



MONTANA
**Natural Heritage
Program** <http://mtnhp.org>



STRATEGIC PLAN

July 2010 – June 2014

STATUTORY MISSION OF PROGRAM

The Montana Natural Heritage Program was established by the 1983 Montana State Legislature as part of the Natural Resource Information System at the Montana State Library as a comprehensive program for acquisition, storage, and retrieval of data relating to the flora, fauna, and biological community types of Montana (Montana Code Annotated 90-15).

PROGRAM BACKGROUND

The Montana Natural Heritage Program has been in existence as part of the Natural Resource Information System at the Montana State Library since 1985. Throughout the program's existence, the Montana State Library has contracted its operation to a second party in order to maximize program flexibility and efficiency. Since July 1, 2006, the Montana Natural Heritage Program has operated as a program under the Office for Research and Sponsored Programs at the University of Montana. The program receives guidance in its operation from the Natural Resource Information System Advisory Committee, its partners, the Digital Library Director, and the Montana Library Commission.

INTRODUCTION TO PLAN

This strategic plan has been developed by staff and program managers and covers major goals and objectives for the overall program as well as the Botany, Zoology, Ecology, and Information Services program areas between July 2010 and June 2014. Under each of these headings, we have listed general and specific goals in order of priority given current data deficiencies and funding sources. Sections covering the overall administration of the program and the individual program areas include goals for staffing, data acquisition, data management, and data dissemination over the next four years. It is important to recognize that due to limited funding we do not have the staff capacity to fully meet all goals listed during this time period. However, it is important to identify all of these goals in order to bring them to the attention of others and take advantage of any potential collaborations or funding opportunities that arise. We would appreciate feedback from our partners and information users to ensure that this strategic plan is used to guide the program toward successful achievement of its mission.

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PROGRAM ADMINISTRATION AND OVERARCHING GOALS

VISION

The Montana Natural Heritage Program (MTNHP) was established by the 1983 Montana State Legislature as part of the Natural Resource Information System at the Montana State Library for acquisition, storage, and retrieval of data relating to the flora, fauna, and biological community types of Montana (Montana Code Annotated 90-15). Our vision for successful implementation of this statutory mission is that state and federal agencies, tribal governments, businesses, educators, students, and private citizens will rely on MTNHP as a neutral one-stop source for information and expertise on Montana's plant and animal species and habitats, especially those of conservation concern, and that ready availability of this information will save users time and money, speed environmental reviews, and avoid unnecessary conflicts and adverse impacts.

HOUSING AND ADMINISTRATION

The MTNHP has been in existence as part of the Natural Resource Information System at the Montana State Library since 1985. Throughout the MTNHP's existence, the Montana State Library has contracted operation of the MTNHP to a second party in order to maximize program flexibility and efficiency. Since July 1, 2006, the MTNHP has operated as a program under the Office for Research and Sponsored Programs at the University of Montana. While the majority of MTNHP staff has, and continues to be, housed at the Montana State Library in Helena, the administrative addition of the Spatial Analysis Lab at the University of Montana in 2007 has led to several staff being housed in the Natural Sciences building on the University of Montana campus in Missoula. At the present time, the MTNHP has adequate space for Helena-based staff at the Montana State Library and there is an opportunity to expand Missoula-based staff by 2 to 3 positions if the need should arise.

Overall administration of the MTNHP's staff and activities is guided by the program Director who in concert with the Botany, Zoology, Ecology, and Information Services Program Managers and the Grants and Finance Administrator, works with the staff at the University of Montana's Office for Research and Sponsored Programs, the Digital Library Director, the Natural Resource Information System Advisory Committee, the Montana Library Commission, the MTNHP Partner's Committee, and individual partners to develop and maintain programs according to the statutory obligations of the program, goals outlined in this strategic plan, partner needs, and available funding. We strive to maintain an excellent working relationship with staff at the Montana State Library, the University of Montana, our partner agencies, and the general public.

FUNDING AND STAFFING

The essential statutory obligation of providing a comprehensive program for acquisition, storage, and retrieval of information relating to the flora, fauna, and biological community types of Montana (MCA 90-15) can only be met through full funding of the following positions (FTE):

Director (1.0)	Data Specialists (1.5)
Information Services Manager (1.0)	Request Specialist (1.0)
Program Botanist (1.0)	Database Manager (1.0)
Program Zoologist (1.0)	Web Programmer (1.0)
Program Ecologist (1.0)	Finance Administrator (0.5)
Aquatic Ecologist (0.5)	

The MTNHP strives to maintain highly skilled professionals in these positions who have specialized, botanical, zoological, ecological, and information technology skills. Unfortunately, as of state fiscal year 2011, the MTNHP receives only 57 percent of the funding necessary to support these essential core service positions through appropriations of the Montana State Legislature. This is partially a result of the fact that when the program was initiated, the internet was not yet available in Montana and web programming and other information technology positions were unnecessary; today these positions are essential to our mission. In addition, despite some budget increases over the years, some offsetting budget cuts, increases in operation costs, and cost-of-living increases have led to an overall decline in the support for these essential core positions. The MTNHP has partially addressed this funding deficit through annual support agreements from partners that recognize the program is underfunded and feel that their best interests are served by contributing funding to MTNHP essential core services. In state fiscal year 2011, legislative and annual service agreements will cover 77 percent of the funding needed to support essential core services. The remaining 23 percent of the funding required for these essential core positions will come from mission-oriented projects that have been requested by partners. Many of these partner-requested projects are focused on acquisition of new information. So, in general, the storage and retrieval components of the MTNHP's statutory obligations are increasingly the underfunded portions of the MTNHP's essential core services (see table of essential core services under the section below on overarching goals). Furthermore, over reliance (43 percent of the state FY11 budget) on soft-funded annual service agreements and partner-requested projects to support the essential core services undermines the stability of those services since these state and federal dollars are at risk of being eliminated at any time. Thus, a major focus of the MTNHP Director under this strategic plan will be to work with partners to increase and stabilize funding for MTNHP's essential core services in order to ensure that the storage and retrieval services are fully developed. Specific funding goals to stabilize funding for essential core positions under this strategic plan include:

- I. Negotiate additional support of core services from the University of Montana through higher rates of retention of indirect costs on partner-funded projects.
- II. Work with individual state agency partners and the Natural Resource Information System Advisory Committee to review and revise the funding model for core services.
- III. Increase core service funding through annual service agreements from federal partners that currently use core services, but make no, or limited, funding contributions to support them. Agencies of highest priority include:
 1. U.S. Fish and Wildlife Service
 2. Bureau of Indian Affairs
 3. U.S. Geological Survey through Landscape Conservation Cooperatives
 4. U.S. Forest Service
 5. U.S. Department of Defense
 6. U.S. Army Corps of Engineers
- IV. Work with agencies to provide new and ongoing funding to support core services that involve new and ongoing commitments of staff time and resources.
- V. Develop one-time-only or intermittent funding sources to support development of core data services that can be developed in segments (e.g., a National Science Foundation or Library Service Grant to more fully develop the Montana Field Guide).

OVERARCHING GOALS

Goals for the Botany, Zoology, Ecology, and Information Services Program areas between 2010 and 2014 are fully developed under program-specific strategic plans in the document below. The essential core services provided by each program area, the importance of those services under statute and from partner feedback, and the likelihood of curtailment of these services due to inadequate legislative, annual service agreement, or partner-supported project funding are summarized in the table beginning on the following page.

In addition to the essential core services for each program area, the MTNHP has overarching goals for meeting our statutory mission of being a comprehensive program for acquisition, storage, and retrieval of data relating to the flora, fauna, and biological community types of Montana (MCA 90-15). Overarching goals include:

I. Information Acquisition

1. Establish and/or lead data working groups with our partners for key data resources that establish standards for gathering, storing, and exchanging data.
2. Provide partners and the general public with a variety of opportunities to submit information to our central databases, including hard copy and digital data forms and web-based data entry forms.
3. Promote integration of data acquisition across program areas and partner's areas of focus (e.g., gathering plant and animal Species of Concern data during habitat surveys).

II. Information Storage and Processing

1. Establish and/or lead committees that evaluate the status of plant and animal species and aquatic, wetland, and terrestrial communities.
2. Create data resources that integrate information on plant and animal species and habitats of conservation concern that can be easily understood and readily used by partners in environmental assessments.
3. Ensure that animal, plant, and community information is stored in a format compatible with data managed by NatureServe and other Natural Heritage Network programs.
4. Create value added products from basic plant, animal, and community information (e.g., models predicting the distribution of plants, animals, and communities).
5. Create links between plants and animal species and the communities in which they occur.

III. Information Retrieval

1. Maintain an up-to-date contact list of partners and data users for purposes of providing them regular updates on data resources.
2. Provide regular updates to partners on our data resources through email and web announcements, annual reports, and announcements to information officers in our partner agencies.
3. Create web pages and applications that smoothly integrate botany, zoology, and ecology data resources.
4. Provide regular training opportunities through webinars, workshops, and partner specific training sessions.
5. Regularly solicit input on our data resources through the MTNHP Partner's Committee, listening sessions with partners, and web-based user surveys.

Essential Core Services of the Montana Natural Heritage Program

Program Area	Service Type	Service	Importance ¹	Opportunity for Project Dollars	Potential Service Curtailment ²
Administrative	Acquisition/ Storage/ Retrieval	Coordinate all program activities with partners and program areas	Primary	No	3
Administrative	Acquisition/ Storage/ Retrieval	Administer contracts and grants	Primary	Regular	3
Administrative	Retrieval	Promote use of Heritage data resources through outreach and training sessions	Primary	No	3
Botany	Acquisition	Collect and manage observation data for plants, lichens, fungi, algae, and diatoms that are not Species of Concern	Secondary	Very Limited	1-C
Botany	Acquisition	Compile literature on plant and lichen species	Primary	Very Limited	1-C
Botany	Acquisition	Compile photographic images of plants, lichens, fungi, algae, and diatoms	Primary	Very Limited	1-C
Botany	Acquisition	Monitor populations of ESA-listed and globally rare plant and lichen species	Secondary	Regular	1-P
Botany	Acquisition	Conduct field surveys for plant and lichen Species of Concern, ESA-listed species, and globally rare species in under-surveyed geographic areas and habitats	Secondary	Regular	1-P
Botany	Acquisition	Collect and manage occurrence and observation data on plant and lichen Species of Concern that has been gathered by others	Primary	Very Limited	2-C
Botany	Storage/Processing	Create and maintain species accounts in the Montana Field Guide for all plants, lichens, fungi, algae, and diatoms that are not Species of Concern	Secondary	Limited	1-C
Botany	Storage/Processing	Develop a geodatabase of unique habitats such as fens that have a high concentration of plant or lichen Species of Concern	Secondary	Limited	1-C
Botany	Storage/Processing	Maintain complete taxonomic list of nonvascular plants, lichens, fungi, algae, and diatoms	Secondary	Very Limited	1-C
Botany	Storage/Processing	Create and maintain species accounts in the Montana Field Guide for all plant and lichen Species of Concern	Primary	Limited	2-C
Botany	Storage/Processing	Work with other Heritage staff to regularly exchange information with NatureServe	Primary	Limited	2-C
Botany	Storage/Processing	Create predicted distribution maps for plant and lichen Species of Concern	Primary	Limited	2-PC
Botany	Storage/Processing	Create associations between plant and lichen Species of Concern and the Ecological Systems in which they are known to occur	Primary	Limited	3
Botany	Storage/Processing	Maintain complete taxonomic list of plant species for Montana	Primary	Very Limited	3
Botany	Storage/Processing	Review the status of plant and lichen taxa, assign state ranks and, where appropriate, assign global ranks, and document these status ranks	Primary	Very Limited	3
Botany	Retrieval	Present results of surveys or status assessments of plants and lichens at professional and public meetings	Secondary	Limited	1-P
Botany	Retrieval	Develop reports and peer reviewed publications on the distribution, status, and biology of Montana's plant and lichen species	Secondary	Regular	1-P
Botany	Retrieval	Work with Information Services staff to maintain and improve content of botanical information on Heritage websites	Primary	Very Limited	2-C
Botany	Retrieval	Maintain a list of related web resources relevant to plant, lichen, fungi, algae, and diatoms	Primary	Very Limited	3
Botany	Retrieval	Respond to requests for information on the identification, biology, ecology, conservation status, management, and appropriate survey methods for plant and lichen species	Primary	Very Limited	3

Zoology	Acquisition	Collect and manage observation data for animals that are not Species of Concern that has been gathered by others	Secondary	Limited	1-C
Zoology	Acquisition	Compile literature on vertebrate and invertebrate animal species with an emphasis on Species of Concern	Primary	Limited	1-C
Zoology	Acquisition	Conduct field surveys for vertebrate and invertebrate species with a focus on Species of Concern and under-surveyed geographic areas and habitats	Secondary	Regular	1-P
Zoology	Acquisition	Collect and manage observation data on animal Species of Concern that has been gathered by others	Primary	Limited	2-C
Zoology	Acquisition	Compile photographic images of vertebrate and invertebrate animal species and locations where animal surveys have been conducted	Primary	Limited	2-C
Zoology	Storage/Processing	Create and maintain species accounts, including state and Western Hemisphere range maps and observation maps, in the Montana Field Guide for animal species that are not Species of Concern	Secondary	Limited	1-C
Zoology	Storage/Processing	Create predicted distribution maps for animal species that are not Species of Concern	Secondary	Limited	1-C
Zoology	Storage/Processing	Maintain a complete taxonomic list of invertebrate animal species for Montana	Secondary	Very Limited	1-C
Zoology	Storage/Processing	Create and maintain species accounts, including state and Western Hemisphere range maps and observation maps, in the Montana Field Guide for all animal Species of Concern	Primary	Limited	2-C
Zoology	Storage/Processing	Create predicted distribution maps for animal Species of Concern	Primary	Limited	2-C
Zoology	Storage/Processing	Create associations between animal species that are not Species of Concern and the Ecological Systems in which they are known to occur	Secondary	Limited	2-C
Zoology	Storage/Processing	Work with other Heritage staff to regularly exchange information with NatureServe	Primary	Limited	2-C
Zoology	Storage/Processing	Review the status of vertebrate and invertebrate animal taxa, assign state ranks, assist NatureServe with assigning global ranks when appropriate, and document these status ranks	Primary	Limited	3
Zoology	Storage/Processing	Create animal species occurrences from high value observations of animal Species of Concern that can be used in Environmental Reviews	Primary	Limited	3
Zoology	Storage/Processing	Create associations between animal Species of Concern and the Ecological Systems in which they are known to occur	Primary	Limited	3
Zoology	Storage/Processing	Maintain a complete taxonomic list of vertebrate animal species for Montana	Primary	Very Limited	3
Zoology	Retrieval	Present results of surveys or status assessments of animals at professional and public meetings	Secondary	Limited	1-P
Zoology	Retrieval	Develop reports and peer reviewed publications on the distribution, status, and biology of Montana's animal species	Secondary	Regular	1-P
Zoology	Retrieval	Work with Information Services staff to maintain and improve content of zoological information on Heritage websites	Primary	Very Limited	2-C
Zoology	Retrieval	Maintain a list of related web resources relevant to vertebrates and invertebrates	Primary	Very Limited	3
Zoology	Retrieval	Respond to requests for information on the identification, biology, ecology, conservation status, management, and appropriate survey methods for vertebrate and invertebrate species	Primary	Very Limited	3
Ecology	Acquisition	Compile literature on terrestrial, wetland, and aquatic communities, with emphasis on those of conservation concern	Primary	Limited	1-C
Ecology	Acquisition	Collect vegetation data to support current and future vegetation classification and mapping efforts	Secondary	Limited	1-P
Ecology	Acquisition	Develop database structures that will support collection and management of ecology data collected by others	Primary	Very Limited	1-C

Ecology	Acquisition	Conduct field surveys for underrepresented or uncommon ecological communities in under-surveyed geographic areas	Secondary	Regular	1-P
Ecology	Acquisition	Compile photographic images of wetland, aquatic, and terrestrial habitats representative of those found in Montana	Primary	Limited	1-P
Ecology	Acquisition	Collect macroinvertebrate and fish data to support aquatic community classification and mapping efforts	Secondary	Regular	1-P
Ecology	Acquisition	Evaluate the status of wetland, aquatic, and terrestrial communities with field surveys	Secondary	Regular	1-P
Ecology	Storage/Processing	Compile information on management and restoration of terrestrial, aquatic, and wetland ecological systems	Primary	Limited	1-C
Ecology	Storage/Processing	Develop and improve a statewide map of aquatic ecological communities	Primary	Limited	1-P
Ecology	Storage/Processing	Develop and maintain an interactive aquatic ecological systems map that provides rapid visual characterization of systems and expected biological communities.	Primary	Limited	1-P
Ecology	Storage/Processing	Assess the status of terrestrial and aquatic communities, assign state ranks, and document the justification behind status ranks	Primary	Limited	2-C
Ecology	Storage/Processing	Identify ecological sites of particular conservation concern that should be included in MTNHP information provided for environmental assessments	Primary	Very Limited	2-C
Ecology	Storage/Processing	Develop crosswalks between different vegetation classification schemes to facilitate use of MTNHP products and products created by others	Primary	Limited	2-P
Ecology	Storage/Processing	Develop a statewide data layer of wetland and riparian mapping information from NAIP imagery	Primary	Regular	2-P
Ecology	Storage/Processing	Update and improve the statewide map of land cover	Primary	Regular	2-P
Ecology	Storage/Processing	Create and maintain accounts for terrestrial and aquatic land cover classes and/or ecological systems in the Montana Field Guide that describe the composition, distribution, status, successional dynamics, and management/restoration needs of each.	Primary	Limited	3
Ecology	Retrieval	Present results of surveys or status assessments of terrestrial and aquatic communities at professional and public meetings	Secondary	Limited	1-P
Ecology	Retrieval	Develop reports and peer reviewed publications on the composition, distribution, and status of Montana's aquatic and terrestrial communities.	Secondary	Regular	1-P
Ecology	Retrieval	Work with Information Services staff to maintain and improve content of ecological information on Heritage websites, including wetland mapping and assessments, land cover mapping, and ecological community accounts.	Primary	Limited	2-C
Ecology	Retrieval	Maintain a list of related web resources relevant to terrestrial, aquatic, and wetland communities	Primary	Very Limited	3
Ecology	Retrieval	Respond to requests for information on the distribution, composition, successional dynamics, conservation status, management, and appropriate survey methods for terrestrial, aquatic, and wetland communities	Primary	Very Limited	3
Info Services	Acquisition	Maintain and develop new ways for data contributors to submit animal, plant, and habitat information, including observations, plot data, and photographs	Primary	Limited	2-C
Info Services	Acquisition/ Storage/ Retrieval	Coordinate exchanges of plant, animal, and community information with NatureServe outside of the Biotics environment	Primary	Limited	2-C
Info Services	Acquisition/ Storage/ Retrieval	Develop SQL databases to replace Biotics database components, including species and community occurrences, references, stewardship, and element information	Primary	No	2-C

Info Services	Acquisition/ Storage/ Retrieval	Within the Natural Heritage Map Viewer application, develop web tools for overlaying and intersecting MTNHP and related data layers to better enable users to characterize and visually analyze geographic areas of interest	Primary	Limited	1-C
Info Services	Acquisition/ Storage/ Retrieval	Work with the MSL Digital Library staff to effectively cross reference and integrate MTNHP information and data with the MSL catalogue, search methods, and reference services	Primary	Very Limited	1-C
Info Services	Storage/Processing	Ensure that botany, zoology, and ecology data is being stored in appropriately designed relational databases and is backed up to prevent catastrophic loss	Primary	Limited	3
Info Services	Acquisition/ Storage/ Retrieval	Administer data servers that are used to store information internal to the firewall and disseminate information external to the firewall as well as roll up services to regularly transfer information between these servers across the firewall. Coordinate with NRIS as needed.	Primary	No	3
Info Services	Retrieval	Create map services for MTNHP data that partners can consume in their GIS or web applications, including stewardship, land cover, species occurrences, wetland and riparian mapping, and animal and plant point observation data	Primary	Limited	1-C
Info Services	Retrieval	Design, develop, and deploy a “Mid-level” functional access to MTNHP Species of Concern, habitat, and species list information to support planning and resource management activities of local government, private consultants, and conservation organizations	Primary	Limited	1-C
Info Services	Retrieval	Provide an ongoing support program to train and inform agency partners in effectively using technical resources, services, and applications, through webinars, powerpoint presentations at professional meetings, or agency groups	Primary	Limited	2-C
Info Services	Retrieval	Maintain and improve web-based access to wetland and land cover mapping information.	Primary	Limited	2-C
Info Services	Retrieval	Gather information from users about their information needs, format/access preferences, and the effectiveness of our delivery systems and tools	Primary	No	2-C
Info Services	Retrieval	Provide regular updates on the website and through emails as new resources become available (including reports, web tools, field guide enhancements, etc.).	Primary	No	2-C
Info Services	Retrieval	Develop better methods of accessing the Natural Heritage Program's bibliography of literature on the plants, animals, and habitats of Montana	Primary	No	2-C
Info Services	Retrieval	Maintain and improve the functionality and ease of use of the Montana Field Guide	Primary	Limited	3
Info Services	Retrieval	Respond to requests for plant and animal occurrences and wetland information used in environmental assessments	Primary	No	3
Info Services	Retrieval	Maintain and improve the functionality and ease of use of the online Plant and Animal Species of Concern Reports	Primary	No	3
Info Services	Retrieval	Maintain and improve the functionality and ease of use of the Natural Heritage Map Viewer and Tracker online mapping applications. Make a single web-based Map Viewer a central component of web resources provided by the program.	Primary	No	3
Info Services	Retrieval	Maintain and improve the functionality and ease of use of general Natural Heritage Program web pages	Primary	Very Limited	3

1 Level of importance is based on statutory obligations (MCA 90-15) and feedback from partners on their needs.

2 Lower numbers indicate higher likelihood of curtailment of service due to inadequate legislative, annual service agreement, or partner-supported project funding. C = Service curtailment would likely be associated with limitations of essential core service funding from the legislature or annual service agreements from partners since the service has little opportunity for partner-supported project funding. P = Service curtailment would likely be associated with restriction of partner-supported project funding since this service is dependent on some level of project funding and/or is a lower level of importance in terms of the program's statutory obligations.

BOTANY PROGRAM STRATEGIC PLAN

MISSION

The mission of the Botany Program is to collect and maintain reliable and comprehensive data on the diversity, status, biology, and conservation needs of Montana's plant and lichen species, focusing on species of conservation concern, and make this information available to resource managers, biologists, and the general public to support and promote informed stewardship of Montana's natural resources.

STAFFING

Maintain a staff recognized for their expertise with the taxonomy, biology and status of the flora of Montana. As resources are limited, maintaining a staff that is skilled and knowledgeable in all areas of botany and lichenology is not feasible. However, the Botany Program strives to consist of staff which: (1) have a thorough knowledge of the taxonomy and identification of Montana's plant and lichen species; (2) are familiar with the biology, ecology, and management of species, particularly those of conservation concern; (3) are familiar with literature on inventory, monitoring, and assessment of status; (4) are trained in field techniques appropriate to the detection of various plant taxa; (5) have up-to-date GIS, database, and statistical skills; (6) are involved with professional societies and working groups; and (7) make results of research and data analysis available to resource managers and the general public through web applications, posters, presentations, reports, and peer-reviewed publications.

DATA CONTENT AND ACQUISITION

Collect and manage critical information on the diversity, distribution, abundance, and conservation needs of Montana's plant and lichen species with emphasis on Species of Concern; vascular plants being the highest priority.

I. Taxonomic Diversity and Related Information

1. Vascular Plant Diversity

Maintain a taxonomic list of vascular plant taxa occurring in the state along with information on species' origin (native vs. exotic), global conservation status, state conservation status, and related ecological and taxonomic information. This information will be made available on the Montana Field Guide and via a Checklist of Montana Vascular Plants.

2. Bryophyte Diversity (mosses, liverworts, and hornworts)

Continue to actively gather information on the diversity of bryophyte taxa in the state with a goal of maintaining a comprehensive taxonomic list of the state's bryophytes.

3. Lichen Diversity

Continue to actively gather information on the diversity of lichen taxa in the state with a goal of maintaining a comprehensive taxonomic list of the state's bryophytes.

4. Other Taxonomic Groups (Fungi, Algae, Diatoms)
Collect information on the occurrence, distribution, taxonomy, and ecology of Fungi, Algae and Diatoms found in Montana. Information sources will include reports, publications, specimen collections and input from experts.

II. Occurrence and Observation Data

1. Collect and manage occurrence and observation data on plant and lichen Species of Concern and other species of potential conservation interest in the state. Data will be collected from a variety of data sources, but high priority sources will include:
 - a. USFS
 - b. NPS
 - c. BLM
 - d. TNC
 - e. Private Contractors
 - f. State Agencies (MDT, FWP, DEQ)
2. Collect and maintain observation data records for all plants through the use of:
 - a. Associated species occurrence records in MTNHP databases;
 - b. Digitized herbaria records;
 - c. Associated species records of digitized herbaria records;
 - d. On-line observation data entry tool for plant species;
 - e. Collection and manual data entry of observation records from published and unpublished reports and literature.

III. Field Surveys and Monitoring

Gather data important to documenting the distribution, abundance and status of Montana's plant species, particularly Species of Concern, through field surveys and monitoring projects.

1. Conduct field surveys for high priority species (e.g. ESA-listed and globally rare species and species of uncertain conservation status).
2. Conduct field surveys of high priority and under-surveyed geographic areas and habitats (tribal lands, glaciated plains, wetland habitats).
3. Conduct field surveys based on needs of partners agencies with a focus on Species of Concern.
4. Conduct population monitoring of high priority species and occurrences (e.g. ESA-listed and globally rare species and highly threatened occurrences of plant SOC).

IV. Taxonomic Literature

Compile and maintain a comprehensive database of literature on Montana's plant and lichen species, including taxonomic, biological, ecological, and management-related information.

V. Photos

Compile and maintain a database of photos for plant and lichen species, with emphasis on Species of Concern, that show the general morphology and habitat, as well as specific characteristics and life history traits of each plant species.

DATA PRODUCTS

Develop products from information contained in the Heritage Program's databases, the scientific literature, external data sources, and through consultation with experts that will promote informed stewardship of Montana's flora and habitats.

I. Vascular Plant Species Checklist

Maintain a current and comprehensive checklist of Montana's vascular plant taxa with full synonymy and information on conservation status.

II. Status Ranks and Reviews

Regularly review status ranks for Montana's plant and lichen species.

1. Review and assign state status ranks for vascular plant taxa and document rank reasons and methods.
2. Review and assign global status ranks for vascular plant taxa and document rank reasons and methods for those taxa for which MTNHP has accepted the responsibility for the global rank.
3. Assist other member programs in reviewing and assigning global ranks by providing information for taxa which are of conservation importance in Montana.
4. Review and assign state status ranks for lichen taxa and document rank reasons and methods through external assistance from professional and amateur lichenologists.
5. Review and assign state status ranks for bryophyte taxa and document rank reasons and methods through external assistance from professional and amateur bryologists.

III. Status Designations

Prioritize and categorize the conservation needs of Montana's plant and lichen species through the designation of Species of Concern and/or other categorization methods.

IV. Montana Field Guide Species' Accounts

Create and maintain species accounts on the Montana Field Guide for plants and lichens with emphasis on species of conservation and management concern. Accounts will include information on synonymy, status ranks and designations, status reasons, species' descriptions, habitats, range, identification, general ecology, references, photos, and summaries of species' occurrence and observation data.

- V. Predicted Habitat Maps
Create predicted habitat models for Montana plant species of concern using available statewide biophysical data layers and plant occurrence data in the botany database.
- VI. Habitat Associations
Create and maintain habitat associations/crosswalks of high priority plant species with Montana land cover, ecological systems, and/or other relevant habitat-based categories.
- VII. Conservation Strategy for Plants
Develop a comprehensive conservation strategy for plant species in Montana in conjunction with agency partners and organizations. The strategy will identify areas important to plant conservation in Montana, with a focus on plants of global conservation concern. This document will ideally be incorporated into Montana's State Wildlife Action Plan.
- VIII. Unique Habitats and Plant Communities
Develop and maintain a database of fens, unique habitats, and important areas for plant conservation in conjunction with other MTNHP program areas.
- IX. Reports and Publications
Produce reports and peer reviewed publications concerning Montana's plant and lichen resources, with a focus on:
1. Reporting the results of field surveys and monitoring projects;
 2. Status reviews of individual species or taxonomic groups;
 3. Identification and taxonomy of Montana plant and lichen taxa.

DATA DISSEMINATION AND SERVICES

Provide data products, services and other information from Heritage databases and staff expertise to the scientific, resource management, and education communities, as well as the general public, to inform stewardship of Montana's plant and lichen species and their habitats.

- I. Web-based Data Dissemination Tools
Develop and improve web applications for access to information in the Heritage Program's databases in conjunction with and assistance from other MTNHP program areas.
1. Maintain and improve current web applications, including:
 - a. Montana Field Guide
 - b. Species of Concern Report
 - c. Natural Heritage Tracker
 - d. Predicted Habitat Models
 - e. Links to Related Websites

2. Develop and/or assist in the development of additional web-based tools and services which improve the dissemination of plant data and information.

II. Information Requests and Exchanges

Conduct regular exchanges of information between our databases and the databases of our partners and answer individual information requests requiring botanical expertise.

1. Respond to requests for information on the biology, ecology, conservation status, management, and appropriate survey methods for individual species or taxonomic groups.
2. Provide botanical expertise related to the type and spatial and temporal extent of information that should be provided in requests of digital data.
3. Provide or exchange digital data with state and federal partners to ensure that data in all databases is current and available to the widest possible audience.
4. Conduct regular exchanges of database information with NatureServe to fulfill our statutory mandate of compatibility with the Heritage Network and make our information available for use at the regional and continental scales.

III. Information Outreach and Education

Promote the exchange and availability of information on Montana's plants and their habitats to the scientific community, resource management community, education community, and the general public through the following means:

1. Answering requests for information via phone, email, and other formats;
2. Presentations at professional and public meetings;
3. Providing assistance with identification and verification of plant material;
4. Coordination and involvement with key agency partners and organizations;
5. Dissemination of information via reports and publications;
6. Conducting training sessions on identification and management of plant species of concern or plants in habitats of particular interest or concern.

ZOOLOGY PROGRAM STRATEGIC PLAN

MISSION

The mission of the Zoology Program is to gather reliable information on the distribution, status, general biology, and conservation needs of Montana's animals (focusing on species of concern) and make this information and staff expertise easily accessible to scientists, resource managers, non-governmental organizations, and the general public in order to promote informed stewardship of Montana's animal species.

STAFFING

Maintaining a staff recognized for their expertise with the biology and status of the fauna of Montana is essential to completing the mission of the Zoology Program. We therefore strive to maintain staff that: (1) have a thorough knowledge of the natural history of Montana's vertebrate and invertebrate animal species; (2) are familiar with literature on the biology of species, particularly those of conservation concern; (3) are familiar with literature on inventory, monitoring, and assessment of the distribution and status of various animal taxa; (4) are trained in field techniques appropriate to the detection of various animal taxa; (5) have up-to-date GIS, database, and statistical skills; (6) are involved with professional societies and working groups; and (7) make results of research and data analysis available to resource managers and the general public through web applications, posters, presentations, reports, and peer-reviewed publications.

DATA ACQUISITION GOALS

Gather information critical to describing the distribution, status, and conservation needs of Montana's fauna, particularly animal species of concern.

I. Comprehensive Taxonomic List of Montana Animal Species

Maintain a comprehensive taxonomic list of animal species documented in Montana along with information on their origin as a native or exotic species, higher level taxonomy, global conservation status, distribution status (e.g., breeding, wintering, migratory), and range and conservation status in Montana. Make this information available on the Montana Field Guide and through a checklist of Montana animal species.

1. The list of all vertebrate taxa and some invertebrate taxa (e.g., terrestrial mollusks, dragonflies, and damselflies) is comprehensive, but requires ongoing maintenance with updates to taxonomy, status, and distribution.
2. Invertebrate taxa of highest priority for review to ensure a comprehensive list include:
 - a. Butterflies and Moths
 - b. Aquatic snails
 - c. Spiders
 - d. Flies and Mosquitoes
 - e. Beetles
 - f. Bees, Wasps, and Ants
 - g. Crickets, Grasshoppers, and Locusts
 - h. True Bugs (Hemipterans)
 - i. Segmented Worms

- j. Round Worms
- k. Flat Worms / Flukes
- l. Taxa important to the health and economic well being of citizens of Montana (e.g., mosquitoes, pine beetles, viruses, bacteria)
- m. Bacteria and parasites important to the demography and ecology of Montana vertebrates

II. Inventory and Monitoring Schemes

Provide a framework for describing the distribution and status of species or taxonomic groups of concern in Montana by developing statewide or regional inventory and monitoring schemes and associated databases

- 1. Taxa of highest priority include:
 - a. Bats
 - b. Grassland birds
 - c. Harlequin Ducks and other selected stream nesting waterfowl
 - d. Nocturnal birds (e.g., owls, Common Poorwill, American Bittern, Black-crowned Night-heron)
 - e. Northern Bog Lemmings
 - f. Spring, seep, and waterfall dependent fauna (e.g., Coeur d'Alene Salamanders, Black Swifts, globally rare invertebrates)
 - g. Selected terrestrial invertebrates (mollusks, dragonflies, and butterflies are highest priority)
 - h. Species dependent on alpine environments (e.g., Pika, Black Rosy-Finch, Butterflies)
 - i. Cave dependent invertebrates

III. Acquisition of Animal Observation Data from External Sources

Ensure that animal observation data from the following entities and efforts is being transferred to MTNHP databases on a regular basis and, where possible, in a digital format

- 1. State and federal agencies of highest priority include:
 - a. Montana Department of Fish, Wildlife, and Parks
 - b. Bureau of Land Management
 - c. U.S. Forest Service
 - d. U.S. Fish and Wildlife Service
 - e. National Park Service
 - f. U.S. Geological Survey
 - g. Montana Department of Transportation
 - h. Montana Department of Environmental Quality
 - i. Montana Department of Natural Resources and Conservation
 - j. Montana Department of Agriculture
 - k. Natural Resources and Conservation Service

2. Major inventory and monitoring efforts of highest priority include:
 - a. Breeding Bird Survey
 - b. Statewide Bird Monitoring
 - c. Landbird Monitoring Program
 - d. Important Bird Areas
 - e. Adopt a Quarter-Quarter Latilong Bird Monitoring Program
 - f. U.S. Forest Service bat inventories
 - g. Christmas Bird Count
 - h. Colonial Waterbird Surveys
 - i. Diversity Monitoring Program (currently led by MTNHP and FWP)
 - j. Monitoring Avian Productivity and Survivorship
 - k. Breeding Bird Census
 - l. Surveys for Prairie Dog Town Associated Species
 - m. Raptor Survey Routes
 - n. North American Butterfly Association 4th of July Count

3. Taxa of highest priority for data acquisition from partners, taxonomic experts, museums, and literature include:
 - a. Fish
 - b. Amphibians
 - c. Reptiles
 - d. Birds
 - e. Mammals
 - f. Terrestrial Mollusks
 - g. Dragonflies and Damselflies
 - h. Butterflies and Moths
 - i. Aquatic snails

4. Other high priority entities for acquisition of animal observations include:
 - a. Tribal governments
 - b. General public
 - c. University faculty and theses and dissertations of graduate students
 - d. Scientific collectors permit data through FWP
 - e. Published Literature
 - f. Private Consultants
 - g. Odonata Central Database
 - h. Lepidopterist Society Database

IV. Compilation of Literature

Gather a comprehensive set of literature relevant to the distribution, status, biology, conservation, and management of animal species documented in Montana and make this available in online applications such as the Montana Field Guide and a Bibliographic Database Search Engine

1. Taxa of highest priority for compilation of literature include:
 - a. Birds
 - b. Mammals
 - c. Dragonflies and Damselflies
 - d. Butterflies and Moths
 - e. Terrestrial Mollusks
 - f. Aquatic snails
 - g. Spiders
 - h. Grasshoppers
 - i. Flies and Mosquitoes
 - j. Segmented Worms
 - k. Round Worms
 - l. Flat Worms / Flukes

2. Priority methods for literature compilation include the following:
 - a. Systematic review of literature in Heritage element files compared to citations in the Heritage Reference Database
 - b. Systematic queries of library search engines
 - c. Establishment of Really Simple Syndication (RSS) search engine feeds in order to keep the Heritage Reference Database up-to-date
 - d. Systematic review of state and federal publication libraries

V. Submission of Animal Observations and Species Information

Provide data contributors with a range of methods to easily submit animal observations and species information to the MTNHP databases.

1. Improve the data entry tool on the Tracker application
 - a. Ensure that entry can be performed on all of the most commonly used browsers
 - b. Improve the speed of the data entry tool through map caching and taxonomic cascading of species lists
 - c. Provide for taxonomic sorting to facilitate species selection

2. Maintain a simplistic web entry tool to facilitate digital data entry by the general public. Identify and provide for the staffing needed to map these observations and place them in a format compatible with the point observation databases

3. Maintain Excel spreadsheets used to submit digital or hard copy versions of animal observation records

4. Establish a method allowing taxonomic experts to submit text for species accounts on the Montana Field Guide which will be reviewed by staff zoologists

5. Work with partners to ensure that state and federal agency employees, tribal governments, and the general public are aware of, and trained on, the various data entry tools available

VI. Heritage Field Surveys

Gather data critical to documenting the distribution, status, and conservation needs of Montana's animal species, particularly those of concern, by conducting field surveys.

1. Conduct broad-scale inventory and monitoring field surveys in priority focal habitats or landscapes:
 - a. Tribal lands (comprehensive inventories)
 - b. Caves and abandoned mines (e.g., bat roost sites for white-nose syndrome, cave invertebrates)
 - c. Sagebrush and grassland habitats (e.g., Pygmy Rabbits, Sagebrush Vole, Merriam's Shrew, Preble's Shrew, Dwarf Shrew, Brewer's Sparrow, Sage Sparrow, Sage Thrasher, Grasshopper Sparrow, McCown's Longspur, Sprague's Pipit, Baird's Sparrow, Chestnut-collared Longspur, and butterflies)
 - d. Rock outcrop habitats (e.g., reptiles, bats, and selected bird species)
 - e. Spring/Seep, waterfall spray zone, and headwater stream old growth habitats for Pacific Northwest Fauna (e.g., Coeur d'Alene Salamanders, Idaho Giant Salamanders, terrestrial mollusks, millipedes, Black Swifts, and rare stream invertebrates)
 - f. Lentic wetlands (e.g., Northern Bog Lemming, lentic breeding amphibians, bats, dragonflies, damselflies, and terrestrial mollusks)
 - g. Aquatic, wetland, and terrestrial vegetation communities in rivers and streams threatened by loss of floodplain and beaver dynamics and invasion of exotic plant species (e.g., Plains Spadefoot, Great Plains Toad, Northern Leopard Frog, Western Hog-nosed Snake, Hoary Bat, Black-billed Cuckoo, Eastern Screech Owl, and terrestrial and aquatic mollusks)
 - h. Aspen stands (e.g., terrestrial mollusks)
 - i. Alpine Species of Concern (e.g., terrestrial mollusks, butterflies, White-tailed Ptarmigan, Black Rosy-Finch, Gray-crowned Rosy-Finch, Dwarf Shrew, Preble's Shrew)
 - j. Prairie Coteau Species of Concern (e.g., Smooth Greensnake, Sedge Wren, Yellow Rail, LeConte's Sparrow, Nelson's Sparrow, Arctic Shrew, Short-tailed Shrew, Pygmy Shrew)
 - k. Wyoming Basin Species of Concern (e.g., Greater Short-horned Lizard, White-tailed Prairie Dogs, Pallid Bat, Spotted Bat)
2. Conduct field surveys requested by partners that entail inventory and monitoring surveys, or treatment versus control assessments, for native Species of Concern
3. Conduct field surveys to document exotic species whose introduction poses a threat to native Montana fauna (e.g., American Bullfrogs predated wetland species; European Starlings using nest cavities of native birds; impacts to wildlife from Russian Olive and Tamarisk)

DATA MANAGEMENT AND ANALYSIS GOALS

Develop products from information contained in the MTNHP's databases and scientific literature that will promote informed stewardship of Montana's fauna, particularly animal Species of Concern.

I. Transition to SQL Database

Create SQL versions of Biotics Database tables and migrate information from Biotics to SQL to meet the needs of the Zoology Program and allow for greater display of information via web applications.

II. Status Reviews of Species

Coordinate regular status reviews of animal species in conjunction with the Montana Department of Fish, Wildlife, and Parks, the Montana Chapter of the Wildlife Society, the Montana Chapter of the American Fisheries Society, and species or taxa experts. Specific goals under this strategic plan include:

1. Using the NatureServe scoring model, assess the conservation status of all regularly occurring vertebrate species every 5-10 years, as new information becomes available, or as requested by our partners;
2. Using the NatureServe scoring model, assess the conservation status of all invertebrate Species of Concern and Potential Species of Concern every 5-10 years, as new information becomes available, or as requested by our partners;
3. Create and populate a SQL database table to document information underlying the various NatureServe ranking criteria for each species;
4. Provide a summary of the information used to assess the status of Species of Concern and Potential Species of Concern in the online Species of Concern Report and Montana Field Guide.

III. Range Polygons

Create and maintain polygons that document current understanding of the ranges of regularly occurring native and introduced vertebrate and invertebrate species documented in the Heritage Program's databases (e.g., year-round, summer breeding, wintering, migratory, historical, and introduced). Display these range polygons in maps on the Montana Field Guide and Natural Heritage Tracker web applications. Use the range polygons to limit the extent of deductive and inductive models as well as identify questionable records in the point observation databases

IV. Species Occurrence Polygons

Maintain an up-to-date set of Species Occurrence polygons based on records in the point observation databases and incorporating literature on habitat use and home range size

V. Montana Field Guide Species Accounts

Create and maintain species accounts for the Montana Field Guide. Each account ideally includes: photos, status summary, general and diagnostic descriptions, Montana and Western Hemisphere range maps, maps and charts summarizing the spatial and temporal distribution of observation records in Montana, and summaries of migration, habitat use, food requirements, general ecology, reproduction, and management. Species accounts will be properly supported with citations and a list of literature cited. Taxa of highest priority for fully developed species accounts include:

1. Species of Concern
2. Potential Species of Concern
3. Terrestrial Mollusk Species
4. Dragonflies and Damselflies
5. Butterflies
6. Amphibians
7. Reptiles
8. Birds
9. Mammals
10. Fish

VI. Bibliographic Database

Create and maintain a comprehensive reference list. Specific goals include:

1. Creating a reference management system using a combination of proprietary software and SQL database tables;
2. Populating the database with all references in the current Biotics database, hard copy references in the element files, and other bibliographic sources including:
 - a. Montana conservation plans for amphibians and reptiles, bats, and loons
 - b. The Montana Department of Fish, Wildlife, and Parks references database
 - c. Literature Review on the Effects of Energy Development on Wildlife
 - d. Bibliographic Database on the Effects of Recreation on Rocky Mountain Wildlife
 - e. Montana Fish, Wildlife, and Park's 1993 report, "A Bibliography of Montana Wildlife Literature Through 1992"
 - f. Montana Department of Natural Resources and Conservation's 1976 report, "An Index to Montana Wildlife Literature 1950-1976"
 - g. Montana Wildlife Legacy;
3. Working with Montana State Library staff to create digital copies of element file materials in order to make them more accessible;
4. Spatial referencing of literature using map coordinates and keywords (e.g., counties).

VII. Animal Associations with Ecological Systems

Identify associations of animal species with ecological systems in the Montana Land Cover map. For each species, identify whether the system is low, medium, or high habitat quality.

Taxa, ranked by highest priority, include:

1. Species of Concern
2. Potential Species of Concern
3. Vertebrate Species
4. Terrestrial Mollusk Species
5. Dragonflies and Damselflies
6. Butterflies
7. Other invertebrate species

VIII. Inductive Predicted Distribution Models

Create inductive models predicting the distribution of Montana animal species using available statewide environmental data layers and records in the point observation databases. Taxa, ranked by highest priority, include:

1. Species of Concern
2. Potential Species of Concern
3. Vertebrate Species
4. Terrestrial Mollusk Species
5. Dragonflies and Damselflies
6. Butterflies
7. Other invertebrate species

IX. Reports and Publications

Produce reports, books, and peer reviewed publications analyzing and interpreting data from field surveys (e.g., Montana bird distribution, terrestrial mollusk field guide, summaries of statewide amphibian and reptile inventory work, summaries of statewide bat and small mammal inventory work).

DATA DISSEMINATION

Provide data products and other information from Heritage databases to the scientific, resource management, and education communities, as well as the general public, to inform stewardship of Montana's fauna.

I. Web Applications

Develop and improve web applications for access to information in the Heritage Program's databases

1. Maintain and improve current web applications, including:
 - a. Montana Field Guide in collaboration with Montana Fish, Wildlife and Parks
 - b. Natural Heritage Tracker
 - c. Species of Concern Report
 - d. Predicted Suitable Habitat Models download page
 - e. Key web links for various animal taxa

2. Develop new web applications, including:
 - a. Ecological Systems and Associated Species (potential species lists)
 - b. Bibliographic Database Search Engine

II. Information Requests and Exchanges

Provide for regular exchanges of information between our databases and the databases of our partners and answer individual information requests requiring zoological expertise.

1. Respond to requests for information on the biology, ecology, conservation status, management, and appropriate survey methods for individual species or taxonomic groups.
2. Provide zoological expertise on the type and spatial and temporal extent of information that should be provided in requests of digital data.
3. Complete regular exchanges of digital data with state and federal partners to ensure that data in all databases is current and available to the widest possible audience.
4. Complete regular exchanges of database information with NatureServe to fulfill our statutory mandate of compatibility with the Heritage Network and make our information available for use at the regional and continental scales.

III. Information Outreach

Promote exchange and availability of information on Montana animal groups to the scientific community, resource management community, education community, and the general public through the following means:

1. Direct communication through presentations at professional and public meetings, phone conversations and email exchanges;
2. Outreach to key partners to distribute information within their agencies and organizations (e.g., FWP Information Management and Community Education Bureaus, Office of Public Instruction, DEQ, DNRC, libraries, BLM, USFS, NRCS, and county planners);
3. Host listservs for various working groups, including: the Montana Bird Conservation Partnership, Harlequin Duck Working Group, Prairie Dog Working Group, Herpetofauna Working Group, Loon Working Group, and Bat Working Group;
4. Post PowerPoint presentations on our website;
5. Develop posters for animal Species of Concern (e.g., turtles and lizards, bats, grassland birds of global importance, freshwater mussels, and dragonflies and damselflies) and exotic species representing a threat to native species (e.g., American Bullfrogs);
6. Disseminate reports, books, and peer reviewed publications on the distribution and status of animal taxa to all heritage partners (e.g., terrestrial mollusk field guide, 7th Edition of P.D. Skaar's Montana Bird Distribution, summaries of statewide amphibian and reptile inventory work, summaries of statewide bat and small mammal inventory work).

ECOLOGY PROGRAM

MISSION

The mission of the Montana Natural Heritage Program's Ecology Program is to gather reliable information on the distribution, status, community composition and successional dynamics of Montana's ecological systems and communities (focusing on systems and communities of concern) and provide this information to scientists, managers, and the general public to promote informed stewardship of our biological heritage.

To this end, the Ecology Program focuses on broad-scale mapping, modeling, and spatial analysis of wetland and terrestrial habitats (Landscape Ecology); description, assessment, and analysis of wetlands (Wetland Ecology); description, assessment, and analysis of plant communities and ecological systems (Vegetation Ecology); classification, description, assessment, and analysis of aquatic communities (Aquatic Ecology); and development of management and restoration practices for terrestrial and wetland habitats (Restoration Ecology). These focus areas are distinct but highly integrated.

The strategic plan below outlines general and specific goals designed to achieve this mission between 2010 and 2014 as funding allows. It is important to recognize that we do not have the staff capacity to fully meet these goals during this time period. However, we feel it is important to identify all of these issues to bring them to the attention of others and to take advantage of any potential collaborations or funding opportunities. General goals of the Ecology Program are listed first, followed by specific goals for each Program component.

GENERAL GOALS

I. Staff expertise

Maintain a staff recognized for expert knowledge and understanding of the distribution, status, community composition and successional dynamics of Montana's ecological systems and communities (focusing on systems and communities of concern).

1. Maintain a staff with current knowledge of the identification, classification, assessment, analysis, and management and restoration of Montana's wetland, upland, and aquatic communities;
2. Maintain a staff skilled in GIS analysis, image interpretation, modeling, survey design and relational databases;
3. Present project findings at scientific, professional, and technical meetings;
4. Promote staff involvement with a wide range of professional societies (e.g., wetland science, range management, forestry, GIS and remote sensing, wildlife, fisheries, etc.).

II. Information Outreach

Provide information to the scientific, management and restoration communities and to the general public to promote informed stewardship of Montana's ecological systems and communities, emphasizing those of conservation concern.

1. Maintain direct communication with the scientific, management, and restoration communities, and with the general public through presentations and phone and email interactions.
2. Develop and promote web-based access to map products, GIS data, and assessment information.
3. Produce reports, field guides, data summaries, technical guidance, and training materials, and make these available through the MTNHP website.
4. Make information accessible and interesting to the general public through materials such as a roadside guide to Montana's ecological systems.
5. Author scientific papers, posters and pamphlets.
6. Collaborate in the development and use of decision-support tools for agency partners.
7. Promote use of Heritage tools and products through outreach and training.

III. Community status assessments

Compile state status rankings for terrestrial, wetland, and aquatic ecological systems and communities, and develop an Ecological Systems of Concern list.

1. Develop an Ecological Systems of Concern review process.
2. Survey partners to determine the usefulness of an Ecological Communities of Concern lists, and the data required for and available to support that list.
3. Crosswalk ecological systems of concern and plant/animal species of concern.

LANDSCAPE ECOLOGY GOALS

I. Broad-scale understanding of the distribution and status of wetland and riparian habitats

Provide a broad framework for describing the distribution and status of wetland and riparian habitats by developing statewide mapping and descriptive materials.

1. Develop a timeline and funding strategy to coordinate mapping and characterization of wetlands and riparian areas across the state at a 1:12,000 scale, working with partners to prioritize completion of the following areas of the state:
 - a. Southwest
 - b. Southeast, east, and southcentral
 - c. The Hi-line

- d. Northwest and northcentral
- e. Central

II. Dissemination of wetland and riparian habitat information

Work with Information Services to develop web applications that support dissemination of wetland maps, GIS data, descriptive materials and survey results.

1. Make provisional GIS data, downloadable digital maps, and descriptive information available from the main Wetland and Riparian Mapping Center web page.
2. Maintain a linked web page showing the status of the statewide mapping effort, updated monthly, with a companion map identifying mapping areas associated with specific partners.
3. Integrate an interactive display of wetland and riparian maps and survey data into the Natural Heritage Map Viewer.

III. Broad-scale understanding of the distribution and status of terrestrial habitats

Provide a framework for describing and evaluating the distribution and status of terrestrial habitats by developing statewide mapping and descriptions of ecological systems.

1. Develop and implement a plan and protocols for systematic correction and improvement of statewide land cover mapping at a 1:100,000-scale, focusing on ecological systems.
2. Correction and refinement of existing descriptive materials for ecological systems and development of descriptive materials for key ecological alliances and associations.
3. Collection of vegetation data to support vegetation classification and mapping efforts.
4. Interpretation and integration of legacy vegetation data and data from other monitoring efforts (e.g., birds, small mammals, wetlands) that enhance classification accuracy.

IV. Dissemination of terrestrial habitat information

Work with Information Services to develop and maintain web resources that support dissemination of vegetation maps, GIS data, descriptive materials and survey results.

1. On an annual basis, update land cover mapping to include new, reclassified, or consolidated ecological systems, and specific ecological systems (e.g. wetlands, agriculture, burned areas) that have been mapped statewide at a higher resolution.
2. Maintain a land cover mapping application with links to the ecological systems field guide, ecological systems rankings, and other information supporting interpretation of the land cover map.

3. Develop data acquisition tools within the Natural Heritage Map Viewer to allow for interactive data submission and/or interactive mapping of ecological system information.

WETLAND ECOLOGY GOALS

I. Managing wetland information

Design statewide and regional sampling schemes, hard copy and digital data forms, standardized data collection protocols, data analysis tools, and databases for assessing and monitoring the condition of herbaceous and woody wetlands and riparian areas.

II. Promoting understanding and exchange of wetland information

Produce classification crosswalks, field operations manuals, and training materials to support collection and exchange of wetland and riparian location data by multiple agencies.

III. Assessing wetland and riparian status

Gather data critical to describing the condition and conservation needs of Montana's wetland and riparian systems and communities (particularly wetland systems and communities of concern) by conducting field surveys.

1. Conducting rotating basin assessments of wetland condition, linking the assessment schedule to wetland map development.
2. Carrying out target surveys of wetland and riparian condition emphasizing the following focal habitats:
 - a. Riparian areas associated with large rivers;
 - b. Riparian areas and wetlands in headwater areas;
 - c. Springs and seeps in semi-arid environments;
 - d. Riparian corridors along rivers and streams associated with critical wildlife habitat and/or corridors, as identified by partners.

VEGETATION ECOLOGY GOALS

I. Managing terrestrial habitat information

Design statewide and regional sampling schemes, hard copy and digital data forms, standardized data collection protocols, remote sensing tools, data analysis methods, and databases for evaluating the extent and status of the following groups of terrestrial ecological systems listed in order of priority:

1. Sage steppe and shrubland
2. Alpine communities subject to climate change
3. Grasslands
4. Woody draws and ravines
5. Low elevation forests susceptible to insects and disease

II. Assessing terrestrial habitat status

Conduct field surveys and assessments of critical upland habitat types identified by partners to meet multiple objectives that include:

1. Refining ecological systems mapping and descriptions of ecological communities; particularly grassland, steppe, and alpine communities;
2. Identifying relationships between disturbances and condition to support further development of desktop-based landscape integrity models;
3. Collecting vegetation data to support current and future vegetation classification and mapping efforts by MTNHP's and partner agencies;
4. Identifying high-quality occurrences of systems and communities of conservation concern.

III. Coordinate collection and dissemination of terrestrial habitat information

Develop coordinated approaches to the collection, compilation and dissemination of information on terrestrial ecological systems and communities, including data collected by others.

1. For vegetation plot data, create web-based training materials and reference documents that will facilitate data compatibility. The National Vegetation Classification Standard (NVC) will be the focus. Materials and reference documents will include:
 - a. Summaries, handouts, and presentations on the NVC;
 - b. Crosswalks between the NVC hierarchy and
 - i. ecological systems used in 1:100,000 mapping;
 - ii. agency-specific classification schemes, as identified and prioritized by partners
 - c. Field data collection protocols, field forms and training materials that will encourage use of Plots 3.0, the NVC-based database used by Natureserve/USGS/NPS
2. Survey all partners, especially federal agencies required to crosswalk classification data to the NVC, to:
 - a. Identify current approaches to vegetation data collection;
 - b. Identify any impediments to adoption of the NVC;
 - c. Identify training needs to facilitate NVC-compatible data collection protocols;
 - d. Identify any organizational impediments to entering data into Plots 3.0;
 - e. Devise strategies to ensure that data not entered into Plots 3.0 can be made available to the MTNHP.
3. Develop standardized protocols and practices for collecting and maintaining ecological site data.
4. Gather literature specific to Montana's vegetation communities; crosswalk to ecological systems and develop into bibliographic database with online access.

IV. Evaluating terrestrial habitat extent and quality

Collaborate with the Zoology and Botany programs and MTNHP partners to develop and implement analytic tools for evaluating habitat extent and quality.

AQUATIC ECOLOGY GOALS

I. Developing statewide aquatic community mapping and descriptive materials

Provide a framework for describing the distribution and status of aquatic ecological systems and communities by developing statewide mapping and descriptive materials.

1. Develop and implement a plan and protocols for systematic correction and improvement of statewide aquatic ecological system classification and mapping at a 1:100,000 scale.
2. Correct and refine existing descriptive materials for aquatic ecological systems and develop descriptive materials for key ecological alliances and associations.
3. Collection of macroinvertebrate and fish data to support classification and mapping efforts.

II. Status assessments for aquatic communities

Design statewide and regional sampling schemes, hard copy and digital data forms, data analysis tools and databases for assessing and monitoring the condition of the following aquatic communities, in order of their priority:

1. Dragonflies, damselflies and wetland invertebrates
2. Large river macroinvertebrate communities, including freshwater mussels
3. Perennial spring and headwater source stream communities
4. Coldwater fish assemblages
5. Warmwater fish assemblages

III. Collect and compile information on aquatic ecological systems and communities collected by others.

1. For fish community data, create database linkages to the Montana Fisheries Information System that will incorporate aquatic ecological system indicator species to differentiate aquatic ecological systems and pull them across to the aquatic ecological system database.
2. For macroinvertebrate community data collected in the state, create database linkages to EDAS (DEQ's database) and BLM's BugLab database that will incorporate aquatic ecological system indicator species to differentiate aquatic ecological systems and pull them across to the aquatic ecological system database.
3. Construct and disseminate field data collection protocols and data forms based on the Aquatic Ecological Systems field guide. Train partners collecting aquatic field data on the use of the aquatic ecological system field guide.

4. Conduct surveys of critical aquatic habitats and communities, emphasizing the following high priority habitats and communities:
 - a. Lentic wetlands and associated macroinvertebrate communities;
 - b. Large prairie and valley river ecological systems and communities, including freshwater mussels
 - c. Perennial spring and headwater source stream communities

IV. Disseminate aquatic ecology information

Work with Information Services to design and maintain web resources that support dissemination of maps, GIS data, descriptive materials and survey results.

1. Using the 1:100,000 National Hydrography Dataset as a base map, develop an interactive aquatic ecological systems map that provides rapid visual characterization of systems and expected biological communities.
2. Link this map with the ecological systems map, and/or with any wetland map application that allows for exploration and display of survey data.

RESTORATION ECOLOGY GOALS

I. Develop program activities focused on restoration ecology

Establish a plan for development of this component of the Ecology Program, including objectives, partnerships, funding sources, and outreach activities.

II. Compile and disseminate existing restoration ecology information

Compile and disseminate information on management and restoration of terrestrial and wetland ecological systems by creating and maintaining a web page with links to information and resources on best management practices and restoration strategies, and incorporating management and restoration information into ecological systems descriptions.

III. Develop and disseminate new restoration ecology information

Work with partners to develop restoration guidelines and strategies for Montana's wetland, riparian, and terrestrial ecological systems.

INFORMATION SERVICES STRATEGIC PLAN

MISSION

The Systems and Services section of the MTNHP provides information technology and services support to the science programs within the MTNHP and is responsible for the delivery of information and services to our users. We provide these services through our internet site and its various applications as well as through personal services.

STAFFING

I. General Staffing

1. Work to maintain competitive salaries for critical information technology positions – especially web programming and database administration.
2. Ensure that there are adequate resources to provide professional development and on going training opportunities for critical web programming and database administration positions.
3. Work to add one FTE to provide information technology support to science program activities and patron requests.
 - a. Look for opportunities to increase core funding to contribute to the web and database positions.
 - b. Develop additional annual service agreement funding.
 - c. Develop internship and work study opportunities as ways to “home grow” staff.
4. Work with NRIS to help them acquire advanced web programming resources and/or database administration staff that would indirectly support MTNHP activities.

II. Information Technology Support for MTNHP

1. Add one FTE to provide information technology support to MTNHP staff and partners.
2. Work with NRIS to help them acquire a database administrator for NRIS/MTNHP databases.
3. Work with NRIS to properly identify, acquire, and maintain the necessary information technology infrastructure to support MTNHP information management and service delivery.

STRATEGIC GOALS

I. Develop web resources and trainings to promote dissemination of information

Actively disseminate information using highly effective tools and formats, and provide staff expertise and support to ensure that users can find, interpret, and successfully utilize information for effective resource management and decision-making.

1. Design, develop, and deploy the next generation of web mapping application; the Montana Natural Heritage Map Viewer. This new application will include features such as:

- a. Fully customizable as to what data layers (base layers and MTNHP data) are displayed
 - b. Ability to configure analytical and overlay tools
 - c. Ability to customize report functions
 - d. Cached map data
 - e. Modular code construction
 - f. Indexed data tables and pre-generated data summaries to improve performance
2. Design, develop, and deploy a “Mid-level” functional access to MTNHP Species of Concern, habitat, and species list information to support planning and resource management activities of local government, private consultants, and conservation organizations.
 - a. Targeted users would include counties, private sector, conservation groups, and interested public
 - b. Improve and develop functions within existing applications such as Field Guide and SOC Report to enable users to obtain sufficient information at a local level while still protecting the sensitive location information
 - c. Make predicted and documented species lists and other data available as a Google Earth service that may be displayed in Google Earth and queried at the level of Public Land Survey Section Townships.
 - d. Provide general training and consultation to support the use of the information
3. Ecology core services web applications
 - a. Documented and predicted aquatic communities
 - b. Land cover mapping
 - c. Ecological systems field guide
 - d. Wetland mapping information
4. Create map services for MTNHP data that partners can consume in their GIS or web applications
 - a. Work with NRIS to create services
 - b. Stewardship map service
 - c. Land cover map service
 - d. Species occurrences
 - e. Wetland and riparian mapping
 - f. Animal and plant point observation data
5. Continue to maintain and improve the public website with content and applications that are easy to use, well designed and documented, and provide users with effective access to information that serves their needs.
 - a. Continue to add key data types of value to users.
 - b. Add landscape/site information to web applications in spatially searchable formats.
 - c. Build access to interpreted observation and element occurrence data (i.e., species associations for ecological systems, predicted suitable habitat model products, etc.).
 - d. Add state rank documentation to the Montana Field Guide.

- e. Develop tools for overlaying and intersecting MTNHP and related data layers to better enable users to characterize and visually analyze geographic areas of interest.
 - f. Integrate species search with NRIS Digital Atlas and the GIS Portal to produce a more unified and integrated approach for accessing spatial/attribute data on biological features and related features.
 - g. Improve users' ability to select and export data and information of interest from the MTNHP website.
 - h. Expand access to images of species and habitats.
 - i. Build linkages to the MTNHP photo archive database.
 - j. Integrate photos and MTNHP reports with MSL catalogue resources.
 - k. Provide land management summary information.
6. Improve an ongoing support program to train and inform agency partners in effectively using technical resources, services, and applications.
- a. Give presentations and workshops at key user meetings to describe resources available and demonstrate data access methods.
 - b. Provide regular webinars on the availability and use of MTNHP data resources.
 - c. Conduct on-site training with partner agencies in use of specialized applications for accessing data on lands and resources that they manage.
 - d. Provide regular updates on the website and through emails as new resources become available (including reports, web tools, field guide enhancements, etc.).
 - e. Regularly gather information from users about their information needs, format/access preferences, and the effectiveness of our delivery systems and tools. Involve users in applications development and testing to ensure that the tools produced meet user needs as effectively as possible.
 - f. Work with agency partners to provide technical assistance in applying biological information in their programs and management activities, emphasizing priority species and habitats.
7. Improve efficiency and effectiveness in responding to information requests.
- a. Minimize staff time for routine responses and maximize the value added per unit of staff time invested in mediated request services.
 - b. Work to provide resources and training to empower users to self-serve basic data requests via web applications and services.

II. Fully develop the internal and external data server system

Improve overall data management capability, efficiency, and security by completing the transition to the new dual data server system with an internal editing environment, an external web-facing environment, and routines for regularly transferring information between these data servers.

1. Create a reference database in SQL to replace the reference database in BIOTICS
 - a. Populate references with an identification number that links each citation to the WorldCat record for the citation.
 - b. Use Reference Manager to harvest literature from Really Simple Syndication (RSS) feeds and transfer these to the SQL database.
 - c. Link the new SQL database to existing web applications that use references.

2. Create a species (element) database interface to replace Biotics Tracker.
 - a. Create and populate the final species database tables in the element SQL database.
 - b. Create web data entry and editing clients to manage information in the element SQL database.
3. Create species geodatabases in SQL to replace the species occurrence database in BIOTICS.
 - a. Implement the current botany geodatabase in SQL.
 - b. Create a new zoology species occurrence geodatabase in SQL.
 - c. Develop methods to roll up zoology observations (POD and BirdPOD points) and automatically create species occurrences based on standard rules developed by zoology staff in the new species occurrence geodatabase.
4. Develop methods to continue MTNHP data exchange with NatureServe outside of the Biotics environment to assure that we are meeting our statutory requirements and improve the currency and accuracy of the information that NatureServe provides in its multi-jurisdictional data services.
 - a. Develop web services for NatureServe to use to acquire species and element occurrence data from Montana.
 - b. Work with NatureServe to assist it in developing web services for global species information for refreshing MTNHP databases.
5. Create a new Stewardship database in SQL Server to replace the Biotics and other Stewardship databases.
 - a. Work with partners to decide what information is important to maintain.
 - b. Develop a SQL Server database to manage the information.
 - c. Develop maintenance and funding strategies for keeping stewardship data up-to-date.
6. Move existing SQL Server databases to new internal server and design roll-up strategies for the web-facing server
 - a. Document what data is currently being used for web applications.
 - b. Clean up redundant and outdated data
 - c. Move all data editing operations to internal server
 - d. Design databases for web-facing server that efficiently roll-up data from internal server
7. Develop a strategy for migrating the Ecology information currently in Biotics to the new SQL database
 - a. Community elements
 - b. Community element occurrences such as wetland and riparian mapping information
 - c. Ecological sites of importance

III. Improve ability to accept data from MTNHP staff and partners

Improve field data collection efficiency and accuracy for MTNHP staff and partners through new and existing hand-held data collection and communication technologies.

1. Improve data collection methods by using handheld data loggers and GPS units that facilitate the initial collection and subsequent transfer of field data into MTNHP databases.
2. Develop web tools to allow easier entry and editing of observations into the point observation databases via a variety of formats, including:
 - a. Entry of tabular data
 - b. Digitized entry of spatial information
 - c. Uploads of data from GPS units
3. Improve speed and accuracy of using spatial data and MTNHP species and habitat data in the field by using high speed data communication methods for two-way transmission of information.

IV. Integrate MTNHP information with the MSL catalogue

Work with the MSL Digital Library staff to effectively cross reference and integrate MTNHP information and data with the MSL catalogue, search methods, and reference services.

1. Ensure that all MTNHP reports and data are properly catalogued in the MSL catalogue system.
 - a. Fully implement the reference management SQL database as the source for the Montana Field Guide and other MTNHP web applications.
 - b. Work with the MSDL Staff to ensure that relevant MSL and MTNHP documents and resources are properly geo-referenced to better enable geographic searches.
 - c. Develop methods for the integration and linkage of full-text MTNHP documents into the Montana Field Guide, MTNHP Tracker, and the SOC Report.
 - d. Develop search tools in MTNHP applications that search the full MSL catalogue and the Montana Shared Catalogue by subject, keywords, and geographic location.