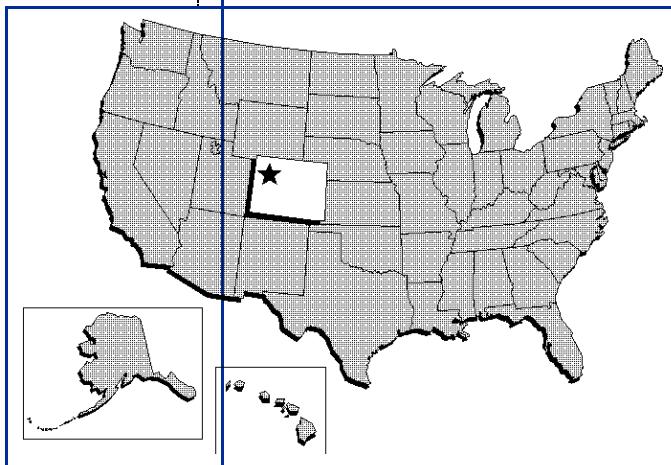
To carry out the proposed restoration, the state of Florida, with support from the KRRPMC, developed a phased approach to backfilling channelized stretches of the river. The first phase of the plan calls for increasing the storage capacity of upper basin lakes to provide continuous and more naturally variable downstream river flow. The second phase will start by backfilling three to five miles of the canal, then creating one to three miles of new river channel and removing levees.

By diverting river flow and restoring natural wetland flooding, water quality will be improved as wetlands filter out sediments and nutrients, enhancing fish and wildlife habitat quality and diversity. By re-creating natural ecological interactions, the river system's environmental, recreational, and cultural functions will be reestablished. Once complete, nearly two thirds of the original 50,000 acres of floodplain wetlands in the Kissimmee River system will be restored. The effort required to reach this level of restoration is proving to be an admirable accomplishment. It is important to note that, even after adjusting for inflation, restoring the ecosystem is costing far more than the actions that caused the damage in the first place.

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Yampa River Basin Partnership of Northwest Colorado: Coordinating Community Groups for a Common Vision



for the community. The region has experienced rapid population growth, creating concern about the river's habitat. Air pollution is also an issue in the region, affecting wilderness areas and scenic vistas.

For many years, groups such as Trout Unlimited, the Bureau of Land Management, and local city councils worked independently to address single issues, such as economic development, fish conservation, or recreation. Organizations acted without knowledge of the other groups' actions or even existence. Lack of coordination among groups meant that they duplicated efforts and tangible progress on development and natural resource issues was limited. Furthermore, these issues are deeply interrelated, and long-term solutions could not be accomplished without coordination. For instance, preserving water quality in the Yampa

Before organizing a new community-based ecosystem protection initiative, some communities have chosen to tap into other existing local groups that have interests in conservation, economic development, or planning. The Yampa River Basin Partnership succeeded in its efforts by drawing on existing groups and encouraging them to undertake a comprehensive and coordinated effort to create a sustainable ecosystem and community.

The Yampa Valley in northwest Colorado faces many growth, development, and natural resource issues. The area is home to the resort town of Steamboat Springs and the Yampa River watershed. The Yampa River, a relatively undisturbed river in the region, is a source of pride and concern

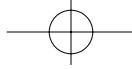
natural state for public enjoyment. They include national organizations such as The Nature Conservancy and the Conservation Fund, as well as local land trusts.

- *Conservation and Environmental Organizations* – These include the Sierra Club, National and state Audubon Societies and the American Water Resources Association.

These organizations already may be working on a strategy your community has identified. They may offer key resources such as experts on staff that you can use to further your effort. Communities also have formed umbrella organizations that help keep different organizations informed of each other's actions and help them work with each other. The *Yampa River Basin Partnership in Northwest Colorado* is an example of such an organization (see above).

5.2 A Hypothetical Community Choosing Its Strategy

To get a clearer picture of what a final strategy might look like, consider a hypothetical community that wants to improve the quality of its harbor, called "Sunrise Bay". Rapid growth in this community has led to development of coastal areas and pollution



River could not be ensured without the creation of a county-wide development plan for river-front property.

As a result, local mayors and city council members recognized the advantage of merging all groups into a single cohesive partnership. To further this effort, community leaders convened a conference to discuss the idea. Over 260 members of the business, non-profit, and government community attended the conference where the Yampa River Basin Partnership was created. Attendees also developed an organizational structure and set goals for the partnership.

Today, the Yampa River Basin Partnership is a successful effort that works to preserve the watershed and the quality of life in the region through coordinated natural resource conservation.

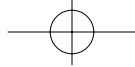
Contacts: Wendy DuBord, Co-coordinator
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of inshore waters by runoff. The community's overarching goals are to reduce pollution and prevent further loss of key ecosystems. In the category of voluntary activities, community members have decided to:

- Organize a beach cleanup every six months, where volunteers spend a day picking up trash
- Organize biannual household hazardous waste pickups and a storm drain stenciling project to reduce hazardous waste pollution of the bay
- Organize a wetland planting day, where volunteers plant grasses to provide stability to the bay's wetlands
- Organize a festival that highlights the recreational activities provided by the bay to boost nature-based tourism
- Encourage owners of beachfront property to donate or offer for sale to a land trust the development rights (easements) to their property between their buildings and the waterfront.

In the category of local government tools, the community is implementing:



- Regulations to reduce septic tank leaks
- Improvements to the storm sewer system to reduce runoff to the harbor
- Zoning ordinances that require clustering of residential developments within or next to existing urban residential or commercial development.

5.3 Analyzing the Socioeconomic Impacts of Strategies

Various ecosystem protection strategies have different effects on economic and social conditions. Some strategies or combinations of strategies will likely yield the best overall future conditions for the ecosystems in your region and the human communities that are a part of them. This section discusses how local business, government, and residents might be affected and how to analyze the outcomes of your strategy.

Effects on Key Segments of the Community

Businesses

Analysis of effects on the business community includes not only short-run effects, but also longer term effects. For example, one strategy may call for reducing the rate of harvesting local shellfish, which could hurt local shellfishers in the short run.

However, this strategy would leave the shellfish beds in much better condition in 10 or 20 years than would a strategy of harvesting all of the shellfish quickly.

Likewise, ecosystem protection strategies affect both businesses that profit from extracting resources as well as companies that benefit from healthy ecosystems. For example, a company that rents sailboats likely would be helped by elimination of floating mats of algae on the local lake. Other businesses that depend on tourist revenues, such as restaurants and hotels, also would benefit.

Healthy ecosystems can benefit local business in less obvious ways as well. For example, some companies give serious consideration to local environmental amenities when making decisions about where to locate new operations. In many instances, employees consider an attractive location to be an important feature of their job.

Finally, strategies have “ripple effects” through the local economy. In addition to industries directly affected by your plan (for example, commercial harbor tour or “dinner tour” operators), there are secondary impacts on businesses that sell to, or buy from, directly affected businesses (for instance, boat

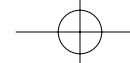


Nature-Based Tourism

Nature-based tourism is travel and recreation for the appreciation of nature. The fastest growing segments of this industry include bird and other wildlife watching, hiking and backpacking, photography, boating, camping, and picnicking. In 1991, Americans spent \$4.4 billion for food and lodging on wildlife viewing trips, \$198 million for guide services, and \$88.6 million for equipment rentals.

Properly managed, nature tourism can enhance the economic well-being of residents. Communities can promote nature tourism by researching the special environmental amenities provided by the community and highlighting them — through printed material, festivals, or other events.

For more information about nature tourism and how to get your community involved, contact the Office of Sustainable Ecosystems and Communities (OSEC), phone (202) 260-5339, at the U.S. Environmental Protection Agency for a copy of OSEC Issue Brief #1: *Nature-Based Tourism* and for other informative reports.



builders, local marinas, restaurants, and other service industries). Later in this chapter we discuss analytic tools for assessing this kind of ripple effect.

Local Government

Most local governments rely upon a combination of property taxes, sales taxes, and fees to fund schools, roads, parks, utilities (including water, sewer, and recycling), and other city services. Changing zoning laws and tax policies to limit sprawl and protect wildlife habitats can reduce the cost of municipal services. Providing services and infrastructure to support lower-density developments, particularly those located far from a community's center, costs considerably more than providing infrastructure and services to higher-density development near the community (Bank of America, 1995). They also cost communities significantly more than farmland — one study estimates that for every tax dollar collected from low-density development, municipalities spend \$1.36 on services, whereas for each tax dollar collected on farmland, municipalities spend 21 cents on services (American Farmland Trust, 1991). Discouraging low-density development, such as strip malls, on the edge of your community while encouraging medium-density townhouse development in the middle of your community can reduce the cost of providing schools, roads, parks, water, recycling, sewage, and other city services. Under certain conditions, medium- to high-density developments built in the center of a town can even yield greater profits to the developer and landowners than low-density developments built on the edge of town or in rural areas.

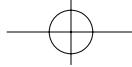
Local Residents and Quality of Life

The most direct effect on quality of life stems from new activities that can be enjoyed as a result of protecting local ecosystems. Local residents may have more opportunities for recreation such as swimming, boating, hiking, picnicking, hunting and fishing, or cross-country skiing. Even if they don't engage in recreational activities, people may enjoy the improved appearance of the community. People who don't use or even see protected natural resources may still place value on preserving them for future generations or derive value simply from knowing that they exist. In particular, some people are concerned with extraordinary ecosystems (such as coral reefs and hot springs), endangered species, and the diversity of species. In addition, steps that a community takes to reduce risks to local ecosystems may also improve human health.

Ways to Present Options

All of the considerations described above can make for a complex decision when looking at options for ecosystem protection. A simple way to present these options to capture all the various implications they have for the community is to make a chart summarizing the pros and cons of each strategy. Table 5-1 presents an example for the strategy chosen by the hypothetical community introduced above that wants to improve the quality of "Sunrise Bay". The community has filled out Table 5-1 for each set of strategies it considered. This effort included asking different businesses and residents what they themselves consider the pros and cons of the plan. Our hypothetical community determined that:

- ▀ Some businesses will profit from increased shellfishing harvests, but other businesses will have to pay for the increased costs of complying with sewer regulations. Developers will be restricted in their choice of development plans (which will reduce the value of some properties), but may incur savings

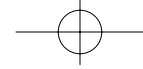


in some development costs through clustering.

- The municipality may spend less to provide city services to new residents because of cluster developments. The conservation of open space also may enhance property values and increase property tax revenues. On the other hand, the town will have to pay for storm sewer improvements.

Table 5-1

Protecting the “Sunrise Bay” Ecosystem: Volunteer Cleanups, Replanting, Easements, Septic Tank Regulations, Storm Sewer Improvements, and Clustered Residential Development Regulations			
	Effects on	Economic Effects on Municipality or State	Effects on Residents’ Quality of Life
Pro s	<ul style="list-style-type: none"> ▫ Increased revenues and employment associated with commercial enterprises related to nature-based tourism, recreation, and commercial shell-fishing ▫ New jobs created in sewer design and installation ▫ Decreased residential development costs (such as the reduced cost of building roads) ▫ Increased value of land near habitat and protected open space 	<ul style="list-style-type: none"> ▫ Decreased capital construction and service costs associated with reduced sprawl ▫ Potential tax revenue increases from property value increases ▫ Increased revenues from fees for beach attendance and boat launching 	<ul style="list-style-type: none"> ▫ Increased opportunity for water- and land-based recreation ▫ Decreased health risk for swimmers ▫ Aesthetic value ▫ Intrinsic value placed on harbor cleanliness among those not directly using the bay
Con s	<ul style="list-style-type: none"> ▫ Monetary, time, and paperwork costs of compliance with sewer regulations ▫ Costs for infrastructure improvements to support nature-based tourism 	<ul style="list-style-type: none"> ▫ Cost of storm sewer improvements, including capital costs as well as hiring inspectors and holding hearings ▫ Cost of implementing septic tank requirements ▫ Cost of developing and implementing new zoning ordinances 	<ul style="list-style-type: none"> ▫ Reduced private space ▫ Cost of compliance with septic tank regulations ▫ Time and effort involved in beach cleanup, wetland planting, and festivals



- Residents' quality of life will improve because of increased recreational opportunities, reduced health risks for swimmers, improved aesthetics as a result of the volunteer activities, and because people take pleasure in knowing that the harbor is healthy and that it will be available for their children to enjoy. On the other hand, residents will have to make do with smaller lots on which to build houses and will have to pay to upgrade their septic systems.

Techniques for Analyzing the Pros and Cons

Beyond considering who is affected by an ecosystem protection strategy, communities can evaluate the *magnitude* of the impacts on different community members. Getting a sense of just how much people will be affected by your plan allows you to decide whether it should be modified somehow to ensure community stability. For example, our hypothetical community might determine that the benefits for charter boat businesses are not large, and that the sewer regulations will be extremely expensive and would put a great strain on the municipality's ability to provide other services. This information may lead the community to improve the sewer system to accommodate new development. Alternatively, the community may decide that the benefits of this kind of business do not outweigh the costs of improved infrastructure and decide against steps that stimulate this kind of ecotourism.

Economic issues such as effects on local business or city tax revenues lend themselves to more quantitative types of analyses. The analyses communities pursue depend on the strategies under consideration; it is impossible to describe the full range of analyses here. However, two types of analyses stand out as potentially useful for assessing the magnitude of the impacts: municipal fiscal analysis and regional economic impact modeling.

Municipal Fiscal Analysis

Municipal fiscal analysis involves determining how local strategies may affect the finances of the municipality. Some ecosystem protection strategies will have clear, direct effects on municipal funds. For example, in our hypothetical community, the municipality would have to pay to make improvements to the sewer system. Another community's plan might call on the municipality to purchase land or easements for conservation purposes. Your strategies might have less obvious effects on municipal finances, some of which have been mentioned above. These may include changes in the cost of providing services and in property tax revenue. Some of these costs may be reduced by acquiring low-cost loans for the development of publicly owned sani-

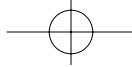


The Cost of Growth in New Hampshire

Like many other states experiencing significant growth, New Hampshire is finding that while much of its new development increases tax revenues for towns, a significant portion of new development drains more funds from municipal budgets than it gives back in taxes. Municipalities are finding that they have to spend too much for roads, schools, and other infrastructure projects.

These circumstances led authors David Harrigan and Kathy Morse to outline a method for towns to determine the cost of new residential development. This involves adding the prospective property tax and auto registration fees to develop a total revenue estimate per household. Then, the authors subtract total prospective school and non-school expenditures per household, as well as the property taxes that would have been paid on the undeveloped land. If this final figure is negative, the development will cost the municipality more than it will contribute in tax revenue.

For more information, see: Harrigan, David and Kathy Morse, *The Cost of Growth, Economic Benefits of Land Protection*, Land Trust Alliance, Washington, DC, April 1994.



tary treatment plants through the EPA's State Revolving Fund. Likewise, costs for public education on remediation of hazardous waste sites may be partially covered through an EPA Technical Assistance Grant (for more information on TAG grants you can contact the EPA's RCRA Hotline listed in Appendix A or your EPA Regional office). Your community also may receive increased revenue from access fees. Cleaning up a harbor or a lake or preserving public land may lead to an increase in attendance at public parks and beaches. If the municipality charges admission to these areas, an increase in attendance means that revenues will go up.

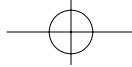
Our hypothetical community could apply municipal fiscal analysis to estimate the change in service costs associated with reduced sprawl, including time spent on garbage pickup and miles of pipeline laid to hook up to town water supplies. The community also may want to estimate potential increases in property values and the resulting increase in property tax revenues. Officials in your town assessor's or public works offices can provide guidance on potential municipal fiscal impacts of



Jackson, Ted and Rosemary Infante, eds., *Economic Benefits of Land Protection*, Land Trust Alliance, 900 Seventeenth Street NW, Washington, DC, April 1994, phone: (202) 785-1410. This publication includes the following articles:

- Brabec, Elizabeth, *On the Value of Open Spaces*, Scenic America Technical Information Series, Volume 1, No. 2, 1992. This article discusses how open space can increase the value of existing developments because residents want to be near undisturbed natural areas.
- Harrigan, David and Kathy Morse, *The Cost of Growth, Forest Notes*, Spring 1989. This article provides a simple method for estimating how much a development will cost the municipal government, and how to compare that estimate to the costs of keeping the land undeveloped.
- Miller, Stephen, *The Economic Benefits of Open Space*, Isleboro Islands Trust, ME, May 11, 1992. This article discusses how open space can increase the value of existing developments because of the appeal of undisturbed natural areas.
- Nantucket Land Council, Inc., *Balancing Today's Development & Tomorrow's Taxes*, 1989. This article discusses how Nantucket, an island in Massachusetts heavily dependent on nature-based tourism, is controlling development to ensure the health of the tourism industry.
- Smith, Van, *Protecting Rivers, Trails, and Greenways Reaps Economic Returns*, (Exchange, Summer 1991). This article discusses the many ways that protecting ecosystems can provide direct economic benefits to the community.
- Thomas, Holly L., *The Economic Benefits of Land Conservation*, Technical Memo of the Dutchess County Department of Planning and Development, February 1991. This article discusses the reasons why land conservation is often less expensive for local governments than development.

American Farmland Trust, *Alternatives for Future Urban Growth in California's Central Valley: The Bottom Line for Agriculture and Taxpayers*, American Farmland Trust, Washington, DC, 1995. This publication discusses how urban sprawl would reduce agriculture in California's Central Valley and estimates the additional costs that taxpayers would bear.



strategies you are considering.

Regional Economic Impact Modeling

As noted earlier, your plan may affect a number of sectors *indirectly* (such as farmers selling produce to restaurants), as well as having direct impacts. A technique called *regional economic impact modeling* can provide estimates of both direct and indirect effects.

Regional economic impact modeling uses computer programs (models) to track the effects of a single economic change on the larger economy — like the ripples on a pond when you throw in a stone. Our hypothetical community, for example, can use regional economic impact modeling to estimate the total effect on the regional economy of an increase in commercial shellfishing. The estimate includes both the increased revenues enjoyed by commercial fishermen as well as the increased revenues of local shipbuilders and ship repair shops, net manufacturers, and other related

American Farmland Trust, *Making a Positive Contribution*, *American Farmland*, pp. 2-3, Fall 1991. This article discusses the difference in tax revenue from developed and agricultural land.

Burchell, Robert W., et al., *Development Impact Assessment Handbook*, Urban Land Institute, Washington, DC, ISBN 0-87420-743-6, 1994. This document provides a comprehensive discussion of how to analyze the environmental, social, fiscal, and economic effects of real estate development. A computer model is provided on diskette.

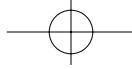
Doucette, Robert, et al., *The Comparative Economics of Residential Development and Open Space Conservation*, Allagash Environmental Institute, University of Maine, Portland, ME, 1977.

Fox, Tom, *Urban Open Space: An Investment That Pays: Real Estate Values*, The Neighborhood Open Space Coalition, New York, NY, 1990. This report describes the contribution that open space makes to the economies of large cities, highlighting impacts on real estate values, public health, city image, and other factors.

Frank, James E., *The Costs of Alternative Development Patterns: A Review of the Literature*, Urban Land Institute, Washington, DC, ISBN 0-87420-695-2, 1989. This publication reviews a number of studies showing that low-density, sprawling development is more expensive than compact development.

Freedgood, Julia, *Is Farmland Protection a Community Investment? How to Do a Cost of Community Services Study*, American Farmland Trust, Washington, DC, 1993.

Hulsey, Brett, *Sprawl Costs Us All: How Uncontrolled Sprawl Increases Your Property Taxes and Threatens Your Quality of Life*, Sierra Club Midwest Office, Madison, WI, 1996. This publication gives estimates of the cost of urban sprawl to resident taxpayers and provides advice on how community members can work to reduce sprawl.



industries. If you want to implement the model, economists in your city government or at a local college or university can help.

5.4 Adapting Strategies to Changing Situations and



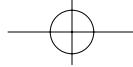
The Minnesota IMPLAN Group (MIG), located in Stillwater, Minnesota, has designed a regional economic impact modeling program called IMPLAN. MIG licenses the software and can be hired to perform regional economic impact analyses.

Useful publications include:

- Byrum, Oliver, *Old Problems in New Times*, American Planners Association Press, Chicago, IL, 1992.
- Coughlin, Cletus C. and Thomas B. Mandelbaum, *A Consumer's Guide to Regional Economic Multipliers*, *Review of the Federal Reserve Bank of St. Louis*, Vol. 73, No. 1, pp. 19-32, January/February 1991. This article provides a short description of regional economics in language that can be understood by non-economists.
- Hustedde, Ronald, Ron Shaffer, and Glen Pulver, *Community Economic Analysis: A How To Manual*, North Regional Center for Rural Development, Iowa State University, Ames, IA, 1995. This manual provides instructions for making calculations using local economic data that can help communities understand their economies.
- National Park Service, *Economic Impact of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book*, National Park Service, Department of the Interior, Washington, DC, 1995. This resource book provides examples of how greenways and parks benefit local economies and gives practical guidance on how to estimate these benefits in your community.

For more information on sustainable communities:

- Scruggs, Patricia, *Guidelines for State Level Sustainable Development*, Center for Policy Alternatives, Washington, DC, September 1993. This document surveys various international, national, and state programs to promote sustainable development. It suggests ways in which various activities do and do not promote sustainability and provides examples of programs, some of which are relevant at the local level as well.
- Region 3 of the U.S. EPA is beginning an effort to develop a "Green Communities Assistance Kit", which would be available to communities seeking to become economically and ecologically sustainable. This assistance kit will provide instruction on public outreach, visioning, socioeconomic analysis, environmental planning, implementation, and indicators. For more information, contact Susan McDowell, U.S. EPA Region 3, 841 Chestnut Street, Philadelphia, PA, 19107, phone: (215) 566-2739.



New Information

Chapters 2 and 3 discussed the importance of indicators in setting goals and assessing ecosystem health. Indicators show whether the strategies the community has chosen are having the desired effects on ecosystems, the economy, and the quality of life. In particular, effective indicators can:

- Tell the community how well its strategies are working; namely, what is going well or what might need to be changed
- Help the community see the full effects of ecosystem planning and management on the ecosystem itself as well as on the quality of life and the economic health of the community
- Help the community decide how to focus community efforts and resources more efficiently and equitably.

For example, our hypothetical community can use the following indicators to measure its progress toward revitalizing “*Sunrise Bay*”:

- Assess the health or abundance of local wetlands by calculating increases in the number of acres of wetlands and the abundance and diversity of wetland-dependent species
- Assess the impact of the plan on the local fishing industry and the health of local fisheries by examining the change in pounds of fish landed per unit of effort (such as hours of fishing) compared to a base year
- Assess the plan’s impact on the local quality of life by calculating increases in beach attendance.

The *Darby Partners in Columbus, Ohio* (discussed on following page) chose a number of different indicators to measure their progress.

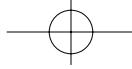
Community changes and new information may require changes in the ecosystem protection plan as well. The changing visions and desires of stakeholders can provide information needed to fine-tune the ecosystem protection plan. Continuous monitoring of the ecosystem protection project and its results indicates which goals the plan is not meeting so that new strategies can be developed, and highlights goals that should be changed to meet the needs of a changing community.

Reasons for Adapting the Ecosystem Protection Plan

Responding to New Information

Projects aimed at improving environmental, ecosystem, social, and economic conditions deal with very complex and interrelated systems. New information may become available that enhances your understanding of the system. The following types of information could affect your ecosystem protection plans:

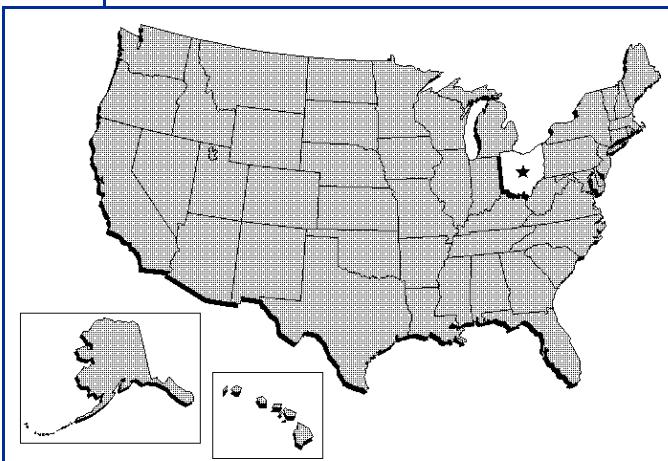
- New technologies may be developed that can better solve environmen-



tal problems. For example, a new treatment process at the local sewage treatment plant might reduce harmful releases to surface water, eliminating the need for ongoing monitoring efforts.

- New government regulations or court decisions may change how the community can address environmental problems. For example, newly created state regulations for septic systems might replace local ordinances developed as part of your ecosystem protection plan, or court decisions may limit governments' ability to regulate the use of private property.
- New scientific and monitoring data sources may be discovered or created. For

Columbus, Ohio: The Darby Partners Monitor Success



Monitoring allows citizens concerned about the Big Darby Creek system to track the results of their efforts. Big Darby Creek is located outside of Columbus, Ohio and consists of 86 miles of main stem river and 245 miles of tributaries. The system drains six counties in central Ohio and is considered to be the healthiest aquatic system of its size in the Midwest and one of the healthiest warm-water habitats in the nation. In 1991, The Nature Conservancy named Big Darby Creek one of the "Last Great Places".

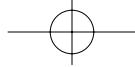
Although little industrial or municipal wastewater has been discharged into the watershed, it has been subjected to stress from

non-point source pollution generated by local farming. Eighty percent of the watershed's 580 square miles is farmland. A decrease in water quality poses a threat to aquatic species, as does increasing development and resulting erosion.

In response, local citizens organized the Darby Partners, a partnership that consists of more than 40 private and public organizations. The group measures its success by tracking benchmarks:

- Over 2,900 individuals have been involved in Darby protection activities
- One-third (284) of all local farms are working to reduce sediment and nutrient runoff
- 18 new wetlands have been created
- 32,056 acres are now in conservation tillage
- 312 acres of trees have been planted
- Sediment transport has been reduced by 35,500 tons
- A number of further studies and research projects have been initiated.

Contact: Teri Devlin
Project Director
The Nature Conservancy
1504 W. First Avenue
Columbus, OH 43212
Phone: (614) 486-4194
Fax: (614) 486-9772



example, a study of local wetlands by a nearby university may shed new light on the consequences of wetlands loss.

Responding to Changes in the Community

Changes within your community, such as rapid growth or the loss of a key industry, can affect the plan. As communities change, goals may change. Community growth also may cause unforeseen problems that require new or revised solutions, or it may allow you to implement solutions that were too expensive for a smaller community. In addition, stakeholders' priorities may change as some problems are addressed successfully and resources become available to address new problems.

Stakeholder Participation in Adapting the Plan

Changes in the plan imply changes in its effects on stakeholders, who likely will want to discuss any proposed alterations. The community may wish to undergo another visioning process to accomplish this. This process can reaffirm or adjust the project's basic direction and confirm whether or not the community in general believes that its priorities have changed. Visioning is also an opportunity to revitalize the community's commitment to the project, recruit new participants, and take on new challenges.

A community effort to manage a local forest in *Nevada County, California*, illustrates the importance of getting feedback from affected stakeholders — in this case, a timber sales contractor (see following page).

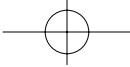
Keeping Everyone Informed

Some communities have used written progress reports as a means of keeping everyone informed about the project. These reports can describe progress toward community goals. To this end, a checklist with completed actions can be a useful part of the progress report. Communities have distributed reports as an easy-to-read pamphlet or a series of articles in the local newspaper. Finally, the community can make these reports the focus of community events, keeping the project in the public eye. As mentioned in Chapter 2, newsletters that document the history of the project help everyone keep progress in mind and serve as a resource to educate newcomers.

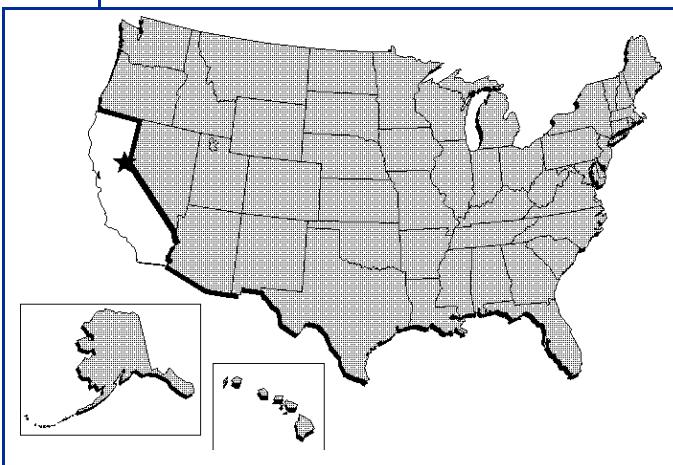
Staying Aware of Problem Areas

No matter how much thought the community has put into its ecosystem protection project, some of the chosen strategies may not work out. Your indicators will help to pinpoint problem areas. Indicators yield data necessary for assessing results periodically and comparing them to your goals. When solutions do not meet expectations, it may be time to reevaluate the plan. Communities often must change strategies to adjust for unexpected results. For example, the ecosystem protection plan may rely on voluntary action, such as the use of erosion control practices by farmers and developers to reduce sedimentation of streams. If sedimentation problems continue, the community may want to consider more direct measures, such as ordinances requiring maintenance of streamside buffer zones, which protect the forest, fields, and wetlands adjacent to local waterways.

Expanding the Scope of the Project



Nevada County, California: Getting Stakeholder Feedback to Improve a Community Forest



The 1995 forest timber harvest on Bureau of Land Management (BLM) land in Nevada County, California, was unique from the very beginning. Communities normally have an opportunity to voice their opinions during development of timber harvest plans on public land, but this local community participated from the start. The residents living in and around the “inimim forest” (a Native American word for Ponderosa Pine, pronounced “IN-I-mim”) now have an integrated role in the management of neighboring public lands. They were involved during the inventory process, through the marking of trees, the felling, and the subsequent sale. While some

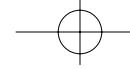
stages of the process were slowed down by involving volunteers in the work (trained and supervised by BLM foresters throughout), other stages went smoothly because of the extent of community involvement.

After putting the timber sale out to bid three times, the BLM finally found a contractor willing to involve local residents. To evaluate the effectiveness of the sale, the forest management committee analyzed the process with the contractor. The committee was trying to assess how much the constraints imposed by citizen involvement reduced the value of the timber sale, if at all. The contractor’s response was mixed. While he disagreed with the way some trees were marked, he did say that he would work with the group again — that it was worth it for him, economically, to manage the sale.

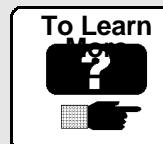
The timber sale took a “light on the land approach”, according to BLM Area Manager, Deane Swickard. The team chose to protect wildlife habitat by leaving dead standing trees and selected individual trees with the intention of producing a high quality, value-added product. The BLM then arranged for local mills to process and sell the wood to the Timber Framer’s Guild (for milled timber-framed houses) and local craftspeople at a premium price.

Evaluation and adaptation is in progress on other features of this innovative partnership. One management prescription included controlled burns. This technique maintains a healthy understory of vegetation for wildlife habitat while simultaneously removing forest debris that may otherwise accumulate to be a serious fire hazard. Prescribed burns, as they are called, are allowed during a small window of time, when it is neither too wet nor too dry. In this fully democratic decision-making process, community members had to be located and quick decisions needed to be made. Project leaders are currently attempting to identify a speedier notification and concurrence system for making more timely decisions about prescribed burns.

Contact: Deane Swickard
Area Manager
Bureau of Land Management
Folsom Resource Area
63 Natoma Street
Folsom, CA 95630
Phone: (916) 985-4474



In tracking the progress of the project, the community may see opportunities to expand the scope of its activities. You may be able to build on existing successes to achieve better protection of your ecosystem or to reinforce a commitment to community sustainability. A re-visioning process may identify further goals and tasks that you could tackle. For example, if the community has succeeded in restoring river-banks in your town, it could consider forming partnerships with towns up- or down-river to show them how they might do the same. Ultimately, this effort might grow into a watershed management project. Likewise, if a goal to reduce erosion is succeeding, the community might consider a broader goal to increase soil productivity so that less chemical fertilizer is needed, or implement integrated pest management practices to reduce the use of chemical pesticides.



USDA Forest Service and Center for Urban Forestry, *An Ecosystem-Based Approach to Urban and Community Forestry*, Center for Urban Forestry, Philadelphia, PA, December 1994. This workbook presents practical information on community-based ecosystem protection, with a focus on urban forestry. In addition to describing steps for monitoring and evaluating ecosystem protection strategies, it provides an excellent overview of all the steps involved with ecosystem protection — from forming a project team to selecting strategies.

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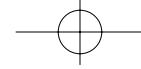
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Frank, James E., *The Costs of Alternative Development Patterns: A Review of the Literature*, Urban Land Institute, Washington, DC, ISBN 0-87420-695-2, 1989.

Freedgood, Julia, *Is Farmland Protection a Community Investment? How to Do a Cost of Community Services Study*, American Farmland Trust, Washington, DC, 1993.

Hulsey, Brett, *Sprawl Costs Us All: How Uncontrolled Sprawl Increases Your Property Taxes and Threatens Your Quality of Life*, Sierra Club Midwest Office, Madison, WI, 1996.

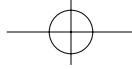
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National Park Service, *Economic Impact of Protecting Rivers, Trails, and Greenway Corridors: A Resource Book*, National Park Service, Department of Interior, Washington, DC, 1995.

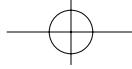


Appendix A

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:

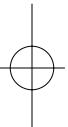
General Information Directories	A-2
Ecosystem Assessment Data (Federal Agencies)	A-3
EPA Hotlines and Regulatory Dockets	A-5
Ecosystem Protection/Land Conservation	A-7
Sustainable Development/Economics	A-9
Program Organization and Funding	A-10
State Environmental Protection Agencies	A-11
Natural Heritage Programs and Related Data Centers	A-17

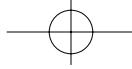


GENERAL INFORMATION DIRECTORIES

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.

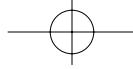
- 1) **National Wildlife Federation, 1996 Conservation Directory, 1996**, phone: (800) 432-6564.
A list of organizations, agencies, and officials concerned with natural resource use and management. Published annually. Check your local public library.
- 2) **Balachandran, Sarojini, ed., Encyclopedia of 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.



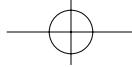


ECOSYSTEM ASSESSMENT DATA (FEDERAL AGENCIES)

- 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 Deatruck (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.



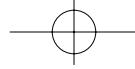
EPA HOTLINES AND REGULATORY DOCKETS

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

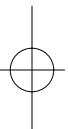
- 1) Green Lights and Energy Stars Programs, phone: (800) 782-7937, Internet Website: <http://www.epa.gov/docs/gcdoar/energystar.html>, provide information and technical support on energy efficient lighting to U.S. businesses and governments.
- 2) Hazardous Waste Ombudsman, phone: (800) 262-7937 in U.S. 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) WASTEWI\$E 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.

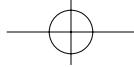
The EPA regulatory dockets provide information about regulations, permitting, and hazardous waste cleanup decisions.

- 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



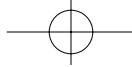
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- 3) Wetlands Docket — Office of Water (4101), U.S. EPA, 401 M Street SW, Washington, DC 20460, phone: (202) 260-1799
 - 4) Resource Conservation and Recovery Act Docket — Office of Solid Waste and Emergency Response (5305), U.S. EPA, 401 M Street 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



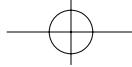


ECOSYSTEM PROTECTION/LAND CONSERVATION

- 1) **U.S. Department of Interior** — 1849 C Street NW, Washington, DC 20240, phone: (202) 208-3171.
 - **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.
 - **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.
 - **National Park Service** — phone: (202) 208-3171.
 - **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.
 - **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/afthome.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.

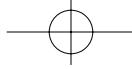


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- 9) **National Wildlife Federation** — 1400 Sixteenth Street NW, Washington, DC 20036-2266, phone (202) 797-6800, Internet Website: <http://www.nwf.org/nwf>. A non-profit organization whose mission is to educate, inspire, and assist individuals to 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:
 - **Episcopal Church Center, Peace and Justice Ministries** — 815 Second Avenue, New York, NY 10017, phone: (800) 334-7626.
 - **Evangelical Lutheran Church in America, Environmental Stewardship and Hunger Education** — 8765 W. Higgins Road, Chicago, IL 60631, phone: (312) 380-1485.
 - **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.
 - **Jewish Theological Seminary of America, Coalition on the Environment and Jewish Life** — 3080 Broadway, New York, NY 10027, phone: (212) 678-8996.
 - **National Council of the Churches of Christ, USA, Environmental Justice** — 475 Riverside Drive, New York, NY 10115, phone: (212) 870-2141.
 - **Presbyterian Church (USA), Office of Environmental Justice** — 100 Witherspoon Street, Room 3046, Louisville, KY 40202, phone: (502) 569-5809.
 - **Progressive National Baptist Convention, Home Mission Office** — 601 Fifth Street NE, Washington, DC 20019, phone: (202) 396-0558.
 - **Roman Catholic Church, U.S. Catholic Conference, Office of International Justice and Peace** — 3211 Fourteenth Street NE, Washington, DC 20017, phone: (202) 541-3140.
 - **United Church of Christ, Office for Church Society** — 700 Prospect Avenue, Cleveland, OH 44115, phone: (216) 736-2174.
 - **United Methodist Church, General Board of Church and Society Resources** — 100 Maryland Avenue NE, Washington, DC 20002, phone: (202) 488-5617.



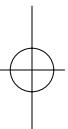
SUSTAINABLE DEVELOPMENT/ECONOMICS

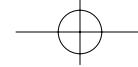
- 1) **U.S. Department of Commerce**, Bureau of Economic Analysis — 1441 L Street NW, Washington, DC 20230, phone: (202) 606-9900. Publishes regional economic data such as employment and revenues of various industries.
- 2) **U.S. Department of Energy**, Center of Excellence for Sustainable Development — 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

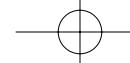
Public Health and Environment Department
4300 Cherry Creek Drive, South
Denver, CO 80222
Phone: (303) 692-2000
Fax: (303) 782-0095
TTY: (303) 691-7700

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

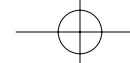
Health and Environment Department
Landon State Office Building
900 S.W. Jackson Street
Topeka, KS 66612-1290
Phone: (913) 296-1500
Fax: (913) 296-6247

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

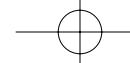
Environmental Quality Department
P.O. Box 20305
Jackson, MS 39289-1305
Phone: (601) 961-5650
Fax: (601) 354-6965

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

New York

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

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

North Carolina

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

Nevada

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

North Dakota

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

New Hampshire

Environmental Services Department
6 Hazen Drive
Concord, NH 03301
Phone: (603) 271-3503
Fax: (603) 271-2867
TTY: (800) 735-2964

Ohio

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

New Jersey

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

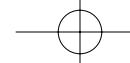
Environmental Protection Agency
1800 WaterMark Drive
P.O. Box 1049
Columbus, OH 43216-0149
Phone: (614) 644-3020
Fax: (614) 644-2329
TTY: (614) 644-2110

New Mexico

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

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

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

Pennsylvania

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

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

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

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

South Carolina

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

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

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

Vermont

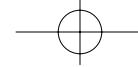
Natural Resources Agency
State Complex
103 S. Main Street
Waterbury, VT 05671
Phone: (802) 241-3600
TTY: (800) 253-0191

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

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

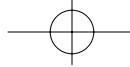
Wyoming

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 Broaddus

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

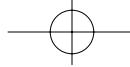
Department of Fish & Game
600 South Walnut Street, Box 25
Boise, ID 83707
Phone: (208) 334-3402
Fax: (208) 334-2114
Coordinator: Bob Moseley

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

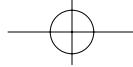
**Montana Natural Heritage
Program**
 State Library Building
 1515 E. Sixth Avenue
 Helena, MT 59620
 Phone: (406) 444-3009
 Fax: (406) 444-0581
 Coordinator: David Genter

**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
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North Carolina Heritage Program

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North Dakota Natural Heritage Inventory

North Dakota Parks & Recreation Department
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Fax: (701) 328-5363
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Ohio Natural Heritage Program

Division of Natural Areas & Preserves
Department of Natural Resources
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Phone: (614) 265-6453
Fax: (614) 267-3096
Division Chief: Guy Denny

Oklahoma Natural Heritage Inventory

Oklahoma Biological Survey
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University of Oklahoma
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Coordinator: Caryn Vaughn

Oregon Natural Heritage Program

Oregon Field Office
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Pennsylvania Natural Diversity Inventory - East

PNDI-East
The Nature Conservancy
34 Airport Drive
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Phone: (717) 948-3962
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Coordinator: Julie Lundgren

Pennsylvania Natural Diversity Inventory - West

Western Pennsylvania Conservancy
Natural Areas Program
316 Fourth Avenue
Pittsburgh, PA 15222
Phone: (412) 288-2777
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Pennsylvania Natural Diversity Inventory - Central

Bureau of Forestry
P.O. Box 8552
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Fax: (717) 783-5109
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Rhode Island Heritage Program

Department of Environmental Management
Division of Planning & Development
83 Park Street
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South Carolina Heritage Trust
SC Wildlife & Marine Resources Department
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South Dakota Natural Heritage Database

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

Tennessee Division of Natural Heritage

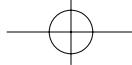
Department of Environment & Conservation
401 Church Street
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Fax: (615) 532-0614
Director: Reggie Reeves

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Utah Natural Heritage Program

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Vermont Nongame & Natural Heritage Program
 Vermont Fish & Wildlife Department
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 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
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 Fax: (804) 371-2674
 Division Director: Tom Smith

Washington Natural Heritage Program
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West Virginia Natural Heritage Program
 Department of Natural Resources Operations Center
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 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
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 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

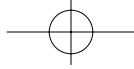
National Forest Data Centers

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

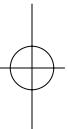
Ouachita National Forest
 P.O. Box 1270 Hot Springs, AR 71902
 Phone: (501) 321-5323

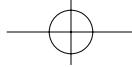
Virginia Coast Reserve
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 Nassawadox, VA 23413
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 Fax: (804) 442-5418
 Director: John M. Hall



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.

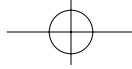
Producers: Plants that perform photosynthesis and provide food to consumers.

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.

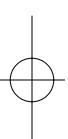
Wetlands: Areas between land-based and surface-water ecosystems, including swamps, bogs, and marshes. Wetlands help control floods, filter pollutants, and serve as spawning and nursery areas for fish.

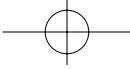


Appendix C

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?

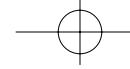
An ecosystem is a community of animals and plants interacting with one another and with their physical environment. Ecosystems include physical and chemical components, such as soils, water, and nutrients, that support the organisms living there. These organisms may range from large animals to microscopic 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.

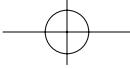
In the case of threatened and endangered plants or animals, loss of even a few individuals is significant, because the species is at or near the point of no return. When the population of a given plant or animal species dwindles, food chains may be broken and biodiversity is lost.

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:

- **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.
- **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.
- **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.
- **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.
- **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.



-
- **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:

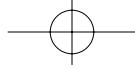
- The physical boundaries of ecosystems don’t always coincide with a community’s political boundaries or developed area.
- The natural range for species of concern may move beyond one ecosystem. For example, songbirds that nest in your backyard may have a migratory range of thousands of miles.
- “Natural” ecosystem boundaries (where one ecosystem begins and the next one ends) are often not easily identified.
- 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 wild-flowers 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.

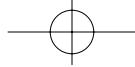
This section briefly reviews the types of ecosystem stressors — physical, biological, and chemical — and the problems they can cause.

- **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.

- **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



To Learn More



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Freedman, Bill, *Environmental Ecology: The Ecological Effects of Pollution, Disturbance, and Other Stresses*, Academic Press, San Diego, CA, ISBN 0-12-266542-2, 1995. This environmental science text provides a detailed explanation of the ecological effects of human activity, with chapters on air pollution, acidification, forest declines, oil pollution, eutrophication, pesticides, and other topics.

Miller, G. Tyler, *Living in the Environment*, Wadsworth Publishing, Belmont, CA, ISBN 0-534-00684-1, 1979.

Noss, R.F. and A.Y. Cooperrider, *Saving Nature's Legacy: Protecting and Restoring Biodiversity*, Defenders of Wildlife, Island Press, Washington, DC 20009, ISBN 1-55963-248-8, 1994.

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:

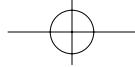
- **Water Supply** — Ecosystems provide fresh water for household uses (such as drinking and bathing) and for agricultural and industrial uses. Surface water sources (such as lakes, reservoirs, and rivers) and underground water sources both play a vital role in the maintenance of human and animal life.
- **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-

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

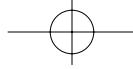
**Table C-1**

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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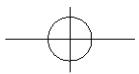
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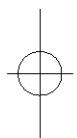
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