Large Landscape Conservation:
Recommendations for Online Data and Tools

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Abstract

The Lincoln Institute of Land Policy initiated the Large Landscape GIS Project to provide design recommendations for an online platform of spatial datasets and planning tools that uniquely support and advance large landscape conservation. This effort focuses on web-based resources which are readily available and valuable for conservation practitioners, decision-makers, managers, and citizens working at the scale of large landscapes.

A gap analysis of over 100 existing web-based spatial datasets and planning tools indicates that there is significant opportunity for future investment in online tools and data for large landscape conservation. Targeted prototyping to explore these gaps, reveals that online technologies exist today that can provide a foundation for improved landscape conservation support. However, additional research and investment is recommended to advance online access to resources that uniquely support large landscape initiatives.

The following are specific recommendations for future work:

- Invest in landscape systems research
- Provide consistent data access options
- Create a searchable inventory of local and regional initiatives that collectively enable large landscape conservation
    - document how each initiative addresses specific conservation goals
    - map initiative service areas
    - allow online users to locate partners in the vicinity of their own initiatives
- Advance online tools that allow online users to
    - tell landscape narratives
    - perform targeted landscape analysis
    - conduct collaborative site planning with progress tracking
- Leverage existing online tools, and
- Create partnerships.

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Table of Contents

List of Figures

Large Landscape Conservation:
Recommendations for Online Data and Tools

Executive Summary

The Lincoln Institute of Land Policy initiated the Large Landscape GIS Project to provide design recommendations for an online platform of spatial datasets and planning tools that uniquely support and advance large landscape conservation. This effort focuses on web-based resources which are readily available and valuable for conservation practitioners, decision-makers, managers, and citizens working at the scale of large landscapes.

First, an inventory was conducted of existing online spatial datasets and planning tools. Over 100 existing datasets and web-based tools were reviewed, with a focus on North American resources that are regional or continental in scale, are sponsored by reputable organizations, offer a broad characterization of landscape systems, and support a framework for considering landscape values, stressors, and opportunities.

Gaps identified in existing spatial datasets for landscape planning included data availability, completeness, currency, access, scale, and cross-boundary regional compatibility. However, the most significant data gap is the absence of datasets that characterize landscape systems as a whole. Further research is needed to better quantify topics such as habitat connectivity, landscape vulnerability, climate resilience, and the economic drivers behind conservation success.

Gaps identified in existing web-based planning tools included the lack of online analysis, the availability of consistent access options, the need for geographic profiling tools, support for conservation progress tracking, and support for storytelling and landscape narratives. Perhaps of greater significance though, is the observation that most existing online portals intended for large landscape practitioners are not widely used by the landscape conservation community. Several informal polls of landscape conservation organizations revealed both lack of awareness of these tools, as well as lack of adoption.

A number of tool design concepts were proposed to help address the issues identified above. These design concepts were further explored via a proof of concept (POC) process. Both existing platforms and custom development techniques were used to create interactive prototypes for selected regional landscapes, exploring themes such as landscape connectivity, cross-boundary collaboration, conservation opportunity analysis, climate impact, and recreation access.

The first prototype, based on the Quabbin to Wachusett region of the Connecticut River Watershed, explores creating a “landscape narrative” by allowing the user to make a case for a particular conservation initiative from the bottom up, showing a detailed progression of on-the-ground conservation initiatives over time.

The second prototype, focused on the Crown of the Continent region of Montana, Alberta and British Columbia, demonstrates the power of analytical tools. This prototype explores the use of embeddable widgets to provide targeted online analysis for exploring conservation opportunities and climate risks. For example, one embedded widget allows the user to use "sliders" to specify which landscape attributes should be given higher priority to analytically highlight promising conservation targets.

The third prototype, focused on recreation access in the Chattahoochee River Corridor, explores how online geographic profiling can enable collaborative protected area site planning, identifying assets and impacts within proposed boundaries for new river access sites.

Additional research and development is required to adequately address the online planning tool and spatial dataset gaps identified for effective large landscape conservation. The following are specific recommendations for future work:

- Invest in landscape systems research.
- Provide consistent data access options.
- Create a searchable inventory of local and regional initiatives that collectively enable large landscape conservation to:
    - document how each initiative addresses specific conservation goals;
    - map initiative service areas; and
    - allow online users to locate partners in the vicinity of their own initiatives.
- Advance online tools that allow online users to:
    - tell landscape narratives;
    - perform targeted landscape analysis; and
    - conduct collaborative site planning with progress tracking.
- Leverage existing online tools.
- Create partnerships.

In summary, the inventory, gap analysis, and prototyping efforts on this project indicate that there is significant opportunity for future investment in online tools and spatial datasets for large landscape conservation. Online technologies exist today that can provide a foundation for improved landscape conservation support. However, additional research and investment is recommended to advance online access to resources that uniquely support large landscape initiatives.

Project Objective

The Lincoln Institute of Land Policy initiated the **Large Landscape GIS Project** to provide design recommendations for an online platform of spatial datasets and planning tools that uniquely support and advance large landscape conservation. Key to this effort is a focus on web-based resources—resources that are immediately available as needed, and can be shared among partners.

The target audience for this work includes conservation practitioners, decision-makers, managers and concerned citizens, with an objective to provide useful, easily accessible information to people who:

- are conceiving, convening and coordinating large landscape conservation initiatives towards long-lasting outcomes and objectives;
- decide where to invest financial, organizational and human resources towards the achievement of positive conservation outcomes on a landscape scale;
- manage those resources to achieve positive outcomes; and
- want to roll up their sleeves and help advance large landscape conservation on a volunteer or professional basis.

Approach

The Large Landscape GIS Project is divided into four stages:

1. Inventory: Identify existing online spatial datasets and planning tools that are pertinent or adaptable to large landscape conservation.
2. Analysis: Evaluate gaps in existing technologies as they relate to large landscape conservation.
3. Design: Recommend an approach and design for a Large Landscape Conservation GIS Portal.
4. Demonstration: Provide proof of concept examples that demonstrate elements of proposed systems within the context of premier North American large landscape initiatives.

This report provides detailed results from the tasks listed above, including an evaluation of gaps in existing technologies, and recommendations for new directions in online tool development for large landscape conservation.

Defining "Large Landscape Conservation"

In order to assess gaps and opportunities for new platforms, it is important to first establish the unique characteristics that define Large Landscape Conservation. This can lead to greater insights as to where existing datasets and tools may fall short for this evolving discipline.

Large landscape conservation initiatives are, generally:

- cross-boundary: including multiple parcels and land owners;
- cross-sector: involving stakeholders from two or more sectors of the economy, including the public, private, nonprofit and academic sectors;

- cross-jurisdictional: encompassing parcels in multiple jurisdictions, across town, county, state, and even national boundaries,
- designed to achieve multiple, measurable outcomes, often including conservation, economic development, and quality of life strategies; and,
- targeted at a specific, mapable territory that is large enough to accommodate systematic, significant, and enduring conservation outcomes.

Definitions provided by both leaders and literature in landscape-scale conservation emphasize the importance of collaboration, green infrastructure planning, and whole systems analysis.

Peter Ericson from MIT Department of Urban Studies and Planning states:

> Landscape Scale Conservation is an emerging framework to conceive, plan, finance, and manage projects with significant conservation value—ecological, economic and social. The broad concept of Landscape Scale Conservation includes three basic features:
>
> 1. There is a regional system of interconnected properties (lands).
> 2. Actions are organized to achieve one or several specific conservation objectives.
> 3. Landowners and managers within a given conservation region cooperate or collaborate in some concrete fashion to achieve those objectives.[1]

Ole Amundsen from The Conservation Fund's Strategic Conservation Planning Program reports:

> Increasingly, land trusts are acting as conveners of green infrastructure planning processes, bringing together a wide range of stakeholders to create a collective vision for regional, landscape-scale conservation. In this planning process, the resulting network of core areas and corridors may not only serve as the focus areas for the land trust but also help guide and direct federal, state and local government conservation efforts. A regional green infrastructure approach is an excellent way to prepare for the adaptations required due to climate change because a network can facilitate wildlife movement and protect crucial resources, such as drinking water recharge areas, for people.[2]

A recent white paper from The Nature Conservancy offers the following definition for "whole systems" conservation:

> [A whole system landscape] has a recognizable unifying ecological feature and includes people. It must be large enough to maintain resilience, sustain key ecological processes and services, and allow for movement of organisms within

[1] Ericson, Peter. Conservation on the Edge: Landscape Scale Conservation at Colorado's Urban-Rural Interface. Massachusetts Institute of Technology, Department of Urban Studies and Planning. 2004.
[2] Amundsen, Ole M. Strategic Conservation Planning. Land Trust Alliance. 2011.

> and through it. It includes conservation areas with high ecological integrity surrounded by a matrix of lands and waters that vary in quality but are important for conservation.… [Whole system conservation] considers the needs of people and an increased emphasis on managing the matrix of lands and waters surrounding portfolio sites. It also requires working at multiple scales, managing for connectivity and a permeable landscape, and tying policy solutions to place.[3]

The very fact that we are working within the context of landscape systems implies many moving parts—multiple jurisdictions, organizations, objectives, scales, time horizons, and outcomes. The planning tools and datasets that are identified must support a multi-faceted approach and offer coordination and synthesis at the system level, while staying relevant to local conservation programs:

- Requires coordination across multiple political jurisdictions.
- Needs participation and buy-in from local initiatives and organizations.
- Typically incorporates multiple objectives and outcomes.
- Applies to multiple geographic scales and time horizons.
- Requires tracking and accountability to quantify progress toward measurable conservation outcomes.

Spatial Datasets Inventory

The first task in this project was to identify existing, online datasets that are pertinent or adaptable to large landscape conservation.

It is important to recognize that this inventory will never be comprehensive. There is an enormous wealth of data available online. We have focused our efforts on identifying existing datasets for North America that are:

- available online;
- national or regional in scale;
- sponsored by reputable organizations;
- offer a broad characterization of landscape systems; and
- Support a framework for considering landscape VALUES, STRESSORS, and OPPORTUNITIES.

Figure 1 summarizes thematic data needs for large landscape conservation analysis and mapping. Appendix B provides detail and examples of existing datasets within each thematic

[3] Ward, J., V. Agostini, M. Anderson, C. Burns, P. Doran, J. Fargione, C. Groves, L. Hanners, J. Hoekstra, R. Marshall, S. Morrison, S. Palmer, D. Shaw, and J Smith. Stepping up to the Challenge: A Concept Paper on Whole System Conservation. The Nature Conservancy, North America Region. 2011.

datasets within each thematic category. Appendix C provides a complete report on data inventory results for the project to date.

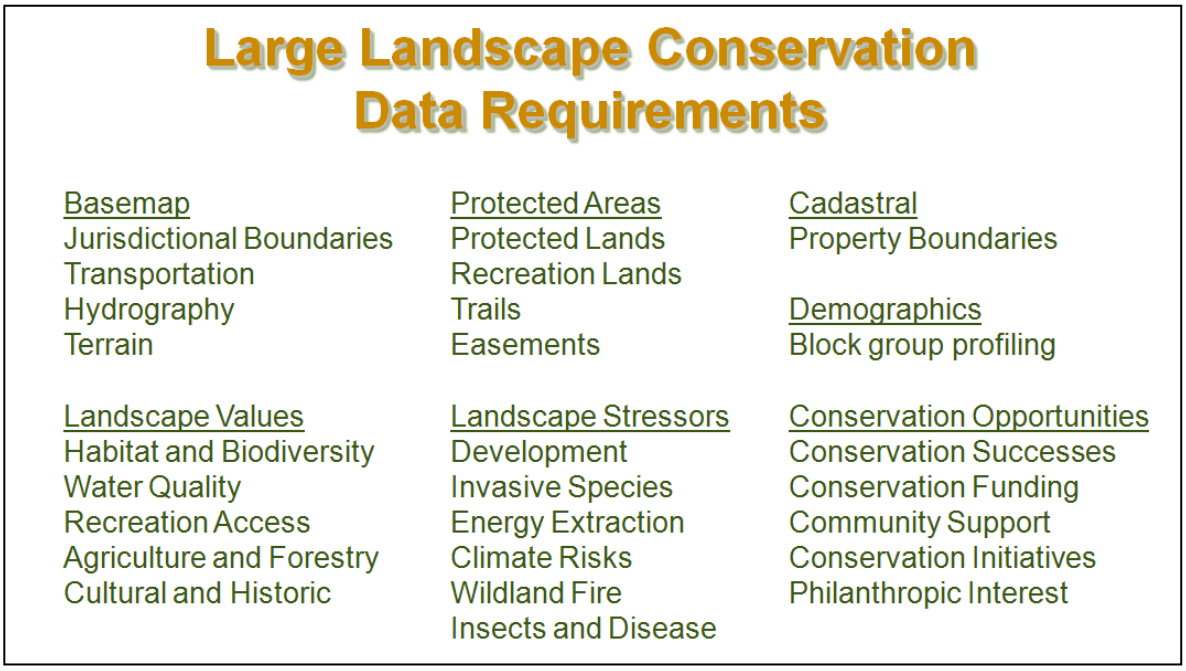

Figure 1: Thematic data needs for large landscape conservation analysis.

Large Landscape Conservation Data Gaps

As we began to assess GAPS in identified in datasets, it became immediately clear that a "gap" doesn't just mean that the data doesn't exist. There are many "gaps" that are more subtle.

Spatial Data Gap Examples

Availability

There are some desired spatial datasets that may exist, but they are not compiled or available online. For example, active forest industry lands are often maintained at the corporate level and are available only upon specific request, and certainly not online. A comprehensive national trails database does not exist. Data on location and focus of various conservation initiatives must be compiled (such as the Northeast Landscape Inventory assembled by RPA and partners).

Completeness

Other spatial datasets are a work in progress. The Protected Areas Database (PAD US) is an incredible data resource for protected lands, but it is only complete down to the county level. Local parks and open space are not reliably accurate or complete.

Currency

Spatial datasets with national coverage can take years and substantial investment to perform an entire update cycle. For example, the currency of National Landcover and GAP datasets is in a constant state of "keep up" with rapidly changing landscapes.

Access/Cost

A national parcel dataset, including assessor attributes, is available from select vendors, however it must be purchased at a substantial cost. Some state and regional data agencies provide access to parcel information at no cost, but the most current records must be obtained from local assessment offices. The data schema (assessor's attributes) for local parcel data is almost always different from one jurisdiction to the next.

Scale/Resolution

Demographic data provided in spatial data formats is typically available at county level from online data servers such as ArcGIS Online or state data agencies. However, higher resolution block group projections must be purchased from national vendors.

Regional Compatibility

Regional spatial datasets such as data from state natural resource agencies, while rich in content, don't always "match up" across state lines.

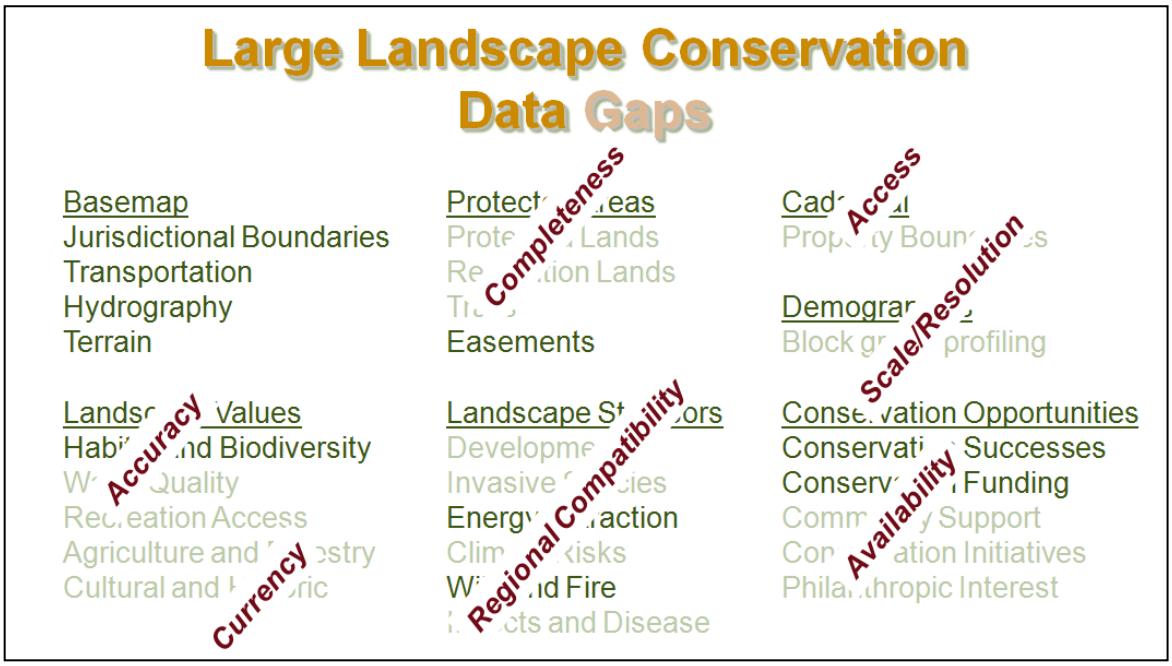

Figure 2: Large landscape conservation data gaps.

Large Landscape "System" Data Gaps

Perhaps an even more significant data gap, as you consider a "systems" approach to large landscape conservation, is the absence of spatial datasets that characterizes landscape systems. The challenge is that these are, by definition, derived datasets. They require expert analysis and aggregation of many of the datasets listed in this outline.

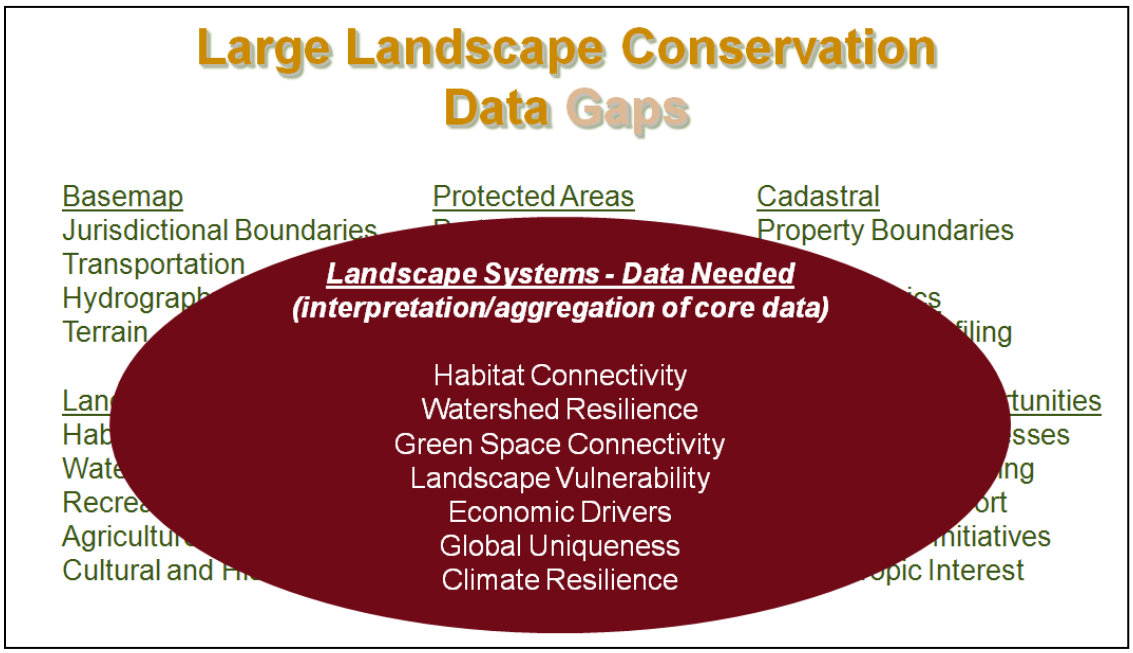

Figure 3: Landscape "system" data gaps.

To guide local conservation initiatives in a way that compliments and strengthens the health of the system, these broader assessments are crucial. We need to be able to address questions such as:

- What locations within a particular landscape contribute most to climate resilience? and
- What locations are at greatest risk if connectivity is broken?

These are not datasets that can be generated overnight. Many require decades of research and a level of science that is still maturing. However, in order to advance large landscape conservation and management, investment in these over-arching spatial datasets is necessary. Fortunately, a national network of public-private partnerships know as Landscape Conservation Cooperatives (LCCs) established by the US Department of Interior are beginning to make great progress toward both funding and development of landscape-scale spatial datasets.

Example System-Level Research and Datasets

The following are examples of organizations and initiatives that are working to fill these system level gaps in data and analysis:

Habitat Connectivity

Causes of Forest Fragmentation in the United States—US EPA

Critical Habitat Portal—US FWS

Gap Analysis Species Distribution Models—USGS GAP

Wildlife Council Pilot Projects—Western Governors Association (WGA)

Watershed Resilience

Watershed Condition Framework—USFS

The Wetlands-At-Risk Protection Tool—US EPA

Green Space Connectivity

Protected Areas Database—CBI

National Trails System—National Park Service

Landscape Vulnerability

Crucial Areas Assessment and Planning System (CAPS)—US FWS

Global Uniqueness

NatureServe Explorer—Nature Serve

Climate Resilience

Climate Wizard and Coastal Resilience Tools—TNC

Sea Level Affecting Marshes Model (SLAMM)—US FWS

Online Planning Tools Inventory

A second effort for this inventory and gap assessment is focused on existing online planning tools.

Online tools were categorized by topic (habitat, climate, recreation, soils, etc.) as well as by functional content. Each tool identified in the inventory was tagged with one of more of the following content categories.

- Background Information Applications—provide training, best practices, case studies, and/or summary info.
- Analytic Tools—allow for some kind of analysis through web-based applications or downloadable extensions.
- Data Portals—provide online access and/or links to downloadable GIS data.

- Interactive Mapping Applications—provide online map viewers supporting zoom, pan, and overlay exploration of multiple datasets.
- Community Interaction Tools—support member interaction, public interaction, expert feedback, and formal or informal workspaces.
- Research Portals—link to research, reports, publications, and news.

Appendix D provides a complete report on online tools inventory results for the project to date.

Large Landscape Conservation Tool Gaps

The following summarizes findings from a gap analysis of online planning tools for large landscape conservation. Tools gaps are characterized both in terms of functionality and usage hurdles.

Functionality Gaps

Online Analysis

Most online planning tools inventoried were "information driven", providing documentation, relevant links, contacts, and maps. For the most part, analytical capabilities were limited to information search and data query. Interactive mapping tools typically supported visual overlay analysis, but overlays of more than two data layers quickly became difficult to interpret without user control of map symbology. Tools with higher levels of analytical capability were available for download and use with desktop mapping systems, but very few tools provided analytical capability online. Some tools (such as SLAMM from US FWS and Climate Wizard from TNC) allowed side-by-side comparison of climate scenarios, but none provided scenario analysis of alterative conservation actions in response to landscape threats.

Effective conservation within the context of landscape systems will require insight into relationships between critical resources, landscape stressors, and conservation opportunities. The following types of online analysis tools might be considered:

- Online diagramming tools for characterizing the relationships between partner capacity, resource threats, and effective conservation actions (similar to the Miradi desktop software from Conservation Measures Partnership)
- Landscape prioritization tools that allow users to analytically weight and combine multiple resource protection objectives, resulting in mapped focal areas across the landscape (similar to GIS weighted overlay analysis).
- Scenario analysis tools that enable consideration of alternative conservation actions within the context of landscape system objectives and threats.

Consistent Data Access Options

Many sites now provide interactive map viewers and/or data download options. However, there is little consistency across access options. Standards governing metadata for spatial datasets have significantly evolved and improved over the last decade; however data formats still vary widely.

Data products for large landscape analysis must serve a wide range of users. It is recommended that systems developed for large landscape conservation provide a consistent range of data access options that accommodate varying levels of technical capability:

- Interactive map viewer (allows non-technical users to explore, query, and print maps in an online environment).
- Map Services such as WMS or KML (allow semi-technical users to take advantage of mapping tools such as Google Earth, Data Basin, or ArcGIS Explorer to assemble custom interactive maps, using a selection of searchable data products without having to tackle data schemas or symbology interpretations).
- Data Download (allows advanced GIS users to incorporate spatial datasets into their internal maps and analysis).

Level of Detail

Most online planning tools that provide information useful to Large Landscape conservation efforts seem to be targeted at addressing the needs of two distinctly different user types: 1) the beginner and 2) the expert. It is difficult to find online information and tools that address a user that is well informed about resources and conservation strategies, but may not have in-depth scientific or technical credentials. There needs to be a broader offering of online conservation tools that bridge the gap between “sound bite” and “science intensive”.

Examples of tools that successfully bridge this gap are those that offer access to landscape “system” results such as Habitat Connectivity (Causes of Forest Fragmentation in the United States—US EPA) or Climate Resilience (Climate Wizard and Coastal Resilience Tools—TNC). These tools provide insights into highly technical subjects by providing summarized research and aggregated data results for application at the landscape level.

Holistic Landscape Tools

Our inventory of spatial datasets and planning tools that have applicability to large landscape conservation revealed an unbalanced focus on habitat and wildlife resources. To better support a systems approach to large landscape conservation, tools are needed that support combination and exploration across multiple resources, stressors, and opportunities such as recreation access, working lands, cultural assets, and economic drivers.

Project profiling

Much effort has been invested in creating resource maps that help guide strategic conservation at the landscape level. Typical landscape initiative strategy reports include a series of maps from various sources that depict critical habitat, climate risk, watershed health, etc. However, interpretation of these maps at the project level is largely a visual exercise.

An online capability is needed for local practitioners to trace or upload a proposed project boundary and receive a "profile report" specific to that property. The tool would "slice" through all available data to summarize resources and opportunities that the proposed project offers. This could be used as screening tool to identify project opportunities that merit additional consideration and in-depth evaluation. This could also be a tremendous time saver for making the case for conservation funding for specific conservation projects.

Usage Hurdles

Progress Tracking

Long term viability of large landscape initiatives requires being able to measure "success" over time. This is essential to maintain financial support, keep local partners engaged, and assess and adapt landscape strategies to meet long term needs.

An online initiative report card that provides visual progress (charts/graphs) toward established landscape goals is envisioned. "Dashboard" tools of this type exist (e.g. ESRI's MapIt Tool), but none have been applied to landscape initiatives. The South Atlantic Landscape Conservation Cooperative (SA LCC) is currently designing a conservation impact assessment tool as part of its Optimal Conservation Strategies Program that shows great promise.[4]

[4] http://www.forestthreats.org/news/ffaccts/Mordecai_FFACCTs_2.3.12.pdf
South Atlantic Landscape Conservation Cooperative—Rua Mordecai, Science Coordinator

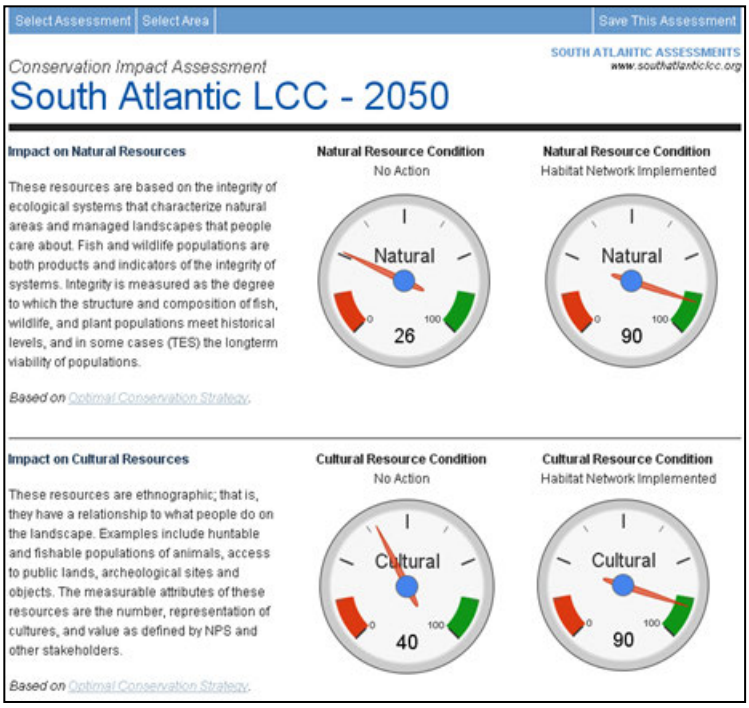

Figure 4: South Atlantic LCC, Conceptual progress tracking tool design

It is important to note that the success of such a tool requires more than just software development. The most challenging hurdles for this type of approach are:

- Establishing appropriate metrics for measuring process at the landscape system level. (These metrics would include, but go beyond, traditional dollars and acres assessments.)
- Creating the mechanisms and the culture among initiative partners to consistently report progress toward landscape goals.
- Interpreting the collected data, on a periodic basis, to adapt overall landscape strategies.

Locating Partners

The success of large landscape conservation is largely dependent on intentional collaboration between partners at the local and regional level. Working within the context of landscape systems implies many moving parts… multiple jurisdictions, organizations, objectives, scales, time horizons, and outcomes. Intentional collaboration between conservation initiatives requires a broad view of who is working on what, and where.

A first step toward facilitating broad collaboration would be the creation of a national-scale searchable database of local and regional initiatives. This inventory of landscape conservation initiatives will serve as the basis for an assessment of how these diverse efforts relate to habitat protection, other natural resource goals, and infrastructure and land use plans. In addition, an atlas should be created that depicts spatial service areas to better understand the geographic relationships between initiatives, important natural resources, and urban growth and infrastructure investment. This would allow online users to locate partners in the vicinity of their own initiatives, as well as take advantage of complementary strengths and goals of

neighboring initiatives. Regional Planning Association provides an excellent example of this type of searchable inventory for the Northeast at http://www.rpa.org/northeastlandscapes/.

Spatial Data Interpretation

Having access to online datasets is a huge asset. However, applying available spatial data to make landscape management decision requires appropriate interpretation of the data.

As discussed above, providing interactive map viewers and/or map services such as WMS or KML allow semi-technical users to take advantage of mapping tools without having to tackle spatial datasets schemas or symbology interpretations. Providing planning tools that offer access to landscape "system" results via aggregated spatial datasets (connectivity, resilience, economic vulnerability) also help to inform users that are not science specialists.

In the end though, making management decisions based on a layman's interpretation of spatial data that may have been collected or mapped for a different purpose is unwise. Online planning tools are not a viable substitute for working with resource experts for guidance and interpretation.

Dataset Sharing

Collaborative spatial data archives are a growing trend in geographic data sharing. Online data exchange tools such as Data Basin from CBI and ArcGIS Online from ESRI provide an excellent resource for searching and exploring spatial datasets from a broad spectrum of researchers and analysts.

However, data availability on collaborative data exchanges depends on broad participation by users. Data producers must be willing to publically share datasets. Proprietary and/or sensitive datasets will not be available from this type of venue. Typically, submissions are not reviewed for accuracy or usability. There is no requirement that data submissions be removed or updated, when updated results become available.

While excellent resources for quick spatial datasets searches and interactive "mash-up" mapping, these tools should be used with full appreciation of the context under which these data products are provided.

Executive Story Telling

Better tools are needed that enable executives to "make the case" using simple, information-rich, presentation tools. Managers and decision makers are often called upon to synthesize a substantial quantity of in-depth research to provide a public synopsis, to support a proposal, or to defend a decision. Maps and charts provide a powerful means to present supporting data. Applications such as MicroSoft Powerpoint are the tool of choice for live presentations, but embedding maps and charts typically requires assistance from a GIS technician. Tools are needed that assist the executive in constructing a story-line with interactive visuals. These tools

should provide the means to format a presentation, and should be stable and intuitive enough to step through during a live seminar.

Leveraging Online Tools

There are a number of existing online tools and resources, as evidenced by the inventory list in Appendix D. A subset of these tools represents a substantial investment by several organizations in providing multi-functional online portals for landscape conservation. Some excellent examples include:

- LandScope from NatureServe;
- Conservation Gateway from TNC;
- Digital Coast from NOAA;
- DataBasin from CBI; and
- ArcGIS Online and ArcExplorer Online from ESRI.

There is indication, though, that these tools are not being widely used by landscape conservation practitioners. An informal poll of attendees at the Large Landscape Practitioners' Network workshop at The Land Trust Alliance Rally, Milwaukee, WI, October 14, 2011. Figure 5 summarizes the results.

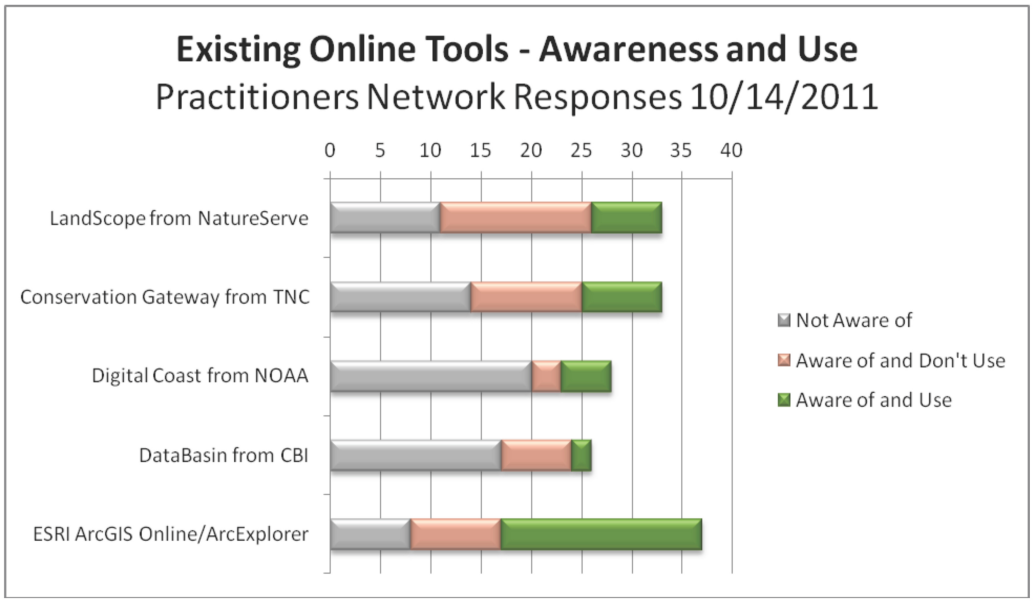

Figure 5: Existing online tool usage, informal poll LTA Rally, October 2011

Other Tools and Data Portals Mentioned via Write-In Comments

Web Soil Survey (WSS)—NRCS
Green Infrastructure Network—TCF
Nat. Map Seamless Server—USGS
NBII Clearing House—USGS
Google Earth—Google
Surf Your Watershed—EPA
Natural Heritage State Programs
Conservation Lands Network—
Bay Area Open Space Council
Conservation Registry—
Defenders of Wildlife
ConPro—TNC
Federal data portals—BLM, FS, USFS
Local & County online mapping sites
State-specific online portals:
Beginning with Habitat—ME DNR
MEGIS—State of Maine
MassGIS—Massachusetts GIS
GRANIT—State of New Hampshire
NY State DEC Env. Mapper

A more formal poll was conducted November-December 2011 by Regional Plan Association (RPA) and University of Montana's Center for Natural Resources and Environmental Policy (NREP). Input was solicited from approximately 1,000 people primarily identified by RPA's Northeast Landscape Practitioners contact list. Of the 49 responses received, top 3 respondent groups included nonprofits, federal agencies, and state government.

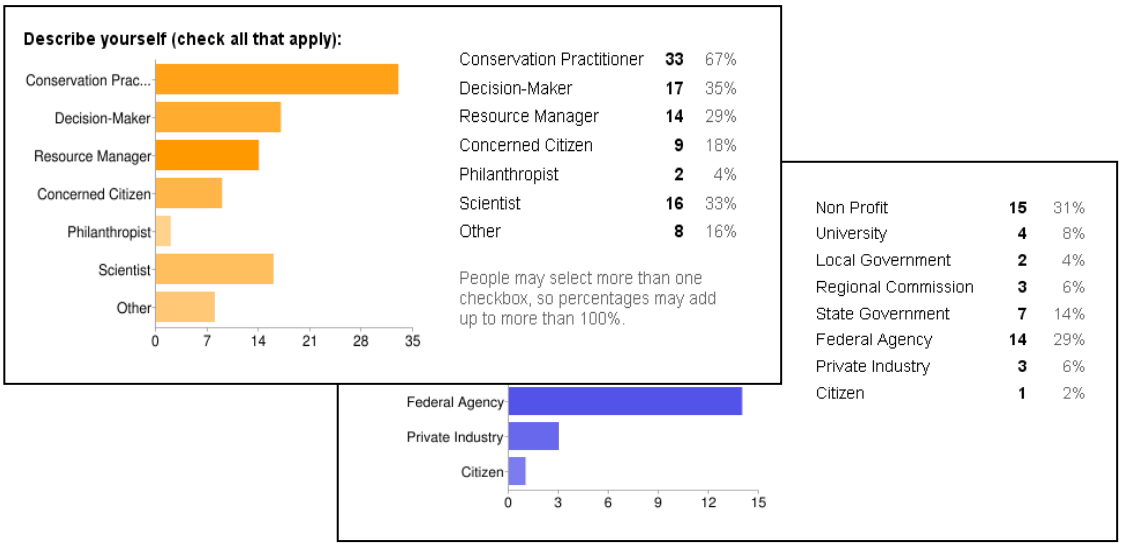

Figure 6: Response Profile, RPA Poll, December 2011

All participants reported a daily use of the internet for other tasks (see Appendix A for complete results from this survey). However, when asked about their knowledge and use of existing online data tools, participants responded as follows:

Figure 7: Existing online tool usage, RPA Poll, December 2011

This poll, once again identified that existing online spatial datasets and planning tools are underutilized within the Large Landscape practitioner community.

The following observations might explain the lack of awareness and the lack of use of these established online resources.

- Dedicated marketing campaigns, sponsored by some of the larger, more established tool providers listed above seem to have contributed to broader tool awareness, but not necessarily consistent use.
- Planning tools, spatial datasets, and processes applicable to one landscape initiative might not be appropriate to another. This can be due to geographic scale, regional characteristics, partner capacity, initiative funding, and landscape objectives.

- The need for organizational "branding" is often a catalyst for reinventing the wheel to produce tools that reflect image, style, and content that are unique to a particular partnership.

Perhaps an online capability is needed to create a personalized presence on the web, allowing conservation partnerships to select capabilities and structure that builds upon existing, proven planning tools and spatial datasets. This would provide a cost effective way to create customized initiative websites that reflect organizational branding and functional needs. It also might help increase awareness of existing tools and platforms.

Large Landscape Online Tools Design Concepts

The following is a list of online tool concepts that could provide value to Large Landscape Conservation Initiatives:

Online Component	Capabilities
"Whole Systems" Conservation Guide	Obtain training, best practices, case studies, and summary info.
Information Exchange and Collaboration	Post questions, share expertise, share lessons learned, and offer success stories.
Partner Locator	Search for current conservation initiatives by location, scale, values, and/or governance.
Partner Network Analyzer	Analyze partner relationships within a particular initiative; consider partner capacity.
Data Portal	Search for spatial datasets by theme, location, and /or provider; download data; share data.
Interactive Map Viewer	Explore geographic datasets, identify features, print custom maps, measure distances and size, and query.
Map Collaboration Tool	Share mark-ups, update missing data, provide comment on others' proposed projects.
Large Landscape Priorities Analysis Tool	Identify areas that address multiple resource values and/or critical "system" viability.
Geographic Profiling Tool	Profile proposed projects, identify impacts to landscape goals, and assess opportunities based on underlying spatial datasets.
Progress Tracker	Upload existing/proposed projects, and track progress toward initiative goals via charts & maps.
Executive Story Telling	Create a platform that enables "telling a story" using interactive maps and text.

Figure 8: Online tool concepts for large landscape conservation.

Note that many of these tools, or combinations of these tools, are already available.

An informal poll of attendees at the Large Landscape Practitioners' Network workshop at The Land Trust Alliance Rally, Milwaukee, WI, October 14, 2011 was conducted to assess the demand and interest in some of these tools concepts. Poll results are as follows:

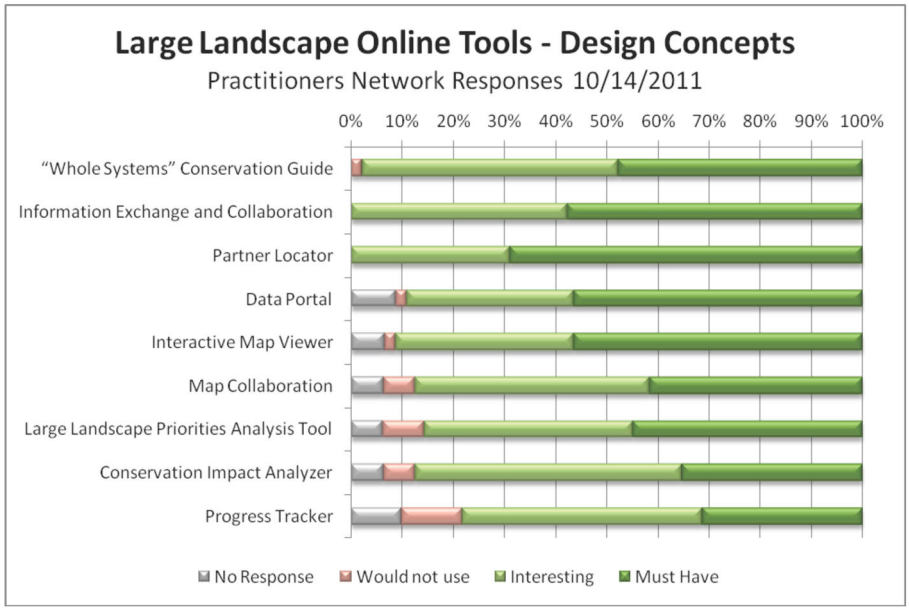

Figure 9: Design concept ranking, informal poll LTA Rally, October 2011

Additional Write-In Comments:

- Data Portal would be very helpful. Include in metadata which organization came from, how updated, when next update.
- Would like to learn to use ArcGIS better.
- Not sure what a "Conservation Impact Analyzer" does.
- Seems like many of the proposed tool concepts are connected. Can't have a portal with one without the other.
- Effectively dealing with duplication of effort is important.
- It's hard to share (to a super detailed extent), when an organization cannot control where/how the data will be used or shared.
- It is good to be reminded about the strength of collaboration.
- Concerned about a universal tool deciding the priorities.
- Need to use LTA's Strategic Conservation Planning Guide.

In reviewing the results from this informal poll, we find that there is significant demand for collaboration tools, especially the Partner Finder. There is also strong interest in the GIS tools (78% or more participants expressed interest in or demand for all tools). There was a noteworthy portion of "no response" on the GIS tools. This and some of the other write-in comments indicate that there may have been confusion on what these tools can offer.

In the more formal online poll conducted by Regional Plan Association (RPA) and University of Montana's Center for Natural Resources and Environmental Policy (NREP), responses showed a stronger demand for interactive mapping and analysis tools:

Figure 10: Design concept ranking, RPA Poll, December 2011

Large Landscape Tool—Design Demonstrations

A key component of this project was to explore potential tools and design options via "proof of concept" (POC) examples. This was done to better investigate conceptual large landscape web tools within the context of premier North American large landscape initiatives. A series of prototypes were created to:

- provide interactive samples of online functionality;
- test design concepts;
- assess the availability and applicability of existing technologies;
- obtain feedback from local landscape partners; and
- establish a baseline for potential future development.

The following is a summary of the themes, landscapes, and tool concepts that were explored as part of this effort. Refer to the table on page 18 for a list of tool design concepts that helped to frame the POC investigations. A detailed description of each prototype follows this list:

Landscape Connectivity: Quabbin to Wachusett Conservation Investment Zone
Executive Story Telling
Interactive Map Viewer

Trans-Boundary Conservation Opportunities: Crown of the Continent
Embeddable Widgets
Map Collaboration Tool
Large Landscape Priorities Analysis Tool
Climate Impact Assessment

Recreation Access in Urban Landscapes: Chattahoochee River Corridor
Interactive Map Viewer
Data Portal
Geographic Profiling Tool

Landscape Connectivity: Quabbin to Wachusett Conservation Investment Zone

The Quabbin to Wauchusett Conservation Investment Zone is a portion of the Massachusetts landscape, largely within the Connecticut River Valley, in which conservationists and sustainable development proponents aim to make significant progress using four inter-related approaches: aggregation for conservation, mitigation for conservation, compact development, and forest-based economic development. These four approaches were identified as priorities in the recently published "Report of the Massachusetts Commission on Financing Forest Conservation" (July 2011). That report, in turn, is inspired in part by the "Woodlands and Wildlands" visions for the Massachusetts and New England forests articulated by David Foster and colleagues at the Harvard Forest, Harvard University in 2005 and 2010.

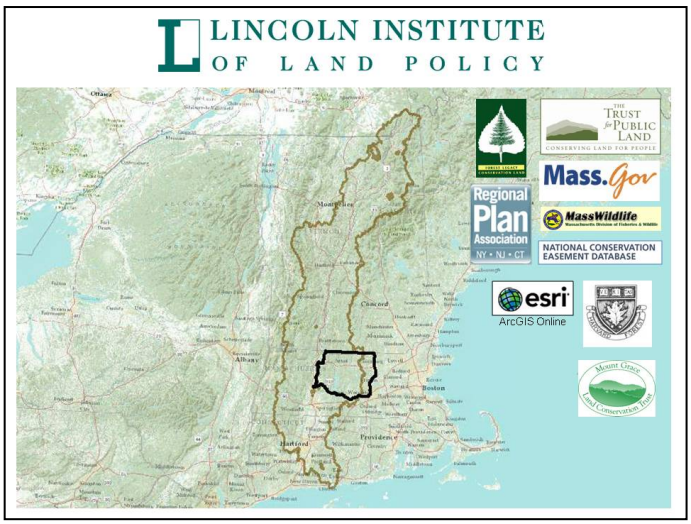

Figure 11: Prototype 1, Quabbin to Wachusett Conservation Investment Zone

The region is part of the greater Connecticut River Watershed. It is located in North Central Massachusetts, and has initially been identified as reaching from the Connecticut River to the west, to the I-190 corridor to the east, to the New Hampshire border to the north, to the Massachusetts Route 9 corridor to the south; the exact boundaries of the region are still under discussion. Within this area, there has already been substantial progress made over the past century by public, private, nonprofit and academic organizations using a wide variety of land conservation techniques, including aggregation techniques, to advance land conservation. Conservation achievement to date is shown in a proof-of-concept (POC) demonstration of a conceptualized Geographic Information System (GIS) portal for Large Landscape conservation prepared for this project.

This sample application demonstrates the capabilities of interactive mapping and executive storytelling. Specifically, a conceptualized GIS portal, if built, would allow the supporters of proposed aggregation projects to show, with considerable detail, how their projects enhance the connectivity of a corridor of woodlands and wildlands protected over the past century by organizations such as the State of Massachusetts, the Mount Grace Land Conservation Trust, Harvard University, and a variety of small and large private land owners. Highlighted in this demonstration is the connectivity-enhancing impact of two recent aggregation initiatives submitted by local project proponents to state and federal land conservation programs. The sample application demonstrates interactive visual validation of proposed conservation sites as compared to factors such as open space connectivity, recent open space ballot measures, projected population growth, and priority habitat.

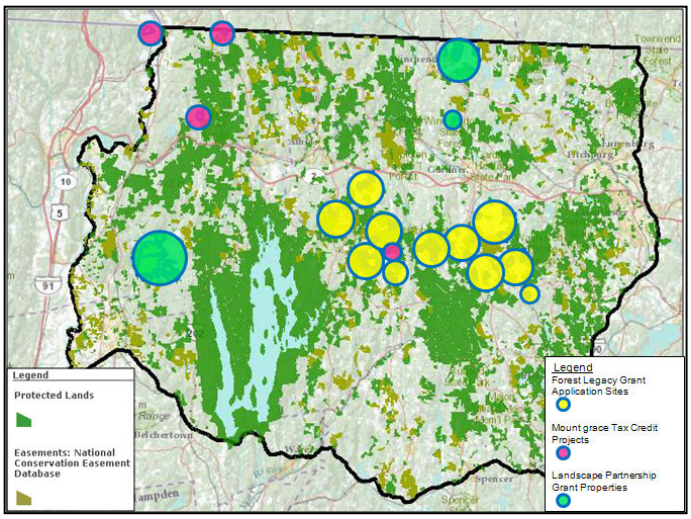

Figure 12: Prototype 1, Landscape Narrative—Progression of conservation initiatives over time

This proof of concept demonstration was developed using the 2012 beta version of ESRI's ArcGIS Online for Organizations. Featured in this new platform are spatial dataset search and sharing tools, interactive mapping applications, and support for creation and hosting of mapping services. It gives organizations the ability to create web-accessible maps and data without the need for desktop server software or technical expertise. It requires a fee-based subscription service.

Because of the sensitivity of the data used for this POC, a link to this demonstration is not publicly available.

Observations and Recommendations—Interactive Map Viewer

The ArcGIS Online for Organizations platform provided an excellent framework for publishing spatial datasets and maps to the web. The trend for vendors to offer cloud hosting for both spatial datasets and map services, without the need for expensive desktop publishing software is an exciting one. The ability to configure groups with specific access permissions was essential for protecting access to sensitive data. Map viewer options provided simple, intuitive controls for interacting with the mapped data.

However, the fee-based structure could be prohibitive for low-budget conservation organizations. In addition, when complex datasets were included in the maps by uploading shapefiles using the online hosting option, viewing performance was slow and often inaccurate at smaller scales. The automatic hosting option is not appropriate for large and/or complicated spatial datasets that need to be preprocessed for optimal performance on the web.

Observations and Recommendations—Executive Story Telling

As noted above in the discussion on usage hurdles, better tools are needed that enable executives to "make the case" using simple, information-rich, presentation tools. Managers and decision makers are often called upon to synthesize a substantial quantity of in-depth research to provide a public synopsis, to support a proposal, or to defend a decision. Interactive maps can provide a powerful means to present supporting spatial datasets.

The ArcGIS Online for Organizations platform made it easy and quick to load spatial datasets, search for data, and build interactive maps. However, support for Executive Story Telling was limited. While a presentation mode is offered in the ArcGIS Explorer map viewer, users can only add a title to saved map views. No other presentation text is supported. ArcGIS Online for Organizations also offers story-telling templates, but these are limited in scope and difficult to customize without technical expertise.

This proof of concept prototype was assembled in collaboration with an executive with interest in presenting the case for pending conservation proposals in the Quabbin to Wachusett region. The executive found great value in being able to directly interact with the spatial datasets using the interactive mapping tools. This allowed him to personally synthesize and create a storyline around the data. However, he was not comfortable with using these tools for a live presentation. The preference was to use screen shots in a prepared MS Powerpoint presentation to eliminate concerns over internet performance, succinct presentation flow, and operator error.

The fact that large GIS vendors like ESRI are beginning to recognize the need for story-telling tools as part of their online platforms is a promising trend. Perhaps online GIS tools that allow automatic download of "canned" desktop presentation slides would be valuable.

Trans-Boundary Conservation Opportunities: Crown of the Continent

The Crown of the Continent Landscape covers approximately 16,000 square miles, spanning a trans-boundary region that encompasses portions of Alberta, British Columbia, and Montana. It has been referred to as one of the most diverse, intact temperate-zone ecosystems in the world. It functions as the headwaters for a number of North American rivers, flowing to the Pacific Ocean, Gulf of Mexico, and Hudson Bay.

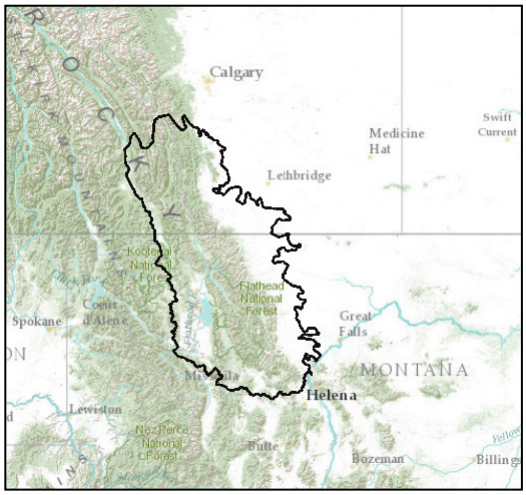

Figure 13: Prototype 2, Crown of the Continent

The region is bound by the Rocky Mountain Trench on the west and the prairie foothills to the east. The southern extent includes the Blackfoot Valley. To the north are the Canadian Rocky Mountain Parks of Banff and Kootenay. The Crown is known for its wide-ranging habitat for species such as grizzly bear, wolverine, wolf, and bull trout. In addition, native people continue to occupy territory that has been their home for thousands of years, preserving ancestral languages and cultural traditions.[5]

A series of proof of concept demonstrations for the Crown of the Continent landscape explored the use of embeddable widgets that can be incorporated into existing websites. This concept has received broad public acceptance via the share options provided in simple web mapping applications such as Google Maps. With these tools, a non-technical user can customize a simple map by zooming into a specific locations and adding descriptive markers. The user can then select "share" and an instant map link is created that can be readily pasted into any webpage. It is now common practice for many websites to provide address or driving directions using this technology. Other vendors, such as ESRI (via ArcGIS online), also use this concept to support embeddable, interactive tools with richer data content. For Large Landscape applications, it is envisioned that using this paradigm for new analysis and data exploration tools might allow established large landscape efforts to provide interactive GIS tools while maintaining an existing, branded presence on the web.

[5] http://www.crownofthecontinent.net

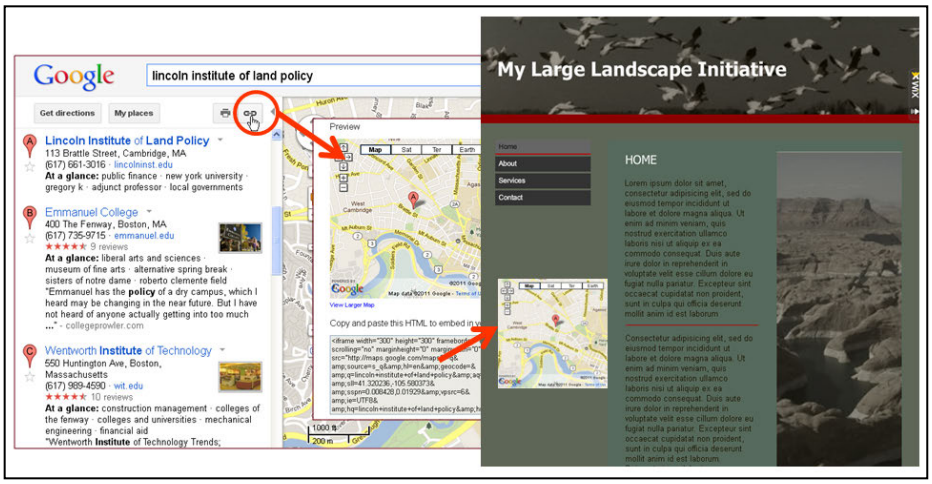

Figure 14: Prototype 2, Embeddable Widgets Concept

Working in collaboration with the Roundtable on the Crown of the Continent[6], several prototype tools were created and embedded in an established website that is maintained by The Center for Natural Resources and Environmental Policy at University of Montana. The website already provides extensive information, maps, pictures, publications, and guidelines for regional collaboration. This project explored extending that base to introduce several embedded GIS tool prototypes. All of the following prototypes are publicly available, and can be explored interactively at http://crownroundtable.org/resources.html.

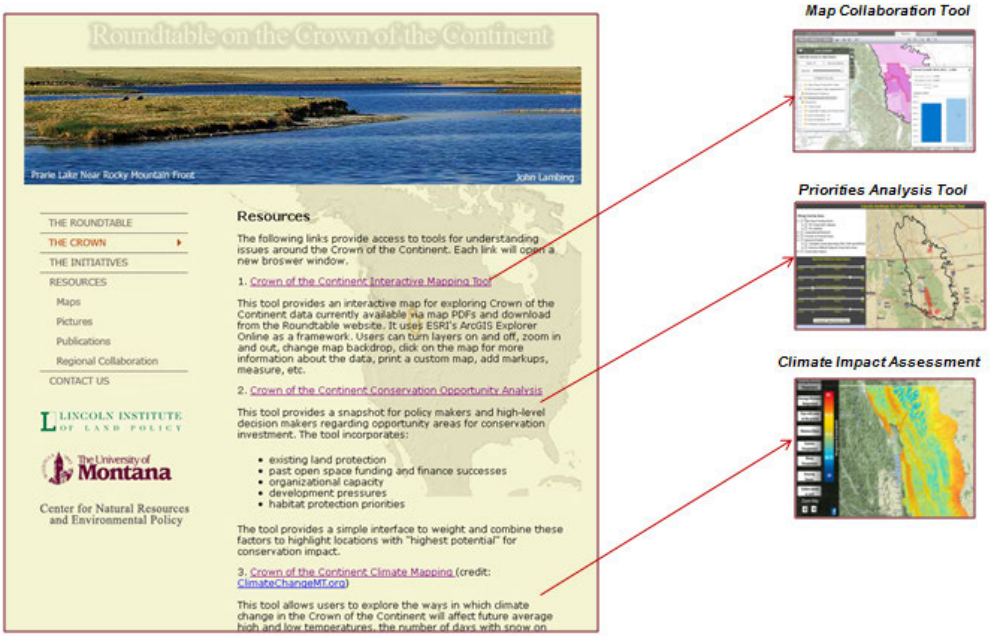

Figure 15: Prototype 2, Embeddable Widgets Example

[6] The *Roundtable on the Crown of the Continent* is an ongoing forum to connect people that care about the Crown of the Continent landscape, supporting partners in the exchange of ideas, building relationships, exploring opportunities to work together, and jointly shaping the future of this shared landscape. The Roundtable is co-convened and staffed by the Center for Natural Resources and Environmental Policy, the Lincoln Institute of Land Policy, and the Center for Large Landscape Conservation.

Map Collaboration Tool

This tool provides an interactive map for exploring Crown of the Continent spatial datasets and resources. It uses ESRI's ArcGIS Explorer Online as a framework. Users can turn layers on and off, zoom in and out, change map backdrop, click on the map for more information about the data, print a custom map, etc. Spatial datasets that was previously available in a more static PDF format, can now be interactively explored online to identify overlapping priorities, query data attributes, and create custom mapping products. Users can collaborate by adding markups to the map and sharing the results.

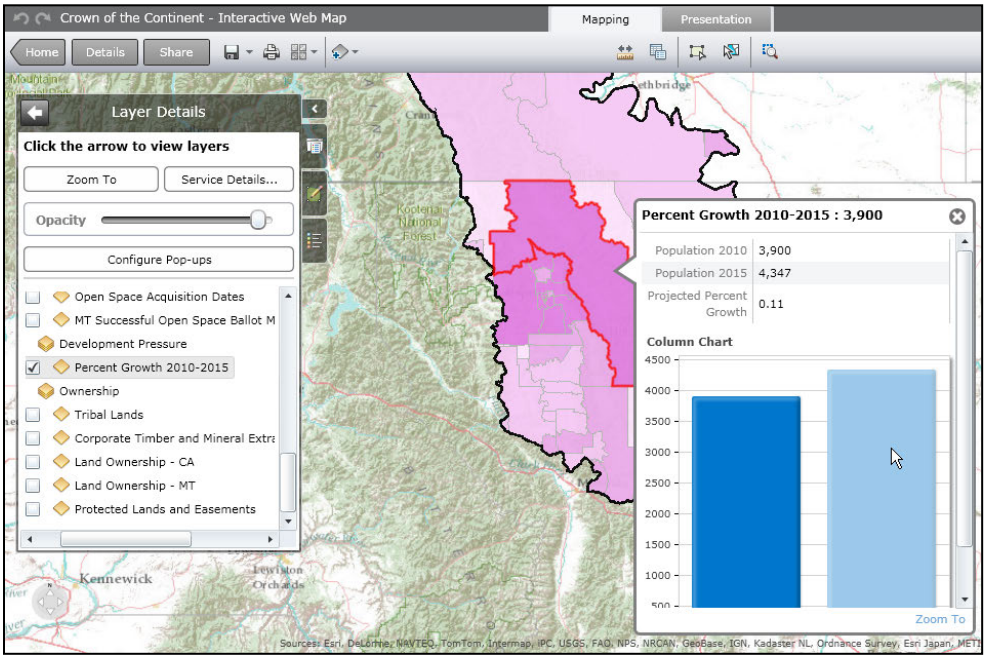

Figure 16: Prototype 2, Map Collaboration Tool

Observations and Recommendations—Map Collaboration Tools

Collaborative spatial data archives are a growing trend in geographic data sharing. Online data exchange tools such as Data Basin from CBI and ArcGIS Online from ESRI provide an excellent resource for searching and exploring spatial datasets from a broad spectrum of researchers and analysts. The addition of customizable maps to these data archives allows users to not only locate relevant spatial datasets, but to also experience "interactive immersion" with the data via customizable overlays, geographic backdrops, and markups.

The most significant challenge of this prototype work was related to locating and aligning spatial datasets across state, provincial, and international boundaries. While extremely rich data exists for this region, differences in data interpretation, collection dates, and content made it difficult to present a consistent cartographic representation across boundaries. A large-scale data mining effort is now underway to advance data-discovery and assessment of the available GIS datasets for the Crown of the Continent Ecosystem. It is part of an on-going collaborative project between

the National Parks Service Rocky Mountain Network, the University of Calgary, the Great Northern Landscape Conservation Cooperative, and the Crown Managers Partnership.[7]

Large Landscape Priorities Analysis Tool

This tool provides a snapshot for policy makers and high-level decision makers regarding opportunity areas for conservation investment. The tool incorporates:

- organizational capacity;
- habitat protection priorities;
- past open space funding and finance successes;
- existing land protection; and
- development pressures.

The tool provides a simple interface to weight and combine these factors to highlight locations with "highest potential" for conservation impact.

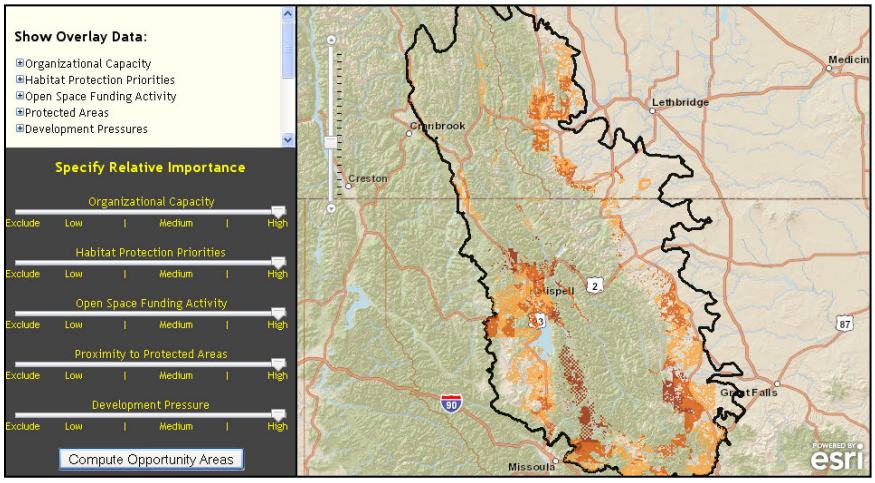

Figure 17: Prototype 2, Landscape Priorities Analysis Tool

The tool was implemented as a custom JavaScript application using the ESRI JavaScript API.

Climate Impact Assessment Tool

This tool allows users to explore the ways in which climate change in the Crown of the Continent will affect future average high and low temperatures, the number of days with snow on the ground, growing season, and a number of other variables. The climate scenarios shown were developed by Professor Steve Running and his graduate students at the University of Montana in 2010.

[7] Sexton, E., A. Sobol, J. Burke, G.J. McDermid, and L. O'Gan, 2010: *Crown Managers Partnership Landscapes Data Review Report—A Review of Baseline Geospatial Datasets for the Crown of the Continent Ecosystem Landscape Project*. Crown Managers Partnership, 248p.

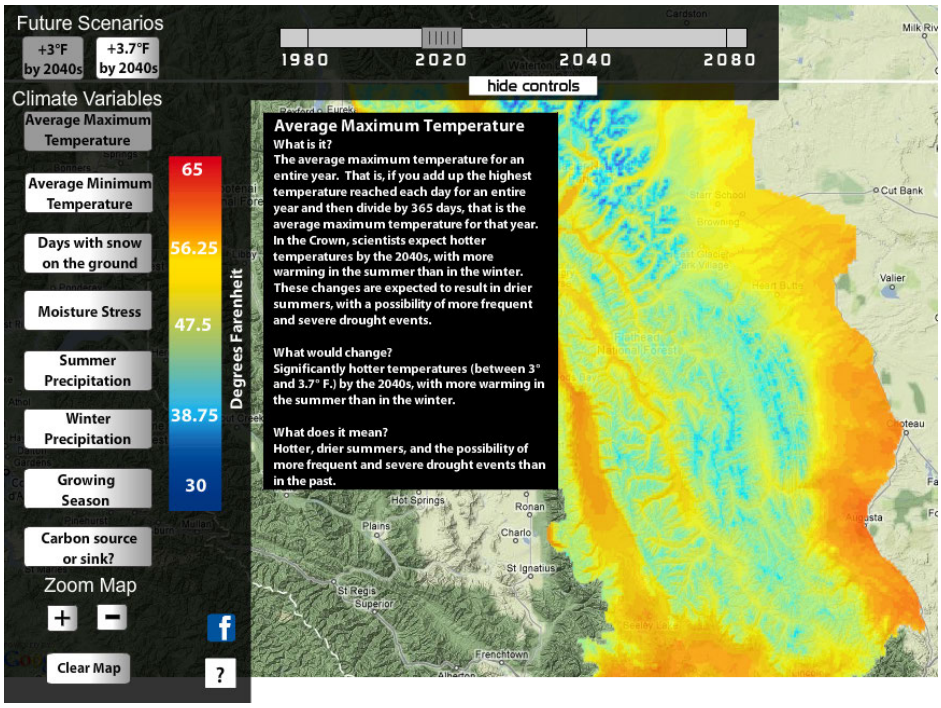

Figure 18: Prototype 2, Climate Impact Assessment Tool

Choosing any climate variable along the left provides a pop-up with a description of the variable and an explanation of its potential impacts within the landscape. Users can use the slider bar at the top of the screen to see how the selected variable is predicted to change over time. Two climate scenarios are provided (including B1 and A1B) from the Intergovernmental Panel on Climate Change in 2007 and published as part of their Fourth Assessment Report.

This tool was created by the Northern Rockies office of The Wilderness Society at ClimateChangeMT.org, who has granted permission to include this link as a demonstration of exemplary embeddable tools for large landscape exploration.

Observations and Recommendations—Online Analysis Tools

The inventory of online spatial datasets and planning tools that have applicability to large landscape conservation (see Appendices C and D) revealed an unbalanced focus on habitat and wildlife resources. Effective conservation within the context of landscape systems may require insight into broader relationships between critical resources, landscape stressors, and conservation opportunities.

The tools described above demonstrate allowing users to analytically explore landscape risks and protection objectives. These types of tools can help to condense an immense amount of information into a simple informative and educational experience, putting advanced GIS analysis capabilities into the hands of a broader spectrum users. However, to create a simple, intuitive, targeted user interfaces such as these will almost certainly require custom development. Sharing these tools as embeddable widgets may encourage other organizations to invest in similar tools, but a clearinghouse for these widgets would be required.

Recreation Access in Urban Landscapes: Chattahoochee River Corridor

On February 29, 2012 Secretary of the Interior Ken Salazar unveiled the National Water Trails System, a new network that will increase access to water-based outdoor recreation, encourage community stewardship of local waterways, and promote tourism that fuels local economies across America. The Chattahoochee River Water Trail in Georgia was the first river to be designated as a National Water Trail System under the new program.

This proof of concept demonstration explores opportunities to expand the Chattahoochee River Water Trail beyond its current extent. It features a number of spatial datasets compiled by Atlanta Regional Commission[8].

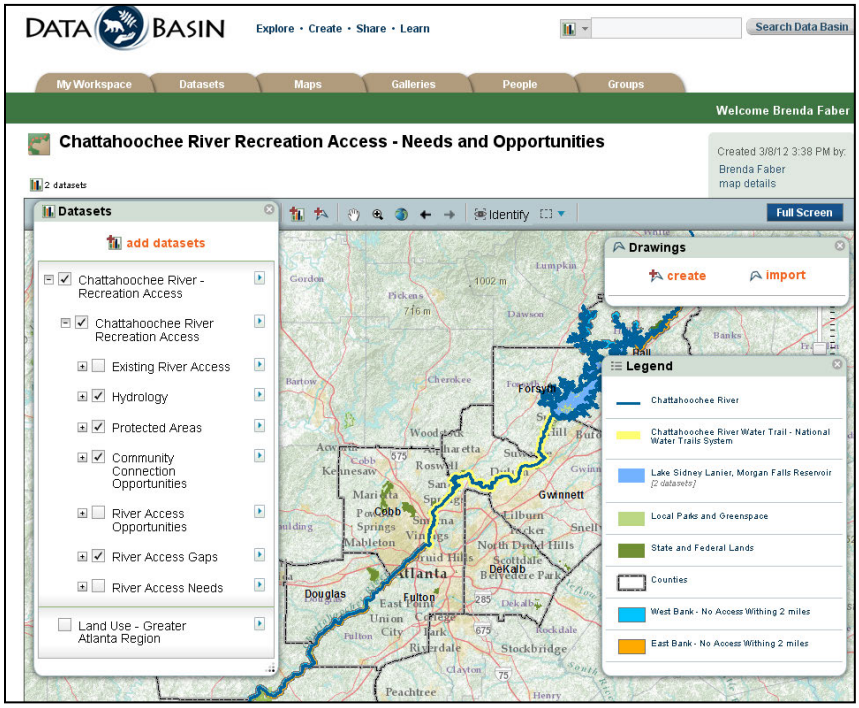

Figure 19: Prototype 3, Chattahoochee River Corridor

The prototype was developed using Data Basin from Conservation Biology Institute (CBI). Data Basin is a free, online system that connects users with spatial datasets, tools, and expertise. Individuals and organizations can explore and download a vast library of datasets, upload their own data, create and publish analysis, utilize working groups, and produce customized maps that can be easily shared. Data Basin includes data search and sharing tools, interactive mapping, and support for creation and hosting of spatial data services.

For this prototype, a Data Basin subscription-only capability was used to demonstrate the dynamic creation of profile reports. The user can interactively draw, select, or buffer a feature. The geographic profiling tool will then automatically create a report that summarizes overlap with any other features displayed in the map.

[8] http://www.atlantaregional.com/

Proposed Access Site (Including 1 km buffer) - Intersection Analysis Results

Datasets Used in the Analysis: **1.** Chattahoochee River - Recreation Access; **2.** Land Use - Greater Atlanta Region

Chattahoochee River - Recreation Access : Chattahoochee River Recreation Access:

Name	# of Features	Intersection Area/Length	Total Area/Length Intersected Featur
Chattahoochee River - Recreation Access : Chattahoochee River Recreation Access	*18*	*1,612 ac*	*12,101 ac*
Protected Areas	1	8.54 ac	8.54 ac
Local Parks and Greenspace	1	8.54 ac	8.54 ac
English Park	1	8.54 ac	8.54 ac
Community Connection Opportunities	3	--	--
Schools within 1.5 mi of River	2	--	--
U.S. Dream Academy	1	--	--
Alfred Blalock Elementary School	1	--	--
Libraries within 1.5 mi of River	1	--	--
Fulton	1	--	--
River Access Opportunities	2	1.06 mi	788 mi
East Bank River Frontage	2	1.06 mi	788 mi
West	1	0.46 mi	483 mi
East	1	0.60 mi	305 mi
River Access Needs	12	1,603 ac	11,779 ac

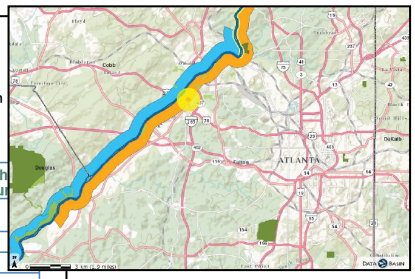

Figure 20: Prototype 3, Geographic Profiling Tool

Observations and Recommendations—Data Portal

Data Basin provides an impressive collaborative data sharing platform, with key national datasets already loaded. It supports free cloud publishing of users' local data sets. Data contributors are required to add extensive metadata to the datasets that they upload to ensure that the datasets can be correctly cited. While this requires more work for sharing data products than other online data archive sites, it helps to guarantee higher quality, defensible, and traceable datasets.

Observations and Recommendations—Geographic Profiling Tool

An online geographic profiling tool that supports characterization of arbitrary project boundaries is a potentially powerful concept for large landscape practitioners. This type of tool could be used as screening tool to identify project opportunities that merit additional consideration and in-depth evaluation. It could also be a tremendous time saver for making the case for conservation funding for specific conservation projects.

Findings and Recommendations

The research presented in this document highlights critical gaps in both online spatial datasets and web-based planning tools related to large landscape conservation. The prototypes, or "proofs-of-concept," developed as part of this project demonstrated that online technologies exist today that can provide a foundation for improved landscape conservation support. However, additional research and substantial investment is required to truly advance online access to resources that uniquely support large landscape initiatives. The following recommendations are intended to guide future development efforts:

Invest in Landscape Systems Research

A "systems" approach to large landscape conservation requires a foundation of research and data that characterizes landscape systems as a whole. Future investment in online planning tools and spatial datasets should support a multi-faceted approach, offering synthesis at the landscape level while staying relevant to local conservation programs.

Continued and future research should consider factors such as habitat connectivity, landscape vulnerability, climate resilience, and the economic drivers behind conservation success. Research needs to expand beyond a focus on habitat and wildlife resources, to support combination and exploration across multiple resources, stressors, and opportunities such as recreational access, working lands, cultural assets, and economic drivers. Effort should also be put toward addressing regional compatibility of spatial datasets for key landscapes.

Provide Consistent Data Access Options

Data products for large landscape analysis must serve a wide range of users. It is recommended that a standard be adopted such that online spatial datasets and mapping tools always provide a consistent range of data access options that accommodate varying levels of technical capability.

- Interactive map viewer (allows non-technical users to explore, query, and print maps in an online environment).
- Map Services such as WMS or KML (allow semi-technical users to take advantage of mapping tools such as Google Earth, Data Basin, or ArcGIS Explorer to assemble custom interactive maps, using a selection of searchable datasets without having to tackle spatial dataset schemas or symbology interpretations).
- Data Download (allows advanced GIS users to incorporate spatial datasets into their internal maps and analysis).

Create a Searchable Inventory of Local and Regional Initiatives that Collectively Enable Large Landscape Conservation

- *Document How Each Initiative Addresses Specific Conservation Goals*
- *Map Initiative Service Areas*
- *Allow Online Users to Locate Partners in the Vicinity of Their Own Initiatives*

The success of large landscape conservation is largely dependent on intentional collaboration between partners at the local and regional level. Working within the context of landscape systems implies many moving parts… multiple jurisdictions, organizations, objectives, scales, time horizons, and outcomes. Intentional collaboration between conservation initiatives requires a broad view of who is working on what, and where.

A first step toward facilitating broad collaboration would be the creation of a national-scale searchable database of local and regional initiatives. This inventory of landscape conservation

initiatives will serve as the basis for an assessment of how these diverse efforts relate to habitat protection, other natural resource goals, and infrastructure and land use plans. In addition, an atlas should be created that depicts spatial service areas to better understand the geographic relationships between initiatives, important natural resources, and urban growth and infrastructure investment. This would allow online users to locate partners in the vicinity of their own initiatives, as well as take advantage of complementary strengths and goals of neighboring initiatives.

Advance Online Tools

- *Targeted Landscape Analysis*
- *Landscape Narratives*
- *Collaborative Site Planning with Progress Tracking*

Effective conservation design within the context of landscape systems requires insight into relationships between critical resources, landscape stressors, and conservation opportunities. Online tools need to move toward allowing users to analytically explore landscape risks and conservation impacts. A new class of targeted online analysis tools should feature a simple, intuitive, and targeted user interface that helps to condense complex concepts into an informative and educational experience. This is substantially different from providing a multi-purpose on-line GIS platform. To be effective, single-purpose tools should be designed to concisely present a single topic or concept, thereby putting appropriate GIS analysis capabilities into the hands of the landscape practitioner. Sharing these tools as embeddable widgets may encourage other organizations to invest in similar tools, but a clearinghouse for these widgets would be required.

In addition, better tools are needed that enable practitioners to "make the case" using simple, information-rich, presentation tools. Managers and decision makers are often called upon to synthesize a substantial quantity of in-depth research to provide a public synopsis, to support a proposal, or to defend a decision. Data synthesis via maps and charts provides a powerful means to present complex topics. Tools are needed that assist the practitioner in constructing a landscape narrative with interactive visuals. These tools should provide the means to format a presentation, and should be stable and intuitive enough to step through during a live seminar.

Finally, long term viability of large landscape initiatives requires collaborative commitment to measure "success" over time. This is essential to maintain financial support, keep local partners engaged, and assess and adapt landscape strategies to meet long term needs. However, it is important to note that the success of collaborative site planning with progress tracking requires more than just online tool development. Challenges will include:

- establishing appropriate metrics for measuring process at the landscape system level;
- creating the mechanisms and the culture among initiative partners to consistently report progress toward landscape goals; and
- interpreting the collected data, on a periodic basis, to adapt overall landscape strategies.

Leverage Existing Online Tools

Several organizations have already made substantial investments in multi-functional online portals for landscape conservation (e.g. LandScope from NatureServe, Conservation Gateway from TNC, ArcGIS Online from ESRI, and others). However, there is indication that these tools are not being widely used by the landscape conservation community. Dedicated marketing campaigns, sponsored by some of the larger, more established tool providers seem to have contributed to broader tool awareness, but not necessarily consistent use.

Before additional investments are made in creating yet another suite of online landscape conservation resources, further analysis is needed to better assess whether existing investments have demonstrated success, and by what measure. Additional research is recommended to assess tool effectiveness with respect to relative cost of development, to determine if value is proportionate to investment. Rather than reinventing platforms, opportunities to expand usage of and/or repurpose elements of existing platforms should be explored.

Create Partnerships

Conservation organizations can offer considerable insight into resources and tools that might increase their effectiveness in landscape conservation efforts. However, NGOs are not always the best long-term stewards for software and data tools. Grant funding might provide for initial development, but successful deployment requires staff and consistent funding to maintain the products over the long-term.

There is opportunity to create partnerships between conservation organizations that can guide innovative tool development and established “big” vendors to host, maintain, and market the tools over the long term.

Conclusion

In conclusion, the inventory, gap analysis, and prototyping efforts on this project indicate that there is significant opportunity for future investment in online planning tools and spatial datasets for large landscape conservation. Online technologies exist today that can provide a foundation for improved landscape conservation support. However, future investment is needed to advance online resources for large landscape conservation.

Appendix A: Survey Results

In November-December 2011 an online poll was conducted by Regional Plan Association (RPA) and University of Montana's Center for Natural Resources and Environmental Policy (NREP). Input was solicited from approximately 1,000 people, primarily identified by RPA's Northeast Landscape Practitioners contact list. Of the 49 responses received, top 3 respondent groups included nonprofits, federal agencies, and state government.

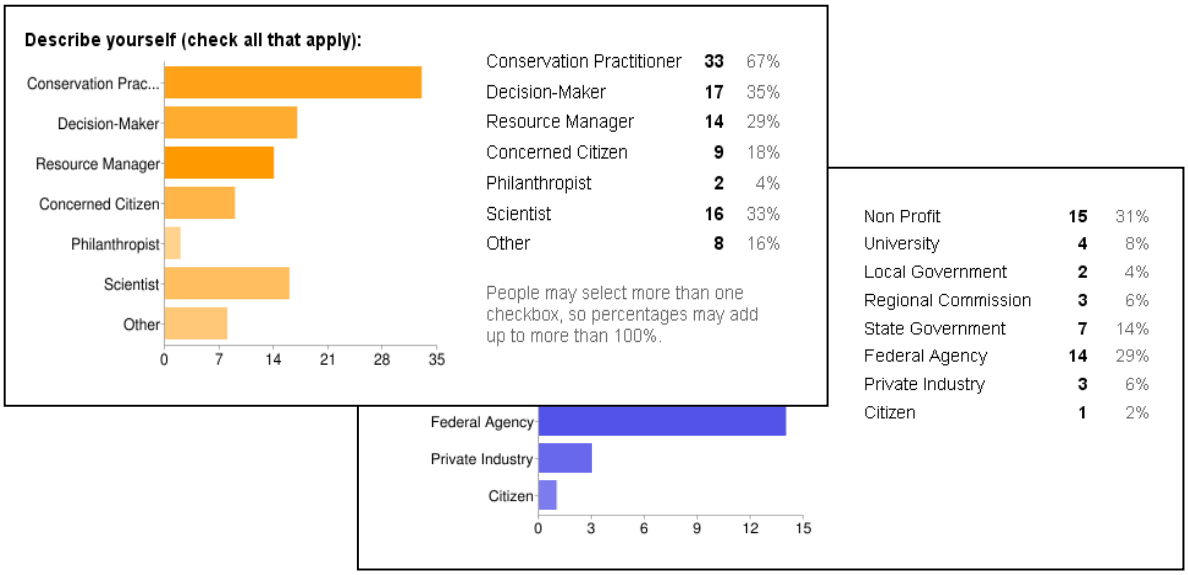

Figure 21: Response Profile, RPA Poll, December 2011

Describe your comfort level with the following technologies (rate each Low, Medium, High):

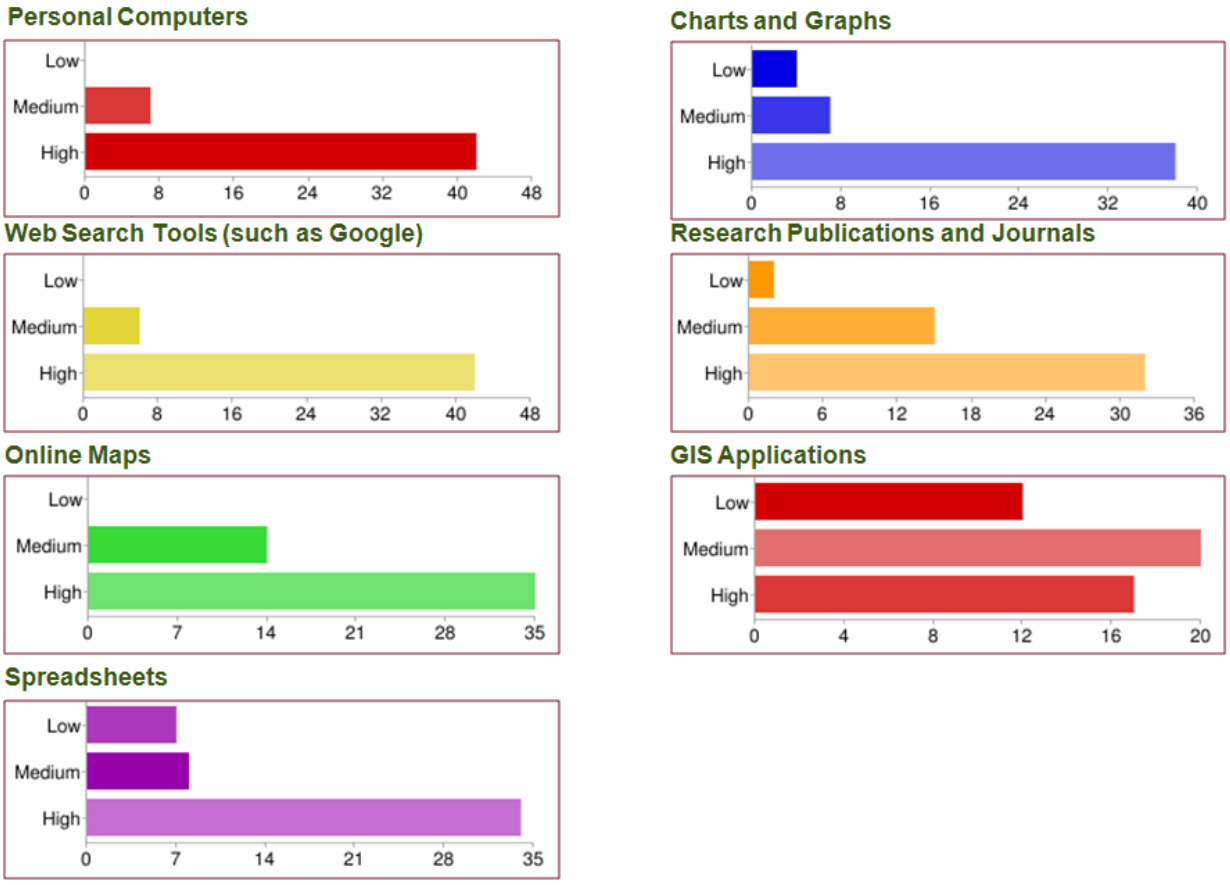

Figure 22: Technology Usage, RPA Poll, December 2011

How frequently do you use the web to support your conservation work? (rate each Rarely, Sometimes, Weekly, Daily):

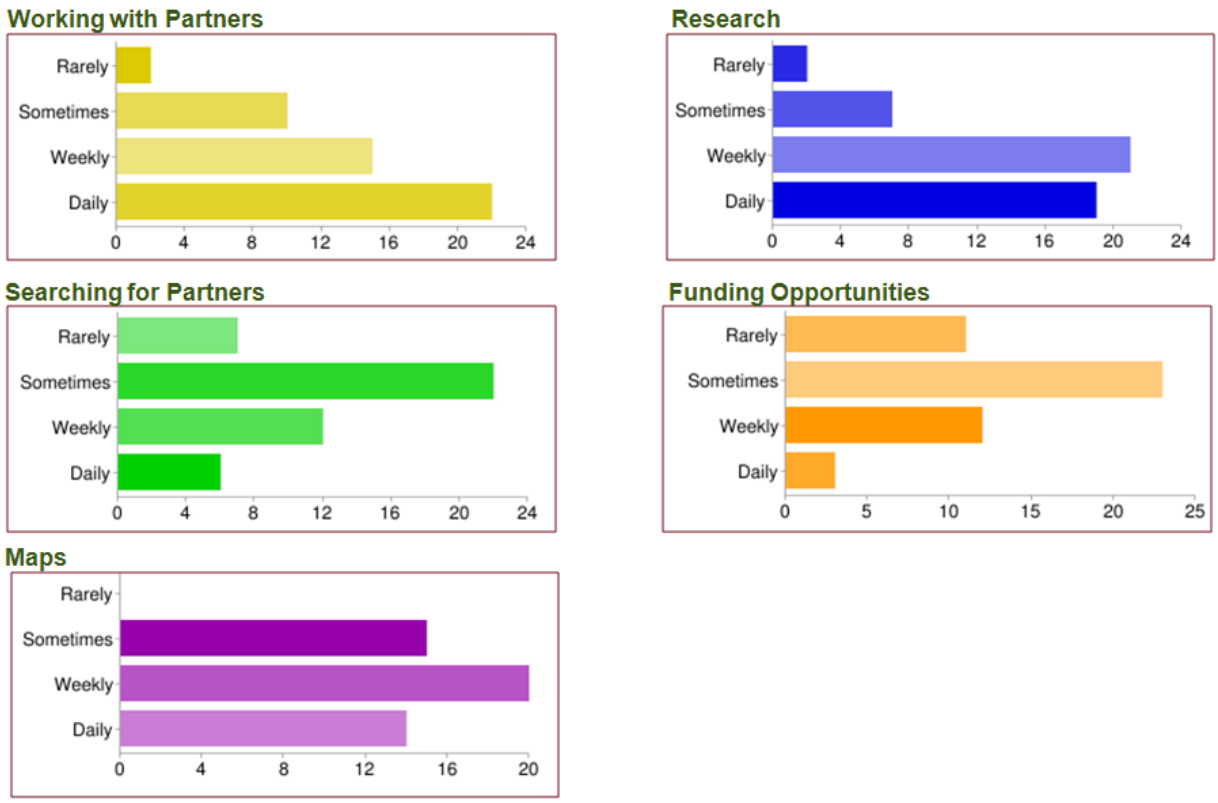

Figure 23: Web use frequency, RPA Poll, December 2011

Are you familiar with the following on-line tools?(rate using Not familiar with, I've heard of it, I use it):

Figure 24: Online Tool Usage, RPA Poll, December 2011

Which of the following online tools would be of interest to you for your work in Large Landscape Conservation (rate using I would NOT use, Interesting, or Must have):

Figure 25: Online Tool Concepts, RPA Poll, December 2011

When creating a Partner Locator Tool, how important is it to know the following (rate using Not Important, Somewhat Important, or Very Important):

Figure 26: Partner Locator Content, RPA Poll, December 2011

For information and collaboration tools, what tools would you be most interested in using:

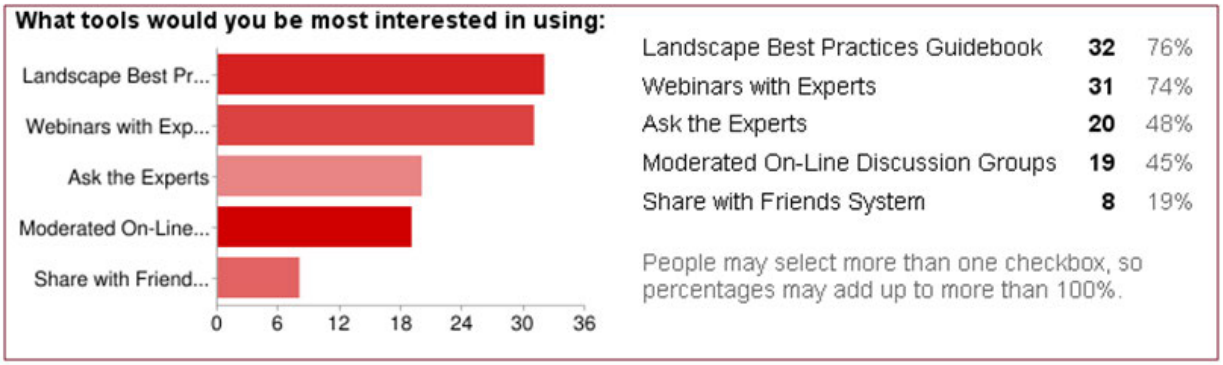

Figure 27: Collaboration Tool Capabilities, RPA Poll, December 2011

For information and collaboration tools, what topics should be included (rate using Not Important, Somewhat Important, or Very Important):

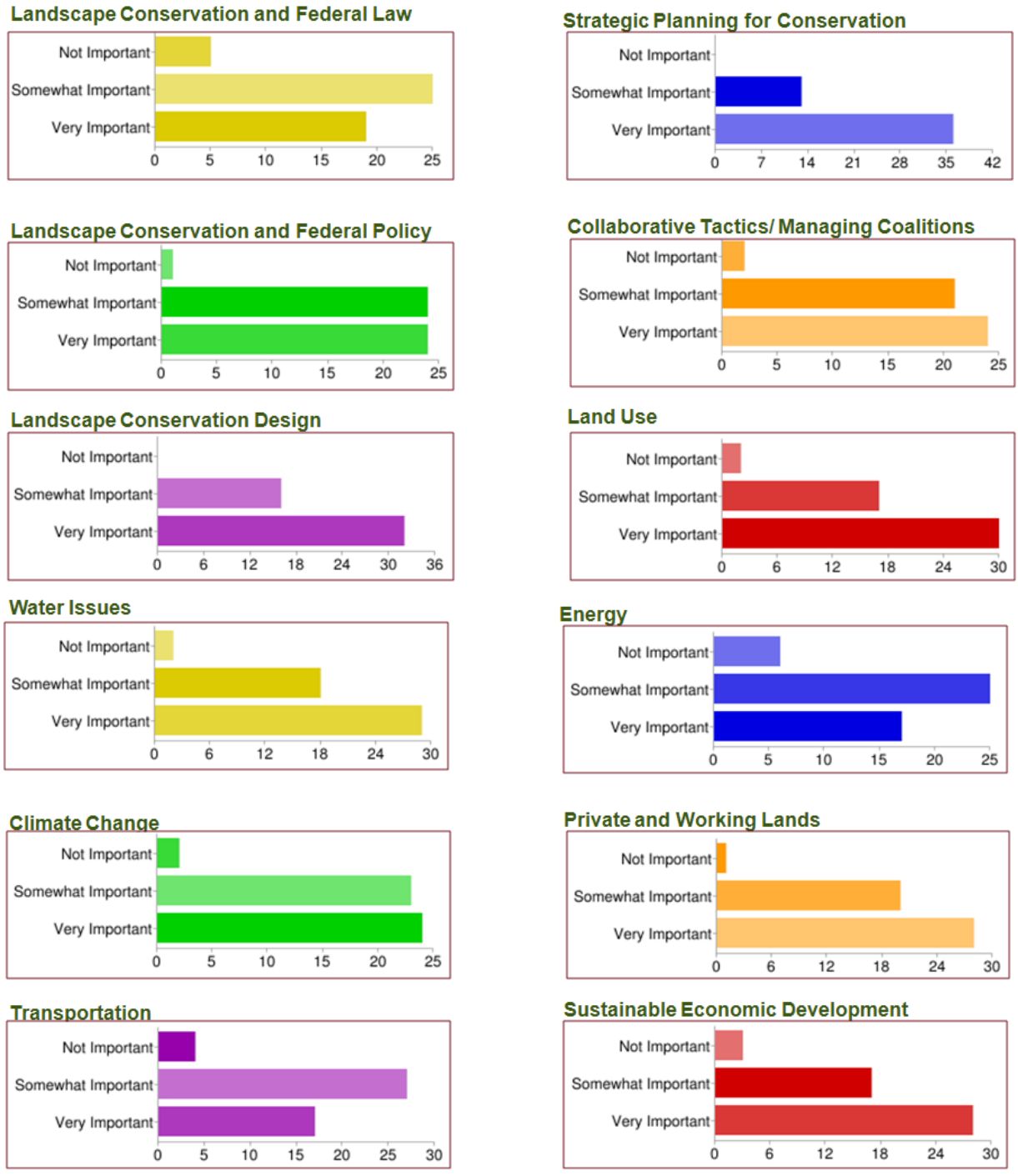

Figure 28: Collaboration Tool Topics, RPA Poll, December 2011

Appendix B: Spatial Data Inventory Overview

Landscape Reference Layers

Base Map

Characteristic Data Layers:
- Jurisdictional Boundaries
- Transportation
- Hydrography
- Terrain

Example Data Providers—National:
- GeoBase (Canada)
- National Atlas (US)
- Instituto Nacional De Estadistica Y GeoGrafia (Mexico)
- National Hydrography Dataset
- USGS Seamless Server

Protected Areas

Characteristic Data Layers:
- Protected Lands
- Recreation Lands
- Trails
- Easements

Example Data Providers—National:
- Protected Areas Database (PAD US—USGS and CBI versions)
- National Trails System (NPS)
- National Conservation Easement Database (NCED)

Cadastral

Characteristic Data Layers:
- Property Boundaries
- Assessor's Records

Example Data Providers—State:
- Utah GIS Portal
- New Jersey Geographic Information Network

Landscape Values

Habitat and Biodiversity

Characteristic Data Layers:
- Rare and Endangered Species
- Species Richness and Species Abundance Measures
- Key Migration Hubs/Connectors
- Unfragmented Natural Areas
- Organizational Conservation Focus Areas
- State Wildlife Action Plans

Example Data Providers—National:
- US F&WS Critical Habitat Portal
- National Atlas: Land Cover Diversity
- LandScope America

Example Data Providers—State
- Florida Natural Areas Inventory
- Maine Natural Areas Program
- Colorado Natural Heritage Program
- Virginia Division of Natural Heritage
- Maryland Green Infrastructure Assessment

Water Quality

Characteristic Data Layers:
- Land Cover
- Streams and Waterbodies with Natural Buffers
- Soil Infiltration and Erodability Characteristics
- Wetlands
- Floodplains
- Terrain
- Source Water Protection Priorities

Example Data Providers—National:
- USGS National Map Viewer
- EPA Impaired Waters
- NRCS SSURGO database
- National Wetlands Inventory

Example Data Providers—State/Regional
- Minnesota Department of Health
- Ohio Division of Drinking and Ground Water
- US EPA RAD database

Recreation Access

Characteristic Data Layers:
- Existing/Proposed Parks
- Existing/Proposed Trails
- Recreation needs (demographic profiles, recreation lands accessibility)
- Recreation Opportunities (Water Access, Hunting, Fishing, Urban Accessibility)

Example Data Providers—National:
- PAD US—Protected Areas Database (USGS and CBI versions)
- NCED—National Conservation Easement Database

Example Data Providers—State/Regional
- California CPAD—GreenInfo Network
- Maine Trail Finder—Center for Community GIS
- Rhode Island—DEM Guide to Outdoor Recreation
- Colorado Hunting Atlas—CO Division of Wildlife

Agriculture and Forestry

Characteristic Data Layers:
- Existing, productive agriculture
- Prime agricultural soils
- Forest Cover
- Working Forests and Timber Production

Example Data Providers—National:

US Agricultural Census—USDA National Agricultural Statistics Service
Forest Cover Types—USFS Forest Inventory and Analysis Project
Forests on the Edge Project—USFS

Example Data Providers—State/Regional
California—Farmland Mapping & Monitoring Program
Agriculture & Forestry Priority Resources in Northeastern Landscapes—RPA

Cultural and Historic Resources

Characteristic Data Layers:
Historic Locations
Scenic Landscapes

Example Data Providers—National:
National Register of Historic Places—National Park Service
National Scenic Byways Online—America's Byways

Landscape Stressors

Development

Characteristic Data Layers:
Urbanization, Housing Density Projections
Land cover change
Road density and fragmentation

Example Data Providers—National:
Spatially Explicit Regional Growth Model (***SERGoM***)—Colorado State University
National Land Cover Dataset (NLCD)—MRLC
Causes of Forest Fragmentation in the United States—US EPA

Invasive Species

Characteristic Data Layers:
Invasive species locations

Example Data Providers—Regional:
Early Detection & Distribution Mapping System—University of Georgia

Energy Extraction

Characteristic Data Layers:
Extraction sites
Resource concentrations

Example Data Providers—National:
MapSearch—National Renewable Energy Lab (NREL)

Climate Risks

Characteristic Data Layers:
Extreme events
Drought/flood
Temperature rise/fall
Sea-level rise

Example Data Providers—National:
Climate Wizard—TNC

Spatial Hazard Events and Losses Database for the United States—The Hazards and Vulnerability Research Institute (HVRI)

Example Data Providers—Regional:

Cal-Adapt—CA Energy Commission

Wildland Fire

Characteristic Data Layers:

Vegetation

Wildland fuels

Fire regimes

Example Data Providers—National:

LANDFIRE—USDA

Conservation Opportunities and Incentives

Property Analysis

Characteristic Data Layers:

Parcels over 100 acres (size, ownership, current use, market value)

Example Data Providers—Regional:

State and local GIS providers

Conservation Success and Progress

Characteristic Data Layers:

Protected Areas

Publically accessible open space

Conservation Easements

Example Data Providers—National:

Protected Areas Database (PAD US)—USGS and CBI versions

National Conservation Easement Database—Conservation Biology Institute, Ducks Unlimited, NatureServe, TPL, Defenders of Wildlife

Conservation Almanac—The Trust for Public Land

Conservation Funding and Community Support

Characteristic Data Layers:

Successful open space ballot measures

Regional history of conservation (land preserved, dollars invested)

History of conservation philanthropy by region

Example Data Providers—National:

Land Vote—The Trust for Public Land

Conservation Almanac—The Trust for Public Land

Conservation Initiatives

Characteristic Data Layers:

Land Trust Service Areas

Regional history of conservation (land preserved, dollars invested)

Example Data Providers—National:

Conservation Almanac—The Trust for Public Land

Example Data Providers—Regional:

Northeast Landscapes Project—Regional Plan Association

The Lincoln Institute and the Trust for Public Land
Landscape Conservation GIS Portal Project

Online Databases Inventory

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
Agriculture Census of the United States	Agriculture & Forestry	National Atlas of the United States	Jay Donnelly (703-648-5395 / atlasmail@usgs.gov)	NASS, USDA	http://nationalatlas.gov/atlasftp.html?openChapters=chpagri#chpagri	Information about America's farmers and their produce, by county.
Canada's National Forest Information System (NFIS)	Agriculture & Forestry	Canadian Council of Forest Ministers	Tel: (250) 298-2308 E-mail: jdechka@pfc.cfs.nrcan.gc.ca	Canadian Council of Forest Ministers	https://ca.nfis.org	Canada's National Forest Information System (NFIS) provides Web tools, ranging from simple portrayal to sophisticated analyses, to users from anywhere in the world. Users can discover, integrate, and display this current, authoritative and accurate information on Canada's forests and on sustainable forest management.
Farmland Mapping and Monitoring	Agriculture & Forestry	California Department of Conservation		California Department of Conservation	http://www.consrv.ca.gov/DLRP/fmmp/Pages/index.aspx	Agricultural land in California is rated according to soil quality and irrigation status; the best quality land is called Prime Farmland.
Farming on the Edge Report	Agriculture & Forestry	American Farmland Trust	202-331-7300 info@farmland.org	American Farmland Trust	http://www.farmland.org/resources/fote/states/default.asp	High-quality farmland areas have relatively large amounts of prime or unique farmland. High-development areas have relatively rapid loss of high-quality farmland to development. Other areas do not meet the two threshold tests. The relative measures compare sub-county areas against their respective statewide averages. This map should be used to identify broad trends, not to make highly localized interpretations.
Forest Cover Types	Agriculture & Forestry	National Atlas of the United States	Zhiliang Zhu (605-594-6131 / zhu@usgs.gov)	USGS, USDA Forest Service	http://nationalatlas.gov/atlasftp.html#foresti	Shows the broad distribution of various tree types (25 classes of forests as well as water and nonforest land) found in the United States and Puerto Rico.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
Forests on the Edge	Agriculture & Forestry	USFS	Susan Stein sstein@fs.fed.us	USFS	http://www.fs.fed.us/openspace/fote/	The Forests on the Edge project employs geographic information systems techniques to identify areas across the country where private forest services such as timber, wildlife habitat and water quality might be affected by factors such as development, fire, insect pests, and diseases. The project also seeks to understand where increases in housing density on lands adjacent to our national forests and grasslands might affect recreation, wildlife, water resources and other important public benefits.
Agriculture & Forestry Priority Resources in Northeastern Landscapes	Agriculture & Forestry	Regional Plan Association and America 2050			Request	Our Agriculture and Forestry resource maps show areas where food and fiber is an important part of the local economy, and where preservation of working farms and forests is a critical conservation concern.
Early Detection & Distribution Mapping System	Agriculture & Forestry	The University of Georgia - Center for Invasive Species and Ecosystem Health	229-386-3298	EDDMapS combines data from other databases and organizations as well as volunteer observations to create a national network of invasive species distribution data that is shared with educators, land managers, conservation biologists, and beyond.	http://www.eddmaps.org/	EDDMapS is a web-based mapping system for documenting invasive species distribution. It is fast, easy to use and doesn't require Geographic Information Systems experience. Launched in 2005 by the Center for Invasive Species and Ecosystem Health at the University of Georgia, it was originally designed as a tool for state Exotic Pest Plant Councils to develop more complete distribution data of invasive species. EDDMapS goal is to maximize the effectiveness and accessibility of the immense numbers of invasive species observations recorded each year. As of November 2011, EDDMapS has over 1.5 million records.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
GeoBase	Basemap	GeoBase Canada	supportgeobase@nrcan.gc.ca 1-800-661-2638	Natural Resoures Cananda and other federal, provincial and territorial agencies	http://www.geobase.ca/geobase/en/index.html	Provides access to foundation and basemap datasets for Canada, also provides WMS mapping service for most data layers
Landscape Conservation Cooperatives (LCCs)	Basemap	USFWS	Chris Lett, National GIS Coordinator (303-274-3574)	USFWS	http://www.fws.gov/gis/data/national/index.html#LCC	Landscape conservation cooperatives (LCCs) are conservation-science partnerships between the U.S. Fish and Wildlife Service, U.S. Geological Survey (USGS), and other federal agencies, states, tribes, NGOs, universities and stakeholders within a geographically defined area. They inform resource management decisions to address national scale stressors.
US Census	Basemap	US Census Bureau	https://ask.census.gov/	US Census Bureau	http://www.census.gov/main/www/access.html	The Census Bureau serves as the leading source of quality data about the nation's people and economy. We honor privacy, protect confidentiality, share our expertise globally, and conduct our work openly. We are guided on this mission by our strong and capable workforce, our readiness to innovate, and our abiding commitment to our customers.
Utah GIS Portal	Basemap	Utah Automated Geographic Reference Center (AGRC)	(801) 538-3665 agrc@utah.gov	Utah state and counties	http://gis.utah.gov/mapserv	State of Utah GIS data clearinghouse
New Jersey Geographic Information Network (NJGIN)	Basemap	NJ Office of Information Technology, Office of GIS	https://njgin.state.nj.us/NJ_NJGINExplorer/jviewer.jsp?pg=contact_njgin	New Jersy state and counties	https://njgin.state.nj.us/	State of NJ GIS data clearinghouse

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
United States Average Annual Precipitation, 1961-1990	Climate Mitigation & Adaption	National Atlas of the United States	Chris Daly (541-737-2531 / daly@coas.oregonstate.edu)	Natural Resources Conservation Service and Oregon State University	http://nationalatlas.gov/atlasftp.html#prism0p	Average annual precipitation for the conterminous United States from 1961 through 1990. Parameter-elevation Regressions on Independent Slopes Model (PRISM) derived raster data is the underlying data set. PRISM is an analytical model that uses point data and a DEM to generate estimates of annual, monthly and event-based climatic parameters.
SHELDUS™ | Spatial Hazard Events and Losses Database for the United States	Climate Mitigation & Adaption	The Hazards and Vulnerability Research Institute (HVRI)	scutter@sc.edu 803.777.1699		http://webra.cas.sc.edu/hvriapps/sheldus_setup/sheldus_login.aspx	SHELDUS™ is a county-level hazard data set for the U.S. for 18 different natural hazard events types such thunderstorms, hurricanes, floods, wildfires, and tornados. For each event the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected each county.
LANDFIRE	Contiguous Natural or Forested Land	USDA and US Department of Interior	helpdesk@landfire.gov	USDA and US Department of Interior	http://www.landfire.gov/dataproduct_natmap.php	LANDFIRE, also known as the Landscape Fire and Resource Management Planning Tools Project, is a five-year, multi-partner project producing consistent and comprehensive maps and data describing vegetation, wildland fuel, and fire regimes across the United States. It is a shared project between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior.
Smart Location Database	Cultural & Historic Resources	EPA	Ramsey.Kevin@epamail.epa.gov	EPA, US Census	TBD as of February 2012	EPA's Smart Location Database includes census block group level statistics about the built environment, demographics, land use, transit, and destination accessibility. We also have some spin off models and indices that utilize this database. The SLD is available for all block groups in the nation.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
National Register of Historic Places	Cultural & Historic Resources	National Park Service	nr_reference@nps.gov	National Park Service	http://nrhp.focus.nps.gov/natreg/docs/Download.html	Find Information about Properties listed on the National Register of Historic Places
Great Lakes Information Network (GLIN)	Environment, Economy, Education, basemaps, Tourism	Great Lakes Commission	Phone: 734-971-9135 E-mail: manninen@glc.org	US and Canadian federal agencies	http://gis.glin.net/	The Great Lakes Information Network (GLIN) is a partnership that provides one place online for people to find information relating to the binational Great Lakes-St. Lawrence region of North America. GLIN offers a wealth of data and information about the region's environment, economy, tourism, education and more.
Bailey's Ecoregions and Subregions of the United States, Puerto Rico, and the U.S. Virgin Islands	Habitat & Biodiversity	National Atlas of the United States and USDA Forest Service	Robert G. Bailey (970-295-5727 / rgbailey@fs.fed.us)	USDA Forest Service	http://nationalatlas.gov/atlasftp.html#ecoregp	Ecoregions defined by common climatic and vegetation characteristics, shown as domains, divisions, provinces and sections.
Causes of Forest Fragmentation in the United States	Habitat & Biodiversity	National Atlas of the United States	Tim Wade (919-541-4119 / wade.timothy@epa.gov)	US EPA, USGS	http://nationalatlas.gov/atlasftp.html#frfrg2i	Shows forest connectivity and whether fragmentation is from human or natural causes. The data are presented in three bands: one each for forest connectivity, human-caused fragmentation, and natural fragmentation.
C-CAP Forest Fragmentation Data	Habitat & Biodiversity				http://www.csc.noaa.gov/digitalcoast/data/forestfrag/index.html	

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
Classification of Forest Fragmentation in North America	Habitat & Biodiversity	National Atlas of the United States	Kurt Riitters (919-549-4015 / kriitters@fs.fed.us)	USGS	http://nationalatlas.gov/atlasftp.html#forfrgi	Shows the amount of forest and the connectivity between patches of forest.
Critical Habitats	Habitat & Biodiversity	USFWS	(970) 226-9468 / ecos-support@ecos.fws.gov	USFWS	http://criticalhabitat.fws.gov/crithab/	Identifies, in general, the areas where final critical habitat exist for species listed as endangered or threatened. Critical habitat are areas considered essential for the conservation of a listed species.
GeoGratis	Habitat & Biodiversity	Natural Resource Canada - Earth Sciences Sector	geoginfo@nrcan.gc.ca 1-800-661-2638	Natural Resoures Canada and other federal, provincial and territorial agencies	http://geogratis.cgdi.gc.ca/geogratis/en/index.html	Natural Resource Canada's primary data portal
Land Cover Diversity	Habitat & Biodiversity	National Atlas of the United States	Kurt Riitters (919-549-4015 / kriitters@fs.fed.us)	USGS	http://nationalatlas.gov/atlasftp.html#lcdvrsi	Shows six classes indicating relative land cover variety, where the darkest colors on the map indicate the greatest level of land cover diversity. Both natural and manmade land covers are considered when measuring diversity, and the intent is to map diversity over large areas.
National Land Cover Database	Habitat & Biodiversity	The Multi-Resolution Land Characterization (MRLC) consortium			http://www.mrlc.gov/	NLCD 2006 quantifies land cover and land cover change between the years 2001 to 2006
North American Land Cover Characteristics	Habitat & Biodiversity	National Atlas of the United States	Jesslyn Brown (605-594-6003 / jfbrown@usgs.gov)	Global Land Cover Characterization Program (GLCC) including the USGS, National Center for Earth Resources Observation and Science (EROS), the University of	http://nationalatlas.gov/atlasftp.html#landcvi	Twenty-five broad classes of land cover, such as urban areas, forests, and croplands.
Omernik's Level III Ecoregions of the Continental United States	Habitat & Biodiversity	National Atlas of the United States and US EPA	James M. Omernik (541-754-4458 / omernik.james@epa.gov)	US EPA	http://nationalatlas.gov/atlasftp.html#ecoomrp	The Omernik ecoregion system is hierarchical (4 levels) and considers the spatial patterns of both the living and non-living components of the region, such as geology, physiography, vegetation, climate, soils, land use, wildlife, water quality, and hydrology.
USGS Gap Analysis Program - Land Cover	Habitat & Biodiversity	USGS Gap Analysis Program	Anne Davidson (208 885-3720 / adavidson@uidaho.edu)	USGS Gap Analysis Program	http://gapanalysis.usgs.gov/viewers/	Displays data on the vegetation and land use patterns. It combines land cover data generated for the various regional GAP projects. For areas without GAP projects, LANDFIRE data was used.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
USGS Gap Analysis Program - PAD-US	Habitat & Biodiversity	USGS Gap Analysis Program	Lisa Duarte (lduarte@uidaho.edu)	Bureau of Land Management (National Operations Center), U.S. Forest Service (Automated Lands Program), GreenInfo Network (California), The Nature Conservancy (TNC – National and Eastern Regional offices)	http://gapanalysis.usgs.gov/viewers/	PAD-US is a national geodatabase that represents public land ownership and conservation lands, including voluntarily provided privately protected areas. The lands included in PAD-US are assigned conservation status codes that both denote the level of biodiversity preservation and indicate other natural, recreational and cultural uses.
USGS Gap Analysis Program - Species Distribution Models	Habitat & Biodiversity	USGS Gap Analysis Program	Jocelyn Aycrigg (208-885-3901 / aycrigg@uidaho.edu)	USGS Gap Analysis Program, NatureServe, IUCN	http://www.gap.uidaho.edu/species_viewer.html	Represents the areas where species are predicted to occur based on habitat associations. GAP distribution models are the spatial arrangement of environments suitable for occupation by a species. In other words, a species distribution is created using a deductive model to predict areas suitable for occupation within a species range.
USGS Gap Analysis Program - Species Ranges	Habitat & Biodiversity	USGS Gap Analysis Program	Jocelyn Aycrigg (208-885-3901 / aycrigg@uidaho.edu)	USGS Gap Analysis Program, NatureServe	http://gapanalysis.usgs.gov/viewers/	Shows a coarse representation of the total areal extent of a species or the geographic limits within which a species can be found.
Beginning With Habitat - Maine	Habitat & Biodiversity	Beginning With Habitat	Steve Walker Beginning with Habitat Program Manager (207) 287-5254 steve.walker@maine.gov	Maine Department of Inland Fisheries & Wildlife Maine Department of Conservation Maine State Planning Office Maine Audubon Society U.S. Fish & Wildlife Service The Nature Conservancy Maine Coast Heritage Trust	http://www.beginningwithhabitat.org/the_maps/index.html	The three primary maps--Water Resources & Riparian Habitats, High Value Plant & Animal Habitats, and Undeveloped Habitat Blocks--form the core of the Beginning with Habitat information. Supplemental information (public and conservation lands, functional characterization of wetlands, habitat for USFWS "priority trust species" and a regional map) are provided on four additional maps.
NBII Clearing House	Habitat & Biodiversity	USGS	NBII Program Manager 703.648.4216 email: nbii@nbii.gov	Multiple	http://mercury.ornl.gov/clearinghouse/index.jsp	A metadata repository holding thousands of records describing scientific datasets, projects, or software tools used in biological and ecological scientific analysis.
Active Mines and Mineral Processing Plants in the United States in 2003	Mineral Resources	USGS	Robert M. Callaghan (703-648-7709 / rcallaghan@usgs.gov)	USGS	http://tin.er.usgs.gov/mineplant/	Shows mineral and metal operations in the United States that are monitored by the National Minerals Information Center of the USGS. Operations included are those considered active in 2003.
Agricultural Minerals Operations	Mineral Resources	National Atlas of the United States	Robert M. Callaghan (703-648-7709 / rcallaghan@usgs.gov)	USGS	http://nationalatlas.gov/atlasftp.html#minop1x	Shows the locations of 236 agricultural minerals plants and mines that extract, process, or distribute agricultural minerals, such as sulfur, peat, and phosphate.
Coal Fields of the United States	Mineral Resources	National Atlas of the United States	Susan J. Tewalt (703-648-6437)	USGS	http://nationalatlas.gov/atlasftp.html#coalfdp	Shows areas that contain significant coal deposits.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
Mineral Resources Data System	Mineral Resources	USGS	Paul G Schruben (703-648-6142 / pschrube@usgs.gov)	USGS	http://tin.er.usgs.gov/mrds/	MRDS is a collection of reports describing metallic and nonmetallic mineral resources throughout the world. The MRDS is a large and complex relational database developed over several decades by hundreds of researchers and reporters.
National Map Seamless Server	Multiple	USGS, EROS Data Center		U.S. Geological Survey (USGS) and the Earth Resources Observation and Science (EROS)	http://seamless.usgs.gov/	The Seamless Data Warehouse is the ideal location to explore and retrieve data. U.S. Geological Survey (USGS) and the Earth Resources Observation and Science (EROS) are committed to providing access to geospatial data through The National Map. An approach is to provide free downloads of national base layers, as well as other geospatial data layers.
USGS National Map	Multiple	USGS	tnm_help@usgs.gov	USGS, GNIS, NHD, NLCD	http://viewer.nationalmap.gov/viewer/	National Map data view and data download portal (allows user added content?)
MassGIS	Multiple	State of Massachusetts	Office of Geographic Information (MassGIS) (617) 619-5611	State Agencies	http://www.mass.gov/mgis/	Statewide Resource for Geospatial Technology and Data
NH GRANIT	Multiple	State of New Hampshire	GRANIT Database Manager (603) 862-1792 granit@unh.edu	State Agencies	http://www.granit.unh.edu/	Statewide Geographic Information System (GIS) Clearinghouse
ME GIS	Multiple	State of Maine	207-624-7700 oit.customer-support @maine.gov	State Agencies	http://www.maine.gov/megis/catalog/	Statewide Geographic Information System (GIS) Clearinghouse
GIS Data for Mexico	Multiple	Instituto Nacional De Estadistica Y GeoGrafia (INEGI)	Av. Héroe de Nacozari Sur Núm. 2301 Fracc. Jardines del Parque C.P. 20276 Aguascalientes, Ags. México	Mexican National Agencies	http://mapserver.inegi.gob.mx/data/inf1m/?c=720	Nation-wid GIS clearinghouse
Federal Lands of the United States	Open Space & Recreation	National Atlas of the United States	Woodley Chu (703-648-6375 / atlasmail@usgs.gov)	USGS	http://nationalatlas.gov/atlasftp.html#fedlanp	Shows lands owned or administered by the Federal government including the BLM, the Bureau of Reclamation, the U.S. Department of Agriculture Forest Service, the DOD, the USFWS, the NPS, the Tennessee Valley Authority, and other agencies. Only areas of 640 acres or more are included.
National Conservation Easement Database	Open Space & Recreation	In progress	Breece Robertson	Conservation Biology Institute, Ducks Unlimited, NatureServe, TPL, Defenders of Wildlife	http://www.conservationeasement.us/	Database of conservation easement information that compiles records from land trusts and public agencies throughout the United States.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
National Trails System	Open Space & Recreation	National Park Service	http://www.nps.gov/nts/	NPS	Graphics (PDF, Photoshop) downloads only	The National Trails System is the network of scenic, historic, and recreation trails created by the National Trails System Act of 1968. These trails provide for outdoor recreation needs, promote the enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources, and encourage public access and citizen involvement.
PAD-US (CBI Edition)	Open Space & Recreation	Data Basin Protected Areas Center / Conservation Biology Institute	Kai Henifin (khenifin@consbio.org)	USDA Forest Service, USGS GAP Analysis Program, Bureau of Land Management and several state agencies, universities and Natural Heritage Programs, as well as private conservation organizations (including the Nature Conservancy)	http://www.databasin.org/protected-center/features/PAD-US-CBI	Focuses on fee protected lands only
PAD-US (USGS Edition)	Open Space & Recreation	USGS Gap Analysis Program	Lisa Duarte (lduarte@uidaho.edu)	Bureau of Land Management (National Operations Center), U.S. Forest Service (Automated Lands Program), GreenInfo Network (California), The Nature Conservancy (TNC – National and Eastern Regional offices)	http://www.protectedlands.net/padus/	PAD-US is a national geodatabase that represents public land ownership and conservation lands, including voluntarily provided privately protected areas. The lands included in PAD-US are assigned conservation status codes that both denote the level of biodiversity preservation and indicate other natural, recreational and cultural uses.
Americas Byways	Open Space & Recreation	DOT FHWA National Scenic Byways Program	helpdesk@byways.org	US DOT	ftp://byways.org/	The National Scenic Byways Program is part of the U.S. Department of Transportation, Federal Highway Administration. The program is a grass-roots collaborative effort established to help recognize, preserve and enhance selected roads throughout the United States.
Federal Land Features of the United States - Parkways and Scenic Rivers	Scenic Views	National Atlas of the United States	Woodley Chu (703-648-6375 / atlasmail@usgs.gov)	USGS	http://nationalatlas.gov/atlasftp.html#fedlanl	Parkways and Scenic Rivers - the linear Federal lands not included in the Federal Lands of the United States map layer.

Dataset Name	Values	Host / Publisher	Contact	Major contributors / Data sources	Download	Summary
EPA Geospatial Data Access Project	Water Quality & Quality	US EPA National Geospatial Program	Pat Garvey (202-566-1687 / Garvey.Pat@epamail.epa.gov)	Generated from the following national environmental programs: Superfund National Priorities List (NPL) from the Compensation, and Liability Information System [CERCLIS], Resource Conservation and Recovery Act (RCRA) - Treatment, Storage, and Disposal Facilities (TSDF) [RCRAINFO], Large Quantity Generators (RCRA LQG), Air Facility System (AFS) Major dischargers of air pollutants, Toxics Release Inventory (TRI) Program for 2004 and 2005 TRI Reporters [TRIS], National Pollutant Discharge Elimination System (NPDES) Majors from Integrated Compliance Information System [ICIS], National Pollutant Discharge Elimination System (NPDES) Majors from the Permit Compliance System [PCS], Assessment, Cleanup and Redevelopment Exchange System [ACRES], Risk Management Plan [RMP] for the Risk Management Program, Section Seven Tracking System [SSTS] for the Pesticide Program	http://www.epa.gov/enviro/geo_data.html	To improve public health and the environment, the EPA collects information about facilities or sites subject to environmental regulation.
Forests, Water, and People in the Northeastern Area	Water Quality & Quality	Forest-to-Faucet Partnership: University of Massachusetts Amherst and the U.S. Forest Service Northeastern Area (State and Private Forestry) Watershed Program.	Paul Barten 413.545.2665	USFS		This project was designed to supplement and build upon the U.S. Forest Service "Forests on the Edge" study by focusing on the linkages between current watershed conditions, public and private forest land ownership patterns, surface water supplies, and human population (in 2000 and estimated for 2030).
Hydrologic Unit Boundaries	Water Quality & Quality	National Atlas of the United States	608-238-9333 / atlasmail@usgs.gov	USGS	http://nationalatlas.gov/atlasftp.html#hucs00m	The boundaries of natural and manmade stream-drainage areas. Included are the boundaries of 2,264 watersheds.
Impaired Waters	Water Quality & Quality	US EPA National Geospatial Program		303(d) imparied waterbodies, 305(b) Assessed Waters and Total Maximum Daily Loads, 303c water quality standards	http://www.epa.gov/waters/data/downloads.html	
National Wetlands Inventory	Water Quality & Quality	NRCS, US F&WS	http://www.fws.gov/wetlands/FAQs.html#contact	US F&W	http://www.fws.gov/wetlands/Data/index.html	The U.S. Fish and Wildlife Service (Service) 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.

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Water Program Reach Address Database (RAD)	Water Quality & Quality	US EPA		State and Tribal Lands Water data including: 303(d) Listed Impaired Waters 305(b) Assessed Waters Beaches Clean Watersheds Needs Survey Fish Consumption Advisories Nonpoint Source Projects STORET Water Monitoring Locations No-Discharge Zones for Vessel Sewage Facilities that Discharge to Water Impaired Waters with TMDLs Water Quality Standards	http://epamap32.epa.gov/radims/	State and Tribal Lands Water data

The Lincoln Institute and the Trust for Public Land
Landscape Conservation GIS Portal Project
Online Tools Inventory

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Farmland Information Center	American Farmland Trust and USDA Natural Resources Conservation Service	http://www.farmlandinfo.org/	background info, research portal, tools inventory	Agriculture	USA	Provides information about farmland protection and stewardship. Includes searchable database cataloguing federal and state laws and regulations, literature, sample documents and worksheets, statistics and technical resources. Resources also listed by state.
Southern Forests for the Future Project	World Resources Institute (WRI)	http://www.seesouthernforests.org/explore-maps	interactive map, research portal	Forestry	USA	WRI's Southern Forests for the Future project seeks to raise awareness of the threats facing the forests of the southern United States and lay the foundation for increasing the acreage that is conserved or managed in a sustainable manner.
cal-adapt	CA Energy Commission, CA Natural Resources Agency, Public Interest Energy Resource Inst.	http://cal-adapt.org/	interactive map, data portal, research portal, community interaction, background info	Climate Change	Other	Focused on climate change in CA. Series of maps show summary data for local climate snapshots, decadal average temps, degrees of change, monthly average temp, decadal average snowpack, decadal average precipitation, sea level rise and wildfire risk. Ask a climate expert feature coming soon.
ChangeMatters	ESRI in partnership with USGS, Kass & Green Associates, Tukman Geospatial, DTSAgile	http://www.esri.com/landsat-imagery/viewer.html	interactive map, research portal, analysis tools	Climate Change	Global	The ChangeMatters Viewer allows you to pan and zoom around the maps to understand earth changes that have happened over time. Advanced change detection tools are also available by clicking any full screen button.
ClimateWizard	The Nature Conservancy	http://www.climatewizard.org/	interactive map	Climate Change	Global	Maps show historic and future predictions for average temperature and precipitation on a monthly or annual basis, including ability to compare and animate models for different time periods. Also includes descriptions of climate models, and ability to download maps.
Coastal Resiliance	The Nature Conservancy	http://coastalresilience.org/	interactive maps, background info	Climate Change	USA	Provides information to assist in coastal planning and management decisions regarding resources at risk from sea level rise and coastal hazards. Can characterize current conditions and visualize the ecological, social and economic impacts of future flooding scenarios. Future scenarios maps currently only available for Gulf of Mexico, Long Island and Virgin Islands. Seems like maps should be featured more upfront on the site. Have to dig to find them: http://coastalresilience.org/geographies
Sea Level Affecting Marshes Model (SLAMM)	US Fish and Wildlife Service	http://www.fws.gov/slamm/	analytic tools, interactive map	Climate Change	USA	A web browser-based application that displays map pairs of the same area, each at different sea levels. The strength of this tool is its ability to visually show the modeling of sea level rise predictions, allowing people to see the impacts in a more intuitive way.

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EMB Tools Database	Coastal-Marine Ecosystem-Based Management (EBM) Tools Network	http://ebmtoolsdatabase.org/tools	research portal, analytic tools, community interaction	Climate Change, Coastal Hazards		The Coastal-Marine Ecosystem-Based Management (EBM) Tools Network is an alliance of EBM tool users, providers, and researchers to promote the use and development of EBM in coastal and marine environments and the terrestrial environments that affect them (watersheds). The EBM Tools Database is an online platform to help a broad range of users find, share, and contribute information about decision-support tools, projects and resources for innovative, interdisciplinary coastal-marine spatial planning and ecosystem-based management. The database organizes information and resources in five areas: Tools, Projects, Resources, Organizations, Practitioners.
International Coastal Atlas Network (ICAN)	Oregon State University and Coastal Marine Research Centre	http://ican.science.oregonstate.edu/en/home	interactive map, data portal, research portal, community interaction, background info	Climate Change, Coastal Hazards	Global	ICAN is a newly-founded, informal group of organizations who have been meeting over the past two years to scope and implement data interoperability approaches to coastal web atlases (CWAs). The mission/strategic aim of ICAN is to share experiences and to find common solutions to CWA development (e.g., user and developer guides, handbooks and articles on best practices, information on standards and web services, expertise and technical support directories, education, outreach, and funding opportunities, etc.), while ensuring maximum relevance and added value for the end users.
Conservation Almanac	The Trust for Public Land	http://www.conservationalmanac.org/	interactive map, background info, analytic tools	Finance	USA	Data dates back to 1998. Interactive maps, graphs and charts display where conservation investments are being made, how a states conservation activity compares to other states, and where new policies exist. Includes county level conservation spending. State conservation profiles include achievements, local programs and funding mechanisms, and policy framework.
LandVote	The Trust for Public Land	http://tplgis.org/LandVoteLaunch/	interactive map	Finance	USA	Brings together the most comprehensive history available for conservation-related public finance measures that have been placed on the ballot. Maps the locations of these ballot measures and illustrates election trends. Currently, the map data is only available for states, counties, and municipalities. Also allows for customizable queries and research requests.
ECOS Critical Habitat Mapper	USFWS	http://criticalhabitat.fws.gov/crithab/flex/crithabMapper.jsp?	interactive map	Habitat	USA	Map layers include USFWS Ecoregions, USFWS Regions, USFWS Refuges, Landscape Conservation Co-ops, Tribal lands, Federal Lands, National Hydrologic dataset, National wetlands inventory, Hydrologic units, Critical habitat

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NatureServe Canada	NatureServe Canada	http://www.natureserve-canada.ca/en/cdcs.htm	background info, analytic tools, data portal, research portal	Habitat	Canada	NatureServe Canada provides scientific information about Canada's species and ecosystems to help guide effective conservation action and natural resource management. A part of the international NatureServe network, it is a leading source for reliable information and analysis on the distribution and conservation status of Canada's plants, animals, and ecological communities. NatureServe Canada works in close partnership with key federal and provincial agencies as well as international and multi-lateral initiatives concerned with environmental protection.
Terra-i	The Nature Conservancy	http://www.terra-i.org/	Interactive maps	Habitat	Other	Region of focus is Latin America. Interactive map-based monitoring platform for viewing data on habitat loss across terrestrial Latin America in near-real time.
EAST - Ecoregion Assessment Tool	TNC	http://east.tnc.org/	research portal, interactive map, background info	Habitat	USA	The Nature Conservancy and its partners have completed over 150 ecoregional assessments around the world over the past 20 years. The Ecoregional Assessment Status Tool (EAST) is The Conservancy's online repository of the assessment reports resulting from The Nature Conservancy's Conservation by Design planning methodology.
Western Governors Wildlife Council Pilot Projects	Western Governors Association (WGA)	http://www.westgov.org/initiatives/wildlife	data portal, interactive map	Habitat	western US and Alaska	In June, 2010, the Governors within WGA adopted a policy resolution that committed their state agencies to complete their decisionsupport systems within three years. Through the Wildlife Council, established in 2008, each participating state is coordinating its wildlife data with neighboring states, applying common definitions for crucial habitat and wildlife corridors. The information developed will be made publically available online by states across the entire region, and any interested party will be able to access and use the GIS-based tools that are designed to be easily interpreted.
Wildlands Network	The Wildlands Project	http://www.twp.org/wildways	background info, research portal	Habitat	North America	Widlands Network represents a vast and growing network of ranchers, hunters, anglers, nature lovers, conservation partners and new allies, spanning North America. Together, we are working to protect enough wild places in North America to sustain wildlife and people through the 21st Century. Our network is working to complete four Continental Wildways (large landscapes for wildlife movement) that span Mexico the U.S. and Canada.
CorridorDesign	Environmental Research, Development and Education for the New Economy (ERDENE) initiative from Northern Arizona University	http://corridordesign.org/	analytic tools	Habitat	Other	CorridorDesigner includes an ArcToolbox toolbox for creating habitat and corridor models with ArcGIS and an ArcMap extension for evaluating corridors.

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Crucial Areas Assessment and Planning System (CAPS)	Montana Department of Fish, Wildlife and Parks	http://fwp.mt.gov/wildthings/conservationInAction/crucialAreas.html	interactive map, analytic tools	Habitat	Other	In 2008, Montana Fish, Wildlife & Parks (FWP) took the lead in conducting a Crucial Areas Assessment. The Assessment evaluated the fish, wildlife and recreational resources of Montana in order to identify crucial areas and fish and wildlife corridors. The Assessment is part of a larger conservation effort that recognizes the importance of landscape scale management of species and habitats by fish and wildlife agencies.
Priority Habitat and Species (PHS)	Washington's Department of Fish and Wildlife	http://wdfwwa.gov/mapping/phs/	interactive map, analytic tools	Habitat	Other	PHS on the Web is a Washington Department of Fish and Wildlife web-based, interactive map for citizens, landowners, cities and counties, tribal governments, other agencies, developers, conservation groups, and interested parties to find basic information about the known location of Priority Habitats and Species (PHS) in Washington State. PHS is a source of best available science that can inform local planning activities, development projects, conservation strategies, incentive programs, and numerous other land use applications.
Southern Great Plains Crucial Habitat Assessment Tool (SGP CHAT)	Oklahoma Department of Wildlife Conservation and the Kansas Department of Wildlife, Parks and Tourism	http://www.kars.ku.edu/geodata/maps/sgpchat/	interactive map, analytic tools	Habitat	Other	The purpose of the project is to model crucial habitat for the lesser prairie-chicken (LEPC) throughout its historical range create an online tool usable by conservation managers, industry, and the public that identifies priority habitat, including connecting corridors that can be used in the early stages of development or conservation planning. The crucial habitat layer displayed in SGP CHAT classifies land by its relative value as LEPC habitat
Miradi Software	Conservation Measures Partnership	http://www.conservationmeasures.org/initiatives/miradi-software	analytic tools, background info	Habitat	Global	Miradi – a Swahili word meaning “project” or “goal” – is a user-friendly program that allows nature conservation practitioners to design, manage, monitor, and learn from their projects to more effectively meet their conservation goals. The program guides users through a series of step-by-step interview wizards, based on the Open Standards for the Practice of Conservation.
MassGIS BioMap2	Massachusetts Natural Heritage & TNC Massachusetts	http://www.mass.gov/mgis/biomap2.htm	data portal, interactive map	Habitat	Other	BioMap2 is designed to guide strategic biodiversity conservation in Massachusetts over the next decade by focusing land protection and stewardship on the areas that are most critical for ensuring the long-term persistence of rare and other native species and their habitats, exemplary natural communities, and a diversity of ecosystems.
Conservation Defense Clearninghouse	Land Trust Alliance	http://clearinghouse.lta.org/site/login	background info	Legal	USA	Contains a wide variety of legal information on conservation defense for land trusts, including cases and related materials; practical tips; law review article, statutes; tax code and sample documents. Login required.
Conservation Gateway	The Nature Conservancy	http://www.conservationgateway.org/	background info	Methods	Global	The primary purpose of this site is to provide guidance to practioners on conservation methods used at TNC and the broader conservation community. It includes tools, resources, case studies and opportunities to participate in discussion and submit content related to the featured topics. Link to TNC spatial data resources, but not well integrated into site: http://maps.tnc.org/

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PlaceMatters	Funders Network	http://www.smartgrowthtools.org/	tools inventory	Methods	USA	Provides an inventory of tools that support different stages of the community decision making process.
Land Trust GIS	GreenInfo Network and Land Trust Alliance	http://landtrustgis.org/	background info	Methods	Global	The information in this web site includes resources and advice organized according to your capacity with GIS: Basic, Advanced, Expert
ArcGIS Explorer Online	ESRI	http://explorer.arcgis.com/	analytic tools, data portal, interactive map	Multiple	Worldwide	ArcGIS Explorer Online is an online application that lets you explore and present maps within an efficient and well-structured environment. Maps show you where things are, they tell you what they are and help you understand why they are that way. ArcGIS Explorer Online lets you open a map, add other content to it, navigate around it, ask questions the map can answer, and present and share the map with others.
ArcGIS Online	ESRI	http://www.arcgis.com	data portal, Interactive map	Multiple	Worldwide	Easy online discovery, access, visualization, and dissemination of geospatial information.
Conservation GIS	ESRI Conservation Program	http://www.conservationgis.org/	Community Interaction	Multiple	Worldwide	The ESRI Conservation Program is the non-profit support arm of the Environmental Systems Research Institute (ESRI). Through our donations, We have helped to create and develop spatial analysis, computer mapping and geographic information systems (GIS) capability among thousands of non-profit organizations and individual projects of all sizes and types worldwide.
Conservation Impact Assessment Tool	South Atlantic LCC	http://www.forestthreats.org/news/ffaccts/Mordecai_FFACCTs_2.3.12.pdf	analytic tools, research portal	Multiple	North America	SALCC Optimal Conservation Strategy project (UNDER DEVELOPMENT) - Our objective is to develop a framework to help partners identify how natural and cultural resources will be vulnerable to future change (climate, urban growth) and where to take action to sustain those resources across the South Atlantic LCC. The tool will provide GIS maps depicting priority places, actions, and potential times for actions to sustain natural and cultural resources in the face of future change
ConserveOnline	The Nature Conservancy	http://conserveonline.org/	community interaction, research portal	Multiple	Global	Connects conservation practitioners worldwide. Includes hundreds of workspaces for different regions or topics. Workspaces are microsites where anyone can post data, docs, images, maps.
Data Basin	Conservation Biology Institute	http://www.databasin.org/	data portal, interactive maps, community interaction	Multiple	Global	Nearly 5,000 datasets. Contains searchable categories of data, including biological, physical, socio-economic categories. Centers (i.e. protected areas center, climate center) provide experts, datasets, maps, galleries, and working groups for more effective collaboration.

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Digital Coast	NOAA Coastal Services Center	http://www.csc.noaa.gov/digitalcoast/index.html	interactive map, data portal, background info, analytic tools	Multiple	USA	Online viewer provides access to data managed by NOAA for user defined region of interest (http://csc-s-maps-q.csc.noaa.gov/dataviewer/viewer.html). Includes an extensive library of analytic tools and viewers that transform NOAA data for particular uses. Some highlightes include the Sea Level Rise and Coastal Flooding Impacts Viewer, Habitat Priority Mapper, Hazard assessment template, and landscape fragmentation tool. More here: http://www.csc.noaa.gov/digitalcoast/tools/index.html
Great Lakes Information Management & Delivery System for strategic habitat conservation	The Nature Conservancy	http://conserveonline.org/workspaces/great-lakes-project/#	data portal, research portal, background info, tools inventory	Multiple	Other	This site is under development. Region of interest is the Great Lakes. Integrates socioeconomic and ecological data and knowledge and decision tools through demonstration projects. Provides spatially explicit mapping of conservation projects and progress toward desired ecological conditions.
Headwaters Economics	Headwaters Economics	http://headwaterseconomics.org/about	background info, interactive map, community interaction, research portal	Multiple	Northwest US	The mission of Headwaters Economics is to improve community development and land management decisions in the West.
LandScope America	NatureServe, National Geographic	http://www.landscope.org/	data portal, interactive map, research portal, background info	Multiple	USA	Beta version launched in 2008. Interactive map viewer brings together maps, data, photos and stories. Map themes include conservation priorities, protected areas, threats, plants, animals, and ecosystems. Data presented are context sensitive based on the current extent of map view (i.e. some state data will only show at state extent). The site also includes state profiles and profiles of Land Trust Alliance's member land trusts. Background information includes conservation priority setting, stewardship, funding, and tools.
National Atlas Map Maker	nationalatlas.gov	http://nationalatlas.gov/mapmaker?AppCmd=CUSTOM&LayerList=Bird&visCats=CAT-bio,CAT-bio	interactive map	Multiple	USA	Map includes layers for all datasets available on nationalatlas.gov.
Northeast Landscapes	America 2050 / Regional Plan Association	http://www.rpa.org/northeastlandscapes/welcome.html	background info, community interaction, research portal, interactive map	Multiple	Northeast US	Our first step is to inventory landscape conservation initiatives and assess how these diverse efforts relate to habitat protection, other natural resource goals, and infrastructure and land use plans. We are using GIS to map and understand the spatial relationships between landscape conservation initiatives, important natural resources, and urban growth and infrastructure investment.

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Spatial Decision Support Knowledge Portal	University of Redlands	http://www.spatial.redlands.edu/sds/	data portal, research portal	Multiple	USA	Provides an inventory of external websites where data can be downloaded, includes ability to filter by topic, coverage area, type, provider.
The Learning Center	Land Trust Alliance	http://learningcenter.lta.org	community interaction, background info, research portal	Multiple	USA	Provides resources for land trusts to prepare for accreditation. Also includes online courses covering governance, strong organizations, land protection, and stewardship.
World Conservation Base Map	ESRI, National Geographic	Background info: http://conserveonline.org/workspaces/cons.geo.portal/nationalgeographicintro Beta map: http://education.nationalgeographic.com/education/mapping/interactive-map/	data portal, interactive maps	Multiple	Global	In development. Not sure about progress as last update was 2007. Will include geospatial data and related geographic information to support conservation planning, action, monitoring, collaboration, and education. This may include reference layers such as roads, waterbodies, topography, and land cover, as well as thematic layers such as protected areas, species ranges, ecoregions, and conservation project areas. Can read more about the project in the Conserve Online workspace dedicated to discussion about its development, including initial proposal: http://conserveonline.org/workspaces/cons.geo.portal
Google maps and GoogleEarth	Google	http://www.google.com/earth/index.html	downloadable mapping application	Multiple	Global	Explore a 3D globe with Earth view in Google Maps and on sites across the web.

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Google Earth Builder	Google	http://www.google.com/enterprise/earthmaps/builder.html	data portal, interactive map	Multiple	Global	Google Earth Builder is a revolutionary geospatial solution that lets you publish your mapping data on our secure, cloud-based mapping platform and share it quickly and easily through Google Earth, Google Maps and Android Phones.
Conservation Lands Network	Bay Area Open Space Council	http://www.bayarealands.org	background info, data portal, interactive map, community interaction, research portal	Multiple	Bay Area, CA	The Conservation Lands Network is a five-year science-based study by over 125 organizations and individuals tasked to identify the most essential lands needed to sustain the "natural infrastructure" of the Bay Area.
Green Infrastructure Network	The Conservation Fund	http://www.greeninfrastructure.net	background info, community interaction	Multiple	USA	The Conservation Fund's Green Infrastructure Leadership Program was created in 1999 to build the capacity of land conservation professionals and their partners to undertake strategic conservation activities that are proactive, systematic, well integrated and applied at multiple scales.
Community Resource Mapper	Southeast Watershed Assistance Network, Building Outside the Box	http://www.watershed-assistance.net/mapper/	interactive map, community interaction, research portal	Multiple	USA	Integrate natural resource protection into your community planning efforts with our mapping service. This service will allow you to create maps at a county, watershed or state level, showcasing your satellite imagery, impaired streams, impervious surface, protected lands, State Wildlife Action Plans and much more.

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LCMap	Great Northern Landscape Conservation Cooperative	http://greatnorthernlcc.org/lcmap	background info, data portal, interactive map, community interaction, research portal	Multiple	USA	The Landscape Conservation Management and Analysis Portal, LC MAP, provides a collaborative virtual workspace allowing partners of the Great Northern LCC to securely share, access, and analyze common datasets and information to further coordinated research, management, and resource conservation. It is a custom-designed platform for data search, data sharing, analysis, and mapping. LCMap is only available to GNLCC members.
MapSearch	National Renewable Energy Lab (NREL)	http://www.nrel.gov/gis/mapsearch.html	research portal	Multiple	Global	Use MapSearch to easily search NREL's collection of maps created by the Geographic Information System (GIS) team. Search by renewable energy technology (biomass, energy efficiency, fossel fuel, etc), geographic extent, country, file type, or date created.
ConPro	The Nature Conservancy	http://conpro.tnc.org/	background info, interactive maps	Protected lands	Global	Searchable repository of over 1000 conservation projects of TNC and partners. Contains details pertaining to ecological targets, threats, strategies being implemented and indicator measurements. Includes ability to view projects in a map. User account provides ability to add projects.
The Conservation Registry	Defenders of Wildlife	http://www.conservationregistry.org/	community interaction, background info	Protected lands	USA	This is a centralized database that records, tracks and maps on-the-ground conservation projects to help users understand the context, distribution, and effectiveness of collective efforts. It gathers project information from multiple sources. A landowner can choose to manually enter a project, while a larger organization or agency could electronically transfer data for import into the Registry. The Registry captures 3 project types 1) habitat restoration and management, 2) changes in land designation, and 3) monitoring, research and education projects tied to a location.

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The Landscape Toolbox	The Nature Conservancy and the USDA Agricultural Research Service	http://www.landscapetoolbox.org/		Rangeland Mgt		Tools and methods for effective rangeland management The Landscape Toolbox integrates existing and emerging field, remote sensing, and ecosystem modeling tools and methods in support of rangeland assessment, monitoring, and planning. The vision of the Landscape Toolbox project is to achieve better ecosystem management at landscape scales by cooperating with public and private partners to develop and synthesize data into working ecological knowledge systems.
National Recreation and Parks Association Website	NRPA	http://nrpaconnect.org/welcome.htm	background info, community interaction	Recreation	USA	Our goal is simple: Connect Members Learn what others are doing. Share Information, ideas and experiences. Engage with your peers.
National Trails Training Partnership, National Recreation Trails	American Trails	http://www.americantrails.org/resources/index.html	backgroud info, community interaction, research portal	Recreation	USA	American Trails is the only national, nonprofit organization working on behalf of all trail interests, including hiking, bicycling, mountain biking, horseback riding, water trails, snowshoeing, cross-country skiing, trail motorcycling, ATVs, snowmobiling and four-wheeling. American Trails members want to create and protect America's network of interconnected trails.
NRPA Connect	National Recreation and Park Association	http://nrpaconnect.org/welcome.htm	research portal, community interaction	Recreation	USA	Tool for professionals and citizens in parks and recreation community to share information, ideas and experience. Includes user profiles, news, focus groups and forums.

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PRORAGIS (Park and Recreation Operating Ratio and Geographic Information System)	National Recreation and Park Association	http://www.nrpa.org/Explore-Parks-and-Recreation/Research/PRORAGIS.aspx	community interaction	Recreation	USA	Work in Progress: A national database and GIS tool for recreation budgets, benchmarks, and best practices designed for public park and recreation agencies. Combines annual snapshots of departments' jurisdiction, organization, finances, resources, staffing, and programs with online mapping capabilities for parks, trails, and facilities. Requires detailed organizational information to create a user profile and view application (have not done this).
Web Soil Survey (WSS)	NRCS	http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm	interactive map	Soils	USA	Access soil data for an area or interest and determine the suitability of the soils for a particular use. Create reports.
Surf Your Watershed	EPA	http://cfpub.epa.gov/surf/locate/index.cfm	background info, research portal	Water Quality	USA	Searchable information by watershed, including watershed characterization and citizen-based groups at work in this watershed
The Wetlands-At-Risk Protection Tool (WARPT)	EPA Center for Watershed Protection	http://www.wetlandprotection.org/	background info, research portal	Water Quality	USA	The Wetlands-At-Risk Protection Tool, or WARPT, is a process for local governments and watershed groups that acknowledges the role of wetlands as an important part of their community infrastructure, and is used to develop a plan for protecting at-risk wetlands and their functions. The basic steps of the process include quantifying the extent of at-risk wetlands, documenting the benefits they provide at various scales, and using the results to select the most effective protection mechanisms.
Forests to Faucets	USDA	http://www.fs.fed.us/ecosystemservices/FS_Efforts/forests2faucets.shtml	data portal, interactive map	Water Quality	USA	The USDA Forest Service Forests to Faucets project uses GIS to model and map the continental United States land areas most important to surface drinking water, the role forests play in protecting these areas, and the extent to which these forests are threatened by development, insects and disease, and wildland fire. The results of this assessment provide information that can identify areas of interest for protecting surface drinking water quality. The spatial dataset can be incorporated into broad-scale planning, such as the State Forest Action Plans, and can help identify areas for further local analysis. In addition it can be incorporated into existing decision support tools that currently lack spatial data on important areas for surface drinking water. This project also sets the groundwork for identifying watersheds where a payment for watershed services (PWS) project may be an option for financing conservation and management on forest lands.

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SPARROW	USGS National Water-Quality Assessment Program (NAWQA)	http://water.usgs.gov/nawqa/sparrow/	data portal, interactive map, analytic tools	Water Quality	USA	SPARROW is a modeling tool for the regional interpretation of water-quality monitoring data. The model relates in-stream water-quality measurements to spatially referenced characteristics of watersheds, including contaminant sources and factors influencing terrestrial and aquatic transport. SPARROW empirically estimates the origin and fate of contaminants in river networks and quantifies uncertainties in model predictions.
Watershed Forest Management Information System (WFMIS)	Forest-to-Faucet Partnership: University of Massachusetts Amherst and the U.S. Forest Service Northeastern Area (State and Private Forestry) Watershed Program.	http://www.forest-to-faucet.org/projects_tools2.html	analytic tools, research portal	Water Quality	USA	The Watershed Forest Management Information System (WFMIS) is a spatial decision support system developed to evaluate and plan (1) forest conservation and nonpoint source pollution mitigation (Module 1: Watershed Management Priority Indices), (2) forest road maintenance (Module 2: Forest Road Evaluation System), and (3) silvicultural operations (Module 3: Harvest Schedule Review System). It uses commonly available GIS data (e.g., topography, land cover, soil properties, etc.) and basic field measurements for road-stream crossings and existing or proposed harvest units.
Wetlands Education Through Maps and Aerial Photography (WETMAAP)	USGS - National Wetlands Research Center and others	http://wetmaap.org	Background Info	Wetlands	USA	WETMAAP Goals are to: - introduce educators to wetland habitats' functions and values - introduce educators and students to wetland mapping, digital databases, and GIS technology - assist educators with the integration of wetland issues into existing curricula - promote public awareness of wetland loss issues and provide an understanding of the cause and effect of wetland change

Application Name	Host / Contributor	Website	**Components** (scroll down for definitions)	Topics	Region of Focus	Description
COMPONENT DEFINITIONS: **background info** = trainings, best practices, case studies, summary info **analytic tools** = allow for some kind of analysis through web-based applications or downloadable extensions **data portal** = GIS data **interactive map** = online map viewer allows for viewing 1 or more datasets **community interaction** = member interaction, public interaction, expert feedback, formal or informal workspaces (microsites) **research portal** = links to research, reports, publications, news						