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EDMUND S. MUSKIE SCHOOL OF PUBLIC SERVICE
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FEASIBILITY STUDY
FOR A GIS INVENTORY OF
NEW ENGLAND CONSERVATION LANDS

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1 Executive Summary

A preliminary assessment of needs in December 2000, by the Environmental Finance Center (EFC) included a recommendation for an inventory of conservation lands in New England. Specifically, the overall goal was to “assess whether a single database of conserved land in New England is feasible and desirable” for planning and policy purposes.

Through interviews with more than 50 individuals representing federal, state, and private sector organizations, Applied Geographics, Inc. (AGI) evaluated the need for a conservation data layer and the feasibility of creating one from existing digital data sources.

The main finding of this study is that implementation of a New England-wide conservation lands GIS data layer will provide substantial benefits to a variety of stakeholders. Many of these benefits, however, will be realized only if improvements are made to existing digital geographic data. Conservation lands data currently exists and is freely available in digital formats in each of the six New England states. Though varying in maturity and completeness, these individual data layers can be assembled with GIS technology to provide a working composite. What the resulting integrated data lack is a consistency of attribution, documentation, scale and currency across the six state region, as well as a common vehicle for access and maintenance.

The greatest benefit of creating a single, regional data layer, therefore, will be achieved if the approach involves the direct and ongoing participation of stakeholders and stewards of existing digital conservation data to:

1. Define common practices and standards of data content and accuracy;
2. Improve the quality of the existing state level digital data; and
3. Enhance the ability of organizations with varying levels of sophistication with GIS and staff resources to access and utilize the data.

If the implementation of the New England-wide Conservation land data layer achieves these goals, it will:

- Provide a widely accepted and utilized source for conservation and open space geographic data;
- Reduce the time and effort spent on projects and programs to collect and integrate conservation data from disparate sources;
- Provide a single source of data (and maps) to organizations without the technical, computing and staff resources to prepare and integrate conservation lands data for themselves;
- Provide a standardized approach to the collection, attribution, and documentation (metadata) for conservation lands data;

- Reduce disparities in data integrated from different sources and the potential for differences in analyses and conclusions concerning current status of conservation lands data;
- Facilitate land use planning, land management, and land acquisition processes of varying geographic scope, from local to regional, statewide to multistate, irrespective of state and local boundaries;
- Increase the level of public awareness of conservation lands, including location, amount and type, thereby more accurately informing public debate and public policy;
- Promote a process of sharing among agencies through increased knowledge of data collection procedures, resources, policies and legal frameworks, and establishing a common data structure for measuring, monitoring and assessing the region's conservation lands.

In order to realize these benefits, it is recommended that the EFC initiate a structured series of meetings among key persons in state GIS offices, other state agencies with land management or programmatic responsibilities for open space lands, federal agencies, and conservation organizations. The purpose of these meetings is :

1. To allow for the exchange of information between states concerning approaches to and constraints on data collection, the nature of state regulations affecting conservation lands and reporting requirements, and other issues affecting data quality and currency.
2. To allow data providers/integrators (state GIS offices) to interact with conservation lands data consumers (conservation organizations, other state agencies, private sector organizations) in order to better understand how the data is being used and/or modified to meet mapping and analytical needs.
3. To enable exchange of ideas concerning the feasibility of standardizing conservation lands data, including attributes and geographic characteristics (scale, positional accuracy).
4. To provide a forum for consensus on standards and procedures concerning conservation lands data collection, accuracy, attribution, documentation, and integration.
5. To establish common standards for conservation lands data storage, access and maintenance.

It is also recommended that EFC undertake the development of a Web-based conservation lands information portal. The portal would:

- Provide a means for disseminating information and findings from the collaborators meetings to the broader public and allow for feedback from this wider audience,
- Present the current (state GIS) conservation lands data as a seamless New England-wide data layer for online viewing and for download,

- Provide links to
 - State GIS Websites,
 - Other organizations involved with conservation lands data collection, and
 - Other sites that are of interest to consumers of conservation lands data.
- Provide distributed, collaborative data updating and error capture capabilities through a common Web interface.

In addition, the realization of project goals has the potential to contribute to national-level programs to enhance the standardization, documentation, interoperability, quality, and accessibility of geospatial data. These national efforts embodied in the Federal Geographic Data Committee (FGDC), the National Spatial Data Inventory (NSDI), the USGS National Map program, and the FGDC I-Team and Geospatial One-Stop initiatives, have the support of the highest levels of the federal government, including the Office of the President. The development of a conservation lands data layer for New England can incorporate the lessons learned from these federal-level initiatives. At the same time, because of its focus on a specific data layer in one region of the country, EFC has the opportunity to organize and promote a process that provides valuable insights and a potential model or pilot project for these national programs.

2 Introduction

2.1 Background, Objectives and Scope

The EPA Region I Environmental Finance Center at the Edmund S. Muskie School of Public Service, University of Southern Maine (NE/EFC) is one of nine such centers nationwide whose mission is to promote sustainable environmental management systems in the public and private sector. The NE/EFC is

...conceived as a knowledge-based clearinghouse, training, and change agent program aimed at helping the EPA's several constituencies find financially successful approaches to necessary environmental improvements. ... The initial focus of the New England EFC will be the emerging importance throughout the region of innovative approaches to land conservation, habitat preservation, and growth guidance that move beyond public regulation to include financial incentives and partnerships between the public, non-profit, and private sectors.¹

A preliminary assessment of client interest in and needs of the NE/EFC (December 2000) included the recommendation for an inventory of conservation lands in New England. This recommendation became one of eight tasks itemized in the Cooperative Agreement for the establishment of the NE/EFC. Specifically, the overall goal is to "assess whether a single database of conserved land in New England is feasible and desirable" for planning and policy purposes.² The scope of this inventory/feasibility study is defined in detail:

- Identification of existing GIS databases of conserved lands in each New England state;
- Assessment of compatibility of data formats and types for integration, including use with planning support system software for scenario building;
- Estimation of project tasks, timeline, and costs for integrating databases;
- Estimation of costs of making data available through the Internet, through both distribution of data directly and providing Web-based maps;
- Estimation of immediate and long-term benefits of establishing the integrated database;
- Identification of potential users of and sources of funds for establishing the integrated database.

¹ Cooperative Agreement between the EPA Region I/New England and the Edmund S. Muskie School of Public Service, July 2001, pp. 3-4.

² Ibid, p. 6.

For the purposes of the study, conservation lands are defined broadly to include: “federal, state, local park lands, lands owned by private land trusts, conservation easements, and other forms of both wholly and partially owned lands”.³

2.2 Overall Approach

The overall approach divides the project into three parts:

Benefits Assessment (Section 3) – identifies and characterizes the benefits or uses for a New England-wide comprehensive conservation lands database and data distribution system;

Sources and Characteristics of Conservation Lands Data (Section 4) – describes in detail the coverage, scale of availability of digital conservation lands geospatial data in the six New England states;

Implementation Approach and Plan (Section 5) – outlines an implementation approach for a series of meetings of conservation lands data providers and data users, for the development of a comprehensive database system, and for the creation of a Web-portal for dissemination of conservation lands data and maps..

All of these assessments are based on detailed information gathered through conversations with respondents representing a variety of organizations in New England, and from several federal agencies involved in regional resource management, planning and conservation (EPA, Forest Service, National Park Service, Fish and Wildlife). The approach to information gathering and review was as follows.

Benefits Assessment:

- (1) Identification of agencies with land management, development, or conservation mandates;
- (2) Interviews with selected organizations representing different levels of government, non-governmental conservation agencies and trusts, and private sector companies.

Conservation Lands Data Identification and Review:

- (1) Research of publicly available data sets through review of descriptive material and metadata.
- (2) Interview of key data managers and data integrators; and
- (3) Integration of data sets to common geography as test case for feasibility of integration and to enhance understanding of the existing data.

³ Letter from Richard Barringer inviting proposals for Pilot GIS Inventory of New England Conservation Lands, October 2001.

3 Benefits Assessment for a Unified New England Conservation Lands Data Layer

3.1 Goal, Scope and Methods

The goal of the benefits assessment is to gain an understanding of what types of organizations and which programs would benefit from access to an integrated New England-wide conservation lands data layer. The assessment is based on interviews with individuals from a diverse selection of federal and state agencies, conservation organizations, and research institutions. Appendix A provides a list of individuals contacted for this part of the feasibility study.

For each agency, AGI's objective was to identify and interview key participants - individuals who had direct knowledge and participation in the use of conservation data or conservation lands programs and initiatives. The opinions of those interviewed are not necessarily official positions of the agencies for which they work, rather they should be interpreted as reflecting individual experience and knowledge of specific programs and organizational operations and goals. In some cases, more than one person was contacted at an agency.

In order to elicit as broad a response as possible, respondents were asked open-ended questions concerning the utility of a New England-wide conservation lands data layer and Web-based access to it. For example, respondents were asked what uses a unified New England conservation layer would have for them, what are the current sources of conservation lands data that they rely on, which agency programs, if any, utilize conservation lands data, what would be the minimum requirements for accuracy/scale for such a database, and whether they have any constraints or concerns with regard to creation and dissemination of such data.

3.2 Findings

3.2.1 Overview of Need for Conservation Lands Data

Many agencies, departments of state government, and private organizations are involved in assessing, or directly protecting and managing conservation lands and open space lands. Not surprisingly, the organizations contacted in this study differ widely in organizational goals and agendas, staff and technical resources, and geographic scope of operation.

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These differences affect how organizations perceive, utilize and would benefit from the development of and access to a regional conservation lands data layer. The following six main themes provide an overview of the need for and relevance of a New England-wide conservation lands data layer.

(1) Broad awareness of digital conservation lands data and capacity to use GIS technology indicates a substantial base of interest and potential for utilization of an integrated conservation lands data layer

Most respondents were using digital conservation lands data and GIS technology. All respondents, and therefore all agencies contacted, were aware of the availability of current conservation digital data resources, e.g., state level GIS open space or conservation lands digital databases. This was true of organizations such as The Northern Forest Alliance, the Trust for Public Lands, the National Park Service, and others who were not directly or currently accessing available digital conservation lands data, but relying on their own digital maps or maps created by others. Many respondents used state offices of GIS data and data from other sources as the base for creating their own conservation lands maps for planning and management purposes.

Almost all organizations contacted had some form of GIS capacity represented by staff actively using GIS software. But the level of utilization of GIS technology varies widely. Constraints on the use of GIS technology and digital spatial data for planning and management appear to be related to the level of staffing and budgetary resources rather than characteristics of the technology or desire to use digital spatial data. Many of the larger federal and state organizations have full-time GIS staff. Smaller organizations and land trusts may have part-time GIS staff or rely on others' GIS capacity. The ability to create or integrate digital spatial data varies accordingly. Smaller organizations tend to rely on published hardcopy maps, or the digital data products developed by other organizations.

(2) The emergence of informal and semi-formal conservation lands data sharing relationships among organizations, as well as the universal recognition of state offices of GIS as digital data providers, indicates the general acceptance and potential utility of a centralized approach to digital conservation lands data management and dissemination.

Within the region, some organizations act as suppliers of digital data and analyses. State offices of GIS are well established as primary integrators, repositories and stewards of digital spatial data at their respective geographies. In addition, other organizations such as The Appalachian Mountain Club (AMC) and The Nature Conservancy (TNC), act as integrators, analysts, and providers of digital conservation lands data and products. For example, The Northern Forest Alliance works with and relies on AMC maps and analysis to meet its spatial data needs. These organizations integrate conservation lands data covering large (multistate) regions, including areas outside of New England, such as New York, the Mid Atlantic states and Canada. The emphasis on the role of data developer/provider and the level of institutional commitment differs, however. The AMC currently is developing a Web-based system for sharing its analyses, maps, and other digital products with other conservation agencies. The objective is to streamline access to and distribution of its spatial products and resources. TNC has created numerous region wide coverages, including a managed lands digital data layer, for its own planning and analysis purposes. These are shared informally and on request with other organizations.

(3) The emergence of collaborative relationships among conservation and other organizations involves the sharing of analysis and GIS products (maps) in addition to

data layers, indicating potential benefits of combining spatial analysis/map creation capability with data dissemination

Organizations involved in advocacy, planning, land acquisition and management, public policy and research, generally but not always have the capacity to perform spatial analysis with existing conservation lands data. It is an open question whether organizations will continue to operate under the assumption that spatial analysis will rely on internal staff resources or whether they will seek data and information through collaborative relationships, such as exemplified by AMC and the Northern Forest Alliance. Agencies with internal capacity can access/download data and perform the spatial overlay and other types of analysis such as combining conservation lands data with other data layers. Organizations without or with limited GIS staff or software resources may realize less benefit from consolidated data because of the additional effort required to interpret and work with the data. Data viewing and data layer combining functions that could be accomplished using Web-based GIS software, however, might extend the benefits of data distribution to organizations needing basic data visualization and mapping. Many organizations expressed interest in the ability to visualize, rather than exhaustively analyze, conservation lands data.

(4) No organization appears to have an institutional commitment to maintaining digital conservation lands data at a regional (multistate) scale, indicating that multistate analyses will continue to require project-by-project data integration and development

State offices of GIS integrate data only within their respective geographies, and their approaches, attributes, data documentation, and the data coverage and currency vary (see Section 4). Their mandate does not extend to integration or standardization of data layers with other neighboring or regional states. Organizations such as the AMC, TNC, US Forest Service, State Departments of Environmental Management, State Departments of Planning and others indicated their reliance on internal staff to collect and integrate information from various sources in order to work in a multistate context.

Whether or not project related or program related integration of multistate conservation lands data has occurred varies by organization. Some respondents indicated that the integration of state level digital data, i.e., from state offices of GIS, was not a constraint and that they gathered the data as needed. Some state agency respondents and even federal agency respondents stated that the state-level or specific property level focus of their organization limited their need for regional (multistate) analysis of conservation lands. Others indicated that lack of region wide data integration was a constraint, and that they did not incorporate data from other states into their analyses and planning, yet many of these respondents within state agencies indicated that they would do so, if they could easily map and view conservation lands across state borders on demand.

(5) Recognition of the importance of the geographic context and characteristics of conservation lands is driving demand for access to better conservation lands data in spite of the fact that many organizations do not operate at broad regional scales

Many respondents indicated that current digital conservation lands data was inadequate to meet their particular analytical needs. The types of limitations identified covered virtually all aspects of the current digital data and reflected the different ways

organizations desire to use digital conservation data. The primary categories of dissatisfaction are:

- Resolution of geographic data –respondents indicated a need for parcel level accuracy in order to accurately map and model conservation lands at large scales and with respect to other data layers such as parcel maps, roads, town boundaries, etc.;
- Comprehensiveness of data – respondents indicated uncertainty about whether existing digital data contained all conservation land types, inclusive of easements and fee owned lands, of lands controlled by municipalities and/or private individuals, etc.;
- Comprehensiveness of attributes – various respondents indicated interest in incorporating additional descriptive information about conservation land parcels such as on permanency of protected status of conservation lands, types of management activities undertaken by owners; and
- Currency of data – respondents expressed concern that data were out of date and did not include recent purchases or sales/conversions of conservation lands.

In response to perceived deficiencies in current digital data, organizations have incorporated data enhancement/development efforts into their current operations, including allocation of staff time and fund raising efforts, as well as the formation of collaborative arrangements as discussed in (2) above.

(6) Some concern about the implications of creating and disseminating regional conservation lands data in digital format were expressed, indicating that policies regarding the attribution, documentation, comprehensiveness, and method of distribution must address the potential and perceived sensitivity of conservation lands data distribution.

Some concerns were functional in nature, i.e., would the creation of a New England wide data layer impose an additional burden on organizations for reporting on land acquisitions and holdings to yet another agency. Other concerns focused on the potential misuse or misinterpretation of data, such as the potential mistaken impression that conservation lands represented in existing data layers represent publicly accessible lands.

3.2.2 Federal Agencies

National Park Service landholdings are small in the eastern U.S. relative to the west and many of the holdings consist of sites that are important for cultural or historical reasons, rather than conservation or biological reasons. There is little direct demand for regional portrayals of conservation data.

EPA representatives indicated that they work across state lines on projects such as widening of interstate highways and review of projects affecting multiple states under the provisions of the national Clean Air and Water Acts. But the majority of EPA programs (~80 percent) operate at the state level. This is because programs are generally coordinated with and activities delegated to specific state agencies and partners among

which EPA plays a coordinating role. Across the range of programs, EPA respondents indicated an interest in access to conservation lands data to support their role of providing a consistency to regional environmental protection.

The USGS acts as a creator and distributor of land use/land cover data and relies on states to provide information for open space mapping for quality control on USGS maps. The USGS National Map program has as its goal the creation of a national base map by 2010, which will also rely on state level data collection/integration and sharing. This vision of data collection and integration at state and sub state levels that supports aggregate multi-state and national level data sets mirrors the vision of the EFC for the conservation lands database. Lessons learned from the EFC effort may contribute to the approach taken in the National Map program and vice versa. Both efforts face issues concerning funding for data collection efforts, standardization of data, and incentives for participation.

The USGS and the EPA have created partnerships for the collection and integration of national land cover and hydrographic data sets. These efforts have involved the creation of national standards classification. USGS is considering different approaches for mitigating the effort and cost of updating national-level data, such as through a participatory process involving ongoing markup by users of the data followed by certification and review by USGS. These programs may eventually rely on substantial participation and/or reliance on state level GIS offices or data.

Forest Service respondents indicated that they work with current digital data provided by states and integrate the data when needed, and expressed an interest in better data on conservation easements. In addition, forest service respondents expressed concern about wide public access to conservation lands maps because of the possibility that conservation lands may be misinterpreted as public access lands. EPA use of the open space data is related to interest in resource protection and permit review, such as for wetlands and water supply protection. An accurate and comprehensive land conservation data layer would provide a useful context for these resource protection programs.

3.2.3 State Agencies

Many state agency respondents indicated that their responsibility was typically for state or sub state level analysis, rather than multistate or New England-wide. State agency respondents typically were aware of or were active users of state-level GIS information. Although many identified situations or programs in which they could use multi-state conservation lands information, very few were actually incorporating conservation lands data from other states in their analyses. At the same time, several state agency respondents identified a number of program-related areas in which they could benefit from access to multistate conservation lands data:

- Coordination within border areas of states – Applies to both management and strategic planning activities and land purchases. A clear knowledge of how holdings on one side of the border are associated, sometimes even connected, with conservation lands on the other side can affect decisions regarding future purchases in the border area. Examples cited by respondents include the Paugatuck Valley in CT and RI, or where large natural resource areas touch or cross border, such as forested areas in western RI.

- Trans-state Linear features – Includes both natural features (rivers, streams and migratory corridors) and human made features (trails, highways, bike paths), which cross state boundaries and require monitoring and management.
- Regional or multistate level planning and protection of ecological functions and habitats – the focus in this case is on
 - Animal freedom of movement - flyways, natural ranges, distribution of habitat;
 - Relative amounts of land/soils/vegetation by type within regions that encompass parts of different states;
 - Major river valley systems, basins or watersheds

State agencies expressed concern with the scale at which data is currently maintained: Layering municipal parcel data at 1:100 scale with open space data at 1:5,000 scale presents obvious problems with positional accuracy and misalignment. . Others indicated that the smaller scale (1:25,000) open space data was adequate for their purposes, but that they were concerned about the comprehensiveness/currency of the coverages. Others expressed frustration that the conservation lands data included a variety of types of open space land that did not match their needs, i.e., cemeteries and recreational areas, that had to be filtered out manually before use.

3.2.4 Land Trusts and Conservation Groups

Land trusts had the most variability in their scope of operations and their level of resources and sophistication of use of GIS technology. Because of differences in state laws, many trusts do not operate across state boundaries and are local in geographic scope. Large conservation organizations, such as the Appalachian Mountain Club and The Nature Conservancy, for example, make extensive use of GIS, have dedicated GIS staff, and provide data and GIS maps and analysis to others either through formal or informal arrangements. The Rhode Island Chapter of The Nature Conservancy creates digital data from information provided by local land trusts throughout the state. It is unknown the extent to which small and local land trusts have GIS resources or utilize GIS technology and digital spatial data. The Trust for Public Land operates throughout New England without a core GIS program.

As one respondent stated, adequate conservation lands data (current and comprehensive and adequately attributed or characterized) is a “missing piece in every project.” Needs expressed by land trusts include the accuracy or resolution of open space data with particular interest in parcel level data, as well as how the data is attributed. Many respondents expressed interest in differentiating easements from fee ownership, in knowing how land was being managed and the permanence and security of its protection status. Respondents who did not currently have GIS or plans to obtain them also indicated interest in access to maps and digital data through the Web.

Land trusts and conservation organizations utilize the data for a wide range of uses, including evaluating and planning for land acquisition, for public awareness campaigns, for municipal planning and development, and for resource conservation activities.

3.2.5 Researchers/Consultants

Other respondents included researchers and private consultants who expressed interest in open space and conservation lands data for smart growth planning and an interest in maintaining a timeline of conservation lands data for assessing change.

3.3 Benefits Assessment

Based on extensive discussion with respondents representing a variety of state agencies and organizations, it is determined that creating a New England-wide Conservation land data layer will provide a variety of significant and measurable benefits. This resource will

- Provide a widely accepted and utilized source for conservation and open space geographic data;
- Reduce the time and effort spent on projects and programs to collect and integrate conservation data from disparate sources;
- Provide a single source of data (and maps) to organizations without the resources – technical, computing, staff time - to prepare/integrate conservation lands data for themselves;
- Provide a standardized approach to the collection, attribution, and documentation (metadata) for conservation lands data;
- Reduce disparities in data integrated from different sources and the potential for differences in analyses and conclusions concerning current status of conservation lands data;
- Facilitate land use planning, land management, and land acquisition processes of varying geographic scope, from local to regional, statewide and multistate, irrespective of state and local boundaries;
- Increase the level of public awareness of conservation lands, including location, amount, and type, and thereby contribute to public debate and public policy;
- Promote a process of sharing among agencies through increased knowledge of data collection procedures, resources, policies and legal frameworks, and database structure across the region’s conservation database stewards; and
- Contribute to data aggregation programs occurring in other regions and nationally, such as the USGS National Map and FGDC Geospatial One-Stop programs.

How and the extent to which these benefits are realized will depend upon the approach to developing the New England-wide conservation lands data and the details of the integration process. The greatest benefit of creating a single, regional data layer will be achieved if the approach involves the direct and ongoing participation of stakeholders and stewards of existing digital conservation data to:

1. Define common practices and standards of data content and accuracy;
2. Improve the quality of the existing data, particularly the process of state level digital data collection, including scope, documentation, and frequency; and
3. Enhance the ability of organizations with varying levels of sophistication with GIS and staff resources to access and utilize the data.

The next sections clarify and articulate this strategy for the realization of benefits. Specifically, Section 4 examines the characteristics of current digital conservation lands and open space data with a particular emphasis on data aggregated and distributed by state offices of GIS. Section 5 presents an approach for achieving a unified and improved conservation lands database. The recommended approach is process-oriented and stakeholder driven.

4 Sources and Characteristics of Conservation Lands Data

This section introduces and describes the primary state-level sources of data on conservation lands. Each of the six New England states is represented individually. The descriptions focus on the types, coverage, scale, and currency of conservation lands data for each state, as well as file formats, availability, and the institutional structure of data collection and integration. Information about the available data provides a foundation for evaluating the opportunities for enhancement of conservation lands GIS data. Discussion of the available data also indicates the substantial achievement that has been made and institutionalized by all New England states to gather conservation lands data. A table that summarizes many of the main characteristics of the conservation data layers available from the six states is presented in Appendix A.

4.1 Connecticut

Even before the State of Connecticut implemented GIS, the Department of Environmental Protection ([DEP](#)) was tracking state-owned open space graphically. DEP would periodically contact towns directly for parcel information and sketch it onto Mylar overlays on USGS 1:24,000 scale topographic quad sheets. Around 1994 this information was converted to a digital format.

In late 1996, The CT Office of Policy and Management ([OPM](#)) created two additional digital data layers as part of their Plan of Conservation and Development. One contained Federally owned open space and one contained municipal and private open space. The municipal and private open space layer was created by gathering hard copies and having them digitized at a local university. The completed layer was sent out to all 169 cities and towns in CT for review and correction.

All of these layers were last updated in 1997, but there is currently another update of the state-owned layer in progress. None of the existing (old) information is being edited, just new information is being added, some using highly accurate coordinate geometry. However, this is to serve as an interim layer, to be used only until the new Protected Open Space Mapping Project is completed.

The Protected Open Space Mapping Project is being directed by the CT DEP and began in Spring 2002. It will take several years to complete, because land records down to the municipal level meeting the defined criteria will be compiled, verified and standardized into a new integrated statewide protected open space database/data layer. Criteria for inclusion will be open space owned by or easements held by local, State and Federal governments, land trusts and other private non-profit entities, and utilities.

In addition to collecting the municipal land records, individuals with intimate knowledge of local open space inventories will be asked to provide supplemental information, improving the overall quality of the final product. The new database will be distributed as well as published on new hardcopy maps.

4.2 Maine

The State of Maine's digital conservation lands data layer has been evolving for more than a decade. In 1989 Richard D. Kelly of the Maine State Planning Office (SPO), completed the first compilation of state and federal conservation lands in Maine. This compilation was done as a set of 1:250,000-scale color maps with a supporting publication (Kelly 1989). The Maine Office of Geographic Information Systems ([MeGIS](#)) made a digital version of these maps available at this time as part of their public GIS data set. The [James W. Sewall Company](#), Old Town, Maine, has also consistently maintained a land ownership database of Maine including private as well as public owners.

An update of the 1989 maps was released in 1993, along with new documentation (Kelly 1993). The 1993 maps were more inclusive than the 1989 edition in that some municipal and private lands were included as well as state and federal conservation areas (Kelly 1993). The 1993 revisions were not added to the 1989 digital database maintained by MeGIS, but apparently were used to revise the Sewall land ownership database.

In 1993, the Maine Cooperative Fish and Wildlife Research Unit (CFWRU) started a GAP Analysis project in Maine. [Gap Analysis](#) is a GIS analysis method that identifies potential geographic gaps in biodiversity conservation, and relies heavily on a conservation lands database in digital form (Scott et al. 1993). As [Maine Gap Analysis](#) progressed, attempts to use the 1989 digital version of Kelly's maps failed as the database was found to be out-of-date and, more importantly, inappropriate for spatial analyses at a 1:100,000 scale. The land ownership map of Sewall Company was purchased by the CFWRU in 1995, and although more complete than the 1989 Kelly maps, still suffered from too small of a scale (i.e., 1:250,000) and incompleteness, especially in regard to private conservation lands.

To build a conservation lands database suitable for statewide use at a 1:100,000 scale, the SPO and CFWRU agreed in 1996 to revise and digitize the 1993 Kelly maps and to construct an attribute database characterizing each polygon on the new maps. In general, the SPO was responsible for contacting agencies and organizations to obtain information on the locations of conservation and public lands, and to do the cartographic work to turn this information into hardcopy maps. The CFWRU was responsible for digitizing the maps and building the attribute database.

The CFWRU and SPO agreed that the database would be built at a 1:100,000 scale with standard U.S. Geological Survey (USGS) 1:100,000 quadrangles as the basic building blocks. Major tasks to be done by both organizations were defined and in June 1996 the CFWRU provided draft quadrangles to the SPO for initial review and revision. Township lines, hydrologic features, and transportation features were used as parcel boundaries wherever appropriate. Township data were obtained from MeGIS, whereas the hydrology and transportation data are 1:100,000 [digital line graph data](#) (DLG) produced by the [U.S. Geological Survey](#) (USGS 1990). The hydrology data included rivers, streams, brooks, lakes, ponds, and coastal waters; transportation data included roads, railroads, trails, transmission lines, and pipelines. After draft maps were corrected by hand they were

returned to the CFWRU for re-digitizing and then returned to the SPO for additional reviews. After at least two iterations of reviews the 32 quadrangles were merged into a single statewide coverage and a final check of accuracy was made. Documentation used to give a final check of selected conservation lands included Hill (1989), [Maine Coast Heritage Trust](#) (1992), [Maine Department of Inland Fisheries and Wildlife](#) (1996a-1996d), and the [Maine Department of Conservation](#) (1996). Items checked included general location, parcel name, and ownership. (UMO GAP, 1996)

No enhancements to this layer have been made since the 1996 GAP project. In 2002 Richard D. Kelly of the Maine State Planning Office was contracted by the Maine Statewide Outdoor Recreation Plan (SCORP) to perform updates and edits to the public and conservation lands layer. As of Summer, 2002, these updates are funded and underway.

4.3 Massachusetts

Massachusetts has a total land area of 5,178,960 acres and an estimated total open space land area of 1,526,660 acres or 29.48%. Conservation and outdoor recreation facilities owned by federal, state, county, municipal, and nonprofit enterprises are included in the estimate of open space. Privately owned recreation lands and lands with deeded restrictions are also included, as are lands in the Chapter 61 program. Part of the impetus for tracking Open Space land in a GIS was the State Comprehensive Outdoor Recreation Plan (SCORP). The SCORP program generated an inventory of land that was recorded as tabular information without spatial information, although there is an address for each site. Information was first automated in 1988 creating the inventory (database) and updated in 1993-5 (paper only) as part of the project discussed below. The Massachusetts GIS office, MassGIS, serves as collector, creator, and integrator of geospatial open space data. MassGIS has committed itself to maintaining the currency of its open space data and has two fulltime staff assigned to this task.

The genesis of the open space data layer at MassGIS dates back to the late 1980s to early 1990s (coinciding with the creation of MassGIS in the early 1990s). Current State holdings data varies in its scale from 1:25,000 up to survey level accuracy. State agencies with dedicated GIS staff do their own data development and MassGIS develops data for those without staff and does quality control and checking on the digital data. State agencies owning land/contributing data to MassGIS include: DEM, MDC, DFWELE, DCS, and the University of Massachusetts. Typically this data is updated on an annual basis driven by the Secretary's office (EOEA) need to summarize and report on progress in acquisition of conservation lands.

In 1993-95, a municipal-level open space data collection process began involving as many as 10-15 MassGIS staff plus volunteers from each municipality. The data capture was based on 1:25,000 MassGIS Base maps using GIS data derived from USGS quadrangle maps. Municipal volunteers drew in open space areas on the maps and MassGIS staff created digital data (polygons) and populated the attribute tables for the polygons. A new base map including the new Open Space parcels was then sent back to the municipalities for quality control and checking. Several iterations per town were usually required. This system continues to the present in an unscheduled manner.

Updates to the municipal open space data are approximately 1:5,000 based on the scale of MassGIS digital orthophotography, which is used as a backdrop for data development and quality control. Because of the volunteer nature of the process of obtaining open space data from municipalities, there is no fixed schedule for updates, and the currency of municipal data is unknown. Updates are opportunistic and depend on municipalities or other land-holding entity reporting information/changes to MassGIS. On occasion, MassGIS may actively pursue updates for a specific town or region to assist EOE agencies working in those areas.

For federally owned lands, MassGIS digitized areas demarcated on USGS quads and then checked with the respective municipalities for accuracy/completeness.

For non-profit entities, MassGIS has a data swap offer. If land trusts give their individual data to MassGIS and provide metadata for any digital data, MassGIS will provide a CD of their data in digital format. Several large land trusts participate in this arrangement, but the coverage is not universal.

4.4 New Hampshire

There is a statewide New Hampshire Conservation/Public Lands layer available through the Geographically Referenced Analysis and Information Transfer System ([GRANIT](#)), a collaborative effort between the University of New Hampshire ([UNH](#)) and the [NH Office of State Planning](#) (OSP). The UNH Complex Systems Research Center (CSRC) manages the central data clearinghouse and provides full-time staff for data maintenance and distribution. This data layer is available to anyone for the cost of reproduction (may be downloaded at no cost) in ESRI Shapefile or Arc Export (.e00) File formats. There is also a [Conservation Lands Viewer](#) on the GRANIT website, which supports thematic mapping, browsing and printing.

The NH Conservation/Public Lands digital data layer primarily includes parcels of two or more acres in size, that are “mostly undeveloped and are protected from future development.” However, smaller adjoining, unique or state-owned parcels may be included where appropriate. The data consist of polygon and line features attributed according to the GRANIT Conservation/Public Lands Layer Mapping and Automation Standards (Revised April, 2001). Data are referenced to NH State Plane feet, NAD83. Metadata are available.

The initial data layer, begun in June 1991, utilized several different sources, including USGS 1:24,000 scale DLGs; records from the Society for the Protection of New Hampshire Forests (www.spnhf.org), various state agencies and [Cartographic Associates, Inc.](#); and original deeds and tax maps. In the beginning, a lot of the information received was in hard copy format (with the exception of the data from Cartographic Associates), and was digitized at UNH. Now updates are received in both hardcopy and digital formats. Parcel boundaries were compiled onto Mylar quadrangle (1:24,000 scale) overlays and then digitized.

Currently, the responsibility for gathering and relaying update information to CSRC is divided among three entities. The NH OSP is responsible for State and Federal Lands; The Society for the Preservation of NH Forests is responsible for private/non-profit lands,

such as land trusts; and the Regional Planning Commissions are responsible for municipal information. These data are now supplied largely in digital formats.

Although there is no official update schedule, the CSRC has allocated part of its core funding from the NH OSP to three database priorities, of which the Conservation/Public Lands layer is one. The priority list is developed in conjunction with the [NH GIS Advisory Committee](#). The Conservation/Public Lands layer has been updated several times (1998, February 2000, February 2002) since its initial creation, and the CSRC still hopes to establish a regular schedule.

4.5 Vermont

The statewide Vermont Conserved Lands Database is maintained by the University of Vermont's ([UVM](#)) Spatial Analysis Laboratory (SAL). However, only the Public Lands Extract is freely available for download via the Vermont Geographic Information System ([VGIS](#)) Web site in ESRI Arc Export File format. The full database must be requested directly from the UVM SAL, because distribution of the database is restricted.

The VT Conserved Lands Database consists of polygon and arc features representing sections (usually parcels, but not always) of conserved land, that are protected from further development. This includes Federal and State lands, private trusts, conservation easements, natural areas, deed restricted parcels, water bodies and municipal lands. The only group of conserved lands that is not yet represented in the database is the Current Use Lands. Over forty attributes are associated with the polygon and arc features in the database. The data are in VT State Plan Meters projection, with a datum of NAD83. Extensive metadata are available for this database.

The original database was compiled by digitizing hard copy maps and some surveyed plans dating from 1996-1999. The source map scales ranged from 1:5000 for town tax maps to 1:24,000. Most of the digitizing was handled at the UVM SAL. They also implemented quality control procedures for both the spatial and attribute data. The spatial data were (and continue to be) checked against digital orthophotos, while the digital files are sent back to cooperating agencies for attribute checks.

Updates to the database are "constant and unpredictable". Although update information may be received regularly from the various contributing entities, the resources (including money and staff) to incorporate the updated information are not regularly available. Contributing entities include [VT Agency of Natural Resources' Department of Forest, Parks and Recreation](#); [VT Land Trust](#); [VT Chapter of The Nature Conservancy](#); [Green Mountain National Forest](#); and the VT Regional Planning Commissions ([RPCs](#)). The RPCs are responsible for aggregating municipal parcel information and sending it up to the UVM SAL.

4.6 Rhode Island

The principal landowners of protected or open space lands include Rhode Island's 39 municipalities, state agencies, local water authorities, local land trusts, and the federal government. Purchases of open space are driven by a variety of objectives, primarily recreation, environmental concerns. Other lands are protected through conservation

easements, such as wellhead protection areas. State-level purchases occur on a weekly basis. The frequency of purchases at the municipal level or by local land trusts is not known.

Rhode Island Geographic Information System (RIGIS) acts as a statewide integrator and disseminator of geospatial data, including multiple data layers characterizing open space and conservation lands. RIGIS data is freely available over the Web in ESRI ArcInfo export format.

Open space data identified in the RIGIS data catalog consists of nine different data layers representing different sources or types of open space – covering recreational lands, lands managed by the Audobon Society, boat ramps, public lands, greenways, private lands, bikeways, wildlife management areas, and open space lands. The most comprehensive open space layer is named Open Space Lands and consists of open space and recreational lands protected by federal, state, municipal governments, and private foundations and societies and groups. RIGIS has been collecting and maintaining these data layers since approximately 1990. RIGIS is currently working on separating recreational from protected open space within this Open Space Lands data layers and on updating this data layer for release this year.

The open space data integrated by RIGIS comes from a variety of sources in electronic form. RIGIS has limited staff and budgetary resources to collect and maintain these data layers and relies on others (state agencies, conservation organizations, municipalities) to develop and provide data. RIGIS does not digitize or develop digital geospatial data. Consequently, the currency of the data is variable, as well as the reference scale, and the coverage is not comprehensive.

Specifically, utilization of GIS technology and creation of electronic data is not universal at the municipal government level, and it is estimated that less than half of Rhode Island's municipalities are actively using GIS. In addition, the open space data from municipalities has not been updated since the early 1990s.

Various state government agencies, authorities, and private sector organizations use GIS and actively collect and maintain geospatial data. The other main sources of digital open space data are the Department of Environmental Management, the Rhode Island chapter of The Nature Conservancy, and the Rhode Island Water Resources Board.

The Department of Environmental Management is the only state agency landowner of protected lands and the source of geospatial data on these lands for RIGIS (Paul Jordan, DEM). DEM data is disseminated through the RIGIS website. DEM land holdings initially were drawn on 1:24,000 scale USGS topographical maps and then digitized. At present, open space purchases are digitally captured in one of two ways. For those municipalities (approximately 10-11 of the 39) with digital parcel layers, the DEM uses the digital parcel data. For municipalities without digital parcel data, DEM digitizes the parcel boundaries from the land-survey conducted as a requirement at purchase. The DEM is adding new parcels to its holding weekly. The reference scale is estimated to be 1:24,000 in general, but the DEM uses the statewide orthophotography, which is 1:5,000 with two-foot pixels, to check its data. Types of open space included in DEM data are: state parks, boating/fishing access areas, beaches and bikeways, agricultural land development rights, wildlife/forestry management areas, watershed protection program

properties and municipal recreation facilities where DEM has provided funds for land acquisition. All lands in the DEM database are protected in perpetuity by fee title ownership w/ deed restrictions, or conservation easements.

Local Land Trust (LLT) data is collected and integrated by The Rhode Island Chapter of The Nature Conservancy (Kevin Rudick, TNC) on an annual basis. It is estimated that there are more than 40 LLTs in the state. The Nature Conservancy (TNC) maintains its own geospatial data and solicits and develops geospatial data for LLTs, and for the Audobon Society of Rhode Island lands. The current approach to land holding data collection consists of direct contact with LLTs at an annual conference as well as through telephone calls and direct mail. Lands owned by LLTs are identified to TNC by deed information, or as depicted on hard copy maps and drawings. TNC uses such information as a guide to identify the parcels on a set of scanned parcel maps that it has georeferenced to state orthophotography. LLT parcels are then on-screen digitized and the data is shared with RIGIS. The reference scale of this data is that of the orthophotography, about 1:5,000. The coverage of the conservation lands held or protected by local land trusts captured in this way is not comprehensive due to uncertainty about the completeness of reporting and record keeping of the local land trusts. This may improve in the future, however, as there is an initiative at the state level that would require LLTs to report on holdings.

4.7 Other Regional Conservation Lands Data Sources

In addition to state-level digital data, efforts have been made to create integrated conservation lands data sets. Two examples are the Protected Area Database (PAD) created by Conservation Biology Institute (CBI) and the World Wildlife Fund (WWF), and the Managed Area GIS database compiled by The Nature Conservancy (TNC)

The original CBI/WWF Protected Areas Database (PAD) was the product of a collaborative effort between the Conservation Biology Institute and World Wildlife Fund, USA (DellaSalla, D.A., N.L. Staus, J.R. Strittholt, A. Hackman, and A. Iacobelli. 2001. An updated protected areas database for the United States and Canada. *Natural Areas Journal* 21:124-135). It represents an updated and improved version of the Managed Areas Database (MAD) produced at U.C. Santa Barbara by Robert Gavin McGhie (McGhie, R.G. 1996. Creation of a comprehensive managed areas database for the coterminous United States. Summary project technical report NASA-NAGW-1743. Remote Sensing Research Unit, University of California, Santa Barbara.). The CBI/WWF PAD, however, was funded and created independently of the MAD and is not associated in any way with the MAD, Robert Gavin McGhie, or the University of California Santa Barbara.

The main purpose of the PAD is to delineate protected areas in the coterminous United States, Alaska, and Canada. It emphasizes federal and state-owned areas, but also includes county, city, and private reserves when data were available. The database contains information about parcel type, ownership, size, and protection level. While the original PAD contained IUCN protection codes as well as GAP protection codes, the updated PAD contains only GAP codes for the coterminous U.S. and Alaska because due to lack of confidence in identifying proper IUCN codes for a given parcels. However, the

PAD for Canada includes IUCN codes which were provided by WWF Canada.

This updated version of the PAD was completed with funding from the Moriah Fund and only includes the coterminous U.S. and Alaska (The PAD for Canada is still the original from WWF Canada). It includes more National Gap Analysis Program (GAP) datasets which became available after the completion of the original PAD. It also contains most of the new National Monuments that were created at the end of the Clinton administration, and significantly more wilderness areas than the original. Like the original, this database was assembled on a state-by-state basis using existing digital data. Because the PAD was assembled using dozens of different source datasets at varying scales and accuracy levels, users should consult the metadata files for their area of interest to determine the scale and accuracy of a given portion of the PAD. Most datasets are at a map scale of 1:100,000 or finer, but some portions of the PAD are at the 1:2 million scale. Consult the Metadata file for more information about data sources/scales.

CBI/WWF used the "best datasets they could obtain". Many of them are being revised on a regular basis, and so the PAD Second Edition may no longer be the most accurate source of protected area data for any given area. Metadata files are included, but are often not complete enough to offer help in locating more recent versions of source material. CBI/WWF were unable to obtain GIS datasets for all protected areas for each state. Therefore, they provided a list of missing protected areas (Gap code of 1 or 2) that they are aware of for each state. Many polygons in the New England region carry these codes. Additionally, large areas (especially within Maine) are coded as protected while in fact they are privately held and subject to parcelization and development.

There are no plans to update the PAD on any regular basis although there may be periodic small revisions.

The Nature conservancy (TNC) began compiling managed area data in 1998 in order to provide more detail to point data already gathered by state natural heritage programs and in order to support TNC's conservation planning. The compiled data covers states from New England to Virginia, and the data is compiled from a variety of sources, including state GIS conservation lands data layers., US Forest Service sources, and state GAP analysis data sources. The data set is considered to be in draft form and is used for internal purposes. Coding of the polygons or land parcels utilizes the GAP status codes for defining the level of protection or management regime based on the National GAP Analysis Program guidelines.

4.8 Main Findings for Current Conservation Land Data

The status of current conservation lands data in New England defies a quick and uniform summary. The characteristics of the data - its collection methods, maintenance schedules, scale, currency, comprehensiveness, availability to the public, and documentation - vary considerably from state to state. The main findings can be grouped into characteristics that the states' level data has in common, and characteristics where states' level conservation data are distinct.

Common characteristics include:

- State GIS offices act as the primary integrators;

- Availability of data in ESRI Arc Export file format is the standard;
- As much data as is integrated at the state level, is freely available to the public through state GIS websites or by request, with the single exception of a portion of the conservation lands data from Vermont;
- Metadata as provided through the state GIS offices is extensive but not complete;
- Open space data layers offer a fairly broad coverage of different types of land owners – federal, state, municipal, conservation organizations, water authorities;
- None of the states has fully realized a parcel-level based open space data layer or method for collection and maintenance at that level, although Connecticut has a project underway intended to create such a parcel-level open space layer.

Distinct features of state level conservation lands data include:

- Open space layers are not defined the same way reflecting broader or narrower views of open space and/or of access to different types of data;
- Resources available for the collection/creation of digital data, maintenance of the data, quality control, etc., vary widely - from state offices having staff assigned specifically to maintaining the open space GIS data layer to state offices where GIS staff have broad responsibility across multiple data layers;
- Currency of the data varies widely across the states, as well as the frequency and methods by which updates are performed:
 - Most state agency data is updated at least annually based on institutional procedures and reporting requirements;
 - Most states rely on voluntary data submissions for data from other specific groups, such as municipalities, local land trusts, etc.;
 - Some states GIS offices rely on data providers to create the digital data, while others have the capacity (staff and financial resources) to work directly with hardcopy or survey data;
- Various legal and reporting requirements are responsible for the type and frequency and accuracy of open space data collection, i.e.,
 - Massachusetts requires that all deeded Conservation Restrictions are signed by the Secretary of the EOEA;
 - Rhode Island has upcoming legislation that will require that all local land trusts must report on their holdings;

Issues and opportunities for the creation of a regional conservation lands database can be identified based on this assessment of the available data:

- Integration of the different states' open space data layers can be done but will not provide a consistent view of the regional status of conservation lands because of the differences (cited above) in scale and currency and comprehensiveness of coverage;

- The designation of protection status of conservation lands is treated differently across the six states, implying the need for standardization of attributes at the regional level;
- Comprehensive parcel-level representation of open space and conservation land data is not a realistic short to medium term goal because of lack of comprehensive parcel-level digital data and data sharing at the municipal level;
- State offices of GIS ability to further improve the coverage and currency of conservation lands data is constrained by available staff and funding resources as well as the magnitude of the task of collecting information from multiple, disparate sources of data – state agencies, regional authorities, federal agencies, local land trusts, and municipalities;
- State offices of GIS are established and recognized as the integrators and providers of digital GIS data and, therefore, can play a leadership role in advocating for and implementing changes in how and what data is collected at the state level, and its potential for integration with other states data;
- State offices of GIS follow federal standards for metadata and are responsive to federal initiatives concerning data standardization and sharing.

5 Proposal for an Enhanced Conservation Lands Database

5.1 Objectives and Approach

The enhancement and integration of conservation lands GIS data for all New England states can provide a variety of substantial benefits. This study concludes that the highest level of benefits to the widest audience will be realized if the integration of existing data is augmented with active stakeholder participation to achieve three main objectives:

1. Standardize geographic and descriptive attributes and documentation;
2. Improve existing data, particularly data collection comprehensiveness and frequency, and
3. Increase access to and ease of use of the data.

In order to realize these objectives, two main activities are proposed:

1. Meetings among stakeholders -- defined broadly to include data providers, integrators, and consumers
2. Creation of a conservation lands data Web Portal

The premise underlying these recommendations is that the improvement of conservation lands data and its integration at a regional level depends primarily on the consensual participation of state-level agencies in a process directed at developing standards and bringing consistency to data collection and formatting. The main role of the EFC is to shape and direct the overall effort of data integration and enhancement, and to provide incentives for state level participation. For example, with regard to the first activity, EFC will have specific responsibility to organize and facilitate meetings, coordinate the overall program and track its progress, identify sources of funding for state or private sector initiatives, coordinate research efforts, distribute meeting minutes, reports and documents, and publish digital data standards agreed to by participants. With regard to the second activity, EFC will have responsibility for management of the Web clearinghouse and information exchange portal, integration of the best available digital conservation lands data, ongoing updating of data and enhancement of site functionality, and development of innovative ways of presenting conservation lands data in conjunction with other GIS data layers for a variety of audiences.

The process of data enhancement and integration of New England conservation lands data parallels several efforts at the national level to enhance the standardization, documentation, interoperability, quality, and accessibility of geospatial data. These national efforts are embodied in programs and initiatives such as the Federal Geographic Data Committee (FGDC), the National Spatial Data Infrastructure (NSDI) framework, the USGS National Map program, and the FGDC I-Team and OMB's Geospatial One-Stop initiatives. The GeoSpatial One-Stop Portal, for example, is an e-government initiative of the Office of Management and Budget, which demands that maps and data services be standards-based and interoperable. The development of a conservation lands

data layer for New England can incorporate and benefit from these federal-level initiatives. By focusing on a specific data layer in one region of the country, EFC also has the opportunity to organize and promote a process that provides valuable insights and a model for these national programs.

5.2 Stakeholder Meetings

Improvement of the conservation lands data depends primarily upon the commitment of state-level agencies, the availability of resources (funds and staff) for data collection and compilation, the nature of regulations and incentives affecting data collection, and the design of database structures and standards. Understanding how states differ with respect to these factors is a prerequisite to assessing whether agreement on a common standard for conservation lands data is feasible or desirable.

The stakeholders in conservation lands data are defined broadly to include data providers, integrators, and consumers. The state GIS agencies and state agencies with land management responsibilities influence how and what data is collected, integrated and disseminated to the public. Lawmakers also play a role by determining the regulations affecting how and what open space or conservation lands data is required to be collected and reported, and by directing funds toward these activities. Conservation and other organizations as well as state and federal agencies play a role as consumers and modifiers of the conservation lands data, and in some cases as contributors to data collection and integration.

It is recommended that the EFC take the lead in initiating a series of meetings involving a selection of such stakeholders - key persons from each state GIS office, state agencies with land management or programmatic responsibilities for open space lands, federal agencies, and conservation organizations. These meetings could occur on an annual or semi-annual basis and could be scheduled in conjunction with other regional professional conferences, such as New England GIS (NEGIS) or New England ARC Users Group (NEARC). Smaller group meetings focused on specific topics could occur at more frequent intervals based on interest or practical urgency.

The purpose of these meetings will be to:

1. Increase the exchange of information between states concerning approaches to and constraints on data collection, the nature of state regulations affecting conservation lands and reporting requirements, and other issues affecting data quality and currency.
2. Allow data providers/integrators (state GIS offices) to interact with conservation lands data consumers (conservation organizations, other state agencies, private sector organizations) in order to better understand how the data are being used and/or modified to meet mapping and analytical needs.
3. Enable exchange of ideas concerning the feasibility of standardizing conservation lands data, including attributes and geographic characteristics (scale, positional accuracy).

4. Provide a forum for achieving consensus on standards and procedures concerning conservation lands data collection, accuracy, attribution, documentation, and integration.
5. Establish common standards for conservation lands data storage, access and maintenance.

It is recommended that the meetings have defined topics and involve presentations by stakeholders followed by facilitated discussion. For example, several topics that can and need to be addressed in this process are:

1. The lifecycle of conservation lands data: What are the current methods of data collection/integration? What constitutes best practices in statewide conservation lands data collection? Where are the reporting gaps? What is the balance between legislative requirements and voluntary reporting?
2. Geodatabases and standardization of data attributes: How much is enough? Is there a standard set that all states can agree on? What attributes are required/desired by conservation organizations, by state agencies and other consumers of the conservation lands data?
3. Geographic or positional accuracy: How fine-grained do the data need to be to meet the needs of data consumers?
4. Keeping data up to date: How often should data be updated, how much does it cost, and what are the cost-benefit trade-offs?
5. Resources: What staff, dollar amounts, and other resources are necessary to make the system work, and where do they currently come from? Are current resources sufficient, and if not, where could additional revenues be created?
6. Privacy concerns: Is there a need to limit the dissemination of conservation lands data of certain types or at certain geographic scales?
7. Federal and other standards for geographic data: Is it appropriate to pursue compliance with federal standards such as the NSDI cadastral framework theme as this evolves? Are conservation lands data layers compliant with Federal Geographic Data Committee (FGDC) standards for metadata?
8. The status of statewide municipal digital parcel data creation and its role in conservation lands data.
9. The experiences and procedures being implemented to compile conservation lands data layers in other states.

EFC would serve as or provide for a facilitator for the meetings. Following meetings, the conservation lands Web portal (discussed below) could be used for dissemination of presentation notes and papers, resulting from the discussion. In advance of the meetings, short synopses of discussion topics and relevant information could be provided to stimulate and direct discussion. EFC would have responsibility for organizing this effort. Specific additional investigations that EFC could lead or obtain from consultants, and that could enrich the information exchange, include:

- Sources of funding and application procedures;
- Experience and approaches to conservation lands data compilation of other states and organizations outside of New England;
- The implications of federal initiatives concerning geospatial data, such as the National Map, Geospatial One-Stop, I-Team, and National Spatial Data Inventory (NSDI) for the New England conservation lands data layer compilation;
- Summary report on legislation influencing the reporting of conservation lands data;
- Characteristics and performance of data models (geodatabases) for conservation lands data

The ultimate goal of these stakeholder meetings will be to add value to the state level data by addressing some or all of the limitations of the existing data, specifically by

- Increasing the standardization of conservation data characteristics – database formats, metadata, specifications;
- Increasing spatial accuracy, i.e., move all of the data from 1:24,000 to 1:5000 or larger scale;
- Defining a set of core attributes including the level of permanency of protection, the currency, the scale, the type of owner, and so forth; and
- Increasing the currency of the data across all types of owners, especially municipal, water authority, land trusts, etc.

Achieving the goal of adding value to the existing data will involve changing the way data is collected currently and will affect all participants in the data collection process to some degree. Creation of an open space geodatabase, for example, will define a set of rules controlling the types of data and spatial properties that can be entered into the data layer. Creation of standards for open space data attribution and positional accuracy, analogous to recently released standards for digital parcel data development in Massachusetts, will affect the scale at which data is collected.

Any discussion of standardization of data, changes to data collection procedures, etc., therefore, must consider the potential burden of added costs and the nature of state-level incentives for compliance and change. The promise of access to a pool of “shared” and improved data is not likely to be a strong enough motivation for substantially redefining the current system. Two specific motivating factors for consideration are:

- Legislation at the state level that requires reporting and standardization of open space records by different entities;
- Additional funds directed specifically for data collection and integration projects at the state level.

An additional incentive for participation is the alignment of state-level programs with ongoing federal-level efforts to standardize and integrate geospatial data.

The role of EFC and the stakeholders would be to identify and increase support for reporting requirements at the state level, and to identify sources of funds. Requirements that affect record keeping and standards of reporting and data dissemination will lower the cost of obtaining and integrating conservation lands data. Depending upon the source of funding, EFC could play the added role of administrator of a grant program directed toward projects that would create measurable improvement in data.

5.3 Conservation Lands Web Portal

The second recommendation for action is that EFC undertake the development of a Web-based conservation lands information portal. The portal would:

- Provide a means for rapidly and broadly disseminating information and findings from the collaborators meetings to the public and allow for feedback from this wider audience,
- Present the current (state GIS) conservation lands data as a seamless New England-wide data layer for online viewing and basic spatial analysis, as well as for download,
- Provide links to
 - State GIS Websites,
 - Other organizations involved with conservation lands data collection, and
 - Other sites that are of interest to consumers of conservation lands data.
- Provide for an ongoing dialogue and information exchange among the participants in stakeholder meetings, i.e., downloadable reports and documentation related to the conservation lands data improvement effort, message board, notices or a calendar for conferences and meetings
- Prototype and deploy web-based tools for collaborative and distributed spatial data redlining and attribute enhancement.

The purpose of creating a Web-based distribution system is to engender greater awareness of the need for and the development of conservation lands data, and to provide a single location for access to a standardized and regional conservation lands data layer, as well as providing a capability to capture user input to conservation lands data.

Technologies for Internet access and manipulation of spatial data are evolving rapidly, and are continually lowering the threshold for access to and editing of spatial data. Distributed computing through such initiatives as Microsoft's .NET render the locations of different data and software services unimportant because they execute according to a common set of rules. This paradigm is pushing its way into many areas of mainstream computing, and the implications are important for Web-based GIS. Operational implementations such as the [OpenGIS Multi-Server Web Mapping site](#) allow users to display and query data hosted from various machines in different locations at one time. It

is possible to display these disparate data in a single, harmonized map frame because all of the hosts subscribe to the common OGC standard for data description and delivery. The user requests a map from his browser and this request may be sent to numerous locations anywhere in the world to query different data and return a consistent picture back to him.

This model applied to New England conservation lands would permit each GIS office to maintain independent map services distributing data for its respective coverage area, and serve this to the client via a ‘multi-viewer’ that would present the user with a seamless map with consistent attributes.

Ideally the portal would serve the needs of both GIS experts and casual users. This would be accomplished by providing multiple types of access to suit the data and analysis needs of different consumers of conservation lands data. For example, the Web site could provide for both data distribution and online viewing, such as described by the following types of capabilities:

1. Downloading data files in standard GIS software formats for a variety of geographical units – New England wide, state level, watershed, county, etc.
2. Allowing for the viewing/analysis of data online in either of two modes:
 - a. Pan and Zoom on static conservation lands map
 - b. Query and analyze conservation lands data using basic GIS techniques for manipulating digital maps
3. Permitting the mark up or input of points or polygons on a digital map so as to describe properties not shown as conservation lands, but that are recognized as such by those with local expertise.

Because most users of GIS data are already familiar with state GIS Websites, data resources, and procedures for obtaining data from them, it is unlikely that simple download capability for a regional data layer will attract a wide audience. Online viewing functions defined to match the information needs of data users would make the site somewhat unique, by meeting the needs of a broad audience (including GIS experts and novices) for easy access to information and analysis rather than raw data. Typical GIS functions that are candidates for inclusion include:

- Navigation by pan and zoom and by search for feature type
- Buffer feature to determine the type or extent of features in surrounding area
- Calculation of area
- Calculation of distance between features
- Linking geographic features with attributes, images, presentation of tables or charts summarizing attributes of selected features,
- Presentation of metadata
- Custom selection of features and aggregation of area or proportional statistics of lands within that area

The functionality that the site offers will evolve over time based on user feedback, improvements to the conservation data, and the addition of other GIS data layers. For example, specific types of analysis could be incorporated as tools or wizards on the Website that would enable the comparison of conservation lands with demographic data; or association of conservation lands with habitat type, transportation infrastructure, build out analysis, etc.

It is assumed that the site would be created and hosted by a third party on EFC's behalf. The third party (or parties) would create the Web application, provide data integration and installation, and host the application as well as monitor activity and usage on the site. EFC's role would include providing resources for the implementation and maintenance of the site, content management, and building the forum for facilitating exchange of data among states and distributed collaborators.

Editing and mark up of map data through a Web browser is rapidly becoming a reality, and should be considered as a target function of the EFC New England conservation lands portal. Numerous companies are coming to market with Java-based applications that allow users to add points or other features with attached attribute data to a map and send these off to a remote server for validation or processing. Such functionality in a conservation lands portal would be invaluable, as it would permit users with little or no experience in GIS but intimate local expertise to add highly accurate data for their small area of familiarity. Such a system of collaborative data capture eventually becomes essential in tracking of high quality, current land status. It is simply impractical for centralized data collectors to stay on top of data changes over an area as large and dynamic as New England. While a number of Web-based distributed editing implementations are currently being attempted, the technology is only now maturing to the point that will permit a useful and cost effective deployment and it has barely evolved out of its novelty stage. EFC could establish a precedent of national significance by implementing this sort of distributed editing technology to support data maintenance of regional conservation lands. For example, it is exactly this process of local, knowledgeable user mark-up followed by verification and data update, that is planned for by the USGS for maintaining its national hydrographic data layer.

5.4 Outcomes, Evaluation of Project Success, and Tangible Benefits

The principal outcomes of the stakeholder meetings and creation of the Web portal are:

- Creation of region wide standards for spatial accuracy and attributes that allows New England-wide conservation lands data to be viewed as a consistent whole,
- Build a community of active data custodians/providers/users from across New England,
- Pilot the integration/regionalization of data creation/distribution processes as a model for national open space methodology and infrastructure,

- Enhance conservation lands information access and utility for planning, conservation, other uses, through online data visualization and data analysis tools, and
- Identify and access funds for support of the data enhancement process and specific data enhancement activities at the state level.

The success of this effort can be judged by several general evaluation criteria:

- How well the resulting improved conservation lands data matches the needs of users,
- Whether the process changes the way data is collected and documented,
- Whether the process changes the frequency of updating,
- Whether the process increases or alters attribution of data,
- Whether the access to data and tools for spatial analysis of conservation lands is easier for a wider array of types of users (i.e., GIS experts and novices),
- Whether public awareness and use of conservation lands data is increased, as evidenced by increases in the level of activity of the proposed Web portal over time.

Tangible benefits will be realized in the form of task efficiencies, cost avoidance, and service enhancements, in the following areas:

- Reduced staff time spent acquiring and integrating conservation lands data for conservation, resource planning, land acquisition, transportation, and other types of projects across all agencies accessing conservation lands data;
- Ability of agencies not having GIS capabilities – staff expertise, hardware, software, etc. - to utilize mapped conservation lands data for planning and decision making;
- Efficient delivery of conservation lands data for user-specified extents, including transboundary areas not covered by state-level GIS data layers taken individually;
- Reduction in project-level data maintenance and updating activities due to improved conservation lands data quality – comprehensiveness, currency, attribution;

5.5 Budget and Schedule Estimates

The following tables presents a budget estimate for a two-year effort to establish the Web Portal and conduct a productive series of four meetings (two per year) among stakeholders leading to concrete initiatives to improve conservation lands data.

Budget Estimate for Two-Year Program to Enhance Conservation Lands Data and to Create a New England Conservation Lands Web Portal

Description	Year 1	Year 2
Stakeholder Meetings		
EFC staff (half-time)	\$ 40,000	\$ 40,000
Participation of Consultants - GIS Analysts/Advisors	\$ 25,000	\$ 15,000
Overhead Costs - Meetings, Mailings, Travel, etc.	\$ 15,000	\$ 15,000
Subtotals	\$ 80,000	\$ 70,000
Web Portal Design and Development		
<u>Applications</u>		
Web Portal Design	\$ 20,000	\$ 5,000
Custom Mapping Applications/Services	\$ 40,000	\$ 20,000
Web Hosting and Maintenance Services	\$ 6,000	\$ 6,000
<u>Data</u>		
Conservation Lands Data	\$ 5,000	\$ 5,000
Orthophotography	\$ 5,000	\$ 1,000
Hydrography	\$ 1,500	\$ 500
Political Boundaries	\$ 1,000	\$ 500
Transportation	\$ 1,500	\$ 1,000
Other Data Layers	\$ 5,000	\$ 1,000
Subtotals	\$ 85,000	\$ 40,000
Grand Total	\$ 165,000	\$ 110,000

The budget assumes that the EFC-led effort will require at least a half-time coordinator position, supported by a consultant with GIS and conservation lands expertise who will participate in meetings and contribute to written documents and analyses, and that can be called upon to perform independent supporting studies. The overall project assumes that there will be two meetings per year from project initiation, providing a basis for substantive progress toward the project goals of achieving consensus on data standards and enhancements to data collection.

The budget does not include funds for a data enhancement-related grant program. If the stakeholders as identify this a priority need for data improvement, then developing such a program would require finding additional funding resources.

The budget estimate also assumes that the creation of the Web Portal will be outsourced to a Website design firm, and that the mapping application development, data integration, and map server hosting services will be provided by a GIS consulting firm. Off-site hosting eliminates the cost of purchasing hardware and software and of providing facility and maintenance services.

It is estimated that an operational Web Portal could be designed and deployed within a four to six month period. This initial site would provide for complete integration of existing conservation lands data layers with viewing and spatial analysis functionality, as well as data download. Further enhancement to the site in the second year would be incorporate the map mark up capability in conjunction with decisions made at stakeholder meetings. Provision is made for updating the map data, particularly the conservation lands data, at the beginning of year two.

Appendix A. Comparison of Characteristics of New England States' Conservation Lands GIS Data Layers

This appendic presents two tables that summarize and facilitate comparison of state GIS data for conservation lands:

1. Table 1. Comparison of Characteristics of Individual State Conservation Lands GIS Data
2. Table 2. Comparison of Consrevation Lands GIS Data Attribute Types

Appendix B. List of Contacted Agencies/Persons

Appendix C. Sample Maps of New England States' Conservation Lands Data

A variety of maps created by AGI from an integrated version of state level conservation lands digital data are viewable in Adobe .pdf format at the following URL:
<http://www.appgeo.com/clients/efc/> .