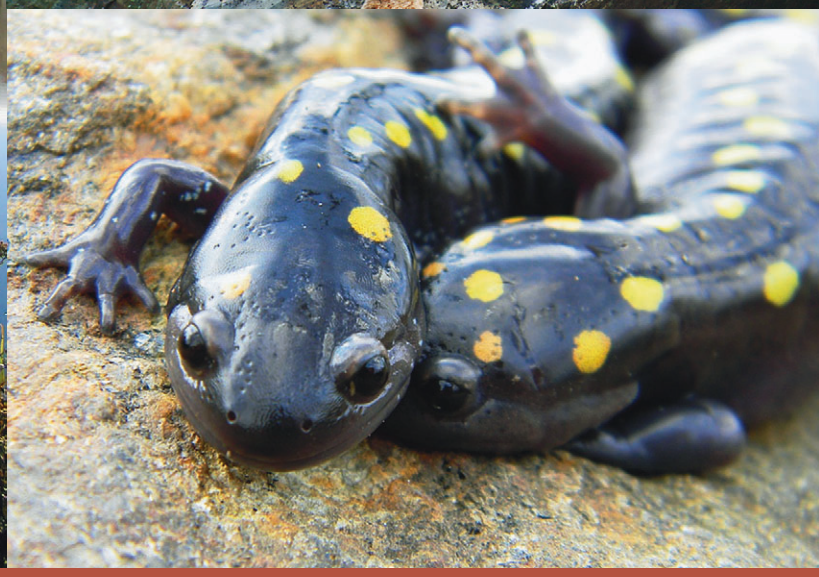
Documenting and Protecting Biodiversity on Land Trust Projects

— an introduction and practical guide —



Written by

Christopher R. Wilson

Published by

Land Trust Alliance

Together, conserving the places you love

With funding from

Sweet Water Trust

Documenting and Protecting Biodiversity on Land Trust Projects

— an introduction and practical guide —

Christopher R. Wilson

Published by the Land Trust Alliance

With Funding from Sweet Water Trust

First Edition

Designed by Peter Holm, Sterling Hill Productions
Copyedited by Kate Mueller
ISBN 978-0-943915-04-3

Contents

List of Charts, Maps, Tables

Charts

Maps

Tables

List of Abbreviations

BDR	Baseline Documentation Report
BRC	Blue Ridge Conservancy
CDOW	Colorado Division of Wildlife
CMP	Conservation Measures Partnership
EO	Element Occurrence
ESA	Endangered Species Act
FGDC	Federal Geographic Data Committee
GAP	Gap Analysis Program
GIS	Geographic Information System
GPS	Global Positioning System
IRC	Internal Revenue Code
IRS	Internal Revenue Service
NCED	National Conservation Easement Database
NHD	National Hydrography Dataset
NMFS	National Marine Fisheries Service
NVC	National Vegetation Classification
NWI	National Wetlands Inventory
NWT	Northeast Wilderness Trust
PAD-US	Protected Area Database of the United States
PIF	Partners in Flight
Q2C	Quabbin to Cardigan Initiative
SGCN	Species of Greatest Conservation Need
SWAP	State Wildlife Action Plan
TNC	The Nature Conservancy
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
WAP	Wildlife Action Plan

Acknowledgments

This handbook was made possible through generous financial support provided by the Sweet Water Trust. I am particularly grateful to Walker Buckner and Eve Endicott of Sweet Water Trust, as well as the staff and board of the Santa Lucia Conservancy, for their enthusiastic support and encouragement of this project. Rob Aldrich of the Land Trust Alliance and Kendall Slee of Kendall Slee Communications served as the primary editors and guided this project to completion.

The handbook benefitted greatly from the experiences, insights, and feedback from the following individuals who reviewed the handbook in sections or in its entirety:

Rob Aldrich, Land Trust Alliance, Washington, D.C.
Paul Beier, Northern Arizona University
Mark Berman, Wildlands Network, North Carolina
Judy Boshoven, Defenders of Wildlife, Living Lands Project, Virginia
Pat Comer, NatureServe, Colorado
Kyle Copas, NatureServe, Virginia
Andrew Cutko, Maine Natural Areas Program, Maine
Amielle DeWan, Defenders of Wildlife, Living Lands Project, Virginia
Eve Endicott, Sweet Water Trust, Massachusetts
Kenyon Fields, Wildlands Network, Washington
Mitch Hartley, U.S. Fish & Wildlife Service, Atlantic Coast Joint Venture, Massachusetts
Mark Lapin, Middlebury College, Vermont
Arvind Panjabi, Rocky Mountain Bird Observatory, Colorado
Conrad Reining, Wildlands Network, Vermont
Kendall Slee, Kendall Slee Communications, Colorado
Kim Vacariu, Wildlands Network, Arizona
Rick Van de Poll, Ecosystem Management Consultants, New Hampshire
Marla S. Wilson, Humane Society Wildlife Land Trust, California

The following individuals provided advice, insights, examples, maps, or figures that contributed to the quality and usefulness of this handbook:

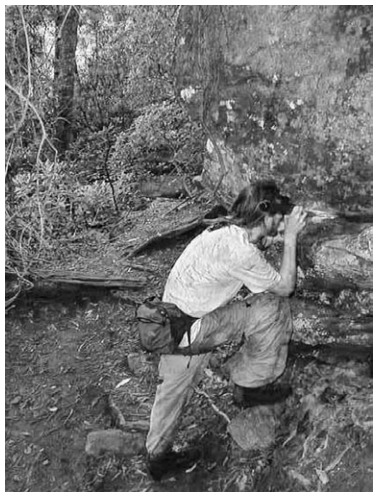
Connor Bailey, Rocky Mountain Wild, Colorado
Mark Berry, Downeast Lakes Land Trust, Maine
Jason Bulluck, Virginia Natural Heritage Program
Kevin Caldwell, Mountains-to-Sea Ecological, North Carolina
Steven Carter, North American Land Trust, Pennsylvania
Jeff Corser, New York Natural Heritage Program, New York
John Davis, Adirondack Council, New York
Lee Echols, North American Land Trust, Georgia
Eric Hiegl, Blue Ridge Conservancy, North Carolina
Timothy Howard, New York Natural Heritage Program
Andrew Johnson, North American Land Trust, Pennsylvania
Janet McMahon, Ecologist, Maine
Jason McNees, NatureServe, Virginia
Paul Myers, TetraTech, Maine
James Northup, Northeast Wilderness Trust, Vermont
Rob Riordan, NatureServe, Virginia
Breece Robertson, The Trust for Public Land, New Mexico
Michael Scisco, BioGeoCreations, New Mexico
Tom Segerstrom, Jackson Hole Land Trust, Wyoming
Paige Bonaker Singer, Rocky Mountain Wild, Colorado
Peter Smith, North American Land Trust, North Carolina
Liz Thompson, Vermont Land Trust, Vermont

I also received advice or assistance from the following organizations: Society for the Protection of New Hampshire Forests, Colorado Natural Heritage Program, New Hampshire Natural Heritage Bureau, Montana Natural Heritage Program, and The Nature Conservancy, Eastern Regional Science Office.

Introduction

People value nature for different reasons and usually for a variety of reasons. I value the big, beautiful mystery of it. The more you search, the more you realize every species, natural community, or landform has a long, beautiful story behind it, and science and the human mind are only prepared to comprehend the first few pages.

An endangered salamander stares back at me from her rock crevice in the North Carolina mountains. I think about how she coevolved with the specific type of forest that surrounds us, which is one of the most diverse in the world. An early version of this forest type used to span the northern hemisphere of the Pangaea supercontinent hundreds of millions of years ago, and now the best remaining examples exist where I stand and in China. The salamander has probably existed as a species for more than 20 million years and might only be around a little while longer. Then I realize, at that moment, I'm probably the only person on the planet having face time with this species and on its terms.



Jeff Corser

I became a biologist because I crave these experiences, but they come at a cost. You become deeply aware of how tragic the biodiversity crisis really is. You feel compelled to do something about it, and you hope others can be convinced to find value in the information you provide and actually use it for the greater good.

In the United States alone, we have lost between 100 and 500 species since European settlement. The current global species extinction rate is 1,000 to 10,000 times the normal background rate throughout the earth's biological history. Such a spike hasn't happened since a large asteroid struck the earth 65 million years ago. Now we are the asteroid.

There are all sorts of perfectly practical and utilitarian reasons why the loss of species should concern everyone. But I like to think of it this way: Losing species and ecosystems in the name of growth and progress is like selling your organs. You can make a quick buck, but you have lost parts of yourself. You have to assume they have value, regardless of whether you understand them.

The biodiversity crisis is driven primarily by habitat loss, which is no surprise. In the United States, only 42 percent of the land remains covered with natural vegetation, more than half the wetlands have been filled since the

American Revolution, and we continue to lose about 1.6 million acres of open space each year to development.

We have all witnessed the disappearance of these places. The woods around my house in south Florida, where I played as a child and went hunting with my dad, have become subdivisions and strip malls. The blissful wildflower meadows of the Colorado Front Range, where I learned botany, suffered the same fate. Fortunately, communities around the country have stepped up and taken action by forming land trusts to protect the natural lands they love. This movement has grown exponentially in recent years and focuses on working with willing landowners to protect private lands for the public good. This is particularly important for biodiversity conservation because private lands hold a disproportionate number of rare or at-risk species and ecosystems compared with public lands.

This handbook evolved from my experiences working as a consulting and staff biologist for land trusts across the country and from my involvement with biodiversity sessions at Rally, the Land Trust Alliance's National Land Conservation Conference. During this time, I have noticed that:

1. Land trust workers often wish to incorporate biological information and protections into their projects but, since they are usually not biologists, are not sure how to proceed.
2. Biologists and consultants, who wish to help land trusts, are not clear on what types of biological information the land trusts need, how the data will be used, and how land trusts operate.
3. Landowners are unsure of how their land protection project will benefit from such information.

This book is meant to help bridge these gaps between conservation science and its application to the protection of private lands. The goal is to help land trust practitioners and landowners understand what biodiversity is, how it's conserved, how the important biological attributes of a project are identified and documented, and how to translate this information into protection and management. It is also meant to help biologists, consultants, and landowners understand the role and responsibilities of land trusts, what types of biological information are most useful, and how this information is used in the land protection process.

In a rush to make a land protection deal happen, biological assessments and inventories are sometimes viewed as unnecessary, complicated, and expensive. To the contrary, they can bolster land protection projects and can be easier and less expensive than most people think. Besides identifying strategic, high-

quality projects that maximize conservation benefits, an analysis of biological conservation values can facilitate the land protection process by enhancing grant applications and inspiring interest from funders. Biological reports can also help defend the project from future legal challenges, which can be of particular interest to landowners claiming tax deductions for the donation or bargain sale of a conservation easement.

Losing species and ecosystems in the name of growth and progress is like selling your organs. You can make a quick buck, but you have lost parts of yourself.

This book reviews free data sources that allow land trusts to assess a wide range of biological attributes easily, quickly, and inexpensively at the very beginning of the land protection process, when such information is most useful. The use of on-the-ground biological inventories is also discussed, including what type of biologist to use, when such studies are recommended, what they should entail, and how to gain the most useful information for the least amount of time and money.

Finally, the book discusses biological reports and how they inform land trust activities, such as project selection, fundraising, drafting conservation easement language, compiling baseline documentation, and writing management plans. The text emphasizes how the biological analysis process can help land trust projects conform to *Land Trust Standards and Practices,* the Internal Revenue Code (IRC), and Internal Revenue Service (IRS) Treasury Regulations, and ultimately contribute to conserving biodiversity.

ONE

Land Trusts' Role in Protecting Biodiversity on Private Lands

It's well known that voluntary protection of private land is essential to the conservation of biodiversity in the United States (Wilcove et al. 1996; Knight 1999). Private lands tend to coincide with high levels of species diversity because they often have more productive soils and are located at lower elevations compared to public lands, which are historically less desirable for logging, farming, or development (Scott et al. 2001). Two-thirds of the species listed as federally endangered or threatened under the Endangered Species Act (ESA), and over half of all imperiled species in the United States, occur on private land (Master et al. 2000).

As nonprofit organizations working to conserve land for the public benefit, land trusts can help fulfill this conservation need by working with private landowners to acquire fee title to property or, more often, to acquire a conservation easement. A conservation easement is a voluntary, legal agreement negotiated between a land trust and a landowner that restricts certain activities on the land, such as commercial or residential development, in order to protect certain conservation values, such as the protection of natural areas. In many cases, the owner is entitled to take advantage of significant federal and state tax incentives in exchange for a donation or bargain sale (sale for less than fair market value) of the conservation easement or fee title to a land trust, based on the appraised value of such a donation.

The land trust movement and voluntary private land protection has skyrocketed in recent years. The number of land trusts increased 32 percent between 2000 and 2005, and the amount of land protected by these groups doubled during this period and totaled over 37 million acres (an area roughly the size of the state of Georgia), according to the 2005 National Land Trust Census (Aldrich and Wyerman 2006). The majority of this land was conserved by a handful of large national organizations such as The Nature Conservancy, Ducks Unlimited, The Conservation Fund, and The Trust for Public Land. However, the vast majority of private land conservation organizations are smaller state, regional, or local land trusts. These groups work in every state and have protected millions of acres of land. The Land Trust Alliance (www.lta.org), a national organization that represents more than 1,700 land trusts, conducts a periodic census of land trusts and the acreage they protect.

Local land trusts typically focus on protecting lands important to the local community, which means they may pursue many types of land protection projects besides the strict protection of natural areas for biodiversity. Such projects include farms, ranch and forestry lands, recreational parks, public view sheds, and areas of historical significance. However, one study shows that 97 percent of local land trusts claim the protection of wildlife habitat or biodiversity as part of their mission, and 60 percent claim habitat conservation as a primary focus of their organization (Defenders of Wildlife 2006). Given that habitat destruction and degradation contribute to the endangerment of 85 percent of imperiled species in the United States (Wilcove et al. 2000), the potential of local land trusts to contribute to protecting biodiversity is significant. But that potential can only be fully realized if such conservation is done intentionally with proper analysis and planning.

Given that habitat destruction and degradation contribute to the endangerment of 85 percent of imperiled species in the United States, the potential of local land trusts to contribute to protecting biodiversity is significant.

For land trusts working to protect biodiversity, knowing the biological conservation values of a potential land protection project is important when deciding whether to take it on. The information is also critical for drafting the conservation easement, the baseline documentation report required by the IRS for a charitable contribution of an easement, and a land management plan (see chapter seven). This information is also useful for fundraising efforts, such as grant applications and campaign appeals, as well as outreach efforts, such as donor cultivation and newsletters.

You Can't Protect What You Don't Know About

Simply placing a conservation easement on a property doesn't mean that its important biological attributes have been protected. Each easement is the outcome of negotiations between the land trust and the landowner. Many easements contain reserved rights that allow limited development or improvements, such as new house sites and accessory structures, barns, driveways, roads, or uses such as commercial forestry and agriculture. While such reserved rights are not necessarily incompatible with biodiversity protection, they can have a degrading effect without proper information and planning. For example, without the involvement of a biologist, a land trust may unknowingly negotiate an easement that allows building on sections

of the land where rare plants or animals occur or allows the construction of a driveway through a rare forest community type. In addition to restricting building or other activities on the land, some properties require active management to maintain their important biological values. For example, a landowner may need to control invasive plant species to prevent them from taking over native plants and habitat. Drafting an easement or a management plan is a form of conservation planning, and good planning requires good information.

Simply placing a conservation easement on a property doesn't mean that its important biological attributes have been protected.

It's the Professional Thing to Do

Land trusts have a responsibility to operate effectively and ensure that land conservation efforts are lasting, which means they must operate strategically and carry out quality, well-informed, and well-documented projects. To this end, the Land Trust Alliance has published ethical and technical guidelines for the responsible operation of a land trust known as *Land Trust Standards and Practices*. All member organizations are required to adopt the standards and practices as the guiding principles for their operations, indicating their commitment to upholding the public trust and the credibility of the land trust community as a whole.

Protecting a project's biological values begins with careful biological analysis and documentation. This information helps the land trust conform to a number of standards and practices, particularly the practices under standard 8, "Evaluating and Selecting Conservation Projects." These include determining if a project meets selection criteria (practice 8B), documenting conservation values of a project (practice 8F), planning properly so that conservation values are protected (practice 8G), and documenting the public benefit of transactions (practice 8D). Biological data are also critical for drafting conservation easements (practice 9E), preparing the baseline documentation report (practice 11B), monitoring easement compliance (practice

RESOURCE FOR PROTECTING BIODIVERSITY

For an overview of how land trusts can work to protect biodiversity, see *Land Trusts and Biodiversity* by Douglas E. Booth (Milwaukee, Wis.: Driftless Conservation Books, 2007) .

11C), managing the land (practice 12C), and monitoring land trust fee properties (practice 12D).

For easement projects that involve tax deductions by the landowner, biological reports help land trusts determine if the project meets applicable federal and state requirements (practice 8C), including the IRS's "conservation purposes test" under IRC 170(h), particularly the "protection of a relatively natural habitat of fish, wildlife, or plants, or similar ecosystem." The IRS Treasury Regulations (1.170A-14[d][3]) suggest such biological features should be "significant" and may include, but are not limited to, "rare, endangered, and threatened species," "high quality examples" of terrestrial or aquatic communities, or natural areas that contribute to the ecological viability of other adjacent or nearby protected areas. These attributes are often identified in the easement document as conservation values, the specific (and significant) attributes of a property that the restrictions in the easement are meant to protect. (Chapter six provides examples of how biological data can be used to inform the drafting of conservation easements.)

As a method of establishing the significance of conservation values, it's helpful to identify those values whose conservation is supported by government programs. (Chapter Four provides information on a number of such programs that identify priority geographic areas, species, and habitats for the purposes of guiding conservation action.) Thus, a report analyzing the significant biological conservation values of an easement project may be particularly important to landowners who wish to claim income tax deductions and are concerned about potential IRS audits or challenges (Byers and Ponte 2005).

In the cases of *Glass v. Commissioner* (2006) and *Kiva Dunes Conservation LLC and E. A. Drummond v. Commissioner* (2009), the IRS challenged the natural habitat conservation purpose claimed under IRC 170(h). The outcomes of both trials were generally in favor of the taxpayers and rested heavily on biological reports in the baseline document that documented how the easements protected priority species and their habitat. Not only are well-documented and executed projects important to protecting biodiversity and complying with professional standards, they also protect the tax benefits of landowners and provide a foundation for strong legal defense.

RESOURCE FOR EVALUATING CONSERVATION PROJECTS

For more information, see *Evaluating and Selecting Conservation Projects* by Jane Ellen Hamilton and Jonathan Moore (Washington, D.C.: Land Trust Alliance, 2007).

EXAMPLE: Biological Inspection Finds Rare Nesting Birds

The North American Land Trust worked with a landowner who wished to place a conservation easement on a large ranch and exclude a particular portion of the property from the easement as building envelopes for a small number of private residences. During the initial site inspection by the land trust, a staff biologist discovered a population of endangered birds nesting in the area proposed for the building envelopes. The land trust then worked with the owner to locate the building envelopes in a less sensitive area of the property and permanently protect the breeding habitat for the birds, which became one of the significant conservation values of the project. Without the involvement of a biologist, the biological values would have unknowingly been degraded and the truly significant conservation opportunities would have gone unnoticed.

Barriers to Biological Assessments

While large land trusts such as The Nature Conservancy use some of the most sophisticated methods and highly trained biologists in the world to inform their land protection projects, most land trusts tend to operate on very small budgets, and the majority have no staff. Even those with paid staff are unlikely to have a staff biologist, particularly with a background in conservation planning and a variety of field naturalist skills.

Often, land trusts rely on volunteers or board members to assess a project's conservation values and conduct site inspections. However, there is little practical guidance available to nonbiologists for assessing, documenting, and protecting biological values on land trust projects.

If the funds are available, a consulting biologist may be hired to assess the project. (Funding may come from the land trust, from grants, or from the landowner.) However, the biologist may not really understand how a land trust operates, what its legal obligations and professional standards are, how the information will be used by the land trust, and exactly how much and what kind of information is needed. (See chapter six for more information on assessing biological values and choosing a biologist.) In some cases, this can lead to very expensive studies and reports that miss the most important types of information or go beyond what is necessary for the project.

Another challenge is that many land trust workers and landowners assume a biological assessment of a project will be a waste of time if no state or federally listed endangered or threatened species are found. While such listed species are certainly a high priority for conservation, biodiversity conservation requires

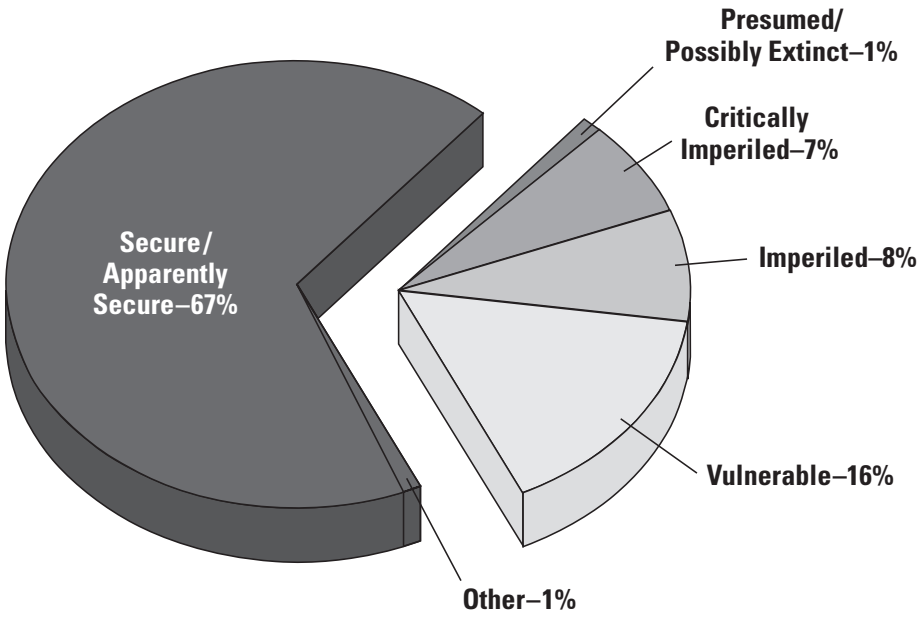
a focus on a much wider array of priority biological features, including rare or at-risk species, vegetation types, and habitats. These features are much more likely to occur on a project, making the odds of finding important conservation features much higher.

TWO

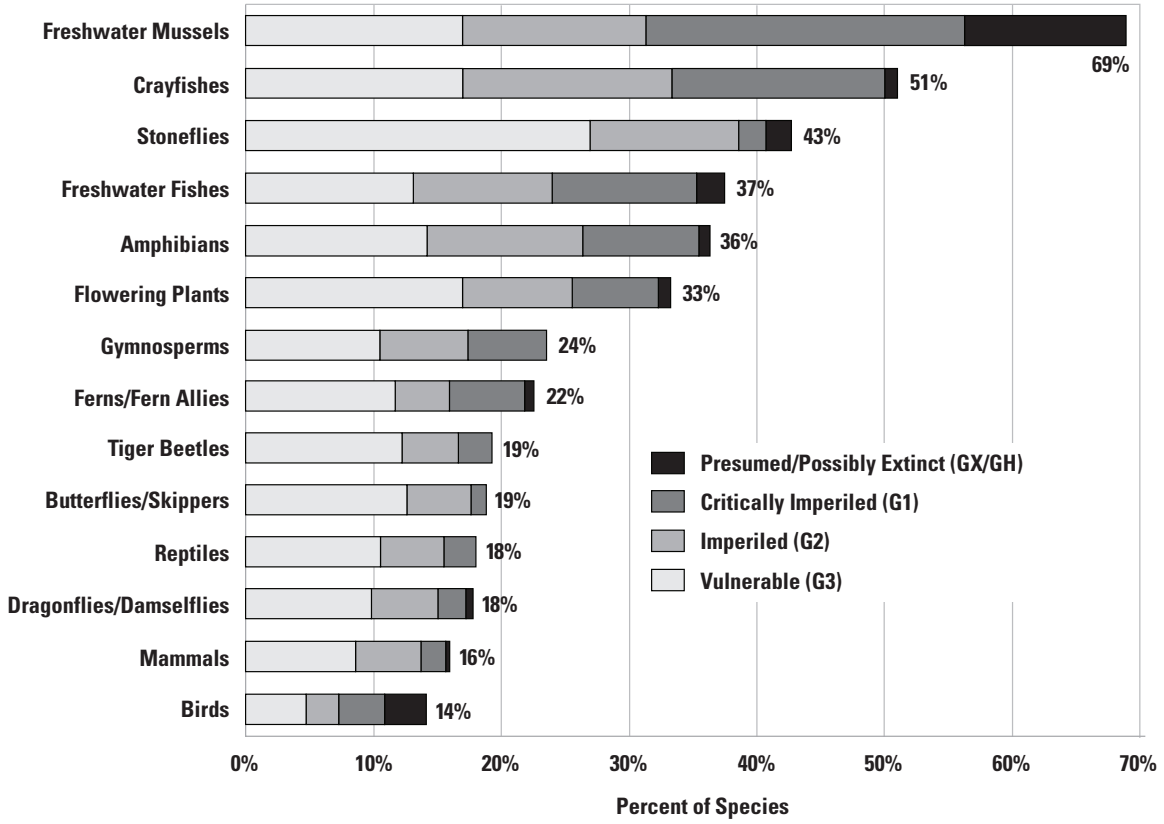
Biodiversity: What Should We Protect and Why?

If you're involved with a land trust, you are already aware of the loss of natural areas in your community, but you may not be aware of the magnitude of the impact on biodiversity. More than 100 U.S. species are already known to have been lost to extinction and another 400 species have not been observed in many years and are considered possibly extinct (Master et al. 2000). The federal Endangered Species Act (ESA) currently lists over 1,300 species as threatened or endangered within the United States, and the rate of new listings averages between 5 and 8 percent a year.

However, listings under the ESA are very time consuming, expensive, and politically influenced. While classifying a species as endangered is often a political determination, there are far more species that scientists consider to be in trouble that remain unlisted under the ESA. Using a more biologically valid system for ranking species' imperilment created by the Natural Heritage



Proportion of U.S. Species at Risk. Approximately one-third of species in the United States are considered to be at risk. (From NatureServe.)



Proportion of Species at Risk by Plant and Animal Group. (From NatureServe.)

Network, researchers found that *one-third* of the native flora and fauna in the United States is considered to be of conservation concern or at risk (Master et al. 2000). This includes 14 percent of all bird species, 16 percent of mammals, 33 percent of flowering plants, 36 percent of amphibians, 37 percent of freshwater fish, and 69 percent of freshwater mussels.

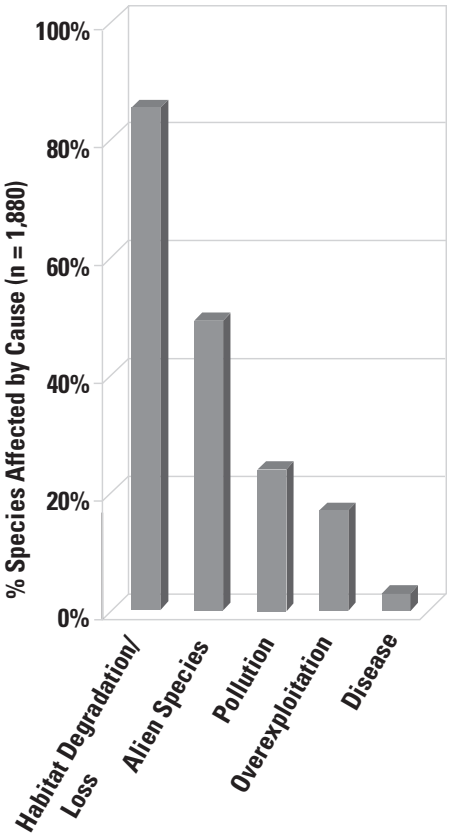
Some may argue there is no need for alarm, that species go extinct naturally. Although it is true that extinction is natural, the problem is that the current *rate* of species extinction is far from natural. Worldwide, species are going extinct at a rate 1,000 to 10,000 times greater than the natural background rate recorded in the fossil record (Baillie et al. 2004). During the last 450 million years, there have been five major mass extinction events when the extinction rate reached levels close to the current period. The last mass extinction event occurred when the dinosaurs disappeared, which is largely believed to be the result of an asteroid strike. Now we are in the sixth mass extinction event (Wilson 1992), and we are the asteroid.

What's Threatening Biodiversity?

According to a comprehensive analysis of the threats to biodiversity in the United States (Wilcove et al. 2000), direct habitat destruction and habitat degradation rank the highest and contribute to the endangerment of 85 percent of imperiled species. This is not surprising when you consider that only 42 percent of U.S. lands remain covered with natural vegetation (Bryer et al. 2000), more than half the nation's wetlands have been filled since the American Revolution (Dahl 1990), and about 1.6 million acres of open space are lost each year to development (U.S. Department of Agriculture 2009). The natural areas that do remain are often small, fragmented, or isolated and lack natural ecological processes, thus degrading their potential as habitat.

The second largest threat is alien (nonnative and invasive) species that affect 49 percent of at-risk species, especially plants, birds, and fish. This is followed by pollution (24 percent), which affects mostly aquatic organisms and is primarily due to siltation in streams and rivers; overexploitation (17 percent), which affects mostly mammals, reptiles, and butterflies through poaching or collecting; and disease (3 percent). The numbers total more than 100 percent because most species face multiple threats. Then, of course, there is human-caused climate change, which is changing plants' and animals' historic ranges and shaking up entire biotic communities, undoubtedly leading to extinctions among a wide variety of species (Lovejoy and Hannah 2005).

It's well known that land conservation is the best tool for conserving biodiversity (Soulé and Wilcox 1980; WRI, IUCN, and UNEP 1992). Land trusts' protection and management actions can contribute to the conservation of biodiversity by counteracting the above threats on private lands and by enlarging and linking protected areas that will support range shifts by plants and animals in the future, allowing them to adapt to climate change (Hannah et al. 2002).



Major Threats to Biodiversity.
(From Wilcove et al. 2000.)

Why Is Biodiversity Important?

People value nature for different reasons, usually a combination of aesthetic, utilitarian, and intrinsic values (Noss and Cooperrider 1994). Aesthetic reasons include protecting natural or wild areas as sources of inspiration, reflection, or

scenic beauty. Utilitarian benefits include ecosystem services such as carbon sequestration or the production of clean air and water, wild animals for hunting or food crop pollination, plant species as potential sources of medicine, gene pools for agricultural breeding, or open spaces for outdoor recreation.

"The last word in ignorance is the man who says of an animal or plant: What good is it? If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering." —Aldo Leopold, *A Sand County Almanac* (Oxford, U.K.: Oxford University Press, 1949)

The aesthetic and utilitarian benefits of nature conservation are important to our quality of life and our survival, but simply using these motivations alone to guide conservation decisions will likely lead to further extinctions and degradation of nature. For example, biologically important areas may not be considered scenic or inspirational, and many species have no obvious usefulness to humans—or science is not yet capable of understanding such uses.

Perhaps the greatest reason to protect biodiversity is that nature is exceedingly complex, interdependent, and interconnected, in ways we often can't understand. Thus, the best way to protect the parts we like is to keep *all* the parts. Another reason to protect nature as a whole is for its intrinsic value: protecting all plants and animals from extinction due to human actions for their own sake because they simply have the right to exist. Protecting the whole of nature is a big task. To make the most of our limited conservation resources, we must systematically determine which elements of biodiversity are most vulnerable to degradation or extinction and work toward their protection and recovery.

What Is Biodiversity?

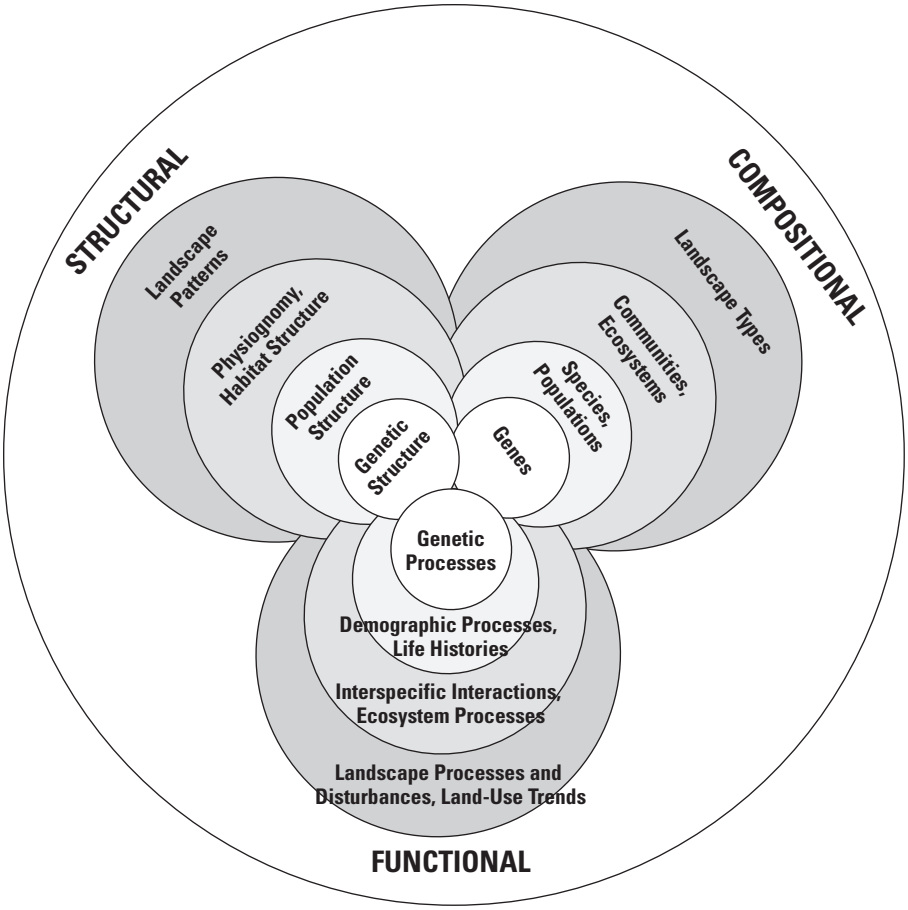
A 2002 poll commissioned by the Biodiversity Project found that 68 percent of the American public has never heard of biodiversity (Biodiversity Project 2002). Even fewer actually understand what it means, which is likely, in part, because there is no universally accepted definition. A quick sound-bite definition might be "the totality of life on earth," which is accurate and conveys the broad-scale and interconnected aspects of the concept. But it doesn't give the conservation practitioner enough to work with because it's too general and doesn't provide guidance for strategic conservation efforts. One might reason that any property with plants and animals has biodiversity on it and is worth protecting. But protecting land comes at a cost and the stakes are high. A more discriminating understanding of biodiversity is needed to determine conservation priorities.

Many assume biodiversity is simply another word for *species* diversity and is measured by how many species occur in a certain area. This measure doesn't tell us anything about the relative priority among species for conservation purposes and can lead to decisions that are actually harmful to biodiversity. For example, some may reason that since biodiversity is declining due to loss of habitat, creating a higher diversity of habitats, and thus species, in any given place is better than fewer (Noss and Cooperrider 1994).

Uninformed attempts to maximize habitat and species diversity on a property (usually "watchable" wildlife or game species) by conducting heavy-handed management, such as logging, disking the soil and installing food crops, and creating permanent openings, can, in certain contexts, actually work against biodiversity conservation as a whole by degrading high-integrity natural communities or rare species habitat, increasing fragmentation, or hastening the spread of invasive species. For example, in some cases clear-cutting a stand of old growth forest can lead to a higher diversity of bird species (usually common species) on the site, but the other species that depend on old growth forests (like the northern spotted owl or more obscure species like beetles, fungi, lichens, and mosses) will be one step closer to extinction when this rare habitat is lost. While maintaining species diversity at the scale of the entire planet is a valid goal for biodiversity conservation, at any smaller scale *what* you are protecting becomes more important than how many (Noss and Cooperrider 1994).

Biodiversity, as a working concept, is very complex and multidimensional (another reason why many people don't fully understand it). After all, you are basically trying to describe how life is organized. It's a big topic. A more discriminating description of biodiversity is "the totality of life on earth across all organizational levels, such as genes, populations, species, communities, ecosystems, and landscapes (ecoregions and biomes), as well as the interactions and processes that sustain each level, and the range of variability within all levels, across space and time."

This description picks apart "the totality of life on earth" into more recognizable, measureable units. It conveys that biodiversity is much more than species diversity and is actually composed of multiple, nested, and hierarchical levels of organization and that there are a range of types (or *composition*) in each level. For example, there are a variety of genes within a population, a variety of populations within a species, a variety of species in a community, a variety of communities in an ecosystem, and so on. In addition to composition (variety and identity), the range of variation within each level also includes *structure*, such as the structure of a population (abundance, density, proportion of juveniles versus breeding adults, etc.) or the physical structure of habitat in a forest community (abundance and density of trees, proportional arrangement of vertical strata, abundance and decay class of woody debris). This definition



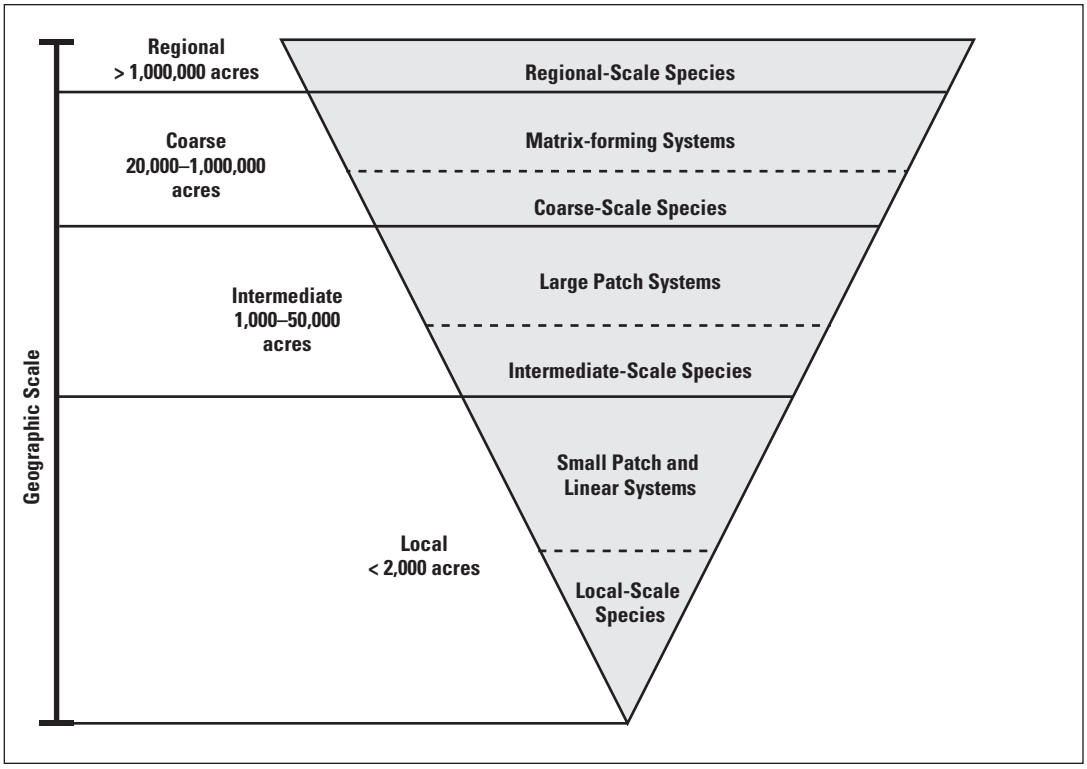
Compositional, Structural, and Functional Components of Biodiversity. Components shown as interconnected spheres. (From EPA, Watershed Academy: http://water.epa.gov/learn/training/wacademy/index.cfm. Redrafted from Noss 1990.)

of biodiversity also indicates that each level and the range of variation within it is sustained by ecological interactions (such as competition and predation) and natural processes (such as nutrient cycling, fire, flooding, and hurricanes). In other words, each level of biodiversity also has a *functional* component.

So, in effect, each level of biodiversity (populations, species, ecosystems, etc.) consists of three components—composition, structure, and function—which are interdependent and dictate the variation of life within each level, while, at the same time, make up the level itself (Noss 1990).

Biodiversity, as a working concept, is very complex and multidimensional.

On the ground, there are spatial patterns to how biodiversity is expressed. For example, individual species, community types, and ecosystem types naturally vary in their distribution patterns across the earth's surface. They naturally



Four Geographical Scales of Biodiversity. This figure illustrates four defined geographic scales for species and ecosystems: local, intermediate, coarse, and regional. (From ConserveOnline, Conserve by Design Gateway: http://conserveonline.org/workspaces/cbdgateway/era/standards/std_7. Adapted from Poiani et al. 2000.)

occur in some areas but not others. (For instance, palm trees are distributed in the tropics but not in the Arctic. The opposite is true for polar bears.)

Such spatial patterns are discernible over areas of different sizes or spatial scales (Poiani et al. 2000). For instance, a salamander may spend its entire life near a vernal pool where it breeds (a local-scale species) but a wolf may range across many habitat types and hundreds of thousands of hectares (a coarse-scale species). Certain small-patch plant community types can naturally be restricted to an outcrop of serpentine rock while others can span an entire region.

The functional components of biodiversity, such as natural disturbances, also occur at different spatial scales. An average wind-throw event in an eastern forest may create canopy openings less than one-quarter acre in size, while an average wildfire event in a western forest may affect hundreds of acres.

Patterns of biodiversity also naturally happen at different time scales. For example, the natural fire-return interval in some forest types can be once every 10 years, while in others it is once in more than 300 years. Over longer time periods, ecosystems naturally change and move in response to a changing climate or other factors, and new species evolve while others naturally go extinct.

Conserving Biodiversity

So if biodiversity is so variable, what are we trying to conserve? The previous description generally conveys how biodiversity is organized and measured, but it doesn't necessarily identify which aspects are immediate priorities for protection. After all, biodiversity will likely continue to exist, in some form or another, regardless of what we as humans do to the planet. Oddly, our effort to conserve biodiversity is less about conserving biodiversity per se as it is about conserving (or restoring) the *natural range of variation* within biodiversity. Examples of this natural range of variation include the natural distribution and abundance of a species, the natural variety of species and structural conditions in a forest type, or the natural intensity, scale, and frequency of natural disturbance (such as fire or flooding).

The definition of *natural* is often a topic of debate. Because the modern biodiversity crisis in North America is primarily a response to the massive and pervasive environmental impacts that have taken place since the arrival of Europeans, the pre-European settlement period is often used as a baseline among conservation biologists for defining *natural*. While imperfect, it is believed that this period, as opposed to more recent periods, provides a better measure of the conditions under which patterns of biodiversity most recently evolved—the environment to which plants and animals are adapted. Human actions that push these conditions too far outside the natural range of variation can lead to the degradation of biodiversity, often in ways we can't predict. Due to the pervasiveness of human influence, we will never restore natural conditions completely, but the pre-European settlement period still provides a meaningful baseline reference for gauging modern human impacts.

The goal of conserving biodiversity is to maintain or restore all native species and ecosystems, and the natural processes that support them, in natural patterns of abundance, quality, and distribution across the landscape.

To be successful, conservation planning for biodiversity must strive to maintain or restore the natural variation across all levels of organization—from genes to ecosystems (not just species)—including the three components (composition, structure, function) that sustain each level. It must also occur at multiple geographic spatial scales—from local to landscape (Noss 1990; Poiani et al. 2000). While that sounds pretty complicated, conservation *action* still happens by focusing on features on the ground that can be inventoried and prioritized, such as occurrences of species populations, habitats, and ecological communities. Thus, in more practical terms, the goal of conserving biodiver-

sity is to maintain or restore all native species and ecosystems, and the natural processes that support them, in natural patterns of abundance, quality, and distribution across the landscape. By analyzing which aspects of biodiversity are farthest from their natural patterns (under- or overrepresented), biologists can determine priorities for protection and management. Fortunately, a number of these priorities have already been identified through government and nonprofit programs, which we will explore in the next chapters.

THREE

Priority Biological Features

So how do land trusts know what the conservation priorities for biodiversity are in their service area?

Biodiversity-related conservation priorities can be in the form of priority biological features (such as on-the-ground occurrences of at-risk species or habitats) and priority geographic areas within a landscape (such as a generalized area important for carnivore dispersal). Within the scope of a conservation project, these priorities can serve as the significant conservation values of a conservation easement or the focus of a management plan. In order to be valid, identification of conservation priorities should be based on objective, repeatable methodologies that are scientifically credible. This may require extensive on-the-ground inventory work throughout the state or region to assess the abundance, distribution, and condition of a wide variety of species and ecosystems. It may also require extensive analyses of the landscape using remote sensing technology and Geographic Information System (GIS) software, sophisticated statistical algorithms, and input from a number of experts. This is clearly beyond the capabilities of most land trusts.

Fortunately, there are a number of programs, sponsored or used by government agencies and operating across the country, that designate biological conservation priorities. (Linking the conservation values of an easement to government-sponsored conservation programs helps to ensure the values are significant and that the project serves a public benefit, as required under Internal Revenue Code [IRC] 170[h].) Every land trust project is different, and not all of the programs discussed will apply to every project. Additionally, many of these programs are evolving rapidly and may be quickly replaced or subsumed by other programs (with a subsequent change in website address). While the specific programs may change in the future, the reviews presented here are meant to show that using a toolbox of prioritization schemes can maximize the probability of detecting, and ultimately protecting, important conservation targets for biodiversity.

This chapter focuses on programs that help land trusts identify priority biological features, such as species, taxa, natural communities, and habitats. These are features that may occur on a specific property and can be addressed in on-the-ground biological inventories, as well as by land protection and management efforts. Chapter four will focus on programs that prioritize geographic areas for biodiversity conservation.

Endangered Species Programs

The most familiar program that identifies priority species for conservation action is the federal Endangered Species Act (ESA) of 1973, which charged the U.S. Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) with identifying and protecting endangered species.

Species are assigned to several categories under the program. An *endangered* species is one that is in danger of extinction throughout all or a significant portion of its range. A *threatened* species is one that is likely to become endangered in the foreseeable future. Species listed under these two categories are afforded the full range of protection under the act, including prohibitions on unauthorized killing, taking, or otherwise harming.

In 2011, more than 1,300 species were listed as endangered or threatened within the United States. There are also additional categories that recognize the vulnerability of species but receive no statutory protection under the ESA. *Candidate species* are species the USFWS and NMFS have decided should be proposed for threatened or endangered status, but are precluded by other higher-priority listing activities (mostly due to lack of congressional funding). *Proposed species* are species that have been formally proposed for listing by the agencies and are currently undergoing review. *Species of concern* is an informal term that more broadly refers to species the USFWS believes might be in need of concentrated conservation actions.

Individual states also maintain their own state endangered species lists, which are limited to species whose populations are endangered within the state's boundaries but may or may not be endangered outside the state. Federally listed species occurring within the state's boundaries are usually included in the state list as well, but not always. Thus, both federal and state lists should be consulted.

As a program for identifying biological conservation priorities, the use of the federal and state endangered species listings has advantages and limitations for land trust applications. Obviously, if a species is listed as endangered or threatened, it clearly is a high priority for conservation efforts. If your project area contains or benefits these species, the conservation value of the project is strongly supported. The importance of listed species is widely recognized, which can be helpful for fundraising campaigns, grant applications, and access to various funding and collaboration opportunities administered through state and federal agencies.

Locational information on federal and state endangered species can be obtained from State Natural Heritage Programs, and a website maintained by NatureServe provides links to such programs in every state (www.natureserve.org). (More about Natural Heritage Programs and NatureServe provided

later in this chapter.) The USFWS has designated critical habitat, areas essential to the conservation of federally threatened or endangered species, for a portion of listed species. To see if a property falls within a critical habitat area, visit the USFWS Critical Habitat Portal: http://criticalhabitat.fws.gov. The USFWS also writes recovery plans for many federally listed species. These provide information on the species' natural history and protection and management needs that can help inform the drafting of conservation easements and management plans. (See USFWS recovery plans: www.fws.gov/endangered/species/recovery-plans.html.)

The importance of listed species is widely recognized, which can be helpful for fundraising campaigns, grant applications, and access to various funding and collaboration opportunities administered through state and federal agencies.

One limitation of using federal and state endangered species lists to identify conservation priorities is that they don't prioritize other important levels of biodiversity, such as natural communities or ecosystems. Another limitation, due to the regulatory implications, is that species listings can be politically influenced and the listing process can take many years. Thus, many species that are, in fact, biologically in danger of extinction are not yet listed. Once a species is finally listed, its situation may be so dire that practical or efficient methods to ensure its full recovery may not be possible. Thus, land trusts should not limit themselves to only considering formally listed species as conservation priorities. The nonstatutory designations, such as candidate or proposed species or species of concern, are still valid priorities for conservation action and useful for land trust projects. Other nonregulatory, and perhaps more biologically relevant, programs exist for identifying conservation priorities and should be used as well.

Bird Conservation Programs

In recent years, birds have received an incredible amount of conservation attention, and numerous assessments and conservation plans have been developed to prioritize conservation efforts. Separate initiatives exist for waterfowl, waterbirds, shorebirds, and landbirds. In most cases, land trust projects contain a greater number of landbird species compared to the other bird groups, thus landbird prioritizations, such as the work by Partners in Flight (PIF), are particularly useful for land trust applications.

PIF is a consortium of nonprofit, academic, and governmental organizations dedicated to landbird conservation in North America. The organization

EXAMPLE: Partners in Flight Species Assessment

Common Name	Action Code	Common Name	Action Code	Common Name	Action Code
Short-eared Owl	PR	Black-billed Cuckoo	MA	Veery	PR
Olive-sided Flycatcher	MA	Belted Kingfisher	MA	Northern Parula	PR
Willow Flycatcher	PR	Yellow-throated Vireo	MA	Magnolia Warbler	PR
Bicknell's Thrush	PR	Boreal Chickadee	MA	Black-throated Blue Warbler	PR
Wood Thrush	MA	Blackpoll Warbler	MA	Black-throated Green Warbler	PR
Blue-winged Warbler	PR	Eastern Towhee	MA	Blackburnian Warbler	PR
Bay-breasted Warbler	PR	Bobolink	MA	Black-and-white Warbler	PR
Canada Warbler	MA	Northern Saw-whet Owl	PR	American Redstart	PR
Nelson's Sharp-tailed Sparrow	PR	Yellow-bellied Sapsucker	PR	White-throated Sparrow	PR
Rusty Blackbird	PR	Blue-headed Vireo	PR	Purple Finch	PR
Ruffed Grouse	MA	Tree Swallow	PR	Evening Grosbeak	PR

This example from the 2005 database shows breeding species of regional importance in Atlantic northern forests (Bird Conservation Region 14). Note: The PIF Species Assessment Database is updated periodically. The above scores are subject to change.

was spearheaded in 1990 by the National Fish and Wildlife Foundation to address the conservation needs of neotropical migrant birds, which were not recognized by other bird conservation initiatives. The PIF approach differs from federal- and state-level endangered species listing processes. Rather than a regulatory, reactive approach, the PIF approach is voluntary, nonregulatory, and proactive, which allows a more objective assessment of conservation priorities and may prevent the need for future regulatory listings. A major benefit of this approach for land trust applications is that a greater number of bird species, including more common species, are identified as priorities, which increases the likelihood that a land protection project will contain identifiable conservation targets, bringing direction and validation to land trust projects that may not necessarily contain listed threatened or endangered species yet still have conservation value for biodiversity. For land trusts, the most useful PIF products are the Species Assessment Database and regional landbird conservation plans.

The PIF Species Assessment Database provides a highly sophisticated evaluation of the conservation status of each landbird species in North America. The process considers biological data on population size, distribution, population trend, threats, and regional abundance to rank each species in terms of its vulnerability and regional status. This information is then used to objectively assign conservation priority categories to birds at both the continental and regional scales, within each bird conservation region (or physiographic region). The database is maintained by the Rocky Mountain Bird Observatory and is available online (www.rmbo.org).

EXAMPLE: Partners in Flight Species Assessment Action Codes

Critical Recovery (CR) Critical recovery actions are needed to prevent likely extirpation or to reintroduce a species that has been extirpated.

Immediate Management (IM) Immediate conservation action is needed to reverse or stabilize population declines. Lack of action may put species at risk of extirpation.

Management Attention (MA) Management or other on-the-ground conservation actions are needed to reverse or stabilize population declines or reduce threats.

Planning and Responsibility (PR) Long-term planning and general conservation actions are needed to ensure that sustainable populations are maintained.

Categories of action most needed for improving or maintaining population status in descending order of importance, from 2005 database. (Adapted from Panjabi et al. 2005. Modified for brevity.)

The PIF assessment process assigns a variety of highly technical prioritization categories that can be confusing for nonbiologists. For typical land trust applications, users may wish to focus on the Regionally Important Bird Species list, which is the most inclusive. Users can quickly view priority breeding bird species for a given area by visiting the PIF species assessment database website, selecting the appropriate bird conservation region, then selecting "Show only regionally important species." Relative priorities within this list are further categorized by action codes, which include critical recovery, immediate management, management attention, and planning and responsibility. (See the table above for definitions.) For in-depth information, the database provides a variety of scores regarding the factors used to determine the priority status of each bird, and the website provides a link to the assessment methodology (Panjabi et al. 2005).

PIF landbird conservation plans have been written for most physiographic areas in the United States (www.partnersinflight.org). These plans provide extensive background information and conservation recommendations, which are useful to land trusts when writing conservation easements, baseline documents, management plans, and grant applications.

If your project contains significant wetland or coastal features, several other bird conservation initiatives are particularly important, including the North American Waterfowl Management Plan, North American Waterbird Conservation Plan, and the U.S. Shorebird Conservation Plan. These plans each designate priority species for their respective taxa. In recent years, there has been an effort, headed by the USFWS Division of Bird Habitat Conservation Joint Ventures Program, to consolidate these initiatives with the PIF initiative for landbirds into "all bird" assessments and conservation plans for each regional joint venture. These are intended to provide one-stop shopping for regional

bird conservation priorities and planning and can be accessed through the joint ventures website (www.fws.gov/birdhabitat/jointventures/index.shtm).

Taken together, these programs are a comprehensive source for identifying priority bird species; however, other bird priority assessments also exist. Although somewhat duplicative, they may be useful as a means of identifying multiple organizations and programs recognizing bird conservation priorities on a land trust project, further emphasizing public support. For instance, the USFWS maintains a list of Birds of Conservation Concern (www.fws.gov/migratorybirds) meant to indicate nongame species in need of conservation in order to avoid future listing. The National Audubon Society maintains a watch list of national priorities, based largely on these other plans and covering all bird taxa. Its website also contains useful species account information (http://web1.audubon.org/science/species/watchlist/browseWatchlist.php). State Natural Heritage Programs and State Wildlife Action Plans, discussed later in this chapter, also assess the priority status of bird species as well as other species.

Land trusts should become familiar with the priority birds for their service area and consider having bird inventories conducted on land protection projects whenever possible. (See chapter six for information on how to do this.) A major advantage of inventorying bird priority species on a property is that birds are usually the most diverse group of vertebrate wildlife likely to occur and the easiest to observe and inventory. Under the right conditions and season, an experienced birder can document a thorough list of breeding birds in as little as a single morning (depending on the size of the property). As indicated by the numerous assessments and conservation plans available, quite a bit is known about birds relative to other animal groups. Thus, bird inventories provide an efficient and practical means to identify biological conservation values on land trust projects. Additionally, birding is one of the most popular recreational activities in the country, and local Audubon Society chapters may be able to provide skilled volunteers.

Keep in mind, however, that bird conservation is only one element of biodiversity, and considering birds alone is likely to miss other important biological values. Other assessment methodologies are needed for additional species groups (plants and other wildlife) and their habitats, as well as other levels of biological organization, such as natural communities and ecosystems.

Clean Water Programs

Wetlands and streams are important habitat features that are threatened by a number of factors, such as impacts to water quantity as a result of withdrawals (primarily a western issue) and water quality as a result of pollution (usually

sedimentation) from surrounding land use, as well as damming, filling, channeling, or diversion.

The Federal Clean Water Act recognizes the value of streams and wetlands as priority conservation features (as do similar state laws), and the objective of the act is to conserve the nation's waters for, among other things, the protection and propagation of fish and wildlife (Federal Water Pollution Control Act, November 27, 2002). Additionally, aquatic habitats and riparian areas frequently provide habitat for at-risk species. Thus streams, wetlands, and their adjacent upland buffers are important biological features that should be assessed, documented, and protected on land trust projects.

The regulatory controls of federal and state stream and wetland laws are mostly confined to so-called navigable or jurisdictional waters, which are defined through narrow, legal criteria as opposed to strictly biological justifications. As a result, many important aquatic features are not recognized under these criteria. For example, many types of nonjurisdictional wetlands (such as vernal pools or other isolated or nonnavigable wetlands) are still valid, high-priority features for conservation (Comer et al. 2005). Thus, stream and wetland inventories on land trust projects should not be limited to only jurisdictional features, as is often the case with delineations prepared by ecological consultants on behalf of developers for regulatory and engineering purposes.

Protecting both jurisdictional and nonjurisdictional aquatic features on land trust projects is an important contribution to conserving biodiversity and has clear public benefit. While jurisdictional wetlands are already subject to use restrictions, placing them under a conservation easement provides the added benefit of permanent protection, since the definition of *jurisdictional* can be weakened in the future due to political or legal activities.

Identifying and mapping some aquatic features can be technically complex and require a biologist. However, most streams and wetlands can be identified using topographic maps, aerial photos, USFWS's National Wetlands Inventory (NWI) data and basic on-the-ground verification (discussed in chapter six).

Natural Heritage Programs

The most important sources for information on priority plants, animals, and ecological communities are Natural Heritage Programs. Initiated by The Nature Conservancy (TNC) in the early 1970s, these programs collect, manage, and share data regarding the status and distribution of species and ecological communities in each state, then use this data to estimate relative imperilment and determine conservation priorities. Usually partnered with state agencies, some of the programs go by other names such as Natural Features Inven-

tory, Natural Areas Program, Conservation Data Center, or Natural Diversity Database; however, most are referred to as Natural Heritage Programs. Each program usually has an ecologist, zoologist, and/or botanist on staff, and they are typically among the most knowledgeable field biologists in their regions.

The Natural Heritage Programs use consistent standards for collecting and managing data, which allows information to be shared and combined regionally, nationally, and internationally. The programs' uniform methodologies are guided by NatureServe, which is the membership organization for Heritage Programs and provides scientific and technical support. NatureServe was originally founded in 1994 by TNC as the Association for Biodiversity Information and took on its current form in 2001. It is an international nonprofit organization headquartered in Arlington, Virginia, with regional offices in four U.S. locations.

The most useful products and services from the Natural Heritage Programs and NatureServe for land trust applications are the standardized ecological community classifications, the lists of at-risk species and ecological communities for each state, and the individualized environmental review services, also known as information requests (discussed in chapter five). To learn more about NatureServe and to locate the natural heritage program in your state, see www.natureserve.org.

Ecological Communities

We know from chapter two that patterns of biodiversity occur at multiple levels of organization and that an exclusive focus on species-level conservation is unlikely to capture the full range of biodiversity values and produce sustainable results (Franklin 1993; Noss and Cooperrider 1994). Species occur within communities that, in themselves, are equally important targets for conservation. When used as such, ecological communities can serve as coarse filters for protecting the web of ecological interactions that are part of each system, as well as obscure plant and animal species that are unknown or poorly understood (Noss 1996). Conserving ecological communities also ensures the perpetuation of ecosystem services, such as clean air and water (Balmford et al. 2002) and provides a natural framework for continued species evolution (Franklin 1993).

Before ecological communities can be strategically protected, they must first be categorized and described and their conservation status assessed. Ecological communities are defined as assemblages of species that co-occur in defined areas and have the potential to interact with each other (McPeek and Miller 1996). While ecological communities include both plants and animals and occur in both aquatic and terrestrial environments, the classification approach for most land conservation applications focuses on terrestrial plant assemblages.

Classifying and protecting plant communities captures the underlying environmental characteristics, habitat structures, ecological processes (including disturbance regimes), and associated fauna that are important for conservation (Franklin 1993). Plant communities are also readily mapable at multiple scales (on the ground, from the air, or through satellite imagery), allowing for practical and systematic characterizations across the landscape and informed conservation planning.

Various classification systems for terrestrial vegetation-based communities exist for different purposes. For instance, a forest-type classification system designed for forestry purposes is useful for commercial timber management but is less likely to capture the subtle variations in plant communities for the purpose of guiding biodiversity conservation. The Natural Heritage Programs and NatureServe have developed several vegetation-based community classification approaches specifically designed for assessing biodiversity. The most useful classification system for typical land trust projects is referred to as the natural community approach, which is the most discriminating and finest scale of classification and can be used for detailed on-the-ground mapping of vegetation types. Most importantly, the Natural Heritage Programs and NatureServe assign conservation status (i.e., rarity) ranks to these natural community types, allowing land trusts to identify and document at-risk community types as priority biological features (or conservation values) on a property.

Natural Community Classification

A number of state Natural Heritage Programs (mostly older programs in the eastern states) have developed their own independent natural community classifications systems. However, most state Natural Heritage Programs, as well as many federal agencies like the National Park Service and U.S. Forest Service, use a more universal and standardized approach known as the National Vegetation Classification (NVC) system.

The NVC system is applicable anywhere in the country and allows for repeatable characterizations across political boundaries and agency jurisdictions (FGDC, VS 2008). This system uses a multitiered, nested hierarchy for classifying vegetation types that requires increasing amounts of information at finer scales.

The finest scales of resolution in this hierarchy are the alliance and association levels, which are similar to the natural community classifications used by individual states. The terms *natural community*, *association,* or *alliance* are often used interchangeably when referring to fine-scale vegetation classifications. It's generally not possible to identify and map this fine-scale classification from satellite data; usually, a skilled ecologist must identify these communities on the ground.

Natural communities (or NVC associations and alliances) are unique re-

EXAMPLE: National Vegetation Classification Hierarchy

Natural Vegetation Hierarchy	Example
Formation Class	Grassland and Shrubland
Formation Subclass	Temperate and Boreal Grassland and Shrubland
Formation	Temperate Grassland, Meadow, and Shrubland
Division	North American Great Plains Grassland and Shrubland
Macrogroup	Great Plains Mixed Grass Prairie Grassland and Shrubland
Group	Mixed Dry Grassland
Alliance	Little Bluestem-Sideoats Grama Herbaceous Alliance
Association	Little Bluestem-Sideoats Grama-Blue Grama-Thread

The NVC system uses a multitiered, nested hierarchy for classifying vegetation types that requires increasing amounts of information at finer scales. The finest scales (alliance and association) can be used on the ground to map and identify at-risk vegetation types as priority biological features on a property. (From FGDC, VS 2008.)

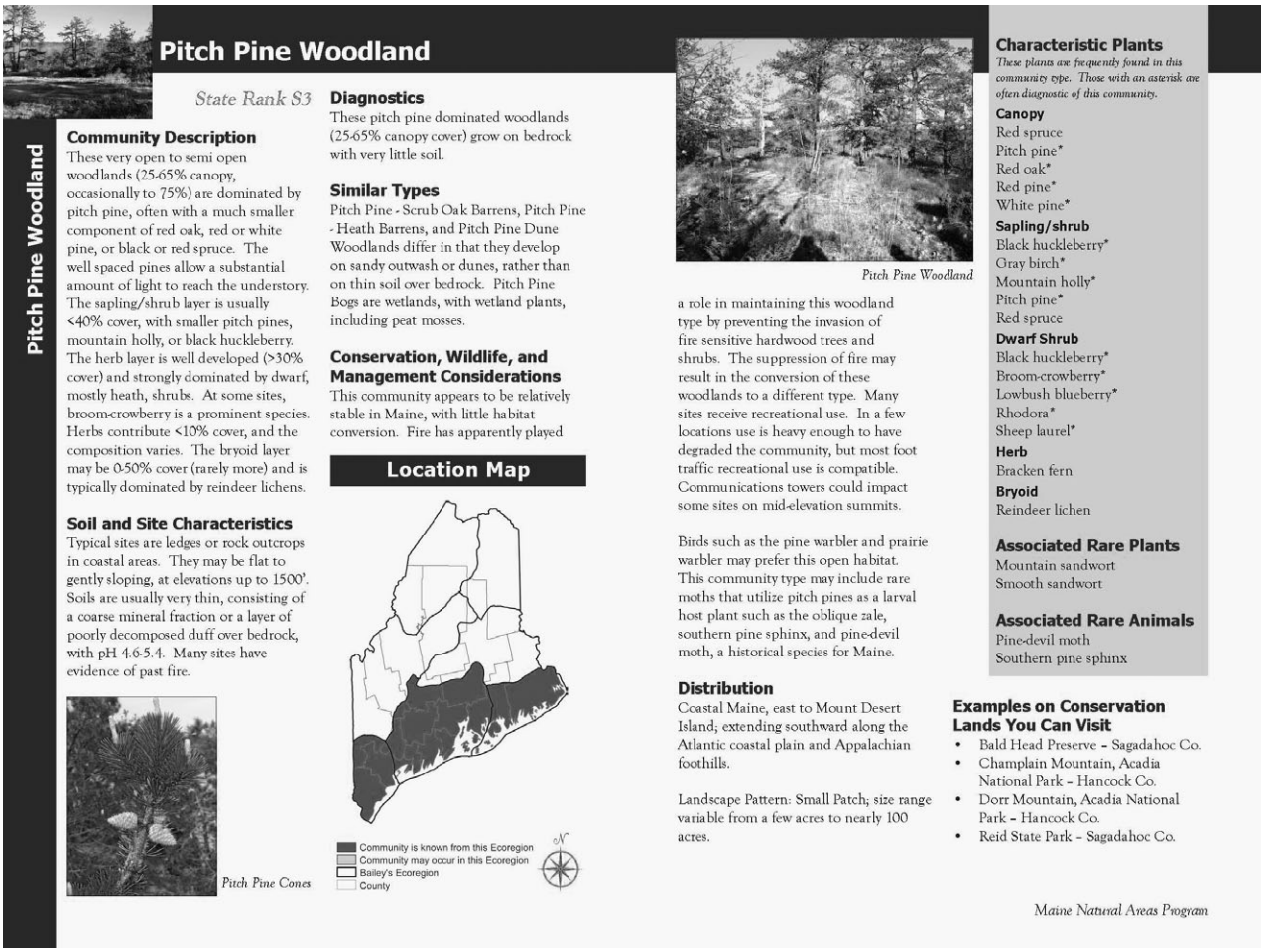
peating assemblages of plant species that respond similarly to physical and environmental conditions (climate, soil, topography, hydrology) and are distinguished by their composition, structure, and function. A natural community is classified by its consistent and repeatable

- plant species composition;
- physical structure (forest, woodland, shrubland, grassland, etc.); and
- set of physical conditions (climatic conditions, substrate type, nutrient availability, moisture levels, etc.).

For example, the hemlock-beech-northern hardwood forest natural community type in New Hampshire is characterized by a dominance of hemlock and northern hardwood tree species, such as sugar maple, yellow birch, and American beech, and occurs at low to midelevations on glacial till and valley bottom soils that are moderately nutrient poor (Sperduto and Nichols 2004). The planeleaf willow/water sedge shrubland plant association of Colorado is a low-stature willow shrubland usually above 9,000 feet that grows in wet to saturated soils of subalpine glacial valleys (Carsey et al. 2003). Most properties will contain multiple natural community types.

The individualized state-specific, natural community classifications, where available, are preferable since they are tailored for local use and tend to be more user-friendly. In states where these are not available, a number of state

EXAMPLE: Natural Community Classification Description (From Gawler and Cutko 2010.)



Pitch Pine Woodland

State Rank S3

Community Description
These very open to semi open woodlands (25-65% canopy, occasionally to 75%) are dominated by pitch pine, often with a much smaller component of red oak, red or white pine, or black or red spruce. The well spaced pines allow a substantial amount of light to reach the understory. The sapling/shrub layer is usually <40% cover, with smaller pitch pines, mountain holly, or black huckleberry. The herb layer is well developed (>30% cover) and strongly dominated by dwarf, mostly heath, shrubs. At some sites, broom-crowberry is a prominent species. Herbs contribute <10% cover, and the composition varies. The bryoid layer may be 0-50% cover (rarely more) and is typically dominated by reindeer lichens.

Soil and Site Characteristics
Typical sites are ledges or rock outcrops in coastal areas. They may be flat to gently sloping, at elevations up to 1500'. Soils are usually very thin, consisting of a coarse mineral fraction or a layer of poorly decomposed duff over bedrock, with pH 4.6-5.4. Many sites have evidence of past fire.

Pitch Pine Cones

Diagnostics
These pitch pine dominated woodlands (25-65% canopy cover) grow on bedrock with very little soil.

Similar Types
Pitch Pine - Scrub Oak Barrens, Pitch Pine - Heath Barrens, and Pitch Pine Dune Woodlands differ in that they develop on sandy outwash or dunes, rather than on thin soil over bedrock. Pitch Pine Bogs are wetlands, with wetland plants, including peat mosses.

Conservation, Wildlife, and Management Considerations
This community appears to be relatively stable in Maine, with little habitat conversion. Fire has apparently played

Location Map

Community is known from this Ecoregion
Community may occur in this Ecoregion
Bailey's Ecoregion
County

Pitch Pine Woodland

a role in maintaining this woodland type by preventing the invasion of fire sensitive hardwood trees and shrubs. The suppression of fire may result in the conversion of these woodlands to a different type. Many sites receive recreational use. In a few locations use is heavy enough to have degraded the community, but most foot traffic recreational use is compatible. Communications towers could impact some sites on mid-elevation summits.

Birds such as the pine warbler and prairie warbler may prefer this open habitat. This community type may include rare moths that utilize pitch pines as a larval host plant such as the oblique zale, southern pine sphinx, and pine-devil moth, a historical species for Maine.

Distribution
Coastal Maine, east to Mount Desert Island; extending southward along the Atlantic coastal plain and Appalachian foothills.

Landscape Pattern: Small Patch; size range variable from a few acres to nearly 100 acres.

Characteristic Plants
These plants are frequently found in this community type. Those with an asterisk are often diagnostic of this community.

Canopy
Red spruce
Pitch pine*
Red oak*
Red pine*
White pine*

Sapling/shrub
Black huckleberry*
Gray birch*
Mountain holly*
Pitch pine*
Red spruce

Dwarf Shrub
Black huckleberry*
Broom-crowberry*
Lowbush blueberry*
Rhodora*
Sheep laurel*

Herb
Bracken fern

Bryoid
Reindeer lichen

Associated Rare Plants
Mountain sandwort
Smooth sandwort

Associated Rare Animals
Pine-devil moth
Southern pine sphinx

Examples on Conservation Lands You Can Visit
- Bald Head Preserve – Sagadahoc Co.
- Champlain Mountain, Acadia National Park – Hancock Co.
- Dorr Mountain, Acadia National Park – Hancock Co.
- Reid State Park – Sagadahoc Co.

Maine Natural Areas Program

Natural Heritage Programs and NatureServe regional offices have developed detailed descriptions of NVC association or alliance types that facilitate their identification in the field. In addition, many national parks and national forests have developed NVC association descriptions for their lands. In states that do not have natural community or NVC association descriptions available, the keys and descriptions created for use on federal lands are useful in nearby areas or within the ecoregion. The USGS Vegetation Characterization Program website at http://biology.usgs.gov/npsveg/themes/veginfo.html provides NVC descriptions for national parks. A local Natural Heritage Program's staff ecologist can suggest the most appropriate natural community classification for the region.

Conservation Status Ranks

The Natural Heritage Programs and NatureServe consider species and natural communities to be elements of biological diversity and assign conservation status (i.e., rarity) ranks to these elements in order to strategically focus inventory, protection, and management actions. An actual, on-the-ground occurrence of a rare element (for instance, if you find a rare plant on a property) is referred to as an Element Occurrence or EO.

Each Natural Heritage Program publishes a list of at-risk (also known as rare or tracked) plants for their state, and most programs also publish lists of at-risk animals and natural communities. Conservation status ranks are assigned at the state and global level (known as S and G ranks) based on rarity, trends, and threats (Faber-Langendoen et al. 2009; Master et al. 2009). The ranks are assigned on a scale of 1 to 5 and have the following meaning:

1. Critically imperiled
2. Imperiled
3. Vulnerable to extirpation

EXAMPLE: Global Conservation Status Ranks (Adapted from Master et al. 2009.)

Rank	Definition
GX	**Presumed Extinct:** Species not located despite intensive searches and virtually no likelihood of rediscovery.
	Extinct: Ecological communities or systems eliminated throughout their range, with no restoration potential due to extinction of dominant or characteristic taxa and/or elimination of the sites and ecological processes on which the types depends.
GH	**Possibly Extinct:** Known from only historical occurrences but still some hope of rediscovery. There is evidence that the species may be extinct or the ecosystem may be eliminated throughout its range but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20 to 40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully but not thoroughly enough to presume that it is extinct or eliminated throughout its range.
G1	**Critically Imperiled:** At very high risk of extinction or elimination due to extreme rarity, very steep declines, or other factors.
G2	**Imperiled:** At high risk of extinction or elimination due to very restricted range, very few populations or occurrences, steep declines, or other factors.
G3	**Vulnerable:** At moderate risk of extinction or elimination due to a restricted range, relatively few populations or occurrences, recent and widespread declines, or other factors.
G4	**Apparently Secure:** Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure:** Common; widespread and abundant.

4. Apparently secure
5. Secure

For example, a rank of G1 indicates that a species is critically imperiled across its entire global range and has a very high risk of extinction. A rank of S1 indicates the species is critically imperiled in a particular state, even though it may be secure globally (G4 or G5). In general, elements with an S or G rank of 1 through 3 are considered at risk and are tracked by Natural Heritage Programs. The tables on page 31 and below provide detailed definitions for the more common S and G ranks. Additional rank variations and qualifiers are also used; more information on these can be found on the NatureServe website (www.natureserve.org/explorer/ranking.htm).

Migratory bird species often receive a double rank to indicate the status of breeding (B) populations and nonbreeding (N) populations. For instance, the southern Appalachian yellow-bellied sapsucker is ranked by the North Carolina Natural Heritage Program as S3B, S5N. This bird breeds in mature, open

EXAMPLE: State Conservation Status Ranks (Adapted from Master et al. 2009.)

Rank	Definition
SX	**Presumed Extirpated:** Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., state/province). Not located despite intensive searches of historical sites and other appropriate habitat and virtually no likelihood that it will be rediscovered.
SH	**Possibly Extirpated:** Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20 to 40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully but not thoroughly enough to presume that it is no longer present in the jurisdiction.
S1	**Critically Imperiled:** Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.
S2	**Imperiled:** Imperiled in the jurisdiction because of rarity due to very restricted range, very few populations or occurrences, steep declines, or other factors making it very vulnerable to extirpation from the jurisdiction.
S3	**Vulnerable:** Vulnerable in the jurisdiction due to a restricted range, relatively few populations or occurrences, recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	**Apparently Secure:** Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure:** Common, widespread, and abundant in the jurisdiction.

northern hardwood forests that are limited to high elevations in the southern Appalachians, a relatively small portion of the state. Thus, breeding occurrences of this species are considered S3—vulnerable—and are conservation targets. During the winter, this bird moves to lower elevations and is more common throughout the majority of the state, thus nonbreeding occurrences are considered S5—secure. A documented breeding occurrence on a project site is considered a conservation target, but finding this bird on a project during the winter months or outside the breeding habitat (say, near the coastal portion of the state) does not represent a priority conservation target.

Why Are There Both Global and State Ranks?

Some may wonder why there is a need for separate global and state ranks. For example, why is it important to worry about a species that is at risk in one state (S1–S3), even though it is very common globally (G4–G5)?

This situation is often the case with populations at the edge of the species' range. Such peripheral populations tend to develop unique genetic traits that may be important for the continued evolution and long-term conservation of the species as a whole (Lesica and Allendorf 1995). Also, working to conserve state-ranked priorities helps to minimize population declines and range contractions in general. When the distribution of a species or natural community becomes less abundant within or shrinks from its native range, it not only becomes more vulnerable to extinction, it also loses its ability to carry on traditional ecological interactions in the areas from which it declined or disappeared, becoming less ecologically effective (Soulé et al. 2003). In addition, state conservation agencies are usually concerned with acting on conservation priorities determined from within their own borders, hence an additional need for state ranks.

On the other hand, simply focusing on state-ranked priorities (and ignoring global-ranked priorities) can lead to the impoverishment of biodiversity on a global scale because a species or natural community can be common within a state (S4–S5) yet occur few other places in the world (G1–G3). Focusing conservation actions on both state and global priorities is important, but when faced with a choice between the two, global priorities should usually take precedence.

Element Occurrence Quality Ranks

The rarity or status of a species or natural community occurrence on a project is not the only factor to consider; it's also important to consider its health, viability, or ecological integrity. Clearly, a high-quality occurrence of a rare natural community (such as an old-growth example of a rare forest type) is not equal to a heavily degraded example. Some EOs may be so degraded from

past land use that there is little hope of persistence, even if they are protected under a conservation easement. Others may need management or restoration to improve their chances of survival. For instance, your project may contain an occurrence of a rare wetland natural community. However, the area within and adjacent to the wetland may have been heavily ditched or otherwise altered in such a way that the ground and surface flow of water into the wetland has been diverted. Without restoration of the hydrology, the wetland will dry up and not survive despite being protected by a conservation easement.

Some EOs may be so degraded from past land use that there is little hope of persistence, even if they are protected under a conservation easement. Others may need management or restoration to improve their chances of survival.

Some Natural Heritage Programs have developed criteria (called *element observation specifications*) to rank the probability of persistence of specific on-the-ground occurrences of species and natural communities relative to other occurrences in the region. These Element Occurrence Quality Ranks, or EO Ranks, are A (excellent), B (good), C (fair), and D (poor). Depending on the program, EO Rank specifications may be available for species populations, but they are more often available for natural communities. Three broad criteria are considered:

1. *Size*. This is important for obvious reasons. Larger patches of natural communities are better able to recover from disturbances and have a better chance of long-term persistence.
2. *Condition*. This criterion focuses on impacts from direct human alterations. One consideration is species composition: Are all the species present that you would expect? Have some been extirpated or suppressed? Are invasive species present? Another consideration is evidence of physical alterations such as clearing, logging, grazing, ditching, and the degree of fragmentation.
3. *Landscape context*. This is particularly important for ecological communities that naturally occur as smaller patches or depend on ecological processes (fire, hydrology) that come from surrounding areas. Connectivity to, and degree of naturalness within, the surrounding landscape (including neighboring properties) are the primary considerations.

Generally speaking, EOs of good size and condition, with at least a fair probability of long-term persistence, are ranked A, B, or C. Those with

EXAMPLE: Atlantic White Cedar Swamp Ecological Integrity Rank Table

Maine Natural Areas Program

Category	Key Ecological Attribute	Indicator	Very Good (A)	Good (B)	Fair (C)	Poor (D)
Size	Area	Area in acres	> 40 acres	5–40 acres	3–5 acres	1–3 acres
Condition	Ecological processes	Degree of anthropogenic disturbance (logging, beaver, ditching, damming, culverts)	Absent	Minor evidence, > 30 years ago or affecting < 25% of occurrence	Fairly significant impact (affect 25–75%)	Significant impact that has irreversibly altered occurrence (affecting > 75%)
	Ecological processes	Natural disturbance regime (hydrological fluctuations, wind)	Intact	Generally intact, minimal anthropogenic disturbances	Likely altered by anthropogenic disturbances (affects 25–75%)	Most of hydrologic regime is altered by anthropogenic disturbances (affects 25–75%)
	Species composition and biological structure	Structural and microhabitat diversity	Good regeneration of Chamaecyparis thyoides under canopy, several age classes including many mature trees > 120 years old	Good regeneration of Chamaecyparis thyoides under canopy; at least two age classes (mature and young), with many older trees 75–120 years old	Limited regeneration of Chamaecyparis thyoides , being out-competed by other trees; only one age class with few trees, if any, > 75 years old	Limited regeneration of Chamaecyparis thyoides, being out-competed by other trees; only one age class with few trees, if any, > 50 years old
	Species composition	Presence of non-native species	Absent or incidental	Incidental	Present and may significantly threaten community structure	Present and may significantly threaten community structure
Landscape Context	Connectivity	Percentage adjoining other natural communities	100%	> 80%	> 50%	< 50%
	Fragmentation	Size of unfragmented natural area to which occurrence belongs	Embedded in unfragmented natural core area > 1,000 acres	Embedded in unfragmented natural or semi-natural core area 500–1,000 acres	May or may not belong to roadless core area (< 100 acres)	Does not belong to roadless core area, or very small area (< 100 acres)
	Condition of surrounding landscape	Degree of surrounding anthropogenic disturbance (development, roads, culverts, logging, agriculture)	Minimal and unlikely to influence integrity (especially hydrology) of occurrence	Not extensive, surrounding landscape may include seminatural communities; has very limited impact on integrity (especially hydrology) of occurrence	Somewhat fragmented landscape, may have significant impact on integrity (especially hydrology) of occurrence; restoration may be possible	Significant impact on integrity (especially hydrology) of occurrence; restoration unlikely

significant degradation or those that need significant restoration work to survive are ranked D or poor. Natural Heritage Programs usually consider occurrences of at-risk natural communities (G1–G3 or S1–S3), as well as occurrences of common natural communities with high integrity (EO Rank of A or B) as exemplary natural communities and are considered priority conservation targets.

Contact your local Natural Heritage Program to determine if EO Rank specifications are available for your land trust's service area. If not, the size, condition, and landscape context of EOs should still be considered and described during biological inventories.

FOUR

Priority Geographic Areas

Chapter three discussed programs that designate priority *features* (species, natural communities, habitats, etc.) that can be used as inventory and conservation targets on individual properties. Yet, these features do not exist in a vacuum; their persistence is often tied to patterns and interactions in the broader surrounding landscape, patterns that operate at larger scales. For example, a natural community occurrence on a property may only persist with regular fire or flood events originating from other areas. Populations of certain species, particularly wide ranging or area dependent species, may only persist if the property is connected to a large landscape of suitable habitat.

To avoid a haphazard piecemeal approach, conservation planning and action must occur strategically at multiple spatial scales, from the individual parcel to the landscape (Franklin 1993; Poiani et al. 2000). In response, many conservation scientists, government agencies, and nongovernment organizations have engaged in conservation planning at the landscape scale. They have identified specific portions of a large geographic planning area (watershed, municipality, county, state, region) that are critical to meet conservation goals and are thus priorities for conservation action.

Land trusts can use landscape-scale conservation plans to identify priority geographic areas and proactively conserve the most important biological lands in their service areas. (By evaluating a large area, land trusts can determine which parcels of land are most important, then approach the owners with conservation options.) Landscape-scale plans can also help land trusts assess the conservation values of more opportunistic projects that come along, such as when a landowner proposes a conservation project.

Some of these conservation plans are tied to funding programs, and funders are increasingly requesting information on how land protection projects support such plans. While all plans strive for the broader goal of strategic conservation, they differ in specific goals, conservation targets, and methodology. The following two planning efforts, the State Wildlife Action Plans (SWAPs) and The Nature Conservancy (TNC) Ecoregional Assessments, are broadly applied and available throughout the country and are very useful for land trust applications. Additional planning efforts are discussed that are more individualized and regional in scale, including a suite of plans designed to address ecological connectivity issues.

State Wildlife Action Plans

Nongame wildlife species (e.g., songbirds, shrews, salamanders) account for the majority of vertebrate diversity found in the United States, yet most government funding sources for wildlife conservation have traditionally been directed toward game species—animals hunted for food or pelts. In 2001, the U.S. Congress passed the State Wildlife Grants Program to provide funding to states for conservation programs that benefit species in greatest conservation need (usually nongame species), and in order to receive funding, every U.S. state and territory was required to produce a comprehensive wildlife conservation strategy, also known as a SWAP. The plans were completed in 2006 and are intended to be nonregulatory and proactive, preventing wildlife from becoming endangered. Conservation easements and fee acquisitions of land are among the top ten most frequently mentioned actions for enhancing habitat protection for wildlife in the SWAPs (Lerner et al. 2006).

Each SWAP was required to develop a list of Species of Greatest Conservation Need (SGCN). The criteria for selecting these species were broadly defined and may include federal- and state-listed species, at-risk species tracked by Natural Heritage Programs, species with fragmented or isolated populations, species with limited dispersal abilities, indicator species (i.e., species whose population health reflects the health of a suite of other species or habitats), responsibility species (i.e., species that have the center of their range within a state), or other species of conservation concern. In addition to providing targets for the landscape-based planning efforts of the SWAPs, the SGCN list for each state provides yet another list of priority species targets for biological inventories and conservation efforts on individual land trust projects.

All of the SWAPs identify and describe key habitat types within the state that support the listed SGCN, which provides a useful (and government-recognized) classification system for conducting on-the-ground habitat inventories on land trust projects. A number of the more useful plans map these habitat types at broad scales and provide the information as Geographic Information System (GIS) layers. Some plans go a step further and map discrete focus areas for conservation, which may include multiple habitat types and are based on considerations such as ecological significance, threat, and/or opportunity. The spatially explicit nature of habitat and focus area mapping can be very useful for land trusts that wish to pursue strategic and proactive conservation in their service areas and for evaluating the conservation values of opportunistic projects.

EXAMPLE: List of Species of Greatest Conservation Need – Colorado's Comprehensive Wildlife Conservation Strategy

Appendix E

Species of Greatest Conservation Need – Tier 1 and Tier 2

Table E1. Tier 1 Species of Greatest Conservation Need

Taxonomic Group	Common Name	*Scientific Name*
Amphibians	Boreal toad (Southern Rocky Mountain Population)	*Bufo boreas boreas*
	Northern leopard Frog	*Rana pipiens*
	Plains leopard Frog	*Rana blairi*
Birds	American bittern	*Botaurus lentiginosus*
	American peregrine falcon	*Falco peregrinus anatum*
	Bald eagle	*Haliaeetus leucocephalus*
	Band-tailed pigeon	*Patagioenas fasciata*
	Black-throated gray warbler	*Dendroica nigrescens*
	Bobolink	*Dolichonyx oryzivorus*
	Boreal owl	*Aegolius funereus*
	Brewer's sparrow	*Spizella breweri*
	Brown-capped rosy-finch	*Leucosticte australis*
	Cassin's sparrow	*Aimophila cassinii*
	Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*
	Ferruginous hawk	*Buteo regalis*
	Flammulated owl	*Otus flammeolus*
	Golden eagle	*Aquila chrysaetos*
	Gray vireo	*Vireo vicinior*
	Greater prairie-chicken	*Tympanuchus cupido*

305

SGCN serve as conservation targets for the landscape-scale planning efforts of the SWAPs. They can also serve as priority targets for inventory and conservation efforts on individual land trust projects. (From CDOW 2006.)

EXAMPLE: Species of Greatest Conservation Need: Priorities, Threats, and Conservation Actions – Colorado's Comprehensive Wildlife Conservation Strategy

Table 16. Species of Greatest Conservation Need – Priorities, Threats, and Conservation Actions Sorted by priority (Tier 1 and 2), then by Taxonomic Group, then by Common Name.

Key to distribution field is in Appendix D. A complete list of Tier 1 and Tier 2 Species of Greatest Conservation Need is available in Appendix E.

Tier 1 Amphibians

Boreal toad (Southern Rocky Mountain Population)

Bufo boreas boreas

Tier 1 Amphibians

Population Status		Population Trend	
Low	D	Stable	D

Distribution	Type
Southern Rocky Mountains	P

Habitat	Primary
Grass/Forb Dominated Wetlands	☑
Mountain Streams	☑
Open Water	☑
Shrub-dominated Wetlands	☑
Aspen Forest	☐
Lodgepole Pine	☐
Mixed Conifer	☐
Spruce-Fir	☐

General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Degradation	Altered animal community (loss of beaver)	Maintain or Restore Habitat	Avoid destruction of large tracts of native habitat	M
Habitat Degradation	Campsite and hiking or OHRV trail development and use	Protected Area Management	Manage public use to be compatible with biodiversity	M
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Research and Monitoring	Monitor population status	M
Invasive or Exotic Species	Pathogen - chytrid fungus	Education and Communication	Publish educational material/sponsor educational programs to raise public awareness	M
Invasive or Exotic Species	Pathogen - chytrid fungus	Invasive Species Control and Prevention	Avoid transfer of chytrid fungus, follow established protocols for species research	H

Northern leopard Frog

Rana pipiens

Tier 1 Amphibians

Population Status		Population Trend	
Low	X	Declining	X

Distribution	Type
Central Shortgrass Prairie	P
Colorado Plateau	P
Front Range	P
Southern Rocky Mountains	P
Utah High Plateau	P
Wyoming Basin	P

Habitat	Primary
Eastern Plains Rivers	☑
Eastern Plains Streams	☑
Grass/Forb Dominated Wetlands	☑
Mountain Streams	☑
Open Water	☑
Shrub-dominated Wetlands	☑
Transition Streams	☑
West Slope Rivers	☑
West Slope Streams	☑
Mixed Conifer	☐

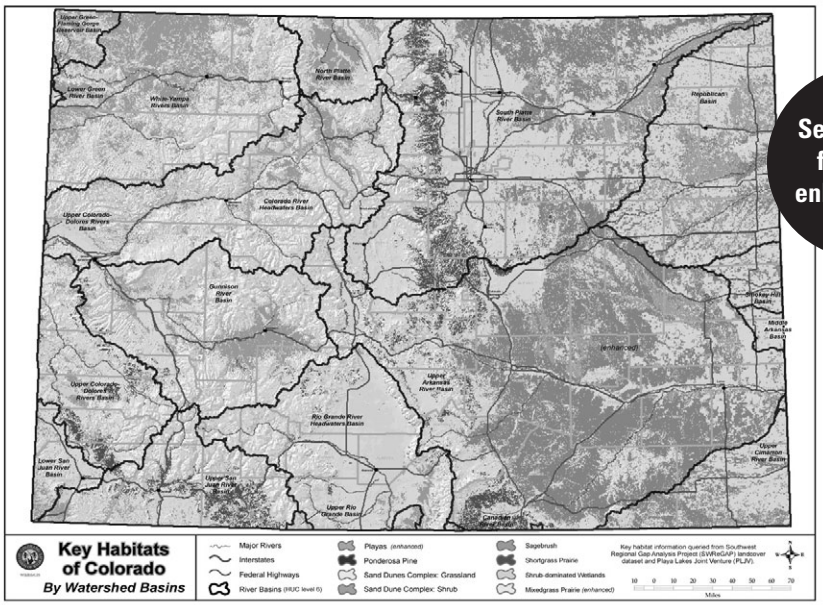
General Threat	Specific Threat	General Conservation Action	Specific Conservation Action	Priority
Habitat Conversion	Housing, urban, and ex-urban development	Planning and Zoning	Maintain native landscape via zoning, conservation easements, acquisition, etc.	H
Habitat Degradation	Altered hydrological regime (surface or aquifer)	Maintain or Restore Natural Processes	Remove dam, or diversion where applicable	M
Invasive or Exotic Species	Invasive animals	Invasive Species Control and Prevention	Control bullfrogs and other introduced species (including predatory fishes)	H
Pollution	Air and water pollution	Research and Monitoring	Monitor population status (including monitoring water quality, temperature, pH)	M

X = Best professional judgement, D = Science-based decision, P = Primary area of distribution, O = Other areas where species occurs.

64

SWAPs identify habitat and conservation needs for SGCN. (From CDOW 2006.)

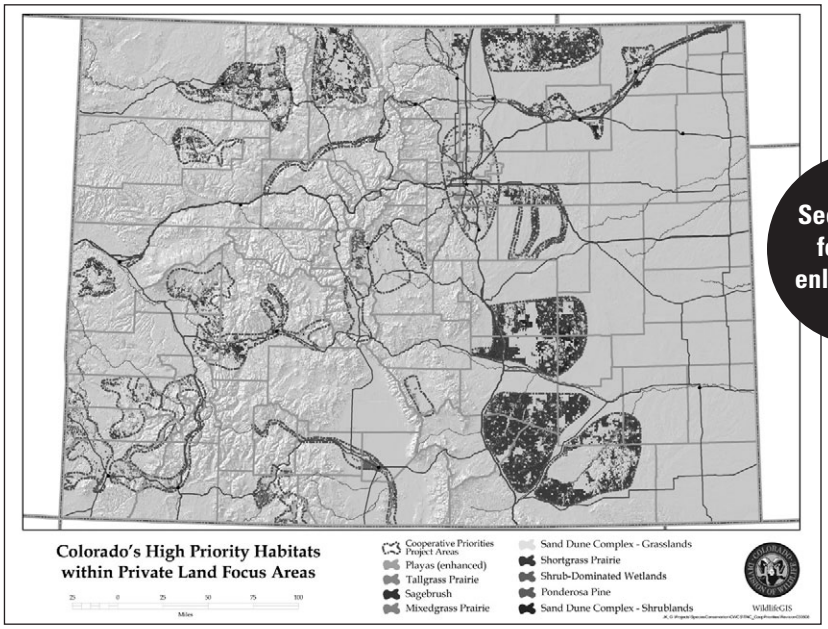
EXAMPLE: Key Habitats Map



See page 76 for color enlargement

A number of SWAPs explicitly map priority or key habitats for SGNC. (From CDOW 2006.)

EXAMPLE: Focus Areas Map



See page 77 for color enlargement

Some SWAPs explicitly map focus areas for conservation action. (From CDOW 2006.)

All of the plans discuss the status, life history, threats, and conservation needs for SGCN and their habitats. This provides an excellent overview of the top wildlife conservation issues for the state and can provide useful information for the drafting of conservation easements and management plans.

Land conservation projects that support priorities identified under the SWAPs will support the strategic conservation of wildlife, have substantiated conservation values supported by a government-funded program, and may receive priority for funding under various government programs administered under the farm bill or from certain private foundations.

A practical limitation of the SWAPs is that many still do not have mapped priority habitats or focal areas. For the plans that do contain habitat mapping, it may be too coarse for planning at the parcel-level scale and should be verified in the field for individual projects (Van de Poll 2008).

Other limitations of SWAPs are that only a few address the needs of plants or natural communities (Stein and Gravuer 2008) and many fail to address connectivity for wide-ranging wildlife (e.g., bears, pronghorn, lynx) or climate change (Joyce et al. 2008). However, future revisions are expected to make progress on these issues.

SWAPs can be downloaded from the Association of Fish & Wildlife Agencies' website (www.wildlifeactionplans.org). The NatureServe/National Geographic Society's LandScope America website (www.landscope.org) provides mapping of SWAP focus areas.

LANDSCOPE AMERICA

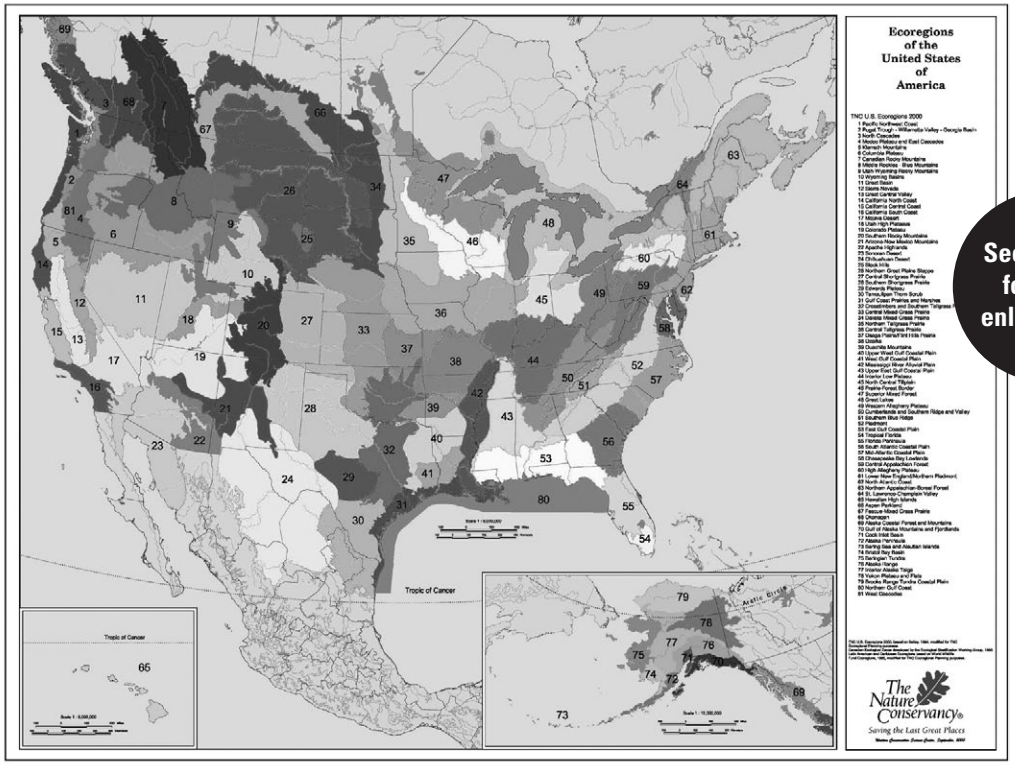
LandScope America (www.landscope.org) is a collaborative effort between NatureServe and the National Geographic Society to provide an online resource for the land protection community and the public that brings together maps, data, photos, and stories about the United States' natural places and open spaces. Perhaps the most useful feature for land trusts is a map viewer, which allows users to view overlays of spatial data relevant to their project areas, such as aerial photography, vegetation and habitat types, SWAP focus areas, TNC Ecoregional Portfolio areas, and other conservation planning efforts.

The Nature Conservancy's Ecoregional Assessments

TNC Ecoregional Assessments (sometimes referred to as ecoregional plans or conservation blueprints) represent some of the most robust and sophisticated conservation planning in the world. Instead of focusing primarily on wildlife, Ecoregional Assessments address the full range of biodiversity by including plants and animals, as well as natural communities and ecosystems of conservation concern within an ecoregion.

Ecoregions are large areas of land and water with similar environmental conditions (climate, geology, soils) and distinct assemblages of natural communities that share a large majority of their species and that function together effectively as a conservation unit (Dinerstein et al. 1995; Groves 2003). Thus,

EXAMPLE: The Nature Conservancy's Ecoregions of the United States of America Map (From TNC Eastern Regional Science Office.)



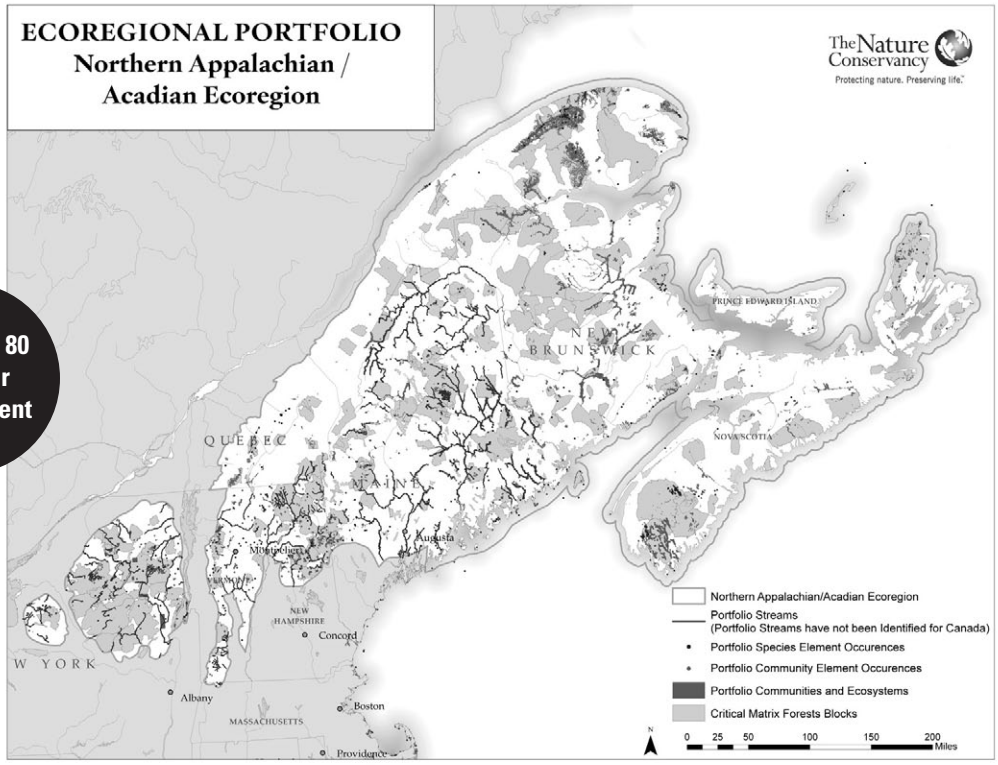
See page 78 for color enlargement

ecoregions are better than biologically arbitrary state or political boundaries for assessing patterns of biodiversity across the landscape. There are 81 ecoregions within the United States, with names such as the Northern Appalachian/Acadian Ecoregion, which includes the Adirondacks and most of northern New England, or the Southern Rocky Mountains Ecoregion, situated mostly within western Colorado and northern New Mexico.

The objective of Ecoregional Assessments is to identify the most important areas of the landscape necessary to conserve the full range of biodiversity in the ecoregion (Groves et al. 2000). As with SWAPs, Ecoregional Assessments rely heavily on the standardized databases of biodiversity data maintained by the Natural Heritage Programs, remotely derived spatial data (e.g., from satellites), and other mapped data used in GIS, as well as expert input. The methodology continually evolves, but in a nutshell, it generally involves:

1. *Identifying conservation targets* (what to protect). This includes the large-scale coarse-filter targets, such as broad vegetation types, but also the smaller fine filter targets, such as the at-risk

EXAMPLE: The Nature Conservancy's Ecoregional Portfolio for the Northern Appalachian/Acadian Ecoregion (From TNC Eastern Regional Science Office.)

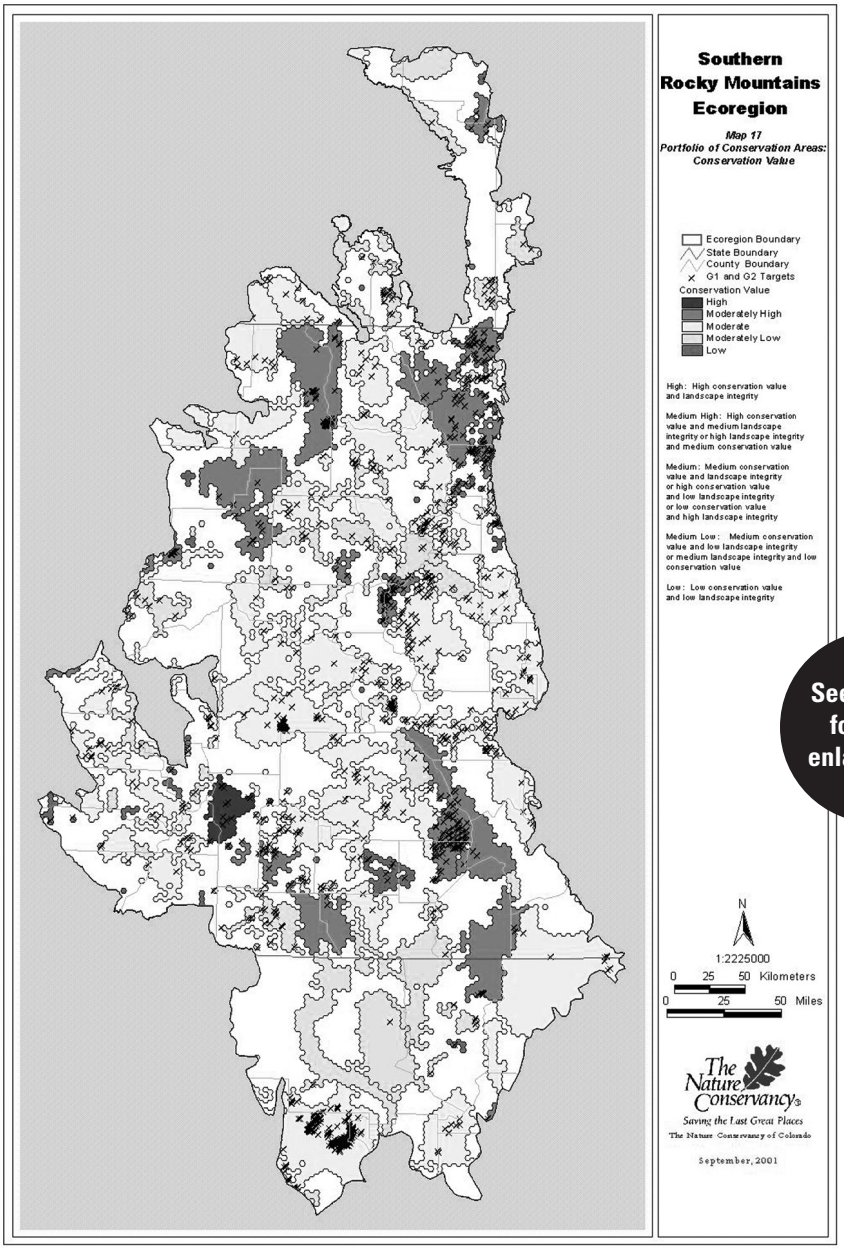


See page 80 for color enlargement

species and natural communities that might not otherwise be captured in the coarse-filter targets.

2. *Setting representational goals* (how much or how many occurrences of each target to protect). Scientists determine how many and how widely distributed the conservation target occurrences need to be to maintain the long-term viability and integrity of those targets.
3. *Evaluating the viability of the target occurrences* (so you don't waste resources protecting nonviable occurrences). Scientists evaluate known, mapped occurrences of the targets to determine if they still have a chance to survive and function over the long term with adequate protection. If certain target occurrences are nonviable, they may be excluded. If there are not enough viable targets to meet the representational goals, scientist may consider whether the nonviable occurrences should be restored (to increase the number of viable occurrences).

EXAMPLE: The Nature Conservancy's Ecoregional Portfolio for the Southern Rocky Mountains Ecoregion (From Neely et al. 2001.)



See page 81 for color enlargement

This assessment process is used to produce an Ecoregional Portfolio—a set of mapped, priority conservation areas that most efficiently achieves the representation goals for the conservation targets in the least amount of area or number of places. (The portfolio is designed to identify priority conservation areas that will give conservationists the biggest bang for their buck.)

In addition to the Ecoregional Portfolio mapping (which is often available in GIS format), Ecoregional Assessments provide an excellent resource for background information on the ecoregion and its priority conservation targets, as well as information regarding threats and current protection levels and needs.

One drawback to Ecoregional Assessments is that, compared to SWAPS, there are not as many sources of funding or incentives dedicated to their implementation. However, the importance of portfolio areas designated in the assessments is still widely recognized by government agencies and funding organizations and can be used by land trusts to prioritize land protection efforts in their service areas and establish the conservation values of individual projects. Projects that contribute to the protection of Ecoregional Portfolio areas may also provide opportunities for collaboration with TNC.

The primary online source for information on Ecoregional Assessments is TNC's ConserveOnline website (http://conserveonline.org). Mapped Ecoregional Portfolio information, for some areas, is viewable on the NatureServe/National Geographic Society's LandScope America website (www.landscope.org). However, the best source for complete Ecoregional Assessment data is through the regional TNC office nearest your project.

Connectivity-Based Landscape Conservation Plans

Habitat fragmentation is widely known to be a leading cause of the biodiversity crisis (Wilcove et al. 2000) and basically has two components:

1. Loss or reduction of a particular type of habitat
2. Division of the remaining habitat into smaller and more isolated patches (Noss and Csuti 1997)

This fragmentation not only causes some species to be eliminated from otherwise suitable habitat patches (Gilpin and Soulé 1986), but also reduces movement and dispersal between patches leading to problems of isolation, such as in-breeding and inability to access seasonal food sources or mates or the recolonization of otherwise suitable habitat. These problems will become even more critical in the near future as habitats shift in response to global climate change (Soulé et al. 2006).

The best way to prevent fragmentation is to protect large, contiguous, high-quality areas of habitat. However, many protected areas, even large national parks, are not big enough to protect the full suite of biodiversity within them (Newmark 1995; Gurd et al. 2001). While striving to protect large, contiguous areas should always be a conservation goal, the reality is that it's not always pos-

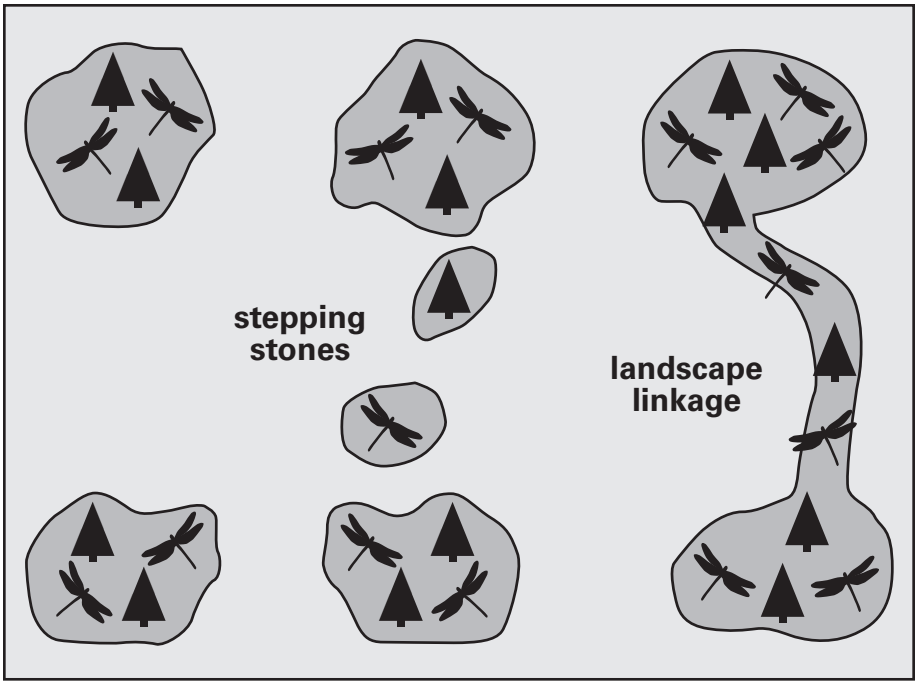
sible. As a compromise, another way to mitigate the adverse effects of fragmentation is to enhance connectivity between protected areas or habitat patches. Recognizing this issue, some initiatives have tried to go beyond the traditional representational approach of conservation planning (simply protecting some of everything) to include connectivity as an additional goal (Noss and Daly 2006).

While the problem of isolation affects plants (via seed dispersal and pollination for instance) as well as small animals (such as amphibians, reptiles, and insects), most terrestrial connectivity *planning* takes place at large, regional scales and focuses on wide-ranging mammals that have large area requirements and are limited by a lack of dispersal opportunities, such as certain ungulates (pronghorn and elk) and carnivores (lynx, marten, wolf, bear, wolverine, fisher, and cougar). A typical approach for connectivity-based conservation planning involves modeling and mapping suitable habitat patches for such focal species using GIS. Linkages between these patches are then analyzed using computerized techniques, such as least-cost path or circuit-theory analysis, to determine which areas provide the lowest resistance to focal species dispersal. Such analyses may also include climate change models to predict where future habitats will occur and where connectivity and land protection efforts will be most critical in the short and long term.

On the ground, connectivity is sometimes enhanced or maintained by protecting narrow, linear strips of dispersal habitat between suitable patches. This core-corridor or hedgerow approach is usually done for single species or when working at small scales or in heavily disturbed or fragmented landscapes. (Think of islands and bridges in a sea of inhospitable habitat.) But in many real-world cases, this approach is overly simplistic; most focal species are not confined to such thin strips during their dispersal movements. Connectivity is more often addressed by protecting or managing broader swaths of the landscape between core habitat areas as generally friendly or permeable to wildlife dispersal, particularly for a suite of focal species (as opposed to just one species). These areas are often referred to as linkage areas or wildways, and because the word resonates so well with the public, the term *corridor* is still used as well, even though it generates the mistaken image of thin, linear strips. Smaller areas of habitat within a broader linkage area may function as stepping-stones to facilitate dispersal.

Many protected areas, even large national parks, are not big enough to protect the full suite of biodiversity within them.

Connectivity within linkage areas is generally accomplished by maintaining natural land cover types, which can be protected with restrictions in conservation easements and compatible with working lands management, such as ranching and forestry. In some cases, depending on the focal species,



Connecting Natural Areas. Ecological connectivity between large blocks of wildland (or core habitat) can be maintained with broad linkage areas. Smaller areas of habitat within a broader linkage area may function as stepping-stones to facilitate dispersal for focal species. (From Defenders of Wildlife, Biodiversity Partnership and Conservation Network Design, Design Principles.)

protecting connectivity may involve more specific actions such as the use of wildlife-friendly fencing, carnivore-friendly ranching methods, or wildlife road crossings. The core habitat patches and stepping-stones (or nodes) that are being connected may consist of areas that are already protected (National Forest Service Wilderness Areas, state parks, conservation easements, etc.) or, if unprotected, may require more restrictive or specific forms of protection or management than the linkage areas, again depending on the focal species.

One of the first organizations to widely promote the development and use of connectivity-based conservation plans was the Wildlands Network, formerly The Wildlands Project, founded in 1991. Since then, numerous connectivity-based conservation plans have been completed by a number of groups, many working together under broad coalitions such as the Yellowstone to Yukon Conservation Initiative in the northern Rockies, Wildlands Network's Spine of the Continent Initiative connecting northern Mexico to Alaska through the intermountain West, and the Two Countries–One Forest coalition in the Northern Appalachian/Acadian Ecoregion.

Smaller-scale planning efforts have been completed in the other parts of the country, and the concept is gaining wider support, particularly with the growing recognition of climate change. A recent coalition called Free-

dom to Roam, formed by the clothing company Patagonia, also promises to advance the cause of connectivity conservation at a national scale. Another encouraging development is a proposal in Congress to create a National Fish and Wildlife Habitat and Corridors information program. Also, the Western Governors Association recently passed a resolution to improve planning for wildlife connectivity by creating the Wildlife Corridors Initiative, a collaborative multistate effort to improve knowledge and management of wildlife corridors and crucial habitat. In addition to providing enhanced guidance and planning, these government programs could be helpful when demonstrating the conservation value of connectivity-related land trust projects under IRC 170(h).

DESIGNING LINKAGES

For more information on the process of designing wildlife corridors and linkages, visit:

- **CorridorDesign, Conceptual steps for designing wildlife corridors: www.corridordesign.org**
- **Defenders of Wildlife, Conservation Network Design: www.defenders.org/programs_and_policy/habitat_conservation/conservation_planning/cnd/principles.shtml**
- **The Wildlands Network, Wildlands Network Designs: www.twp.org/what-we-do/scientific-approach/wildlands-network-designs**

The following organizations have developed conservation plans that include the connectivity needs of focal species. As with SWAPs and TNC Ecoregional Portfolios, spatial data is often available in GIS format; the reports contain useful information on the planning area, focal species, and protection and management needs.

- The Algonquin To Adirondacks Conservation Association (A2A): www.a2alink.org/objectives.html
- American Wildlands, Corridors of Life, Priority Linkage Areas Assessment
- Arizona Missing Linkages: http://corridordesign.org/linkages/arizona
- California Essential Habitat Connectivity Project: www.dfg.ca.gov/habcon/connectivity/
- California Wilderness Coalition: www.calwild.org/index.html
- Center for Native Ecosystems, Southern Rockies Wildlands Network Vision: http://nativeecosystems.org/srep/southern-rockies-wildland-network-vision
- Corridor Design: www.corridordesign.org/arizona/
- The EPA Southeastern US Ecological Framework Project: www.geoplan.ufl.edu/epa/results.html
- Grand Canyon Wildlands Network Design: www.grandcanyonwildlands.org

EXAMPLE: Wildlands Network's Spine of the Continent Initiative

(From Wildlands Network.)

See page 82 for color enlargement

- New Mexico Highlands Wildlands Network Design: www.twp.org/what-we-do/scientific-approach/wildlands-network-designs
- New Mexico 2003 Critical Mass Workshop: www.wildlife.state.nm.us/conservation/criticalmass/index.htm
- Pima County–Sonoran Desert Conservation Plan: www.pima.gov/CMO/SDCP/habitat.html
- South Coast Missing Linkages Project: www.scwildlands.org/projects/scml.aspx
- Sky Islands Wildlands Network Design: www.wildlandsnetwork.org
- Two Countries One Forest, Priority Locations for Conservation Action: www.2c1forest.org/atlas/index.html
- Wildlands Network: www.wildlandsnetwork.org
- Wild Utah Project (see The Heart of the West Conservation Plan): http://wildutahproject.org/resources
- Yellowstone to Yukon Conservation Initiative: www.y2y.net

Additional Landscape-Scale Conservation Plans

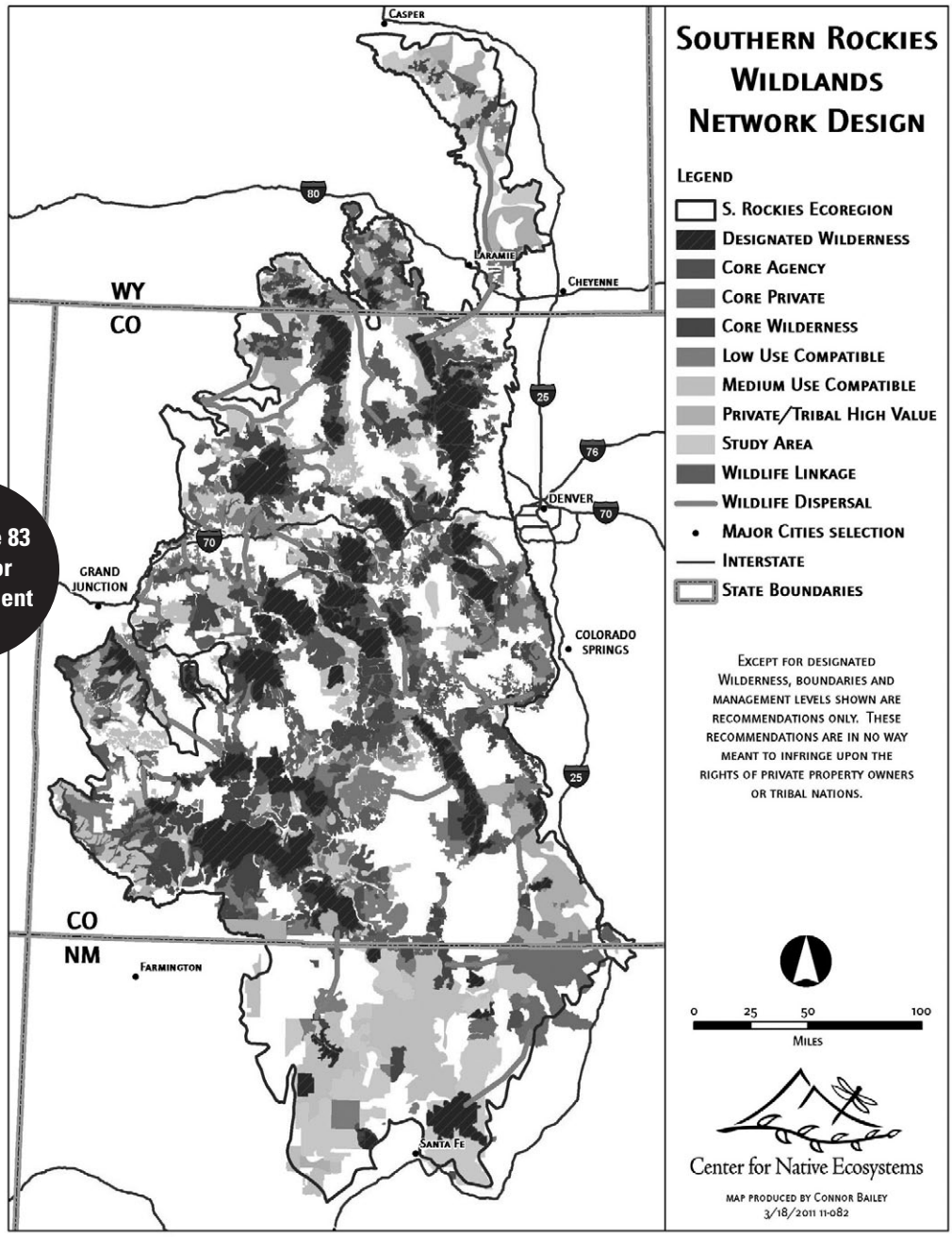
Many additional landscape-scale planning efforts are active throughout the country and vary greatly in their objectives, approaches, scope, and methodologies, as well as financial support. While there is no central clearinghouse for landscape-scale conservation plans and a thorough listing is beyond the scope of this handbook, here is a sampling of additional planning efforts containing mapped priority areas useful for land trust projects. Finally, consider more traditional planning efforts, such as reports by regional planning commissions and town comprehensive plans, which may also identify important areas for biodiversity.

National Plans

- Audubon Important Bird Areas: www.audubon.org/bird/iba
- The Conservation Fund's Green Infrastructure Program: www.conservationfund.org/strategic_conservation/projects
- Defenders of Wildlife Conservation Planning: www.defenders.org/programs_and_policy/habitat_conservation/conservation_planning
- Trout Unlimited Conservation Success Index: www.tu.org/science/conservation-success-index

EXAMPLE: Wildlands Network's Design for the Southern Rocky Mountains Ecoregion

(From Miller et al. 2003.)



See page 83 for color enlargement

- The Trust for Public Land, Greenprinting and Conservation Vision service: www.tpl.org/what-we-do/services/conservation-vision/
- USFWS Critical Habitat: http://criticalhabitat.fws.gov/crithab/

Local, State, and Regional Plans

- Florida Closing the Gaps: http://research.myfwc.com/publications/publication_info.asp?id=48583
- Florida Forever: www.dep.state.fl.us/lands/fl_forever.htm
- Maine's Beginning with Habitat: www.beginningwithhabitat.org
- Massachusetts BioMap: www.mass.gov/dfwele/dfw/nhesp/land_protection/biomap/biomap_home.htm
- New Jersey Landscape Project: www.state.nj.us/dep/fgw/ensp/landscape
- North Carolina Naturally: www.onencnaturally.org/pages/ConservationPlanningTool.html
- Quabbin to Cardigan Initiative (Q2C): http://q2cpartnership.org
- Virginia Natural Landscape Assessment: www.dcr.virginia.gov/natural_heritage/vclnavnla.shtml

Limitations of Landscape-Scale Conservation Plans

Landscape-scale conservation planning efforts are critically important for biodiversity conservation and can provide a uniform and cost-effective method for prioritizing land protection efforts across large areas (which is part of their appeal for government agencies and funding organizations). However, large-scale planning efforts are often limited by the types and quality of data available. Obtaining certain types of accurate, high-resolution, field-verified GIS data for large areas is difficult. Thus, landscape-scale planning is coarse or "fuzzy" by its very nature, particularly at the scale of an individual parcel.

For these reasons, such macroplans are not a replacement for on-the-ground fieldwork when evaluating and designing individual land protection projects. For example, computer-modeled habitat or land cover types in some plans (like SWAP priority habitats) can be mapped at such coarse scales that they may be misidentified or the boundaries may be very different on the ground (Van de Poll 2008). Also, landscape-scale plans may draw heavily on existing biological inventory work (such as Natural Heritage data), which can be spotty and limited and thus risk omitting important areas for conservation simply because no biologists have inventoried them. The hope is that landscape-scale conservation planning and habitat modeling is correct most of the time over most of the planning area.

Another common issue observed with landscape-scale conservation plans is that conservationists will feel certain areas should qualify as priorities, even though those areas are not identified as such in the plan. In these cases, it's important to question three things:

1. The limitations of the input data available
2. The goals and methodology used in the planning
3. Scale

Methodologies among landscape-scale conservation plans differ, primarily in what variables are included and how they are weighted. For example, one plan may simply aim to prioritize groupings of rare species' locations for conservation, while another may also include risk or threat as an important variable. Thus, even though a particular area is extremely ecologically rich, it may be considered adequately protected (low threat) relative to other important areas and thus not show as a high conservation priority.

Another source of confusion comes from the fact that priorities are relative and change according to scale. For instance, you wouldn't expect the president of the United States to be concerned with local town politics (e.g., whether the town recycling day should be two days a week instead of one). For a similar reason, it's very possible that a landscape-scale plan analyzing the top priorities for an entire ecoregion (coarse scale) would not identify areas considered priorities by a county-level land trust (a finer scale). In general, areas that are categorized as conservation priorities at multiple scales or in multiple plans should be the highest priorities.

In short, landscape-scale conservation plans can help land trusts work strategically by identifying coarse-scale priority areas for conservation action within their service areas, supporting fundraising appeals and applications, and substantiating conservation values for individual projects. Yet, such plans are not a replacement for fieldwork and should be recognized for what they are and what they are not.

FIVE

Conducting an Off-Site Review of Biological Information

Now that you are familiar with programs that identify biological conservation priorities for your service area, it's time to assess and document the significant biological conservation values of your land protection project. (Please note that the term *biological assessment* used here refers to an assessment of the biological conservation values of a land protection project and should not be confused with the more formally defined term under the National Environmental Policy Act of 1969.)

Start Early!

Unfortunately, when biological assessments of land trust projects do occur, they are often done *after* the easement is signed or the property is purchased. This seems to happen for several reasons:

1. Biological assessments are frequently viewed by land trusts as simply part of the baseline documentation process and not necessarily part of the preliminary site inspection process.
2. The land trust, or landowner, doesn't want to spend the time and money doing a biological assessment until they know a deal is actually going to happen, which usually isn't until the deal is done.
3. Most land protection transactions are initiated toward the end of the tax year deadline, and it's assumed there is not enough time for biological assessments or that it would be better to wait until spring when more species are observable.

This pattern is unfortunate because biological data is most useful early in the process, when it can inform project selection and easement drafting and negotiation, as opposed to simply informing the baseline document after the fact. Ironically, taking the time to gather biological data can actually accelerate a deal by reinforcing the project's significance, inspiring interest among potential partners, or enhancing fundraising efforts, such as grant applications.

Early assessments can also help avoid headaches by letting the parties involved know what types of protections are going to be needed upfront, reducing the potential for deal-breakers or other surprises down the road (for instance, just before the deal is done, someone realizes there is an imperiled natural community where the owner or land planner wants to cut a view clearing, place a building envelope, or build a road). Because deals and agreements get harder to change once they're set in motion, the best way to ensure protections for biodiversity and create a well-informed project is to incorporate biological information from the very beginning. Fortunately, there is a lot of useful biological information that can be gathered for a project quickly, cheaply, easily, and at any time of the year.

Early biological assessments can help avoid headaches by letting the parties involved know what types of protections are going to be needed upfront, reducing the potential for deal-breakers or other surprises down the road.

The biological assessment process described here is for typical land trust projects with the goal of providing the most useful information in the shortest amount of time and for the least amount of money. This assessment process has two parts:

1. *Off-site review* of existing biological data and mapping (discussed in this chapter)
2. *Field-based inventory* of biological features and their condition (discussed in chapter six)

Initial Landowner Interview

Get a general description of the property features. During initial conversations, have the landowner describe the natural features of the property and its management history and current conditions in as much detail as possible. Try to ask specific questions related to the condition of priority biological features and the types of natural resource information available for the property.

Get a description of the landowner's intentions. The landowner may have certain reserved rights in mind such as grazing, logging, road, pond and building construction, view clearing, and so on. This information is good to keep in mind when evaluating the potential conservation values of a project; the intended reserved rights could be harmful to certain biological features, and it helps to identify such conflicts early. On the other hand, the owner's intended reserved

rights may complement the potential conservation values and can reinforce a project's viability.

Get a map of the property boundaries. This probably sounds obvious, but it's frequently the first impediment to the assessment process. This seems to happen for a number of reasons: For example, the land trust is waiting for the landowner to send a survey plat, or parcel data isn't easily available. Keep in mind that, for preliminary biological assessments, the exact survey boundaries aren't as important as the general area encompassed by the boundaries. Simply having the landowner sketch in the rough boundaries (on a topographic or aerial map) based on their knowledge will be helpful in the meantime. Ideally, you want to have the boundary plotted on a USGS topographical map, as this type of map provides a lot of useful information for assessments and fieldwork and is a standardized reference when comparing other mapped information. Such a map is also specifically mentioned in the IRS Treasury Regulations (1.170A-14) as a recommended part of the baseline documentation report.

QUESTIONS FOR THE LANDOWNER

Consider covering these questions when interviewing landowner(s) of a potential conservation project:

1. **Do the owners know of any rare, endangered, or unusual species on the property?**
2. **What types of interesting plants or wildlife do they see on the property?**
3. **What's the elevation and topography like?**
4. **What types of general habitats are available?**
   - **Forests, woodlands, shrublands, grasslands?**
   - **Cliffs, rock outcrops, talus slopes?**
   - **Lakes, ponds, vernal pools, seeps, wetlands (bogs, fens, swamps)?**
   - **Rivers or streams (calm and flat or steep and rough)?**
5. **What are the past and current land uses, including surrounding properties?**
   - **Grazing, forestry, agricultural crops?**
   - **Camping, hunting, fishing, off-road vehicles, other recreational uses?**
   - **Development?**
6. **What types of mapping and natural resource reports are available?**
   - **Timber cruise information, maps of forest stand types?**
   - **Aerial photography, wetland delineations?**
   - **Environmental consultant reports?**
   - **Land management plans?**

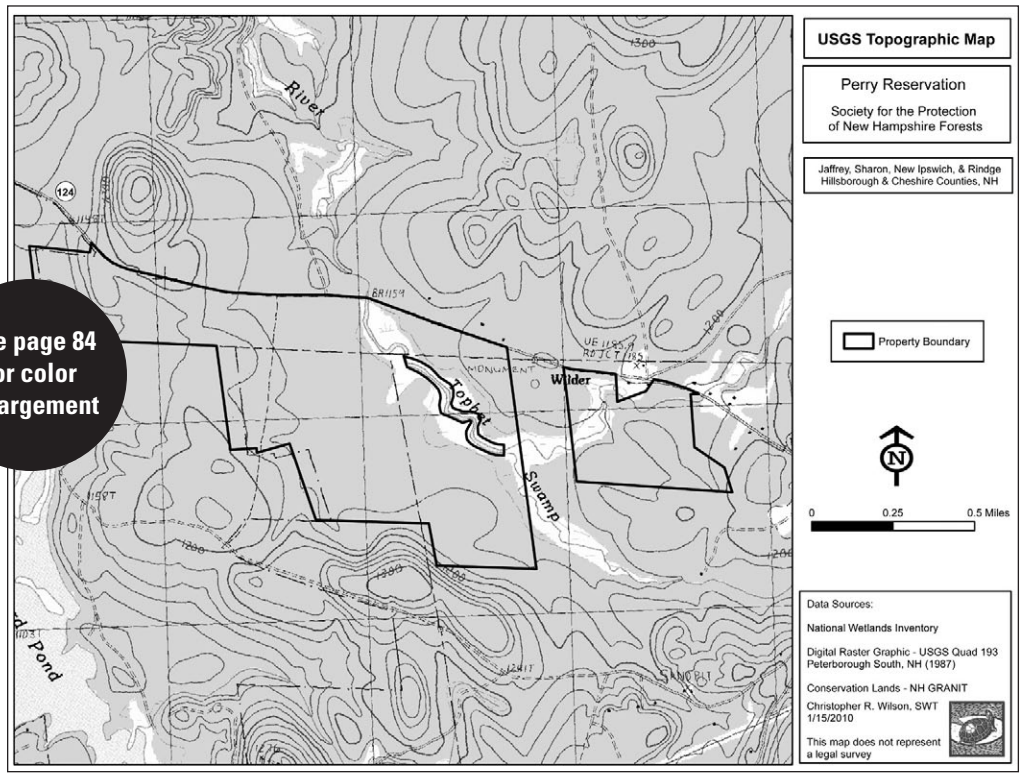
If you have taken the time to become familiar with the priority species, natural community types, and habitats that occur in your service area, you can ask more specific questions and begin to develop an idea of what priority features the property might contain. Such questions will facilitate the assessment process going forward, and for land trusts, asking these questions of the owner upfront reinforces your values and interests in the property.

Submit an Information Request to the Natural Heritage Program

One of the most useful (and underused) resources for land trust projects is the information request or environmental review available from Natural Heritage Programs. These reports are often free to land trusts and provide a review of

EXAMPLE: The Perry Reservation

The Perry Reservation is a conservation property owned by the Society for the Protection of New Hampshire Forests and held under a conservation easement by the Sweet Water Trust. This chapter uses the conservation property as an example of how data can be collected for an off-site review and to illustrate how to apply different, freely available spatial data layers to assess the biological conservation values of a land protection project.



See page 84 for color enlargement

(Map by the author.)

Natural Heritage Program records regarding the occurrence of rare plants, animals, and natural communities on a specific property and the surrounding area.

Such requests typically require permission from the landowner, a brief description of the project, and a map showing the property boundaries and surrounding landmarks (such as a USGS topographic map with the boundaries sketched in). Since there may be a certain amount of turnaround time involved (usually one to two weeks), information requests should be submitted as early as possible.

The information request report will include a list of rare or imperiled species and natural communities known from the property and surrounding areas,

mapped locational data for these features (depending on data sensitivity, state restrictions, and need), imperilment ranks and legal status, date of last observation, and data source. Additional data, such as species accounts, habitat descriptions, and management information, may also be available.

Land trusts should consider using heritage information requests during the project selection process (*Land Trust Standards and Practices*, standard 8) and examination of the property (standard 10) for every project that intends to protect relatively natural habitat (IRC 170(h)(4)(A)(ii)) as a conservation purpose. The heritage information request report is also a part of due diligence. It would be unfortunate if a land trust negotiated an easement, claiming to protect relatively natural habitat, only to learn it permitted an incompatible use where the Natural Heritage Program had records of a rare species or natural community. (See *inconsistent use* in IRS 1.170A-14.)

One thing to keep in mind is that these reports only indicate *known* records, and they are not a replacement for on-the-ground biological inventories. If the reports do not indicate rare species or natural communities (Element Occurrences or EOs) for your project, it doesn't mean there are none; a biologist may never have inventoried the site or reported the results.

Regardless of whether or not records exist for your project, the list of known EOs within the county, town, or surrounding areas is still very useful for identifying *potential* rare species and natural communities on your project and providing survey targets for biological inventories.

Land trusts may be able to form an official data-sharing agreement with their state's Natural Heritage Program, whereby the land trust is provided with regular updates of the EO database in the form of Geographic Information System (GIS) files. Having this information in-house makes it easier and quicker to access and increases the likelihood that the data will be used. However, such data is considered sensitive due to landowner privacy and political issues and because it can be used by poachers and collectors (orchid and herpetile collectors, for example). Thus, Natural Heritage Programs differ greatly in their ability to share such data.

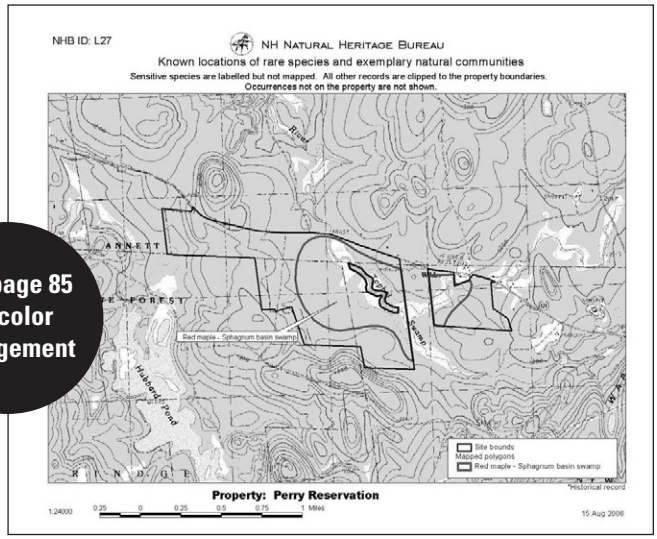
INTERPRETING NATURAL HERITAGE PROGRAM INFORMATION REQUEST REPORTS

Consider these questions when reviewing Natural Heritage Program information request reports:

- **Does the project contain Element Occurrence records (records of rare species or natural communities) according to the Natural Heritage database?**
- **Are there Element Occurrences in the vicinity of the project? If so, it's possible that such elements also occur on the project site, but no one has looked for them. It's also possible that protection of the property will benefit elements in the vicinity by providing potential habitats for future recovery, seasonal movements, and so on.**

EXAMPLE: Natural Heritage Information Request Report

(From New Hampshire Natural Heritage Bureau.)



See page 85 for color enlargement

NEW HAMPSHIRE NATURAL HERITAGE BUREAU
DRED - DIVISION OF FORESTS & LANDS
PO BOX 1856 -- 172 PEMBROKE ROAD, CONCORD, NH 03302-1856
PHONE: (603) 271-2214 FAX: (603) 271-6488

To: Christopher Wilson, Sweet Water Trust
PO Box xx
Ripton VT 05766

From: Sara Cairns, NH Natural Heritage Bureau
Date: 8/15/2006
Re: Review by NH Natural Heritage Bureau of request dated 8/15/2006

NHB File ID: 27 **Town:** Sharon, Rindge, New Ipswich
Project type: Landowner Request **Location:** Perry Reservation

I have searched our database for records of rare species and exemplary natural communities on the property(s) identified in your request. Our database includes known records for species officially listed as Threatened or Endangered by either the state of New Hampshire or the federal government, as well as species and natural communities judged by experts to be at risk in New Hampshire but not yet formally listed.

NHB records on the property(s):

	Mapping Precision	% within tract	Last Reported	Listing Status		Conservation Rank	
Natural Community				**Federal**	**NH**	**Global**	**State**
Red maple - Sphagnum basin swamp	Good	76	1987	--	--	-	S4

NHB records within one mile of the property(s):

	Last Reported	Listing Status		Conservation Rank	
Vertebrate species (For more information on animal species, contact Kim Tuttle, NH F&G at 271-6544)		**Federal**	**NH**	**Global**	**State**
Slimy Salamander (*Plethodon glutinosus*)	1962	--	--	G5	SH
Natural Community		**Federal**	**NH**	**Global**	**State**
Medium level fen system	1998	--	--	--	S3

Listing codes: T = Threatened, E = Endangered
Rank prefix: G = Global, S = State, T = Global or state rank for a sub-species or variety (taxon)
Rank suffix: 1-5 = Most (1) to least (5) imperiled. "--", U, NR = Not ranked.
B = Breeding population, N = Non-breeding. H = Historical, X = Extirpated.

NOTE: Detailed information is only given for NHB records actually on a property. Records in adjacent areas are either not reported or only listed by type. For this reason, this review cannot be used to satisfy a permit or other regulatory requirement to check for rare species or habitats that could be affected by a proposed project.

New Hampshire Natural Heritage Bureau - Community Record

Red maple - Sphagnum basin swamp

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Not ranked (need more information)
State:	Not listed	State:	Apparently secure but with cause for concern

Description at this Location

Conservation Rank:	Good quality, condition and lanscape context ('B' on a scale of A-D).
Comments on Rank:	Very large, mature swamp.
Detailed Description:	1987: Large forested wetland around Gridley River. Areas near river with dead trees and open marsh. Dominated by *Acer rubrum* (red maple), *Tsuga canadensis* (hemlock), *Calamagrostis canadensis* (blue-joint), *Vaccinium corymbosum* (highbush blueberry), and *Rhododendron canadense* (rhodora). *Ledum groenlandicum* (Labrador-tea) scattered throughout.
General Area:	1987: The Gridley River flows into and out of this community. An acidic level fen borders it to the east. 1987: Might better be named a basin swamp due to minimal influence of river and size of swamp. This is the southern end of the range for Ledum groenlandicum.

Comments: Location

Survey Site Name:	Tophet Swamp		
Managed By:	Multiple		
County:	Hillsborough	USGS quad(s):	Peterborough South (4207178)
Town(s):	New Ipswich	Lat, Long:	424706N, 0715620W
Size:	298.0 acres	Elevation:	1150 feet

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: From Rte. 202 in Jaffrey, take Rte. 124 ca. 4.5 miles east, to bridge over Gridley River (2 miles west of junction of Rte. 123 and 124).

Dates documented

First reported:	1987-07-13	Last reported:	1987-07-13

Korpi, John. 1987. Field survey to Tophet Swamp of 13 July.

Review Mapping from Conservation Plans

Many of the following recommendations can be facilitated using Geographic Information System (GIS) software. Land trusts with GIS capabilities should consider taking the time to research and compile all the relevant conservation planning spatial data available for their service area, both to help set priorities for proactive land protection and to have the data in hand to evaluate opportunistic projects when they arise. For those land trusts without GIS capabilities, much of the data is now viewable on the Internet, although with less detail and functionality.

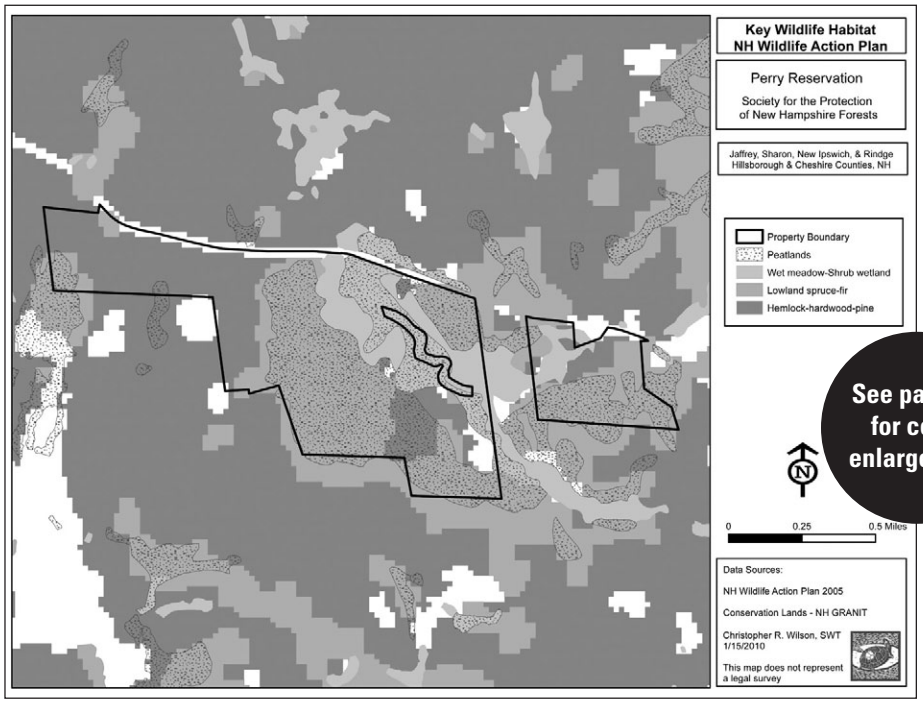
QUESTIONS FOR REVIEWING MAPS AND GEOGRAPHICAL DATA

Consider these questions when reviewing maps and GIS data for a potential conservation project:

1. **Does the project lie within an area formally designated as critical habitat for a federally listed species?**
2. **Does the project lie within a mapped priority area identified in the SWAP?**
   - **Does the project contain mapped key or priority habitats?**
   - **Does it occur in a focus area?**
3. **Does the project lie within an area identified as a priority under the TNC Ecoregional Assessment?**
   - **Does the project contain mapped conservation targets identified in the plan?**
   - **Does it lie within the Ecoregional Portfolio?**
4. **Does the project lie within an area identified as a priority under other conservation plans for the area (see chapter four)?**
   - **Connectivity-based plans?**
   - **National, state, regional, or local planning efforts?**

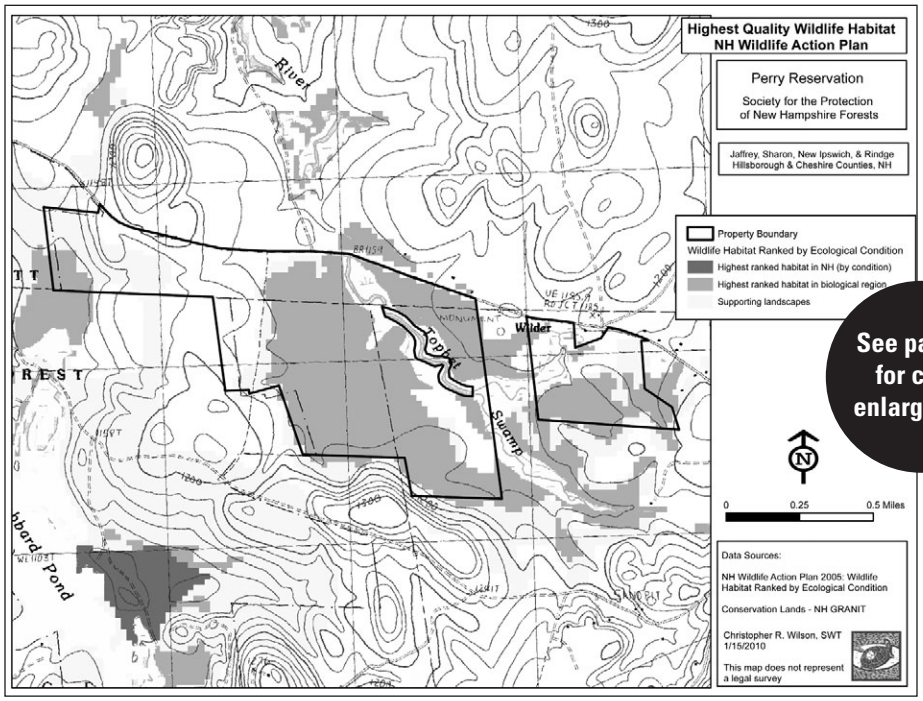
As discussed in chapter four, there are a variety of landscape-based conservation planning efforts that identify mapped priority areas for conservation action across the country. In addition to the USFWS's critical habitat mapping for federally listed species (see http://criticalhabitat.fws.gov), the two most broadly applied efforts are the State Wildlife Action Plans (SWAPs) and The Nature Conservancy's (TNC) Ecoregional Assessments.

The SWAPs can be downloaded from the Association of Fish & Wildlife Agencies' website (www.wildlifeactionplans.org). A number of these plans have explicitly mapped priority or key habitats and/or focus areas, which may be available as GIS data from the state agencies. Many of the Ecoregional Assessments can be downloaded from TNC's ConserveOnline website (http://conserveonline.org). However, the best source for complete Ecoregional Assessment data (both the reports and the GIS data) is through a regional TNC office. Both SWAP focus area mapping and mapped Ecoregional Portfolio information are viewable on the NatureServe/National Geographic Society's LandScope America website (www.landscope.org). More landscape-scale conservation planning efforts may exist for your area. See chapter four for a list of potential Internet sources.



See page 86 for color enlargement

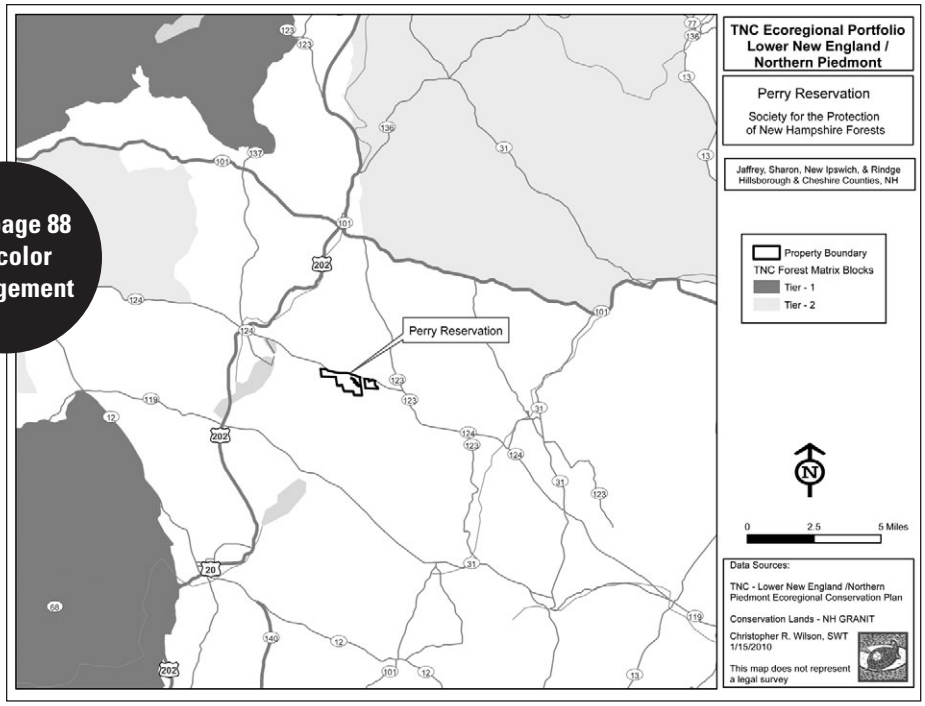
The Perry Reservation contains key habitats for SGCN, according to habitat mapping from the New Hampshire Wildlife Action Plan. These habitats are wet meadow-shrub wetland, lowland spruce-fir, and hemlock-hardwood-pine. (Map by the author.)



See page 87 for color enlargement

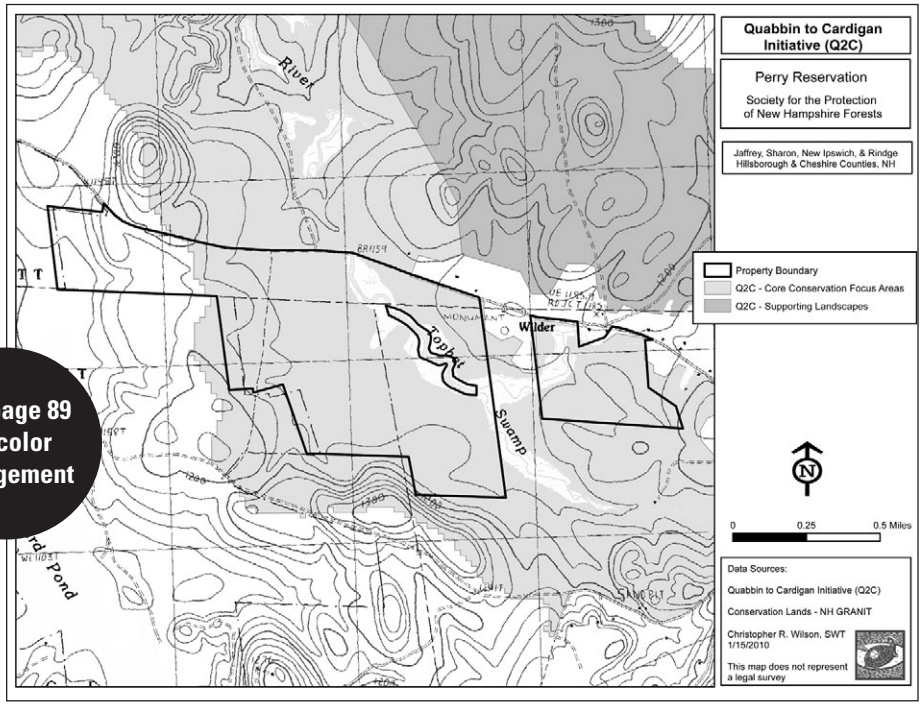
The Perry Reservation contains highest ranked habitat in its biological region and supporting landscapes for SGCN, according to habitat mapping in the New Hampshire Wildlife Action Plan. (Map by the author.)

See page 88 for color enlargement



The Perry Reservation was not identified as part of the Ecoregional Portfolio from TNC's Lower New England/Northern Piedmont Ecoregional Conservation Plan. (Map by the author.)

See page 89 for color enlargement



The Perry Reservation contains core conservation focus areas identified in the Q2C, a collaborative, landscape-scale effort to conserve the Monadnock Highlands of north central Massachusetts and western New Hampshire. (Map by the author.)

Assess Wetland and Stream Information

As discussed in chapter four, streams and wetlands are limited and threatened habitats, and their protection on a land trust project constitutes a conservation value supported by federal- and state-funded programs. The presence of wetlands and streams on a project can be preliminarily determined by reviewing USGS topographic maps, aerial photography, or digitized hydrography data in GIS. A free and convenient source for wetland information is the National Wetlands Inventory (NWI) of the U.S. Fish & Wildlife Service (USFWS). The website contains an easy-to-use wetlands mapping tool (www.fws.gov/wetlands/Data/Mapper.html) for viewing wetland data and creating basic maps. This program not only maps wetlands for the entire country, but it also provides descriptive habitat information by assigning a three-part code to each wetland that corresponds to a hierarchical classification consisting of a system, class, and subclass (Cowardin et al. 1979). For example, a wetland classified as PFO1 indicates that it's a palustrine (P), meaning freshwater and vegetated; forested (FO); and broad-leaved deciduous (1) wetland. Modifiers are often added to the classifications; for instance, PFO1Eb would indicate a palustrine, forested, broad-leaved deciduous wetland that is seasonally flooded (E) and impounded by beavers (b).

NATIONAL WETLANDS INVENTORY

The USFWS is the principal federal agency that provides information to the public on the extent and status of the nation's wetlands. The agency has developed a series of topical maps to show wetlands and deepwater habitats, known as the National Wetlands Inventory.

RIVERS, STREAMS, AND WETLANDS QUESTIONS

Consider these questions when analyzing rivers, streams, and wetlands for a property:

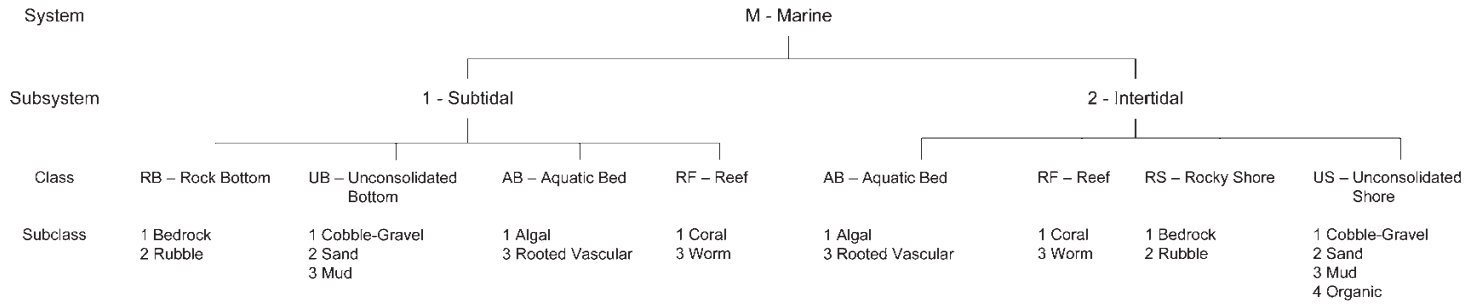
- **Are wetlands or streams indicated on the USGS topographical map?**
- **Do wetlands occur on the property according to NWI data? If so, what are the wetland habitats categorized by NWI?**

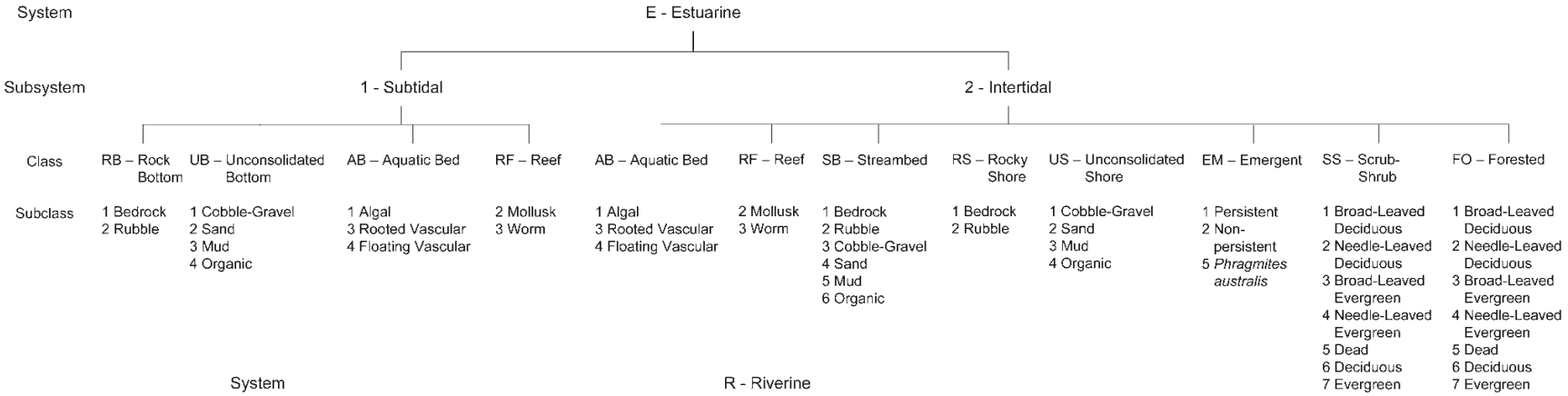
If GIS is available, calculate the following data :

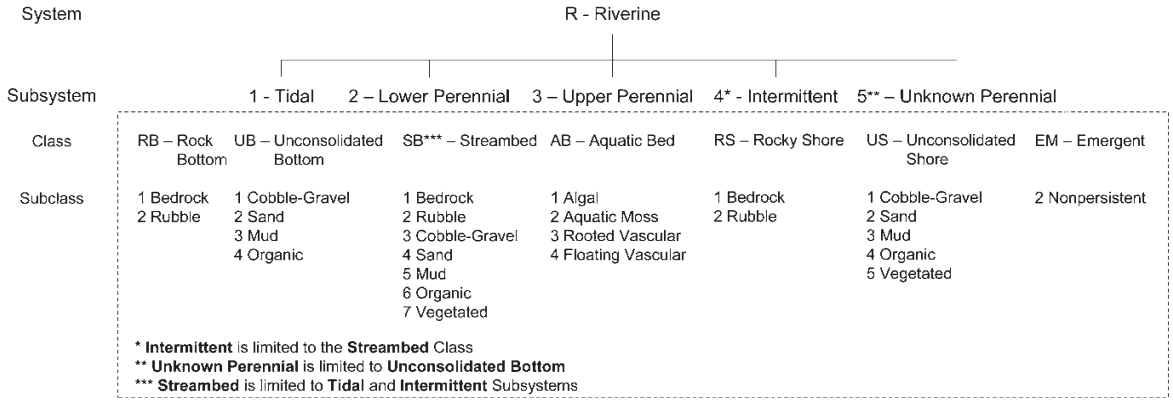
- **Wetland acreages**
- **Total length of streams on the property**
- **Acreage of upland vegetated buffers adjacent to wetlands and streams**

Using GIS, NWI data can be downloaded and used to calculate wetland acreages by habitat type. The National Hydrography Dataset (NHD) website (http://nhd.usgs.gov) provides downloadable stream data that can be used to calculate the length of river or stream segments on a property using GIS. Since water quality and habitat in wetlands and streams benefits from the protection of the adjacent upland vegetated buffer areas (usually within a specified distance from the water's edge), it's also helpful to calculate and report the acreage of these buffers surrounding streams and wetlands.

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

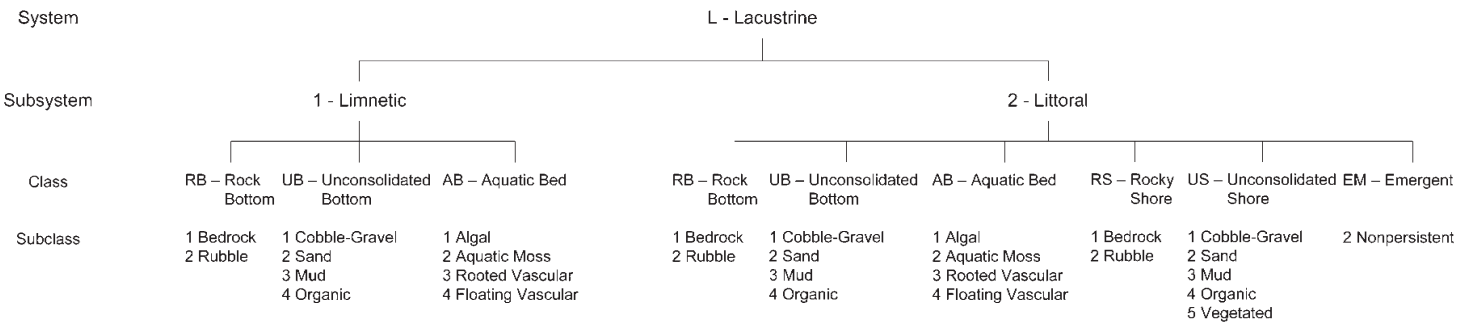


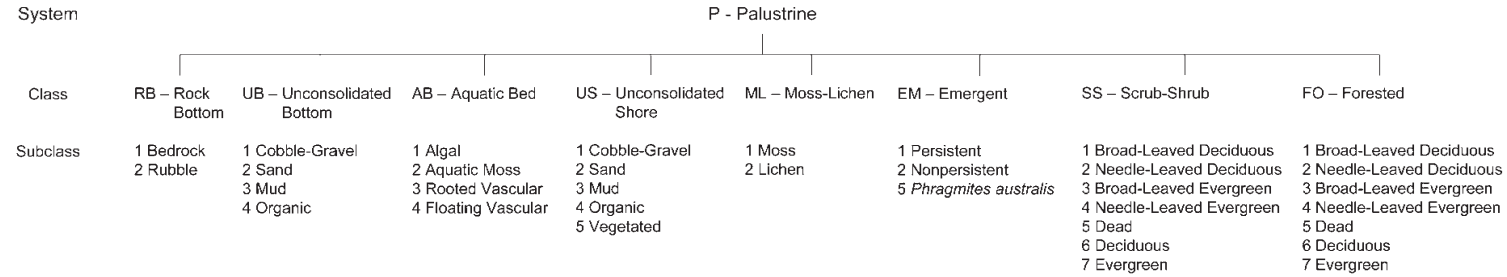




Classification of Wetlands and Deepwater Habitats of the United States, Cowardin *et al.* 1979

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



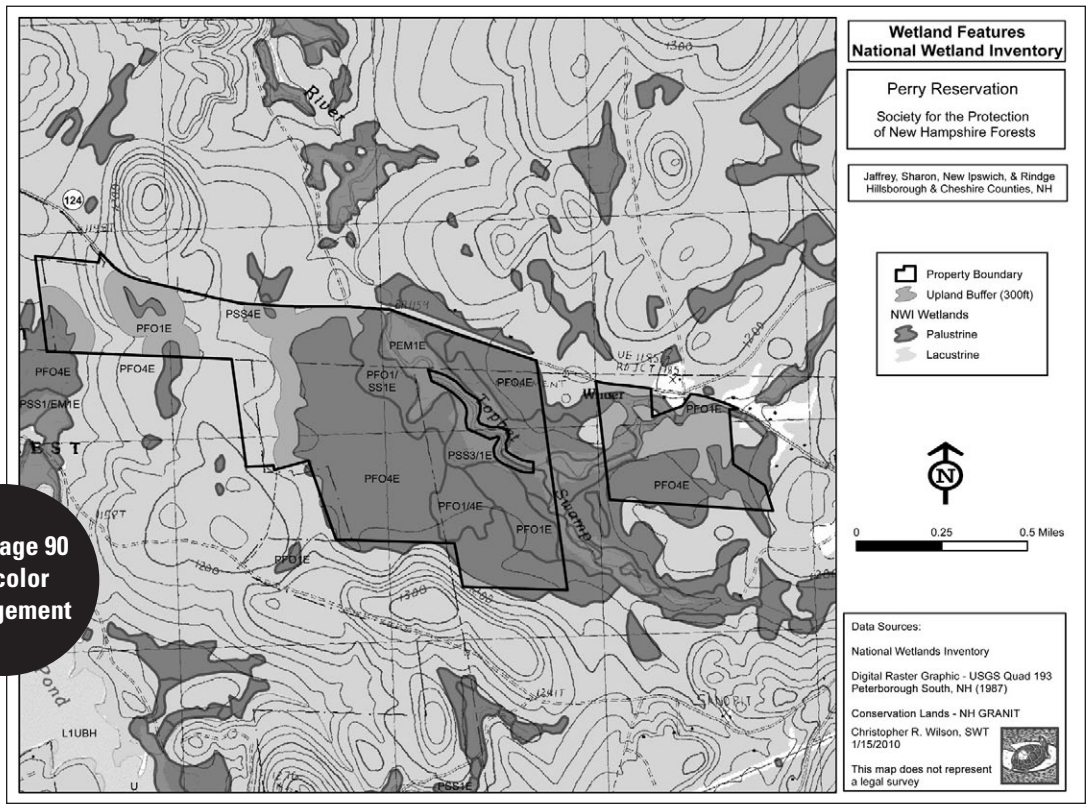


MODIFIERS

In order to more adequately describe the wetland and deepwater habitats, one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

Water Regime			Special Modifiers	Water Chemistry			Soil
Nontidal	**Saltwater Tidal**	**Freshwater Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for all Fresh Water**	
A Temporarily Flooded	L Subtidal	S Temporarily Flooded-Tidal	b Beaver	1 Hyperhaline	7 Hypersaline	a Acid	g Organic
B Saturated	M Irregularly Exposed	R Seasonally Flooded-Tidal	d Partly Drained/Ditched	2 Euhaline	8 Eusaline	t Circumneutral	n Mineral
C Seasonally Flooded	N Regularly Flooded	T Semipermanently Flooded-Tidal	f Farmed	3 Mixohaline (Brackish)	9 Mixosaline	l Alkaline	
E Seasonally Flooded/ Saturated	P Irregularly Flooded	V Permanently Flooded-Tidal	h Diked/Impounded	4 Polyhaline	0 Fresh		
F Semipermanently Flooded			r Artificial	5 Mesohaline			
G Intermittently Exposed			s Spoil	6 Oligohaline			
H Permanently Flooded			x Excavated	0 Fresh			
J Intermittently Flooded							
K Artificially Flooded							

Classification of Wetlands and Deepwater Habitats of the United States. (From Cowardin et al. 1979.)



See page 90 for color enlargement

The USGS quadrangle map (Peterborough South) indicates that the Society for the Protection of New Hampshire Forests' Perry Reservation contains a portion of the Gridley River, a tributary stream, and a large portion of Tophet Swamp. USFWS's NWI data indicate the presence of 359 acres of palustrine wetlands on the project site, including forested, emergent, and scrub-shrub wetlands. The property also contains 98 acres of 300-foot-wide upland buffers surrounding these aquatic features. More than 86 percent of the property is comprised of wetland or upland buffers. (Map by the author.)

Keep in mind that while the NWI and NHD data is more informative than simply looking at USGS topographic maps it is still somewhat coarse and should be considered preliminary. Wetland boundaries are usually different on the ground, wetland habitat categorizations may be inaccurate, and smaller wetlands and vernal pools (both important biological features) may not be indicated by NWI data. Similarly, some streams may not be indicated in NHD data, and some mapped streams may no longer exist.

NWI CODE	Acres	% of Total Property
PEM1/SS1E	7.1	1.3
PEM1E	3.9	0.7
PFO1/4E	17.5	3.3
PFO1/SS1E	46.7	8.8
PFO1E	27.5	5.2
PFO4E	212.4	40.2
PSS1/EM1E	2.9	0.6
PSS3/1E	39.2	7.4
PSS4E	1.9	0.4
Total PEM	11.0	2.1
Total PFO	304.1	57.6
Total PSS	44.0	8.3
Total Palustrine Wetland	359.1	68.0
Total Upland Buffer (300 ft)	98.0	18.6
Total Upland	168.7	32.0
Total Property Acreage	527.8	100.0

Acreage of NWI wetlands and upland vegetated buffers on the Perry Reservation (as calculated with GIS).

Assess the Conservation Context

The position of a conservation property relative to other protected properties and surrounding land use says a lot about its conservation value. Protected areas that are adjacent or in close proximity can minimize fragmentation by increasing contiguous habitat and enhancing connectivity for various species and ecological processes. Adjacency and/or close proximity between protected properties is clearly a biological conservation value and is also recognized by section 1.170A-14(d)(4)(iv)(4) of the IRS Treasury Regulations as a factor in the evaluation of significant public benefit, helping to qualify a project under the open space provision of the conservation purposes test of the IRC 170(h)(4)(A)(iii)(II).

The USGS Gap Analysis Program (GAP) and the Conservation Biology Institute recently led a major effort to compile detailed, protected lands mapping for the entire country known as the Protected Area Database of the United States (PAD-US). The database contains information on federal- and state-protected lands and voluntarily provided information on private conservation lands (including land trust projects and conservation easements) and can be used to assess the conservation context of a land trust project. In addition to

mapping protected parcels of land, the database also contains information on ownership and management. Because protected areas can differ in their management and the types of restrictions on land use (not all protected areas are protected equally), the PAD-US database also categorizes the level of protection for biodiversity using GAP Status Codes:

- **GAP Status 1:** An area permanently protected from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.
- **GAP Status 2:** An area permanently protected from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.
- **GAP Status 3:** An area permanently protected from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging or off-highway recreation vehicles) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area.

For example, a land trust project that is strictly protected as a natural area, ecological preserve, or wildland, where no extractive uses are permitted, might qualify as GAP Status 1 or 2, whereas a project protected as working lands where limited logging and grazing are allowed might be categorized as GAP Status 3.

The PAD-US website (www.protectedlands.net) contains links allowing users to download the database for use in GIS and map viewers allowing users to view the data online and create basic maps. Mapped PAD-US data is also viewable on the LandScope America website.

Compiling detailed mapping of protected lands across the country is very challenging, and there is a variety of state and national efforts underway that ultimately contribute to the PAD-

CONSERVATION CONTEXT QUESTIONS

Questions to consider when evaluating a property's conservation context:

Is the project adjacent, or in proximity, to other protected areas? If so:

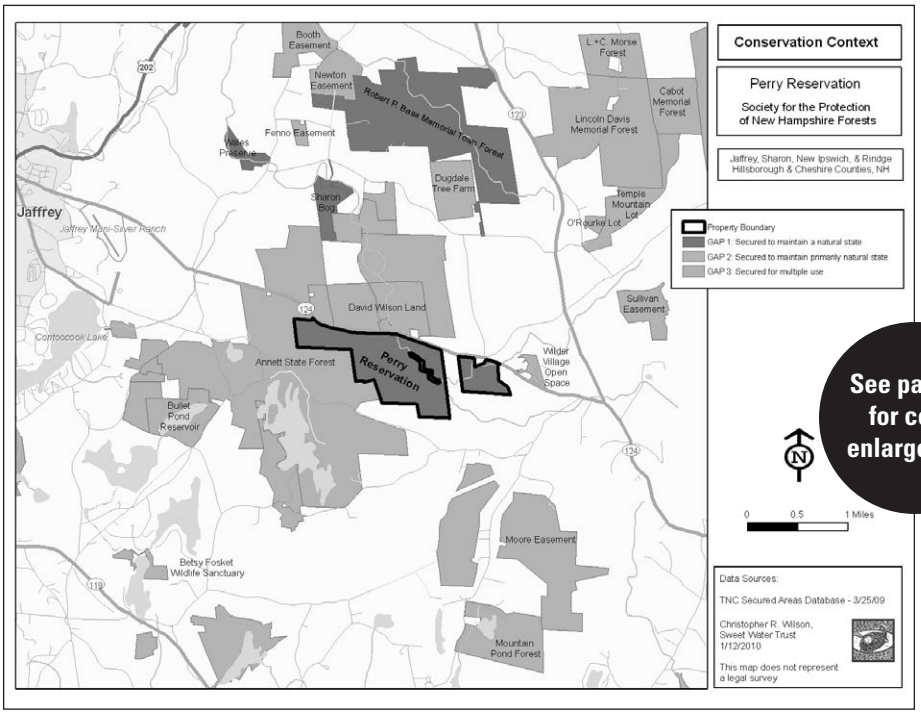
- **How far away are the properties?**
- **Who are the owners and managers?**
- **What level of protection for biodiversity do the properties have? (What are the GAP Status Codes?)**

US database. A particular challenge has been the inclusion of smaller land trust projects in such mapping. Typically, government-owned lands and larger easement lands will be included in protected areas mapping, but smaller land trust projects are a challenge because many land trusts lack digital spatial data for their projects or a GIS capability, or such projects are simply not reported to a centralized organization responsible for compiling the information (to protect the privacy of the landowners or for other reasons).

NATIONAL CONSERVATION EASEMENT DATABASE

The National Conservation Easement Database (NCED) (www.conservationeasement.us) is a national effort to include conservation easement projects in protected areas mapping (including the PAD-US database). All land trusts are encouraged to contact the NCED representative for their region to learn more about contributing to the database.

Another challenge is that new conservation projects are continually being completed. Thus, the thoroughness,



See page 91 for color enlargement

Approximately two-thirds of the perimeter of the western tract of the Perry Reservation abuts the David Wilson land (owned by the Society for the Protection of New Hampshire Forests) and the Annett State Forest. These protected properties are also abutted by other conservation lands, creating approximately 3,670 acres of contiguous protected land. While the Perry Reservation is strictly protected as an ecological preserve (GAP 1), the majority of the surrounding conservation lands allow for some level of resource extraction (GAP 3). These surrounding lands supplement the effective size of certain habitats on the Perry Reservation, provide connectivity for certain ecological processes, and provide a buffer that reduces the threat of fragmentation. Likewise, the Perry Reservation enhances the conservation values of surrounding protected lands. (Map by the author.)

EXAMPLE: Mapped Data Is Key for the Blue Ridge Conservancy

Blue Ridge Conservancy (BRC) in North Carolina routinely uses GIS data sources to assess the biological conservation values of new land protection projects. These sources include the North Carolina Natural Heritage Program database and multiple data layers available from the One North Carolina Naturally program, such as the Biodiversity and Wildlife Habitat, Open Space and Conservation Lands, and Water Services Assessments layers.

"Having this mapped data in-house is indispensable," said Eric Hiegl, deputy director of BRC. "We can easily look to see if a property has records of rare species, if it contains high value habitat, and if it's adjacent to other protected lands in the area." The information helps BRC's board consider whether to move forward with a land protection project. It is also useful for drafting the conservation easement and for fundraising appeals and applications.

accuracy, and currency of protected areas mapping efforts will never be 100 percent. However, it's still very useful and should be consulted whenever a land trust is evaluating a land protection project.

Assess Land Cover Types

Land cover is basically the material covering the surface of the earth at a particular place, such as cropland, asphalt, or natural vegetation types. For obvious reasons, it's helpful to know what land cover types occur on a land trust project.

During biological inventories, the natural community descriptions (or NVC associations and alliances) provided by the Natural Heritage Programs and NatureServe (see chapter four) can be used to classify and map the vegetation types in great detail. Because these classifications have associated conservation status ranks (state and global ranks), they can be used to establish significant conservation values for a land trust project. Also, because they are mapped in detail using on-the-ground fieldwork, they can be used to inform land management and planning. However, in the meantime, it's still very helpful to have a general idea of land cover on a project, particularly at the earliest stages of project evaluation. For example, does the property contain cropland or hay pastures, or is it mostly covered with natural vegetation types?

The USGS GAP website (http://gapanalysis.usgs.gov/viewers) provides mapped land cover data for the entire United States that uses the ecological systems approach, developed by NatureServe, to classify broad vegetation types, which represent recurring groups of natural communities that are found in similar physical environments and are influenced by similar ecologi-

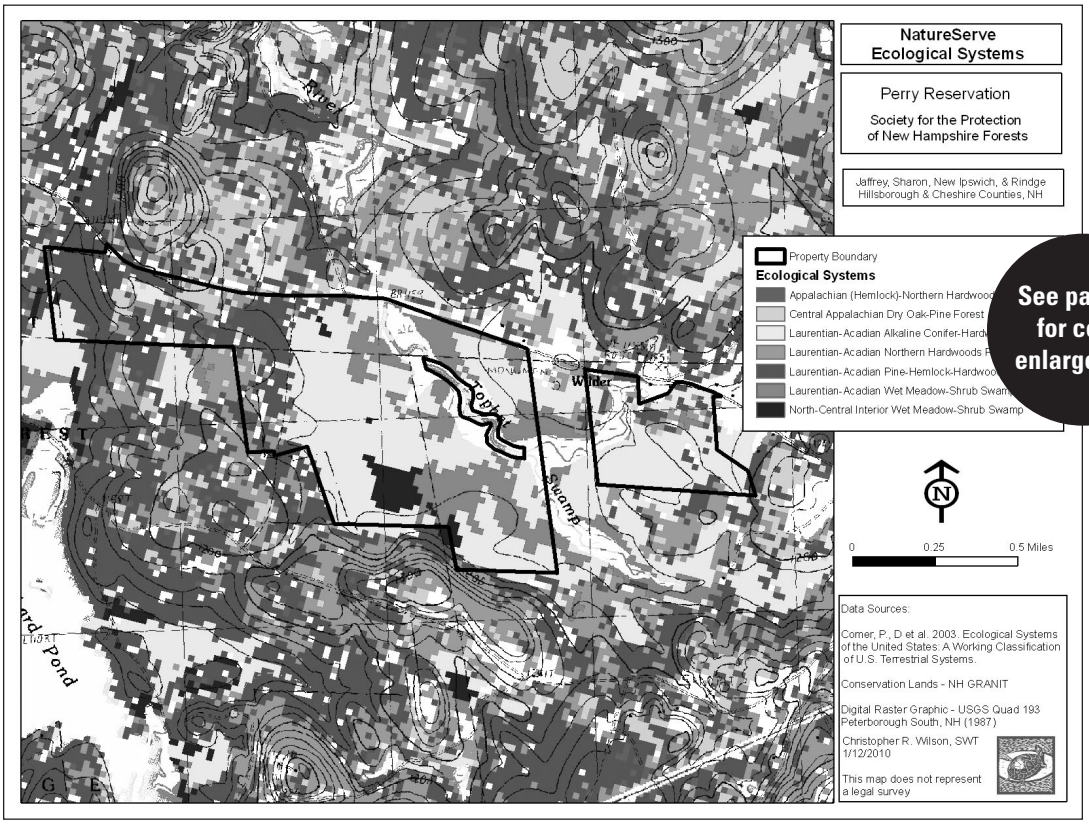
cal processes and natural disturbances (Comer et al. 2003). The GAP land cover mapping classifies 551 types of vegetation (or system types) with names such as Acadian-Appalachian Montane Spruce-Fir Forest, Laurentian-Acadian Northern Hardwoods Forest, and Boreal-Laurentian Conifer Acidic Swamp. It also includes 32 land-use classes that depict various intensities of developed or disturbed areas such as quarries, vineyards, and cropland.

LAND COVER QUESTIONS

Questions to consider concerning land cover types:

- **What land cover types occur on the property according to USGS GAP land cover mapping?**
- **What are the descriptions for the vegetation types according to the NatureServe Explorer website?**

The website provides online map viewers for viewing the land cover data and making basic maps. The data is also freely available for download in GIS format. A different website, called NatureServe Explorer (www.natureserve.org/explorer), provides detailed descriptions of the individual vegetation types, such as the characteristic plant species, landforms, and ecological process. However, a single vegetation type can span multiple states, and some of the information in the descriptions (such as the component species) may not apply to a specific project area.



See page 92 for color enlargement

The Perry Reservation contains seven vegetation types (NatureServe Ecological System types) according to USGS GAP land cover mapping. (Map by the author.)

EXAMPLE: Ecological System Type

This is an example of ecological system type descriptions from the NatureServe Explorer website. Note: An ecological system type can span multiple ecoregions. Thus, some of the constituent species mentioned in a system type description may not actually occur in your project area.

Ecological System Comprehensive Report

Scientific Name: Appalachian (Hemlock)-Northern Hardwood Forest
Unique Identifier: CES202.593

Summary: This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to the higher elevations of Virginia and West Virginia. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum, Betula alleghaniensis*, and *Fagus grandifolia* are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (or in some cases *Pinus strobus*). Other common and sometimes dominant trees include *Quercus* spp. (most commonly *Quercus rubra*), *Liriodendron tulipifera*, *Prunus serotina*, and *Betula lenta*. It is of more limited extent and more ecologically constrained in the southern part of its range, in northern parts of Virginia and West Virginia.

Scientific Name: Central Appalachian Dry Oak-Pine Forest
Unique Identifier: CES202.591

Summary: These oak and oak-pine forests cover large areas in the low- to mid-elevation central Appalachians and middle Piedmont. The topography and landscape position range from rolling hills to steep slopes, with occasional occurrences on more level, ancient alluvial fans. In the highly dissected fall zone of Maryland and the District of Columbia, where the Piedmont and Coastal Plain meet, it is also found on dry knolls capped with Pleistocene- and Tertiary-aged fluvial cobble and gravel terrace deposits. Soils are typically coarse and infertile; they may be deep (on glacial deposits in the northern and terrace deposits in the southern parts of the system's range), or more commonly shallow, on rocky slopes of acidic rock (shale, sandstone, other acidic igneous or metamorphic rock). The well-drained soils and exposure create dry conditions. The forest is mostly closed canopy but can include patches of more open woodlands. It is dominated by a variable mixture of dry-site oak and pine species, most typically *Quercus prinus, Pinus virginiana*, and *Pinus strobus*, but sometimes *Quercus alba* and/or *Quercus coccinea*. The system may include areas of oak forest, pine forest (usually small), and mixed oak-pine forest. Heath shrubs such as *Vaccinium pallidum*, *Gaylussacia baccata*, and *Kalmia latifolia* are common in the understory and often form a dense layer. Embedded submesic ravines and concave landforms support slightly more diverse forests characterized by mixtures of oaks, several hickories, *Cornus florida*, and sometimes *Liriodendron tulipifera*. Small hillslope pockets with impeded drainage may support small isolated wetlands with *Acer rubrum* and *Nyssa sylvatica* characteristic. Disturbance agents include fire, windthrow, and ice damage. Increased site disturbance generally leads to secondary forest vegetation with a greater proportion of *Pinus virginiana* and weedy hardwoods such as *Acer rubrum.*

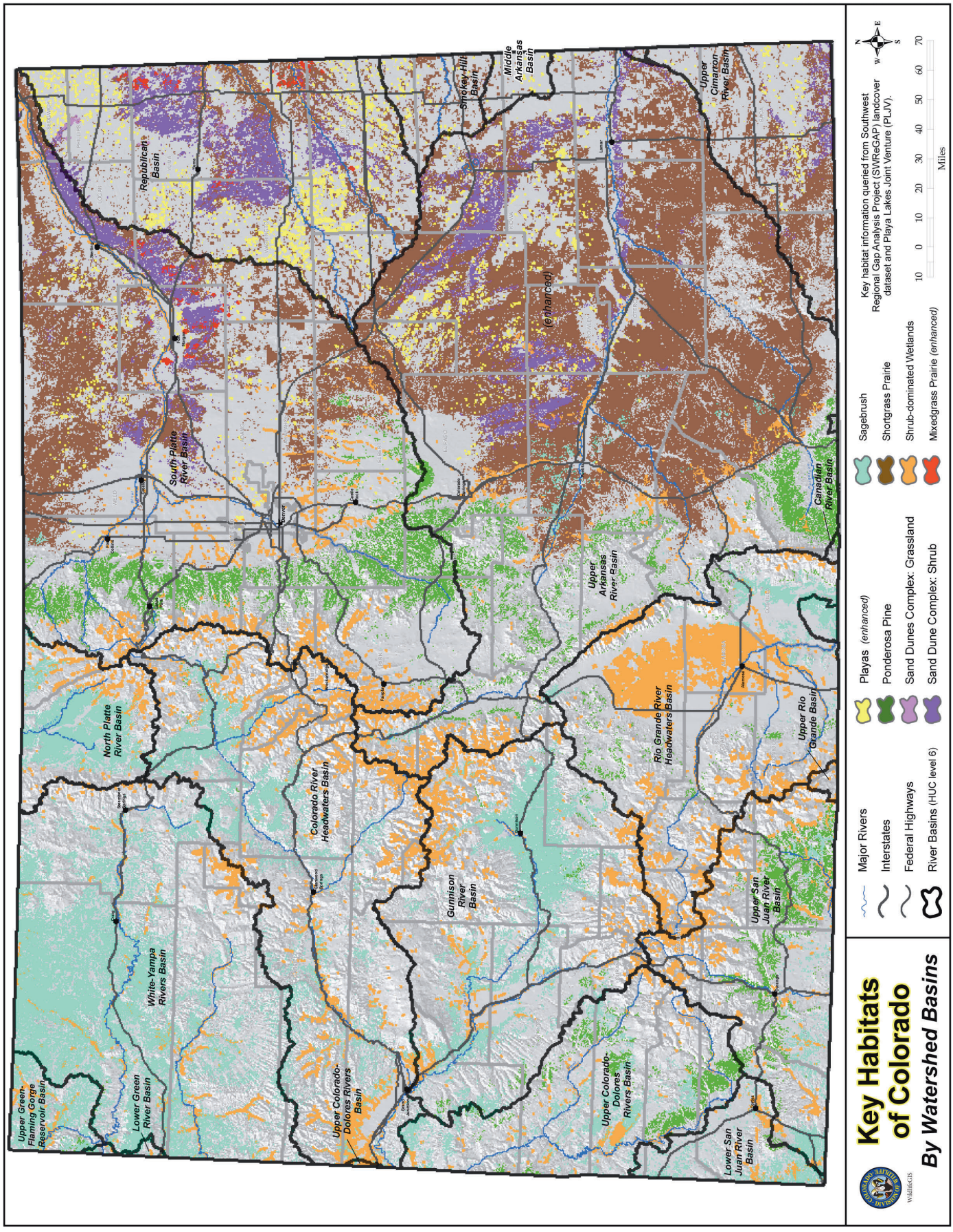
While the GAP land cover mapping lacks the conservation status ranks and detail of on-the-ground natural community mapping, it still provides a quick and easy general assessment of vegetation types on a property, particularly for the earliest stages of project evaluation.

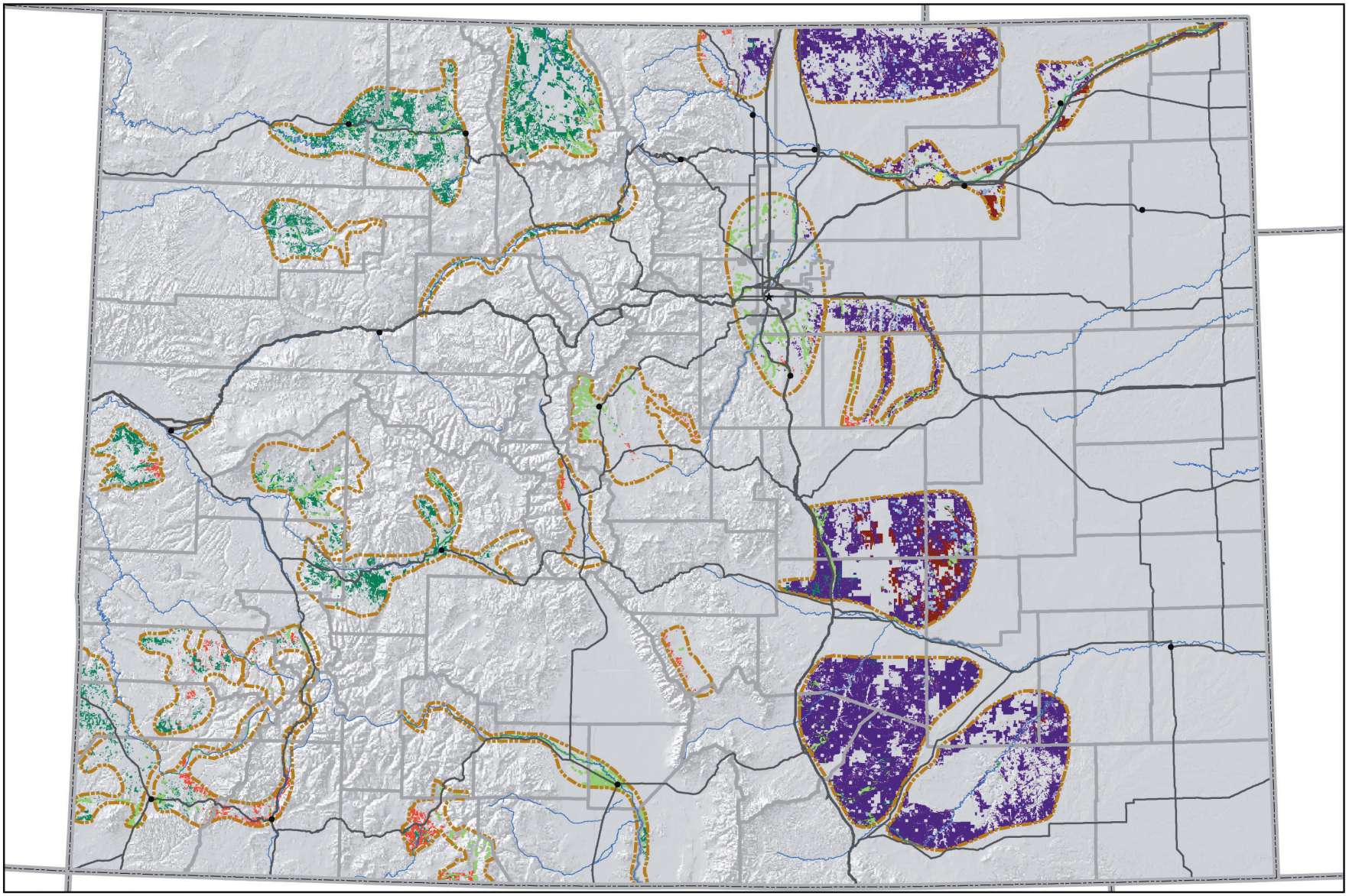
NATURESERVE EXPLORER

NatureServe Explorer (www.natureserve.org/explorer) is an authoritative source for information on more than 70,000 plants, animals, and ecosystems of the United States and Canada. It includes particularly in-depth coverage of rare and endangered species.

Preparing for Fieldwork

From landowner interviews to free online land cover mapping, there are many tools for land trusts to construct a quick and dirty biological assessment of a project at the earliest stages of planning. These free and convenient resources can be very helpful for gauging a project's significance, for identifying potential funding and partnership opportunities, and for guiding a more detailed, on-the-ground biological inventory of the property later on. However, they are not a replacement for fieldwork. The Natural Heritage Program database may have no records of rare species and natural communities for the property simply because no biologist has ever visited the property. The priority habitats mapped in a SWAP, wetlands mapped by NWI, and vegetation types mapped by the USGS GAP are derived from aerial photographs or satellite data are often inaccurate at the parcel scale and need to be inspected and verified on the ground. The point is not to eliminate the need for fieldwork but to get as much information regarding biological priorities injected into the land protection discussion as early as possible when it has the greatest impact on the trajectory of the project. When resources allow, consider a more detailed, on-the-ground biological inventory by a qualified biologist.


Key Habitats of Colorado
By Watershed Basins
WildlifeGIS
Major Rivers
Interstates
Federal Highways
River Basins (HUC level 6)
Playas (enhanced)
Ponderosa Pine
Sand Dunes Complex: Grassland
Sand Dune Complex: Shrub
Sagebrush
Shortgrass Prairie
Shrub-dominated Wetlands
Mixedgrass Prairie (enhanced)
Key habitat information queried from Southwest Regional Gap Analysis Project (SWReGAP) landcover dataset and Playa Lakes Joint Venture (PLJV).
N
W
E
S
10 0 10 20 30 40 50 60 70
Miles
Upper Green-Flaming Gorge Reservoir Basin
Lower Green River Basin
White-Yampa Rivers Basin
North Platte River Basin
Republican Basin
South Platte River Basin
Upper Colorado-Dolores Rivers Basin
Colorado River Headwaters Basin
Gunnison River Basin
Upper Arkansas River Basin
Smokey Hill Basin
Middle Arkansas Basin
(enhanced)
Upper Cimarron River Basin
Canadian River Basin
Rio Grande River Headwaters Basin
Upper Rio Grande Basin
Upper San Juan River Basin
Lower San Juan River Basin



Colorado's High Priority Habitats within Private Land Focus Areas

25 0 25 50 75 100

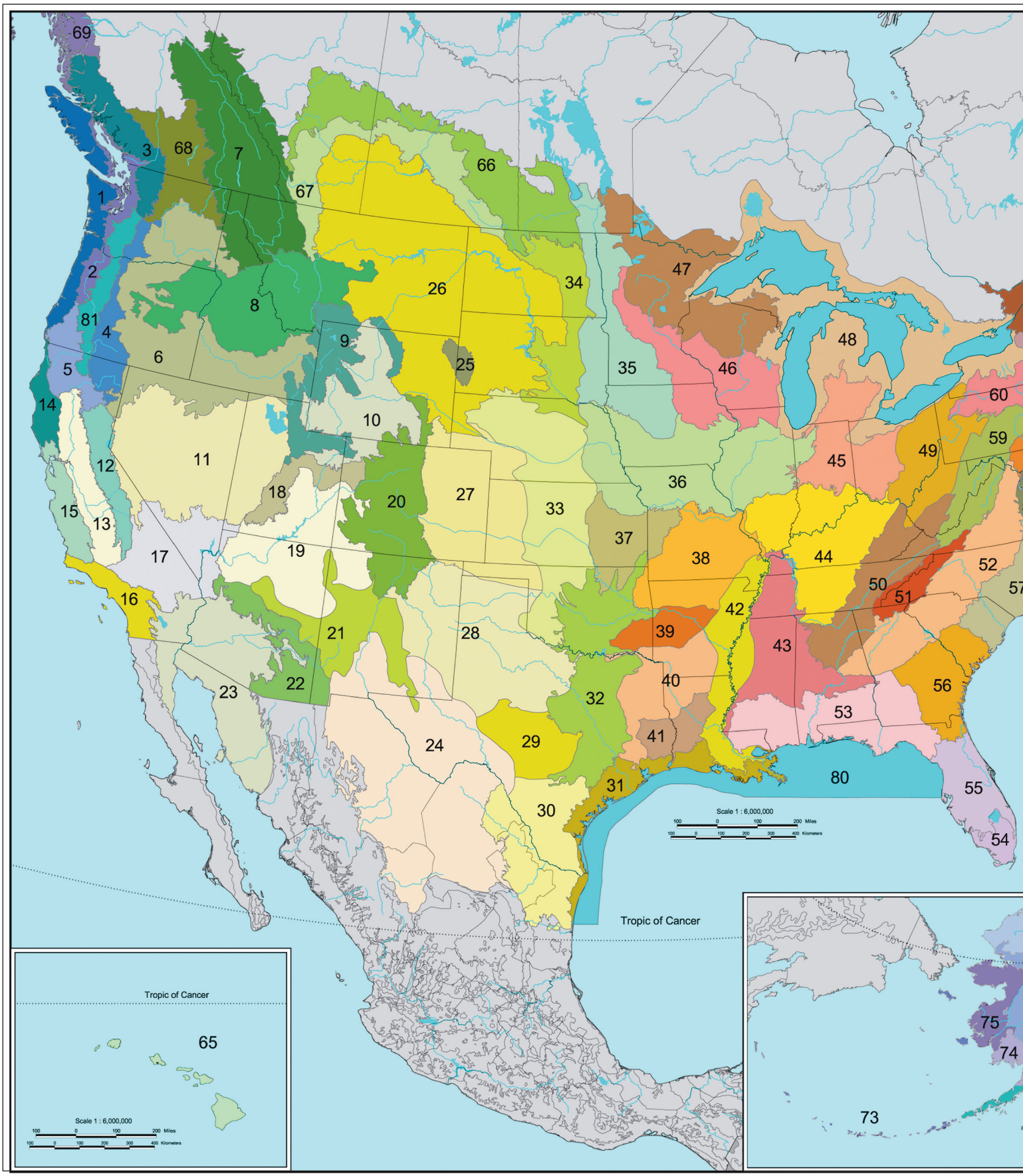
Miles

- Cooperative Priorities Project Areas
- Playas (enhanced)
- Tallgrass Prairie
- Sagebrush
- Mixedgrass Prairie
- Sand Dune Complex - Grasslands
- Shortgrass Prairie
- Shrub-Dominated Wetlands
- Ponderosa Pine
- Sand Dune Complex - Shrublands

COLORADO DIVISION OF WILDLIFE

WildlifeGIS

JK, G:\Projects\SpeciesConservation\CWCS\TNC_CoopPriorities\Revision030508


69
3
68
7
66
67
1
2
47
26
34
8
81
4
48
9
6
25
35
46
5
14
60
10
59
11
49
45
12
36
18
20
27
33
15
13
37
17
19
38
44
52
16
50
51
57
42
21
28
39
43
23
22
40
56
32
53
24
29
41
80
31
55
30
54
Scale 1 : 6,000,000
100 0 100 200 Miles
100 0 100 200 300 400 Kilometers
Tropic of Cancer
75
74
73
Tropic of Cancer
65
Scale 1 : 6,000,000
100 0 100 200 Miles
100 0 100 200 300 400 Kilometers

Ecoregions of the United States of America

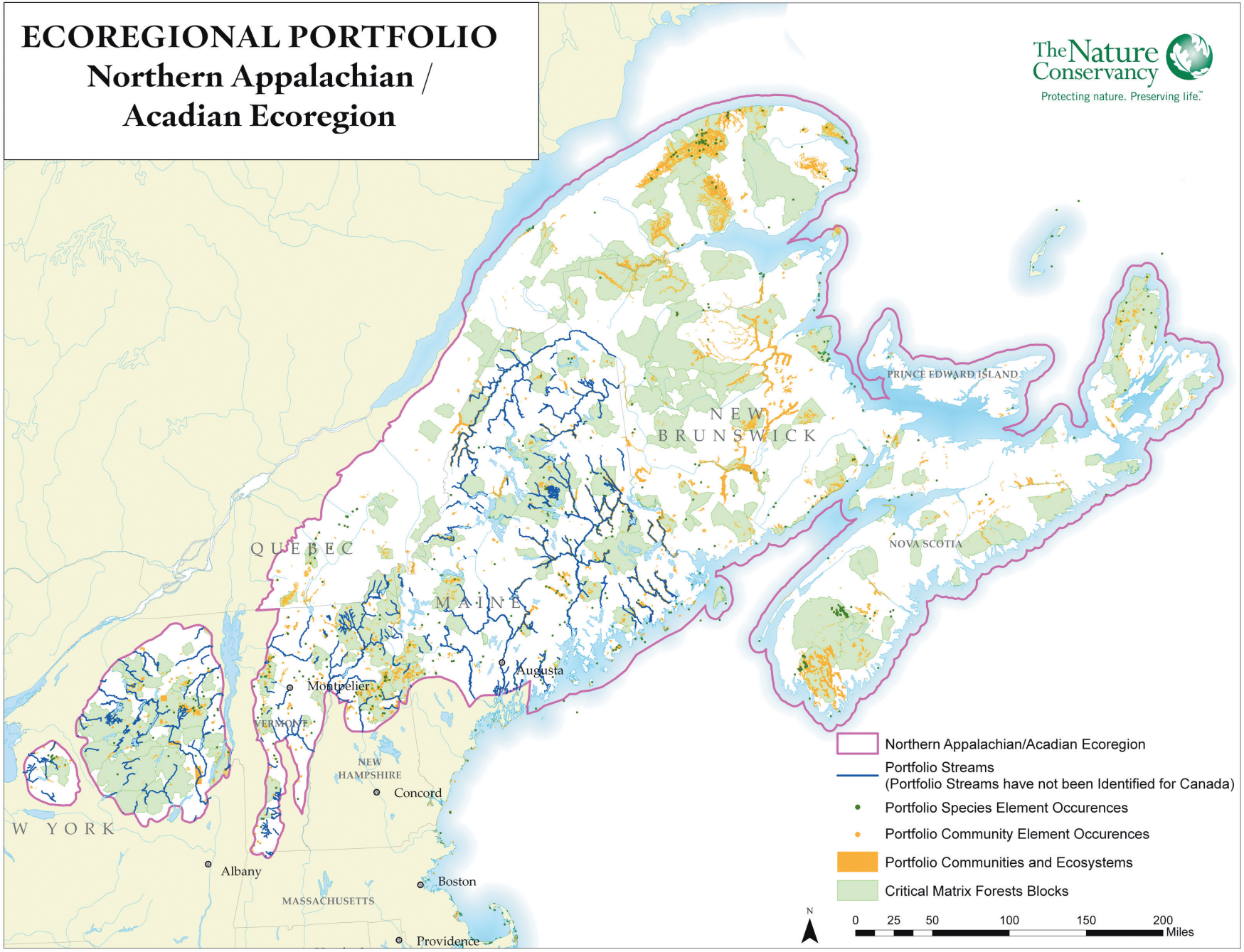
TNC U.S. Ecoregions 2000

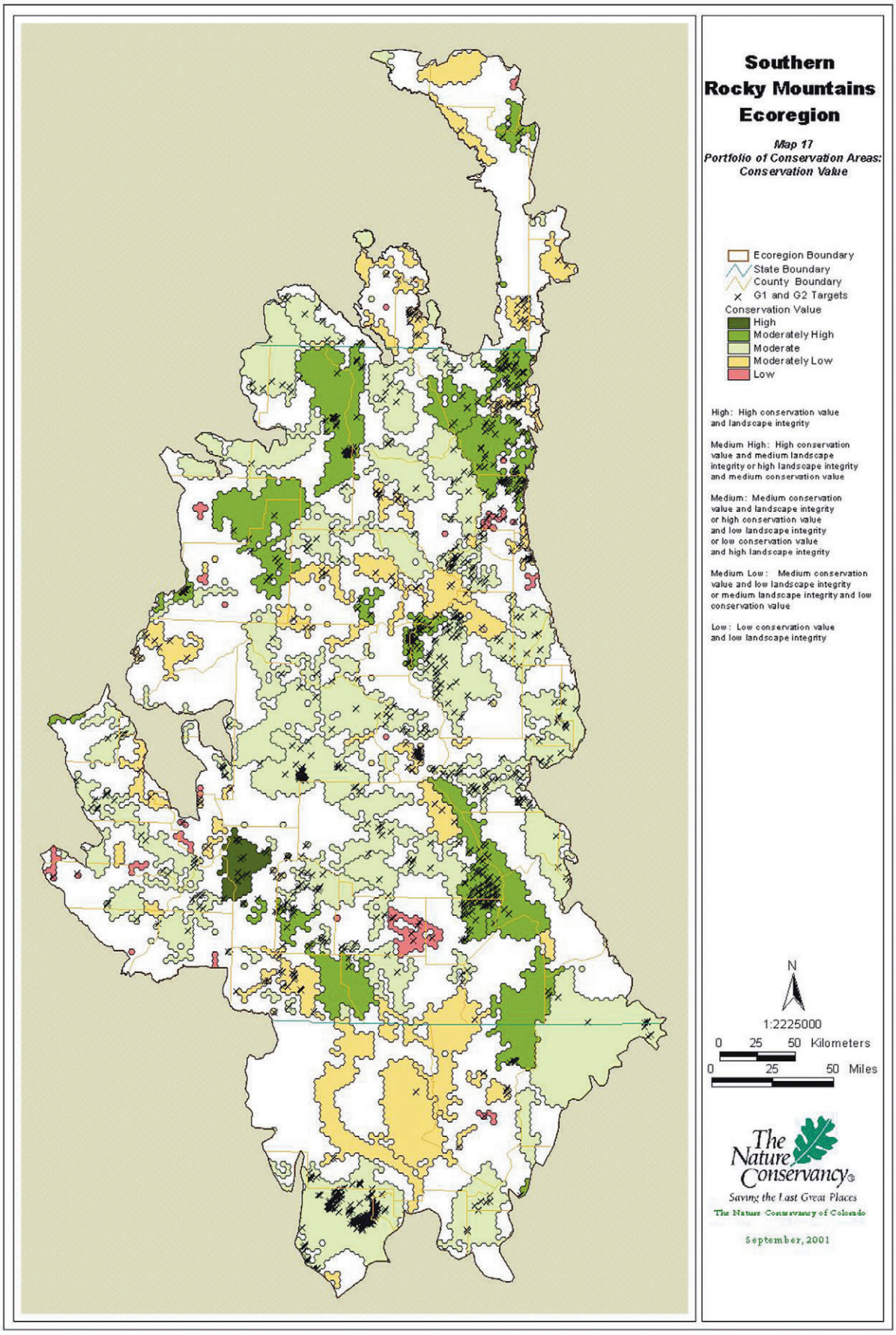
1 Pacific Northwest Coast
2 Puget Trough - Willamette Valley - Georgia Basir
3 North Cascades
4 Modoc Plateau and East Cascades
5 Klamath Mountains
6 Columbia Plateau
7 Canadian Rocky Mountains
8 Middle Rockies - Blue Mountains
9 Utah-Wyoming Rocky Mountains
10 Wyoming Basins
11 Great Basin
12 Sierra Nevada
13 Great Central Valley
14 California North Coast
15 California Central Coast
16 California South Coast
17 Mojave Desert
18 Utah High Plateaus
19 Colorado Plateau
20 Southern Rocky Mountains
21 Arizona-New Mexico Mountains
22 Apache Highlands
23 Sonoran Desert
24 Chihuahuan Desert
25 Black Hills
26 Northern Great Plains Steppe
27 Central Shortgrass Prairie
28 Southern Shortgrass Prairie
29 Edwards Plateau
30 Tamaulipan Thorn Scrub
31 Gulf Coast Prairies and Marshes
32 Crosstimbers and Southern Tallgrass Prairie
33 Central Mixed-Grass Prairie
34 Dakota Mixed-Grass Prairie
35 Northern Tallgrass Prairie
36 Central Tallgrass Prairie
37 Osage Plains/Flint Hills Prairie
38 Ozarks
39 Ouachita Mountains
40 Upper West Gulf Coastal Plain
41 West Gulf Coastal Plain
42 Mississippi River Alluvial Plain
43 Upper East Gulf Coastal Plain
44 Interior Low Plateau
45 North Central Tillplain
46 Prairie-Forest Border
47 Superior Mixed Forest
48 Great Lakes
49 Western Allegheny Plateau
50 Cumberlands and Southern Ridge and Valley
51 Southern Blue Ridge
52 Piedmont
53 East Gulf Coastal Plain
54 Tropical Florida
55 Florida Peninsula
56 South Atlantic Coastal Plain
57 Mid-Atlantic Coastal Plain
58 Chesapeake Bay Lowlands
59 Central Appalachian Forest
60 High Allegheny Plateau
61 Lower New England/Northern Piedmont
62 North Atlantic Coast
63 Northern Appalachian-Boreal Forest
64 St. Lawrence-Champlain Valley
65 Hawaiian High Islands
66 Aspen Parkland
67 Fescue-Mixed Grass Prairie
68 Okanagan
69 Alaska Coastal Forest and Mountains
70 Gulf of Alaska Mountains and Fjordlands
71 Cook Inlet Basin
72 Alaska Peninsula
73 Bering Sea and Aleutian Islands
74 Bristol Bay Basin
75 Beringian Tundra
76 Alaska Range
77 Interior Alaska Taiga
78 Yukon Plateau and Flats
79 Brooks Range Tundra Coastal Plain
80 Northern Gulf Coast
81 West Cascades

TNC U.S. Ecoregions 2000, based on Bailey, 1994, modified for TNC Ecoregional Planning purposes.
Canadian Ecological Zones developed by the Ecological Stratification Working Group, 1995.
Latin American and Caribbean Ecoregions based on World Wildlife Fund Ecoregions, 1995, modified for TNC Ecoregional Planning purposes.

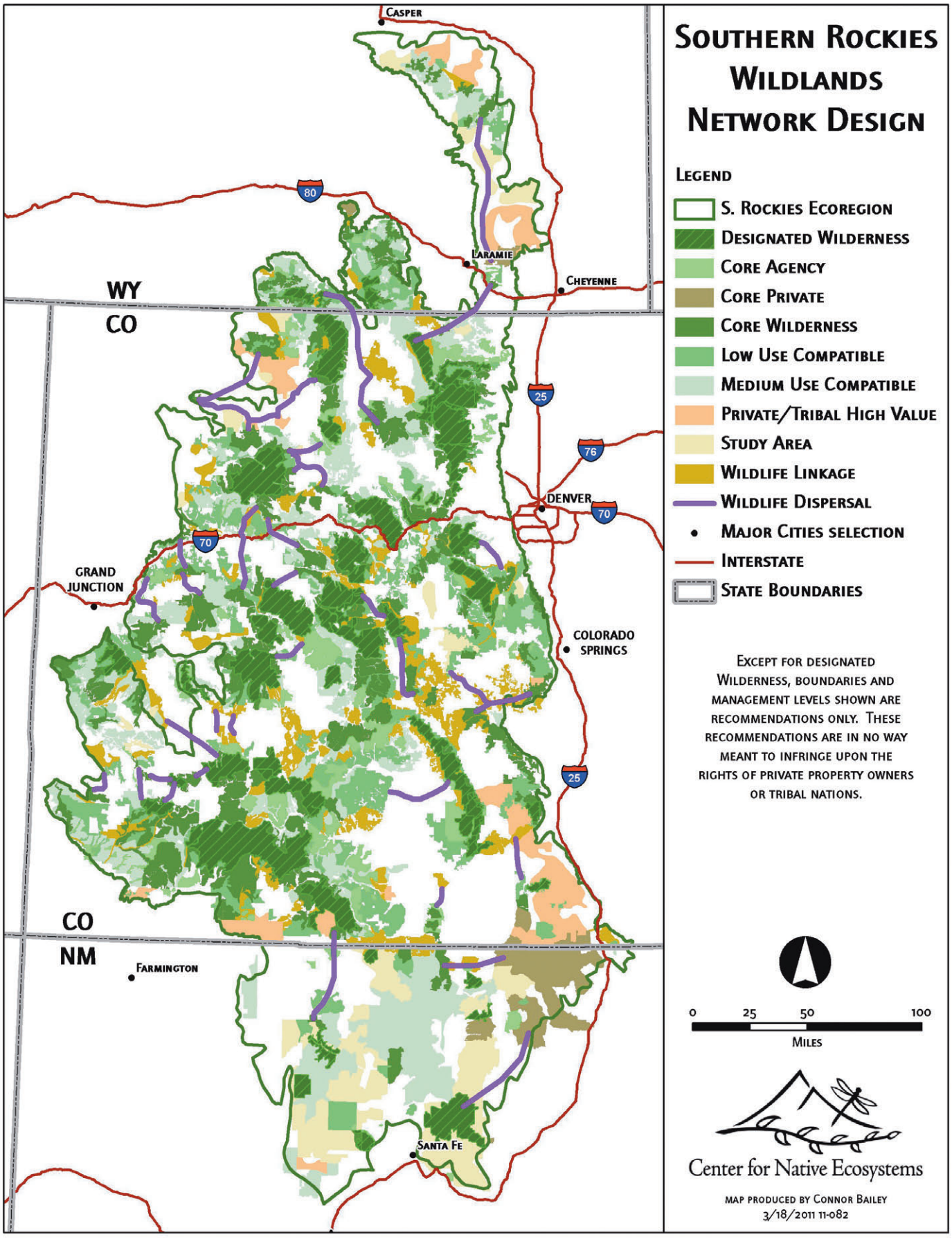
The Nature Conservancy®
Saving the Last Great Places

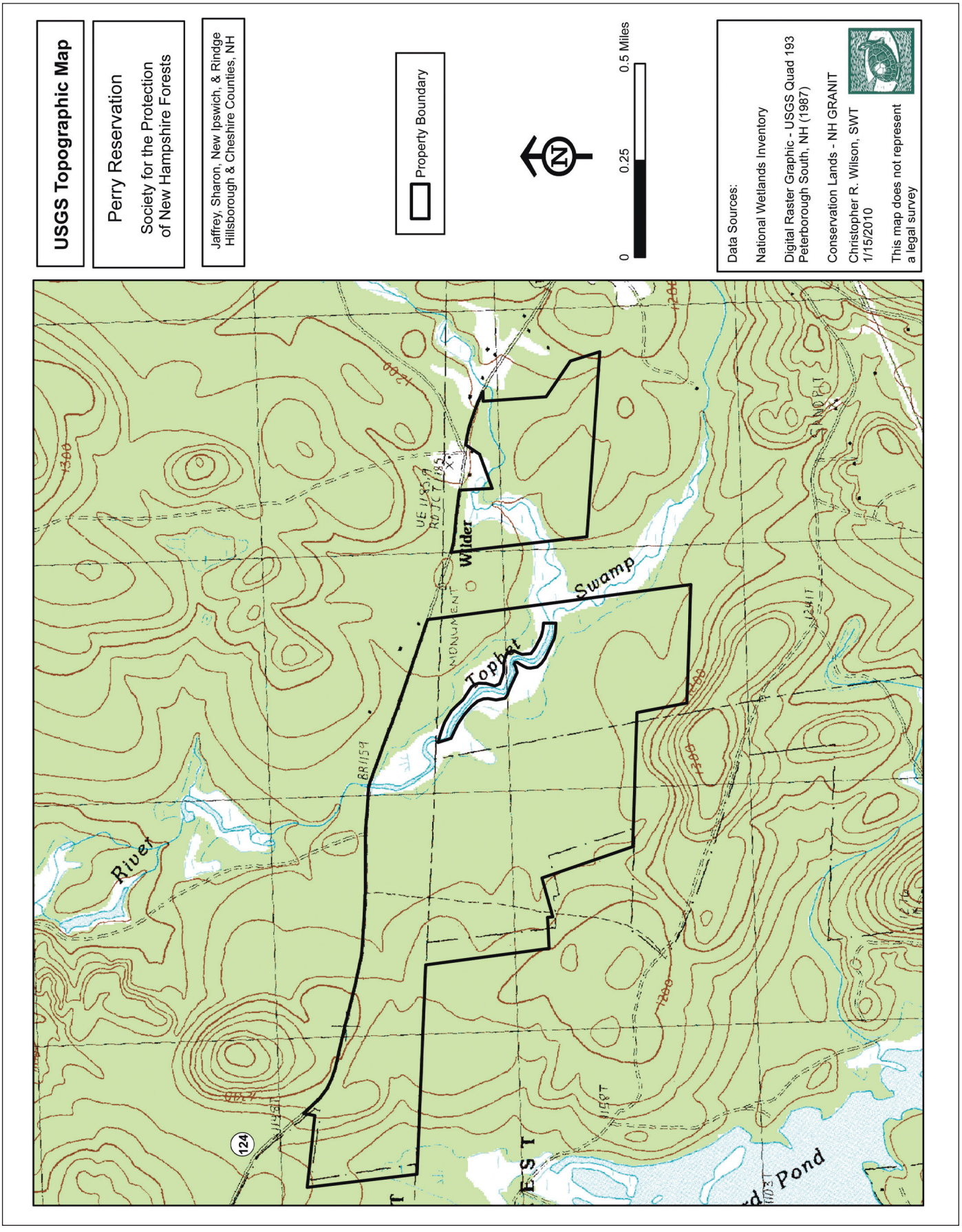
Western Conservation Science Center, September, 2000


ECOREGIONAL PORTFOLIO
Northern Appalachian / Acadian Ecoregion
The Nature Conservancy
Protecting nature. Preserving life.™
PRINCE EDWARD ISLAND
NEW BRUNSWICK
NOVA SCOTIA
QUEBEC
MAINE
Augusta
Montpelier
VERMONT
NEW HAMPSHIRE
Concord
W YORK
Albany
Boston
MASSACHUSETTS
Providence
Northern Appalachian/Acadian Ecoregion
Portfolio Streams
(Portfolio Streams have not been Identified for Canada)
Portfolio Species Element Occurences
Portfolio Community Element Occurences
Portfolio Communities and Ecosystems
Critical Matrix Forests Blocks
N
0 25 50 100 150 200
Miles


Southern Rocky Mountains Ecoregion
Map 17
Portfolio of Conservation Areas: Conservation Value
Ecoregion Boundary
State Boundary
County Boundary
G1 and G2 Targets
Conservation Value
High
Moderately High
Moderate
Moderately Low
Low
High: High conservation value and landscape integrity
Medium High: High conservation value and medium landscape integrity or high landscape integrity and medium conservation value
Medium: Medium conservation value and landscape integrity or high conservation value and low landscape integrity or low conservation value and high landscape integrity
Medium Low: Medium conservation value and low landscape integrity or medium landscape integrity and low conservation value
Low: Low conservation value and low landscape integrity
N
1:2225000
0 25 50 Kilometers
0 25 50 Miles
The Nature Conservancy
Saving the Last Great Places
The Nature Conservancy of Colorado
September, 2001


THE SPINE OF THE CONTINENT INITIATIVE
Brooks Range
ALASKA
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
Rockies
WASHINGTON
OREGON
MONTANA
WYOMING
NEVADA
UTAH
COLORADO
ARIZONA
NEW MEXICO
SONORA
CHIHUAHUA
1
2
3
4
5
6
7
8
9
10
The Spine of the Continent Initiative
brings together ten of the West's most respected conservation organizations in an effort to accelerate tangible habitat protection. Working jointly will expedite fundraising and organization, speed sharing of innovations and outreach tools, and more effectively focus international attention on protection of our most loved—and most threatened—natural treasures.
Through the Spine of the Continent Initiative, these partners will strive to reach new audiences and nontraditional allies, while collaborating with other compatible national outreach campaigns.
The orange line at right depicts the general Spine of the Continent area, with numbered dots showing the general regions in which partner organizations are working. Additions of new partners will begin to fill the gaps on the map as our initiative grows, with a goal of connecting and protecting a full 5,000-mile wildlife corridor from Alaska's Brooks Range, through the Canadian and U.S. Rockies, to Mexico's Sierra Madre Occidental.
Success by compatible conservation initiatives, such as Yellowstone to Yukon Conservation Initiative, and by new partners in Alaska and Canada, will be key to the success of the Spine of the Continent Initiative.
0 MI 150 300
0 KM 250 500
1 ROUND RIVER CONSERVATION STUDIES Taku River Wildlife Connection Project Dedicated to conservation strategies that preserve and restore wild places and support local traditions that sustain wildness.
ROUND RIVER
2 AMERICAN WILDLANDS Mullan Pass Connectivity Project Dedicated to keeping the U.S. Northern Rockies ecologically intact by restoring and maintaining connections between key habitats for healthy populations of native fish and wildlife.
American Wildlands
3 HEART OF THE WEST COALITION Bear River Link Connectivity Project Coalition members: Wild Utah Project; Western Wildlife Conservancy; Biodiversity Conservation Alliance; Center for Native Ecosystems • Seeks to restore and maintain the regional integrity of the Great Basin and Colorado Plateau ecosystems through the design and establishment of a connected system of wildlands.
Heart of the West Coalition
4 COLORADO SAFE PASSAGE COALITION Intermountain Connectivity Project Coalition members: Colorado Wild; San Juan Citizens Alliance; Center for Native Ecosystems; Western Environmental Law Center A coalition of transportation and conservation organizations working to provide safe passage for people and wildlife across roadways via wildlife crossings and landscape corridors along the intermountain segments of I-70 and U.S. 160 in Colorado.
Colorado Safe Passage Coalition
5 WESTERN ENVIRONMENTAL LAW CENTER Spine of the Continent Policy and Law Strategy A nonprofit public interest law firm that works to protect and restore western wildlands and advocates for a healthy environment for communities throughout the West.
Western Environmental Law Center
6 GRAND CANYON WILDLANDS COUNCIL Northern Arizona's Forest Connectivity Project Works to create and apply a dynamic conservation area network that ensures the persistence and health of all native species and natural ecosystems in the Grand Canyon ecoregion.
WILDLANDS COUNCIL
7 NEW MEXICO PRIORITY WILDLIFE LINKAGES New Mexico Priority Wildlife Linkages Project A coalition of organizations, agencies and individuals working to identify and protect wildlife corridors throughout New Mexico.
8 DEFENDERS OF WILDLIFE Borderlands Connectivity Project One of North America's most experienced leaders in science-based, results-oriented wildlife conservation.
DEFENDERS OF WILDLIFE
9 WILDLANDS NETWORK Sky Islands Wildlife Linkage Protection Project A science-based organization working to protect and connect healthy wildlife habitat across North America by collaborating with land managers, communities, and other partners.
WILDLANDS NETWORK
10 NATURALIA, A.C. Northern Jaguar Connectivity Project A non-profit association working to protect Mexican biodiversity. Naturalia designs conservation projects to preserve ecosystems and their species, buys and restores wildlands to protect endangered species, and promotes environmental education and awareness.
Naturalia


Southern Rockies Wildlands Network Design
Legend
S. Rockies Ecoregion
Designated Wilderness
Core Agency
Core Private
Core Wilderness
Low Use Compatible
Medium Use Compatible
Private/Tribal High Value
Study Area
Wildlife Linkage
Wildlife Dispersal
Major Cities selection
Interstate
State Boundaries
Except for designated Wilderness, boundaries and management levels shown are recommendations only. These recommendations are in no way meant to infringe upon the rights of private property owners or tribal nations.
0 25 50 100
Miles
Center for Native Ecosystems
Map produced by Connor Bailey
3/18/2011 11-082
Casper
Laramie
Cheyenne
Denver
Colorado Springs
Grand Junction
Farmington
Santa Fe
WY
CO
CO
NM
80
25
76
70
70
25

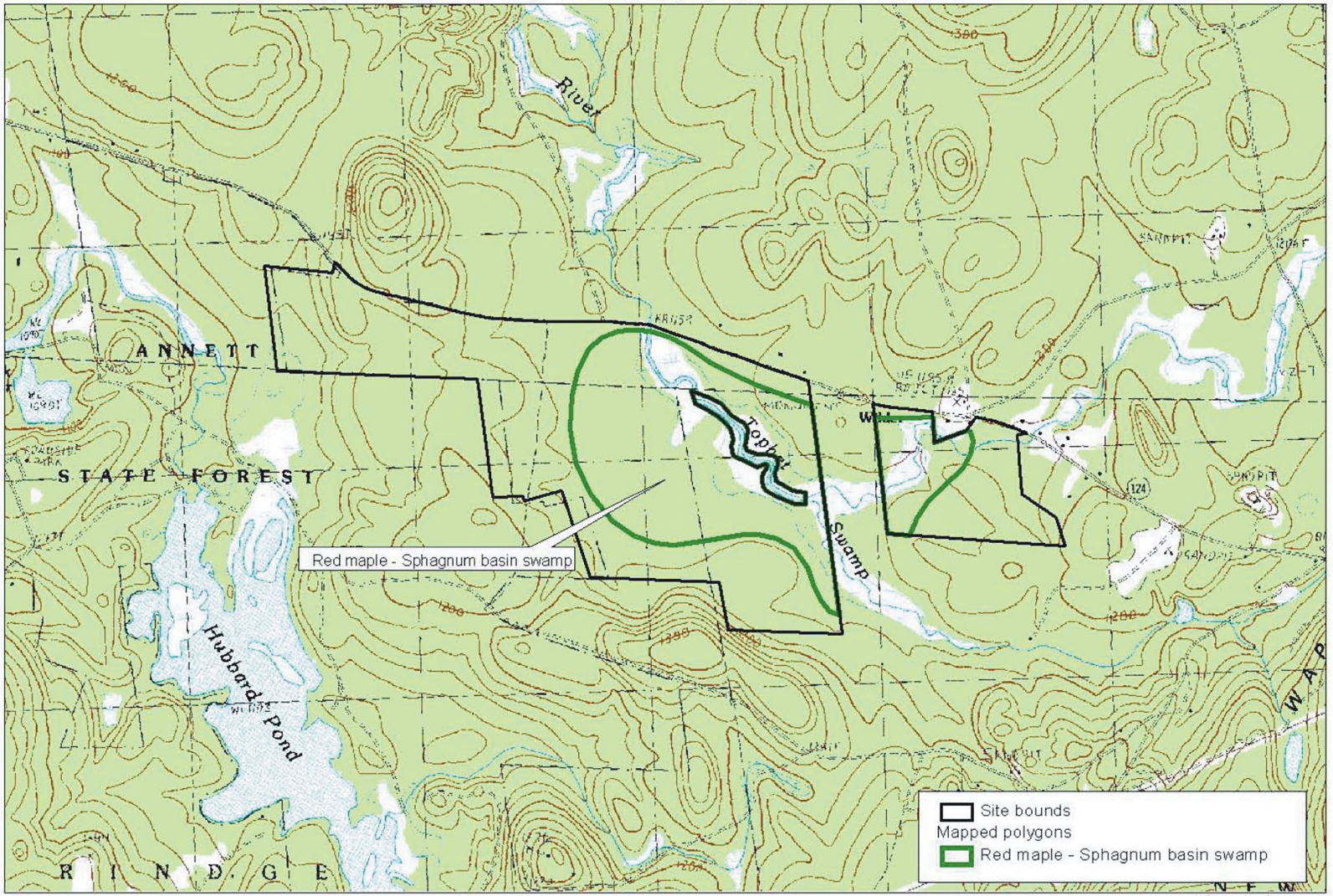

USGS Topographic Map
Perry Reservation
Society for the Protection of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
N
0
0.25
0.5 Miles
Data Sources:
National Wetlands Inventory
Digital Raster Graphic - USGS Quad 193 Peterborough South, NH (1987)
Conservation Lands - NH GRANIT
Christopher R. Wilson, SWT
1/15/2010
This map does not represent a legal survey
Wilder
Swamp
Tophat
River
Pond
124

NHB ID: L27

NH NATURAL HERITAGE BUREAU

Known locations of rare species and exemplary natural communities

Sensitive species are labelled but not mapped. All other records are clipped to the property boundaries.
Occurrences not on the property are not shown.

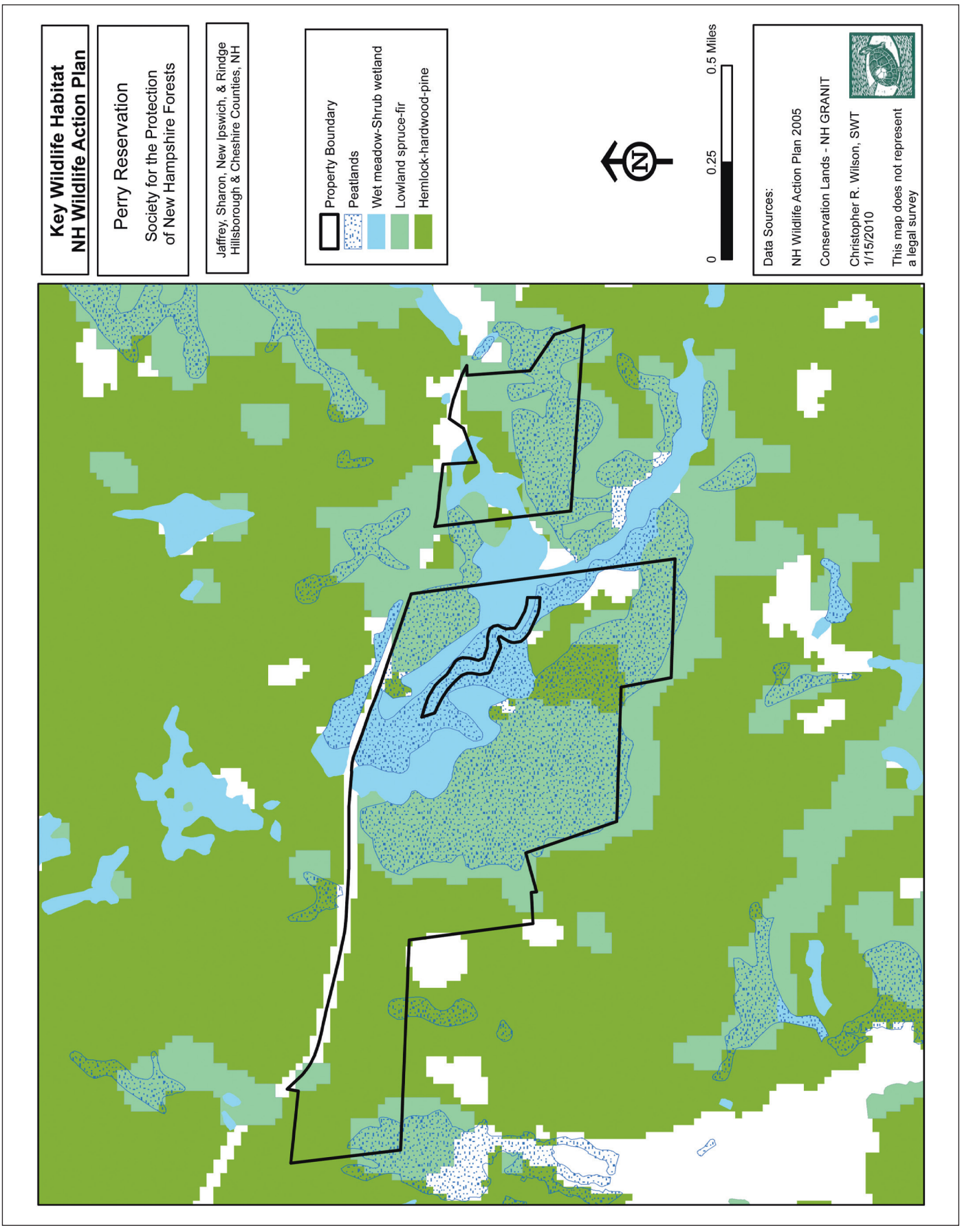


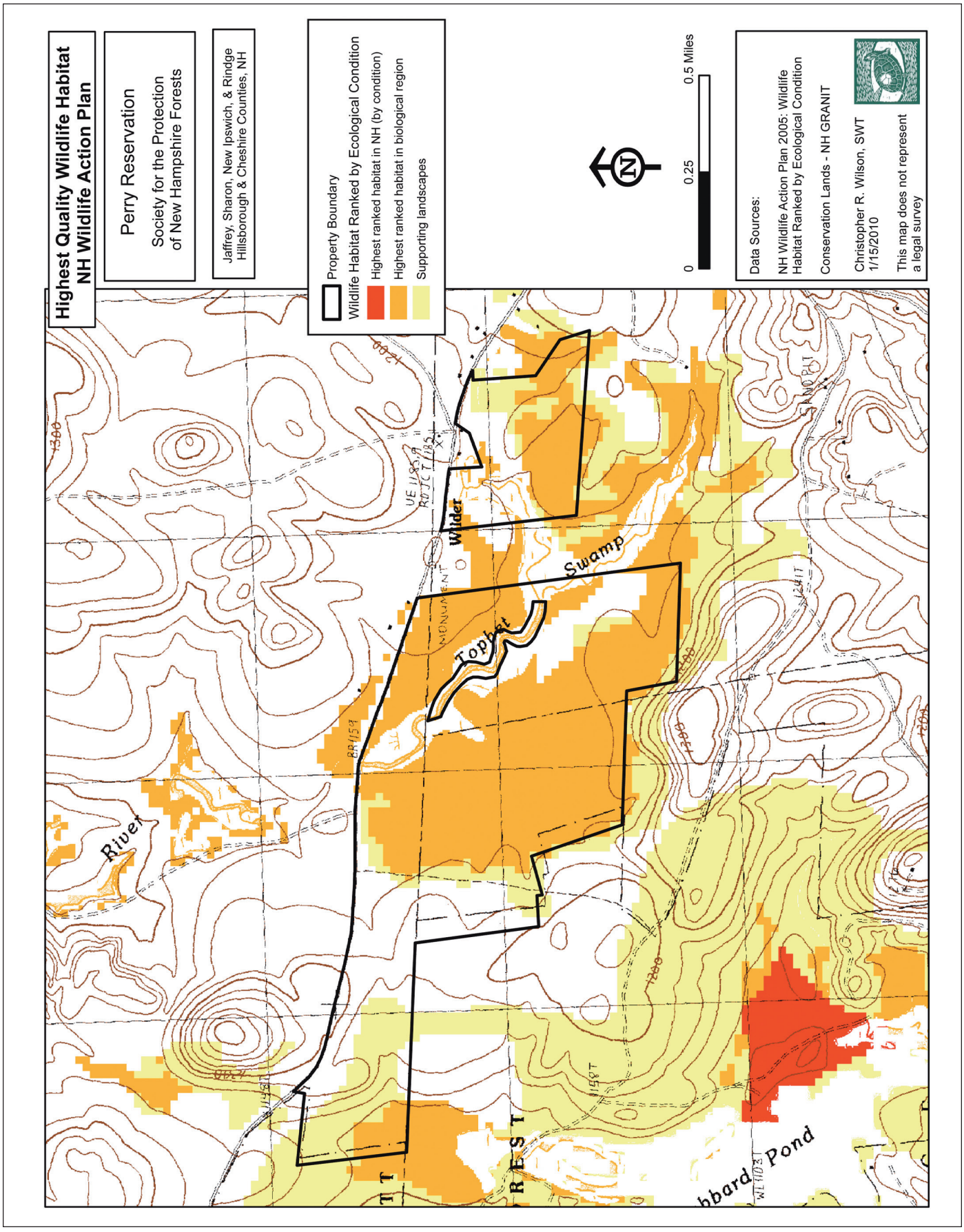
*Historical record

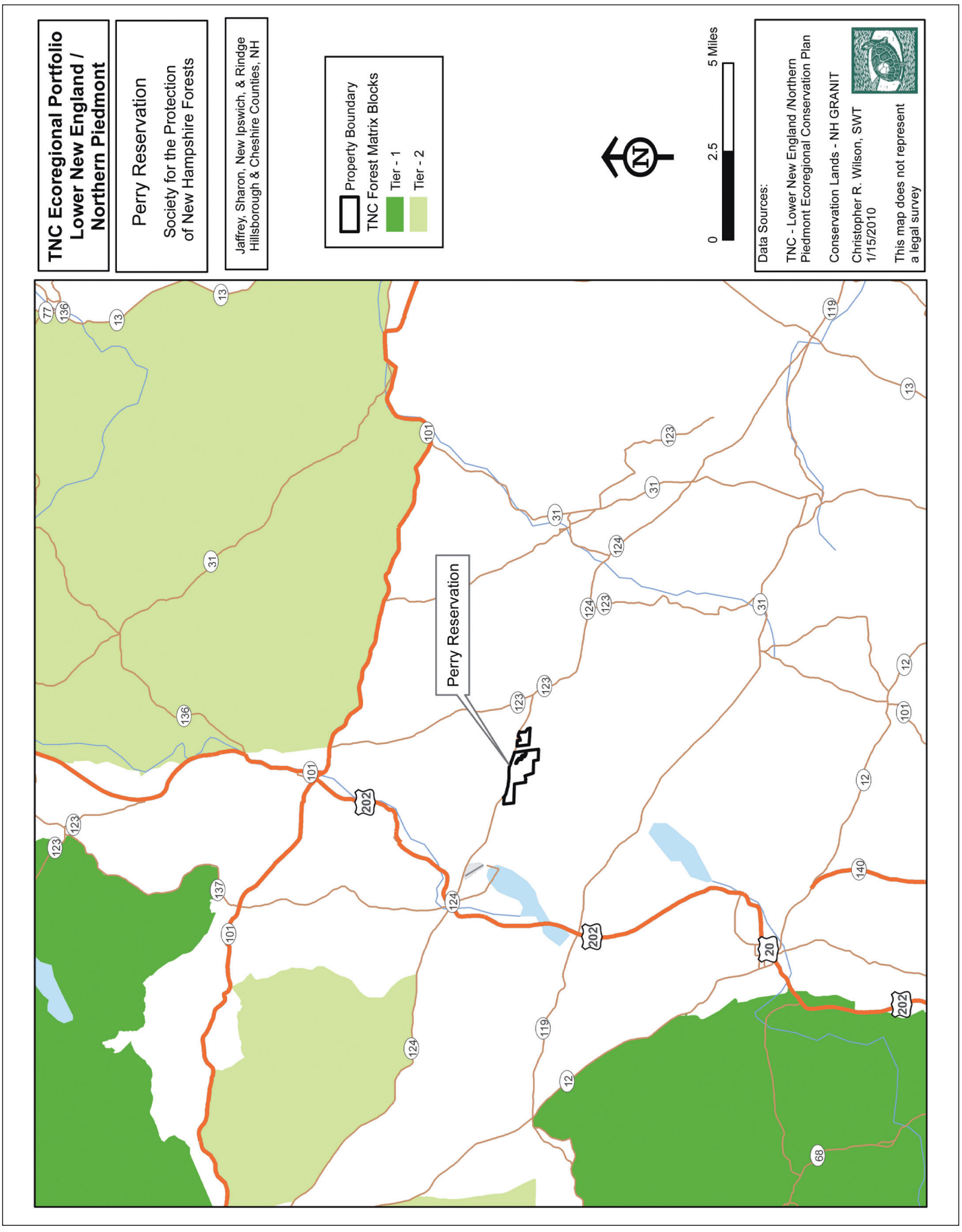
Property: Perry Reservation

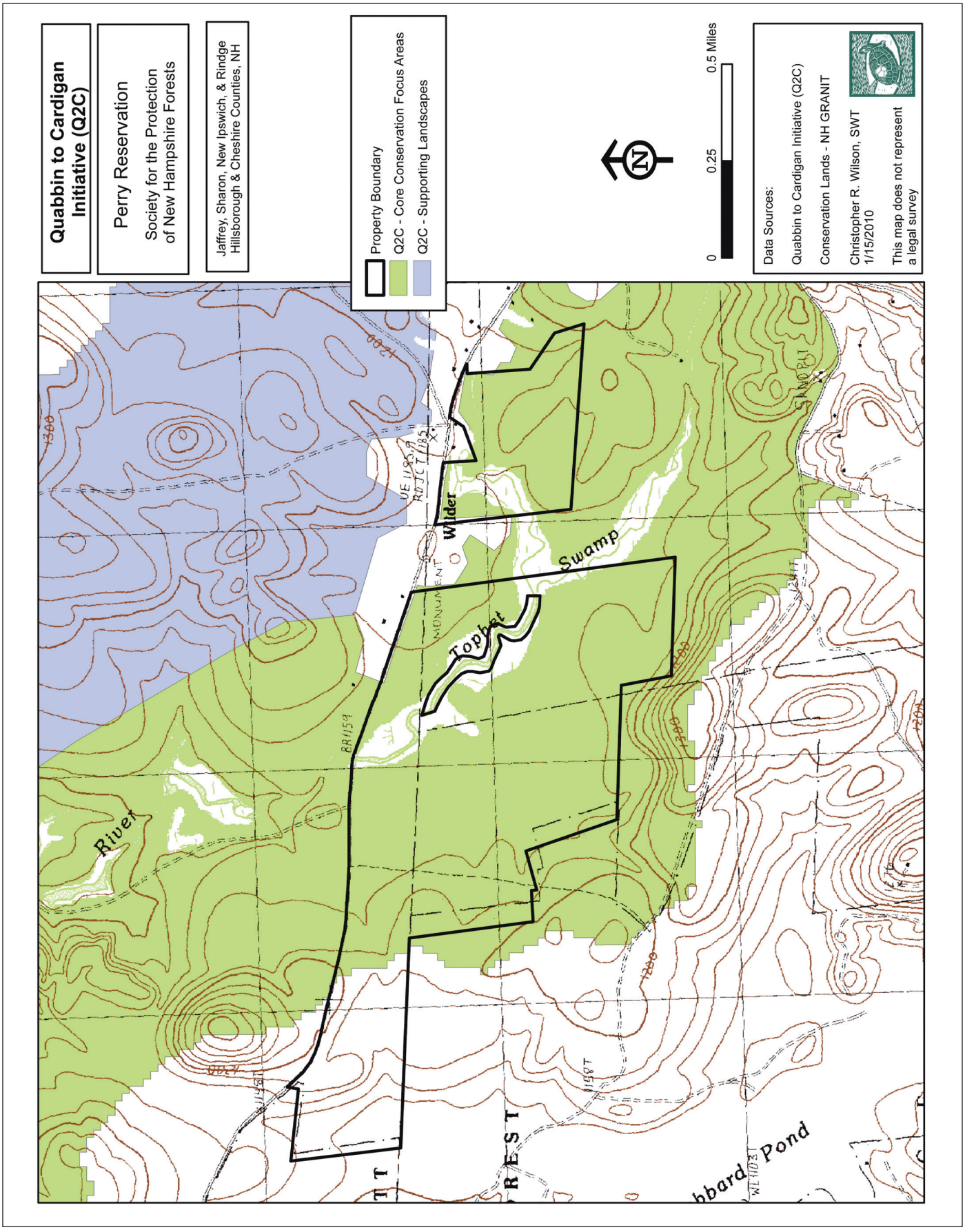
1:24000 0.25 0 0.25 0.5 0.75 1 Miles

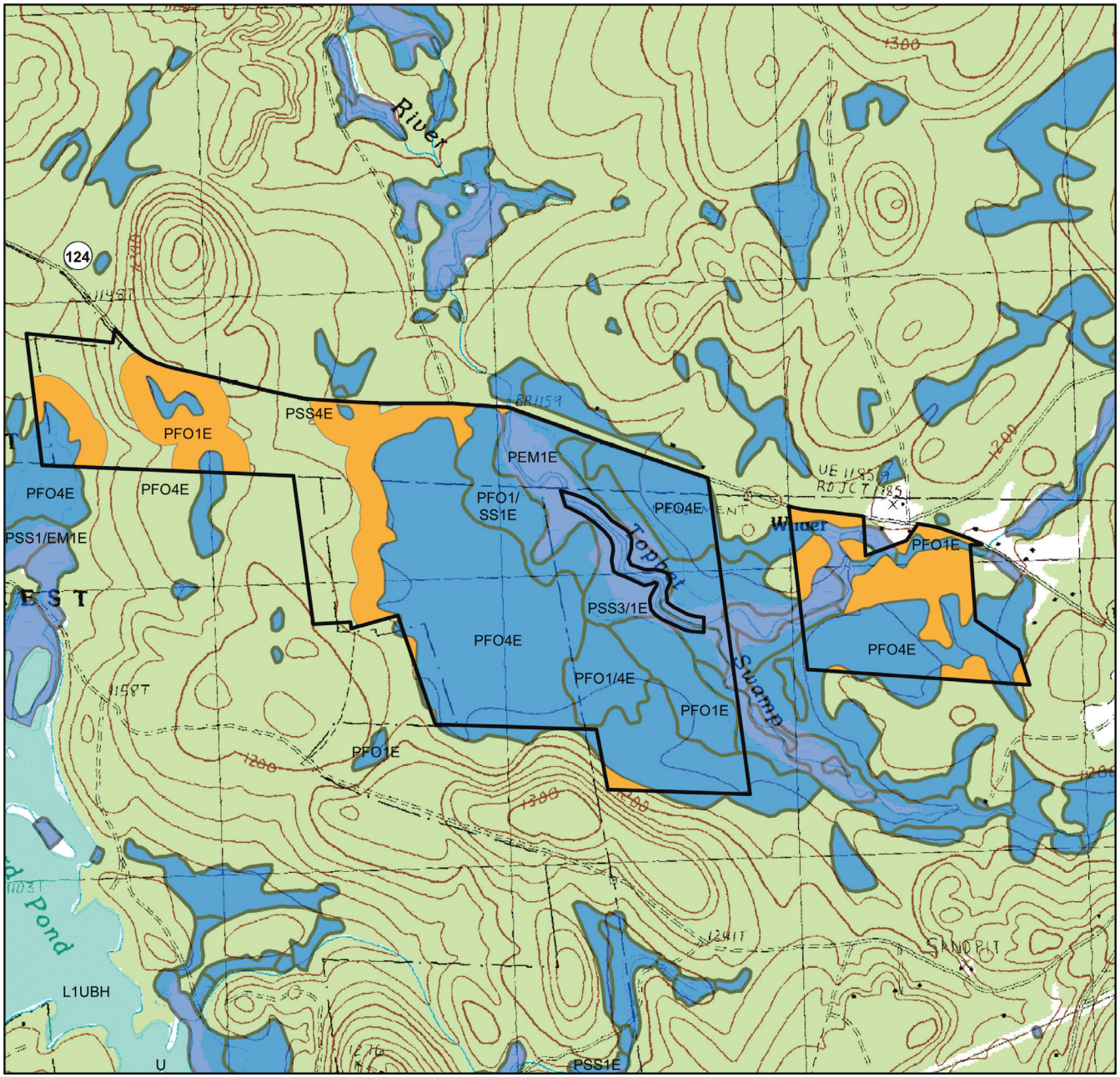
15 Aug 2006


Key Wildlife Habitat
NH Wildlife Action Plan
Perry Reservation
Society for the Protection
of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
Peatlands
Wet meadow-Shrub wetland
Lowland spruce-fir
Hemlock-hardwood-pine
N
0
0.25
0.5 Miles
Data Sources:
NH Wildlife Action Plan 2005
Conservation Lands - NH GRANIT
Christopher R. Wilson, SWT
1/15/2010
This map does not represent
a legal survey


Highest Quality Wildlife Habitat
NH Wildlife Action Plan
Perry Reservation
Society for the Protection
of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
Wildlife Habitat Ranked by Ecological Condition
Highest ranked habitat in NH (by condition)
Highest ranked habitat in biological region
Supporting landscapes
N
0
0.25
0.5 Miles
Data Sources:
NH Wildlife Action Plan 2005: Wildlife
Habitat Ranked by Ecological Condition
Conservation Lands - NH GRANIT
Christopher R. Wilson, SWT
1/15/2010
This map does not represent
a legal survey
Wilder
Topliff
Swamp
River
Pond


TNC Ecoregional Portfolio
Lower New England /
Northern Piedmont
Perry Reservation
Society for the Protection
of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
TNC Forest Matrix Blocks
Tier - 1
Tier - 2
N
0
2.5
5 Miles
Data Sources:
TNC - Lower New England /Northern
Piedmont Ecoregional Conservation Plan
Conservation Lands - NH GRANIT
Christopher R. Wilson, SWT
1/15/2010
This map does not represent
a legal survey
Perry Reservation


Quabbin to Cardigan Initiative (Q2C)
Perry Reservation
Society for the Protection of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
Q2C - Core Conservation Focus Areas
Q2C - Supporting Landscapes
0
0.25
0.5 Miles
N
Data Sources:
Quabbin to Cardigan Initiative (Q2C)
Conservation Lands - NH GRANIT
Christopher R. Wilson, SWT
1/15/2010
This map does not represent a legal survey
Wilder
Swamp
Topbat
River
Pond



Wetland Features
National Wetland Inventory

Perry Reservation

Society for the Protection
of New Hampshire Forests

Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH

- Property Boundary
- Upland Buffer (300ft)

NWI Wetlands

- Palustrine
- Lacustrine

N

0 0.25 0.5 Miles

Data Sources:

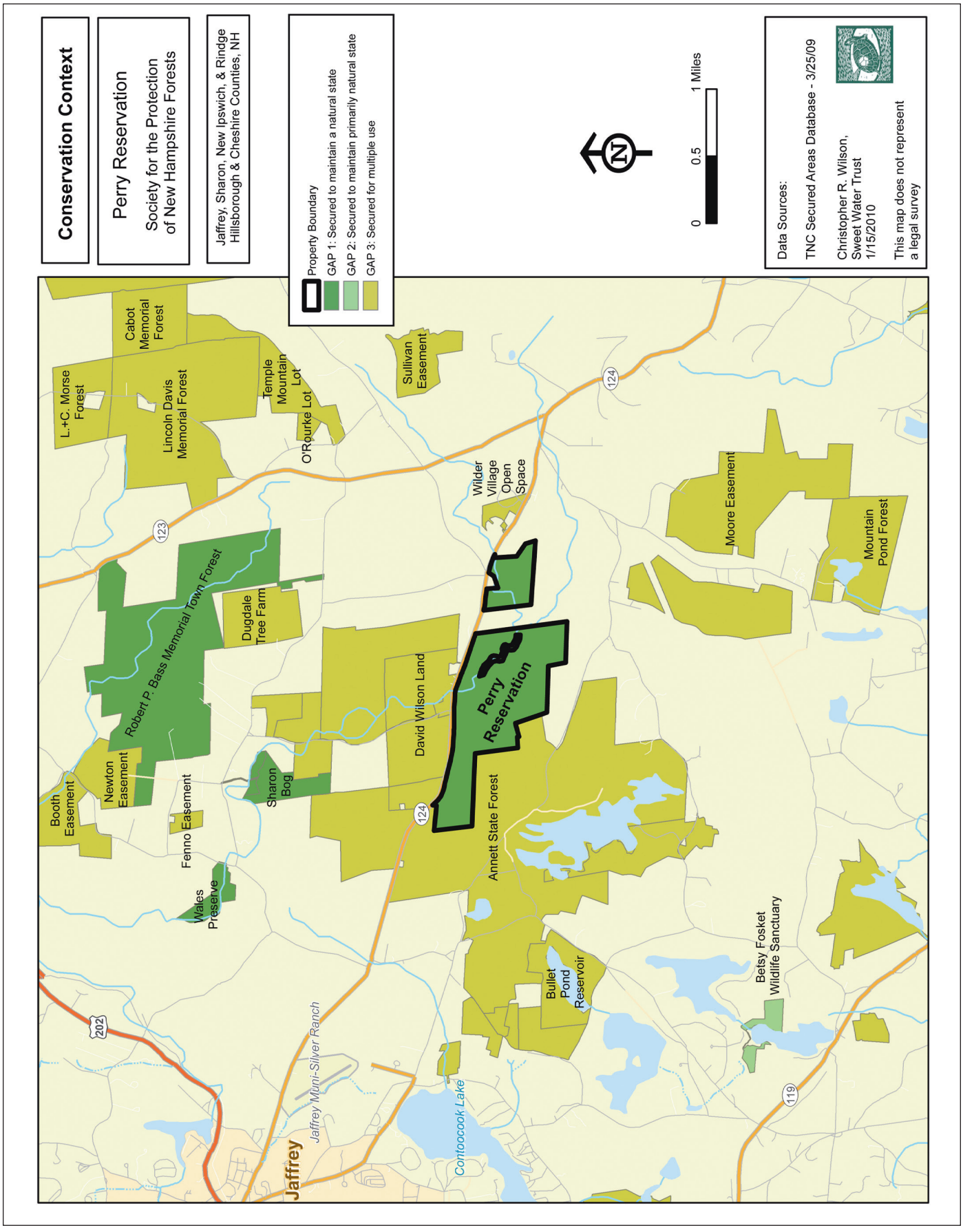
National Wetlands Inventory

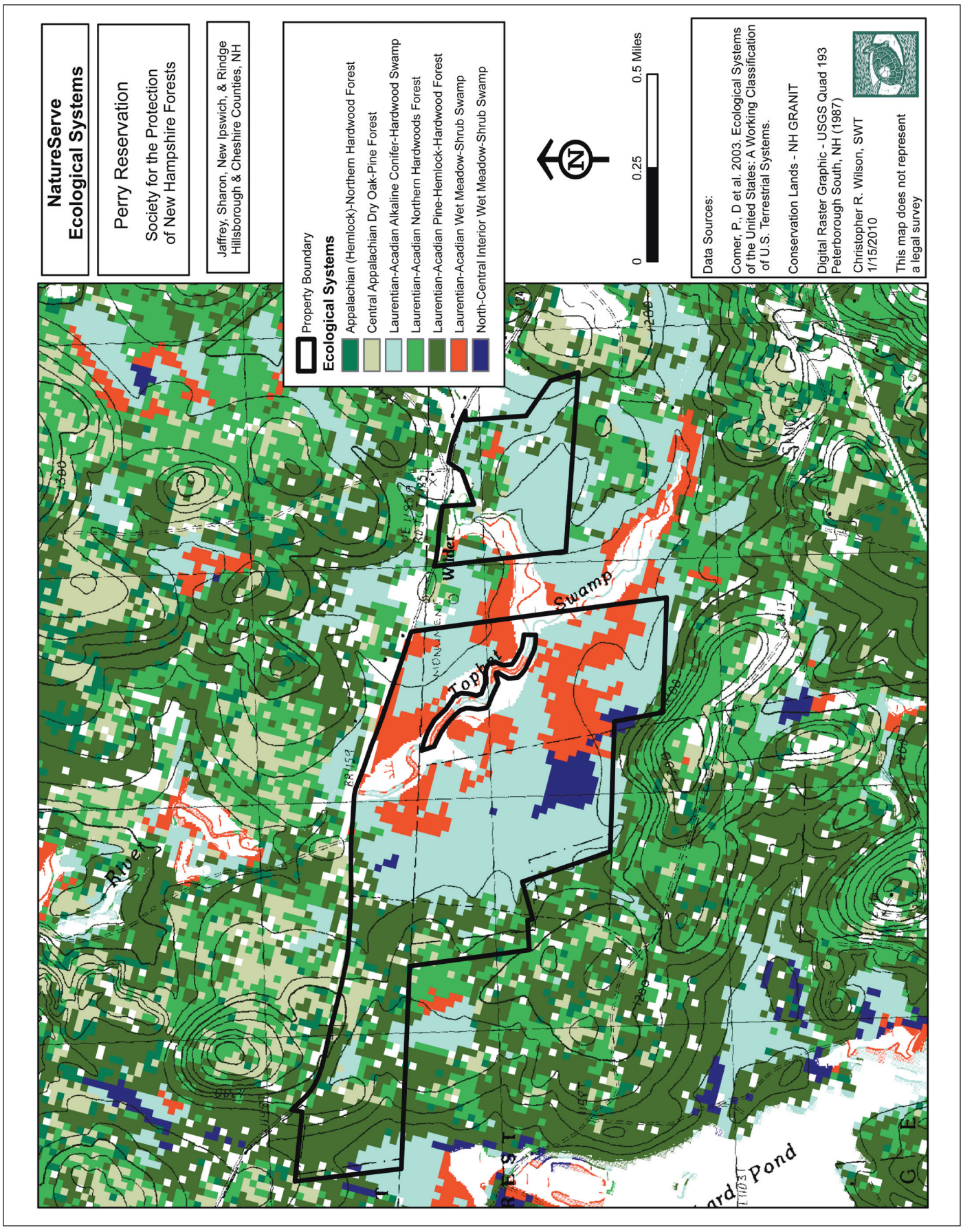
Digital Raster Graphic - USGS Quad 193
Peterborough South, NH (1987)

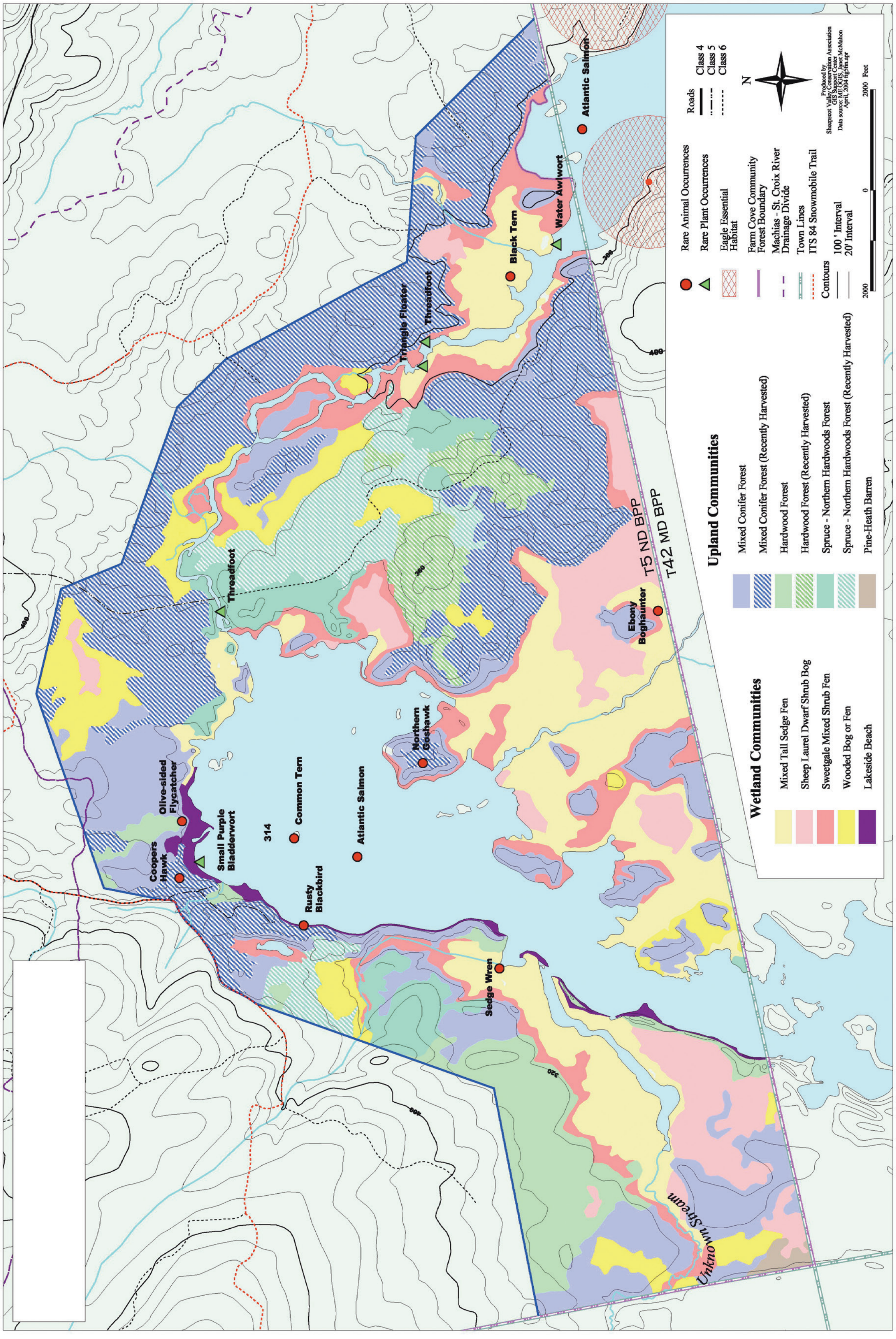
Conservation Lands - NH GRANIT

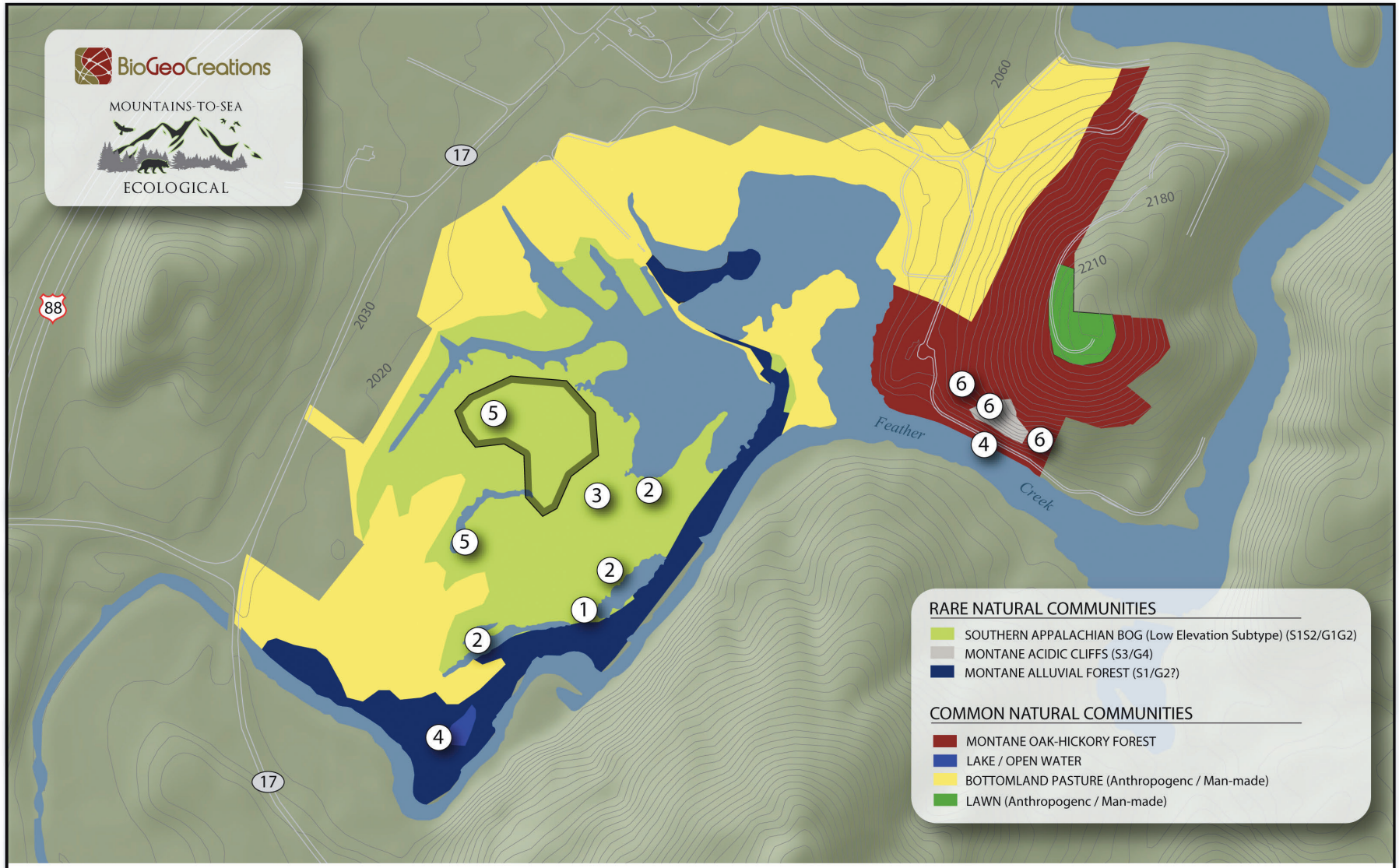
Christopher R. Wilson, SWT
1/15/2010

This map does not represent
a legal survey


Conservation Context
Perry Reservation
Society for the Protection of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
GAP 1: Secured to maintain a natural state
GAP 2: Secured to maintain primarily natural state
GAP 3: Secured for multiple use
0
0.5
1 Miles
Data Sources:
TNC Secured Areas Database - 3/25/09
Christopher R. Wilson, Sweet Water Trust 1/15/2010
This map does not represent a legal survey
Cabot Memorial Forest
L.+C. Morse Forest
Lincoln Davis Memorial Forest
Temple Mountain Lot
O'Rourke Lot
Sullivan Easement
Wilder Village Open Space
Moore Easement
Mountain Pond Forest
Robert P. Bass Memorial Town Forest
Dugdale Tree Farm
David Wilson Land
Perry Reservation
Booth Easement
Newton Easement
Fenno Easement
Sharon Bog
Wales Preserve
Annett State Forest
Bullet Pond Reservoir
Betsy Fosket Wildlife Sanctuary
Jaffrey
Jaffrey Muni-Silver Ranch
Contoocook Lake
123
124
202
119


NatureServe
Ecological Systems
Perry Reservation
Society for the Protection
of New Hampshire Forests
Jaffrey, Sharon, New Ipswich, & Rindge
Hillsborough & Cheshire Counties, NH
Property Boundary
Ecological Systems
Appalachian (Hemlock)-Northern Hardwood Forest
Central Appalachian Dry Oak-Pine Forest
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp
Laurentian-Acadian Northern Hardwoods Forest
Laurentian-Acadian Pine-Hemlock-Hardwood Forest
Laurentian-Acadian Wet Meadow-Shrub Swamp
North-Central Interior Wet Meadow-Shrub Swamp
N
0
0.25
0.5 Miles
Data Sources:
Comer, P., D et al. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems.
Conservation Lands - NH GRANIT
Digital Raster Graphic - USGS Quad 193 Peterborough South, NH (1987)
Christopher R. Wilson, SWT
1/15/2010
This map does not represent a legal survey
Swamp
Pond


Upland Communities
Mixed Conifer Forest
Mixed Conifer Forest (Recently Harvested)
Hardwood Forest
Hardwood Forest (Recently Harvested)
Spruce - Northern Hardwoods Forest
Spruce - Northern Hardwoods Forest (Recently Harvested)
Pine-Heath Barren
Wetland Communities
Mixed Tall Sedge Fen
Sheep Laurel Dwarf Shrub Bog
Sweetgale Mixed Shrub Fen
Wooded Bog or Fen
Lakeside Beach
Rare Animal Occurrences
Rare Plant Occurrences
Eagle Essential Habitat
Farm Cove Community Forest Boundary
Machias - St. Croix River Drainage Divide
Town Lines
ITS 84 Snowmobile Trail
Contours
100' Interval
20' Interval
Roads
Class 4
Class 5
Class 6
N
2000
0
2000 Feet
T5 ND BPP
T42 MD BPP
Atlantic Salmon
Water Awlwort
Black Tern
Threadfoot
Triangle Floater
Threadfoot
Ebony Boghaunter
Northern Goshawk
Common Tern
Atlantic Salmon
314
Olive-sided Flycatcher
Small Purple Bladderwort
Coopers Hawk
Rusty Blackbird
Sedge Wren
Unknown Stream
300
320
400



Natural Communities & Rare Species

Feather Inlet Conservation Easement Area

Zirconia, NC - Henderson County

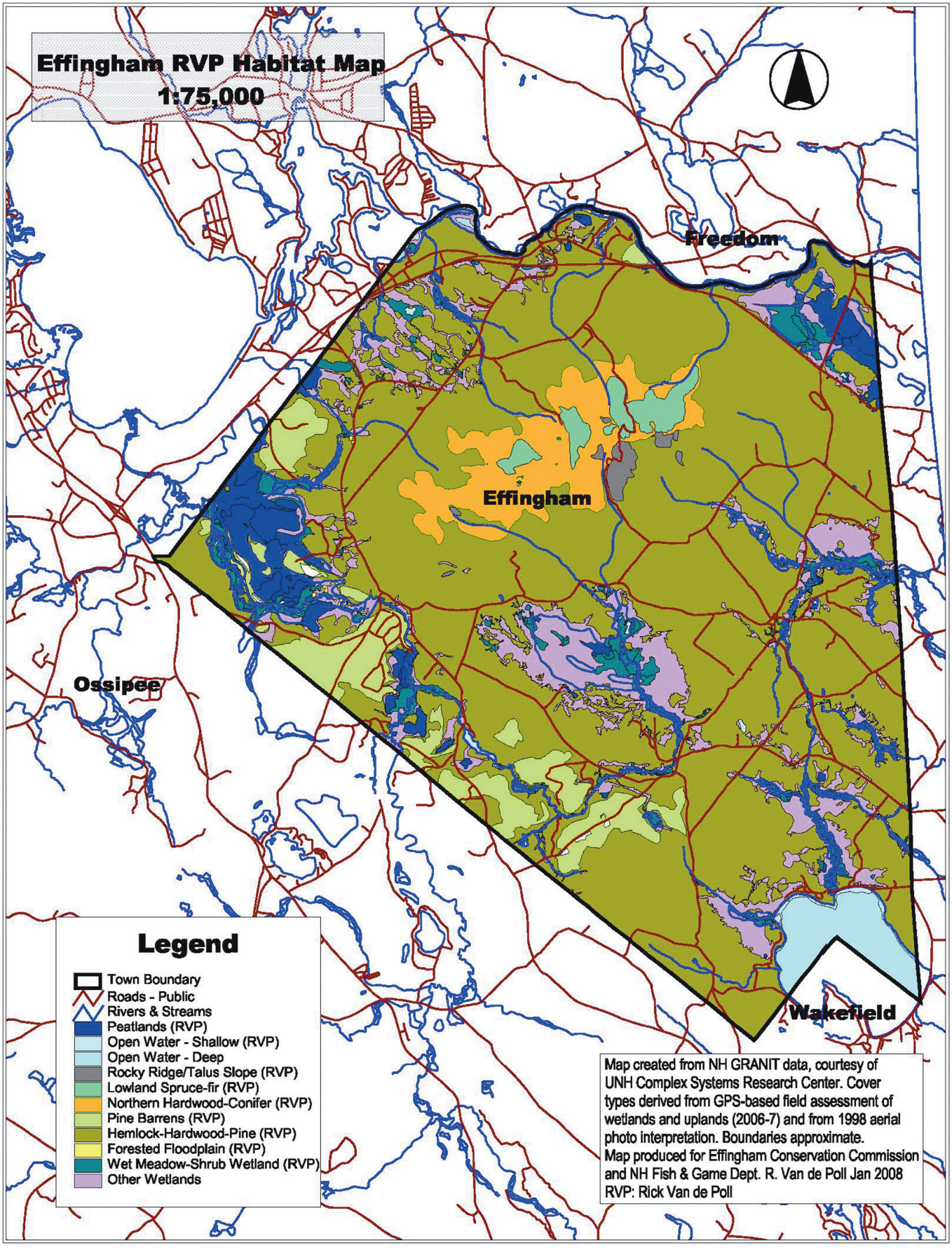
RARE SPECIES

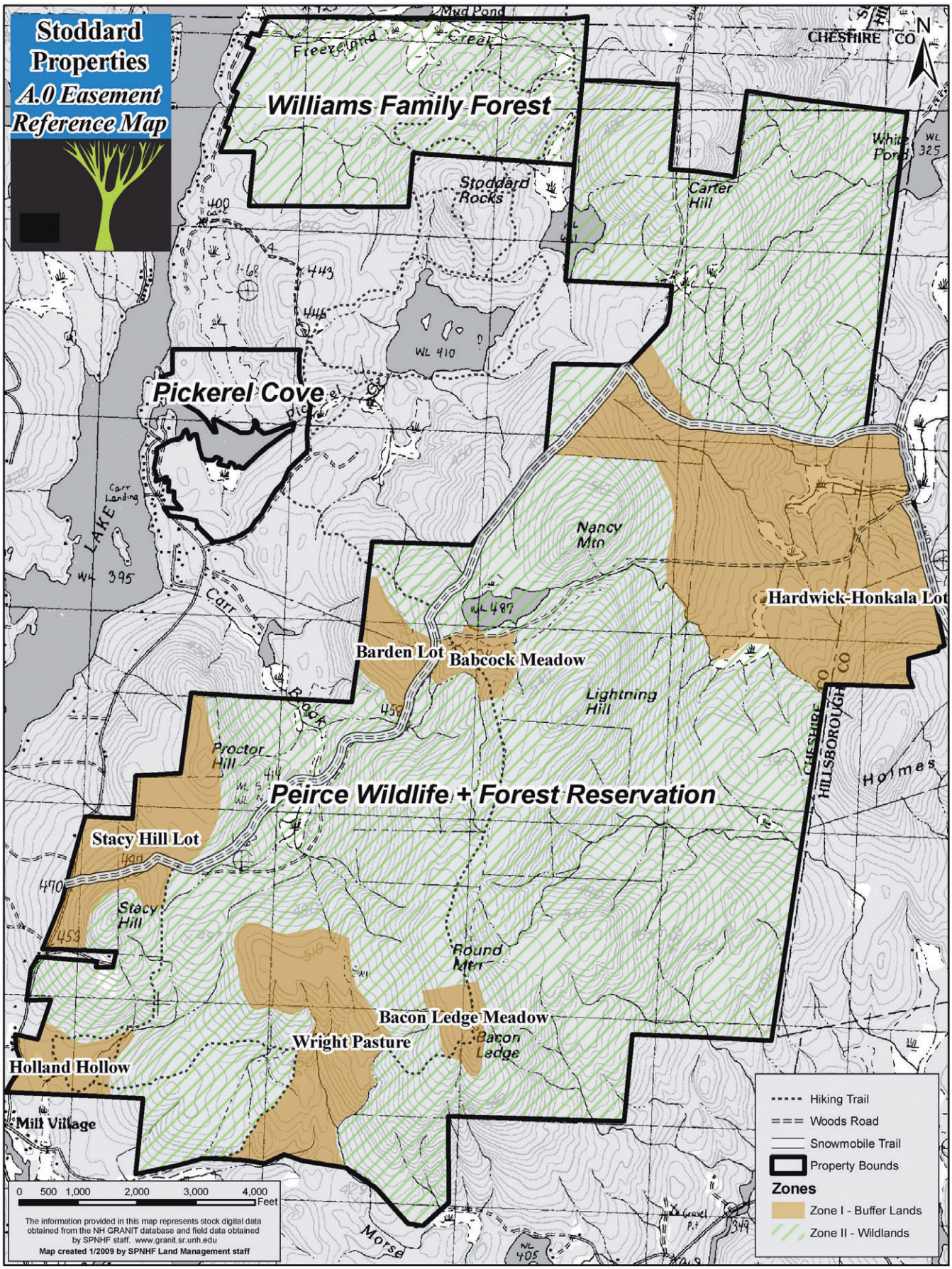
- SWEET GALE (Myrica gale) (S1/G5)
- (1) CHEROKEE SEDGE (Carex cherokeensis) (S1/G4G5)
- (2) MARSH BELFLOWER (Campanula aparinoides) (S2/G5)
- (3) BOG TURTLE (Glyptemys muhlenbergii) (S1/G3)
- (4) WARBLING VIREO (Vireo gifus) (S2B/G5)
- (5) MOLE SALAMANDER (Ambystoma talpoideum) (S2/G5)
- (6) MOUNTAIN HEARTLEAF (Hexastylis contracta) (S1/G3)

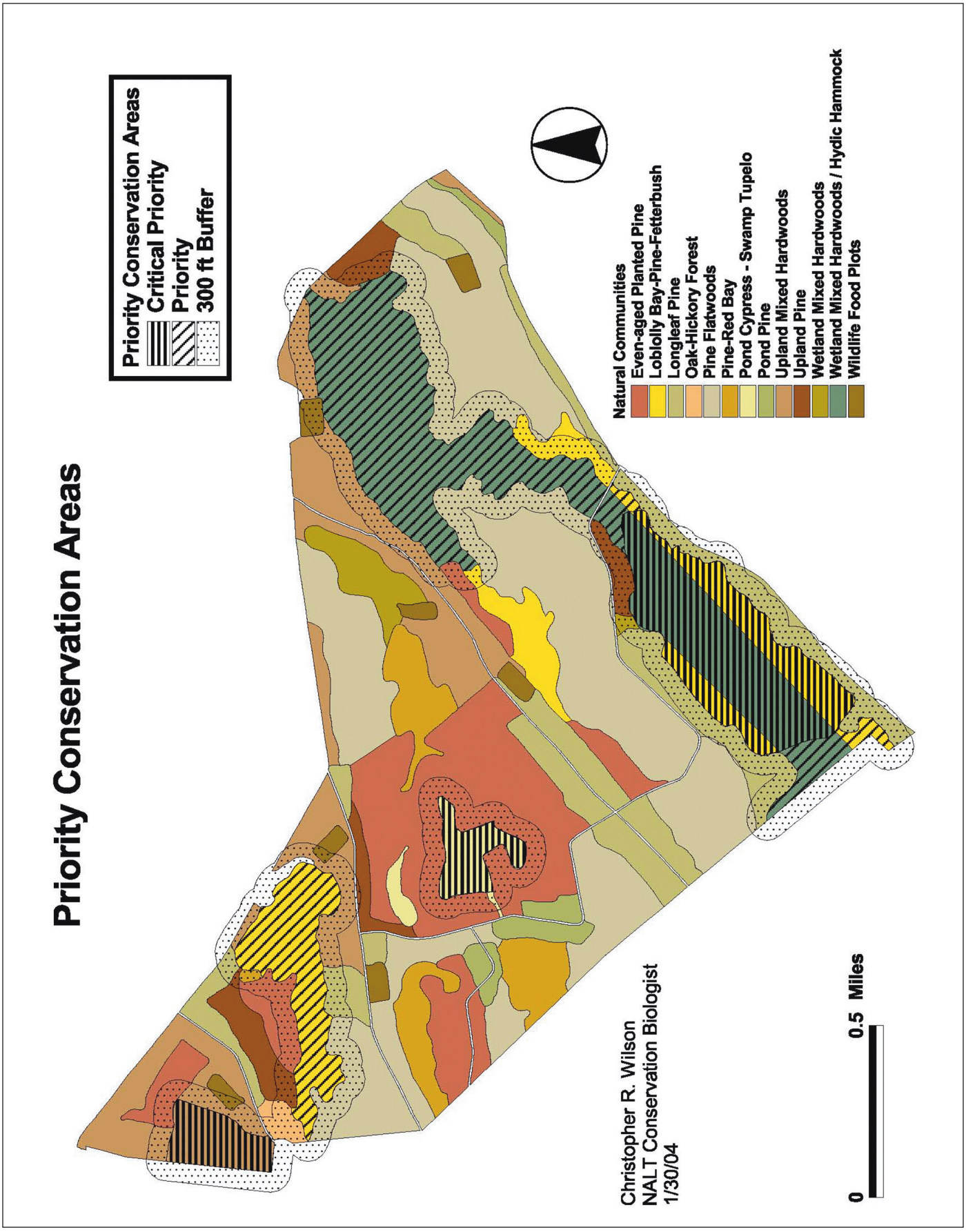
0 500 1,000 1,500 2,000
Feet

N

State Plane North Carolina, NAD 1983
Map produced: November 2010
This map is for informational purposes and was not prepared for, and is not suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.


Effingham RVP Habitat Map
1:75,000
Freedom
Effingham
Ossipee
Wakefield
Legend
Town Boundary
Roads - Public
Rivers & Streams
Peatlands (RVP)
Open Water - Shallow (RVP)
Open Water - Deep
Rocky Ridge/Talus Slope (RVP)
Lowland Spruce-fir (RVP)
Northern Hardwood-Conifer (RVP)
Pine Barrens (RVP)
Hemlock-Hardwood-Pine (RVP)
Forested Floodplain (RVP)
Wet Meadow-Shrub Wetland (RVP)
Other Wetlands
Map created from NH GRANIT data, courtesy of UNH Complex Systems Research Center. Cover types derived from GPS-based field assessment of wetlands and uplands (2006-7) and from 1998 aerial photo interpretation. Boundaries approximate.
Map produced for Effingham Conservation Commission and NH Fish & Game Dept. R. Van de Poll Jan 2008
RVP: Rick Van de Poll


Stoddard Properties
A.0 Easement Reference Map
Williams Family Forest
Pickerel Cove
Barden Lot
Babcock Meadow
Hardwick-Honkala Lot
Peirce Wildlife + Forest Reservation
Stacy Hill Lot
Holland Hollow
Mill Village
Wright Pasture
Bacon Ledge Meadow
Mud Pond
Freeze Pond
Creek
Stoddard Rocks
Carter Hill
White Pond
Nancy Mtn
Lightning Hill
Proctor Hill
Stacy Hill
Round Mtn
Bacon Ledge
Holmes
CHESHIRE CO
HILLSBOROUGH CO
Carr Landing
LAKE
Carr
Brook
Morse
Gravel Pit
N
Hiking Trail
Woods Road
Snowmobile Trail
Property Bounds
Zones
Zone I - Buffer Lands
Zone II - Wildlands
0 500 1,000 2,000 3,000 4,000 Feet
The information provided in this map represents stock digital data obtained from the NH GRANIT database and field data obtained by SPNHF staff. www.granit.sr.unh.edu
Map created 1/2009 by SPNHF Land Management staff


Priority Conservation Areas
Priority Conservation Areas
Critical Priority
Priority
300 ft Buffer
Natural Communities
Even-aged Planted Pine
Loblolly Bay-Pine-Fetterbush
Longleaf Pine
Oak-Hickory Forest
Pine Flatwoods
Pine-Red Bay
Pond Cypress - Swamp Tupelo
Pond Pine
Upland Mixed Hardwoods
Upland Pine
Wetland Mixed Hardwoods
Wetland Mixed Hardwoods / Hydic Hammock
Wildlife Food Plots
Christopher R. Wilson
NALT Conservation Biologist
1/30/04
0
0.5 Miles

SIX

On-site Biological Features Inventories

As we discussed in chapter five, there are two components of a biological assessment. The first is to gather and analyze maps and information on a potential project in an off-site review. Next, it is helpful to follow up with an on-site biological inventory to verify the data you have collected and find information that may not be in your preliminary data.

Is a Biological Inventory Necessary?

One way or another, on-site biological inventories take time and usually money. Land trust staff and volunteers (as well as landowners) may question when a biological inventory is needed.

Determining if a biological inventory is needed is related to the risk of damaging or not adequately protecting priority biological features, should they occur. Inventories are particularly recommended for projects that appear to have a high potential for containing priority biological features and when the owner's intended reserved rights or uses of the property (such as forestry, ranching, building envelopes) might conflict with those attributes. Biological inventories are also recommended for projects where the landowner intends to claim a tax deduction for the donation of a conservation easement and wishes to have robust documentation of the conservation values that qualify the project for such a deduction under the conservation purposes test of Internal Revenue Code (IRC) 170(h).

To determine the potential for priority biological features on a property (and help determine the need for an inventory), the off-site assessment methods reviewed above should first be completed. This will provide a good idea of the types of species, communities, and habitats that may occur on the property. For instance, USGS topographic maps and National Wetlands Inventory (NWI) data may indicate the presence of streams and wetlands; the Natural Heritage information request report may indicate the presence of rare species or natural communities on the property or in nearby areas; the State Wildlife Action Plan (SWAP) mapping may indicate the presence of significant habitat for Species of Greatest Conservation Need (SGCN). The next step is to conduct a site visit and make sure that the property is in good condition: The

vegetation appears natural, and obvious features indicated from the mapping (such as streams, wetlands, forests, shrublands, and general habitat types) do, in fact, occur on the property.

Next, it is helpful to speak with a Natural Heritage biologist (or other knowledgeable biologist) and describe the property's physical features, the results of the off-site assessment, observations from the site visit, the current uses of the land, and the landowner's (and the land trust's) intentions for the future protection, management, and uses of the property. Based on your descriptions, the biologist can give his or her opinion on what rare species and natural communities might occur on the project, how likely it is that these features occur, which are most important to verify, what seasons to look for them, how to look for them, and if the intended uses and management of the property will pose a threat to such features. In some cases, Natural Heritage biologists may be willing to come look at your project for free.

Determining if a biological inventory is needed is related to the risk of damaging or not adequately protecting priority biological features, should they occur.

If you decide to proceed with a biological inventory, it will likely require recruiting a volunteer biologist or hiring a biological consultant. In order to get the biggest bang for the buck, it's important to have a basic understanding of what biological inventories involve so that you know what to ask for and what kind of biologist to use.

What Do Biological Inventories for Land Trust Projects Involve?

Many assume that a biological inventory entails cataloging all the plants and animals that occur on a property. But documenting all the species on a property is impossible; some species will only be detectable during certain seasons, some require costly laboratory methods to identify, and some are so obscure that few biologists can identify them. Obviously, a biological inventory specific to a land trust project needs to be more practical and narrower in scope.

First, it is important to consider how the information will be used. For typical land trust purposes, a biological inventory should provide information useful for:

- Determining the significant biological conservation values of the project

- Enhancing fundraising and outreach efforts such as grant applications, campaign brochures, or newsletters
- Drafting conservation easement language, including the conservation purposes, "whereas" clauses, restrictions, and reserved rights
- Designating the easement area (or conservation area) boundaries and special management zones for sensitive features within the easement area (if needed)
- Developing the baseline documentation report, including supporting documentation that substantiates the conservation purposes under IRC 170(h)
- Developing a management plan for the property

To be useful for these applications, the biological inventory should focus on the identification of *priority* biological features on the property—specifically, conservation priorities designated by formal methodologies and government-sponsored programs. These features, reviewed in chapters three and four, can include state or federally protected species, priority birds designated by Partners in Flight (PIF) or the U.S. Fish & Wildlife Service (USFWS) Joint Ventures program, streams and wetlands, species or natural communities tracked by Natural Heritage Programs, Species of Greatest Conservation Need (or their habitat) listed under SWAPs, or other features. Just because a property contains priority biological features doesn't mean that the project will actually protect those features; the actual conservation values of a project will depend on what sorts or protections are negotiated in the easement document and what sorts of management (including restoration activities) are necessary and possible over the long term. Thus, the objective of a biological inventory on land trust projects should be to evaluate the property in terms of its *current and potential* contributions to the conservation of *priority* biological features.

RESOURCE FOR BIOLOGICAL INVENTORIES

For more information on biological inventories, see *Biodiversity Inventory of Natural Lands: A How-to Manual for Foresters and Biologists* by Andy Cutko (Arlington, Va.: NatureServe, 2009).

The objective of a biological inventory on land trust projects should be to evaluate the property in terms of its *current and potential* contributions to the conservation of *priority* biological features.

In other words, what priority biological features occur on, or use, the property and what can be done for their protection and management? This is very different from asking the biologist to simply make a species list for the property.

There is no single right way to answer this question. Every project will have its own set of unique circumstances, and biologists will approach the question differently. But due to time and funding constraints, which are certain to be universal among land trust projects, the most practical approach is a reconnaissance-based or walk-through biological inventory, which places greater emphasis on detecting the *presence* of priority biological features, as opposed to counting them, such as using quantitative sampling techniques. The goals of this approach are to:

1. Document as many priority biological features as possible during a brief visit to the property by focusing on those that are most likely to occur, are readily observable and recognizable, and provide the most useful information for protection and management.
2. Assess protection and management needs for those features and the property in general.
3. Determine if additional, possibly more technical, time-consuming, or season-specific fieldwork is needed.

In practice, the three most useful activities for biologists inventorying land trust projects are:

1. Natural community classification and mapping
2. Habitat assessments
3. Targeted searches for priority species

The extent to which any of these three activities are accomplished during an inventory will depend on the skill set of the biologist, season and weather conditions, time and funding available, and how appropriate they are for the region or project.

Natural Community and Habitat Inventories

Natural community and habitat inventories involve classifying and mapping such features on a property and describing their condition and management needs. Thus, they are highly informative for conservation easement language, baseline documents, and management plans. Another benefit is that the seasonal window for assessing these features is much longer than for many species inventory targets, such as plants or breeding birds. When conducting such inventories, special emphasis should be placed on finding

and documenting rare or high-integrity natural communities and habitats for rare or priority species.

Natural Community Inventories

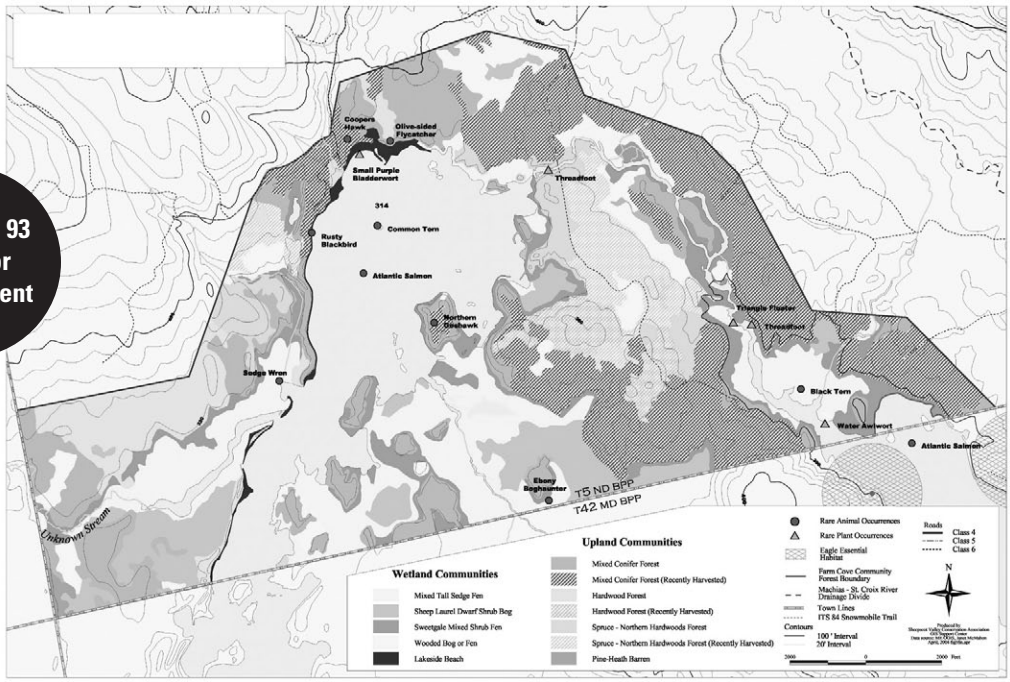
If time permits, a biologist should identify and map the fine-scale natural community (or National Vegetation Classification [NVC] association or alliance) types on the entire property using the standardized classification system provided by the state Natural Heritage Program or NatureServe (see chapter four). The level of identification and mapping detail will depend on the season (some natural communities require the identification of herbaceous species, which could be dormant or buried under snow), mobility and access issues (some properties can be hard to get around on), the size of the property, and how much time the biologist has to do fieldwork. At a minimum, the rare or high-integrity natural community occurrences should be mapped.

During a natural community inventory, a biologist may begin by reviewing descriptions of natural communities known to occur in the general area based on publications and Natural Heritage Program data. Then, the biologist may review aerial photographs and topographical, geological, soil, and land cover maps and use this information to sketch a preliminary map (perhaps mentally)

EXAMPLE: Fine-Scale Natural Community Mapping

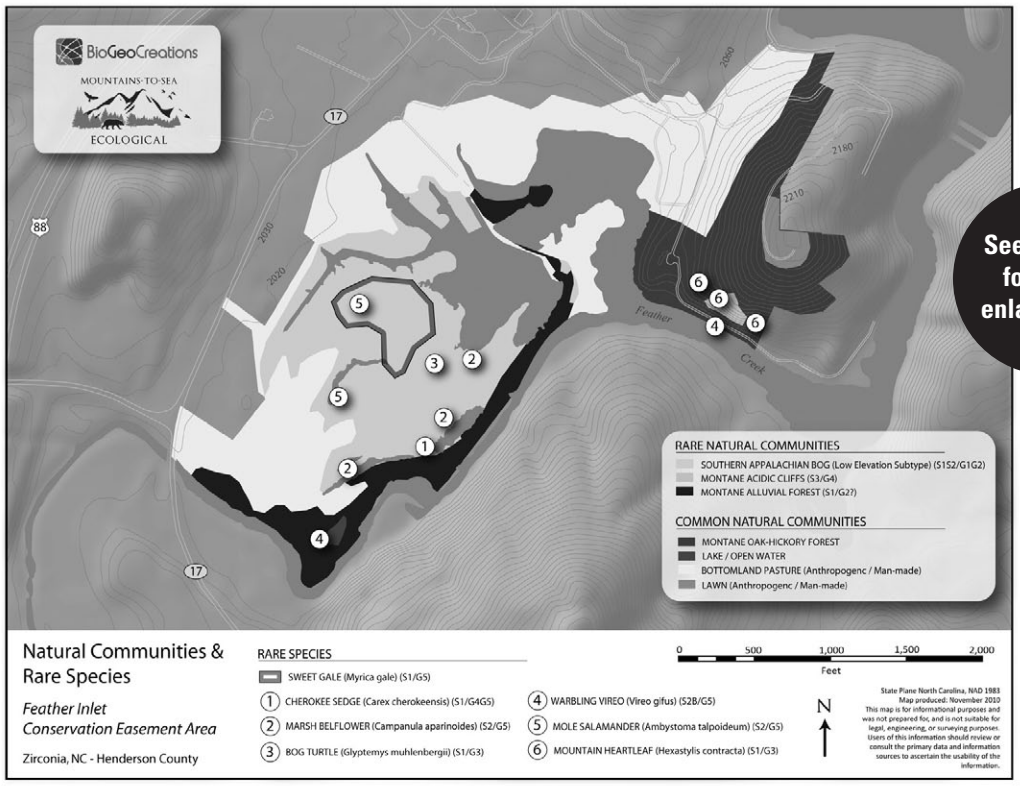
(From Sheepscott Valley Conservation Association.)

See page 93 for color enlargement



EXAMPLE: Natural Community Mapping

(From Michael Scisco, BioGeoCreations.)



See page 94 for color enlargement

of natural communities and habitats for the project. Once in the field, the biologist will seek to confirm the identity and boundaries of the communities on this map and make adjustments as needed.

To the extent practical, the biologist should also assess (or rank) the *quality* or integrity of the individual natural community occurrences by applying the Natural Heritage Programs' or NatureServe's element observation specifications (if they have been developed for the community types in question) or by generally assessing the condition, size, and landscape context of the occurrences (reviewed in chapter three). This can help demonstrate significance under IRC 170(h) by providing evidence of a high-quality example of a terrestrial community (IRS 1.170A-14 "significant habitat or ecosystem") and give an indication of what management actions are needed (such as restoration).

Habitat Inventories

Identification of rare plant habitat on a project is often synonymous with the natural community mapping process. (Many Natural Heritage Programs list

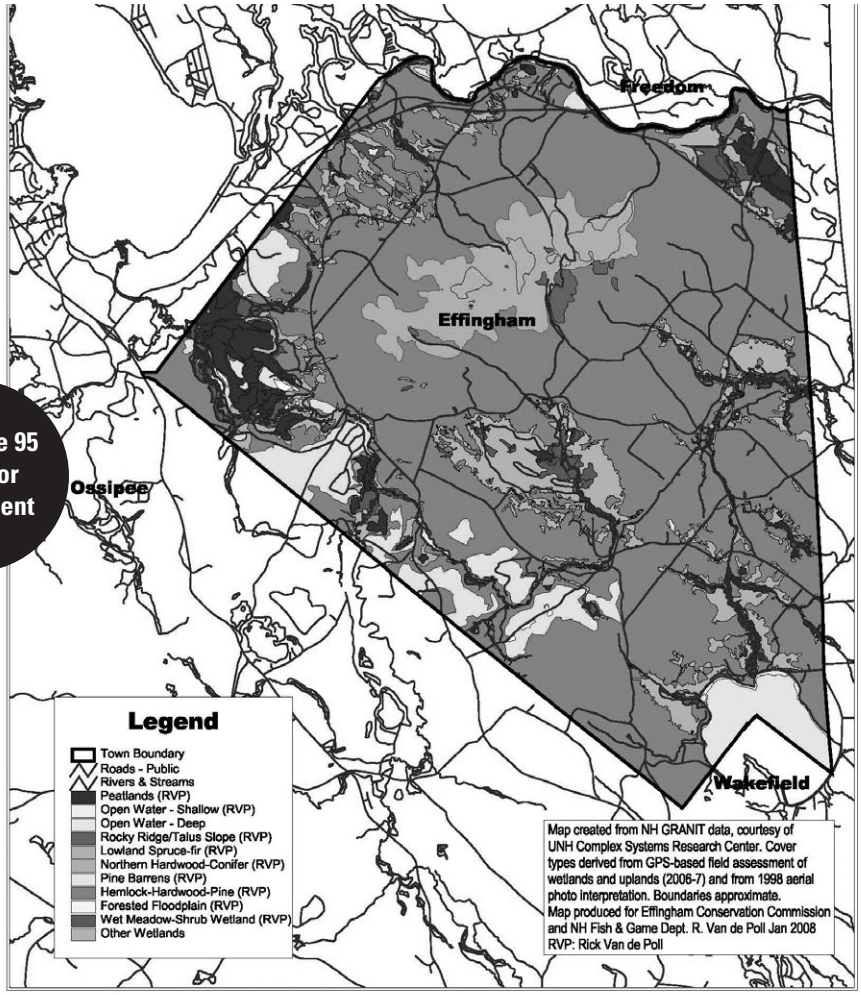
rare plants associated with natural communities.) Thus, habitat mapping often implies a focus on wildlife.

The habitat descriptions in SWAPs provide a standardized, government-supported framework for classifying wildlife habitats, including priority habitats for SGCN. If SWAP habitat types have already been mapped for the state (available as GIS layers), the most straightforward approach is to confirm the identification and boundaries of those mapped habitats in the field. If SWAP habitat mapping is not available, a biologist can use the habitat classifications described in the SWAPs to manually identify and map habitat types in the field. The vegetation types indicated in the USGS GAP land cover mapping

EXAMPLE: On-the-Ground Wildlife Habitat Mapping

This map uses classifications from the New Hampshire SWAP.

(Adapted from Van de Poll 2008.)



See page 95 for color enlargment

can be helpful for this process by providing preliminary delineations that can be modified, based on fieldwork.

Habitats described in SWAPs tend to be generalized (for example, spruce-fir forest, cove forest, early successional areas) and are meant to capture suites of species. In certain cases, it may be appropriate to also map more specific habitat features for individual priority wildlife species. For example, in North Carolina's SWAP, low-elevation cliffs and rock outcrops are identified as a habitat type for the green salamander (state endangered), eastern woodrat (state special concern), and the timber rattlesnake (state special concern) in the Southern Appalachian Ecoregion. Yet, the specific types of low-elevation cliffs and rock outcrops used by each of these species can be quite different. A biologist conducting an inventory in this area may wish to differentiate between rock outcrops that appear suitable for green salamander breeding from those that appear suitable for the eastern woodrat, or for maternity sites for the timber rattlesnakes.

Species Inventories

The objective of a species inventory for land protection applications is to document occurrences of plant and wildlife species, particularly priority species. However, there are practical issues to consider when choosing which species, or groups of species to focus on during fieldwork. Some species are more readily observable over a wider range of seasons and conditions or are more readily recognizable than others. Also, some species groups have been better studied than others, and their conservation priority and protection and management needs are better understood. Thus, certain species groups are more amenable to inventory work and more useful for informing land protection projects.

During an inventory, the biologist should record all recognizable species observed during the course of fieldwork, but the primary goal should be to document as many *priority* species as possible, to the extent season, time, and conditions permit. This is done by searching for those priority species with the highest potential to occur that are readily observable without time-consuming techniques, within the appropriate habitats.

Targeted species searches are usually done by first creating a list of potential priority species for the project based on occurrences already known from the property or nearby areas (such as those identified in the Natural Heritage information request report, SWAPs, or bird checklists for the area). Then the biologist reviews habitat descriptions for those species and identifies potential habitat areas on the property based on aerial photographs, topographical and land cover maps, and other mapped information, or by direct observation in

(Photo by the author.)

the field (such as during the habitat mapping process). Next, the biologist uses this information to focus searches in the areas of the property with the highest probability of containing priority species.

When a priority species is found (or evidence of its occurrence, such as tracks or scat), its location should be mapped (perhaps recorded with a Global Positioning System unit, or GPS) and basic information related to relative abundance and viability should be quickly noted, such as the number of stems in a patch of rare plants, extent of the patch, number of animals observed during a recorded amount of time, and evidence of reproduction (flowers, seed heads, eggs, juveniles, nests), disease, predation, and so on. Natural Heritage Programs often request this type of information for reports on rare species occurrences.

Species inventories will usually need to be conducted by qualified biologists. Detailed information on identification and sampling methods is beyond the scope of this book; however, such references are easily found by searching the Internet. The following is a review of the sorts of activities and practical considerations involved during species inventories. Field workers should be sure to have the appropriate scientific collection permits, particularly when targeting state and federally protected species or when trapping, handling, or otherwise potentially harassing animals, even if no collecting is anticipated.

Plants

Plants, particularly vascular species, tend to be the most diverse group of readily observable organisms on a property, and a typical property can have hundreds of species. Plants are well studied, and most regions have higher numbers of rare plants than rare animals. Plus, they don't run away like animals do, lending themselves nicely to biological inventories, and botanical surveys can often be done simultaneously with natural community mapping. Thus, botanical inventories can be very productive for determining conservation values and for informing protection and management efforts. However, some plants can only be identified during the growing season or when the plant is flowering or fruiting. Others are not easily recognizable in the field, even by experts, and will need to be collected and identified using magnification and botanical keys.

Plants don't run away like animals do, lending themselves nicely to biological inventories, and botanical surveys can often be done simultaneously with natural community mapping.

Birds

Perhaps the most practical and useful group of animals to target during species inventories is birds, which tend to be the most diverse and easily observable vertebrate wildlife on a property. As discussed in chapter three, there are numerous priority assessments and conservation plans available for birds, and under the right conditions and season (usually spring), a thorough list of breeding birds can be documented in as little as a single morning (depending on the size of the property) by an investigator able to identify birds by sight, song, and call.

Since birding is a popular recreational activity, there is also a large pool of potential volunteers (such as from the local Audubon Society chapter). Multitalented biologists can easily tally bird species while doing other tasks, such as natural community or plant inventories. Rare or secretive target bird species can sometimes be observed by playing amplified recordings of their songs and calls within the appropriate season, habitats, and times of day (although this should be done sparingly so as not to harass breeding birds). Other more standardized and quantitative sampling methods include mist netting and point counts, where the observer stands in one place while counting all the birds heard and seen within a certain distance and period of time (usually three to ten minutes). However, simply counting the number of each bird species observed during the field visit, while visiting as many habitats as possible, is usually adequate for basic inventory purposes and maximizes the number of species detected.

Birding clubs, such as the local Audubon Society chapter, are potential sources of qualified volunteers for conducting bird inventories. (Photo by Lishka Arata.)

Bird prioritization schemes (such as PIF or Natural Heritage Programs' conservation status rankings) typically apply to breeding occurrences, thus breeding bird surveys in spring are the most useful for determining conservation values on a property. However, bird surveys during other seasons can be useful as well. For instance, documenting migratory use or overwinter use of the property by birds, particularly by waterfowl and shorebirds on properties with large wetland features, can be useful for documenting conservation values substantiated by conservation plans administered by the USFWS Division of Bird Habitat Conservation–Joint Ventures Program, such as the North American Waterfowl Management Plan and U.S. Shorebird Conservation Plan. This information is also very important if applying for North American Wetland Conservation Act grants.

Amphibians

As with most animals, many amphibian species are more detectable in certain seasons. Aquatic breeding species of amphibians can be detected by dip netting, seine netting, searching for their eggs, using aquatic funnel or minnow

Searches for eggs is one method to inventory pond breeding amphibians. (Photo by Jonathan Mays.)

traps, or—for some frogs and toads—listening for their breeding calls during the appropriate season and weather conditions.

Other species can be surveyed by turning over cover objects such as rocks and logs, driving roads or searching the ground with a flashlight on warm, wet nights, or by using pitfall traps (deep and narrow buckets or cans buried flush with the surface of the ground where animals fall in but can't jump out). Searches for terrestrial and stream-dwelling salamander species can be a productive inventory activity, particularly in regions of the country with high numbers of rare and endemic species, such as the Pacific Northwest and southeastern states (especially the southern Appalachians).

Reptiles

Snakes and lizards can be surveyed in appropriate seasons by searching basking areas during the appropriate time of day, turning over cover objects, raking through leaf litter and debris, or using pitfall traps. Certain turtles can also be detected by searching basking areas, by probing in muddy or boggy areas, or by setting various live-capture turtle traps. Carefully driving roads on cool nights when reptiles are drawn to the road's warmth is also a useful inventory method.

Lizards can be surveyed in appropriate seasons by searching basking areas during the appropriate time of day. (Photo by the author.)

Carnivores can be documented by direct observation, by searching for tracks and scat, or with the use of motion-detecting game cameras. (Photo by the author.)

Mammals

Larger mammals and some smaller mammals can sometimes be observed directly, but more often by sign, such as tracks or scat. Carnivores are also commonly inventoried with baited, motion-detecting game cameras. Surveying small mammals (such as shrews, moles, voles, and other rodents) usually requires trapping them with Sherman traps (a small aluminum live trap), snap traps, or pitfall traps. Small mammal trapping can be laborious and time consuming and usually requires frequent return visits by the biologist to check and reset traps. Thus, the costs (time and money) and benefits (number of priority species detected) of trapping compared with focusing fieldwork on other, more easily detected species groups should be considered.

Fish

Typical fish-sampling methods include the use of dip nets, aquatic funnel traps, seine nets, snorkeling, and electro-fishing. Consult state wildlife agencies because they may already have fish inventory data for the water bodies on your project. Fish inventories using electro-fishing techniques require specialized equipment and personnel and can be expensive. As with small mammal trapping, the number of priority species likely to be detected, compared to the costs, should be considered.

Electro-fishing is an effective inventory method for fish but requires specialized equipment. **(Photo by the author.)**

Butterflies and Dragonflies

Butterflies and dragonflies (including skippers and damselflies) can be surveyed by searching appropriate habitats during the hours of favorable weather (sunny with low wind speeds) in the appropriate season. They are usually directly observed on the wing with close-focus binoculars or by capture with a hand net. As with birds, they can be quite diverse on a property and can be a very productive group to target, particularly during the middle, hotter portions of the day when birds are less detectable.

Other Species Groups

Other species groups such as moss, lichens, fungi, and many invertebrates (besides butterflies and dragonflies) represent more of a challenge and are less frequently targeted during basic biological inventories. When occurrences of priority species from these groups can be identified, it's obviously very useful. However, these species are less well studied and there are fewer biologist qualified to search for them. Moreover, the relative conservation status and priority of species from these groups may not be well established in some states.

Finding the Right Person for the Job

The majority of land trusts do not have field biologists on their staff or board, and biological inventories usually entail hiring a consultant, but volunteers may be available. Professors, graduate students, or student interns from local universities are a potential source. The local botanical or herpetological society or chapter of the Audubon Society may provide excellent volunteers. Using volunteers is a way to cut costs and engage the local community. However, there is the risk that the results will be less predictable, lower quality, and slower in coming. Volunteers may also require significant staff time to organize. And keep in mind, just because someone is willing to volunteer doesn't mean he or she is highly qualified. Land trusts should interpret the work of volunteers and college interns within the context of their background and experience.

Another thing to consider is that field biologists tend to specialize and differ in their expertise. For example, a typical wildlife biologist may be qualified to assess a property in terms of managing habitats for the production of game species like white-tailed deer, turkey, and grouse but may not have experience conducting inventories of nongame species such as salamanders, butterflies, and songbirds. A forester may be qualified to map the timber stands on the property and make silvicultural recommendations but may not have experience applying the natural community classifications developed by Natural Heritage Programs and NatureServe or managing for imperiled plant species. If you crack open the local yellow pages and look up a consulting biologist, chances are that you will get someone who specializes in environmental regulatory issues and focuses on those biological attributes that are relevant to permitting, such as jurisdictional streams and wetlands and federal- and state-endangered species. Remember, the majority of priority biological features that are important to document for land trust purposes are not necessarily listed or protected, thus many environmental consultants will have little experience with them. However, such regulatory consultants are very useful for the separate purpose

(Photo by the author.)

of ensuring a landowner's compliance with environmental laws, depending on the proposed uses of the land.

For land trust purposes, the ideal inventory biologist is a widely trained field naturalist with the ability to:

1. Identify and map natural communities.
2. Identify and map habitats for priority species.
3. Recognize and conduct inventories for a variety of species groups.

Typically biologists specialize in either plants or animals, so it may be difficult to find someone who can do everything; usually the best option is an ecologist, botanist, or nongame zoologist. Biologists with field experience working in the vicinity of the project area will generally be more knowledgeable about the local flora and fauna than those from away. It's also good if the biologist has experience working for land trusts. Someone who understands the basics of the land protection process is likely to give you a more useful product. Natural Heritage Programs and TNC often hire consulting biologists and are a good source for biologist referrals.

Another consideration is the technological capabilities of the biologist. Consider if the biologist is able to submit reports in an electronic format, collect locational information in the field using GPS, create finished maps using GIS, provide digital photographs, and so on.

Getting the Most from a Biologist

When you hire a professional biologist for an on-site biological inventory, you want to make the best use of his or her time—and the best use of the contract fee—to get the information you need. That starts with good communication about the research you've already completed and a clear description of the reports you expect from his or her fieldwork.

Communicate the Project Background
Give the biologist any relevant background information that might save time and duplication of effort.

- Give the biologist the results of the off-site review process described in chapter five, particularly the results from the Natural Heritage information request.
- Provide any other natural resource related reports, such as forest management plans, wetland delineations, and so on.
- Tell the biologist what the intentions of the landowner and land trust are for the protection and management of the property. Ask him or her to inspect specific areas where the owner is considering conducting such activities as timber harvests, clearing for pasture, creating wildlife food plots, digging ponds, or building structures, roads, or driveways. This way the biologist can provide advice on any biodiversity considerations.

Communicate Your Needs to a Biologist
Ask the biologist to evaluate the property in terms of its current and potential contributions to the conservation of priority biological features. The following is an idealized list of on-site inventory objectives. The extent to which any of these are accomplished will depend on the season, the funding and time available, and the investigator's expertise:

1. Identify, map, and assess the quality of:
   - Natural community types (or NVC associations or alliances) using standardized classifications developed by the state Natural Heritage Program or NatureServe
   - Habitat types using the broad habitat classifications described in the SWAP for suites of species or narrower habitats described by other sources for individual priority species

- Priority species occurrences, targeting those species with the highest potential to occur on the project and that are readily observable during the season and timing of the visit

2. Record all recognizable species observed during the course of fieldwork.

It is also important to specify what you expect from the biologist—what the deliverables will be and what the report should contain. (See "Final Report and Mapping" section later in this chapter.)

PLAN FOR LOGISTICS

When sending a biologist in the field, be sure to make all the necessary arrangements and give the biologist everything needed ahead of time. This will save time and money and avoid problems.

1. **Make sure the biologist has adequate boundary maps for the property, preferably a USGS map with the boundary plotted on top.**
2. **Make sure to inform the biologist of any logistical and access issues:**
   - **Are detailed instructions to the field site needed?**
   - **Is four-wheel drive needed?**
   - **Are keys or combinations needed for locked gates?**
   - **Are there property managers, confrontational neighbors, potential marijuana farmers, or dogs to be aware of?**
   - **Is there cell phone service?**
3. **Tell the landowner or property manager when the biologist will visit and make sure the biologist knows whom to call if there is a problem.**

(Photo by the author.)

Potential Rare Species

In terms of deliverables, it is often helpful to have the biologist (to the best of her or his ability) provide a list of rare or priority species that potentially use the property, based on the biologist's observation of apparently suitable habitat on site and known occurrences in the vicinity of the project. He or she should describe the protections and management actions necessary to conserve those habitats, as if the habitat were occupied. Regardless of whether the species themselves have been observed on the property, this list can help document the project's conservation value and provide targets for protection and management actions.

Even with a significant survey effort, species may be present but escape detection. A species may only use the habitats on a particular property intermittently from year to year or, even when present, may not be detectable every year. A species may also go undetected during the inventory due to season, bad weather conditions, or lack of time and resources.

Given these challenges and uncertainties, and the fact that the leading threat to biodiversity is habitat loss, land trusts can stack the odds in favor of bio-

diversity by protecting apparently suitable habitat, regardless of whether it is currently occupied. This not only provides for a species if it is present, but also provides for future recovery or recolonization if it's currently absent. Obviously, confirmation of habitat use by a rare species provides more certainty and should be pursued when possible. (It may be necessary when asking a landowner to give up certain rights through restrictions in an easement.) But if a biologist thinks the habitat looks good for a rare species, the species is known to occur in nearby areas, and the landowner is amenable, why not claim it as a conservation value and protect that habitat as if it were occupied?

Even with a significant survey effort, target species may be present but escape detection.

Another benefit of identifying a list of potential priority species based on apparently suitable habitat is that it provides a target list for additional species-specific inventory fieldwork that may need to occur in follow-up visits, in a specific season, or using specific sampling techniques.

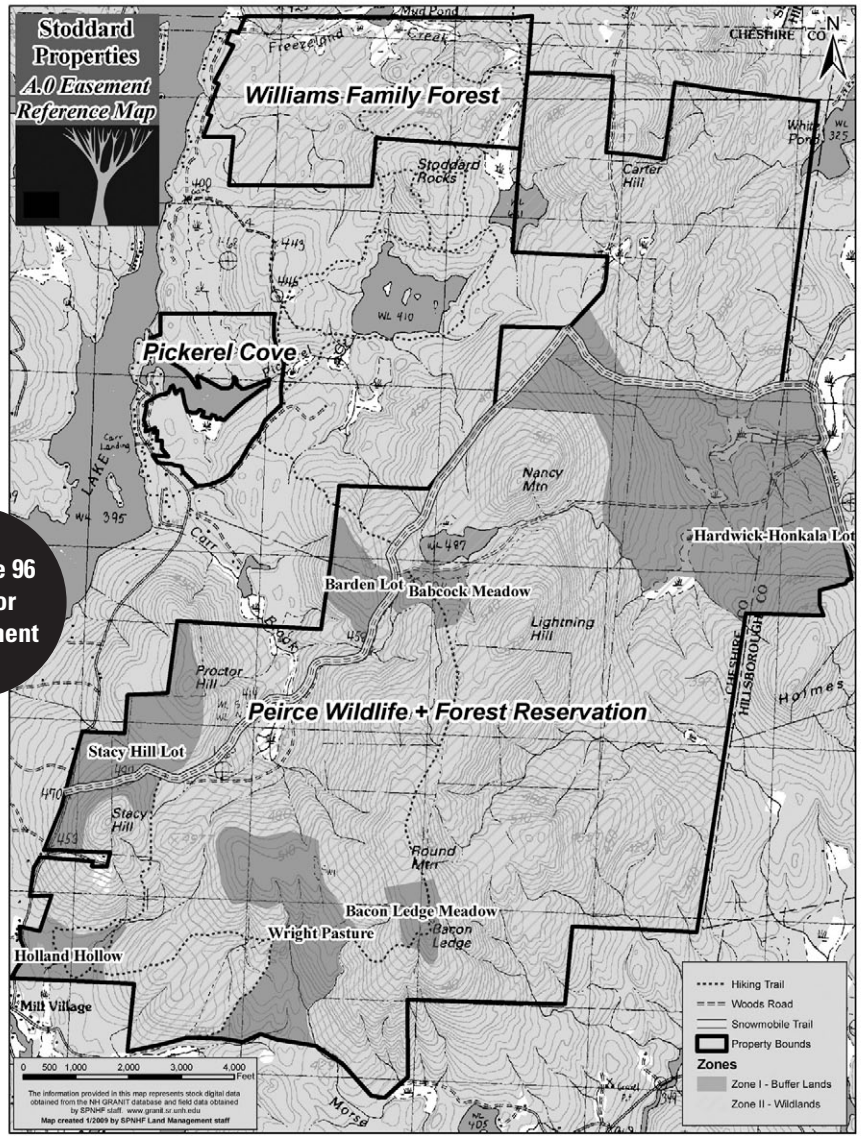
Sensitive Areas, Special Management Zones, and Buffers

Another deliverable to request from the biologist is to have him or her identify specific areas within the property that should receive special protections and/or management. These areas may contain priority features such as priority species, priority habitat, rare or high-integrity natural communities, streams, wetlands or other priority features, or concentrations of such features. This is particularly important for land trust projects where the protection of biodiversity must be balanced with uses such as farming, ranching, forestry, or limited development on the same property.

An easement document may address this situation by delineating different zones on the property subject to different sets of restrictions, such as highly restricted areas for biodiversity protection (also called forever wild zones, natural areas, environmentally sensitive areas, or special management zones) and less restricted areas for compatible uses such as commercial forestry (compatible use zones). Sensitive area mapping can also provide a constraint map for limited development or conservation development projects (Milder 2006), allowing planners or landscape architects to locate building envelopes, roads, driveways, and so forth in the least sensitive areas and allowing land trusts to determine which areas are priorities for protection and what these protections should entail.

Ensuring the protection of priority biological features can involve protecting more area than where the feature itself occurs; such features usually need to be buffered from incompatible uses on adjacent areas. For example, conservation

EXAMPLE: Designating Multiple Zones of Use in a Conservation Easement



See page 96 for color enlargement

Prior to drafting a conservation easement to protect the Peirce Wildlife and Forest Reservation (a property owned by the Society for the Protection of New Hampshire Forests), detailed biological and timber stand inventories were conducted to determine which areas were most appropriate for sustainable forestry or protection as wildlands. Based on this information, the conservation easement designates special management zones, each subject to different restrictions and permitted uses. In this map, Zone II, or wildlands, are highly restricted areas for biodiversity protection, and Zone I, or buffer lands, are less restricted areas for compatible uses such as commercial forestry. (From the Society for the Protection of New Hampshire Forests.)

easements are often placed on jurisdictionally delineated wetlands as part of mitigation or development projects. Simply using the jurisdictional wetland delineation boundaries as the easement area boundaries (or special management zone boundaries within an easement area) without securing adequate buffer protections in the surrounding upland areas may not actually protect the ecological processes that support the wetland or its habitat values. For instance, digging a pond in an upland area adjacent to a jurisdictional wetland boundary can alter the subsurface hydrology, effectively draining the wetland. Placing a building envelope adjacent to a jurisdictional wetland boundary could destroy habitat for imperiled plant species that grow in the transition zone (or ecotone) between wetlands and uplands.

Ensuring the protection of priority biological features can involve protecting a larger area than where the feature itself occurs.

The necessary widths of and restrictions within buffers vary regionally and depend on the features you are trying to protect. Protecting a narrow, vegetated buffer along a creek or stream may help protect water quality, but a much larger vegetated buffer may be needed to protect riparian habitat features for rare animals and plants. Protecting habitat for rare vernal pool-breeding amphibians (like certain salamanders) may actually require protecting a much larger life zone surrounding the pool (the terrestrial habitat where the animal spends most of its life) in addition to the pool area itself.

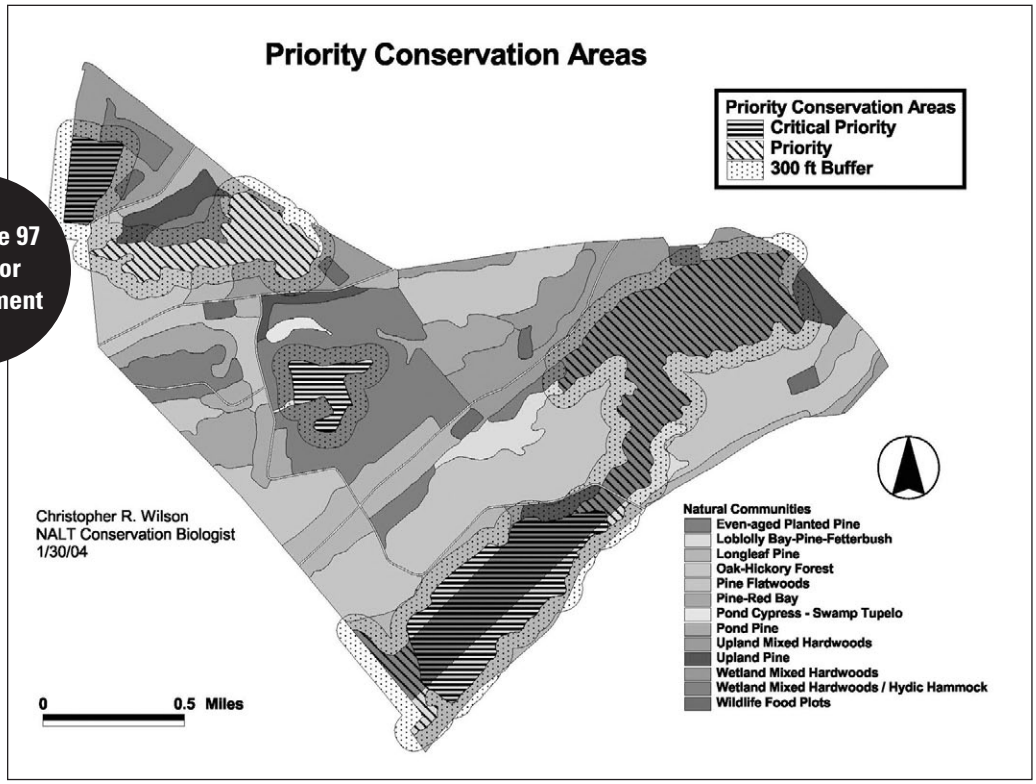
In addition to buffer areas, intervening areas between priority features may need to be protected as small-scale linkage areas to provide connectivity and prevent habitat fragmentation. Linkage areas may also provide connectivity to areas outside the project, such as adjacent protected properties. Priority features, buffer areas, and linkage areas may be combined and treated as the easement area itself (excluding the other areas of the property from the easement), combined as a single special management zone within a larger easement area, or treated separately as multiple types of special management zones in a single easement.

Determining the boundaries of the easement area, or special management zones within the easement, may require negotiations between the land trust and the landowner. In such cases, it is helpful if sensitive areas are categorized according to their relative conservation priority. For instance, the most important features (such as G1–G2 Element Occurrences) can be captured in areas categorized as critical priority, whereas the more common or less sensitive priority features can be captured in areas categorized as basic priorities.

The biologist should be asked to identify sensitive areas requiring special protections and management, provide maps depicting such areas, categorize

EXAMPLE: Map of Priority Conservation Areas on a Project

(From Sheepscott Valley Conservation Association.)



See page 97 for color enlargement

This map shows sensitive areas categorized by their relative conservation priority. Such a map is useful when negotiating the boundaries of an easement area, or the boundaries of special management zones within an easement area. **(Map by the author.)**

their relative conservation priority, and suggest restoration, protection, and management needs within them.

Natural Heritage Program Reporting

After the fieldwork is completed, and with landowner permission, the biologist should report all rare species and natural communities (Element Occurrences) to the Natural Heritage Program. Most Natural Heritage Programs provide a field survey form for reporting such observations, and these should be included in the final biological report as well. Reporting such observations helps scientists understand the distribution and status of rare species and maximizes the conservation benefit of survey efforts.

Mail to:
California Natural Diversity Database
Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95811
Fax: (916) 324-0475 email: CNDDB@dfg.ca.gov

For Office Use Only
Source Code _____ Quad Code _____
Elm Code _____ Occ. No. _____
EO Index No. _____ Map Index No. _____

Date of Field Work (mm/dd/yyyy): _____

Reset

California Native Species Field Survey Form

Send Form

Scientific Name:

Common Name:

Species Found? ☐ Yes ☐ No _____ If not, why?
Total No. Individuals _____ Subsequent Visit? ☐ yes ☐ no
Is this an existing NDDB occurrence? _____ Yes, Occ. # ☐ no ☐ unk.
Collection? If yes: _____ Number _____ Museum / Herbarium

Reporter: _____
Address: _____
_____
E-mail Address: _____
Phone: _____

Plant Information
Phenology: _____% vegetative _____% flowering _____% fruiting

Animal Information
_____ # adults _____ # juveniles _____ # larvae _____ # egg masses _____ # unknown
☐ wintering ☐ breeding ☐ nesting ☐ rookery ☐ burrow site ☐ other

Location Description ***(please attach map AND/OR fill out your choice of coordinates, below)***

County: _____ Landowner / Mgr.: _____
Quad Name: _____ Elevation: _____
T____ R____ Sec ____, ____ ¼ of _____¼, Meridian: H☐ M☐ S☐ Source of Coordinates (GPS, topo. map & type): _____
T____ R____ Sec ____, ____ ¼ of _____¼, Meridian: H☐ M☐ S☐ GPS Make & Model _____
DATUM: NAD27 ☐ NAD83 ☐ WGS84 ☐ Horizontal Accuracy _____ meters/feet
Coordinate System: UTM Zone 10 ☐ UTM Zone 11 ☐ *OR* Geographic (Latitude & Longitude) ☐
Coordinates:

Habitat Description (plants & animals) *plant communities, dominants, associates, substrates/soils, aspects/slope:*
Animal Behavior *(Describe observed behavior, such as territoriality, foraging, singing, calling, copulating, perching, roosting, etc., especially for avifauna):*

Please fill out separate form for other rare taxa seen at this site.

Site Information Overall site/occurrence quality/viability (site + population): ☐ Excellent ☐ Good ☐ Fair ☐ Poor
Immediate AND surrounding land use:
Visible disturbances:
Threats:
Comments:

Determination: *(check one or more, and fill in blanks)*
☐ Keyed (cite reference): _____
☐ Compared with specimen housed at: _____
☐ Compared with photo / drawing in: _____
☐ By another person (name): _____
☐ Other: _____

Photographs: *(check one or more)* Slide Print Digital
Plant / animal ☐ ☐ ☐
Habitat ☐ ☐ ☐
Diagnostic feature ☐ ☐ ☐
May we obtain duplicates at our expense? yes ☐ no ☐

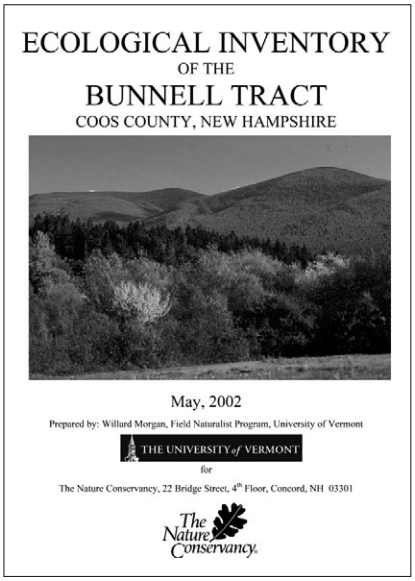
DFG/BDB/1747 Rev. 6/16/09

Many Natural Heritage Programs provide field survey forms for reporting field research findings, like this one for the California Natural Diversity Database. **(From California Natural Diversity Database: www.dfg.ca.gov/biogeodata/cnddb/submitting_data_to_cnddb.asp.)**

Final Report and Mapping

As a final product, the biologist should provide a written report that contains:

1. Useful results from the preliminary off-site reviews of biological conservation values.
2. Maps (including GIS layers) and descriptions of natural communities, habitats, and priority species locations determined from on-site fieldwork.
3. A list of potential priority species for the property based on field observations of apparently suitable habitat and known occurrences near the project.
4. Lists of all species observed.
5. Descriptions of protection and management needs:
   - What areas of the property are priorities for special protections and management, including sensitive areas, special management zones, and buffer areas?
   - What specific protections, such as restrictions in an easement or management actions (including restoration), are needed to maintain or enhance the identified priority conservation features?
6. Descriptions of future fieldwork and research needs that may require specialized techniques or specific seasons.
7. Completed field survey forms submitted to the Natural Heritage Program for observations of rare species and natural communities.



SEVEN

Using Biological Assessments to Protect Biodiversity

Once the biological assessment and report are complete, it's time to put that information to work!

Project Selection and Fundraising

The off- and on-site biological assessment process identifies the potential conservation values of a project and what protection and management actions are needed. The land trust should first use this information to reevaluate its interest in pursuing the project and determine if the site meets its acquisition criteria. While there are many factors to consider when selecting a project (*Land Trust Standards and Practices*, standard 8), the biological analysis helps land trusts determine if:

1. The conservation values are significant and can be realistically protected.
2. There is a demonstrable public benefit to the project.
3. The project supports the mission of the land trust.

Assuming the land trust decides to proceed with the project, it often must raise funds for the purchase of a conservation easement or fee title to the property, as well as a stewardship endowment. Fundraising appeals and grant applications are usually stronger with information from biological assessments. Substantiated biological information can dramatically reinforce the importance of the project by providing validation of its conservation values and by emphasizing that the project has a public benefit and is a strategic use of funds. Some grants may specifically require information on the property's priority species and natural communities and habitats or how the project contributes to the goals of a landscape-scale conservation plan.

It Pays to Know: Biological Information Can Help Fundraising
The Northeast Wilderness Trust (NWT) needed to raise almost $2 million to acquire a fee title to a property in central Maine that was adjacent to, and

Alder Stream Preserve. (Photo by Jim Northup.)

complemented, several other large land protection projects of ecological significance. To ensure the property's significant biological features were protected and to bolster fundraising efforts, the NWT worked with Sweet Water Trust's staff biologist to compile existing biological data for the area, conduct additional biological inventories, and visit the property with an ecologist from the Maine Natural Areas Program.

The off-site review of existing biological data revealed that the property contained known occurrences of several state rare animals and was identified in The Nature Conservancy (TNC) Ecoregional Portfolio. On-site biological inventories on the property and the surrounding project areas resulted in the discovery of new rare animal occurrences, a new county record for a state rare plant, and several new records of rare and high-integrity natural communities. The information was critical to obtaining a $1 million grant through the North American Wetland Conservation Act.

Largely as a result of this new biological information, the project area was designated as a focus area under the State Wildlife Action Plan (SWAP), which gave the NWT access to an additional $200,000 of grant funding for which it was previously ineligible and greatly bolstered the organization's chances of obtaining funds from other grantors.

"The detailed biological information collected about the property was absolutely essential in raising two-thirds of our project budget and extremely helpful in raising the rest," said NWT executive director Jim Northup.

Drafting Conservation Easement Language for Biodiversity Protection

A conservation easement is a voluntary, legal agreement negotiated between the landowner and the land trust that restricts certain uses of the land, such as development, to achieve certain conservation goals, such as the protection of farmland, working forests, and/or biodiversity. While some easements are temporary, most (including those that qualify for charitable tax deductions) are permanent and bind the property owner (and his or her successors) "in perpetuity." For easements where conserving biodiversity is the primary goal, the biological analysis and inventory report is critical to the negotiation and drafting of the easement because it identifies the priority biological attributes of the property and specifies what uses are compatible or incompatible with those attributes.

There are many resources available that provide guidance on drafting conservation easement documents, and many models are available for different types of projects, such as farmland protection, working forests, and water quality protection. Much of an easement document will be standardized boilerplate language and may be influenced by certain state statutes. Other sections are more flexible and can be tailored to the circumstances of the individual project, such as the conservation purposes, restrictions and reserved rights sections, and the whereas clauses (discussed in the next paragraph). Sweet Water Trust, a grant-making foundation dedicated to wildlands conservation in the northeastern United States, collaborated with a number of experts with legal, biological, and stewardship backgrounds to create a "forever wild" model easement with language specifically tailored for the protection of biodiversity, natural area, and wildland values. This model also provides an excellent example of how the findings of a biological analysis can be incorporated into conservation easement language. The Sweet Water Trust's *Model Conservation Easement: To Protect Land as Wild* can be downloaded from its website (www.sweetwatertrust.org).

RESOURCES FOR DRAFTING CONSERVATION EASEMENTS

- ***The Sweet Water Trust Model Conservation Easement: To Protect Land as Wild*** **(www.sweetwatertrust.org).**
- ***The Conservation Easement Handbook*****, second edition, by Elizabeth Byers and Karin Marchetti Ponte (Washington, D.C.: Land Trust Alliance and The Trust for Public Land, 2005).**
- ***Protecting Surface Water Quality with Conservation Easements: A Process Guide for Land Trusts, Landowners, and Public Agencies*** **by Brenda Lind (Washington, D.C.: Land Trust Alliance, 2004).**
- ***Working Forest Conservation Easements: A Process Guide for Land Trusts, Landowners, and Public Agencies*** **by Brenda Lind (Washington, D.C.: Land Trust Alliance, 2001).**

Conservation easements usually begin with a list of recitals or whereas clauses that contain factual descriptions of the property and provide the background, legal foundation, and public benefit rationale for the conservation easement and its restrictions. These clauses should clearly describe each

conservation value so that all current and future stakeholders (including the courts) will have clear insight into the reasons the land was initially protected, so as to avoid future problems related to interpretation and enforceability of the easement.

Whenever possible, the conservation values stated in the whereas clauses should cite applicable governmental policies or programs designed to promote their protection. This not only makes the case for meeting the conservation purposes test for the deductibility of charitable donations of conservation easements under state and federal tax laws, it also substantiates the public benefit of the project, providing a public policy rational for enforcing the easement against future challenges (Byers and Ponte 2005). Thus, whereas clauses should emphasize public and ecological values by, for example, specifically mentioning if the property contains priority features or geographic areas identified by government supported programs such as the SWAP, the federal and state Endangered Species Act (ESA), Partners in Flight (PIF), U.S. Fish & Wildlife Service (USFWS) Joint Ventures, the Clean Water Act, Natural Heritage Programs, and so forth. Other important conservation programs may not technically be government supported yet are still designed to protect species and natural communities that are priorities identified by government programs. For example, TNC Ecoregional Assessments are largely designed to conserve priority species and natural communities identified by Natural Heritage Programs, which are usually government supported. Thus, such programs should also be mentioned in the whereas clauses when appropriate.

Here are examples of how whereas clauses can be drafted using the information gathered during the biological assessment process described in chapters five and six:

Indicate if the property is in a geographic area designated as a conservation priority by a government-sponsored conservation planning program (such as SWAPs or Comprehensive Wildlife Conservation Strategies) or other conservation planning initiatives (such as TNC Ecoregional Assessments) that target the protection of species or habitats recognized as conservation priorities by government agencies:

> *WHEREAS, the Property lies within the Alder Stream Focus Area, an area of statewide ecological significance identified in the Maine Department of Inland Fisheries and Wildlife's Comprehensive Wildlife Conservation Strategy.*
>
> *WHEREAS, the Property lies within the Paul Bunyan Forest Matrix Block, a 27,000 acre area of contiguous forest with few roads and intact interior forest ecosystem features, designated as a Tier-1 con-*

servation target in The Nature Conservancy's 2006 Conservation Assessment for the North Appalachian/Acadian Ecoregion.

WHEREAS, the Property lies within an area identified as important for ecoregional connectivity according to a 2008 report titled "The Northern Appalachian/Acadian Ecoregion: Priority Locations for Conservation Action" by Two Countries–One Forest, a major Canadian-U.S. collaborative of conservation organizations, researchers, foundations, and conservation-minded individuals.

Indicate adjacency and proximity to public and nonprofit conservation lands (a conservation value recognized by the IRS Treasury Regulations as a factor in evaluating significant public benefit):

WHEREAS, the Property is adjacent to, and thus increases the ecologically effective size of, the No Name Wilderness Area of the White Mountain National Forest and lies between, and in close proximity to, three other conserved properties protected by The Nature Conservancy, Northeast Wilderness Trust, and The Society for the Protection of New Hampshire Forests; and . . .

Emphasize specific biological features on the property, particularly those identified as conservation priorities by government programs:

WHEREAS, the Property supports breeding populations of at least ten (10) species of birds recognized as conservation priorities by Partners in Flight, a consortium of governmental, academic, and nonprofit organizations dedicated to landbird conservation in North America.

WHEREAS, the Property supports breeding populations of at least three (3) species of birds listed in the U.S. Fish & Wildlife Service's "Birds of Conservation Concern 2008" report for the Atlantic Northern Forests Bird Conservation Region, including rusty blackbird, least bittern, and olive-sided flycatcher.

WHEREAS, the Property contains populations of at least twenty-three (23) Species of Greatest Conservation Need identified in the Maine Department of Inland Fisheries and Wildlife's Comprehensive Wildlife Conservation Strategy.

WHEREAS, the Property contains rare natural communities tracked by the Maine Natural Areas Program, including the State Imperiled (S3) Hardwood River Terrace Forest and the State Rare (S2) Bluejoint Meadow and an Exemplary (B-ranked) occurrence of an Unpatterned Stream Drainage Fen Ecosystem.

Because conservation easement documents are a public record, you may not wish to mention certain rare species by name that are susceptible to poaching or collection (rare orchids, butterflies, or herpetiles for example):

> *WHEREAS, the Property supports populations of State Imperiled (S2) and State Rare (S3) plant species tracked by the Maine Natural Areas Program and State Threatened animal species listed under the Maine Endangered Species Program administered by the Maine Department of Inland Fisheries and Wildlife.*

Mention priority habitats or other conservation targets identified in conservation plans, such as SWAP and TNC Ecoregional Assessments:

> *WHEREAS, the Property contains Significant Wildlife Habitats described in the Maine Department of Inland Fisheries and Wildlife's Comprehensive Wildlife Conservation Strategy including high and moderate value Freshwater Waterfowl/Wading Bird Habitat, high and moderate value Deer Wintering Areas, and significant Vernal Pools.*
>
> *WHEREAS, the Property contains Critical Floodplain and Priority 1 Riparian Ecosystems identified in The Nature Conservancy's 2006 Conservation Assessment for the North Appalachian/Acadian Ecoregion.*

Also mention *potential* priority species based on apparently suitable habitat or species that use the property seasonally or intermittently:

> *WHEREAS, the Property contains apparently suitable habitat for fifteen (15) animal species tracked by the Natural Heritage Program and known to occur in nearby areas.*
>
> *WHEREAS, the Property provides or potentially provides suitable habitat for many wide-ranging wildlife species of conservation interest including bobcat, American marten, black bear, moose, Canada lynx, and eastern wolf.*

The justification for an easement should be broader than the existence of one or two rare species, which might disappear or recover. Mention other plants and animals not yet considered imperiled but whose decline is well documented, or exemplary occurrences of otherwise common natural communities, or habitat features that are somewhat limited or uncommon or known to be in decline:

WHEREAS, the Property, which exists in a substantially undisturbed natural state, harbors a diversity of plant and animal life in an unusually broad range of habitats for a property of its size, including a cobble barrier beach and associated wetlands, nesting ledges, spruce-fir forest, and open meadows.

Mention water quality benefits, particularly those substantiated under Clean Water Act legislation and similar state laws:

WHEREAS, the Property contains seven (7) miles of Rocky Creek and its tributary streams and 115 acres of wetlands, which are under the jurisdiction of the Army Corps of Engineers subject to Section 404 of the Clean Water Act and the Maine Department of Environmental Protection subject to Chapter 310 of the Maine Natural Resources Protection Act.

WHEREAS, the property will protect a significant portion of the Rocky Creek watershed in a naturally forested condition, require compliance with best management practice for water quality protection, and protect a 300-foot forested buffer along all streams and wetlands, thereby contributing to the water quality and protection of significant aquatic habitat within Rocky Creek.

Perhaps the most important section of a conservation easement is the conservation purposes statement. It provides the touchstone for interpreting and enforcing the terms of the easement (Byers and Ponte 2005). There may be multiple purposes for a single easement, or in some cases, different purposes will apply to different zones of the easement area. Model easements provide examples of purpose language for different types of projects (farming, ranching, forestry, historical). Sweet Water Trust's model provides the following conservation purpose language for biodiversity-, natural area-, and wilderness-oriented applications.

PURPOSE

It is the purpose of this Easement to protect the Property as Forever Wild, to safeguard biological diversity by protecting the environments and ecological processes, including those described in the Whereas Clauses above, that support viable populations of native plants, animals, and other organisms, and to preserve and restore the wild qualities and natural beauty of the Property as free from human disturbance, noise, artificial light, and pollution as practicable.

In addition to informing the recitals section of a conservation easement, the biological report information is critical to drafting meaningful restrictions and reserved rights. First, the restrictions and reserved rights must actually protect the conservation values stated in the recitals. Make sure to incorporate the protection and management recommendations from the biologist's report when drafting the restrictions and reserved rights, and if sufficient protections cannot be achieved during the negotiation of easement language, then those conservation values should be removed from the recitals. For these reasons, it is highly recommended to have a biologist review a draft of the easement document to ensure consistency between the recitals and the restrictions and reserved rights sections.

Some conservation values, such as grassland bird habitat, fire- or flood-dependent natural communities, or natural communities that are highly susceptible to invasion by invasive species, may require proactive management to maintain. Because easements are primarily a prohibitive instrument (rather than a proactive management instrument), claiming such successional or potentially temporal habitats as protected conservation values should be done cautiously, and additional conservation values that are less temporal should be added to the recitals as much as possible. Projects that need extensive active management to maintain the conservation values should be considered for fee acquisition.

DRAFTING EASEMENTS FOR A CHANGING WORLD

What if the significant biological conservation values of a conservation easement project degrade, disappear, or cease to be recognized as conservation priorities in the future? For example, an endangered species becomes extinct, the composition of a natural community changes due to climate change, or a rare species recovers and becomes common? Conservation easement projects usually contain a variety of significant conservation values, and these values should all be carefully considered and described when drafting easement documents. This way, even if some of the conservation values become obsolete, others will still justify the continued defense of the easement. For example, even if a rare species disappears, the property can still serve other significant conservation purposes, such as the protection of water quality, supplementing the effective size of adjacent or nearby conservation areas, or providing recreational, scenic, or other open space values.

Preparing the Baseline Documentation Report

Baseline Documentation Reports (BDRs) are recommended for all easement and fee properties acquired by land trusts (*Land Trust Standards and Practices*, standard 10), and the IRS requires BDRs for conservation easements for which the donor intends to claim an income tax reduction. BDRs should provide "documentation sufficient to establish the condition of the property at the time of gift" (Treas. Reg. 1.170A-14[g][5][i]) and generally serve three primary functions:

1. Provide evidence to substantiate the conservation values and purposes claimed in the easement.
2. Establish the condition of the resources on the property that may be affected by the restrictions and reserved rights in the easement (providing a baseline condition necessary for monitoring future compliance with the terms of the easement).
3. Serve as a summary file for organizational use (providing background information on the project purpose, acquisition history, and so on, so that stewardship personnel can efficiently review the project information).

Biological reports can contribute to each of these functions. They are particularly useful for substantiating the conservation values of a project (*Land Trust Standards and Practices*, practice 10B), and they provide maps and descriptions of the "vegetation and identification of flora and fauna (including, for example, rare species locations, animal breeding and roosting areas, and migration routes)" and "distinct natural features (such as large trees and aquatic areas)" as recommended in the Treasury Regulations (Sec. 1.170A-14[g][5][i][B]).

Biological reports should be used to supplement a baseline documentation report, but not as the report itself.

However, a lot more information is needed for a BDR that is not covered in a biological report, particularly information regarding man-made improvements (roads, driveways, structures, fences, condition of property boundaries, etc.) and other information relevant to compliance monitoring and stewardship. Thus, biological reports should be used to supplement a BDR, but not as the BDR itself. The biologist can also be asked (or hired) to create a BDR for the property. However, baselines are best prepared by people who have experience with easement enforcement and stewardship, and the biologist's experience in these areas should be considered.

Developing a Management Plan

According to *Land Trust Standards and Practices* (practice 12C), land trusts are required to prepare management plans for properties they own. For properties where the land trust simply holds the conservation easement (not the fee title), management plans may or may not be required. If they are required by the easement, it is usually the landowner's (not the easement holder's) responsibility to prepare the plan and conduct property management. Depending on the

terms of the easement, the management plan may or may not require the easement holder's review or approval or require periodic revisions.

Biodiversity-focused management plans use the results from biological assessments to identify and prioritize conservation targets on the property (species and natural communities, habitats, etc.). Such plans will typically identify and rank the threats to these targets (altered fire regimes, invasive plants, inappropriate grazing, or the potential exercise of a reserved right under the easement), actions to be taken to ameliorate these threats, and who will perform them. Plans may also include work schedules and budgets.

More sophisticated plans will specify quantitative goals and measurable indicators to monitor success and inform adaptive management. They may measure the extent of actions taken (e.g., acres of shrubs mowed) and the resulting response of a conservation target (e.g., percent increase in the population of a rare grassland bird). However, management plans for most land trust projects address a wider range of objectives besides maintenance of biodiversity, such as the maintenance of roads, boundaries, and gates; posting signs; conducting timber harvests, and so on. When a management plan includes biodiversity-oriented goals, the information from the biological assessment is critical.

While it is relatively straightforward to protect biodiversity by using a conservation easement to restrict uses of the land, it is more difficult to compel a landowner to develop and carry out a management plan (particularly one designed for a noncommercial purpose, such as maintaining biodiversity). However, easements can be (and often are) written to require the owner to produce a management plan as a condition of exercising certain reserved rights that (if not done correctly) have the potential to negatively affect the conservation values or purposes of the project, such as the right to build structures, log forests, clear fields, engage in agricultural activities, or even perform ecological restoration, such as controlling invasive species or conducting prescribed burns.

Active property management to promote biodiversity values can be expensive and time consuming. Ideally, land protection projects will contain relatively intact natural communities and ecological processes such that extensive active

RESOURCES FOR MANAGEMENT PLANS

For more information on developing land management plans, see:

- ***Caring for Land Trust Properties*** **by Hugh Brown and Andrew Pitz (Washington, D.C.: Land Trust Alliance, 2009).**
- **The *Open Standards for the Practice of Conservation* created by the Conservation Measures Partnership (CMP), a partnership of conservation organizations seeking to develop better ways to design, manage, and measure the impacts of conservation actions (www.conservationmeasures.org).**
- **The CMP worked with Benetech (a technology nonprofit) to develop Miradi software (https://miradi.org). This software helps users apply the open standards to individual land conservation projects, including threat prioritization, development of objectives and conservation actions, and selection of monitoring indicators.**

management or restoration is not necessary. When proactive management for biodiversity is necessary, it is usually for controlling nonnative invasive species or compensating for the loss or alteration of an ecological process or natural disturbance regime. Thus, the most common management actions on land trust projects involve suppressing or eradicating invasive plants, restoring natural hydrology to streams and wetlands, conducting prescribed burns, or controlling the encroachment of woody vegetation into otherwise open areas, such as grasslands. Controlling recreational impacts is another common activity.

For ambitious projects that require extensive management or restoration to maintain important biological features, it may be appropriate for the land trust to pursue outright purchase of fee title to the property instead of holding an easement. Even if the current landowner is eager to manage the land for biodiversity, future landowners might not be.

Conservation Easement Monitoring

In order for land trusts to qualify as conservation easement holders, the IRS requires that they "have a commitment to protect the conservation purposes of the donation" (Treas. Reg. 1.170-A-14[c][1]). To demonstrate this commitment, the land trust must regularly interact with the owners to remind them of the easement restrictions, regularly visit and monitor the property to ensure compliance, and enforce the easement when the terms are violated. *Land Trust Standards and Practices* recommends that easements are monitored for compliance at least annually and that detailed written records of the visit are maintained by the land trust, usually resulting in a monitoring report (practice 11C). The baseline document report and previous monitoring reports are used as background information during the visit to determine what changes have occurred on the property.

RESOURCE FOR EASEMENT STEWARDSHIP

For more information on easement monitoring, see *Conservation Easement Stewardship* by Renee J. Bouplon and Brenda Lind (Washington, D.C.: Land Trust Alliance, 2008).

This type of compliance monitoring differs from the type of monitoring that biologists often equate with the term. Biologists usually think of ecological monitoring, which involves taking repeated quantitative measurements over time, such as tracking the abundance of a certain species or the vegetative structure of a natural community before and after a management treatment (effects monitoring), or over years or decades to detect long-term trends (surveillance monitoring). While effects monitoring is helpful for informing adaptive management plans and surveillance monitoring is important for advancing science, these quantitative types of monitoring are usually beyond the organizational capacity of

land trusts to perform, and easements are deliberately written to avoid such burdensome monitoring requirements. When a land trust project does involve quantitative types of monitoring, it is usually called for by a management plan (not the easement).

While easement compliance monitoring typically does not require a biologist, it is still useful to have a biologist periodically inspect an easement property to assess the general outcome of protection and management efforts and identify new or updated management needs. This may involve revisiting a rare natural community to comment on its condition; relocating a rare species or trying to find new ones; or searching for signs of overgrazing, lack of fire, shrub encroachment in grasslands, altered hydrology in wetlands, or new occurrences of invasive species. The original biological analysis and inventory report can provide a baseline and background information for this purpose.

Land trusts that are interested in conducting quantitative ecological monitoring to inform adaptive management, or for the general purpose of advancing science, should consult or collaborate with other organizations that specialize in such research, such as regional bird observatories, universities, or citizen science projects. Designing meaningful ecological monitoring programs is notoriously difficult and collaborating with experts will ensure that monitoring efforts are more productive and the results are more useful.

Conclusion

We are experiencing one of the greatest species extinction events in the earth's history and the first due to human actions. The major cause of this biodiversity crisis is habitat destruction, most of which occurs on private land. Land trusts can help conserve biodiversity by working cooperatively with willing landowners to protect significant habitat on private lands for the public good. But meaningful protection requires good information; simply placing a conservation easement on a piece of land doesn't mean that its important biological features have been protected.

Land trusts must work strategically to make the best use of funds and serve the public's interest, and for biodiversity conservation, this means focusing on species, natural communities, and landscapes that have been identified as priorities by government-supported conservation programs. The biological assessment process outlined in this handbook provides guidance on how to document such features on a property and use the information for project selection and fundraising, as well as drafting conservation easements, baseline documents, and management plans. In addition to ensuring that the biological conservation values of a land protection project are maximized, this process

can also help to defend the tax benefits for the landowner and the long-term enforceability of conservation easements.

The recent explosion in the land trust movement represents a beautiful culmination of communities realizing that a future with less nature is not a future they want, and then coming together to work cooperatively with their neighbors to save something they love—for their grandkids, for the greater good, and for nature itself. I hope this book helps.

Miles Tager

References

Aldrich, R., and J. Wyerman. 2006. *2005 National Land Trust Census Report.* C. Soto and A.W. Garnett, eds. Washington, D.C.: Land Trust Alliance.

Baillie, J. E., M. C. Hilton-Taylor, and S. N. Stuart, eds. 2004. *2004 IUCN Red List of Threatened Species: A Global Species Assessment*. Gland, Switzerland and Cambridge, U.K.: International Union for Conservation of Nature.

Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. J. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and K. Turner. 2002. "Economic reasons for conserving wild nature." *Science* 297:950–53.

Biodiversity Project. 2002. *Americans and Biodiversity: New Perspectives in 2002; Questionnaire and Topline Results for Biodiversity Project.* Washington, D.C.: Belden, Russonello, & Stewart Research and Communications.

Bryer, M. T., K. Maybury, J. S. Adams, and D. H. Grossman. 2000. "More than the sum of the parts: Diversity and status of ecological systems." *Precious Heritage: The Status of Biodiversity in the United States*. B. A. Stein, L. S. Kunter, and J. S. Adams, eds. Oxford, U.K.: Oxford University Press: 201–38.

Byers, E., and K. M Ponte. 2005. *The Conservation Easement Handbook*. Washington, D.C.: Land Trust Alliance and The Trust for Public Land.

Carsey, K., G. Kittel, K. Decker, D. J. Cooper, and D. Culveret. 2003. *Field Guide to the Wetland and Riparian Plant Associations of Colorado.* Fort Collins, Colo.: Colorado Natural Heritage Program.

CDOW (Colorado Division of Wildlife). 2006. *Colorado's Comprehensive Wildlife Conservation Strategy and Wildlife Action Plans.* Denver, Colo.: CDOW.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teagueet. 2003. *Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems*. Arlington, Va.: NatureServe.

Comer, P., K. Goodin, A. Tomaino, G. Hammerson, G. Kittel, S. Menard, C. Nordman, M. Pyne, M. Reid, L. Sneddon, and K. Snow. 2005. *Biodiversity Values of Geographically Isolated Wetlands in the United States.* Arlington, Va.: NatureServe.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* Washington, D.C.: U.S. Fish & Wildlife Service.

Dahl, T. E. 1990. *Wetlands: Losses in the United States, 1780's to 1980's.* Washington, D.C.: U.S. Fish & Wildlife Service.

Defenders of Wildlife. 2009. "Land Trust Biodiversity Survey, Winter 2006: Living Lands Project." Washington, D.C.: Defenders of Wildlife.

Dinerstein, E., D. M. Olson, D. J. Graham, A. L. Webster, S. A. Primm, M. P. Bookbinder, and G. Ledecet. 1995. *A Conservation Assessment of the Terrestrial Ecoregions of Latin America and the Caribbean*. Washington, D.C.: The World Bank.

Faber-Langendoen, D., L. Master, J. Nichols, K. Snow, A. Tomaino, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, and B. Young. 2009. *NatureServe Conservation Status Assessments: Methodology for Assigning Ranks*. Arlington, Va.: NatureServe.

FGDC, VS (Federal Geographic Data Committee, Vegetation Subcommittee). 2008. "National Vegetation Classification Standard, Version 2." Reston, Va.: FGDC.

Franklin, J. F. 1993. "Preserving Biodiversity: Species, Ecosystems, or Landscapes?" *Ecological Applications* 3:202–5.

Gawler, S., and A. Cutko. 2010. *Natural Landscapes of Maine: A Guide to Natural Communities and Ecosystems*. Augusta, Maine: Maine Natural Areas Program.

Gilpin, M. E., and M. E. Soulé. 1986. "Minimum viable populations: Processes of species extinction." In *Conservation Biology: The Science of Scarcity and Diversity*, 19–34. M. E. Soulé, ed. Sunderland, Mass.: Sinauer Associates, Inc.

Groves, C. R. 2003. *Drafting a Conservation Blueprint: A Practitioner's Guide to Planning for Biodiversity.* Washington, D.C.: Island Press.

Groves, C. R., L. Valutis, D. Vosick, B. Neely, K. Wheaton, J. Touval, and B. Runnels. 2000. *Designing a Geography of Hope: A Practitioner's Handbook for Ecoregional Conservation Planning*. Arlington Va.: The Nature Conservancy.

Gurd, D. B., T. D. Nudds, and D. A. Rivard. 2001. "Conservation of mammals in eastern North American wildlife reserves: How small is too small?" *Conservation Biology* 15:1355–63.

Hannah, L., G. F. Midgley, T. Lovejoy, W. J. Bond, M. L. Bush, D. Scott, and F. I. Woodward. 2002. "Conservation of biodiversity in a changing climate." *Conservation Biology* 16:11–15.

Joyce, L. A., C. H. Flather, and M. Koopman. 2008. *Analysis of Potential Impacts of Climate Change on Wildlife Habitats in the U.S., Final Project Report: October 13, 2008.* Fort Collins, Colo.: U.S. Forest Service Rocky Mountain Research Station.

Knight R. L. 1999. "Private lands: The neglected geography." *Conservation Biology* 13:223–24.

Lerner, J., B. Cochran, and J. Michalak. 2006. *Conservation across the Landscape: A Review of the State Wildlife Action Plans*. Washington, D.C.: Defenders of Wildlife.

Lesica, P., and F. W. Allendorf. 1995. "When are peripheral populations valuable for conservation?" *Conservation Biology* 9:753–60.

Lovejoy, T. E., and L. Hannah, eds. 2005. *Climate Change and Biodiversity*. New Haven, Conn.: Yale University Press.

Master, L., D. Faber-Langendoen, R. Bittman, G. A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. *NatureServe Conservation Status Assessments: Factors for Assessing Extinction Risk.* Arlington, Va.: NatureServe.

Master, L., B. A. Stein, L. S. Kutner, and G. A. Hammerson. 2000. "Vanishing Assets: Conservation Status of U.S. Species." In *Precious Heritage: The Status of Biodiversity in the United States*, 201–38. B. A. Stein, L. S. Kunter, and J. S. Adams, eds. Oxford, U.K.: Oxford University Press.

McPeek, M. A., and T. E. Miller. "Evolutionary biology and community ecology." *Ecology* 77 (1996): 1319–20.

Miller, B., D. Foreman, M. Fink, D. Shinneman, J. Smith, M. DeMarco, M. Soulé, and R. Howard. 2003. *Southern Rockies Wildlands Network Vision: A Science-Based Approach to Rewilding the Southern Rockies*. Boulder, Colo.: Southern Rockies Ecosystem Project.

Milder, J. C. 2006. "Using limited development to conserve land and natural resources." *Exchange* 25:14–19.

Neely, B., P. Comer, C. Moritz, M. Lammert, R. Rondeau, C. Pague, G. Bell, H. Copeland, J. Humke, S. Spackman, T. Schulz, D. Theobald, and L. Valutis. 2001. "Southern Rocky

Mountains: An ecoregional assessment and conservation blueprint." Prepared by The Nature Conservancy with support from the U.S. Forest Service, Rocky Mountain Region, Colorado Division of Wildlife, and Bureau of Land Management.

Newmark, W. D. 1995. "Extinction of mammal populations in western North American national parks." *Conservation Biology* 9:512–26.

Noss, R. F. 1990. "Indicators for monitoring biodiversity: A hierarchical approach." *Conservation Biology* 4:355–64.

Noss, R. F. 1996. "Ecosystems as conservation targets." *Trends in Ecology & Evolution* 11:351.

Noss, R. F., and A. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity*. Washington, D.C.: Island Press.

Noss, R. F., and B. Csuti. 1997. "Habitat fragmentation." In *Principles of Conservation Biology,* 2d ed, 269–304. G. Meffe, C. R. Carroll, and contributors. Sunderland, Mass.: Sinauer Associates, Inc.

Noss, R. F., and K. Daly. 2006. "Incorporating connectivity into broad-scale conservation planning." In *Connectivity Conservation: Maintaining Connections for Nature*, 587–619. K. Crooks and M. Sanjayan, eds. Cambridge, U.K: Cambridge University Press.

Panjabi, A. O., E. H. Dunn, P. J. Blancher, W. C. Hunter, B. Altman, J. Bart, C. J. Beardmore, H. Berlanga, G. S. Butcher, S. K. Davis, D. W. Demarest, R. Dettmers, W. Easton, H. Gomez de Silva Garza, E. E. Iñigo-Elias, D. N. Pashley, C. J. Ralph, T. D. Rich, K. V. Rosenberg, C. M. Rustay, J. M. Poiani, K.A., B. D. Richter, M. G. Anderson, and H. E. Richter. 2000. "Biodiversity conservation at multiple scales: Functional sites, landscapes, and networks." *BioScience* 50:133–46.

Ruth, J., S. Wendt, and T. C. Will. 2005. *The Partners in Flight Handbook on Species Assessment. Version 2005. Partners in Flight Technical Series No. 3*. Fort Collins, Colo.: Rocky Mountain Bird Observatory.

Scott, J. M., F. W. Davis, R. G. McGhie, R. G. Wright, C. Groves, and J. Estes. 2001. "Nature reserves: Do they capture the full range of America's biological diversity?" *Ecological Applications* 11:999–1007.

Soulé, M. E., J. A. Estes, J. Berger, and C. Martinez del Rio. 2003. "Ecological effectiveness: Conservation goals for interactive species." *Conservation Biology* 17:1238–50.

Soulé, M. E., B. G. Mackey, H. F. Recher, J. E. Williams, J. C. Z. Woinarski, D. Driscoll, W. C. Dennison, and M. Jones. 2006. "The role of connectivity in Australian conservation." In *Connectivity Conservation*, 649–75. K. Crooks and M. Sanjayan, eds. Cambridge, N.Y.: Cambridge University Press.

Soulé, M. E., and B. A. Wilcox. 1980. "Conservation biology: Its scope and challenge." *Conservation Biology: An Evolutionary and Ecological Perspectiv*e. M. E. Soulé and B. A. Wilcox, eds. Sunderland, Mass.: Sinauer Associates, Inc.

Sperduto, D. D., and W. F. Nichols. 2004. *Natural Communities of New Hampshire.* Concord, N.H.: New Hampshire Natural Heritage Bureau.

Stein, B. A., and K. Gravuer. 2008. *Hidden in Plain Sight: The Role of Plants in State Wildlife Action Plans*. Arlington, Va.: NatureServe.

U.S. Department of Agriculture. 2009. *Summary Report: 2007 National Resources Inventory*. Washington, D.C.: Natural Resources Conservation Service and Ames, Iowa: Center for Survey Statistics and Methodology, Iowa State University.

Van de Poll, R. 2008. "Wildlife Action Plan (WAP) Implementation Project." Effingham, N.H.: Effingham Conservation Commission.

Wilcove, D., M. J. Bean, R. Bonnie, and M. McMillan. 1996. *Rebuilding the Ark: Toward a More Effective Endangered Species Act for Private Land.* Washington, D.C: Environmental Defense Fund.

Wilcove, D., D. Rothstein, J. Dubow, A. Phillips, and E. Losos. "Leading threats to biodiversity: What's imperiling U.S. species." In *Precious Heritage: The Status of Biodiversity in the United States,* 201–38. B. A. Stein, L. S. Kunter, and J. S. Adams, eds. Oxford, U.K.: Oxford University Press (2000).

Wilson, E. O. 1992. *The Diversity of Life*. Cambridge, Mass.: Harvard University Press.

WRI, IUCN, and UNEP (World Resources Institute, IUCN-The World Conservation Union, UN Environment Programme). 1992. *Global Biodiversity Strategy: Guidelines for Action to Save, Study, and Use Earth's Biotic Wealth Sustainably and Equitably.* In consultation with FAO and UNESCO. WRI, IUCN, and UNEP: Washington, D.C.

About the Author

Christopher R. Wilson is a conservation planner, stewardship expert, and field biologist. He is currently the Wildlife Conservation Biologist for the Santa Lucia Conservancy and formerly served as the Director of Stewardship and Science for the Sweet Water Trust and as the Conservation Biologist for the North American Land Trust. He holds bachelor degrees in wildlife ecology and conservation biology from the Evergreen State College in Olympia, Washington, and a master's degree in biology from the Appalachian State University in Boone, North Carolina. His professional interests include the application of conservation science to private land conservation and making such information accessible and useful to land trusts.

"This book falls into that rare category of 'necessary.' For people concerned about preserving the fabric of this earth in a time of tempestuous change, Chris Wilson has provided a mandatory manual. It will do much good in the world."

BILL MCKIBBEN, Author of *The End of Nature* and *Deep Economy*, Advisor to Northeast Wilderness Trust

"Everybody talks about saving nature. Here's your operating manual for getting the job done. It clearly explains how to assess biodiversity on a property, what it takes to maintain or restore it, where to find expert help at each stage, and why this all matters. Add solid advice on subjects from fundraising for projects to complying with regulations, and you have a book that belongs in every land trust office. The sooner, the better."

DOUGLAS H. CHADWICK, wildlife biologist, author of *The Wolverine Way*, and a founding board member of the conservation land trust Vital Ground.

"This book should serve as an important resource to land conservation practitioners hoping to maximize their conservation impact. It provides a concise introduction to many important facets of the rapidly changing world of biodiversity conservation; where information can be quite powerful, and bringing the right information to your decisions can make all the difference."

PATRICK COMER, Chief Ecologist, NatureServe

The Land Trust Alliance promotes voluntary land conservation and strengthens the land trust movement by providing the leadership, information, skills and resources land trusts need to conserve land for the benefit of communities and natural systems. www.landtrustalliance.org.

Sweet Water Trust is a grant-making foundation whose mission is to support land conservation that safeguards wild lands and waters, native wild flora and fauna, and living soils. Since its establishment in 1991, Sweet Water Trust has been actively involved in conservation work in New England and upstate New York, focusing in recent years on the forests of the Northern Appalachians, including neighboring lands in Canada. www.sweetwatertrust.org.