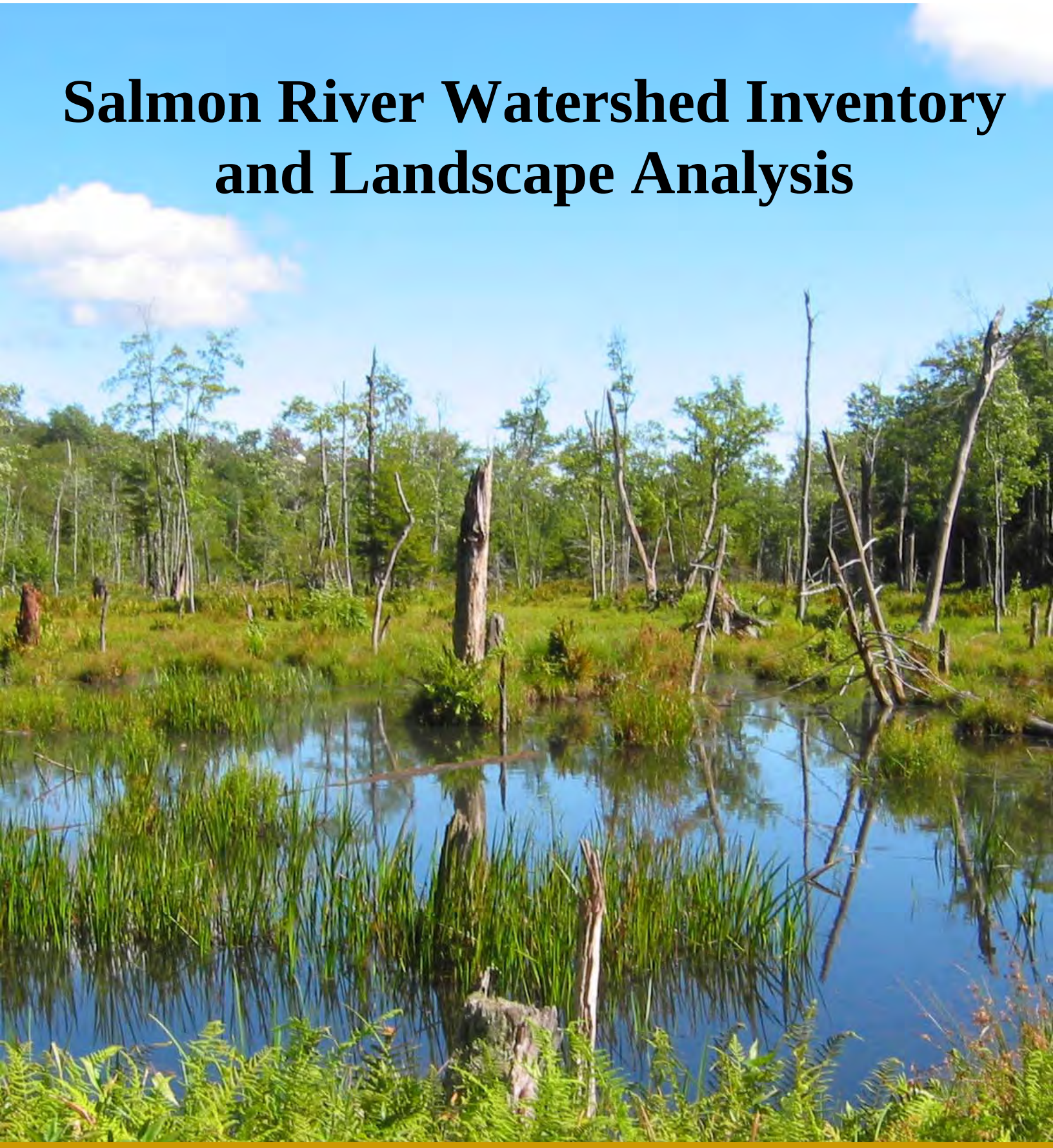
Salmon River Watershed Inventory and Landscape Analysis



New York Natural Heritage Program

A Partnership between The Nature Conservancy and the NYS Department of Environmental Conservation

625 Broadway, 5th Floor Albany, NY 12233-4757 (518) 402-8935 Fax (518) 402-8925 www.nynhp.org

Salmon River Watershed Inventory and Landscape Analysis

Timothy G. Howard
New York Natural Heritage Program
625 Broadway, 5th Floor
Albany, NY 12233-4757

Prepared for the
NYS Tug Hill Commission
Dulles State Office Building
317 Washington Street
Watertown, New York 13601-3782

June 2006

This project was supported by
NYS Department of Environmental Conservation with funding from the **Wildlife Conservation and Restoration Program (United States Fish and Wildlife Service).**

Cover Photo by Tim Howard (shallow emergent marsh and beaver meadow at Hall Island State Forest). All photos in document by Tim Howard unless otherwise noted.

This document was printed on recycled paper with 30% post-consumer content

(this page intentionally left blank)

Report Summary

The purpose of this project is to evaluate the biological integrity and relative biological quality of subwatersheds within the entire Salmon River watershed. There are three components to this project. Using known locations for rare species statewide, we build computer models for rare species and natural communities that are likely to occur within the watershed. Second, we conduct field inventories for rare species and significant natural communities based on the predictions of the models and other factors. Third, we conduct an assessment of the subwatersheds within the entire basin using our computer models, our field inventory data, and other GIS data available to us. The goal of the GIS analysis is to identify and rank the highest quality sub-watersheds within the entire basin using a transparent system that can then be applied to other basins in the state.

Inventory efforts during 2005 resulted in many new and updated locations for rare species and significant ecological communities. In all, we know of 61 different occurrences of rare species and significant natural communities within the entire basin. Eleven of these are locations for rare animals, twelve for rare plants, and 39 for significant natural communities. Clusters of rare species and significant natural communities occur near the mouth of the Salmon River, at Sloperville Fen, and within the Salmon River Gorge.

We gain a broader perspective of the basin as a whole and of the relative differences among locations throughout the basin by comparing different metrics of viability and biodiversity among subwatersheds. This analysis singles out the Mad River subwatershed as the subwatershed with the most intact landscape and the least anthropogenic disturbances, barriers, and alterations (Appendix 4). Cold Brook, a narrow subwatershed adjacent to Mad River on the south side comes in a close second.

Combining these two perspectives, the patterns of biodiversity and patterns of “landscape intactness” offers a useful dichotomy and permits two focal perspectives for conservation. First, the entire Salmon River Watershed crosses through very different ecosystems as it extends from the Lake Ontario shoreline to the top of the Tug Hill plateau. Any basin-wide conservation plan should have representation from all these broad ecosystems. The variation in species and natural communities is one surrogate representation of this and the divide between the Lake Ontario shoreline and the Tug Hill is clearly shown with the rare species hotspots at the mouth of the Salmon River and the very few rare species but great many significant natural communities up on the Tug Hill.

The results from this inventory and assessment project can be applied to basin-wide conservation strategies by considering both the patterns in rare species distribution throughout the basin and the patterns in subwatershed integrity in the basin.

(this page intentionally left blank)

Table of Contents

List of Tables

List of Figures

List of Appendices

INTRODUCTION

Purpose and Goals

The purpose of this project is to evaluate the biological integrity and relative biological quality of subwatersheds within the entire Salmon River Watershed. This watershed falls within Oswego, Lewis, Oneida, and Jefferson Counties in northwest New York State (Figure 1). This project is part of a larger collaborative natural resource assessment project undertaken by the Tug Hill Commission, Tug Hill Tomorrow Land Trust, New York State Department of Environmental Conservation (NYSDEC), and others. The New York Natural Heritage Program completed this project under contract to The Tug Hill Commission with funding from the NYSDEC.

There are three components to this project. Using known locations for rare species statewide, we first build computer models for rare species and natural communities that are likely to occur within the watershed. Second, we conduct field inventories for rare species and significant natural communities based on the predictions of the models and other factors. Third, we conduct an assessment of the subwatersheds within the entire watershed using our computer models, our field inventory data, and other spatial data available to us. The goal of the geographic information systems (GIS) analysis is to identify and rank the highest quality subwatersheds within the entire basin using a transparent system that can then be applied to other basins in the state. We hypothesize that the most viable plant and animal populations and the highest quality ecological communities are located within the subwatersheds of highest quality. Our subwatershed ranking system is proposed as a blueprint for protection strategies and possibly management and restoration efforts within the basin.

Grass-pink (*Calopogon tubersosus*) at Sloperville Fen.

We use new computer modeling techniques in GIS to help refine and prioritize inventory locations for rare species and significant natural communities. The resulting habitat models (or element distribution models – EDM) predict locations of appropriate habitat for target rare species or natural communities. Our goal was to model all the species and natural communities with known, extant locations within and near the Salmon River Watershed.

Our second goal to conduct targeted field inventories was based on the premise that we should strive to understand as much as possible about the entire watershed as we go into the watershed assessment phase. Thus, we used the element distribution models and other information to prioritize site visits. With the help of the Tug Hill Tomorrow Land Trust we requested permission to conduct inventories on prioritized private lands. While conducting inventories we focused on documenting new and existing locations for natural communities of state-wide significance and state-rare plants and animals.

Calcareous cliff community along the Salmon River

Finally, we embarked on a watershed-wide assessment that combines the results of the previous two goals plus additional information to develop a broad-scale picture of the natural biological status of the watershed. To implement this goal, we divided the Salmon River Watershed into smaller units (subwatersheds) with which we could make comparisons. We used GIS to assess, in broad terms, the relative biological integrity of each unit.

The scope of this project, as defined by our contract with the Tug Hill Commission is as follows:

A. Employ and refine an initial GIS approach to quantitatively assess the integrity and the potential for community and species biodiversity in the sub-watersheds of the Salmon River Watershed by (1) examining roadless block size and intruding road density among and within these blocks to delineate and rank subwatersheds, and (2) using the state multi-resolution land classification (MRLC) coverage (or other higher resolution coverages) to examine large unfragmented and contiguous natural areas and the interplay of these areas with the roadless areas;
B. Use the GIS analysis to conduct a preliminary assessment of sites with higher biodiversity, as predicted by the element distribution models;
C. Conduct targeted field inventories at the sites predicted as having the highest priority for ecological integrity and biodiversity, using the data collected to modify the GIS model for higher accuracy;
D. Base field surveys for rare animals and plants on a review of records in NY Natural Heritage files, records obtained through the New York State Department of Environmental Conservation's Endangered Species and Nongame Units, Breeding Bird Atlas records, and consultation with other scientists and field biologists familiar with rare species locations and habitats within the local area;
E. Conduct surveys of stream reaches for rare aquatic species on a case-by-case basis depending on the likelihood of finding the target rare species, mapping the extent of the population and collecting data on population size, reproductive biology, and habitat characteristics as time permits;
F. Record observations about disturbances, threats, and general site quality where inventories are taken;
G. Convey data to the Commission, the New York State Department of Environmental Conservation's Salmon River Program Coordinator and Watershed Conservation Coordinator, and The Nature Conservancy for use in developing the system's viability analysis.

OVERVIEW

Definitions of Terms Used

In order to discuss the various components of this study, we have applied a consistent terminology appropriate for various landscape scales and biodiversity features.

Element: each plant species, animal species, and unique ecological community type is an element of biodiversity, or element.

Element Occurrence: The documented locations of rare plants, animals, and significant natural communities.

Element Distribution Model (EDM): A map showing predicted locations for a rare species or natural community. An EDM is a computer-generated model that uses statistics to examine known species or community locations and then find other, similar locations across the landscape. The final model reports a probability that a location is of a similar habitat to that occupied by the targeted rare species or natural community.

Natural Community: an assemblage or group of plants and animals that share a common environment (Edinger *et al.* 2002). These assemblages usually occur repeatedly across the landscape. The New York Natural Heritage Program follows the community classification as defined by *Ecological Communities of New York State* (Edinger *et al.* 2002). Edinger (2002) is an update of Reschke (1990).

Significant Community Occurrence: Community occurrences worthy of tracking in NY Natural Heritage databases because of their state and/or global importance to biodiversity conservation. For river types documented during this project, significant occurrences have ranks of A through B (e.g., A, AB, or B). Each occurrence rank is derived from three ranking factors: size, condition, and landscape context.

Stream Community: a riverine community described in Ecological Communities of New York State (Reschke 1990, Edinger *et al.* 2002) by NY Natural Heritage (e.g., marsh headwater stream, rocky headwater stream, confined river, and main channel stream). NY Natural Heritage stream communities are similar in concept to "stream macrohabitats" in other riverine classifications.

Study Area: the primary "study area" or "project area" for this inventory represents the entire Salmon River Watershed. The watershed boundary is a slightly modified version of the three 11-digit Hydrologic Unit Classification (HUC) polygons for the watershed as developed by the National Resources Conservation Service. The study area will also be referred to as the "basin" to avoid confusion with subwatersheds.

Sub-watershed: we divided the study area into fifteen (15) relatively equal-sized parcels based on the main streams and tributaries in the basin. These subwatersheds are the main units of comparison within the basin. We discuss the creation of these subwatersheds further in the methods section.

The Salmon River Watershed

The Salmon River Watershed is located in New York State, north of the cities of Utica, Rome, and Syracuse. Pulaski, the largest town within the watershed, occurs along the Salmon River about 4.5 miles from the shores of Lake Ontario. The only major highway is Interstate 81, which runs north from Syracuse and through Pulaski on its way to Watertown and then Route 401 in Canada.

The Salmon River drains an area totaling about 176,270 acres (Figure 1). Most of the headwaters for this watershed begin in the Tug Hill at elevations ranging from 1,200 to 1,900 feet. The streams flow in a westerly direction, with much of the water passing through the upper Salmon River Reservoir (about 940 feet elevation), Salmon River Falls (860 feet), the lower Salmon River Reservoir (650 feet), and finally drain into Lake Ontario at about 250 feet elevation above sea level.

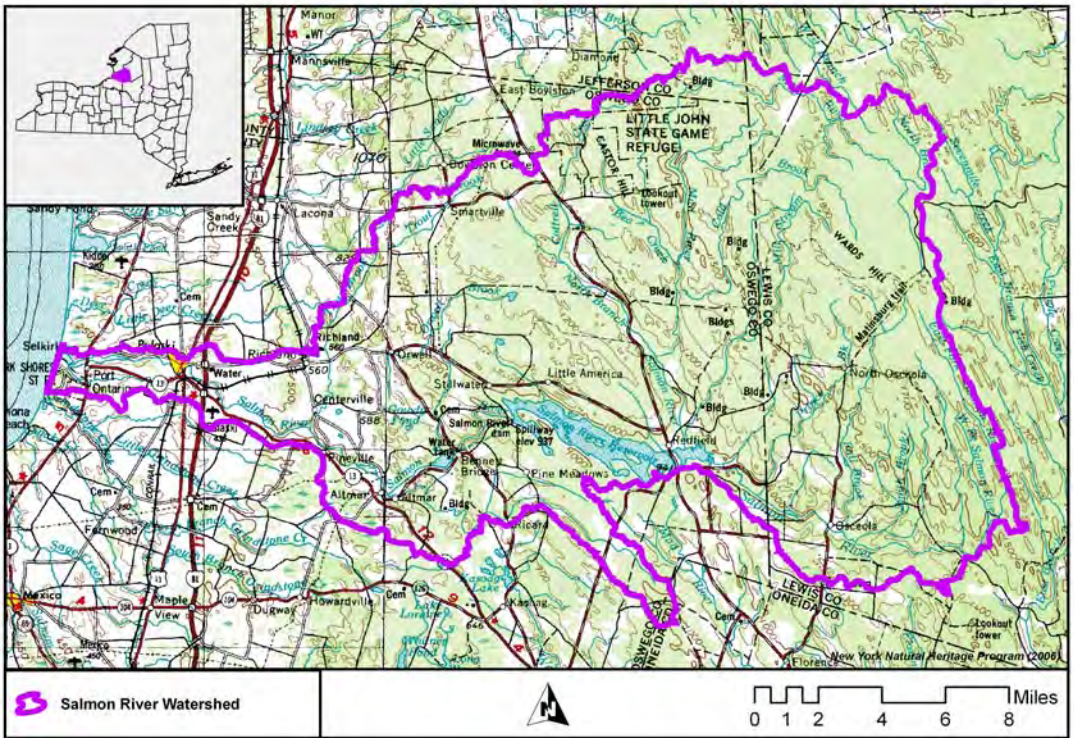


Figure 1. The Salmon River Watershed, the study area.

The upper parts of the watershed fall into the Northern Appalachian Ecoregion, while the western portion falls into two subsections of the Great Lakes Ecoregion (Figure 2, right), as designated by The Nature Conservancy (TNC). Although only a small portion of the entire watershed extends into the Great Lakes Ecoregion, this portion adds considerably to the overall biological diversity of the watershed, particularly because the wetlands along the Lake Ontario shore differ considerably from the wetlands on the Tug Hill. Similarly, the State Department of Environmental Conservation (NYSDEC) delineates the Central Tug Hill and Tug Hill Transition Ecozones near the Northern Appalachian Ecoregion boundaries. The Eastern Ontario Plain and Oswego Lowlands Ecozones make up the western lowlands of the watershed (Figure 2, left). Lands within the Salmon River Watershed make up 45% of the Central Tug Hill Ecoregional subsection, 13% of the perimeter Transition Ecoregional subsection, and a very small percentage of the Great Lakes Ecoregion.

Inventorying a floodplain forest along the Salmon River. Photo: Tracey Tomajer.

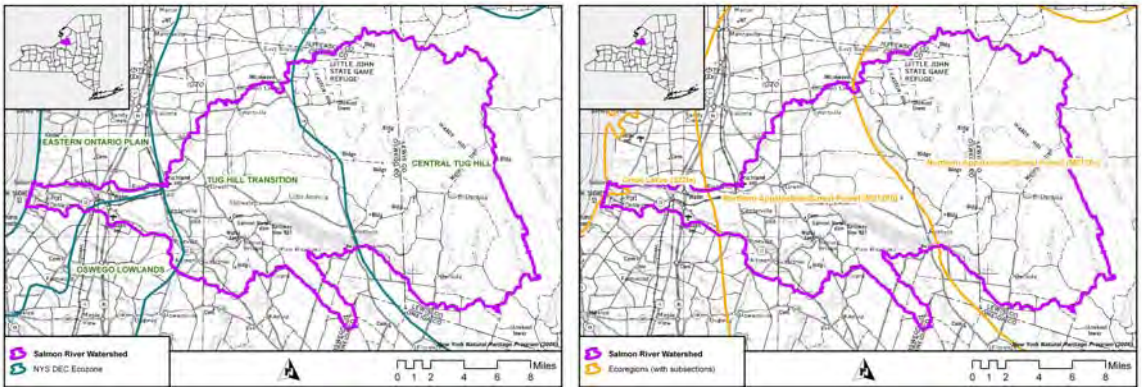


Figure 2. NYSDEC Ecozones (left) and Ecoregions and Ecoregional subsections (right) for the Salmon River Watershed.

Central to the lower, western portion of the watershed is the Salmon River itself. This river is a world class fishery and extremely popular for steelhead, chinook salmon, and coho salmon fishing. The NYSDEC maintains a fish hatchery in Altmar about 6.5 miles east of Pulaski where many of the fish return to spawn. The hatchery attracts more than 500,000 visitors annually; annual fish production at the hatchery totals 120,000 pounds. In addition to steelhead, chinook salmon, and coho salmon, the hatchery also produces brown trout and landlocked salmon. Additional information on the hatchery can be found online at <http://www.dec.state.ny.us/website/dfwmr/fish/foe4chat.html>.

Over 200 inches of annual snowfall in the Tug Hill makes the eastern portion of the watershed a very popular recreational snowmobile destination. This area has over 2,000 miles of snowmobile trails and has become a snowmobiling destination for many. Additional information on snowmobiling New York's Tug Hill region can be found online at <http://www.snowmobileny.com/tughill.htm>. The upper and lower Salmon River reservoirs offer other recreational opportunities and public boat launches are present on both reservoirs. The upper reservoir provides the power for a hydro-electric generation station at Bennett's Bridge.

Much of the study area is heavily forested, particularly on the Tug Hill. The majority of these forested lands are classified with the NY Natural Heritage community name of beech-maple mesic forest (McNamara 1999, Hunt & Lyons-Swift 1999), a forest of moist, well-drained soils with northern hardwood tree species as the most abundant in the canopy (Edinger *et al.* 2002). This forest type is broadly classified and generally matches the 'northern hardwood' forest type of other classifications. Much of these forests in the watershed are "working forests" with active forest management and harvest schedules. Indeed, harvesting may have played a role in reducing the presence of spruce in the upland forests and causing a shift away from the NY Heritage spruce-northern hardwood community type in much of the higher elevation portions of the Tug Hill. Streams and wetlands are also common throughout the Tug Hill, including wooded swamps, marshes, wet meadows, beaver flows, marsh headwater streams, and rocky headwater streams (McNamara 1999, Hunt & Lyons-Swift 1999). The Tug Hill is an area of low road density and contains large areas that are not bisected by major roads. Farming becomes much more prevalent away from the core Tug

Hill region, and agricultural fields include row crops, hay fields, pasture land, and fallow fields.

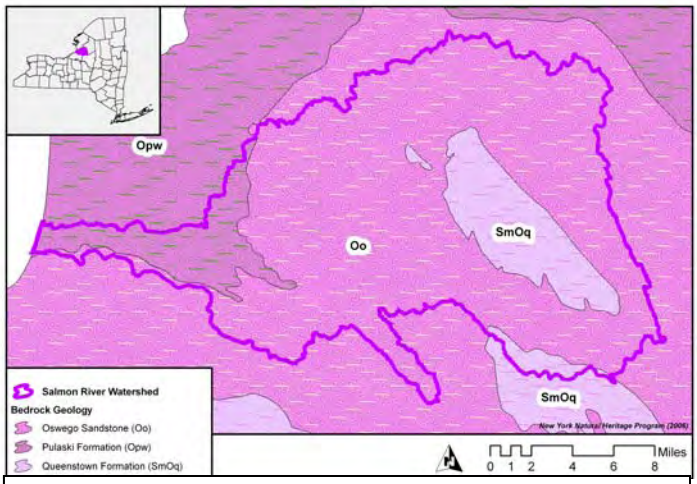


Figure 3. Bedrock Geology of the Salmon River Watershed.

Bedrock geology (Figure 3) varies in formation type but is generally shale and sandstone throughout the watershed. The majority of the Central Tug Hill and Tug Hill Transition ecozones (Figure 2, left) consist of Ordovician-aged Oswego Sandstone (sandstone and shale). The Tug Hill core is also underlain in part by sandstone of the Queenstown formation. The Pulaski formation (Ordovician sandstone and shale) makes up the majority of the lower, western portion of the watershed. Surficial geology of the region consists primarily of various types of glacial till. Outwash sand and gravel, recent alluvium, and exposed bedrock occur at the surface along some of the major stream corridors. Lake deposits, including remnant sand beaches, lacustrine silt and clay, and lacustrine sands are common in the western portion of the watershed. A comprehensive study of the Tug Hill region including detailed information on the air, water, geology, soil, and vegetation was completed by the State University of New York College of Environmental Science and Forestry (State University of New York College of Environmental Science and Forestry 1974). Additional resources include the book entitled *Tug Hill, A Four Season Guide to the Natural Side* (McNamara 1999), publications from the Tug Hill Tomorrow Land Trust (e.g., Tug Hill Tomorrow 1996), and NYS Department of Environmental Conservation Resources Unit Management Plans (e.g., Sawchuck 2006).

Protected areas (Figure 4) in the watershed include one state park (Selkirk Shores State Park), numerous state reforestation areas, several state forest preserve areas, two wildlife management areas (Littlejohn Wildlife Management Area, Tug Hill Wildlife Management Area), a portion of a county forest land, and a few private nature preserves (including the recent purchase of Hancock Timber Resource Group lands by The Nature Conservancy. This land was inventoried in the late 1990's by NY Heritage [Hunt & Lyons-Swift 1999]). Additionally, Niagara Mohawk is in the process of transferring about 2500 acres along the Salmon River to NYSDEC (see <http://www.state.ny.us/governor/press/05/jan11_05.htm>). Private timberlands are numerous and include some very large tracts.

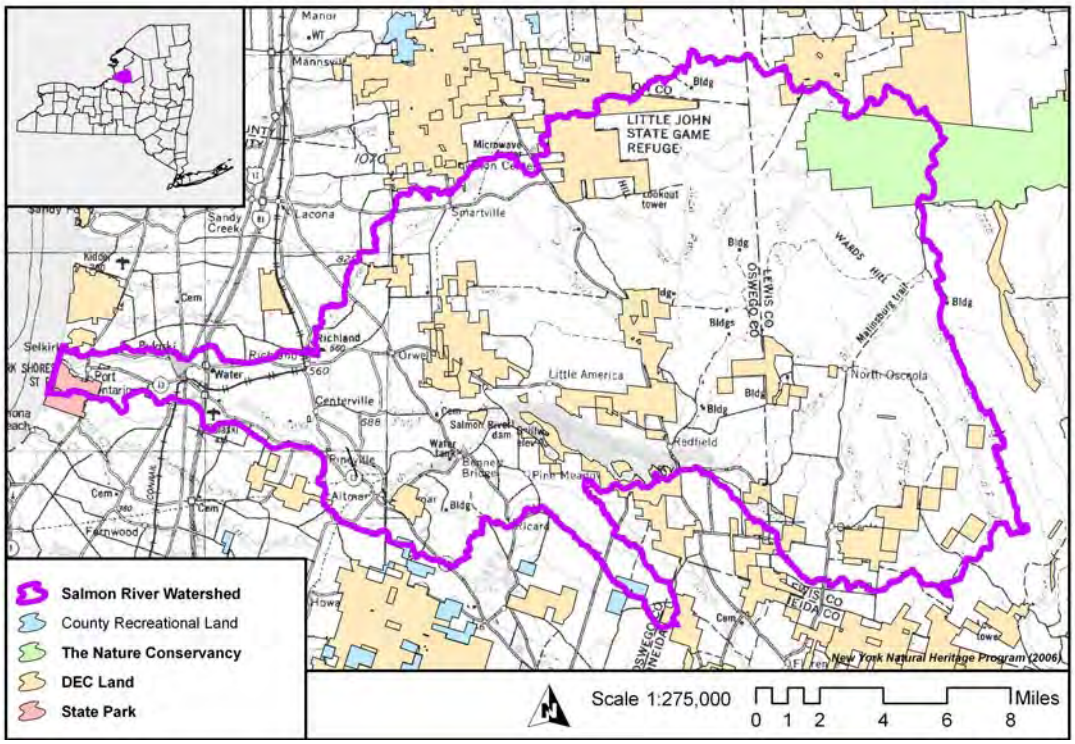


Figure 4. Public and protected areas within the Salmon River Watershed.

METHODS

Heritage Methodology

A nationwide cooperative effort between The Nature Conservancy (TNC) and state governments, the Natural Heritage Network specializes in compiling biodiversity information by conducting inventories of rare plants, rare animals, and ecologically significant examples of natural communities. Aimed at identifying the most sensitive biodiversity resources in a defined geographic area, TNC has spent more than two decades helping to develop and refine the inventory methodology used by Natural Heritage Programs throughout all 50 states, most Canadian Provinces, and some Central and South American countries.

The coarse filter/fine filter

Heritage inventory methodology works by focusing on the identification, documentation, and mapping of all occurrences of rare species and significant ecological communities. We use a "coarse filter/fine filter" approach to identify and prioritize the protection of these significant biological resources. Ecological communities represent a "coarse filter" aggregate of biodiversity at a scale larger than the species level as defined in Reschke (1990) and Edinger *et al*. (2002). Their identification and documentation can be used to describe whole assemblages of plant and animal species, both common and rare. The conservation of the best remaining examples of natural communities assures the protection of most of the common species that make up the biological diversity of the state. Rare animals and plants often have narrow or unusual habitat requirements. These species may fall through the coarse filter, and are sometimes not protected within representative communities. Identifying and documenting viable populations of each of the rare species serves as the fine filter for protecting the state's

biological diversity. This coarse filter/fine filter approach to a natural resources inventory has proven to be an efficient means of identifying the most sensitive animals, plants, and ecological communities of an area.

Element rarity and vulnerability

The NY Natural Heritage statewide inventory efforts revolve around lists of rare species and all types of natural communities known to occur, or to have historically occurred, in the state. These lists are based on a variety of sources including museum collections, scientific literature, information from state and local government agencies, regional and local experts, and data from neighboring states. As with all state Heritage Programs, the NY Natural Heritage ranking system assesses rarity at two geographic scales. Each community and rare species is assigned a global rank and a state rank. The global rank reflects the rarity of the species or community throughout its range, whereas the state rank indicates its rarity within New York State. Both of these ranks are usually based on the range of the species or community, the number of occurrences, the viability of the occurrences, and the vulnerability of the species or community around the globe or across the state. As new data become available, the ranks may be revised to reflect the most current information. Infraspecific taxa (e.g. subspecies and varieties) are also assigned a taxon rank that indicates the infraspecific taxon's rank throughout its range. Individuals who are knowledgeable about the range-wide status of each particular species or natural community typically assign global ranks. These knowledgeable individuals may come from either within or outside the Heritage Network. State ranks are assigned by biologists of NY Natural Heritage, with the assistance of other knowledgeable individuals from within or outside the state government. NY Natural Heritage ranking criteria are enumerated in Table 1 and used throughout this report.

Beaver meadow in a narrow stream valley along Cottrell Creek.

Table 1. Explanation of ranks and codes used in Natural Heritage database reports. Each element has a global and state rank as determined by the NY Natural Heritage Program. These ranks carry no legal weight but are believed to accurately reflect the relative rarity of the species. The global rank reflects the rarity of the element throughout the world and the state rank reflects the rarity within New York State. Infraspecific taxa are also assigned a taxon rank to reflect the infraspecific taxon's rank throughout the world. The Taxon or T-ranks (T1 - T5) are defined like the Global ranks (G1 - G5), but the T-rank *only* refers to the rarity of the subspecific taxon of the species.

GLOBAL RANK

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences), or very few remaining acres, or miles of stream) or especially vulnerable to extinction because of some factor of its biology.

G2 = Imperiled globally because of rarity (6 - 20 occurrences, or few remaining acres, or miles of stream) or very vulnerable to extinction throughout its range because of other factors.

G3 = Either rare or local throughout its range (21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range (e.g., a physiographic region), or vulnerable to extinction throughout its range because of other factors.

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Historically known, with the expectation that it might be rediscovered.

GX = Species believed to be extinct.

GU = Status unknown.

STATE RANK

S1 = Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology making it especially vulnerable in New York State.

S2 = Typically 6 to 20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York State.

S3 = Typically 21 to 100 occurrences, limited acreage, or miles of stream in New York State.

S4 = Apparently secure in New York State.

S5 = Demonstrably secure in New York State.

SH = Historically known from New York State, but not seen in the past 15 years.

SX = Apparently extirpated from New York State.

SE = Exotic, not native to New York State.

SR = State report only, no verified specimens known from New York State.

SU = Status unknown.

TAXON RANK

T1 - T5 = indicates a rank assigned to a subspecies following the Global Rank definitions above.

Q = indicates a question exists whether or not the taxon is a good taxonomic entity.

? = indicates a question exists about the rank.

Element occurrence viability

Individual occurrences of rare plants, rare animals, and natural communities are ranked according to their quality, or perceived viability, based on factors such as size, condition, and landscape context in which they are found. All occurrences of the elements documented in this report have been assigned a quality rank of A to F, H, or X (Table 2). Combinations of letters, or intermediate ranks, such as AB, BC, and CD are also possible.

Table 2. Explanation of element occurrence quality ranks used in Natural Heritage database reports.

Element Occurrence Rank	Definition
A	**Excellent**
B	**Good**
C	**Marginal**
D	**Poor**
E	**Extant**. Existing, but not enough information to rank A-D
F	Failed to Find. Not found at the previously documented site, but potential habitat was observed and /or a more thorough searching needed.
H	**Historical**. No recent field information. For animals this means the particular population has not been seen or, in the case of a nest, has not been active within last 15 years. For plants a "historical" rank means that the population has not been observed in greater than 20 years.
X	**Extirpated**. Believed to no longer exist. In many cases, habitat has been significantly altered and is believed no longer suitable for maintenance of the element.

Significant natural community occurrences may be assigned any of the ranks listed above, which are based on quality and are evaluated within the context of the known or hypothesized distribution of that particular community. Several ecological and spatial factors must be considered when determining the element occurrence rank of a community. These include the occurrence size, maturity, evidence and degree of unnatural disturbance, continued existence of important ecological processes, overall landscape context, and existing and potential threats. A-ranked community occurrences are among the largest and highest quality of their type. These community occurrences should be large enough to provide reasonable assurance for long-term viability of component ecological processes. They are essentially undisturbed by humans or have nearly recovered from past human disturbance, typically exhibiting little or no unnatural fragmentation. Exotic or particularly invasive native species are usually absent in high quality community occurrences, or, if present, are observed at very low levels.

Narrow-leaved gentian (*Gentiana linearis*) along a logging road near Hooker Brook.

Heritage data collection priorities

Significant examples of natural communities are determined using occurrence quality ranks in conjunction with global and state rarity ranks (Table 3). In this way, communities are documented and mapped in NY Natural Heritage databases if they are either rare in New York State or are an outstanding example of a more common natural community. Cultural communities (as defined in Edinger *et al.* 2002) are not considered significant and are therefore not tracked by NY Natural Heritage.

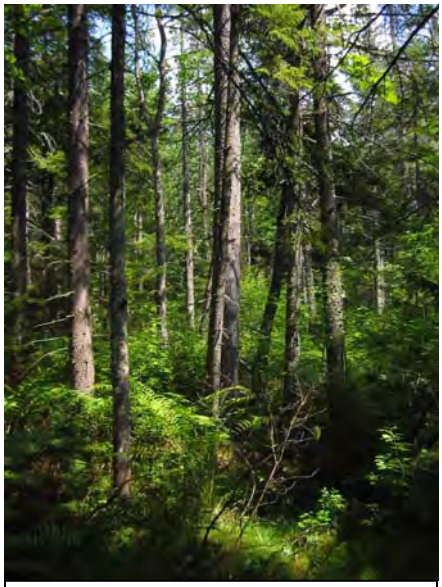
Table 3. Criteria used by Heritage Programs to determine significant natural communities.

Element Rarity Rank			Element Occurrence Rank
G1, G2	or	S1	all occurrences ranked A-D
G3	or	S2	all occurrences ranked A-C
G3, G4	or	S3	all occurrences ranked A-BC
G4, G5	or	S4, S5	all occurrences ranked A-B

Reschke (1990) developed the first comprehensive ecological community classification for New York State. This classification and the subsequent draft revision (Edinger *et al*. 2002) have been the basis of natural community inventories conducted by NY Natural Heritage since 1985. One of the objectives of this effort is to assess the rarity of each perceived natural community type in New York State. To date, there is no comprehensive legislation at the federal or state level providing legal protection to rare natural communities or high quality examples of more common community types. Federal, state, and local laws protect certain types of wetlands, streams, and beaches, but most terrestrial communities have no legal status.

Element Distribution Modeling

Element distribution modeling (EDM) is the process that maps the environments predicted to be suitable for occupation by a particular species or natural community (Beauvais *et al.* 2004). Also described as habitat modeling, this method is receiving more and more attention as desktop computers become more adept at handling large data sets and complex algorithms (Guisan & Zimmerman 2000).



Spruce-fir swamp near the Salmon River South Branch

There are two basic classes of EDM. Deductive modeling is a method whereby species-specific studies and expert assessment develop a set of environmental traits associated with a species. This set of characteristics is then applied throughout the study area to find new locations where all the characteristics are found. For example, studies may show that rattlesnakes prefer to den on south-facing, moderate to steep slopes with acidic bedrock types. Given GIS data for aspect,

slope, and bedrock, one could then map all the locations with this combination of characteristics.

In contrast, inductive modeling is a method that uses known locations for a particular species to determine the set of traits to be applied to the study area. Following the example above, if we have known locations for rattlesnake dens, we could use the known locations to gather the known range of aspect, slope, and bedrock types and then apply these characteristics study-wide. Because they don't rely on expert knowledge and previous research, inductive models tend to be more objective and data-driven (Beauvais *et al.* 2004). An inductive modeling approach also allows us to apply a very similar method to many different species and yet get an individualized product for each of these species. In creating our element distribution models, we chose to use an inductive approach.

This EDM effort marks an innovative undertaking for NY Natural Heritage. It was supported both by the current project and by the State Lands Assessment Project funded by the NYSDEC and the NY Biodiversity Research Institute. The following sections provide an overview of the methods we developed for generating EDMs in our office.

Select species and refine known locations

The first step in the process is to select species to model and to evaluate which of their known locations to feed into the modeling algorithms. We begin the selection process with the NY Natural Heritage Element Occurrence Database. For this project, we elected to create models for every rare species or natural community we might expect to find within the Salmon River watershed. In general, this translated to species and communities that were already known to occur within or near the study area. To date, we have created 281 element distribution models for plants, animals, and natural communities.

Dwarf shrub bog co-mingling with shrub swamp near Finnegan Brook.

After choosing which species and communities to model, we next compile spatially accurate locational information for them. A spatial component of the element occurrence database consists of polygons that represent where rare species or significant natural communities occur on the landscape. Some of these polygons may represent older occurrences (e.g., herbarium records) or records of poorly defined spatial resolution (e.g., the most precise information may be a county or town). Biologists review each record of each species before submitting it to be modeled. Records with poor spatial resolution that could not be improved and historical records were removed from the data set. Records remaining were those for populations and communities considered extant and mapped at a scale of 1:24,000 or larger.

The number of records for each species varied considerably from a single polygon to dozens of polygons.

Prepare environmental data

Although the focus area of this study encompassed only the Salmon River Watershed, we generated statewide element distribution models. Our method required this because we needed to use all known locations for each species, whether or not these locations occurred within the focus area. Indeed, many model predictions for species and natural communities fell within the study area even though no known locations had yet been documented there.

With a statewide focus, all environmental data need to have full, statewide coverage. Building the environmental data layers can be a considerable task for any EDM effort. The products of a SUNY-ESF doctoral graduate student were made available to us near the beginning of this project. Matt Buff had gathered and/or built environmental data layers for a NYSDEC-funded effort to model a few rare species statewide. He shared his data layers and helped by indicating which tended to have the most importance for predicting species distributions. After careful assessment of these layers we added or altered a few (bedrock geology, surficial geology, and some of the elevation-derived data layers). Our zoologists also added a few layers that might be relatively more important for animals (such as early summer rainfall data). Our final list consists of 36 (or 37; depending on the algorithm, see below) different environmental data layers. Table 4 lists these layers. For more detailed information on each layer, please see Appendix 1.

Sedge meadow near South Branch Salmon River.

Table 4. Environmental data layers used in the production of element distribution models (EDM).

Environmental Data Layer	Source[1]
% clay in surface layer, area weighted (% * 10)	MB
% organic matter in surface layer, area weighted (% * 10)	MB
Absolute maximum of regional percent pH ranges *10	MB
Absolute minimum of regional percent pH ranges *10	MB
Annual record minimum temperature (°C/10)	MB
Available water holding capacity, area weighted median (mm)	MB
Average annual minimum temperature (°C/10)	MB
Average minimum temperature (°C/10) in July	MB
Average minimum temperature (°C/10) in June	MB
Average minimum temperature (°C/10) in May	MB
Calcium carbonate in surface layer, area weighted median (% * 10)	MB
Calcium carbonate in surface layer, maximum (% * 10)	MB
Cation exchange capacity (CEC) in surface layer, area weighted median (value * 10)	MB
Class of bedrock, based on acidity and calcareousness	TNC
Class of surficial soil layer grouped to 22 classes	NYNHP
Class of surficial soil layer grouped to 35 classes	NYNHP
Cumulative annual solar radiation (kJ/m^2)	MB
Distance to nearest soil polygon containing calcium carbonate (m)	MB
Elevation (m)	MB
Mean number of frost free days per year	MB
National land cover data	MB
Permeability of top layer (inches of water per hour * 10)	MB
pH of top layer (pH * 10), area weighted average of median values	MB
Potential evapotranspiration independent of vegetation, AET + D, (mm)	MB
Precipitation (mm) in July	MB
Precipitation (mm) in June	MB
Precipitation (mm) in May	MB
Site water balance - cumulative annual water surplus or deficit (mm)	MB
Slope (degrees)	MB & NYNHP
Slope aspect	MB & NYNHP
Topographic index at multiple radii	MB & NYNHP
Topographic index in a 540 m radius (index)	MB & NYNHP
Topographic index in a 90 m radius (index)	MB & NYNHP
Topographic index in a 990 m radius (index)	MB & NYNHP
Topographic wetness index	MB & NYNHP
Total annual growing degree days	MB
Total annual precipitation (mm)	MB

[1] MB = Matt Buff, NYNHP = NY Natural Heritage, MB & NYNHP = original layer from Matt Buff updated, fixed, or otherwise re-created by NY Heritage, TNC = geology layer based on classes developed by The Nature Conservancy Conservation Science Support, Boston, MA.

Generate and attribute points

Presence data

Species habitat modelers classically use point data as inputs for modeling (e.g., Guisan & Zimmerman 2000, Furlanello *et al.* 2003, Phillips *et al.* 2004, Browning *et al.* 2005, Phillips *et al.* 2006, Prasad *et al.* 2006). These point locations are typically specific observations of the target species on the ground. Species populations and natural communities, however, occur in regions of space, not points on the ground. These regions are usually best approximated in GIS by polygons. This presents a conundrum. Our spatial description of populations and natural communities is much more realistic than a simple point location on the ground; however, it is not easy to assign environmental attributes to polygon data. For example, a plant population may occupy a curving hillside that faces south, south-southeast, and southeast. A single attribute for aspect can not be applied to the polygon delineating this plant population.

Tracey Tomajer at a small cascade in the Salmon River Gorge

A few different methods are available to solve the problem of polygon-based presence data. One solution simply uses the centroid or a random point placed within each polygon as the representation of that population or community. Inevitably, much of the variability inherent in environmental information is lost with this method, as in the aspect example above, if only a single aspect could be used to represent that particular population. Another solution is to calculate summary statistics for each environmental variable. This method works well for continuous variables such as elevation and slope but less so for categorical variables such as aspect, soil type, and bedrock class. One method for generating summary statistics for categorical variables is to calculate the percentage of each category within the polygon (e.g., %E-facing slopes, %SE-facing slopes, etc.; see Anderson & Ferree 2006). This method, most importantly, maintains a single record for each polygon of known location. The number of environmental attributes, however, become greatly expanded as a new attribute is added for each factor of a categorical variable.

A third solution for attributing polygon-based presence data is to place a number of points within each polygon, thereby capturing the variability in attributes for the polygon through resampling, not through summary statistics. Resampling in this manner eliminates the production of additional attributes and generally succeeds in representing the variability within the entire polygon. However, by its nature, this method creates more records for each

single polygon. Thus, when running the model more than the number of original known locations are submitted as inputs.

Recognizing the costs and benefits of all three methods described above, we chose to use the third solution. Thus, inside every polygon describing a known location for a species or natural community we placed a set of points. Choosing the number and placement of points became the next stumbling block. We wanted our sampling to best represent the entire variability contained within each polygon; for the smallest polygons we wanted to sample essentially all raster cells intersecting the polygon. We chose to use random rather than regular point placement, particularly because of the ability of GIS to interpolate continuous data values as the point diverges from the center of a cell (e.g. to return a value near 15 rather than 10 if within an elevation cell of 10 but very near the adjacent elevation cell whose value is 20). Setting the random point sampling to a constant number would result in multiple resampling of the same cells in very small polygons, thus giving bias towards the environmental attributes contained in the small polygons. However, a per-area sampling scheme would greatly over-sample (and thus create sampling bias towards) the larger polygons. We designed a sampling formula to balance the best features of a points-per-polygon and a points-per-area approach. This formula samples smaller polygons on a per-area basis, but then asymptotes at 400 points, in effect sampling larger polygons on a per-polygon basis.

The formula is a derivation of the logistic function:

$$Y = A\left[\left(\frac{2}{1+e^{-kx}}\right)-1\right]$$

where Y is the number of points to sample, A is the asymptote, k is the shape of the curve, and x is the baseline per-area sample size. We chose 400 points as the asymptote by evaluating 1702 species polygons that we expected to use in this EDM effort. At a sampling rate of one point per one 30m × 30m pixel, 80% of all polygons would contain a sample 434 or fewer points. Recognizing that we capture the vast majority of polygons at a one-to-one ratio, we simply rounded to 400 points as the asymptote for the 20% remaining large polygons.

Finally, we attributed the presence points for each species and natural community to be modeled with its corresponding value from each environmental layer used in the model. We built a special ArcGIS tool (called GrasPo) with the Visual Basic programming language to accomplish this task.

Absence data

One class of inductive EDM algorithms requires, in addition to locations where a species is known to occur, locations where a species is known not to occur. Developing absence data has received a lot of attention in the primary literature (Zaniewski *et al.* 2002, Elith *et al.* 2006). Ideally, a researcher would conduct systematic studies to locate the target species and locations where the target species was not found would be plugged into analytic routine as absence data. Unfortunately, Heritage data sets generally lack any robust absence data and

we had to resort to another approach. We generated a set of 1000 randomly located "available" or "pseudo-absence" points to use as our contrast to presence points (Zaniewski *et al.* 2002, Beauvais *et al.* 2004, Engler *et al.* 2004). We attributed these 1000 random points with the appropriate values from each environmental layer used in the modeling process. We used the same 1000 random points for every model we ran.

Run models

Many different statistical procedures have been used in the past to create element distribution models (Guisan & Zimmerman 2000). Our research and training pointed us towards two relatively new approaches that held much promise in terms of their utility and effectiveness. We chose to use two procedures in order to take advantage of the benefits of each. Our method is to merge the results of each model into a final, single, more robust result. Although there has been some discussion about utilizing multiple models in this manner (e.g., Beauvais *et al.* 2004), we don't know of any other efforts to apply this method as broadly and consistently as we have. The two modeling approaches are MaxEnt and Random Forests.

Maximum entropy

MaxEnt is a computer program built specifically for element distribution modeling. This software is available online:<http://www.cs.princeton.edu/~schapire/maxent/ >. It applies maximum-entropy techniques that were first developed in other fields. In this method, each environmental variable among the set of known locations creates a distinct distribution, which may differ from the full distribution of the environmental variable for the entire study area. The goal of MaxEnt is to estimate a target distribution range-wide using the constraints of the distribution of known locations and the idea that target distribution be as close to uniform as possible (i.e. that of maximum entropy) (Phillips *et al.* 2004, Phillips *et al.* 2006). It takes about 5 hours for a dedicated computer to create an EDM using this method.

Alpine cottongrass (*Trichophorum alpinum*) on calcareous shoreline outcrop in the Salmon River Gorge.

The MaxEnt approach requires only presence data and a representation of the entire study area (background data). For very large datasets like ours this background dataset translates to a set of attributed random points. MaxEnt does not consider these points to be pseudo-negatives but only a representation of the entire study area. This we considered an appealing advantage of the MaxEnt method. This method is also attractive in that it appears to work well with very few data points (known locations). MaxEnt, however, finds a single best solution (combination of environmental variables). This is in contrast to the other procedure we chose to use: the random forests method.

Random forests
Random forests is an extension of classification and regression tree (CART) statistical modeling (Breiman *et al.* 1984). In classic CART modeling for EDM, a single classification tree is built in the following manner. The program evaluates all the variables and decides which variable is most effective at splitting the dataset into two groups (target species present or absent). The algorithm repeats the procedure with each subgroup, building a "tree" that ends with subgroups fully classified as present or absent. This classification tree is then essentially a set of rules for modeling where appropriate habitat exists for our target species. A benefit of CART (and random forests) is that there may be many solutions to model. Thus, the model may predict a species at higher elevation, north-facing slopes at one portion of its range and at lower, south-facing slopes at another portion of its range. One drawback of classic CART involves a pruning routine that is somewhat arbitrary. Random forests requires no pruning.

The basic method for this procedure is to choose a random subset of records (presence and absence points) as well as a random subset of environmental variables to build a classification tree. This is repeated for many trees (we generally used 600 trees), each with new random subsets of the data and environmental variables. To predict whether an unknown location should be classified as present or absent for a target species, the program sends the conditions of the location down all the trees and tallies votes of how predictions are made on each tree (Breiman *et al.* 1984, Liaw & Wiener 2002). Although rules can vary, we simply used a "majority wins" rule.

Background information and a program for running random forests is available from the developers of the concept as FORTRAN code <http://www.stat.berkeley.edu/users/breiman/RandomForests/>. This algorithm has also been ported to R, an open-source statistical software program (R Development Core Team 2005), by Andy Liaw and Matthew Wiener (Liaw & Wiener 2002). This is the software (named randomForest) that we used to build our EDMs using this algorithm. It takes approximately 14 hours for a dedicated computer to create an EDM using this random forest method.

Merge, display, and evaluate models for inventory
After building an EDM with both MaxEnt and randomForest, we convert each ARC GRID file to integer (from floating-point) and then merge the files using a simple summation command in the Spatial Analyst extension of ArcGIS.

Each model is then represented in GIS as a color range from low prediction of habitat suitability (e.g. green) to a high prediction (e.g., red; Figure 5).

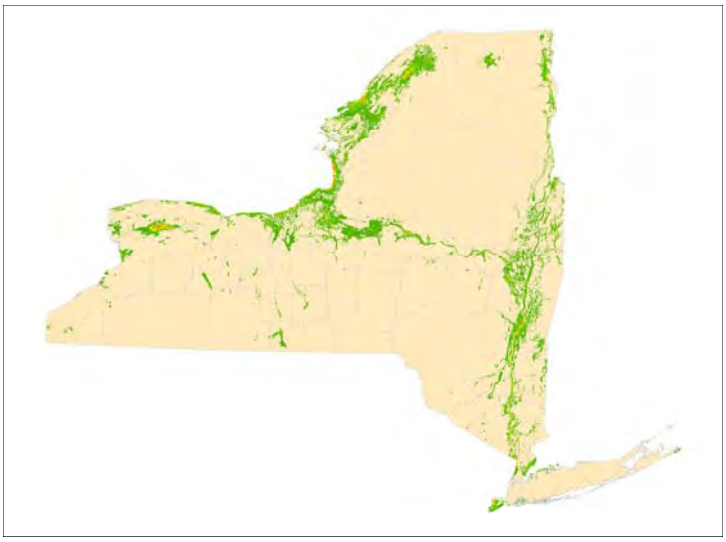


Figure 5. Statewide element distribution model for least bittern (*Ixobrychus exilis*).

Before going into the field, we evaluated the prediction levels of each EDM throughout the Salmon River Watershed. Locations that showed high promise were targeted for inventory during the summer of 2005.

Models as a part of the landscape assessment

We also used the EDMs as part of the overall landscape assessment. For this assessment, we wanted to dichotomize the continuous prediction map into a predicted/not predicted map (see Figure 6). Although turning a continuous surface into only two classes results in a loss of information (and is sometimes considered inappropriate; see Royston *et al.* 2006), it is not an uncommon task in habitat modeling. For our purposes, the main reason to do this was to synthesize across the many EDMs and create a layer showing the number of predicted species across the landscape. Thus we needed each EDM to show either yes, appropriate habitat for the species is predicted, or no, appropriate habitat is not predicted for the target species.

In order to create a predicted/not predicted EDM map, we needed to determine the appropriate cutoff value for each EDM. To determine the appropriate percentage we used receiver-operator characteristics (ROC) coding in R (R Development Core Team 2005) that assessed the success of the model to correctly predict known present and absent locations. For example, setting the entire study area to "present" would successfully capture all the known present locations (100% correct positives), but also capture all the "absent" locations as present (0% correct negatives). We chose an analytic routine that maximizes correct positives and correct negatives at the same time.

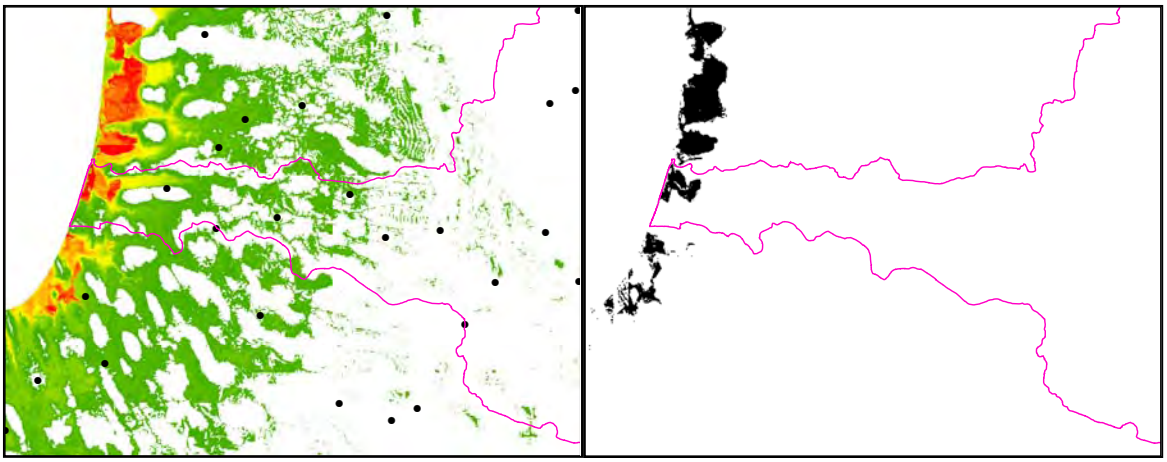


Figure 6. Least bittern EDM along the shore of Lake Ontario at the mouth of the Salmon River Watershed (pink outline). Left: continuous prediction, low prediction of suitable habitat = green; high prediction of suitable habitat = red. Pseudo-absence locations are indicated as black points. Right: dichotomous present/absent EDM showing predicted suitable habitat.

Pre-Inventory Methods: Landowner Permissions

During the winter and spring of 2005, we identified priority private landholdings for field inventories. These private parcels had a high probability of having rare species or rare natural communities based on expert opinion, element distribution models, or other evaluation, or were large parcels that might house more extensive natural communities. With the help of the Tug Hill Tomorrow Land Trust, we sent letters requesting permission to conduct inventories to about 84 private landowners based on predictions for suitable rare species or natural communities habitat and to an additional 51 private owners of large parcels. Of the 84 private parcels having predictions for rare species or natural communities, 63 of these were targeted towards rare plants, nine were targeted for rare animals (least bittern and a dragonfly, *Ophiogomphus anomalus*), and 15 were targeted for natural community inventory. These numbers sum to a value greater than 84 as some parcels were targets for more than one group.

Inventory Methods for Ecological Communities and Rare Species

Along with private lands, we also targeted NYS land, including wildlife management areas and state forests; land owned by The Nature Conservancy; and land under conservation easement by The Nature Conservancy.

Rare Animal and Plant Inventories

We focused our rare animal surveys on marsh birds, dragonflies, the bog buckmoth, and the bog turtle. Zoological field surveys were conducted by NY Natural Heritage zoologist Jeff Corser, NY Natural Heritage Program zoologist Paul Novak, and NY Natural Heritage assistant zoologists Andrea Chaloux and Tara Seoane.

Marsh bird surveys generally consisted of visiting targeted marshes during nesting season and, oftentimes, playing a recorded call of the least bittern or pied-billed grebe, two of our

targeted birds. Most of these surveys were targeted in and around the wetlands towards the western side of the watershed.

The extra-striped snaketail (*Ophiogomphus anomalus*), an extremely rare (S1) dragonfly that may occur in the watershed, was searched for along the shores of the Salmon River. We also searched for bog buckmoth (*Hemileuca* sp. 1), another extremely rare species (S1), at a small wetland near the mouth of the Salmon River.

We contracted a local expert (Peter Rosenbaum, SUNY Oswego) to look for bog turtles (State Endangered; Federally Threatened) at one wetland complex that has good potential for harboring this species. The most effective survey methods for this species is to set live traps throughout the wetland. Dr. Rosenbaum completed a month of trapping at the Sloperville wetland complex (Rosenbaum 2005).

Least bittern (*Ixobrychus exilis*). Photo: Sandy Muller, Irene Mazzocchi

Rare plant searches were targeted at places where we were granted permission and within the lands owned by The Nature Conservancy on the Tug Hill. NY Natural Heritage botanist Troy Weldy and Heritage contractor David Werier conducted botanical inventories for this project. During each visit, the botanist builds a species list of all plants identified during the course of the survey. These data are grouped by survey area and GPS points are taken at specific collection points or other points of interest. Species lists for these visits are kept electronically in-house in our Field Forms Database. When a rare plant species is discovered, we collect additional information describing the location, and the health and vigor of the population.

Ecological Community Inventories

General field methodology

We conducted natural community inventories within the context of the community classification and community descriptions found in *Ecological Communities of New York State* (Edinger *et al*. 2002). Inventories focused on palustrine (wetland) and terrestrial natural communities. An earlier assessment of Tug Hill streams (Hunt *et al.* 2005) already set out priorities for stream systems and natural communities within much of the study area. Field visits were made to sites where element distribution models produced relatively high predictions for rare natural communities and where manual GIS assessment indicated a high potential for significant natural communities.

This study used standard inventory methodology developed by The Nature Conservancy, NatureServe, and the Natural Heritage Network, and refined by NY Natural Heritage (Edinger *et al.* 2000). General survey methodology for natural communities involves collecting data on all or most of the following for each targeted community occurrence: plant species composition and structure in all strata, unvegetated ground and water surfaces, soil

properties, slope, aspect, elevation, geology, and hydrology (Edinger *et al*. 2000). These data allow an accurate identification of each community surveyed. We also collect and record information on occurrence size, maturity, level of disturbance, abundance of exotic species, threats, and landscape context. These data allow us to compare the quality and assess the viability of each community occurrence in relation to others throughout the range of the community, both within and outside of New York State.

Project-specific field methodology

Detailed field surveys were conducted in about 14 different locations over 18 days throughout the watershed during the summer of 2005. NY Natural Heritage program scientist Tim Howard conducted the ecological field inventories for this project, with the assistance of NYSDEC Watershed conservation coordinator Tracey Tomajer. Additional recent field inventory at a series of wetlands along the Salmon River Corridor was conducted during 2005 (Evans *et al.* 2005). These wetland inventories helped frame where we would focus our inventory efforts and the results from these inventories will greatly support the watershed assessment of this project.

Plot and observation point sampling

For each suspected new element occurrence discovered in the field we strove to collect at least one detailed releve plot and additional observation points scattered throughout the occurrence. Plots were placed via a random direction and distance into the natural community. They were typically 20m × 20m in size for forest occurrences and 10m × 10m for wetland and other terrestrial community types with dense understory. Plot data collection followed Edinger (2000). We also captured a digital photographic record of each plot when cameras were cooperating. These photos are stored in the NY Natural Heritage digital images database and referenced on the final field forms and in the Field Forms Database at the appropriate locations.

In order to best capture the variability throughout a natural community occurrence, we strove to collect observation points throughout the occurrence. These points describe the dominant species in each vegetation stratum with enough information to classify the community and help evaluate the quality and viability of the entire community. Observation points may be completed much more quickly than plots, however, allowing us to visit much more of the site given a certain amount of time. In all, 11 plots and 146 observation points were collected during the 2005 field season.

Information Processing and Mapping

NY Natural Heritage ecology staff followed standard methods for documenting rare species and natural community occurrences determined to be significant from a statewide perspective. All plot and observation data were collected with digital technology and spatially located using a global positioning system (GPS). More specifically, NY Natural Heritage has built a data-entry database for use on a hand-held PDA (personal digital assistant). This database is built in VisualCE (Syware Corp.) and greatly speeds data transfer into our Field Forms Database and data synthesis and compilation into our Heritage Conservation Databases. GPS points at plots and observation points were collected using a Magellan SportTrack with WAAS capability. We collected GPS-averaged positions of at

least 100 seconds whenever possible. Botanical surveys were also conducted using GPS and, in part, using the electronic handheld data recorders and electronic database.

Zoological site survey forms, rare species forms, and negative survey forms, when appropriate, were completed for all zoological inventories and filed in our paper filing system. All botanical and ecological data were uploaded or entered into the NY Natural Heritage Field Forms Database, and edited for completeness and accuracy. For each botanical survey, we created general survey forms with species lists and rare species forms where appropriate, for each inventory day. For ecological inventories, we completed plots and observation point field forms with associated locator maps and for each significant community we completed community ranking forms that include a community description, ranking analysis, observed disturbances, stresses and anticipated threats, and associated management and protection recommendations. These forms are archived electronically as well as in paper form in the NY Natural Heritage office.

Northern bog clubmoss (*Lycopodiella inundata*) near the headwaters of Finnegan Brook.

We created digital maps of all rare species and significant natural community occurrences. For natural communities, we displayed all observation points and plots in a GIS, with digital topographic images, high-resolution digital ortho-images (from both 2001 and 1994), and other relevant GIS layers. The final delineations were drawn at a minimum scale of 1:24,000. For a description and sources of all GIS data layers used see Appendix 2.

Following field surveys, data for significant ecological community occurrences were synthesized from field data into standardized element occurrence records and entered into NY Natural Heritage element occurrence databases.

Watershed Integrity Analysis Methods

Analysis units

The goal of the integrity analysis was not to compare the Salmon River Watershed to other basins in the state, but to evaluate the relative quality of places *within* the watershed. The first step in comparing the relative quality within a single, large watershed is to determine the unit of comparison. There are many different possible ways to split a basin into smaller units for comparison. Rather than using a political (e.g., town) or regular (e.g., the breeding bird atlas grid) set of divisions, we chose to split the watershed into smaller drainage units.

The Salmon River Watershed is composed of three 11-digit Hydrologic Units, as available from US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (Figure 7), based on the NRCS Hydrologic Unit Classification (HUC) system. This is the smallest available hydrologic unit for the region. We used these 11-digit hydrologic units as a starting point and manually divided the basin further into subwatersheds. The USGS 1:24,000 topographic maps provided the main source of flow direction and watershed boundaries.

The 15 subwatersheds vary in size from 4,600 acres to 21,000 acres (Table 5) and tend to be elongated and narrow, following the dominant stream courses in the basin (Figure 8).

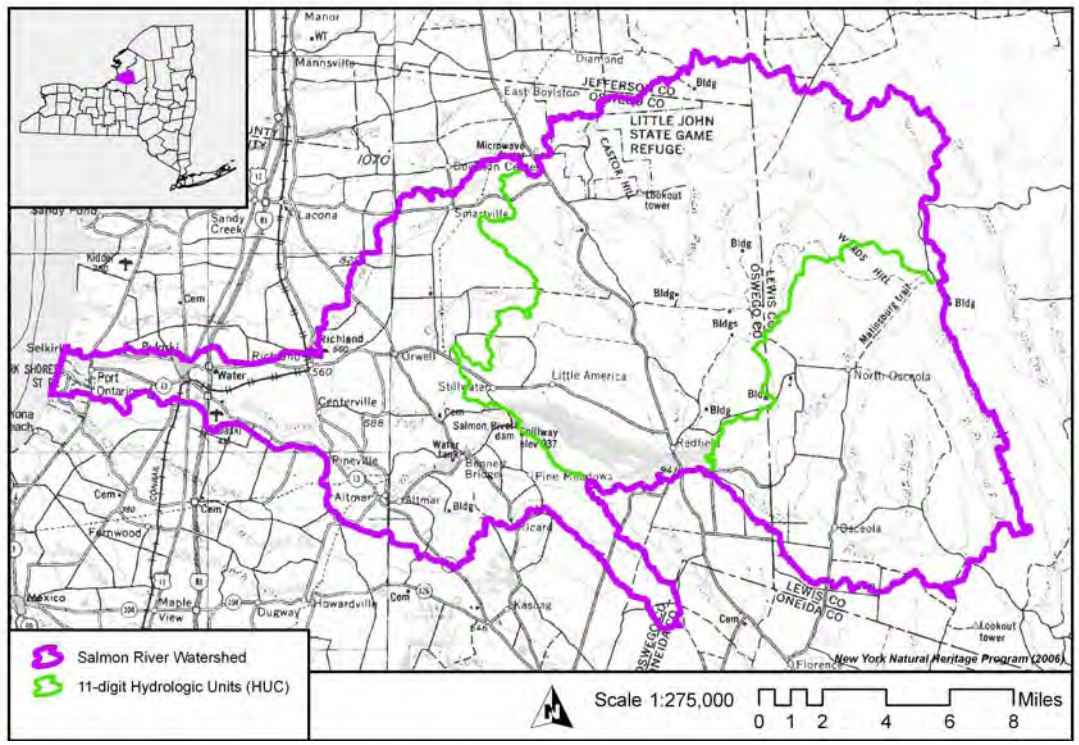


Figure 7. The three 11-digit Hydrologic Units (HUC) that make up the Salmon River Watershed.

Table 5. Subwatersheds used for the internal evaluation of the Salmon River Watershed. "Code" refers to the acronym used for labels in the maps (e.g., Figure 8).

NAME	Code	Acres	Perimeter (mi)
Stony Brook - Line Brook	SBLB	4623	20.6755
Prince - Mulligan - Little Baker	PMLB	7245	20.7153
Fall Brook - Twomile - Threemile	FBTT	9862	27.1409
Keese - Smith - Finnegan	KESF	6419	14.7414
Upper Salmon River	UPSR	16365	45.9746
Trout Brook	TRBR	12938	30.8256
Orwell - Pekin	ORPE	12992	28.3731
Pennock - Coey - Kenny	PECK	10880	24.0303
Grindstone - Mill - Muddy	GRMM	11183	30.6553
North Branch	NOBR	17993	38.2584
Beaverdam Brook - Meadow Creek - Reservoir	BBMC	19721	41.6431
Lower Salmon River - Mainstem	LSRM	11544	34.2680
Cold Brook	COBR	6558	49.8644
Beaver - Gillmore - Willow - McDougal	BGWM	6963	49.8644
Mad River	MARI	21013	49.8644

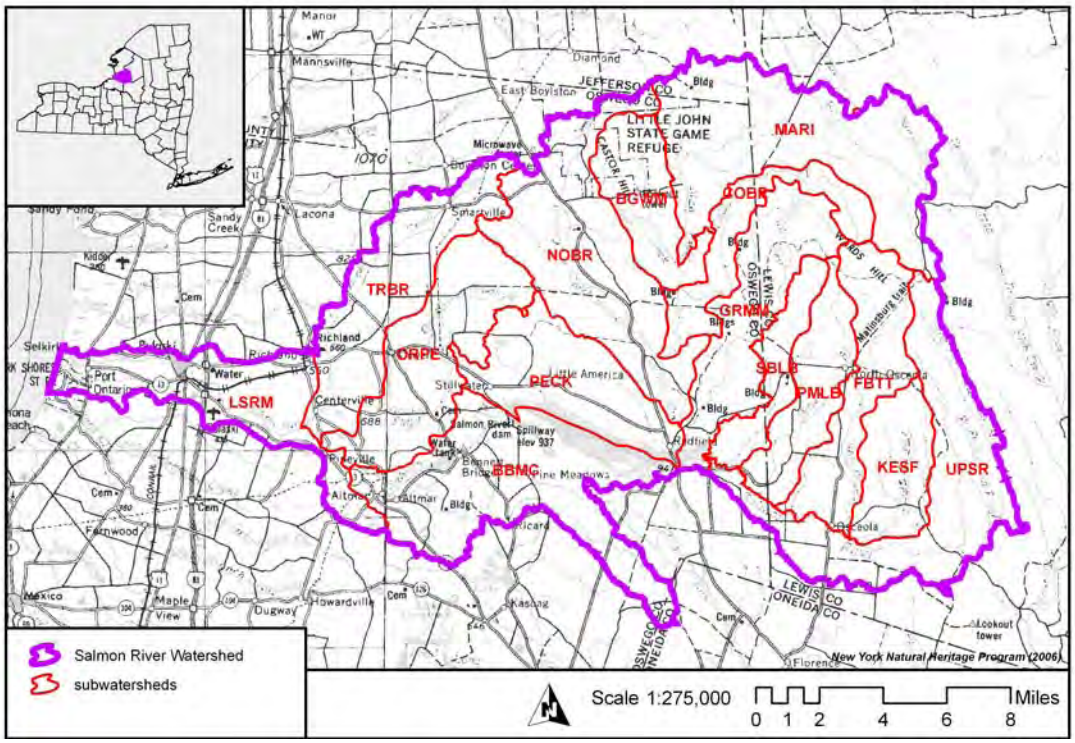


Figure 8. The 15 subwatersheds created by NY Natural Heritage for use as analysis units for this study.

Watershed analysis model development

We conducted a detailed GIS analysis of the 15 subwatersheds to help guide conservation efforts in the region. This analysis followed the model initially developed during the Lake Erie Gorges Biodiversity Inventory (Hunt *et al.* 2002) and further refined for the Tug Hill Stream System Inventory (Hunt *et al.* 2005). This NY Natural Heritage landscape integrity model uses methods for 1) ranking the integrity of watersheds and functional landscapes, and 2) determining the location of relatively unfragmented stretches of water and relatively unfragmented patches of forests, thus comparing the relative conservation importance of watersheds and stream systems across a given area. Applying a comparative approach of this sort was expected to add credibility to, and enhance the utility of, this project as a landscape-scale inventory. This prioritization considered parameters with parallels to 1) factors used in the ranking of community occurrences at NY Natural Heritage, and 2) the watershed integrity and diversity indices developed by The Nature Conservancy's Eastern Conservation Science office.

Sedge meadow along Hooker Brook

Ecological parameters

We began with the list of parameters selected for the final analyses of Tug Hill stream systems (Hunt *et al.* 2005) and added additional parameters appropriate for this analysis. The Tug Hill streams assessment was based on earlier work in the Saint Lawrence/Champlain Valley (Hunt 2001) and the Lake Erie Gorges (Hunt *et al.* 2002). The final set of parameters used, we believe, are the most important in ranking landscape integrity among those readily available for GIS analysis. Parameter availability (or ease of parameter creation from available data) is an important component to this assessment for both full transparency of our process and for ease of transfer to other basins. The parameters analyzed in this effort are described in Appendix 2.

Our evaluation of subwatersheds considered several factors related to the distribution and density of natural cover, cultural barriers to native species and ecological processes (e.g., dams, cleared stream buffers), and disturbance corridors for exotic species and anthropogenic processes (e.g., roads, cleared stream buffers). Key ranking parameters sought for the watershed integrity analysis for the study area were classified into five general categories: 1) biological condition, 2) flow alterations (i.e., dams and diversions), 3) land cover, 4) roads, and 5) water quality. Land cover is further divided into watershed land cover and stream buffer land cover characteristics. When applied, assessment of the condition or integrity of

each individual watershed and stream system was based on existing data on the number and capacity of dams, percentage of developed or agricultural lands and their distribution relative to streams, the density of roads and their distribution relative to streams (Figure 9), and water quality.

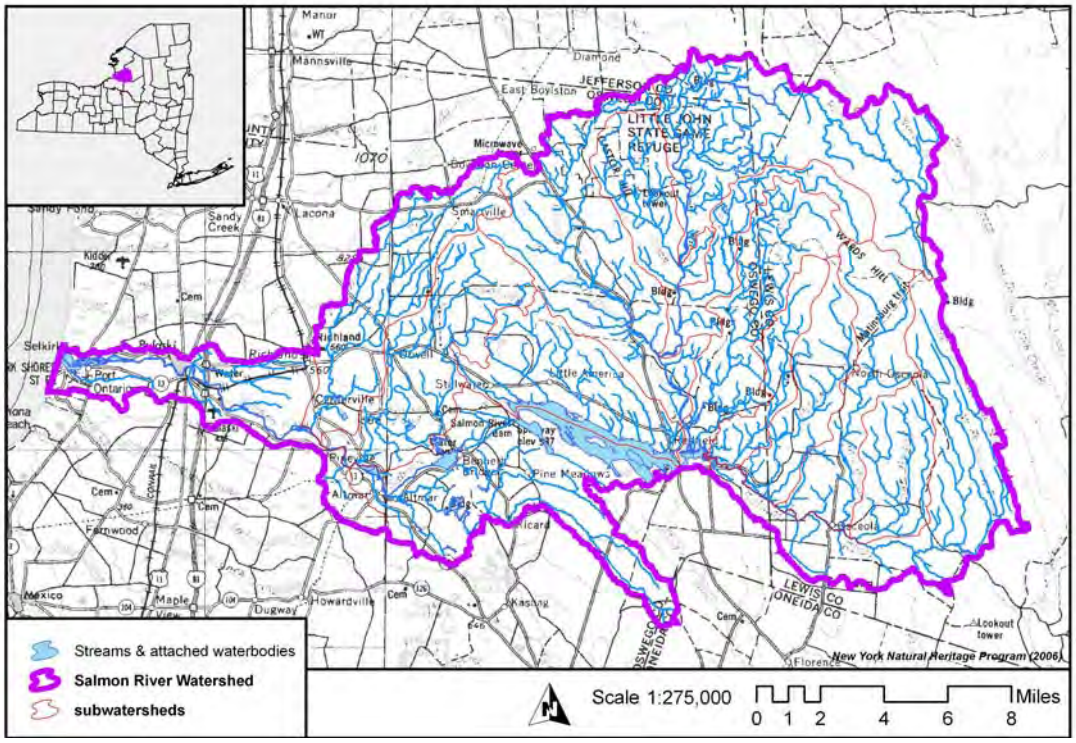


Figure 9. Streams and attached waterbodies in the Salmon River Watershed and subwatersheds.

A few analysis parameters were included in the Tug Hill Aquatics project but removed from this project. We did not assess natural lands within a 400 meter stream buffer. The Tug Hill project included both this and a 100 meter assessment and, it appears the 100 meter metric is more standard, and apparently considered to be enough in most cases (e.g., Growns & Davis 1991, Lambert & Hannon 2000). We used only the 100 meter assessment metrics in this project. Also, as this assessment was more focused on the entire landscape rather than stream systems only, we excluded the 'upstream' metrics (streams miles and percent stream miles with 100% natural land upstream, stream miles and percent stream miles with no dam upstream). These measures are difficult to automate (and thus, also difficult to replicate) and thus are less appropriate for inclusion in a transparent, repeatable assessment method. Finally, dam water storage values were not available to us this time. For unknown reasons, these data were removed from the dataset, making it impossible for us to evaluate storage metrics (max storage, dam capacity).

We included a new metric that provides a roadless block score that varies with roadless block size. The original metric, which we also include in the analysis, measures the percentage of each watershed occupied by roadless blocks over 300 acres. The value of roadless blocks

varies by size, however (e.g., Anderson 1999, Kennedy *et al.* 2003) and a metric that takes this into account is more meaningful. We outline the method for generating this metric in Appendix 2.

Finally, we include known and predicted estimates of rare species richness (numbers of species) in the analysis. Known rare species occurrences are based on the NY Natural Heritage Element Occurrence database. Estimates of rare species richness are based on the element distribution models generated for this project.

Ecological data layers

NY Natural Heritage staff continued research on GIS data availability for key ecological parameters that were to be used to produce integrity indices for comparing among the subwatersheds of the study area. Information on GIS data that were used in the analyses and map production is detailed in Appendix 2. We sought consistent and uniform data layers that were feasible to assess comprehensively throughout the study area and also contained appropriate resolution to evaluate at the subwatershed scale. Breeding Bird Atlas data, for example, is an excellent dataset and very useful at small scales, but the blocks are slightly too large to incorporate into an assessment of the targeted subwatersheds in this study.

Most data used in the analyses were available from the NYSDEC, an agency that has acquired a variety of data from multiple sources, with the exception of the Point Source Discharges data layer. This data layer was acquired from EPA's BASINS (Better Assessment Science Integrating Point and Non-point Sources) program. BASINS emphasizes watershed and water quality-based assessment and integrated analysis of pollution sources. It integrates GIS with national watershed data and modeling tools. Land cover, roads, and dams data layers available from the NYSDEC are at a more precise scale, or level of detail, than that which was available from the EPA.

Much water quality data is available on GIS layers. Examples of water quality parameters found as EPA BASINS data layers, but not considered temporally or spatially uniform for the study area included toxins, phosphorous, nitrogen, fecal coliform, and pesticides. The one water quality parameter analyzed, number of permitted point source discharges per watershed, was considered comprehensively available throughout the subwatersheds. This dataset was derived by appending EPA BASINS GIS coverages of Toxic Release Inventory Site for Water Releases (TRI) and Permit Compliance Systems for Permitted Discharges (PCS).

Numerous parameters were available for flow alterations (i.e., land cover, dams and diversions, and road distribution). The land cover data layer used in the preliminary analyses of 2001 was the EPA's Multi-Resolution Landscape Characteristic (MRLC) dataset (see http://www.epa.gov/mrlc/nlcd.html). It was obtained from the NYSDEC, and deemed at that time to be the most recent (1988-1993) and the most precise (30 meter pixel scale) land cover dataset that covered the entire study area. Land cover characteristics were assessed for entire watersheds and within 100 meter distances from streams. The streams data layer is a digital version of the streams shown on USGS 1:24,000 scale quadrangle maps. Flow alteration

parameters were available only for dams. Road distribution parameters focused on a combination of road density and the proximity of roads to streams.

Data interpretation

Raw data on aquatic features were converted into ecologically important metrics or indices for broad categories of aquatic parameters following the GIS model of the Lake Erie Gorges and Tug Hill Aquatics projects (Hunt *et al.* 2002, Hunt *et al.* 2005).For each watershed integrity category, two indices were ideally sought, an *integrity index*, focusing on a combination of the size of the highest quality portions of the watersheds or stream buffers relative to the size of the entire watershed or stream buffer throughout the entire watershed, and an *impact index*, averaging disturbance features across an entire watershed. Each index was calculated based on one to four parameters. Initial calculations of indices assumed equal weighting within each set of normalized parameters chosen to capture the variation in describing the general integrity and impacts of that category, provided data were available for those parameters. Integrity and impact indices for each watershed integrity category were averaged, treating the integrity index as a positive value and the impact index as a negative value.

RESULTS AND DISCUSSION

Landowner Contact

About 16 private landowners gave permission for us to conduct inventories on their property. As we were also visiting public lands, we had to prioritize our final visits into the field. We made it to many of the private landholdings, but not all. During the winter of 2006, we provided information to those landowners who requested follow-up information on our surveys. Again, we worked with Linda Garrett at the Tug Hill Tomorrow Land Trust. We provided information on what we found to Linda, who, in turn, sent follow-up letters to each of these landowners.

Collecting data in a shrub swamp at Prince Brook Swamp. Photo: Tracey Tomajer.

Inventory Efforts - Field Inventory

Heritage ecologists spent approximately 20 days in the field conducting inventories throughout the Salmon River Watershed. Inventory efforts focused on private lands where permission was granted and public lands. Ecological observation point locations, including detailed plots, are shown in Figure 10.

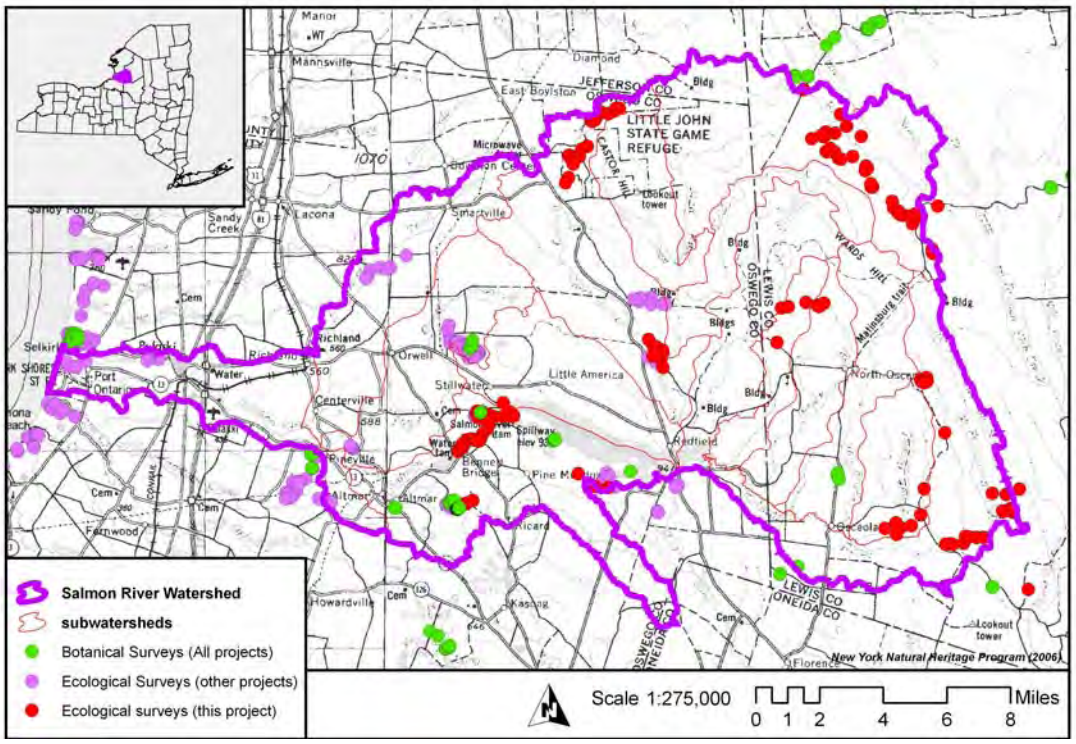


Figure 10. Ecological and botanical inventory locations within and nearby the Salmon River Watershed. Ecological surveys conducted in the area but not directly funded by this project are identified by a different color.

Heritage botanists and their contractors spent about seven days in the field conducting rare plant inventories. Inventory locations are also indicated in Figure 10. Three new sites for pod grass (*Scheuchzeria palustris*, Rare: S3) were found during this time period (one was just outside the watershed). One site was discovered by a Heritage Ecologist working on the Salmon River Corridor project (Evans *et al.* 2005), the other two discoveries were made by Heritage Botanist Troy Weldy. All these localities were predicted at some level by the computer models.

Heritage Zoologists spent about 14 person-days in the field looking for rare animals. Additional contractor time was spent trapping for bog turtles. Program zoologist Paul Novak looked for the extra-striped snaketail dragonfly (*Ophiogomphus anomalus*, Extremely Rare: S1) on the Salmon River. Both the main branch below the reservoir and the north branch of the Salmon were predicted by our computer-generated models as potential habitats. Paul searched both locations but did not find the species nor ideal habitat. He also searched for bog buckmoth (*Hemileuca* sp. 1, Extremely Rare: S1) at a small wetland south of the boat launch at the mouth of the Salmon River but did not find the required food plant for the buckmoth.

Zoologist Jeff Corser and assistant zoologists Andrea Chaloux and Tara Seoane conducted 2 marshbird surveys using taped playback at the mouth of the Salmon river. They got responses from several pied-billed grebes (Rare: S3, for breeding populations), 3 least bitterns (Rare: S3, for breeding populations), a Virginia rail, and heard lots of moorhens.

Virginia rail is a species tracked as rare by NY Natural Heritage, but was not known to be breeding in that specific area by the NY Breeding Bird Atlas and will now be updated as such. They also saw black terns, a common tern, two Ospreys, and several marsh wrens. Jeff also inventoried computer-predicted least bittern marsh habitat on four different private land parcels. Although he did not find any least bittern, he did find a new pied-billed grebe site. Jeff also collected a black-tipped darner (*Aeshna tuberculifera*) in the East Branch Salmon River. This is a new dragonfly county record for Lewis County.

New and updated locations for the rare species and significant natural communities inventoried as a part of this project are described briefly in the next sections. More detailed information is provided for all known element occurrence records in Appendix 3.

Subwatersheds – Inventory, Known Occurrences, Assessment Metrics

Many rare species and significant natural community occurrences (= "element occurrences") were already known throughout the study area before the beginning of our inventory efforts for this project. This project, as well as the Salmon River Corridor project (Evans *et al.* 2005) added a significant number of element occurrences to the study area. In this section, we briefly discuss all element occurrences in the watershed, as they occur by watershed. Appendix 3 provides more detailed information about each element occurrence.

Cobble shore, rocky headwater stream, and floodplain forest near Salmon River Bog.

In all, we know of 61 different occurrences of rare species and significant natural communities within the entire basin. Eleven of these are locations for rare animals, twelve for rare plants, and 39 for significant natural communities. Figures 11, 12, and 13 show the rare animal, rare plant, and significant natural community occurrences for the basin, respectively.

The full subwatershed analysis, with raw numbers and derived metrics, is provided in Appendix 4. In this section, however, we cover some of the highlights from the analysis.

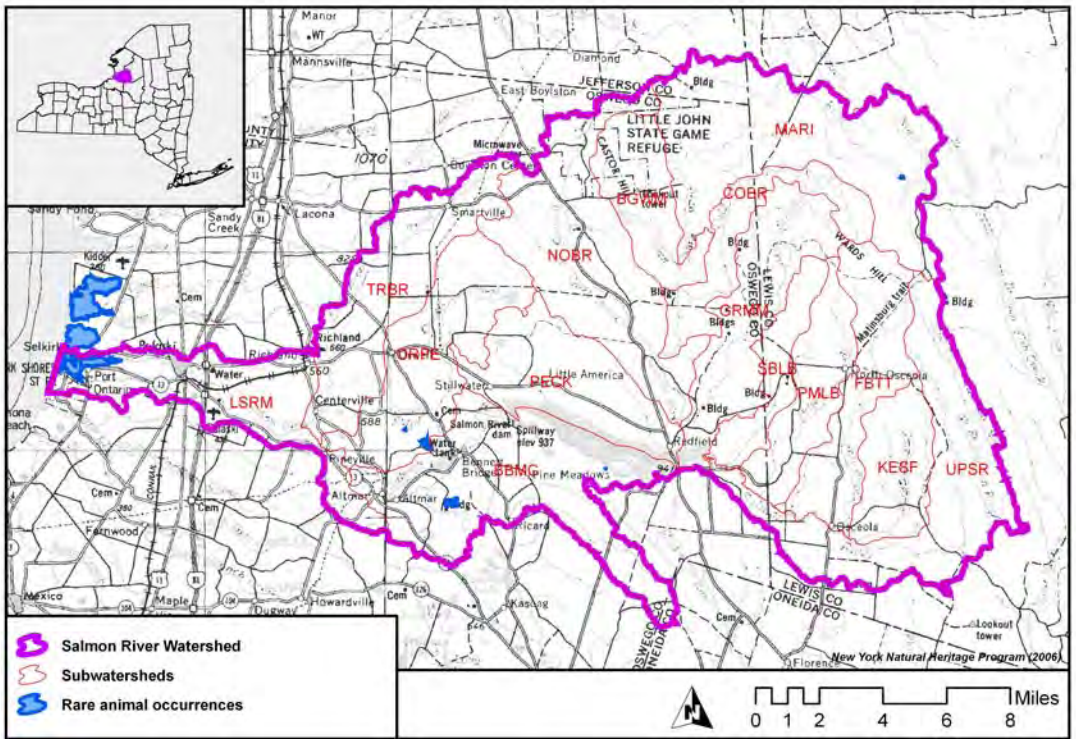


Figure 11. Rare animal occurrences in the Salmon River Watershed.

Lower Salmon River-Mainstem (LSRM)

The westernmost portion of the basin, here designated the Lower Salmon River – mainstem subwatershed contains the towns of Pulaski and Port Ontario. Interstate 81, a Conrail track, and many roads also pass through this section of the basin. This section also contains the shore of Lake Ontario and the mouth of the Salmon River.

Calcareous shoreline outcrop along the Salmon River.

Element occurrences

The influence and uniqueness of the Lake Ontario shoreline make this portion of the watershed quite interesting biologically and many rare species and special natural communities are found here near the mouth of the Salmon River. Table 6 lists the rare species and significant natural communities for this subwatershed – all of these occur right at the western edge of this subwatershed.

Table 6. Element occurrences falling within or crossing into the "Lower Salmon River-Mainstream" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank[1]	Last Observed	Elem. Type[2]	This Project[3]	cross-subw[4]
6890	Warm Water Fish Concentration Area	U	1977	O		
1844	Deep Emergent Marsh	B	2001-08-07	C		
5778	Shallow Emergent Marsh	B	2001-08-07	C		
136	Sand Dune Willow	CD	2001-06-14	P		
4349	Low Sand-cherry	CD	2001-06-14	P		
6911	Ram's-head Ladyslipper	F	1900-05-26	P		
7144	Slender Bulrush	C	2002-07-10	P		
9648	Giant Pine-drops	H	1854-07	P		
533	Northern Harrier	E	2002-05-18	A		
1036	Least Bittern	BC	2005-06-20	A	U	
2982	Pied-billed Grebe	BC	2005-06-20	A	U	
10414	Black Tern	C	2005-06-01	A	U	

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

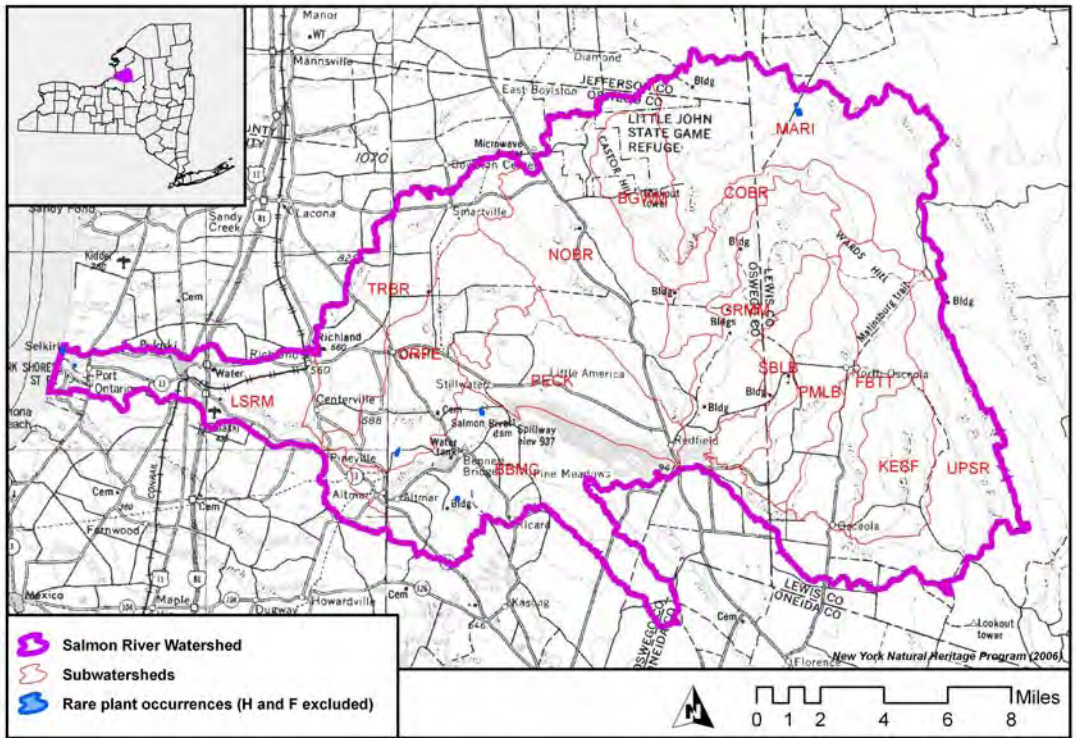


Figure 12. Rare plant occurrences in the Salmon River Watershed. Historic records (an element occurrence rank of "H"; see Table 2) and those recently searched for but not found (e.g., an element occurrence rank of "F") are not included in this map, but are included in the subwatershed tables.

Subwatershed analysis
At 7000 acres, the Lower Salmon River subwatershed is the sixth smallest of the fifteen. Being located on the Lake Ontario plains carries some integrity issues: this subwatershed has by far the least natural land cover (64%), has the lowest roadless block score, the fewest acres in larger natural blocks, and the lowest percentage of streams running through natural land (79%) (Appendix 4). These development pressures also create more roads (60 miles), more stream/road crossings (39), more dams, and more documented point-source pollution.

However, the Lake Ontario plain also brings unique geology, landforms, and habitats to this basin. The wetlands and natural areas in and around the mouth of the Salmon River are hotspots for biological diversity, rare species, and unique and interesting natural communities. Much of known occurrences are noted in the section above, but our EDMs also predicted the highest number of rare species in this subwatershed (22) as well as the highest number predicted in any single location in a subwatershed (e.g., hotspot), at 11 species. These factors make evaluation of this watershed important; perhaps less at the scale of the subwatershed but more at the scale of specific targets and sites.

Trout Brook (TRBR)
Element occurrences
Trout Brook diverges north from the Salmon River just downstream (NW) of Pineville, near Centerville. The Trout Brook subwatershed forms the northwestern edge of the Salmon River Basin up through Smartville to about Plantz Corners. We know of no rare species or significant natural communities for this subwatershed. This does not mean that there are none, however. The narrow ravines in and around Trout Brook reforestation area and the larger wetlands in the southern portion of the subwatershed may eventually turn up interesting species or natural communities.

Subwatershed analysis
At the edge of the Lake Ontario plain in the transition zone to the Tug Hill, the Trout Brook subwatershed has a large agricultural base. Thus, although relatively large in size (12900 acres), this subwatershed has the second lowest coverage of natural land (76%). Many roads cross through this region and the roadless block score is the second lowest of the basin. In the final ranking scheme (Appendix 4), the Trout Brook subwatershed comes out second to last behind the Lower Salmon River.

Agricultural systems, however, play an important role in biodiversity conservation and maintenance. Many grassland birds, for example, depend on agricultural fields for nesting. Also, the open space and relatively unfragmented nature of agricultural systems is far more beneficial to wildlife than other commercial or residential developments.

Orwell-Pekin (ORPE)
Orwell Brook leaves the Salmon River between Pineville and Altmar and flows north through Orwell to “Tamarack Swamp” just south of Smartville. Pekin Brook initiates from the same swamp and joins Orwell Brook about two miles before the Salmon River.

Element occurrences

A bald eagle has chosen a nest site in the southern portion of this subwatershed recently, and a new pied-billed grebe nesting site was found as a result of surveys undertaken as a part of this project. A cluster of vernal pools, an inland poor fen, and a new site for pod grass (*Scheuchzeria palustris*) were newly documented in this subwatershed during the Salmon River Corridor project (Evans *et al.* 2005). Two headwater areas contain significant natural communities. A spruce-fir swamp and shallow emergent marsh at Pennock Bog near Chateaugay feed into Pekin Brook. A very large hemlock-hardwood swamp encompasses much of "Tamarack Swamp" to the north. This swamp crosses into the adjacent North Branch subwatershed.

Table 7. Element occurrences falling within or crossing into the "Orwell-Pekin" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11644	Pied-billed Grebe	CD	2005-06-15	A	N	
5979	Bald Eagle	C	2005-su	A		BBMC
11353	Shallow Emergent Marsh	B	2004-07-13	C		
11354	Spruce-Fir Swamp	B	2004-07-21	C		
10259	Hemlock-Hardwood Swamp	A	1997-07-14	C		NOBR
11616	Inland Poor Fen	A	2005	C		BBMC
11617	Vernal Pool	A	2005	C		
11623	Pod Grass	A	2005	P		

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

The Orwell-Pekin subwatershed, at nearly 13,000 acres, spans most of the Tug Hill Transition zone. In comparison with those further up on the Tug Hill, this subwatershed has relatively low forested cover (82%), a low roadless block score, and a lower than most others (but still quite impressive) percentage of streams within natural lands (93%). A fairly large number of roads (30 miles) and road/stream crossings (32) appear here. On the plus side, Orwell-Pekin has rare species present (above) and predicted: 3 rare animal species and 3 rare plant species are predicted for this subwatershed. See Appendix 4 for an itemization of all the metrics and ranking scores.

Canadian burnet (*Sanguisorba canadensis*) nearby South Branch Salmon River.

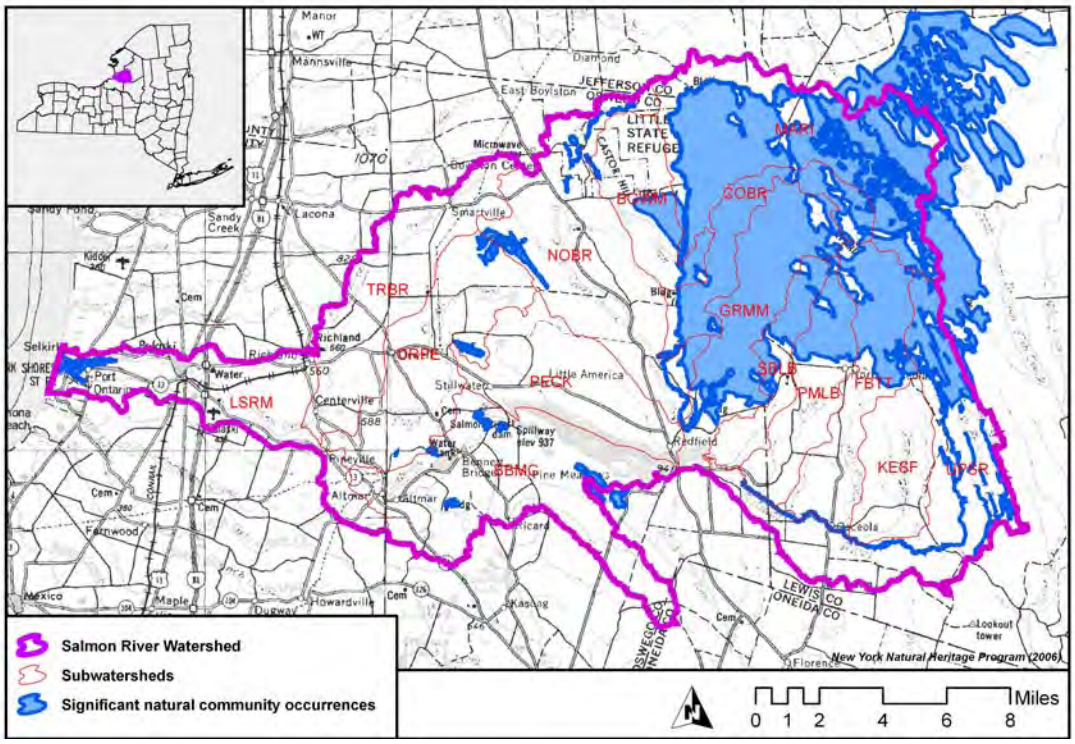


Figure 13. Significant natural community occurrences in the Salmon River Watershed.

Beaverdam Brook-Meadow Creek-Reservoir (BBMC)
The middle reach of the Salmon River, including the lower reservoir and upper reservoir (in part), fall into this subwatershed. This subwatershed also includes the tributaries flowing south from this stretch of the River. These tributaries include Beaverdam Brook and Pine Meadows Creek.

Element occurrences
A large, significant red maple-hardwood swamp occurs at the Fox Brook headwaters just south of the upper reservoir. Two vernal pool clusters are newly documented for this subwatershed via the Salmon River Corridor project (Evans *et al.* 2005).

There are two important species and significant natural community clusters in this subwatershed. The area within and around Sloperville Fen makes up a large wetland complex with a large peatland in its center. Here we have found a high-quality inland poor fen, the pitcher plant borer moth, lesser bladderwort, and a large great blue heron rookery. The inland poor fen was first described with information from both the Salmon River Corridor project and this project.

Another cluster of unique biodiversity occurs in the Salmon River Gorge. The cliffs at and downstream from the falls have rare plants (bird's eye primrose and yellow mountain saxifrage). A new sub-population of the primrose was found in the gorge during this study. We also updated (and extended) the occurrences for shale talus slope woodland and shale cliff and talus community in the gorge and mapped new significant occurrences for

calcareous shoreline outcrop, calcareous cliff community and floodplain forest for this project.

Table 8. Element occurrences falling within or crossing into the "Beaverdam Brook-Meadow Creek-Reservoir" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
33	Pitcher Plant Borer Moth	A	1992-09-16	A		
11491	Great Blue Heron	B	2004-05-11	A		
5979	Bald Eagle	C	2005-su	A		ORPE
7200	Red Maple-Hardwood Swamp	A	2004-07-22	C		
11605	Inland Poor Fen	A	2005-06-28	C	N	
3836	Shale Talus Slope Woodland	AB	2005-08-24	C	U	
6544	Shale Cliff and Talus Community	B	2005-06-29	C	U	
12013	Calcareous Shoreline Outcrop	B	2004-08-24	C	N	
12014	Calcareous Cliff Community	B	2005-08-24	C	N	
12015	Floodplain Forest	B	2005-08-24	C	N	
4261	Lesser Bladderwort	C	1997-07-19	P		
2370	Bird's-eye Primrose	B	2005-06-29	P	U	
6895	Yellow Mountain-saxifrage	B	2005-06-29	P	U	
11617	Vernal Pool	A	2005	C		ORPE
11621	Vernal Pool	A	2005	C		

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

At 19,700 acres the Beaverdam Brook-Meadow Creek-Reservoir subwatershed is the second largest in the basin. It has a relatively low amount of natural land cover (82%), and a relatively low roadless block score. The largest number of known dams are in this subwatershed (11), but these dams are spread throughout the second largest number of streams (70 miles). Combine this stream mileage with the second longest road mileage and the result is the largest number of road/stream crossings in the basin (46). See Appendix 4 for an itemization of all the metrics and ranking scores.

The final, overall rank for this subwatershed is low (fifth from last) however, as with the lower Salmon River, the biodiversity within this watershed forces us to take a second look. Element distribution models predicted eight different rare plant (3) and rare animal (5) species for this subwatershed and five different species at one single location. Strategies for conserving or otherwise protecting natural biodiversity within this watershed might be most appropriately targeted towards specific sites or species.

Pennock-Coey-Kenny (PECK)

Element occurrences

A few relatively small streams flow south into the northern side of the upper reservoir. These include Pennock Brook, Coey Creek, Kenny Brook, and some other unnamed streams. We lumped these together into a single subwatershed. Route 2, from about Chateaugay through

Stillwater and Little America to Redfield, travels through this subwatershed. Although this section is mostly forested with many wetlands in the northern regions, at this time we know of no significant natural communities or rare species in this subwatershed.

Subwatershed analysis
The Pennock-Coey-Kenny subwatershed falls into the middle of the pack for most of the analysis metrics. At 11,000 acres it is ninth of the 15 subwatersheds for size, 12th in natural land cover (90%) and roadless block score, and second from last in the proportion of natural land nearby streams (79%). This subwatershed sorts out to third from last in the final ranking. See Appendix 4 for an itemization of all the metrics and ranking scores.

North Branch (NOBR)
The North Branch Salmon River flows north from Redfield and is fed along its western side by Pine Creek (with headwaters in Tamarack Swamp) and Beech Creek. Beginning in Littlejohn Wildlife Management Area at the border of Jefferson and Oswego Counties, Cottrell Creek flows south and joins North Branch just south of Greenboro.

Purple flowering raspberry (*Rubus odoratus*) on shale cliff and talus community in the Salmon River Gorge.

Element occurrences
The Tug Hill Aquatics project (Hunt *et al.* 2005) recognized the highest quality streams and rivers in the Tug Hill. The very bottom of the North Branch where it co-mingles with the Mad River is classified as a confined river and recognized as one of these stream courses of statewide significance. This natural community occurrence (confined river) continues up the Mad River.

Most of the large hemlock-hardwood swamp that occurs partially in the Orwell-Pekin subwatershed is in this subwatershed. This is a very large, mature, and diverse wetland within a relatively large natural area. The hemlock-hardwood swamp is mapped at 350 acres but the entire wetland is much larger.

Heritage surveys of Wildlife Management Areas in the early 1990's turned up the significant spruce-fir swamp in Littlejohn WMA (New York Natural Heritage Program 1996). Extending over a small divide, this swamp crosses into the adjacent subwatershed (BGWM). Element distribution models also directed us to the Littlejohn WMA because of the short, steep slopes adjacent to Cottrell Creek. These slopes had a few unique seeps that were too small to map at this time, but otherwise were too short to support the shale slope communities predicted by the EDMs. However, these slopes have been an effective deterrent for most travel and human-induced disturbance along Cottrell Creek. The creek supports a mosaic of beaver – altered wetlands

and high quality floodplain forest. We mapped this high quality floodplain forest as a significant natural community during this project.

Table 9. Element occurrences falling within or crossing into the North Branch subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
2616	Spruce-Fir Swamp	B	1994-09-10	C		BGWM
11018	Confined River	A	2003-08-26	C		COBR, BRMM, MARI, BGWM
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, FBTT, GRMM, MARI, PMLB, SBLB, UPSR
11850	Floodplain Forest	AB	2005-06-15	C	N	
10259	Hemlock-Hardwood Swamp	A	1997-07-14	C		ORPE

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

At 17400 acres, North Branch is the third largest subwatershed in the basin. This subwatershed falls along the cusp between the Tug Hill Transition and Tug Hill Core zones and thus still has a larger proportion of agricultural lands than those solely in the Tug Hill Core. Amazingly, the proportion of natural land in the subwatershed, 96.5%, is only enough to make it ninth within the basin. The roadless block score is higher than the subwatersheds to the west, but lower than those in the Tug Hill Core. This subwatershed has many streams (69 miles), moderate road mileage (30), and a moderate number of stream/road crossings (33). North Branch falls out right in the middle of the pack with a rank of seventh. See Appendix 4 for an itemization of all the metrics and ranking scores.

Beaver-Gillmore-Willow-McDougal (BGWM)

From the North Branch, the Mad River forms a watershed too large for our assessment and we needed to divide it further. We merged the lowest portion (about 2.5 miles) with the Cold Brook subwatershed flowing from the east and the next portion (about 1 mile) with the series of tributaries flowing from the west, adjacent to Cottrell Creek. These tributaries include Beaver Creek, Gillmore (Gillman) Creek, Willow Creek, and McDougal Creek.

Element occurrences

Included in this subwatershed is the spruce-fir swamp on the Littlejohn WMA, a portion of the confined river occurrence on Mad River, and a mapped portion of the matrix-forming beech-maple mesic forest that makes up the major forest type in the Tug Hill.

Recall that the goal for NY Natural Heritage natural community tracking is to find and document all rare natural communities *and* all excellent examples of common natural communities (thus we apply the term *significant natural communities* for this entire set of tracked natural communities). The beech-maple mesic forest of the Tug Hill falls into the

latter category: a forest community common throughout the state but of particularly good quality here in the Tug Hill. We recognize this is a mostly working forest with timber harvest as a major component. However, the minimal intrusion of roads, the presence of core protected areas, and other factors all indicate an extensive, presumably viable forest ecosystem. The full delineation of this beech-maple mesic forest is not yet complete; much is mapped at a very coarse scale and more study is needed to determine the appropriate extent and precision for the huge natural community. We have mostly used the Mad River as the western edge of the forest, simply for convenience. Quality forest certainly extends west of this demarcation.

Table 10. Element occurrences falling within or crossing into the "Beaver-Gillmore-Willow-McDougal" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
2616	Spruce-Fir Swamp	B	1994-09-10	C		NOBR
11018	Confined River	A	2003-08-26	C		NOBR, COBR, BRMM, MARI
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		COBR, FBTT, GRMM, MARI, NOBR, PMLB, SBLB, UPSR

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

The Beaver-Gillmore-Willow-McDougal subwatershed is fully within the Tug Hill Core ecozone and the fourth smallest in the basin (6960 acres). It has the highest proportion of natural land (99.5%), the third from highest roadless block score, and the highest proportion of natural land near its streams (99.3%). We found no dams in this subwatershed and only 2.5 miles of roads with eight road/stream crossings. There was only one rare species predicted to have appropriate habitat within this subwatershed. The final assessment score for this subwatershed ranked it third overall. See Appendix 4 for an itemization of all the metrics and ranking scores.

Mad River (MARI)

The Mad River subwatershed occupies the northern portions of the basin. Beginning near Monteola, the north and south branches of the Mad River join, flow north, then east, then curve south to join waters flowing from other subwatersheds. This is the largest subwatershed, at 21,000 acres. A large portion of the upper reaches of this subwatershed are now owned and protected by The Nature Conservancy in its Tug Hill Conservation Area.

Element occurrences

One rare plant species is known to grow in this subwatershed. Jacob's Ladder (*Polemonium vanbruntiae*) is found in seepage areas and other wetlands in this part of the Tug Hill and in

the Catskills and adjacent High Allegheny Plateau. There are other populations just north of this subwatershed, outside of the basin, as well as populations of another rare plant, wild sweet-william (*Phlox maculata ssp. maculata*). We expect there are more locations for both of these species in the vicinity.

One rare animal species is known from this subwatershed as well. One male three-toed woodpecker was observed in 1999 along the Monteola road. These forests are perfect habitat for this species and, again, we expect more occurrences for this species if the forests are maintained in high quality.

The Mad River subwatershed also envelops a large number of significant palustrine (wetland) natural communities. These communities are relatively large, remotely located, relatively undisturbed by humans, and often a part of intact, natural beaver cycles. A series of these communities (mostly in Mad River Swamp) were originally documented and mapped in 1999 (Hunt & Lyons-Swift 1999). These communities include shrub swamp, sedge meadow, spruce-fir swamp and were updated as a part of this project. A second set of communities (mostly along Hooker Brook) were documented and mapped as a part of this project. These include black spruce-tamarack bog, sedge meadow, spruce-fir swamp, and shrub swamp.

Table 11. Element occurrences falling within or crossing into the "Mad River" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
6423	Three-toed Woodpecker	E	1999-09-10	A		
7873	Marsh Headwater Stream	A	2003-08-04	C		
11018	Confined River	A	2003-08-26	C		COBR, GRMM, NOBR, BGWM
9476	Spruce-Fir Swamp	A	2005-08-18	C	U	
40	Shrub Swamp	AB	2005-08-19	C	U	
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, FBTT, GRMM, NOBR, PMLB, SBLB, UPSR
9346	Sedge Meadow	A	2005-08-10	C	U	
11952	Black Spruce-Tamarack Bog	B	2005-07-15	C	N	
11953	Spruce-Fir Swamp	B	2005-08-18	C	N	
11954	Sedge Meadow	AB	2005-07-15	C	N	
11955	Spruce-Fir Swamp	AB	2005-08-19	C	N	COBR
12003	Shrub Swamp	B	2005-07-14	C	N	
3333	Jacob's-ladder	A	1999-07-08	P		

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

The Mad River subwatershed is the largest in the basin, at 21,000 acres. Holding 98% natural lands places it seventh based on this category. It has, however, a very high roadless block score, meaning that it intersects and/or contains the largest roadless blocks in the basin. We

found no dams within this subwatershed and there are only a few roads (20 miles). There were two rare plant species and one rare animal species predicted to have appropriate habitat in this subwatershed. In all, the Mad River rises to the top as the subwatershed with the highest landscape integrity. See Appendix 4 for an itemization of all the metrics and ranking scores.

Cold Brook (COBR)

Cold Brook begins near Otto Mills in Redfield and generally follows the same path, but just south, of Mad River. It is a narrow subwatershed, with a width less than a mile in most places.

Element occurrences

The confined river significant natural community on the Mad River crosses through the bottom of this subwatershed and a small portion of the newly documented spruce-fir swamp at Hooker Brook crosses into the top end of this watershed. The majority of the watershed consists of the matrix-forming beech-maple mesic forest described above in the BGWM section.

Table 12. Element occurrences falling within or crossing into the "Cold Brook" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11018	Confined River	A	2003-08-26	C		GRMM, MARI, NOBR
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, FBTT, GRMM, MARI, NOBR, PMLB, SBLB, UPSR
11955	Spruce-Fir Swamp	AB	2005-08-19	C	N	MARI

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

At 6,600 acres, Cold Brook is the third smallest subwatershed and, as all the subwatersheds in the Tug Hill core, has quite high percentage of natural land (4th highest: 98.6%). Cold Brook has the highest roadless block score. Interestingly, as with Mad River, this subwatershed ranked slightly lower for the amount of natural land adjacent to streams. Although we have not investigated fully, this pattern may be due to misclassification within the land use/land cover layer of the large sedge meadows and other beaver meadows in these subwatersheds or our lack of inclusion of the emergent wetland types into the "natural lands" group. At any rate, these apparent inconsistencies do

Inventorying floodplain forest on Cottrell Creek.

not play a large role in the overall assessment of these watersheds.

Cold Brook also has few roads (3.5 miles) and few stream/road crossings (six), making for a very low road crossings per stream mile metric (0.19). Overall, Cold Brook comes to second highest in the final subwatershed viability rank. See Appendix 4 for an itemization of all the metrics and ranking scores.

Grindstone-Mill-Muddy (GRMM)

Mill Stream rises from the North Branch Salmon River about one-half mile upstream from the upper reservoir at Redfield and continues up into the core of the Tug Hill. Tributaries to Mill Stream include Castor Brook and Grindstone Brook. Adjacent Mill Stream, a small tributary named Muddy Creek feeds directly into the reservoir and is included in this subwatershed.

Element occurrences

The major feature of this basin is the documentation of the high quality rocky headwater stream, encompassing most of Mill Creek and its tributaries. This natural community was inventoried and documented through an earlier project (Hunt *et al.* 2005) and apparently is in excellent condition. The matrix beech-maple mesic forest also extends nearly throughout this subwatershed.

Table 13. Element occurrences falling within or crossing into the "Grindstone-Mill-Muddy" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11018	Confined River	A	2003-08-26	C		COBR, MARI, NOBR
11019	Rocky Headwater Stream	A	2003-08-07	C		
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, FBTT, MARI, NOBR, PMLB, SBLB, UPSR

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

At 11,000 acres, Grindstone-Mill-Muddy falls in the middle of the pack for size. The metric for proportion of natural lands places it fifth (98.4%); the metric for proportion of streams in natural land places it fourth (98.6%). There are no dams in this subwatershed and about 12 miles of roads. With 57 miles of stream and 14 stream/road crossings, there are 0.25 road crossings per stream mile. Element distribution models predicted appropriate habitat for one rare animal species and two rare plant species. Overall, this subwatershed was ranked fifth. See Appendix 4 for an itemization of all the metrics and ranking scores.

Stony Brook-Line Brook (SBLB)

Stony Brook flows from the north into the Salmon River just east of the upper reservoir. About 2.5 miles upstream, Line Brook diverges and both continue in parallel up towards the old logging camp called New Campbellwood Wye on the USGS topographic maps. This is the smallest subwatershed, at about 4,600 acres and averages about 0.7 mile wide and about 7 miles long.

Element occurrences

Only the extensive beech-maple mesic forest matrix-forming significant natural community occurs in this subwatershed. We have no rare species documented within this subwatershed.

Table 14. Element occurrences falling within or crossing into the "Stony Brook-Line Brook" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	Cross-subw
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, FBTT, GRMM, MARI, NOBR, PMLB, UPSR

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

Snowmobile trail in summer on Littlejohn WMA.

Stony Brook-Line Brook is the smallest subwatershed (4600 acres) and is nestled between two larger, but similarly linear, watersheds. A very high proportion of this watershed is natural (98.6%) and a very high proportion of natural land occurs within the stream buffers (98.3%), based on our use of the term natural. Only about 5.7 miles of roads traverse this subwatershed but these roads help make up relatively smaller roadless blocks. This is reflected in a moderate roadless block score. Seven road crossings occur in this subwatershed, resulting in a road crossing per stream mile metric of 0.32. Element distribution models predicted appropriate habitat for one rare animal species and two rare plant species. Overall, this subwatershed was ranked sixth. See Appendix 4 for an itemization of all the metrics and ranking scores.

Prince-Mulligan-Little Baker (PMLB)

Prince Brook is the next major stream east of east of Stony Brook leaving north from the Salmon River. Prince Brook passes through North Osceola and ends at its headwaters just

south of New Campbellwood Wye. Mulligan Brook joins Prince Brook from the west just south of North Osceola. This subwatershed also includes Little Baker Brook, a small tributaries flowing directly into the Salmon River just upstream of Prince Brook.

Element occurrences
This portion of the Salmon River makes up the end of the second confined river significant natural community in the basin. This confined river occurrence extends from this portion of the Salmon River up to where Route 46 crosses and the river splits into the East and West Forks. The other known significant natural community within this subwatershed is the matrix-forming beech-maple mesic forest in the upper reaches of the subwatershed.

Table 15. Element occurrences falling within or crossing into the "Prince-Mulligan-Little Baker" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11013	Confined River	A	2001-10-03	C		FBTT, KESF, UPSR
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, FBTT, GRMM, MARI, NOBR, SBLB, UPSR

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis
At 7200 acres, the Prince-Mulligan-Little Baker subwatershed is fifth smallest. It has lower proportions of natural land (97%) and natural land within stream buffers (97%), primarily because of North Osceola and environs. There are no known dams, 14 miles of road, and 13 road stream crossings with a resulting 0.46 road crossings per stream mile. As with many of the adjacent subwatersheds, the element distribution models predicted appropriate habitat for one rare animal species and two rare plant species. Overall, this subwatershed was ranked tenth. See Appendix 4 for an itemization of all the metrics and ranking scores.

Sloperville Fen.

Fall Brook-Twomile-Threemile (FBTT)
Fall Brook merges with the Salmon River at Osceola, passing under Route 46 about 0.4 mile from the town's center. Crooked Brook, Onemile Creek, Twomile Creek, and Threemile Creek are all small tributaries to Fall Brook and included in this subwatershed. The top of the

subwatershed surrounds Wards Hill between New Campbellwood Wye and Old Campbellwood Wye.

Element occurrences
The extensive beech-maple mesic forest matrix-forming significant natural community occurs in this subwatershed. The confined river significant natural community of the East Branch also passes along (and makes up) the southern boundary of this subwatershed.

The only record for a rare species in the subwatershed is a New York State Museum herbarium specimen of a rare orchid (broad-lipped twayblade) from collected in 1927. We searched for this plant in 2005 but did not find it.

Table 16. Element occurrences falling within or crossing into the "Fall Brook-Twomile-Threemile" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11013	Confined River	A	2001-10-03	C		KESF, PMLB, UPSR
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, GRMM, MARI, NOBR, PMLB, SBLB, UPSR
180	Broad-lipped Twayblade	F	1927-06-24	P	U	

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis
At 9800 acres, Fall Brook-Twomile-Threemile is the tenth largest subwatershed in the basin. None of the other metrics help this watershed stand out either: it is tenth for percent natural land (95.4%), seventh for roadless block score, and ninth for the proportion of natural land within the stream buffer of 100m (96.3%). Our available information on dams located one in this subwatershed. Nineteen road crossings along 32 miles of stream works out to 0.59 road crossings per stream mile (sixth most for the basin). Overall, this subwatershed ranks eighth in our evaluation. See Appendix 4 for an itemization of all the metrics and ranking scores.

Keese-Smith-Finnegan (KESF)
The second smallest subwatershed is made up by Keese Brook, Smith Brook, and Finnegan Brook. They all merge before joining the Salmon River just east of Osceola.

Element occurrences
This subwatershed borders the Salmon River and contains the confined river significant natural community mapped for this River. We also discovered and mapped new significant natural communities within this subwatershed. Right at an inside corner of Osceola State Forest, south of Route 46 about three miles east of Osceola, is a small basin with a very nice dwarf shrub bog with high species richness. The outlet of this wetland feeds into Malloy Brook. The southeast corner of the wetland is on private land.

At the very northern headwaters of this watershed is a wetland that crosses the divide and appears to flow into both West Fork Salmon River and Finnegan Brook. A dwarf shrub bog fills the center of this wetland and a black spruce tamarack bog rings the edges. Most (if not all) of this bog flows into the West Fork where there are relatively recent signs of beaver-induced flooding. This peatland is now revegetating from this flooding. Periodic beaver flooding may be the dynamic that keeps this peatland and others in the region open and mostly free of trees.

Table 17. Element occurrences falling within or crossing into the "Keese-Smith-Finnegan" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11013	Confined River	A	2001-10-03	C		FBTT, PMLB, UPSR
12000	Dwarf Shrub Bog	B	2005-09-08	C	N	UPSR
12001	Dwarf Shrub Bog	B	2005-07-20	C	N	
12002	Black Spruce-Tamarack Bog	B	2005-09-08	C	N	UPSR

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

The Keese-Smith-Finnegan subwatershed is the second smallest at 6400 acres. It has a high proportion of natural land (98.8%, second highest) and natural land within the 100m stream buffer (98.7%, second highest). However, we found two dams in this subwatershed, and a relatively poor roadless block score (ranked tenth). The final score for this subwatershed was ninth. See Appendix 4 for an itemization of all the metrics and ranking scores.

Upper Salmon River (UPSR)

From the upper reservoir at Redfield, the Salmon River flows southeast by Osceola and then turns north as the West Fork and East Fork Salmon River. A series of tributaries flow south into the river and these we have separated into the four subwatersheds described immediately above. No such tributaries flow from the south, however, and thus we have kept the southern portion of this subwatershed together with the West Fork and East Fork subwatershed.

This subwatershed is sickle-shaped, beginning at the upper end of the upper reservoir and extending in a curve about 17 miles to the headwaters of the Mad River. Pickens Brook, West Fork Salmon River and East Fork Salmon River make up the major tributaries in this subwatershed.

Element occurrences

The Salmon River itself makes up a confined river significant natural community. This significant community extends as mapped for about eight miles along the mainstem of this portion of the Salmon River. This confined river also passes through the subwatersheds feeding into the Salmon River along this stretch. Much of the West Fork Salmon River is

mapped as significant marsh headwater stream and significant rocky headwater stream. Much of the East Fork Salmon River is mapped as significant rocky headwater stream.

As a part of this project, we documented and mapped a floodplain forest at the convergence between the West Fork and East Fork. This occurrence likely extends beyond the currently mapped extent. We also visited and updated the dwarf shrub bog at Salmon River Bog.

At the northwestern headwaters of this subwatershed is a wetland that flows mostly into West Fork Salmon River. A dwarf shrub bog fills the center of this wetland and a black spruce tamarack bog rings the edges. This peatland is now revegetating from beaver flooding; periodic beaver flooding may be the dynamic that keeps this peatland and others in the region open and mostly free of trees.

Table 18. Element occurrences falling within or crossing into the "Upper Salmon River" subwatershed of the Salmon River Watershed.

EOID	Element	Viability Rank	Last Observed	Elem. Type[2]	This Project[3]	cross-subw
11013	Confined River	A	2001-10-03	C		FBTT, KESF, PMLB
11015	Marsh Headwater Stream	AB	2001-10-02	C		
6603	Rocky Headwater Stream	AB	2001-09-12	C		
1052	Black Spruce-Tamarack Bog	AB	1999-06-23	C		
4633	Rocky Headwater Stream	AB	1999-07-29	C		
15	Dwarf Shrub Bog	AB	2005-09-07	C	U	
8599	Beech-Maple Mesic Forest	B	2001-05-30	C		BGWM, COBR, FBTT, GRMM, MARI, NOBR, PMLB, SBLB
12000	Dwarf Shrub Bog	B	2005-09-08	C	N	KESF
12002	Black Spruce-Tamarack Bog	B	2005-09-08	C	N	KESF
12012	Floodplain Forest	B	2005-09-09	C	N	

[1.] For viability rank definitions, see Table 2. [2] A=Animal, C = Community, P = Plant, O= Other. [3] U = Existing record updated during this project, N = New record created during this project. [4] If this element occurrence crosses into other subwatersheds, these are noted here.

Subwatershed analysis

The Upper Salmon River subwatershed is fourth largest, at 16,400 acres. It has a relatively moderate amount of natural land, both overall (97%) and within the 100m stream buffer (97%). This subwatershed is 5th in its roadless block score, and has the lowest (=best) proportion of road crossings per stream mile. These factors help bring the relative overall ranking for this subwatershed to fourth. See Appendix 4 for an itemization of all the metrics and ranking scores.

CONCLUSIONS

Our rare species and natural community inventories turned up new locations for rare animals, rare plants, and significant natural communities. We do not feel that all element occurrence locations are known for the entire Salmon River Watershed. Certainly more locations exist on private lands and in other locations we just did not have time or opportunities to visit.

With that said, however, the known locations of rare species and significant natural communities provide an excellent picture of both the general and specific patterns of biodiversity throughout the basin. Known rare species hotspots are present at the mouth of the Salmon River, within the Salmon River Gorge, and in a few of the larger peatlands in the basin, such as Sloperville Fen.

We can extend what we know about patterns in biodiversity with the spatial models of rare species (element distribution models). Although only a prediction of appropriate habitat for rare species, these models can help us view the basin from the perspective of a full map of where targeted species (in this case rare plants and animals) may be across the entire landscape (rather than just the known locations). This picture simply reinforces the perspective we gain from looking at only known locations: many rare species are clustered in a few locations in the basin but some are not. These clusters tend to occur towards the mouth of the watershed (Figure 14). Additionally, there is excellent potential for other rare species sites in the basin with additional survey effort.

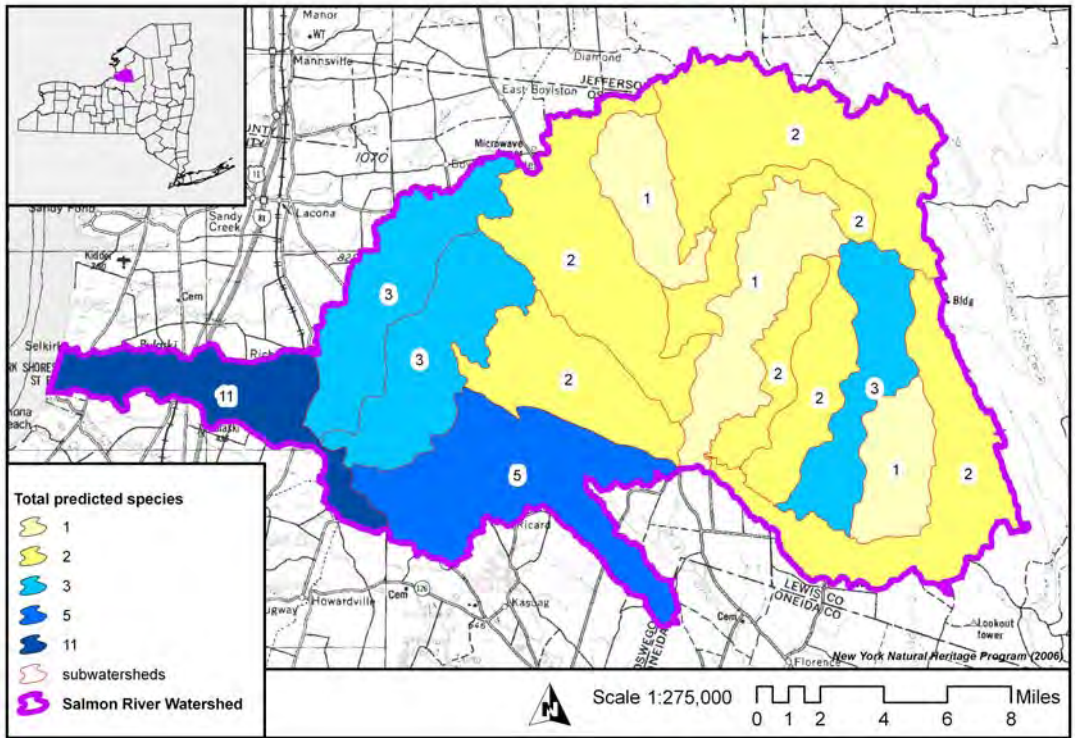


Figure 14. Element distribution model (EDM) 'hotspots' by subwatershed. Overlaps of all plant and animal EDMs are tallied and the highest number of overlapping models (the biggest predicted rare species hotspot) are noted for each subwatershed.

We gain a broader perspective of the basin as a whole and of the relative differences among locations throughout the basin by comparing different metrics of viability and biodiversity among subwatersheds. This analysis singles out the Mad River subwatershed as the subwatershed with the most intact landscape and the least anthropogenic disturbances, barriers, and alterations (Figure 15, Appendix 4). Cold Brook, a narrow subwatershed adjacent to Mad River on the south side comes in a close second. Indeed, the reason (in part)

for such a high number of significant natural communities in these subwatersheds is because natural communities are evaluated partly on the quality of the surrounding landscape (landscape context) and the high quality of the landscape is evident.

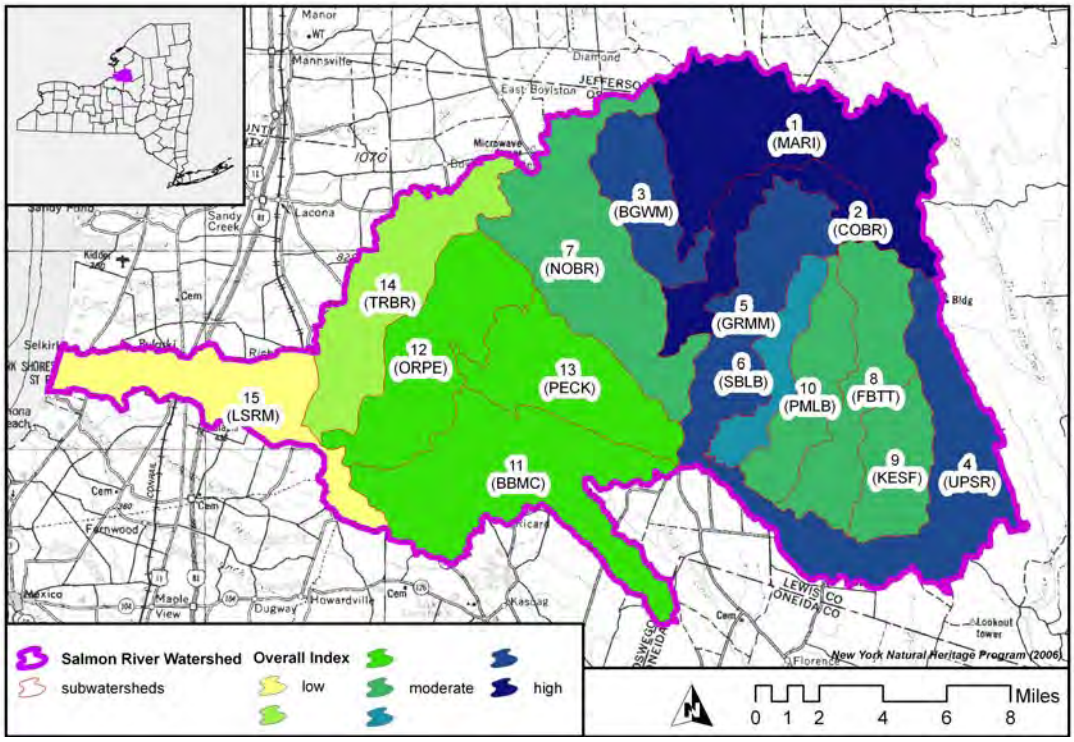


Figure 15. The final relative landscape ranking for the subwatersheds within the study area. Label numbers denote the final rank, similarly colored subwatersheds had close ranks.

Combining these two perspectives, the patterns of biodiversity and patterns of "landscape intactness" offers a useful dichotomy and permits two focal perspectives for conservation. First, the entire Salmon River Watershed crosses through very different ecosystems as it extends from the Lake Ontario shoreline to the top of the Tug Hill plateau. Any basin-wide conservation plan should have representation from all these broad ecosystems. The variation in species and natural communities is one surrogate representation of this and the divide between the Lake Ontario shoreline and the Tug Hill is clearly shown with the rare species hotspots at the mouth of the Salmon River and the very few rare species but a great many significant natural communities up on the Tug Hill.

A fine filter/coarse filter (Poiani *et al.* 2000) approach may be appropriate for targeted conservation actions in this basin. The "fine filter" in this approach refers to conservation actions based on individual species, groups of species, or other distinctly targeted elements (Figures 11, 12). The known biodiversity hotspots act as one set of fine filter targets. Other rare species locations, and perhaps very highly predicted rare species habitats, may act as another set of fine filter targets.

Natural communities, on the other hand, describe and represent species assemblages. Natural communities host a wide variety of species and good examples of natural communities will be most likely to harbor the most viable populations of the widest variety of species living in

the community. Conservation priorities based on natural communities represent a coarse filter conservation strategy in that all species within the natural community are at least in part captured by that conservation strategy.

In the same way, a conservation strategy based on the most intact subwatersheds is also a coarse filter approach. An evaluation of subwatersheds is appropriate and effective when evaluating larger landscapes such as the entire basin of the Salmon River and allows us to quickly narrow the perspective on relative landscape quality and viability. The information and tools presented in this report can help guide a multi-tiered conservation planning effort that focuses at the smaller scales of species, the small to large scales of natural communities, and the large scale of subwatersheds.

ACKNOWLEDGEMENTS

Linda Gibbs at the Tug Hill Commission (THC) and Linda Garrett at the Tug Hill Tomorrow Land Trust have been particularly helpful and supportive throughout this project. I thank them and other members of their organizations for the help they have provided. Tracey Tomajer at the Department of Environmental Conservation helped considerably securing funds, structuring and managing contracts, and even with difficult fieldwork. All participants in project planning meetings helped me refine my ideas and direct this work in general, including but not limited to: Linda Gibbs, Linda Garrett, Tracey Tomajer, Fran Verdoliva (NY DEC), Greg McGee (SUNY ESF), Peter Rosenbaum (SUNY Oswego), John Bartow (THC), Doug Thompson (The Nature Conservancy), Patrick Crast (The Nature Conservancy), and Michelle Peach (The Nature Conservancy). I am also grateful to The Nature Conservancy Tug Hill office for providing vehicular support for some of the fieldwork.

I had considerable help from other staff at the New York Natural Heritage Program on this project, including Jennifer Garrett for element occurrence mapping; Rachel Novak for element occurrence transcription quality control; John Schmid for providing previous landscape assessment methodologies in digital form; and Jennifer Garrett, Greg Edinger, Aissa Feldmann, and Greg McGee for reviewing early drafts.

Paul Novak, Jeff Corser, and Troy Weldy, all of the New York Natural Heritage Program conducted rare species inventories, as did other contractors, including Peter Rosenbaum and David Werier.

This work expands on work originally completed by David Hunt; his vision and thoroughness in earlier projects is recognized and respected here.

REFERENCES CITED

Anderson, M. G. 1999. Viability and spatial assessment of ecological communities in the Northern Appalachian Ecoregion. Ph.D. University of New Hampshire, Durham, NH. 224 pp.

Anderson, M. G. and C. Ferree. 2006. Predictive Distribution Models of two Rare Plant Species in the Eastern U.S. A report prepared for NatureServe, for a project commissioned by The US Fish and Wildlife Service. The Nature Conservancy, Eastern Resource Office. 12 pp.

Beauvais, G. P., D. A. Keinath, P. Hernandez, L. Master, and R. Thurston. 2004. Element distribution modeling: a primer.

Breiman, L., J. H. Friedman, R. A. Olshen, and C. J. Stone. 1984. Classification and Regression Trees. Chapman & Hall, New York.

Browning, D. M., S. J. Beaupre, and L. Duncan. 2005. Using Partitioned Mahalanobis $D^2(K)$ to Formulate a GIS-Based Model of Timber Rattlesnake Hibernacula. Journal of Wildlife Management 69:33-44.

Edinger, G. J., D. J. Evans, A. D. Finton, D. M. Hunt, L. Lyons-Swift, and A. Olivero. 2000. Community field form instructions: Community Forms 1, 2, & 3. New York Natural Heritage Program, Latham, NY.

Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt and A. M. Olivero, eds. 2002. Ecological communities of New York State, Second Edition (Draft for review). A revised and expanded edition of Reschke, C. 1990. Ecological Communities of New York State. New York Natural Heritage Program, Albany, NY. 136 pp.

Elith, J., H. Graham, P. Anderson, M. Dudik, S. Ferrier, A. Guisan, J. Hijmans, F. Huettmann, R. Leathwick, A. Lehmann, J. Li, G. Lohmann, A. Loiselle, G. Manion, C. Moritz, M. Nakamura, Y. Nakazawa, C. M. Overton, A. Townsend Peterson, J. Phillips, K. Richardson, R. Scachetti-Pereira, E. Schapire, J. Soberon, S. Williams, S. Wisz, and E. Zimmermann. 2006. Novel methods improve prediction of species' distributions from occurrence data. Ecography 29:129-151.

Engler, R., A. Guisan, and L. Rechsteiner. 2004. An improved approach for predicting the distribution of rare and endangered species from occurrence and pseudo-absence data. Journal of Applied Ecology 41:263-274.

Evans, D. J., P. G. Novak, and T. W. Weldy. 2005. Salmon River Greenway Corridor Wetlands Biodiversity Inventory. A report prepared for the Oswego County Department of Planning and Community Development. New York Natural Heritage Program, Albany, NY. 71 pp.

Furlanello, C., M. Meteler, S. Merler, S. Menegon, S. Fontanari, A. Donini, A. Rizzoli, and C. Chemini. 2003. GIS and the Random Forest Predictor: Integration in R for Tick-Borne Disease Risk Assessment. Proceedings of the 3rd International Workshop on Distributed Statistical Computing (DSC 2003) .

Growns, I. O. and J. A. Davis. 1991. Comparison of the macroinvertebrate communities in streams in logged and undisturbed catchments 8 years after harvesting. Australian Journal of Marine and Freshwater Research 42:689-706.

Guisan, A. and N. E. Zimmerman. 2000. Predictive habitat distribution models in ecology. Ecological Modelling 135:147-186.

Hunt, D. M. 2001. Saint Lawrence/Champlain Valley (STL) known or suspected, extirpated or extant lacustrine macrohabitats/alliances. New York Natural Heritage Program, Latham, NY.

Hunt, D. M., G. J. Edinger, A. L. Feldmann, J. J. Schmid, and C. N. Voight. 2005. Tug Hill: Stream System Inventory & Watershed Integrity Analysis. A report prepared for Central/Western Chapter of The Nature Conservancy. New York Natural Heritage Program, Albany, NY. 141 pp.

Hunt, D. M., G. J. Edinger, J. J. Schmid, D. J. Evans, P. G. Novak, A. M. Olivero, and S. M. Young. 2002. Lake Erie Gorges Biodiversity Inventory & Landscape Integrity Analysis. A report

prepared for the Central/Western New York Chapter of The Nature Conservancy. New York Natural Heritage Program, Albany, NY. 100 pp.
Hunt, D. M. and L. Lyons-Swift. 1999. Biodiversity Inventory of the John Hancock Lands on Tug Hill. A report prepared for Central/Western New York Chapter of The Nature Conservancy. New York Natural Heritage Program, Latham, NY. 90 pp.
Kennedy, C., J. Wilkinson, and J. Balch. 2003. Conservation thresholds for land use planners. Environmental Law Institute, Washington, D.C. 55 pp.
Lambert, J. D. and S. J. Hannon. 2000. Short-term effects of timber harvest on abundance, territory characteristics, and pairing success of ovenbirds in riparian buffer strips. Auk 117:687-698.
Liaw, A. and M. Wiener. 2002. Classification and Regression by randomForest. R News 2:18-22.
McNamara, R. 1999. Tug Hill. A four season guide to the natural side. 1st. North County Books, Utica, NY.
New York Natural Heritage Program. 1996. Littlejohn Wildlife Management Area Biodiversity Inventory Final Report. A report prepared for New York State Department of Environmental Conservation. New York Natural Heritage Program, Latham, NY. 19 pp.
Phillips, S. J., R. P. Anderson, and R. E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. Ecological Modelling 190:231-259.
Phillips, S. J., M. Dudik, and R. A. Scheffer. 2004. A Maximum Entropy Approach to Species Distribution Modeling. Proceedings of the 21st International Conference on Machine Learning .
Poiani, K. A., B. D. Richter, M. G. Anderson, and H. E. Richter. 2000. Biodiversity Conservation at Multiple Scales: Functional sites, landscapes, and Networks. BioScience 50:133-146.
Prasad, A. M., L. R. Iverson, and A. Liaw. 2006. Newer Classification and Regression Tree Techniques: Bagging and Random Forests for Ecological Prediction. Ecosystems 9:181-199.
R Development Core Team. 2005. R: A language and environment for statistical computing. 2005. R Foundation for Statistical Computing, Vienna, Austria.
Reschke, C., B. L. Bedford, N. Slack, and F. R. Wesley. 1990. Fen Vegetation of New York State. Ecological Society of America Annual Meeting, Snowbird, Utah.
Reschke, C. 1990. Ecological Communities of New York State. New York Natural Heritage Program, Latham, NY. 96 pp.
Rosenbaum, P. A. 2005. Surveys for uncommon dragonflies in Oswego County Wetlands and Trapping for Bog Turtles (Clemmys = Glyptemys muhlenbergii) at Sloperville Bog in Oswego County, New York. A report prepared for The New York Natural Heritage Program. SUNY - Oswego, Oswego, NY.
Royston, P., D. G. Altman, and W. Sauerbrei. 2006. Dichotomizing continuous predictors in multiple regression: a bad idea. Statistics in Medicine 25:127-141.
Sawchuck, D. J. 2006. Salmon River Falls Unique Area Unit Management Plan. New York State Department of Environmental Conservation, Altmar, NY. 35 pp.
State University of New York College of Environmental Science and Forestry. 1974. Resources of the Tug Hill Region. A report prepared for The Temporary State Commission on Tug Hill. State University of New York College of Environmental Science and Forestry, Syracuse, NY.
Tug Hill Tomorrow, I. 1996. Protecting Tug Hill's Land Legacy. Priorities for a Land Trust: Land Protection Projects in the Tug Hill Region. Tug Hill Tomorrow, Inc., Watertown, NY. 35 pp.
Zaniewski, A. E., A. Lehmann, and J. M. Overton. 2002. Predicting species spatial distributions using presence-only data: a case study of native New Zealand ferns. Ecological Modelling 157:261-280.

Appendix 1. Data source information for each environmental layer used in creating the element distribution models.

Variable	Description (units)	Categ-orical	Data Source	Method Citation[1]	Scale/ Resolution	Web source[2]
awc_mm	Available water holding capacity, area weighted median (mm)		USDA NRCS STATSGO		1:100,000	C
caco31t	Calcium carbonate in surface layer, area weighted median (% * 10)		USDA NRCS STATSGO		1:100,000	C
cec1t	CEC in surface layer, area weighted median (value * 10)		USDA NRCS STATSGO		1:100,000	C
clay1t	% clay in surface layer, area weighted (% * 10)		USDA NRCS STATSGO		1:100,000	C
Distcalc	Distance to nearest soil polygon containing calcium carbonate (m)		Derived from maxcaco31		1:100,000	
Geoclass	Bedrock Geology Class	yes	NYS Geological Survey (NYSGS)	in-house	1:250,000	
max_phh	Absolute maximum of regional percent pH ranges * 10		USDA NRCS STATSGO		1:100,000	C
Maxc31	Calcium carbonate in surface layer, maximum (% * 10)		USDA NRCS STATSGO		1:100,000	C
Min_phl	Absolute minimum of regional pH ranges * 10		USDA NRCS STATSGO		1:100,000	C
minav05	Average minimum temperature (°C/10) in May		USDA PRISM data	3	1 km	D
minav06	Average minimum temperature (°C/10) in June		USDA PRISM data	3	1 km	D
minav07	Average minimum temperature (°C/10) in July		USDA PRISM data	3	1 km	D
minav13	Average annual minimum temperature (°C/10)		USDA PRISM data	3	1 km	D
minex13	Annual record minimum temperature (°C/10)		USDA PRISM data	3	1 km	D
Nyaspect	Aspect (eight categories: N, NE, E, SE, S, SW, W, NW)	Yes	Derived from elevation		10 m	
Nyelev30	Elevation (m)		USGS Digital elevation model (DEM)		Horiz. – 30 m vert. – 0.1 m	A
Nyfreefm	Mean number of frost free days per year		USDA PRISM data	3	1 km	D
nygdd13	Total annual growing degree days		USDA PRISM data	3	1 km	D
Nynlcd83	National Landcover Data (NLCD) class	Yes	USGS		30 m	B
Nyslope	Slope (degrees)		Derived from elevation		10 m	
Om1t	% organic matter in surface layer, area weighted (% * 10)		USDA NRCS STATSGO		1:100,000	C
Perm1t	permeability of top layer (inches of water per hour * 10)		USDA NRCS STATSGO		1:100,000	C
Pet	Potential evapotranspiration independent of vegetation, AET + D, (mm)		Derived from solar radiation and temperature	2	30 m	B

Variable	Description (units)	Categ-orical	Data Source	Method Citation[1]	Scale/ Resolution	Web source[2]
ph1t	pH of top layer (pH * 10), area weighted average of median values		USDA NRCS STATSGO		1:100,000	C
prec05	Precipitation (mm) in May		USDA PRISM data	3	1 km	D
prec06	Precipitation (mm) in June		USDA PRISM data	3	1 km	D
prec07	Precipitation (mm) in July		USDA PRISM data	3	1 km	D
prec13	Total annual precipitation (mm)		USDA PRISM data	3	1 km	D
Solrad	Cumulative annual solar radiation (kJ/m^2)		Derived from monthly cumulative solar radiation		30 m	
surfg22	Surficial geology material (depositional method)	Yes	NYS Geological Survey (NYSGS)	in-house	1:250,000	
surfg35	Surficial geology material (depositional method)	Yes	NYS Geological Survey (NYSGS)	in-house	1:250,000	
Swb1i	Site water balance (swb) - cumulative annual water surplus or deficit (mm)		Derived from solar radiation and temperature	2	30 m	B
Topo18	Topographic index in a 540 m radius (index)		Derived from elevation	2	30 m	B
Topo3	Topographic index in a 90 m radius (index)		Derived from elevation	2	30 m	B
Topo33	Topographic index in a 990 m radius (index)		Derived from elevation	2	30 m	B
Topoall	Topographic index at radii of 90 m, 540 m and 990 m (index)		Derived from elevation	2	30 m	B
Twi_t	Terrain wetness indicator (TWI) based on modeled flow accumulation (index)		Derived from slope	1	30 m	

[1]. Method citation: 1. Beven & Kirby 1979, 2. Zimmerman 2001, 3. Daly *et al.* 1994

[2] Web sources for code or data: A. http://edc.usgs.gov/geodata/ B. http://www.wsl.ch/staff/niklaus.zimmermann/programs/aml.html#3 C. http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/ D. http://www.ocs.orst.edu/prism/ E.

Appendix 2. Digital GIS data used for inventory, mapping, and analysis, excluding those environmental layers used solely for element distribution modeling (see Appendix 1).

Notes on GIS maps and analysis in this report:

- All maps were created by the NY Natural Heritage Program (NYNHP) on contract with the Tug Hill Commission. These maps are intended for planning purposes only and shall not be used for engineering, survey, legal, or regulatory purposes.
- GIS software used: ArcGIS 9.1 (including ArcInfo Workstation, and ArcMap) and Spatial Analyst
- The GIS project files used to create the maps in this report are not portable because of network paths.

However, all maps are in image format (PDF) and may be obtained upon permission from NYNHP and the Tug Hill Commission.

I. Basemaps and Background Layers

1) USGS 1:250,000 Map Scans (image)
Source: NYS DEC, USGS
Description: the data set consists of scans of U.S.G.S. 1:250,000 quadrangle maps (Digital Raster Graphics), and purchased by DEC from the USGS in March 1998 and revised in 2000. NYNHP manipulated the colors for thematic purposes. For example, topographic lines and background area were made transparent so that feature data sets could be viewed cleanly "underneath".
Analysis Parameter: None

2) County Boundary (polygon)
Source: NYS Department of Transportation (DOT), NYS DEC
Description: This coverage was originally made by the DOT and modified by the DEC.
Analysis Parameter: None.

II. Boundaries

1) Watersheds (polygon)
Source: A cooperative effort by USDA Natural Resources Conservation Service, NYS Department of Environmental Conservation - Division of Water, and US Geological Survey - Water Division. Adapted by NYNHP.
Description: This is the definition datalayer of the study area and analysis units for the project. We developed this in-house by beginning with 11 digit Hydrologic Unit Coverage (HUC) watersheds, and then custom-delineating smaller watershed using the 1:24,000 USGS topographic quadrangle basemaps and the stream hydrology layer to define water flow.
Analysis Parameter: Used as the boundary layer for the analyses, it is the study area.
Supplied on accompanying CD as: Watersheds_HUC11, Watershed_noBuff, Watershed_2kmBuff

4) TNC Ecoregions or "Subsections" (polygon)
Source: The Nature Conservancy (TNC)
Description: Developed by TNC (ecoregional planning teams). Written justification for each modification is available through The Nature Conservancy's Ecoregional Planning Office. Scale is 1:7,500,000. Note this scale! Most other data in this report is at 1:100,000 or better, and is why these ecoregions may appear to not "match up."
Analysis Parameter: None

5) NY Ecozones
Source: NYS DEC
Description: Digitized from the statewide mylar map Ecological Zones of New York State, scale 1:500,000, prepared by DEC's Habitat Inventory Unit in the mid-1980's. The map by consolidates two source documents: N. Dickenson. 1983. Physiographic zones of southern and western New York. DEC manuscript; and G. Will, R. Stumvoll, R. Gotie and E. Smith. 1982. The ecological zones of northern New York. New York Fish and Game Journal 29: 1-25.
Analysis Parameter: None

III. Datalayers used in the Integrity Analysis and Maps
1) EPA Region II Multi-Resolution Landscape Characteristics (MRLC) (*Natural Land Cover*) (polygon)
Source: EPA, NYS DEC, and adapted by NYNHP
Description: This data set is maintained by the EPA Region II Office. The MRLC data set consists of 30 by 30-meter cells that correspond to an area on the earth. Each cell contains one of fifteen possible land cover types. Each pixel had one of the following values:

		Classified as Natural
1	·Water	Y
2	·Low Intensity Residential	
3	·High Intensity Residential	
4	·Hight Intensity Commercial/Industrial	
5	·Pasture/Hay	
6	·Row Crops	
7	·Other Grasses (other than pasture/hay, like golf courses)	
8	·Evergreen Forest	Y
9	·Mixed Forest	Y
10	·Deciduous Forest	Y
11	·Woody Wetlands	Y
12	·Emergent Wetlands	Y
13	·Barren; Quarries; Strip Mines, and Gravel Pits	
14	·Barren; Bare Rock and Sand (dunes)	Y
15	·Barren Transitional (including clear cut areas) – not in study area	
16	·No Data	

The land cover data used were interpreted from (Satellite Imagery) Landsat Thematic Mapper (TM), acquired in 1988, 1989, 1991, 1992, and 1993. While most of the leaves-off data sets were acquired in spring, a few were from late autumn. NYNHP converted this dataset to vector (polygon) coverage for analysis with other vector datasets. NYNHP selected a subset considered "natural" land cover (as noted above, rows 1, 8, 9, 10, 11, 12, 14).
Further Information: http://www.epa.gov/mrlc/sect1.html
Analysis Parameter: Used in the following parameters:
a) Natural Land subset of the EPA MRLC dataset as mentioned above
b) > 300 acre Natural Land Cover Blocks: just subset of the natural land cover dataset, of that size acreage
c) Natural Land in 100 meter Distance from Streams See 100m Distance from Streams.

c) Streams in Natural Land See Hydrography.
c) Streams in 100% Natural Land Upstream See Hydrography.
Supplied on accompanying CD as: MRLC, NaturalLand, NaturalLand_by_SubWtrShd

2) Hydrography *(Streams*)(line)
Source: NYS DEC, USGS, and adapted by NYNHP
Description: These data were being developed by the DEC (Division of Water and the Habitat Inventory Unit of the Division of Fish and Wildlife), as digital versions of the water features in the USGS 1:24,000 quadrangle maps. They are still in development stages.
Analysis Parameter:
a) Streams in Natural Land Automated selection using Natural Land Cover as the intersecting feature for streams that fell within natural land cover.
b) Density of Dams per Stream Mile See Dams.
c) Pollution Points per Stream Mile See Pollution Points.
d) Road Crossing Density per Stream Mile See Road/Stream Crossing.
Supplied on accompanying CD as: AllStreams, AllsurfWater, Fluvial100Buff_bySubW

3) Roads (line)
Source: NYS DEC, DMV, and DOT
Description: The Accident Location Information System (ALIS) project is a multi-agency project that the NYS Office of Cyber Security & Critical Infrastructure Coordination (CSCIC) is jointly developing with the NYS Department of Motor Vehicles (DMV) and the NYS Department of Transportation (DOT).A major component of the ALIS Project is the creation of an up-to-date statewide Geographic Information System (GIS) street map file containing all public roads, along with their street names, alternate/alias street names, route numbers, and address ranges on each street segment
Analysis Parameter:
a) Road Density Miles of roads per watershed acre.
b) Road Crossing Density per Stream Mile See Road/Stream Crossing.
c) Roadless Blocks.
Supplied on accompanying CD as: ALIS, RoadStreamCrossings

4) Roadless Blocks (polygon)
Source: NYNHP from datalayers acquired from NYS DEC
Description: Using the ALIS roads data NYNHP built a polygon coverage, using roads as boundaries for the polygons, to create blocks of roadless areas. The Lake Ontario lakeshore was hand-digitized and the waterbodies and Salmon River from the upper reservoir to Lake Ontario were added as their outer boundaries, resulting in these (wide rivers and reservoirs) becoming "roadless blocks" of their own.
Description of Roadless Block Score
The goal of developing this scoring method was to give greater credit to bigger blocks and some (but lesser) credit to smaller blocks. The Environmental law Institute (Kennedy *et al.* 2003) and others (Anderson 1999) recognize the relative importance of block size for wildlife, habitat, and natural communities.

NY Heritage developed the following score:

Roadless block score = 100*((2/(1+EXP(-(D2/100)*0.0045))-1))

The score asymptotes at approximately 125,000 acres (the range of bobcat) and increases steeply from about 1000 acres. Small blocks still receive some points (as these blocks still support species), but much fewer than larger blocks, as in the figure below:

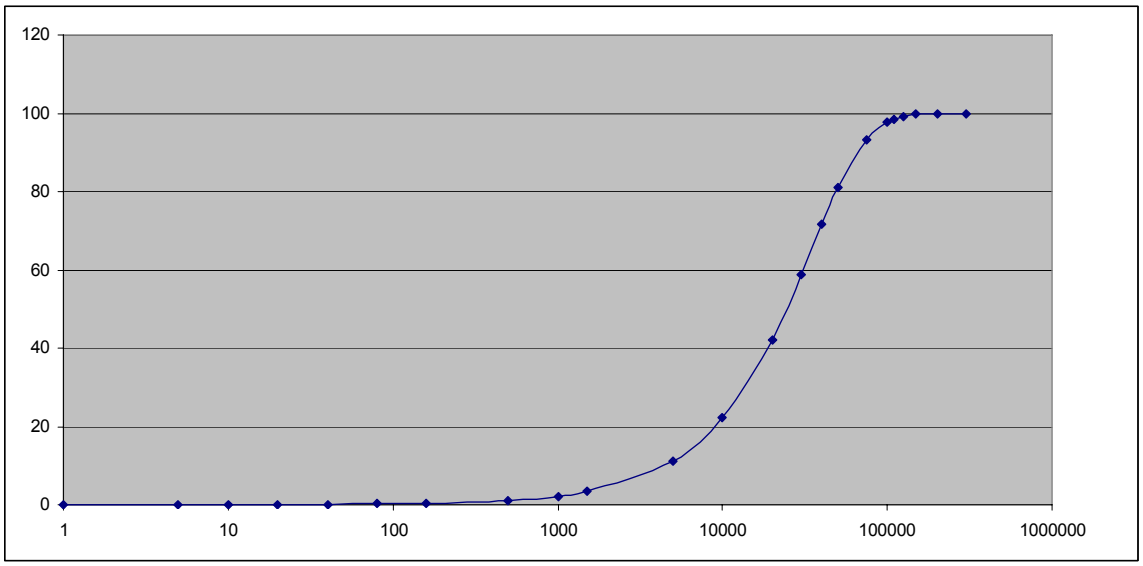


Figure A2.1. Roadless block score (Y-axis) as a function of roadless block size (X-axis, log transformed) in acres.

After each block is assigned a score, we calculated an area-weighted mean of roadless block scores for each subwatershed.
Analysis Parameter:
a) Roadless block score
Supplied on accompanying CD as: RoadlessBlocks_ALIS

5) Road/Stream Crossing Points (point)
Source: NYNHP
Description: Road features were intersected with stream features (both described above). Points were generated where these two features intersected.
Analysis Parameter:
a) Road Crossing Density per Stream Mile These point features per stream mile in a given watershed.
Supplied on accompanying CD as: RoadStreamCrossings

6) Dams (point)
Source: NYS DEC
Description: Metadata for this data set are not available at this time (2006). Point locations of dams located by DEC though out the study area.
Analysis Parameter:
a) Dam Density (Watersheds Analysis): Number of dams per stream mile.
Supplied on accompanying CD as: Not supplied – distribution restricted by NYS DOW.

7) Point Source Discharges (point)

Source: EPA BASINS
Description: Appended shapefiles containing Industrial Facilities Discharge, Permitted Compliance Systems for Permitted Discharges, Superfund Sites, and Toxic Release Inventory Site for Water Releases.
Analysis Parameter:
a) Point Source Discharges per Stream Mile
Supplied on accompanying CD as: not supplied – go to source

9) 100 meter Stream Distance from Streams (polygon)
Source: NYNHP
Description: Created by buffering the hydrography coverage line features (coverage described above), 100 meters.
Analysis Parameter:
a) Natural Land in 100 meter Distance from Streams 100m Distance from Streams was the intersecting feature that selected the natural land cover features.
Supplied on accompanying CD as: Fluvial100Buff_bySubW

V. Rare Plants, Animals, and Significant Natural Communities
1) NY Natural Heritage Program Rare Species and Significant Natural Communities (polygon)
Source: NYNHP
Description: This data set contains areal delineations of significant natural communities in the NYNHP database (as delineated by NYNHP ecologists) for selected functional landscape sites. These boundaries are true locations, at a scale of 1:24,000, and are dated June 2002.
Analysis Parameter: None.
Supplied on accompanying CD as: Not supplied – ever changing, request directly from Heritage.

Appendix 1 Literature Cited

Anderson, M. G. 1999. Viability and spatial assessment of ecological communities in the Northern Appalachian Ecoregion. Ph.D. University of New Hampshire, Durham, NH. 224 pp.

Beven, K. J. and M. J. Kirby. 1979. A physically based, variable contributing area model of basin hydrology. Hydrological Sciences Bulletin 24:43-69.

Daly, C., R. P. Neilson, and D. L. Phillips. 1994. A Statistical-Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. Journal of Applied Meteorology 33:140-158.

Kennedy, C., J. Wilkinson, and J. Balch. 2003. Conservation thresholds for land use planners. Environmental Law Institute, Washington, D.C. 55 pp.

Zimmerman, N. E. 2001. Arc Macro Language (AML) routines for solar radiation, climate mapping, evapotranspiration, topographic position, soil property, and site water balance.

(this page intentionally left blank)

Appendix 3. Rare species and significant natural community records for the entire Salmon River Watershed, sorted by common name.

Bald Eagle

(Haliaeetus leucocephalus)

EO number ABNKC10010 63 EO ID 5979

STATUS Heritage Global Rank: G5 Heritage State Rank: S2S3B,S2N

LOCATION

County: Oswego

Towns: Redfield and Orwell

USGS topographic quadrangle maps: Redfield and Orwell

Survey sites: Sensitive information, contact DEC.

OBSERVATION and QUALITY STATUS

Last observed: 2005-su

Occurrence quality: C - Fair estimated viability

Quality comments:

The rank is based on occupancy over nine years with successful reproduction (fledged young) in six out of the seven years.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 0.00

The birds have successfully fledged 10 or 11 young since 1998.

The area is privately owned and is very isolated, easily accessible only easily by a gated, private road. The nests are located a hundred feet or so from one another, in large white pines on a narrow peninsula alongside one of the wetlands. Associated species: great horned owl, scarlet tanager, great crested flycatcher, black capped chickadee, eastern kingbird, cedar waxwing, red eyed vireo, hairy woodpecker, downy woodpecker, and least flycatcher.

MANAGEMENT

Threats:

Disturbance by great horned owls is a potential threat.

Management Comments:

Monitor the nests for continued nesting in subsequent years.

ADDITIONAL COMMENTS

Beech-Maple Mesic Forest

Central Tug Hill Forest
EO number CTERFC0I00 14 EO ID 8599
STATUS Heritage Global Rank: G4 Heritage State Rank: S4
LOCATION
Counties: Lewis, Oswego, and Jefferson
Towns: Martinsburg, Redfield, West Turin, Osceola, Montague, and Worth
USGS topographic quad maps: Redfield, North Osceola, Worth Center, Sears Pond, Page, and High Market
Survey site: Central Tug Hill Forest
OBSERVATION and QUALITY STATUS
Last observed: 2001-05-30 Occurrence quality: B - Good estimated viability
Quality comments: This is a very large example of primarily second and third growth with a few scattered small patches of relatively mature forest, forming a substantial part of a very large forest matrix landscape with little or no paved or publicly accessible roads, but undergoing intensive logging.

ECOLOGICAL DATA

A hardwood forest averaging about 75% tree canopy cover. The tree canopy and sub-canopy include Acer saccharum (40%), Fagus grandifolia (40%), Betula alleghiensis (15%), Acer pensylvanicum (10%) and Prunus serotina (5%). Acer pensylvanicum is predominantly in the sub canopy. The tall shrub layer averages about 30% cover and includes Fagus grandifolia (20%), Acer pensylvanicum (10%) and Acer saccharum. The short shrub layer has about 30% cover and includes Viburnum lantanoides (20%), Acer saccharum, Acer pensylvanicum, and Fagus grandifolia. The herbaceous layer has 40% cover and includes Dryopteris intermedia (15%), Erythronium americanum (10%), Maianthemum canadense (7%), Lycopodium lucidulum (5%), and Polygonatum biflorum (5%). Other characteristic herbs include Trillium erectum, Trientalis borealis, Oxalis montana, Medeola virginiana, Aralia nudicaulis, Panax trifolius, Smilacina racemosa. The non-vascular layer has 5% cover and consists primarily of mosses on logs including Brachythecium sp., Dicranum scoparium, Hypnum imponens and Polytrichum commune. Common epiphytes include Ulota crispa and polypores. The most abundant vertebrate animals include white-tailed deer, black-throated green warbler, black and white warbler, black-throated blue warbler and red backed salamander. Canopy dominants vary locally between Fagus grandifolia-Acer saccharum patches to Betula alleghaniensis-Acer saccharum patches. Large areas of blowdown from the 1995 microburst are common, and tree canopy ranges from nearly 100% cover in undisturbed areas to 60% or less cover in areas of heavy selective logging. The most mature patches are over 80 years old but not old growth. Maturity indicators include pit and mound topography, large decayed logs and large canopy trees, the largest of which include (in cm dbh) Acer saccharum (60 to 75), Fagus grandifolia (60 to 80), Betula alleghaniensis (60), Picea rubens (60 to 70) and Prunus serotina (60 to 70). One 65 cm dbh Picea rubens was cored at 135 years old. Widespread regeneration of key beech maple mesic forest species is present primarily due to an absence of heavy deer browsing. The shrub layer cover is variable between mature areas and areas that have been more recently logged. Characteristic understory plants in recently logged areas include Brachyelytrum erectum, Rubus spp. and Dennstaedtia punctilobula. Canopy coverage in the best of sites approaches 100%, but these compose probably less than 2% of the land area and the majority of the forest is a degraded fragmented matrix of 40-60% canopy coverage with substantial areas, perhaps as much as 15% of the total land surface, brushy cleared land of recently harvested areas.

HABITAT DESCRIPTION

Size (acres): 51,460.00

This is the predominant forest type within a large relatively remote area representing approximately 121,000 acres of forest matrix on the central part of the Tug Hill Plateau. Beech-maple mesic forest co-occurs in the upland forest matrix with successional northern hardwoods and embedded small patches of spruce-northern hardwood forest that have recovered from past logging, spruce flats surrounding wetlands, and brushy cleared land in recently logged areas. Also embedded in the upland matrix are linear drainages which form a spectacular matrix of beaver impounded wetlands dominated by sedge meadow, shallow emergent marsh, shrub swamp, and spruce-fir swamp. Beech maple mesic forest developed on extensive 1300-1900 ft plateau with 200-inch-per-year lake effect snows, and has a cool, windy, and sharply seasonal microclimate. The forest is found on rolling bedrock influenced till plain composed in the north of bedrock-cored drumlinized northwest to southeast trending ridges of recessional moraine. The southern section of the community is ablation till of similar physiography with some additional ice-contact features and includes two deeply incised valleys of the Salmon River and the east branch of Fish Creek. Soils are coarse textured poorly sorted tills with a high (15-30%) coarse fragment content dominated by cobbles. The pre-settlement forest was most likely dominated by a complex mosaic of beech maple mesic forest, spruce-northern hardwoods, and spruce flats, most containing a super story of 100-130 ft tall Picea rubens.

MANAGEMENT

Threats:

Continuation of intensive logging is resulting in conversion of this community into successional northern hardwoods.

Management Comments:

The forest has excellent recovery potential due to widespread regeneration of key beech maple mesic forest species primarily due to an absence of heavy deer browsing. Establishment of a core area of several hundred acres which would exclude logging and allow recovery to an old-growth state is recommended. Focus this recovery on most mature sections (especially the wildlife management area). Adjust logging practices in surrounding areas to a state that sustains climax forest types. The size of the community can be increased and its condition improved by 1) allowing areas to recover regaining stand structure and composition, 2) ceasing road construction and new camp construction, 3) establishing a central roadless corridor, 4) establishing sustainable canopy coverage targets and average stand age goals, 5) eliminating some bisecting roads and lowering road width of existing roads to 8-10 feet, and 6) creating a moratorium on clear cutting and high grading. Low-impact, long rotation, ecosystem-based logging plans are recommended to assist with restoration of forest structure and composition.

ADDITIONAL COMMENTS

Inventory needs include: 1) conduct more field work to confirm or revise boundaries; 2) further locate, survey, and map the oldest and least logged core areas; 3) expand the map to the full extent of this principal occurrence and the survey site of up to about 150,000 acres using 1995 NAPP (National Aerial Photography Program) photos and 2000 digital ortho-images. Mapping of the west side of occurrence was updated slightly in 2004 and 2005 to pull the west boundary back to the east side of Mad River. More extensive field work should be done on this occurrence and all boundaries refined to represent the full principal occurrence and several possible sub-occurrences. Embedded wetland and other community types need to be delineated to get more accurate calculation of the acreage.

Bird's-eye Primrose

(Primula mistassinica)

Salmon River Falls

EO number PDPRI080D0 14 EO ID 2370

STATUS Heritage Global Rank: G5 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey site: Salmon River Falls

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-29

Occurrence quality: B - Good estimated viability

Quality comments:

There is an estimate of 500 plants within a well-protected and good quality shale cliff and talus slope woodland.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 1.00

B: A few hundred individuals are present within this population.

These plants are located in seepage areas of a shale cliff community. The partially shaded wet cliffs rising 100 feet or more above the creek bottom below. Vegetation covers approximately 25-50% of the area where the plants are located. Elsewhere the vegetation cover may approach 100%. The wet seepage areas seem to have some calcium and other mineral influences. Associated species: Apios americana, Apocynum cannabinum, Aquilegia canadensis, Aster prenanthoides, Carex aurea, Carex disperma, Carex flava, Conocephalum (liverwort), Cystopteris bulbifera, Eupatorium maculatum, Eupatorium rugosum, Lobelia kalmii, Lysimachia ciliata, Parnassia glauca, Prenanthes, Primula mistassinica, Saxifraga virginiensis, and Thalictrum dioicum.

MANAGEMENT

ADDITIONAL COMMENTS

See the Heritage GMF for precise locations.

Black Spruce-Tamarack Bog

Salmon River Bog

EO number CPALFP0G00 29 EO ID 1052

STATUS Heritage Global Rank: G4G5 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Lewis

USGS topographic quadrangle map: High Market

Survey site: Salmon River Bog

OBSERVATION and QUALITY STATUS

Last observed: 1999-06-23

Occurrence quality: AB - Excellent or good estimated viability

Quality comments:

This is a relatively small occurrence in good condition within a very large natural complex of communities with the upland matrix forest commonly under selective logging.

ECOLOGICAL DATA

This black spruce-tamaract bog has an open to closed-canopy with patches of dwarf shrub bog. This occurrence nearly completely surrounds a dwarf shrub bog to the inside of the wetland. Logging stumps are present in some locations but also many standing and fallen dead trees add to the diverse physiognomy and stand structure of the site. The tree canopy layer (15 m) has 45% cover and Picea rubens (30.0%), Larix laricina (20.0%), and Picea mariana (15%) as the most abundant species. The tall shrub layer (3 m) has 50% cover and Picea rubens (10%), Nemopanthus mucronatus (30%), Picea mariana (10%), Acer rubrum (5%), and Viburnum nudum (1.0%) as the most abundant species. The short shrub layer (1 m) has Viburnum nudum (10.0%), Vaccinium myrtilloides (6.0%), Nemopanthus mucronatus (25.0%), Acer rubrum (2.0%), and Rhododendron groenlandicum (<1%) as the most abundant species. The herbaceous layer includes Osmunda cinnamomea (50.0%), Carex trisperma (1.0%), Cornus canadensis (1.0%), Calla palustris, Sarracenia purpurea, Maianthemum trifolium, Maianthemum canadense, Gaultheria hispidula, Eriophorum angustifolium, and Clintonia borealis. The non-vascular layer includes Sphagnum (80.0%) and Bazzania trilobata (2.0%). Peat has a pH of 4.7 and offers no resistance to a corer >1m deep.

HABITAT DESCRIPTION Size (acres): 31.00

This is a moderate-sized occurrence in the shape of a thin doughnut. The shape index is 4.39 (Shumaker 1996). This community may be slowly replacing the dwarf shrub bog. If so, then the size is slowly increasing.

This peatland is mostly an open basin that is oriented northwest to southeast between two parallel ridges. The dwarf shrub bog in the center of the peatland grades into and is surrounded by the black spruce-tamarack bog. There are also small pockets of spruce-fir swamp at the north and south ends of the peatland complex and balsam flats/spruce flats on three islands and at some edges of the black spruce-tamarack bog. The surrounding uplands consist of beech-maple mesic forest that has been selectively logged in the past. Floodplain forest occurs along the Salmon River to the north and west and a small patch of hemlock-northern hardwood forest to the west.

MANAGEMENT

Threats:

The only threat is a potential nutrient run-off related to logging of surrounding forested uplands.

Management Comments:

Avoid logging of forested slopes around the perimeter of the peatland basin.

ADDITIONAL COMMENTS

Additional releve plots and additional survey to further distinguish the delineation between this community and the adjacent dwarf shrub bog are needed.

Black Spruce-Tamarack Bog

Hooker Brook

EO number CPALFP0G00 35 EO ID 11952

STATUS Heritage Global Rank: G4G5 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Montague

USGS topographic quadrangle map: Sears Pond

Survey sites: Hooker Brook

OBSERVATION and QUALITY STATUS

Last observed: 2005-07-15

Occurrence quality: B - Good estimated viability

Quality comments:

This community is a small occurrence in two patches in good condition but a little different species component than would normally be expected for this community type. This occurrence is located within an excellent forested landscape.

ECOLOGICAL DATA

This occurrence has a very open canopy with scattered spruce, fir, and tamarack. The tree canopy layer (5 m) has 15% cover and Picea mariana (12.0%), and Abies balsamea (3.0%) as the most abundant species. The tall shrub layer (2.5 m) has 5% cover and Picea mariana (5.0%) as the most abundant species. The short shrub layer (1.5 m) has 40% cover and Nemopanthus mucronatus (20.0%), Picea mariana (6.0%), Acer rubrum (5.0%), Vaccinium myrtilloides (3.0%), and Photinia melanocarpa (1.0%) as the most abundant species. The herbaceous layer has Carex trisperma (20.0%), Osmunda cinnamomea (7.0%), Carex gynandra (4.0%), and Carex seorsa (3.0%) as the most abundant species. Sphagnum is abundant (95.0%) in the non-vascular layer. The soil consists of peat at least 1m deep.

HABITAT DESCRIPTION Size (acres): 10.00

These patches are relatively small. The patches are relatively regularly shaped. The average shape index is 1.2 (Schumaker 1996).

This black spruce-tamarack bog occurs in two patches within a broad matrix of beech-maple mesic forest. Adjacent or nearby small patches include spruce-fir swamp, shrub swamp, sedge meadow, and shallow emergent marsh. Beaver activity is an integral component of fluvial dynamics along Hooker Brook and may influence the hydrology within these patches. Logging has been a very large component of this landscape in the past, however most of the adjacent upland forest is now under conservation protection and should improve in condition and viability over time.

MANAGEMENT

ADDITIONAL COMMENTS

Managed Area: East Branch Fish Creek Conservation Area. Inventory needs: Additional visits and plot data are needed to confirm quality, viability, composition, and identity of this community.

Black Spruce-Tamarack Bog

Finnegan Brook West Fork bog

EO number CPALFP0G00 36 EO ID 12002

STATUS Heritage Global Rank: G4G5 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Osceola

USGS topographic quadrangle map: North Osceola

Survey site: Finnegan Brook West Fork bog

OBSERVATION and QUALITY STATUS

Last observed: 2005-09-08

Occurrence quality: B - Good estimated viability

Quality comments:

A relatively small bog ringing a dwarf shrub bog in very good condition surrounded by a very large forest where logging is common.

ECOLOGICAL DATA

A black spruce-tamarack bog ringing a more open peatland (dwarf shrub bog). The tree canopy layer (6 m) averages about 25% cover and has Larix laricina (15.0%), Picea rubens (5%), and Acer rubrum as the most abundant species. The tall shrub layer (2.5 m) has 5% cover and Acer rubrum, Picea rubens, Nemopanthus mucronatus, and Viburnum nudum as the most abundant species. The short shrub layer (1 m) has about 20% cover and Nemopanthus mucronatus (10%), Vaccinium myrtilloides (5%), Acer rubrum (5%), Ilex verticillata (1%), and Viburnum nudum (1%) as the most abundant species. The vine layer has Rubus hispidus (2.0%) as the most abundant species. The herbaceous layer (1 m) has 50% cover and Osmunda cinnamomea (30%), Carex canescens (10%), Eriophorum angustifolium (5%), Gaultheria hispidula (1.0%), and Triadenum fraseri (0.3%) as the most abundant species. The non-vascular layer has Sphagnum (80%) as the most abundant species. Uncommon species include Cornus canadensis, Lycopodiella inundata, and Cypripedium acaule.

HABITAT DESCRIPTION Size (acres): 19.80

With the exception of possible adjustments to the boundary with dwarf shrub bog, the full extent of this occurrence is known. This occurrence is regularly shaped, in a thin, horseshoe shaped ring. The shape index is 2.54 (Shumaker 1996).

This black spruce-tamarack bog occurs around the edges of a small basin peatland that drains into the West Fork Salmon River. The center of the peatland has dwarf shrub bog and small patches of shrub swamp and possibly inland poor fen or sedge meadow. Uplands consist mostly of matrix beech-maple mesic forest. This is a working forest and logging is a common acitivity.

MANAGEMENT

Threats:

Logging near the edge of the wetland may adversely effect the hydrology, chemical composition, and sedimentation in this wetland.

Management Comments:

Managers should maintain buffers for any logging activities near the wetland.

ADDITIONAL COMMENTS

Additional research to confirm the classification to black spruce-tamarack bog is needed. For example, red spruce is more common than black spruce and Nemopanthus is a slightly confusing species for this community type.

Black Tern

(Chlidonias niger)

Salmon River Mouth

EO number ABNNM10020 16 EO ID 10414

STATUS Heritage Global Rank: G4 Heritage State Rank: S2B

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Salmon River Mouth

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-01

Occurrence quality: C - Fair estimated viability

Quality comments:

The rank is based on draft element occurrence specifications of 1988. Although the number of nesting pairs during the last four statewide surveys is lower than it had been in the previous two, the habitat is still excellent, the site is still used every year, and the occurrence is clearly still viable.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 343.54

The mouth of the Salmon River is a wide, expansive area with an open channel and a shallow open bay with several 'islands' of emergent vegetation. The vegetation is dominated by cattail with areas of bur-reed, and rushes as well as shallow pool areas with pickerel weed, water lily, and duckweed. There are also many muskrat houses and feeding platforms. Associated species: Botaurus lentiginosus, Circus cyaneus, Cistothorus palustris, Podilymbus podiceps, Sterna caspia, and Sterna hirundo.

MANAGEMENT

Threats:

The north shore of the Salmon River is heavily developed and the river is heavily used by boaters and fishermen. Disturbance from motorboats and fishermen may be a problem. This could contribute to reduced numbers of nesting pairs in recent years or may be completely unrelated.

ADDITIONAL COMMENTS

Confirmed breeding occurred in 1983 within the Breeding Bird Atlas block: 3982D. The site referred to by Carroll (1988) as Selkirk Shores State

Park is probably this site. Significant Habitat Unit file: 38011.

Broad-lipped Twayblade

(Listera convallarioides)

Osceola

EO number PMORC1N050 6 EO ID 180

STATUS Heritage Global Rank: G5 Heritage State Rank: SH

LOCATION

County: Lewis

Town: Osceola

USGS topographic quadrangle map: North Osceola

Survey site: Osceola

OBSERVATION and QUALITY STATUS

Last observed: 1927-06-24

Occurrence quality: F - Failed to find

Quality comments:

Potential habitat remains, but no plants were found.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres):

Wetland.

MANAGEMENT

ADDITIONAL COMMENTS

Calcareous Cliff Community

Salmon River Gorge

EO number CTEROC0Q02 22 EO ID 12014

STATUS Heritage Global Rank: G4 Heritage State Rank: S3

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey site: Salmon River Gorge

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-24

Occurrence quality: B - Good estimated viability

Quality comments:

A relatively small series of calcareous cliffs in very good condition within a small but contained and protected landscape.

ECOLOGICAL DATA

This cliff community occurs along the Salmon River above the lower reservoir and usually rises right from the edge of the river. Portions are shaded by trees and shrubs above the cliffs or from vegetation on small ledges. Most of the cliffs are very steep to vertical and vary from dry to wet from seeping water. Alnus incana and Rubus odoratus are infrequent on ledges or along the cliff edges. The herbaceous layer has Parnassia glauca (11.7%), Deschampsia cespitosa (11.7%), Lobelia kalmii (6.7%), Primula mistassinica (5.0%), Cystopteris bulbifera (3.3%), Symphyotrichum ciliolatum (2.7%), Conioselinum chinense (1.7%), Cystopteris fragilis (1.7%), Symphyotrichum lanceolatum (1.0%), and Prenanthes alba (1.0%) as the most abundant species. Mosses and liverworts are also common.

HABITAT DESCRIPTION Size (acres): 6.30

This is a moderate-sized occurrence and may be larger as some cliffs upstream may be more appropriately included in this occurrence. Currently, this occurrence is made up of two linear, regularly shaped polygons.

This cliff community occurs in two patches among a range of natural community types in the Salmon River Gorge. These communities include shale talus slope woodland, calcareous shoreline outcrop, floodplain forest, and shale cliff and talus community. Successional northern hardwood forest and young beech-maple mesic forest occur outside of the gorge on both sides. Roads, pipelines, and other anthropogenic disturbances are nearby outside of the gorge.

MANAGEMENT

ADDITIONAL COMMENTS

Some cliffs upstream may more appropriately be included in this occurrence.

These cliffs are nearly vertical, so to calculate the size of the community, polygon surface area was added to the estimated area of the cliff face (= average height * length). Thus 3.21 aerial acres + (13m * 955m = 3.07 acres) = 6.28 acres.

Calcareous Shoreline Outcrop

Salmon River Gorge and Salmon River Falls

EO number CTEROC0F02 22 EO ID 12013

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey sites: Salmon River Gorge and Salmon River Falls

OBSERVATION and QUALITY STATUS

Last observed: 2004-08-24

Occurrence quality: B - Good estimated viability

Quality comments:

A moderate-sized shoreline outcrop in many patches along the Salmon River. Herbaceous species diversity is relatively high and maintained by periodic releases from the upstream dam.

ECOLOGICAL DATA

This outcrop community occurs along the Salmon River between the upper and lower reservoir and is regularly flooded and scoured by ice and water. Vegetation grows primarily in cracks in the bedrock. Shrubs are common along the edges of this community and Spiraea tomentosa and Spiraea alba sometimes grow in the cracks. Common herbaceous species include Oenothera perennis, Carex flava, Danthonia spicata, Drosera rotundifolia, Equisetum sp., Erigeron sp., Eupatorium perfoliatum, Houstonia caerulea, Hypericum ellipticum, Lycopus americanus, Osmunda regalis, Parnassia glauca, Pilosella piloselloides, Prunella vulgaris, Spiranthes lucida, Symphyotrichum ontarione, Triadenum fraseri, Trichophorum alpinum, and Lobelia kalmii. Bare rock covers the majority of the surface (about 60%) along with pools and running water (35%).

HABITAT DESCRIPTION Size (acres): 5.40

This is a medium to small sized occurrence. It occurs in regular to irregular shapes, the average shape index is 1.8 (Shumaker 1996). The size depends, in part, on disturbance regime. The disturbance regime here is unlikely to change and thus the size of this community is probably pretty stable. This occurrence is currently mapped as eleven patches. More patches are likely.

This community makes up the bare, flat, outcrops along the Salmon River between the upper and lower reservoir. Patches occur both above and below the falls. Floodplain forest is commonly adjacent this community, with shale talus slope woodland, calcareous cliff community, and shale cliff and talus slope communities nearby. On the uplands outside of the gorge, forests are generally successional or logged.

MANAGEMENT

Management Comments:

Hydrologic dynamics should be maintained and perhaps even higher variability in flood regimes should be introduced into this system.

ADDITIONAL COMMENTS

Additional plots are needed during different times of the year to capture the full complement of species at this community.

Confined River

East Branch Salmon River

EO number CRIV000C00 9 EO ID 11013

STATUS Heritage Global Rank: G4 Heritage State Rank: S3S4

LOCATION

Counties: Oswego and Lewis

Towns: Osceola, Redfield, and Lewis

USGS topographic quadrangle maps: Redfield, North Osceola, and Florence

Survey site: East Branch Salmon River

OBSERVATION and QUALITY STATUS

Last observed: 2001-10-03

Occurrence quality: A - Excellent estimated viability

Quality comments:

The occurrence is moderate sized with good diversity in excellent condition in a large natural landscape with limited disturbances.

ECOLOGICAL DATA

A 3rd to 4th order, gently sloping, riffle/run dominated stream with low sinuousity located on the Tug Hill Plateau. Reaches are variously dominated by riffle, riffle/run, riffle/run/pool, and run segments. Physical habitats include abundant cobble riffles and cobble runs; scattered cobble, gravel and sand pools; and sparse gravelly to sandy runs. Riffles include mid-channel riffles, several riffle braids, and one 1m tall waterfall. Pool types are diverse and include numerous lateral scour pools, some lateral log dam pools, lateral eddy pools, small riffle pools, and a few mid-channel confluence pools. Runs include some deep mid-channel basins. The channel averages 11 m wide (3 to 22 m range) with narrow, shaded upper reaches to wide open lower reaches. Physiognomy varies from sparsely vegetated areas to riffles with dense cover of epilithic algae. No mussel beds were observed. Morphometric features include: numerous channel braids (up to 4 or 5 braids in some areas), laterally undercut banks, mid-channel and lateral cobble bars, and submerged gravel bars. Smaller scale features include emergent boulders, abundant coarse woody debris (including large leaning dead trees), underwater rock cavities, leaf packs, local sand to silt pockets (1% of stream), and foam clusters. The stream is reportedly a good trout stream with high integrity and has high water quality. Vegetation consists primarily of submerged non-vascular aquatic plants, which range from 3% cover in pools to 30% cover in riffles. Dominant flora includes epilithic green algae (21%), Fissidens fontanus, (<1%), and Cardamine pensylvanica (<<1%). Fauna is diverse and includes at least 4 fish, 17 caddisfly, 7 mayfly, 7 stonefly, 4 true fly, and 2 beetle species. Dominant fauna include Brachycentrus appalachia (1015/m2), Chironomidae (606/m2), Heptageniidae (309/m2), Psilotreta (223/m2), Nectopsyche (180/m2), Goera (146/m2), Hydropsychidae (137/m2), Rhinichthys atratalus (1/m2), and Isonychia (60/m2). Other characteristic animals include Eurylophella, Helicopsyche, Glossosoma, Rhyacophila, Cambarus robustus, and Hexatoma.

HABITAT DESCRIPTION Size (acres): 33.70

The stream is 7.7 miles long including 4.4 miles of 4th order segments and 3.3 miles of 3rd order segments. Width ranges from 3 to 22 meters; average width is 11 meters.

This occurrence consists of a gently sloping, riffle/run dominated stream with low sinuosity on the lower slopes of the Tug Hill Plateau. The stream is fed by a complex of headwater streams (rocky and marsh types) and feeds into a short main channel stream before flowing into a large reservoir (a barrier to upstream movement). Riverside communities associated with the stream include scattered small patches of riverside sand/gravel bar, cobble shore, eroding slope, with narrow strips of bordering wetlands (shrub swamp and floodplain forest), and occasional swales and backwater sloughs. Banks average about 130 cm tall. Uplands buffering the streams include primarily beech-maple mesic forest and hemlock-northern hardwood forest on terraces and hill slopes, with local areas of successional southern hardwoods. The watershed is large and contains about 98% forest, primarily second to third growth. The stream is near the edge of a large contiguous forested area of about 121,000 acres and about 85% forested. It is bisected by 3 road crossings and centered within 4 roadless areas, each of hundreds of acres.

MANAGEMENT

Threats:

Threats include increased trash, turbidity levels, and introduction/spread of riverside exotic plants, especially at and downstream of road crossings; increased development and forest clearing in the watershed, especially along banks and within a 0.1 mile buffer of stream, causing increased upland runoff and nutrient loading; unsustainable fish harvest; stocking of fish, especially brown trout, and subsequent alteration of trophic structure of stream.

Management Comments:

Minimize or eliminate trash and siltation/erosion at bridge crossings, especially at Oseola Road crossing. Monitor road crossings for exotic plants, especially invasive species, and ideally prevent use of contaminated road-fill at these crossings. Expand the natural buffer along the stream at Osceola to prevent further erosion from existing lawns. Maintain the hydrological integrity, especially by minimizing nutrient input into the stream and avoiding disturbances within the stream buffer. Ideally avoid stocking fish. Maintain the landscape integrity, especially high percent forest cover and mature forest throughout the buffer.

ADDITIONAL COMMENTS

Conduct more intensive surveys for additional reaches, sample plots in additional habitat types, perform large-scale fish quantification, expand species lists, conduct water quality assessment, determine the extent of exotic species, more critically evaluate upstream and downstream boundaries, and seek out additional literature. The stream has been designated as a unique stream by the Tug Hill Commission.

Confined River

Mad River
EO number CRIV000C00 11 EO ID 11018
STATUS Heritage Global Rank: G4 Heritage State Rank: S3S4
LOCATION
Counties: Jefferson, Oswego, and Lewis Towns: Montague, Redfield, and Worth
USGS topographic quadrangle maps: Worth Center, Sears Pond, and Redfield
Survey site: Mad River

OBSERVATION and QUALITY STATUS

Last observed: 2003-08-26` Occurrence quality: A - Excellent estimated viability
Quality comments:
The midreach stream is moderately large with only few and minor disturbances, good habitat and species diversity, and intact hydrology in a large natural landscape with 100% forest cover and only a few minor road crossings.

ECOLOGICAL DATA

A 3rd to 4th order moderate to gently sloping, fast flowing, riffle/run/pool codominated stream with low sinuosity on the Tug Hill Plateau. Water is circumneutral, cool, and very clear. Reaches vary, dominated by riffles, riffle/run, riffle/pool and riffle-run-pool. Physical habitats include abundant bedrock riffles, runs and pools, cobble riffles and runs, scattered cobble pools, and sparse gravel riffles and pools and, in lower reaches, sandy runs and pools. Pool types are diverse and include numerous lateral scour pools, some dam pools, a few shore pools, at least 2 large mid-channel eddy pools, and at least 3 plunge pools (to 20 m wide). Riffle types include several small waterfalls (the largest of which is 5 m tall Mad River Falls) and torrential rapids. The channel averages 7 m wide (2 to 12 m range) at low flow and 20 m wide at high flow, with narrow, shaded upper reaches to wide open lower reaches. The flow is permanent but fluctuates between low flow and bankfull conditions. Low flow discharge varies along the length of the community from about 0.14 to 0.64 m3/sec. Low flow dimensions include a depth of about 2 cm to at least 4 m (23 cm average). Riffles average 104 cm/sec at low flow. Physiognomic types include sparsely vegetated areas, mid-channel riffles and runs with dense cover of epilithic algae, and a few lateral riffles with dense cover of bryophytes. No mussel beds were observed, however one area of scattered Margaritifera margaritifera was observed in upper reaches. Morphometric features include: stairstep cascades, rocky chutes, several areas of channel braids, (up to 4 or more braids in some areas such as the mouth of mad river), laterally undercut banks, mid-channel and lateral cobble bars, and, in deep pools, submerged bedrock pavement shelves, vertical cliffs, and boulder fields. Smaller scale features include emergent and submergent boulders (to 3 m wide), abundant coarse woody debris (including large overhanging and submergent dead trees), underwater rock cavities, local sand flats (<1% of stream in deep pools), twig piles, local submerged peat chunks (in upper reaches), foam clusters in pools, and bedrock potholes. The stream is about 35 km (22 miles) long, about 50% each of which is 3rd and 4th order segments. Flora is dominated by the submergent non-vascular layer, ranging from 18% cover in pools to 45% cover in runs. Dominant species, mostly in submerged aquatic layers, are epilithic green algae (30%), Eurynchium riparioides (3%), blue-green algae (3%), Brachythecium sp. (1%), and Fissidens cristatus (1%). Other characteristic flora include Scapania sp. in runs. Fauna is diverse and includes at least 5 fish, 2 mollusk, 10 caddisfly, 6 mayfly, 3 stonefly, and 2 true fly species. Dominant fauna include Simulidae (200/m2), Hydropsychidae (106/m2), Brachycentrus cf. appalachia (71/m2), Heptageniidae (101/m2), Perlidae (50/m2), Metrobates (7/m2), Rhinichthys atratalus (2/m2), Ephemera (3.9/m2), and Margaritifera margaritifera (1.2/m2). Other species include Etheostoma flabellare, Semotilus atromaculatus, Cambarus robustus, Psephenidae, Isonychia, Goera, Neophylax, and Psilotreta.

HABITAT DESCRIPTION

Size (acres): 61.00

The midreach stream is long and of moderate width with an essentially regular shape for the community type, although with relatively narrow upper transitional reaches and 3 areas of heavily braided channel. The community is not patchy; there is only one small, partial intrusion. The total size is stable, with naturally dynamic boundaries and is probably slowly expanding from headward erosion above and shrinking from lateral erosion at lower end.

A moderate to gently sloping, riffle/run/pool codominated midreach portion of a large stream complex draining the southwest section of the Tug Hill Plateau. The banks are vegetated and natural. Associated shoreline communities include abundant cobble shore and calcareous shoreline outcrop. Stream banks are bordered by narrow bands of shrub swamp or shallow emergent marsh in the upper reaches, shale cliff and talus community and one local eroding slope in the middle reaches, and upland forests elsewhere. Stream buffer is mostly upland forest including hemlock-northern hardwood forest and successional northern hardwoods, with local patches of mowed lawn in the lower reaches. The main stem of the stream is fed by a large marsh headwater stream. Along its length, the stream is fed laterally by numerous small to large streams, mostly rocky headwater stream with some intermittent streams. The middle portion of the stream merges with a main channel stream with an indistinct transition. The downstream end transitions into a main channel stream shortly before emptying into a large reservoir. The watershed is large, about 50,000 acres, and has about 95% forest communities. Most of the Mad River watershed is 100% forested. The stream is centered within two large contiguous forested areas of about 120,000 and 60,000 acres with about 85% forest cover. The stream is bisected by only 4 roads: two paved roads along the lower 3 miles, and two dirt roads. It is centered within 3 areas unbisected by paved or publicly accessible roads: the upper and mid/lower 50% of segments within such an area of 120,000 acres, the mid/upper 40% of segments within such an area of 40,000 acres, and the lower 10% of segments within such an area of 1,000 acres.

MANAGEMENT

Threats:

Threats include increased impacts at road crossings, especially from pollution and exotic species introduction into stream corridor; any fish stocking; unsustainable fish harvest; additional road crossings or bank stabilization; septic runoff from camps; intensive logging in forest buffer; impounments. The largest imminent threat is probable spread of Tussilago farfara throughout the lower 50% of the stream. The elevated culvert at Little John Drive ford is the largest disturbance and is a persistent threat to upstream migration.

Management Comments:

Maintain hydrologic and biotic integrity of the stream, including sparse road crossings, high forest integrity in the buffer and watershed. Ideally restore flow at Little John Drive ford by replacing the dike and culvert with a high suspension bridge that minimizes impacts to flow and banks. Avoid additional road crossings and impoundments. Monitor distribution and abundance of Tussilago farfara. Monitor road crossings for new exotic plants entering stream corridor, especially Polygonum cuspidatum.

ADDITIONAL COMMENTS

Conduct more intensive surveys for additional reaches, sample plots in additional habitat types (substrate type-flow combinations, pysiognomic types, unusual features), perform large-scale fish quantification (especially for game fish), expand species lists, refine species abundances, examine seasonal differences, conduct a water quality assessment, quantify suspected disturbances and the extent of exotic species, more critically evaluate upstream and downstream boundaries, and refine the map of special large scale habitat features. Refine collected biota identifications to a finer level for algae and insects. Use biotic indices to evaluate water quality.

Review the NYS Department of Environmental Conservation fish and macroinvertebrate data. Seek out additional literature and expert knowledge.

Deep Emergent Marsh

Salmon River Pulaski

EO number CPALOM0A00 26 EO ID 1844

STATUS Heritage Global Rank: G5 Heritage State Rank: S5

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Salmon River Pulaski

OBSERVATION and QUALITY STATUS

Last observed: 2001-08-07

Occurrence quality: B - Good estimated viability

Quality comments:

This is a moderate size, diverse marsh with localized exotics, partially protected by a state park, in a moderately fragmented landscape.

ECOLOGICAL DATA

A moderate size shallow emergent marsh with localized exotics. The emergent aquatic layer has 88% cover. The most abundant herbaceous species are Typha latifolia (70%), Pontederia cordata (25%), and Peltandra virginica (8%). Other characteristic species are Nuphar variegata, Nymphaea odorata, Scirpus acutus, and Sparganium eurycarpum. The marsh is seasonally flooded.

HABITAT DESCRIPTION Size (acres): 81.28

AB.

A moderate size deep emergent marsh at the mouth of the Salmon River where it flows into Lake Ontario. The deep emergent marsh grades into and forms a mosaic with shallow emergent marsh. Patches of marsh occur as islands in the midreach stream. The deep emergent marsh tends to occur closer to the mouth of the river while the shallow emergent marsh occurs upstream and in patches near the upland. Shrub swamp and floodplain forest occur upstream of the shallow emergent marsh. A bridge crosses the river east of the deep emergent marsh at Rte 3, bisecting the wetland. The area beneath the bridge is most similar to an open successional upland. Shallow emergent marsh occurs west and east of the bridge. The landscape also includes a spit with a pier to the west, successional northern hardwoods and pine plantations to the south, and cropland and residences to the north and east. The marsh is partially contained within an approximately 425 acre area unbisected by paved roads that is approximately 70% natural area.

MANAGEMENT

Threats:

Disturbances: dredging of the channel opening to Lake Ontario, construction of the Route 3 bridge, and water level regulation of Lake Ontario. Invasive exotic plants including Lythrum salicaria and Hydrocharis morsus-ranae have about 5% cover. Threats: spread of exotic species. Further development in the immediate landscape.

Management Comments:

Monitor and possibly control invasive plants.

ADDITIONAL COMMENTS

Inventory needs: releve plot.

Dragon's Mouth Orchid

(Arethusa bulbosa)

Brennan Beach Fen

EO number PMORC04010 1 EO ID 7714

STATUS Heritage Global Rank: G4 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Brennan Beach Fen

OBSERVATION and QUALITY STATUS

Last observed: 1994-06-22

Occurrence quality: A - Excellent estimated viability

Quality comments:

Outstanding occurrence, a phenomenal number of plants.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 20.00

A large poor fen, just inland of the barrier beach east of Lake Ontario. The fen grades into shrub carr and eventually forest to the east. There is fill along the west edge. Flat/open to partial shade, saturated on Sphagnum hummocks either in open or beneath Myrica gale-Cassandra shrub canopy. Associated species: Carex lasiocarpa, Carex exilis, Potentilla palustris, Aarracenia calopogon, etc.

MANAGEMENT

ADDITIONAL COMMENTS

Dwarf Shrub Bog

Salmon River Bog

EO number CPALOP0N00 42 EO ID 15

STATUS Heritage Global Rank: G4 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Lewis

USGS topographic quadrangle map: High Market

Survey site: Salmon River Bog

OBSERVATION and QUALITY STATUS

Last observed: 2005-09-07

Occurrence quality: AB - Excellent or good estimated viability

Quality comments:

This community is a moderate-sized dwarf shrub bog in very good condition within a very large natural complex of communities with the upland matrix forest commonly under selective logging.

ECOLOGICAL DATA

A diverse shrubland community dominated by evergreen heaths on deep acidic peat. The center of the bog mat is dominated by taller Nemopanthus shrubs with less evergreen, dwarf shrubs. The tree canopy layer (5% cover, 10 m tall) includes Larix laricina (2%) and Picea mariana (2%). The tall shrub layer (5% cover) consists of Larix laricina (3%) and Picea marina (2%). The short shrub layer (85% cover) includes Chamaedaphne calyculata (50%), Picea mariana (8%), Nemopanthus mucronatus (15%), Vaccinium myrtilloides (5%), Aronia melanocarpa (5%) and Ledum groenlandicum (12%). The herbaceous layer (25% cover) includes Carex trisperma (12%), Rhynchospora alba (7%), Eriophorum spissum (5%), Carex canescens (2%) and Sarracenia purpurea (<1%). The non-vascular layer (70% cover) consists of Sphagnum spp. (70%). Animals include black flies, deerflies, dragonflies, white-throated sparrow, white-tailed deer and black-capped chickadee. Soil at this site is organic and consists of live peat (0-10 cm deep), fibrous peat/root mat (10-30 cm deep, von post scale=h2), very well decomposed peat (30-60 cm deep, von post scale=h7, pH 4.4, 2.5y) and black muck (60-100 cm deep, h10). The site is stone free, regularly inundated and very poorly drained.

HABITAT DESCRIPTION Size (acres): 23.00

The size may be decreasing if the edges continue to convert to black spruce-tamarack bog. The bog has an elongated, oval shape with a shape index of 1.99 (Shumaker 1996).

The dwarf shrub bog occupies the center of a 60 acre, half mile long peatland complex. The peatland itself is mostly an open basin peatland that is oriented north to south between two parallel ridges. The dwarf shrub bog grades into and is surrounded by a black spruce-tamarack bog. There
are also small pockets of spruce-fir swamp at the north and south ends of the peatland complex. In addition, there are small upland islands and thin bands of spruce flats within the site. The surrounding uplands consists of a beech-maple mesic forest that has been selectively logged in the past (>20 years).

MANAGEMENT

Threats:

The only threat is a potential nutrient run-off related to logging of surrounding forested uplands.

Management Comments:

Avoid logging of forested slopes around the perimeter of the peatland basin.

ADDITIONAL COMMENTS

It is difficult to determine separation of dwarf shrub bog and black spruce tamarack bog at this site.

Dwarf Shrub Bog

Finnegan Brook West Fork bog

EO number CPALOP0N00 60 EO ID 12000

STATUS Heritage Global Rank: G4 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Osceola

USGS topographic quadrangle map: North Osceola

Survey site: Finnegan Brook West Fork bog

OBSERVATION and QUALITY STATUS

Last observed: 2005-09-08

Occurrence quality: B - Good estimated viability

Quality comments:

This is a small to moderate-sized dwarf shrub bog that apears to be participating in a long-term dynamic with beaver-induced flooding. A mosaic of patch types are present throughout the bog which is in good condition overall and located in a very good landcape of mostly working forest.

ECOLOGICAL DATA

This dwarf shrub bog is a variable mosaic of patches with most closely matching the dwarf shrub bog community and others resembling inland poor fen, sedge meadow, and possibly shrub swamp. Ilex verticillata, Picea mariana, Larix laricina, and Abies balsamea are present, in local patches, in the tall shrub layer (> 2m). The short shrub layer (1 m) has Chamaedaphne calyculata (55%), Nemopanthus mucronatus (10%), Rhododendron groenlandicum (5%), Picea mariana (1%), Photinia pyrifolia (1%), Larix laricina (1%), Kalmia angustifolia (1%), and Vaccinium myrtilloides (<1%), as the most abundant species. The herbaceous layer has Eriophorum angustifolium (5%), Triadenum fraseri (4%), Carex stricta (3%), Carex canescens (1%), Sarracenia purpurea (<1%), and Maianthemum trifolium (<1%) as the most abundant species. The non-vascular layer has Sphagnum (25%) as the most abundant species. At the site of the 2005 releve plot, peat was deeper than 1.5m with a pH of 3.9.

HABITAT DESCRIPTION Size (acres): 5.30

This is a relatively small occurrence, especially for the northern part of the state. It is elongated but otherwise regularly shaped, in one patch with a shape index of 2.02 (Shumaker 1996).

This dwarf shrub bog occurs in the center of a small basin peatland that drains into the West Fork Salmon River. The edges of the peatland is black spruce-tamarack bog. Uplands consist mostly of matrix beech-maple mesic forest. This beech-maple mesic forest is a working forest and logging is a common acitivity.

MANAGEMENT

Threats:

Logging near the edge of the wetland may adversely effect the hydrology, chemical composition, and sedimentation in this wetland.

Management Comments:

Managers should maintain buffers for any logging activities near the wetland.

ADDITIONAL COMMENTS

This occurrence is not a perfect fit with dwarf shrub bog and varies along its length. The occurrence has patches with high percentages of graminoids that might be better classified as inlaand poor fen; a few patches close to the outlet have denser, taller shrubs approaching shrub swamp. Overall as a mosaic, dwarf shrub bog seems most appropriate but additional evaluation is needed.

Dwarf Shrub Bog

Malloy Brook Bog and Malloy Brook

EO number CPALOP0N00 61 EO ID 12001

STATUS Heritage Global Rank: G4 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Osceola

USGS topographic quadrangle map: Florence

Survey sites: Malloy Brook Bog and Malloy Brook

OBSERVATION and QUALITY STATUS

Last observed: 2005-07-20

Occurrence quality: B - Good estimated viability

Quality comments:

A small dwarf shrub bog in a small, contained basin in excellent condition within large landscape undergoing active forest management.

ECOLOGICAL DATA

This dwarf shrub bog sits in a small basin surrounded by forest. At one randomly located plot, the short shrub layer (0.3 m) has 75% cover and Chamaedaphne calyculata (50.0%), and Andromeda polifolia (25.0%) as the most abundant species. The herbaceous layer has Utricularia cornuta, Rhynchospora alba, Eriophorum angustifolium, and Drosera rotundifolia. A fruticose lichen is abundant (55%) in the non-vascular layer, while Sphagnum is only present in low abundance. The vegetated mat covers nearly all of the basin, however, a few small open water patches are present. Other species present in other locations of the bog include Carex megellanica ssp. Irrigua, Menyanthes trifoliata (moat edges), Calopogon tuberosus, Drosera intermedia, Sarracenia purpuria, and Woodwardia virginica.

HABITAT DESCRIPTION Size (acres): 8.30

This is a relatively small occurrence, the full extent is known as it occurs as a single patch in a confined basin. It is regularly shaped, with a shape index 1.30 (Shumaker 1996).

This dwarf shrub bog has maple-basswood rich mesic forest and beech-maple mesic forest surrounding it. Nearby Malloy Brook and Salmon River
have a large, rich, floodplain forest along their banks. The forest upslope (N and NE) was recently (2004-2005) logged.

MANAGEMENT

Threats:

Disturbance to the hydrology suppporting this occurrence threatens the quality of this occurrence. Such disturbances include eroded skidder trails and cutting too close to the wetland.

Management Comments:

Maintain a buffer to the wetland where no cutting or surface disturbances will occur.

ADDITIONAL COMMENTS

Managed area: Malloy Brook State Forest.

Floodplain Forest

Cottrell Creek Redfield

EO number CPALFM0A00 52 EO ID 11850

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S2S3

LOCATION

County: Oswego
Town: Redfield

USGS topographic quadrangle maps: Worth Center and Boylston Center

Survey sites: Cottrell Creek Redfield

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-15
Occurrence quality: AB - Excellent or good estimated viability

Quality comments:
This is a moderate-sized floodplain forest in excellent condition with a high diversity of plants within a very large landscape.

ECOLOGICAL DATA

This floodplain forest occurs in relatively large linear patches along this section of Cottrell Creek and at least one of its tributaries, alternating with beaver-influenced wetlands. These wetlands include pools, meadows, and shrub swamps. Some portions appear to have been left relatively untouched by human disturbance for many years; evidence for late-successional forests include very large (e.g. 79 cm dbh) and old trees (spalling bark of yellow birch), large standing snags (94 cm dbh), and a rich understory. Community composition varies depending on the hydrologic regime (some localities seem to collect runoff or hold moisture longer than others) however the overall composition approximates the following. The tree canopy layer (18 m) has 60-90% cover and Betula alleghaniensis (35.0%), Acer saccharum (12.7%), Fraxinus americana (5.7%), Tsuga canadensis (2.5%), and Tilia americana (1.7%) as the most abundant species. The tree subcanopy layer (9 m) has Acer saccharum (3.5%), Betula alleghaniensis (1.0%), and Tilia americana (0.7%) as the most abundant species. The tall shrub layer (2.5 m) is relatively sparse overall and has Acer saccharum (0.8%), Picea rubens (0.7%), Fagus grandifolia (0.7%), Tilia americana (0.3%), and Acer rubrum (0.3%) as the most abundant species. The short shrub layer has Viburnum lantanoides (2.0%), Corylus cornuta (0.7%), Rubus pubescens (0.5%), Acer saccharum (0.3%), and Betula alleghaniensis (0.2%) as the most abundant species. Rubus pubescens (0.2%) is a common vine. The herbaceous layer (0.5 m) has 48.7% cover and Veratrum viride (17.5%), Thelypteris noveboracensis (17.3%), Onoclea sensibilis (12.2%), Matteuccia struthiopteris (4.7%), Athyrium filix-femina (4.0%), Caltha palustris (2.5%), Thalictrum dioicum (1.5%), Solidago gigantea (1.2%), Thalictrum dasycarpum (0.8%), Caulophyllum thalictroides (0.7%), Solidago canadensis (0.5%), Carex laxiflora (0.5%), Carex haydenii (0.5%), Glyceria striata (0.5%), Cardamine pratensis (0.3%), Carex projecta (0.3%), Laportea canadensis (0.3%), Tiarella cordifolia (0.3%), Uvularia sessilifolia (0.3%), Angelica atropurpurea (0.3%), Dryopteris intermedia (0.2%), Ranunculus hispidus (0.2%), and Carex bromoides (0.2%) as the most abundant species.

HABITAT DESCRIPTION Size (acres): 88.60

This is a relatively narrow and linear occurrence. Average shape index is 2.86 (Shumaker 1986). It occurs in five patches with about 550 meters as the widest distance between patches. Some portions are in a dynamic with beaver. The size is potentially increasing.

This floodplain forest occurs in relatively large linear patches along this section of Cottrell Creek and at least one of its tributaries, alternating with beaver-influenced wetlands. These wetlands include pools, meadows, and shrub swamps. While the beaver-influenced communities participate in a long-term successional dynamic, this forest appears to be avoiding this dynamic for the most part. Upland communites surrounding the floodplain forest include beech-maple mesic forest and spruce-northern hardwood forest. Nearby wetland communities include spruce-fir swamp, hemlock-hardwood swamp, shrub swamp, and of course Cottrell Creek which is mostly rocky headwater stream. Active snowmobile trails pass through the floodplain forest and the adjacent natural areas.

MANAGEMENT

Threats:

Additional and an intensifying of vehicular traffic threatens the quality of this community. Forestry activities must be buffered by enough distance upslope so as to not create forest edges or increased siltation on the ground surface and in the stream running through the floodplain forest.

Management Comments:
Managers should strive to minimize impacts of vehicular traffic (e.g. erosion, siltation, compaction, alteration of hydrology) and fragmentation. Particularly, pay attention to summer maintenance of snowmobile trails and year-round maintenance of nearby dirt roads.

ADDITIONAL COMMENTS

Additional floodplain forest may be present upstream or downstream from the currently delineated sections.

Floodplain Forest

East Fork Salmon River

EO number CPALFM0A00 53 EO ID 12012

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S2S3

LOCATION

County: Lewis

Town: Lewis

USGS topographic quadrangle maps: Point Rock, High Market, and Florence

Survey sites: East Fork Salmon River

OBSERVATION and QUALITY STATUS

Last observed: 2005-09-09

Occurrence quality: B - Good estimated viability

Quality comments:

This floodplain forest is moderate to large-sized and likely extends upstream and downstream from what is currently described. Some portions are in very good condition, other portions show signs of recent human disturbance. The surrounding landscape very large and overall in good condition.

ECOLOGICAL DATA

This floodplain forest occurs on both low fllats with heavily braided stream channels and narrower streamside terraces adjacent higher-energy stream reaches. The tree canopy layer (19.7 m) has 83% cover and Acer saccharum (59.2%), Betula alleghaniensis (15.0%), Tsuga canadensis (3.3%), Fraxinus americana (1.8%), Fraxinus pennsylvanica (1.7%), Acer rubrum (1.7%), and Tilia americana (0.8%) as the most abundant species. The tree subcanopy layer (3 m) has 1.7% cover and Acer saccharum (1.2%), Tsuga canadensis (0.5%), and Ulmus americana (0.5%) as the most abundant species. The tall shrub layer (0.5 m) has 0.5% cover and Fagus grandifolia (1.2%), Acer saccharum (0.8%), Picea rubens (0.3%), and Ostrya virginiana (0.3%) as the most abundant species. The short shrub layer has Viburnum lantanoides (5.8%), and Acer saccharum (4.2%) as the most abundant species. The herbaceous layer has Deparia acrostichoides (10.5%), Matteuccia struthiopteris (5.8%), Dryopteris intermedia (5.8%), Onoclea sensibilis (5.0%), Athyrium filix-femina (4.2%), Osmunda claytoniana (3.8%), Thelypteris noveboracensis (3.3%), Carex intumescens (2.5%), Asarum canadense (1.7%), Maianthemum canadense (0.8%), Polystichum acrostichoides (0.3%), Solidago flexicaulis (0.3%), Caulophyllum thalictroides (0.3%), Carex scabrata (0.2%), and Solidago canadensis (0.2%) as the most abundant species.

HABITAT DESCRIPTION Size (acres): 137.00

As mapped, this is a moderate-sized occurrence. However this floodplain forest likely extends both upstream and downstream. It is long and narrow in most locations, but otherwise with a relatively regular edge. There are some recoverable acres. It is currently mapped in fifteen (15) patches.

A floodplain forest along approximately seven kilometers of East Fork Salmon River. Small patches of hemlock-northern hardwood forest abut this community in places where steep, west-facing slopes reach the floodplain. Beech-maple mesic forest forms a matrix around these communities as well as other nearby (and sometimes adjacent) wetlands. Logging has occurred within some of the floodplain forest and some of the privately held adjacent uplands. However, other landowners did not cut within a buffer to the stream and floodplain and the floodplain is more mature. Portions of the forest on public land is also more mature. A paved road bounds the forest on the south side and the stream is crossed by one or more skidder trails.

MANAGEMENT

Management Comments:

Create a buffer that excludes logging along this riparian corridor.

ADDITIONAL COMMENTS

This occurrence likely extends both upstream and downstream.

Floodplain Forest

Salmon River Gorge

EO number CPALFM0A00 54 EO ID 12015

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S2S3

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey site: Salmon River Gorge

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-24

Occurrence quality: B - Good estimated viability

Quality comments:

A relatively small floodplain forest sporting very high diversity and a wide range of substrate and physiognomic types in a moderately-sized and moderate-condition landscape.

ECOLOGICAL DATA

This floodplain forest occurs in patches along the Salmon River between the upper and lower reservoirs, both upstream and downstream from the falls. The substrate is often stony but varies among patches, as does the complement of species. The tree canopy layer (21 m) has 86% cover and Acer saccharum (50%), Tilia americana (10%), Quercus rubra (10%), Fraxinus americana (8%), Betula alleghaniensis (8%), Fagus grandifolia (4.0%), Populus deltoides (3.0%), Tsuga canadensis (3.0%), Fraxinus pennsylvanica (2.0%), and Carya cordiformis (1.0%) as the most abundant species. The tree subcanopy layer (10 m) has 10% cover and Carpinus caroliniana (5%), Fagus grandifolia (4%), Tsuga canadensis (3%), Betula alleghaniensis (1.0%), Acer saccharum (0.6%), Tilia americana (0.6%), and Ostrya virginiana (0.4%) as the most abundant species. The tall shrub layer (3 m) has 5% cover and Carpinus caroliniana (3.8%), Hamamelis virginiana (2.0%), Fagus grandifolia (1.4%), and Tilia americana (0.6%) as the most abundant species. The short shrub layer has Carpinus caroliniana (3.8%), and Alnus incana (0.8%) as the most abundant species. The vine layer has Toxicodendron radicans (4.0%), Rubus hispidus (3.0%), Parthenocissus vitacea (0.8%), Apios americana (0.6%), and Vitis riparia (0.2%) as the most abundant species. The herbaceous layer (0.5 m) has 18% cover and Carex communis (6.0%), Athyrium filix-femina (3.2%), Maianthemum racemosum (3.0%), Osmunda claytoniana (3.0%), Pedicularis canadensis (2.4%), Desmodium glutinosum (2.4%), Caulophyllum thalictroides (2.4%), Solidago caesia (2.2%), Deparia acrostichoides (2.0%), Collinsonia canadensis (1.6%), Eurybia macrophylla (1.4%), Laportea canadensis (1.0%), Podophyllum peltatum L. peltatum (1.0%), Prenanthes altissima (1.0%), Cystopteris fragilis (1.0%), Solidago (1.0%), Helianthus tuberosus (1.0%), Brachyelytrum erectum (1.0%), Solidago flexicaulis (0.6%), Impatiens capensis (0.6%), Lysimachia nummularia (0.4%), Zizia aurea (0.4%), Impatiens pallida (0.4%), Onoclea sensibilis (0.4%), Eurybia divaricata (0.4%), Danthonia spicata (0.4%), Rudbeckia laciniata (0.4%), and Dryopteris intermedia (0.4%) as the most abundant species.

HABITAT DESCRIPTION Size (acres): 37.10

This is a relatively small occurrence. This floodplain forest is in mostly linear patches, restricted along steep-sided, forested walls. The average shape index is 2.25 (Shumaker 1996). The size may vary depending on disturbance regime but is mostly relatively stable.

This community makes up the wooded flats along the Salmon River between the upper and lower reservoir. Patches occur both above and below the falls. Calcareous shoreline outcrop is commonly adjacent this community, with shale talus slope woodland, calcareous cliff community, and shale cliff and talus slope communities also adjacent or nearby. On the uplands outside of the gorge, forests are generally successional or logged.

MANAGEMENT

Threats:

Further alteration (smoothing) of the flooding regime would significantly effect this community.

Management Comments:

Maintain hydrologic variability.

ADDITIONAL COMMENTS

Giant Pine-drops

(Pterospora andromedea)

Port Ontario

EO number PDMON07010 25 EO ID 9648

STATUS Heritage Global Rank: G5 Heritage State Rank: S1

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Port Ontario

OBSERVATION and QUALITY STATUS

Last observed: 1854-07

Occurrence quality: H - Historical

Quality comments:

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres):

The sandy banks of a river.

MANAGEMENT

ADDITIONAL COMMENTS

Great Blue Heron

(Ardea herodias)

Sloperville Fen

EO number ABNGA04010 90 EO ID 11491

STATUS Heritage Global Rank: G5 Heritage State Rank: S5

LOCATION

County: Oswego

Town: Albion

USGS topographic quadrangle map: Orwell

Survey site: Sloperville Fen

OBSERVATION and QUALITY STATUS

Last observed: 2004-05-11

Occurrence quality: B - Good estimated viability

Quality comments:

The rank is based on the global ranking specifications of February 7, 2000.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 0.00

The fen is an extensive (200+ acre), diverse wetland, composed of several interconnected bog/fen wetlands separated by small knobs and eskers of hardwoods. The bogs/fens are in roughly three areas: southeast, south, and north. The northern bog/fen is a classic open bog with a quaking mat and covered with pitcher plant, blueberries, leatherleaf, cranberry, etc., and scattered black spruce and tamarack with a small deep bog pond. There are open shallow pools and an open water area at the northeast end of this bog. The heron rookery is on a hardwood slope that juts into the marshy open water portion of the bog.

MANAGEMENT

Management Comments:

Periodically monitor the rookery to determine if it is still active.

ADDITIONAL COMMENTS

Hemlock-Hardwood Swamp

Tamarack Swamp Boylston

EO number CPALFM0F00 10 EO ID 10259

STATUS Heritage Global Rank: G4G5 Heritage State Rank: S4

LOCATION

County: Oswego

Town: Boylston

USGS topographic quadrangle maps: Orwell and Boylston Center

Survey site: Tamarack Swamp Boylston

OBSERVATION and QUALITY STATUS

Last observed: 1997-07-14

Occurrence quality: A - Excellent estimated viability

Quality comments:

A very large, diverse, mature, possibly old-growth and essentially undisturbed occurrence in a large intact but selectively logged forest block.

ECOLOGICAL DATA

Mature, possibly old growth, hemlock-yellow birch codominated swamp with excellent herb and habitat diversity. The tree layers average 75% cover including Tsuga canadensis (35%), Betula alleghaniensis (25%) and Acer rubrum (20%). The shrub layers have 30% cover including Betula alleghaniensis (10%), Tsuga canadensis (9%), Viburnum cassinoides (3%) and Vaccinium myrtilloides (3%). The herb layer has 50% cover including Carex trisperma (10%), Osmunda cinnamomea (5%), Onoclea sensibilis (5%). The non-vascular layer has 75% cover including Sphagnum centrale (25%), Sphagnum girgensohnii (20%), Sphagnum cf. fimbriatum (15%) and Sphagnum squarrosum (10%). Animals include beaver, white-tailed deer, and red-eyed vireo. Other characteristic plants include Equisetum sylvaticum, Uvularia sessilifolia, Tiarella cordifolia and Coptis trifolia. Old growth evidence includes one Tsuga canadensis cored at 124 years old, Tsuga canadensis to 75 cm dbh, Betula alleghaniensis to 70 cm dbh and Acer rubrum to 50 cm dbh. Canopy varies from pure Tsuga canadensis to Betula alleghaniensis-Fraxinus nigra patches with 2% Tsuga. Other variants range from rich to poor, moist to wet, shallow to moderately deep peat, dense forest to near woodland condition, plus basin versus terrace positions. Occurrence contains five associated patches of 10 to 150 acres.

HABITAT DESCRIPTION Size (acres): 350.00

Large mixed hemlock-hardwood swamp in a two-mile long glacial basin on the Tug Hill Plateau. Community occupies a large part of swamp complex, associated with spruce-fir swamp and beaver-influenced shallow emergent marsh in wetter areas. The swamp forms the headwater source for two streams. Surrounding uplands are selectively logged forests, mostly beech-maple. Swamp is situated in a large forest block of about 8000 acres unbisected by roads and with intact forest cover.

MANAGEMENT

Threats:

Disturbances: cut trees at upland fringe, selectively logged landscape, localized areas of native pioneer species. Threats: cutting and logging roads in wetland, intensive logging in surrounding landscape.

Management Comments:

Allow recovery of wetland fringe plus 0.1 mile upland buffer. Monitor logging roads for invasive plants. Avoid clear cuts in surrounding uplands.

ADDITIONAL COMMENTS

One 20 m X 20 m plot was sampled in 1997. Inventory needs: refine boundaries (especially distinguishing spruce-fir swamp), improve animal list, more critically assess old growth status, explore north and west part of swamp and review more recent aerial photos.

Houghton's Sedge
(Carex houghtoniana)

Brennan Beach Fen

EO number PMCYP03690 1 EO ID 1388

STATUS Heritage Global Rank: G5 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Brennan Beach Fen

OBSERVATION and QUALITY STATUS

Last observed: 1985-06-06

Occurrence quality: B - Good estimated viability

Quality comments:

100-1000 individuals.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 1.00

Inland dune system, fen. West-sloping to flat, open.

MANAGEMENT

ADDITIONAL COMMENTS

Inland Poor Fen

Sloperville Fen

EO number CPALOP0J00 30 EO ID 11605

STATUS Heritage Global Rank: G4 Heritage State Rank: S3

LOCATION

County: Oswego

Town: Albion

USGS topographic quadrangle map: Orwell

Survey site: Sloperville Fen

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-28

Occurrence quality: A - Excellent estimated viability

Quality comments:

This fen has an extensive and well-developed mat, a diverse complement of characteristic flora, and no evidence of invasive species or anthropogenic disturbance; it is surrounded primarily by mature forest and wetland communities, and the larger landscape has a low level of human development.

ECOLOGICAL DATA

A diverse herbaceous inland poor fen with patches of dense dwarf shrubs and some small medium fen inclusions. The short shrub layer (0.4 m) has 35% cover. The most abundant short shrub species are Chamaedaphne calyculata (26%), Vaccinium oxycoccos (3%), Andromeda polifolia (2%), Kalmia polifolia (2%), and Cephalanthus occidentalis (2%); species in this layer with less than 1% cover include Vaccinium macrocarpon, Vaccinium corymbosum, Spiraea tomentosa, Acer rubrum, Pinus strobus, Larix laricina, Photinia melanocarpa, and Nemopanthus mucronatus.The

herbaceous layer (0.1 m) has 41% cover. The most abundant herbaceous species are Rhynchospora alba (25%), Carex lasiocarpa (4%), Drosera rotundifolia (3%), Juncus canadensis (3%), Carex interior (3%), Thelypteris palustris (2%), Rhynchospora sp. (2%), Dulichium arundinaceum (2%), Utricularia cornuta (1%), and Eriophorum virginicum (1%); species in this layer with less than 1% cover include Carex stricta, Eriophorum tenellum, Pogonia ophioglossoides, Lycopodiella inundata, Woodwardia virginica, Calopogon tuberosus, Nuphar variegata, Scirpus sp., Triadenum virginicum, Drosera intermedia, Sarracenia purpurea, Osmunda regalis, Lysmachia thyrsiflora, Platanthera blephariglottis, Triadenum fraseri, and Osmunda cinnamomea. Nymphaea odorata (2%) is present in the aquatic emergent layer. The nonvascular layer has 50% cover; the dominant species are Sphagnum magellanicum (19%), Sphagnum papillosum (11%), and Sphagnum recurvum (5%); Sphagnum capillifolium has less than 1% cover. Open water (2%) is the dominant unvegetated surface.

HABITAT DESCRIPTION Size (acres): 30.45

The fen is medium- to large-sized relative to other inland poor fens in New York. It is contiguous and slightly irregularly shaped.

A large herbaceous inland poor fen with patches of dense dwarf shrubs, some small medium fen inclusions, and an associated small bog lake surrounded by a spruce-tamarack bog community. This fen is part of a larger wetland complex (including a shrub swamp, a small rich shrub fen, and areas of open water and cattail marsh) associated with Beaverdam Brook. The fen is surrounded primarily by mature forest, including a maple-basswood rich mesic forest to the east, and other wetlands. Conifer plantations are located within 200 m to the north, and clearings to the north and southeast include some houses and agricultural land. The larger landscape consists of a mix of privately owned forest and agricultural land.

MANAGEMENT

Threats:

Logging and further development could occur in the surrounding area and may affect the quality of the fen and its associated wetlands.

Management Comments:

Maintain a buffer between the fen and human activities, such as logging, to protect against introduction of invasive species and sedimentation. Regular monitoring would allow managers to discover and curtail a potential future invasion in the early stages.

ADDITIONAL COMMENTS

Jacob's-ladder

(Polemonium vanbruntiae)

South Of Hooker

EO number PDPLM0E0L0 26 EO ID 3333

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Lewis

Town: Montague

USGS topographic quadrangle map: Sears Pond

Survey site: South Of Hooker

OBSERVATION and QUALITY STATUS

Last observed: 1999-07-08

Occurrence quality: A - Excellent estimated viability

Quality comments:

Thousands of plants.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 8.10

On the east side of the road: Carex stricta-dominated sedge meadow with some Calamagrostis canadensis, Carex stipata, Viola sororia and scattered alder clumps. On west side of road: abandoned beaver marsh; Associated species: Anemone canadensis, Carex spp., Scirpus spp., Iris versicolor, Typha latifolia, Geum rivale, Galium ssp., Sanquisorba canadensis, Hypericum virginicum, Potentilla palustris, Veratrum viride, Senecio aureus, Oenothera fruticosa, Festicua rubba, Onoclea sensibilis and Sphagnum moss.

MANAGEMENT

ADDITIONAL COMMENTS

More habitat around.

Least Bittern

(Ixobrychus exilis)

Salmon River Mouth

EO number ABNGA02010 29 EO ID 1036

STATUS Heritage Global Rank: G5 Heritage State Rank: S3B,S1N

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Salmon River Mouth

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-20

Occurrence quality: BC - Good or fair estimated viability

Quality comments:

A minimum of 1 to 2 breeding pairs have occupied the site since 2001 with abundant suitable habitat available.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 124.00

At least 2 pairs were estimated to be present at this site based on 3 tape playback surveys between June 1, 2005 to July 6, 2005. The area of suitable habitat is large and additional pairs are likely present.

The mouth of the Salmon River is a wide, expansive areas with an open channel and a shallow, open bay with several "islands" of emergent vegetation. The vegetation is dominated by cattail with areas of bur-reed and rushes. There are also shallow pools with pickerel weed. Associated species: Podilymbus podiceps and Chlidonias niger.

MANAGEMENT

Threats:

Excessive boat traffic is a potential threat.

ADDITIONAL COMMENTS

Lesser Bladderwort

(Utricularia minor)

Sloperville Bog

EO number PDLNT020D0 8 EO ID 4261

STATUS Heritage Global Rank: G5 Heritage State Rank: S3

LOCATION

County: Oswego

Town: Albion

USGS topographic quadrangle map: Orwell

Survey site: Sloperville Bog

OBSERVATION and QUALITY STATUS

Last observed: 1997-07-19

Occurrence quality: C - Fair estimated viability

Quality comments:

This is a small colony in a relatively undisturbed area.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 1.00

An open, wet graminoid fen. Associated species: Carex lasiocarpa, Carex aquatilis, Carex stricta, Potentilla palustris, Cladium mariscoides, Menyanthes trifoliata, Thelypteris palustris, and Utricularia.

MANAGEMENT

ADDITIONAL COMMENTS

Low Sand-cherry

(Prunus pumila var. pumila)

Selkirk Shores

EO number PDROS1C162 6 EO ID 4349

STATUS Heritage Global Rank: G5T4 Heritage State Rank: S1

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Selkirk Shores

OBSERVATION and QUALITY STATUS

Last observed: 2001-06-14

Occurrence quality: CD - Fair or poor estimated viability

Quality comments:

There are approximately 500 stems in 5 groups widely distributed on a beach with active residental developments.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 2.00

These plants are located on the low sand deposits and degraded sand dunes located along this section of the eastern shore of Lake Ontario. One of the plants is located within an area with signs and flagging that indicate the area is part of the state park, however, the GIS parks boundary file does not confirm this. This area is the only undeveloped section of the dunes. The remainder of plants are located south of the park boundary and between the housing development and Lake Ontario. Associated species: Acer negundo, Cornus sericea, Populus grandidentata,
Salix cordata, Salix cf. pedunculata, Vitis riparia, Artemisia campestris ssp. caudata, Festuca rubra.

MANAGEMENT

Threats:

These plants are located near the border of a state park but the vast majority of the plants are located on the beach within a residential development. Increased activities along the beach may threaten these plants.

ADDITIONAL COMMENTS

Marsh Headwater Stream

South Branch Mad River
EO number CRIV000B00 3 EO ID 7873

STATUS Heritage Global Rank: G4 Heritage State Rank: S4

LOCATION

County: Lewis
Towns: Montague and Osceola
USGS topographic quadrangle maps: North Osceola and Sears Pond
Survey site: South Branch Mad River

OBSERVATION and QUALITY STATUS

Last observed: 2003-08-04
Occurrence quality: A - Excellent estimated viability

Quality comments:
This is a moderately long, diverse, essentially undisturbed headwater stream located in a large, selectively logged landscape with intact forest cover.

ECOLOGICAL DATA

A 1st- to 3rd-order low-gradient, slow-flowing, run-dominated, headwater stream on the Tug Hill Plateau with low sinuosity and a sandy/loamy bottom flowing through a large wetland complex that includes patches of shrub swamp, sedge meadow, and shallow emergent marsh. The water is moderately acidic, cool, low turbidity, and lightly stained. Physical habitats include abundant mucky-loam reaches and sand-gravel reaches, and local areas of cobble reach transitional to rocky headwater stream. Pool types include lateral eddy pools and several log dam pools. Runs are represented by numerous winding meanders. The channel averages 7 m wide (5 to 15 m range) and 1.2 m deep (0 cm to 2 m range) at low flow condition. The flow is permanent but fluctuates between low flow and bankfull conditions. Low flow discharge varies along the length of the community from 0 to over 0.23 m^3/sec. Runs average 24 cm/sec at low flow. Small-scale features include at least 6 beaver dams, beaver lodges, submerged logs with epidendric algae, and narrow bands of emergent aquatic vegetation along the channel edges. The stream occurrence is 10.6 miles long and is roughly equally proportioned among 1st-, 2nd-, and 3rd-order segments. Emergent aquatic vegetation occurs along the stream edges

with 2% cover in runs. Floating aquatic plants range from 10% cover in runs to 15% cover in pools. Submerged vascular aquatic plants range from 35% cover in runs to 20% cover in pools. Submerged non-vascular aquatic plants range from 5% cover in runs to 8% cover in pools. Dominant species include Potamogeton epihydrus (15%), Sparganium americanum (15%), Carex sp. (9%), Ceratophyllum demersum (5%), Potentilla palustris (2%), and filamentous green algae (4%). Other characteristic species include Sparganium euycarpum, Glyceria striata, Carex gynandra, C. stricta, Eleocharis sp., and Iris versicolor in the emergent aquatic layer; Nuphar lutea and Brasenia schreberi in the floating aquatic layer; and nitella in the submergent non-vascular layer. Fauna is diverse and includes at least 1 fish, 3 mollusk, 2 caddisfly, 4 true bug, and 1 leech species. Dominant fauna includes Agarodes (88/m2), minnows (0.81/m2), Chironomidae (0.75/m2), Trepobates (0.60/m2), Pisidium (0.24/m2), and Castor canadensis (30/mi). Other characteristic species include mallard,

Hirudinae, Amphipoda, Heliosoma trivolvis, Sphaerium simile, Platycentropus, Corixidae, and Nepidae.

HABITAT DESCRIPTION Size (acres): 29.00

Due to its position on a plateau, this is undoubtedly a longer occurrence than many.

A low-gradient, run-dominated headwater stream flowing through a large wetland complex and draining the central portion of the Tug Hill Plateau. The stream flows through alder-dominated shrub swamp and shallow emergent marsh. In many areas, alder shrubs overhang the stream. Stream buffer consists primarily of wide patches of wetland, although some areas are bordered by spruce-fir swamp, spruce flats, spruce-northern hardwood forest, or beech-maple mesic forest. The stream is in a mosaic with one short stretch of rocky headwater stream. It originates directly in marshes or is fed by a few small rocky headwater streams. The downstream end transitions into the small upper extreme of a long midreach stream. The watershed is about 6,000 acres in size with essentially 100% coverage by forest communities, mostly second to third growth. The core of the stream is unbisected by roads. The peripheral portions of the stream are bisected in 4 places by small, private dirt roads. The site is centered in an area of about 120,000 acres with about 85% forest cover that is unbisected by paved and publicly accessible roads.

MANAGEMENT

Threats:

Nutrient enrichment from camps is a potential threat.

Management Comments:
Maintain flow and water quality. Restore 0.1 mile of old-growth forest buffer around the stream corridor and maintain landscape integrity.

ADDITIONAL COMMENTS

Conduct more intensive surveys to locate additional reaches; sample plots in additional habitat types (substrate type-flow combinations, physiognomic types, unusual features); conduct large-scale fish quantification; expand species lists; examine seasonal differences; perform a water quality assessment that includes the use of biotic indices; evaluate suspected disturbances at all road crossings; perform a more critical evaluation of upstream boundaries, transitions to ponds, and small 1st-order rivulets; and refine map of special large scale habitat features. Refine collected biota identifications to finer levels for algae and insects, periodically remap to reflect changes from beaver activity, and seek out additional expert knowledge.

The size of this occurrence was calculated by multiplying its total length (10.6 miles) by its average width (7 m).

Marsh Headwater Stream

West Fork Salmon River

EO number CRIV000B00 5 EO ID 11015

STATUS Heritage Global Rank: G4 Heritage State Rank: S4

LOCATION

County: Lewis Towns: Osceola and Lewis

USGS topographic quadrangle map: North Osceola

Survey site: West Fork Salmon River

OBSERVATION and QUALITY STATUS

Last observed: 2001-10-02

Occurrence quality: AB - Excellent or good estimated viability

Quality comments:

The marsh headwater stream is moderate sized with good habitat and species diversity in excellent condition in a large forested landscape.

ECOLOGICAL DATA

An assemblage of associated cool, clear, circumneutral, moderately shallow and narrow, 1st to 2nd order, very low gradient headwater stream segments with high sinuosity and bordered by marshes in the northern Appalachians. Flow rates are slow, volume is low at low flow, and bottoms are silty. Channel width averages 4 m and ranges up to 7 m in runs and 30 m in pools. Depth ranges up to about 100 cm. Reaches are typically run-dominated, with many run/pool sections and small, localized sandy pools, runs, and log riffles. Physiognomic associations vary from abundant emergent Sparganium sp. channel edges, submerged Potamogeton epihydrus beds, and unvegetated silt to local algae-dominated cobbles and iron fixing bacteria colonies. Pool types include numerous beaver ponds and scattered lateral scour pools, log debris dam pools, and one small confluence pool. Pool size varies from small (about 10 cm2 area) to large (about 3000 m2 area and grading into an oligotrophic pond). Riffles are typically short, have very small waves and a flow rate of about 10 cm/sec. Morphometric features include a few channel braids, small rivulets draining marshes, braids bypassing beaver dams, and a series of beaver pools linked by short riffles. Boundaries can be dynamic in as little as 2 years with changes in beaver activity (new impoundments, breaching of old dams). Physiognamic variation includes about 20% cover of emergent aquatics along channel edges, 20% cover of submergent vascular plants, and 15% cover of floating aquatics. Small-scale features include beaver dams and lodges, woody debris (from beaver activity), leaf packs, and submerged clay and peat banks. The emergent aquatic layer ranges from 3% to 5% cover in pools and runs. The floating aquatic layer ranges from 1% to 3% cover in pools and runs. The submerged vascular aquatic layer has 10% cover. The submerged non-vascular layer ranges from 1% cover in runs to 5% cover in pools. Dominant flora includes Sparganium americanum (6%), Potamogeton epihydrus (5%), Callitriche palustris (2%), filamentous epilithic green algae (2%), Potamogeton natans (1%), and Potamogeton pusillus (1%). Other characteristic plants include Nuphar variegatum, Nymphaea odorata, Utricularia gibba, Eleocharis obtusa var. ovata, Porella pinnata, Chara sp. and Nostoc sp. Fauna is diverse and includes at least 6 fish, 2 mollusk, 12 caddisfly, 2 mayfly, 3 odonate, 2 true fly, 2 beetle, and 2 leech species. Dominant fauna includes Chironomidae (1500/m2), Helobdella stagnalis (263/m2), Platycentropus (260/m2), Habrophlebia (134/m2), Heptageniidae (172/m2), and Merycomyia (48/m2). Other animals include beaver, great blue heron, red spotted newt, Placobdella papillifera, Planaridae, Amphipoda, and Ferresia rivularis.

HABITAT DESCRIPTION Size (acres): 5.00

The occurrence is moderate sized with a somewhat atypical shape because of gradations into pond communities because of beaver activities. The occurrence is patchy and consists of 12 patches separated by up to about 0.8 mile. Size is probably stable, but could increase if beaver impoundments were converted back to flowing segments.

A very low gradient, slow flowing, meandering headwater stream bordered primarily by open wetlands on the Tug Hill Plateau. The stream complex consists of about equal portions of this stream type and rocky headwater stream, interspersed in a mosaic over about 12 miles of stream length. The headwater streams eventually flow into a midreach stream. Banks are low and natural, about 5 cm tall, vegetated adjacent to pools, and unvegetated along runs. There is a streamside buffer consisting of open wetlands of narrow to broad width (over 200 m wide). These wetlands/marshes are predominated by shallow emergent marsh, with lesser shrub swamp and sedge meadow. Upland forests typically surround the wetlands. Small riverside sand/gravel bars are scattered along the stream. The watershed is long (6 miles) and narrow (1 mile wide), totaling about 3,200 acres. It contains >99% natural communities (6 acres of logging landings), primarily forests but with some heavily logged areas (estimated at about 121,000 acres and about 85% forested), unbisected by paved and publicly accessible roads but with numerous dirt logging road intrusions.

MANAGEMENT

Threats:

Threats include more intensive impacts at one road crossing, especially from clogged culverts; any cultural impoundments and water diversions; more intensive upland runoff, especially from logging activity within stream buffer; any adjacent development; septic runoff from adjacent camps.

Management Comments:

Maintain the natural hydrology (including dynamics with beaver influence). Maintain high landscape integrity, especially a wide buffer of unlogged forest. Improve drainage under the road crossing of the stream. Monitor runoff from one adjacent camp. Avoid additional road crossings and large clearings within the watershed.

ADDITIONAL COMMENTS

More critically assess the identity of pools as this community type, and periodically remap them to reflect changes from beaver activity; conduct more intensive surveys for additional reaches, sample plots in different habitat types, and complile expanded species lists.

Northern Harrier

(Circus cyaneus)

Salmon River Mouth and Selkirk Shores Marshes and Fields

EO number ABNKC11010 80 EO ID 533

STATUS Heritage Global Rank: G5 Heritage State Rank: S3B,S3N

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey sites: Salmon River Mouth and Selkirk Shores Marshes And fields

OBSERVATION and QUALITY STATUS

Last observed: 2002-05-18

Occurrence quality: E - Verified extant (viability not assessed)

Quality comments:

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres):

A marshy river outlet dominated by cattails with some grassy and shrubby areas.

MANAGEMENT

ADDITIONAL COMMENTS

Breeding Bird Atlas block: 3982D. Inventory needs: Additional surveys are needed to find the nest site.

Pied-billed Grebe

(Podilymbus podiceps)

Salmon River Mouth

EO number ABNCA02010 21 EO ID 2982

STATUS Heritage Global Rank: G5 Heritage State Rank: S3B,S1N

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Salmon River Mouth

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-20

Occurrence quality: BC - Good or fair estimated viability

Quality comments:

The rank is based on comparison to other sites in New York. One to 2 pairs were estimated in 2001 with at least 4 pairs encountered in 2005 using a standardized survey protocol.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 124.00

Four pairs were estimated to be present at this site based on 3 tape playback surveys between June 1, 2005 to July 6, 2005.

The mouth of the Salmon River is a wide, expansive area with an open channel and a shallow open bay and several islands of emergent vegetation. The vegetation is dominated by cattail with areas of bur-reed and rushes as well as areas of shallow pools with pickerel weed and water lily. Associated species: Ixobrychus exilis and Chlidonias niger.

MANAGEMENT

Threats:

Excessive boat traffic could be a problem.

ADDITIONAL COMMENTS

Pied-billed Grebe

(Podilymbus podiceps)

Pekin Brook Marsh

EO number ABNCA02010 76 EO ID 11644

STATUS Heritage Global Rank: G5 Heritage State Rank: S3B,S1N

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey site: Pekin Brook Marsh

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-15

Occurrence quality: CD - Fair or poor estimated viability

Quality comments:

The rank is based on a comparison to other sites in New York. One territorial male was present.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 23.00

Pekin Brook forms a small shallow emergent marsh in this location with about 70% open water and 30% emergent vegetation. The marsh is rimmed by hardwood forest. A steep bank with larger hemlock trees is immediately below the road.

MANAGEMENT

ADDITIONAL COMMENTS

Pitcher Plant Borer Moth

(Papaipema appassionata)

Sloperville Bog

EO number IILEYC0300 2 EO ID 33

STATUS Heritage Global Rank: G4 Heritage State Rank: SU

LOCATION

County: Oswego

Town: Albion

USGS topographic quadrangle map: Orwell

Survey site: Sloperville Bog

OBSERVATION and QUALITY STATUS

Last observed: 1992-09-16

Occurrence quality: A - Excellent estimated viability

Quality comments:

The habitat is extensive and food plant abundant.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 40.00

A large Sphagnum bog with a fairly even mix of low shrubs and graminoids. Ferns ring the edges. There are islands with larch and red maple. Most conspicuous plants include cottongrass, pitcher plants, bog rosemary, cranberry, royal fern, cattails, bogbean and white pine. Bog gets much wetter to the north and here bulrushes dominate.

MANAGEMENT

Threats:

Nothing obvious but hydrology certainly should not be altered.

ADDITIONAL COMMENTS

The boundary is based on habitat requirements of the food plant.

Ram's-head Ladyslipper

(Cypripedium arietinum)

Port Ontario

EO number PMORC0Q020 23 EO ID 6911

STATUS Heritage Global Rank: G3 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Port Ontario

OBSERVATION and QUALITY STATUS

Last observed: 1900-05-26

Occurrence quality: F - Failed to find

Quality comments:

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres):

Sandy slopes near a peat-bog.

MANAGEMENT

ADDITIONAL COMMENTS

Red Maple-Hardwood Swamp

Fox Brook Wetlands

EO number CPALFM0B00 7 EO ID 7200

STATUS Heritage Global Rank: G5 Heritage State Rank: S4S5

LOCATION

County: Oswego

Town: Redfield

USGS topographic quadrangle maps: Redfield and Orwell

Survey site: Fox Brook Wetlands

OBSERVATION and QUALITY STATUS

Last observed: 2004-07-22

Occurrence quality: A - Excellent estimated viability

Quality comments:

This occurrence is a large, mature, diverse example, with no recent (last 75-100 years) disturbance in a moderate sized landscape block managed primarily for timber resources.

ECOLOGICAL DATA

A mature, diverse, red maple-codominated, open canopy hardwood swamp. The tree layers have 60% cover including Acer rubrum (35%), Betula alleghaniensis (35%) and Fraxinus nigra (15%). The shrub layers have 40% cover including Viburnum recognitum (10%), Viburnum cassinoides (8%), Alnus rugosa (10%) and Alnus serrulata (7%). The herb layer has 58% cover including Osmunda cinnamomea (20%), Osmunda regalis (4%), Onoclea sensibilis (20%) and Thalictrum pubescens (4%). The non-vascular layer has 25% cover, primarily Sphagnum centrale (20%). Coniferous trees (Tsuga canadensis, Picea rubens) occur at low abundance. Soils are very wet shallow peat over deep muck. Animals include beaver. Local variants include small rich patches with Geum rivale, Carex bromoides and Rhamnus alnifolia, seasonally flooded moist sloping seeps with facultative wetland species, plus small pools and beaver channels with obligate aquatics. Downed decaying trunks are abundant as well as large standing trees such as Acer rubrum to 65 cm dbh and Betula alleghaniensis to 43 cm dbh. One Betula alleghaniensis was cored at 64 years old.

HABITAT DESCRIPTION Size (acres): 264.69

This is the 7th largest of 16 documented examples in the state.

A large red maple-codominated hardwood swamp forest in an extensive basin swamp complex in the southwest part of Tug Hill Plateau. This forest occupies most of the swamp, associated with embedded beaver-influenced shallow emergent marsh, marsh headwater stream and shrub swamp plus fringed by bands of hemlock-hardwood swamp. Adjacent uplands are primarily historically selectively logged beech-maple mesic forest. The landscape is essentially intact, and is a moderate sized area unbisected by roads and with intact forest cover but with one large reservoir.

MANAGEMENT

Threats:

Potential threats include intensive hunting, logging within the wetland, excessive road run-off, loss of landscape integrity due to residential and recreational development.

Management Comments:

Maintain the landscape integrity. Allow recovery of upland forest buffer.

ADDITIONAL COMMENTS

Field work was conducted in 2004 to refine the boundaries. One 15x15 meter releve plot was sampled in 1997. Boundaries primarily from aerial photo interpretation with limited field verification. Need more field work to refine boundaries.

Rocky Headwater Stream

East Fork Salmon River
EO number CRIV000A00 4 EO ID 4633

STATUS Heritage Global Rank: G4 Heritage State Rank: S4

LOCATION

County: Lewis Towns: Lewis and Osceola
USGS topographic quadrangle maps: North Osceola, Point Rock, High Market, and Florence
Survey site: East Fork Salmon River

OBSERVATION and QUALITY STATUS

Last observed: 1999-07-29
Occurrence quality: AB - Excellent or good estimated viability

Quality comments:
Moderately long, but narrow, low gradient, mostly undisturbed community with good diversity of fauna. In a large natural landscape wih forested buffer, but somewhat intensively logged nearby uplands and no major road crossings.

ECOLOGICAL DATA

An assemblage of associated cool, clear, circumneutral, shallow, and narrow first to second order, low gradient headwater stream segments in the northern Appalachians. They have moderately low flow rate and low volume at low flow. They have cobble bottoms, slight lateral erosion and moderate shading. The flow is permanent, but fluctuates seasonally between bankfull flow and low flow conditions by up to 1.5 m. This is attributable in part to a large snowmelt. The low flow discharge ranges form 0 to 0.034 m3/sec. Channel dimensions include a width of 2 m to 5 m (3 m on average). Low flow dimensions include 1 to 3 m width (2 m on average) and 0 to 1.5 m depth (20 cm average). The community is composed of 13 stream segments of 0.2-2.6 miles long totaling 10.8 miles. These represent one main branch with 3 tributaries, and 9 first order stream segments (6.0 miles) and 4 second order stream segments (4-8 miles). Segments are separatd by up to 1.0 mile. Dominant flora are epilithic filamentous green algae and Fontanalis sp., primarily in riffles. Dominant animals are benthic epianimals including members of Trichoptera, Plecoptera, Ephemeroptera, Chironimidae and Psephenidae; and the fish Semotilus atromaculatus (creek chub).

Stream reaches are dominated by pools with moderate amounts of riffles. Flow and slope varies from pools to runs to riffles with the later averaging 33 cm/sec low flow rate and 2 degree slope. The low slopes and predominance of pools makes this community somewhat close to a marsh headwater stream, but substrate is rocky and bordering communities are uplands. Microfeatures include cobble bars, cobble islands, undercut banks, log jams, coarse woody debris piles and small secondary channel braids. The stream classifies as "transition water fishery" water quality is apparently high.

HABITAT DESCRIPTION Size (acres): 13.00

A rocky portion of a low gradient headwater stream complex in the center of the Tug Hill Plateau. The stream complex consists of several portions of rocky and marsh headwater streams. The latter are beaver influenced and interspersed over about 17.8 miles of total stream length. The stream contains one main branch and four associated tributaries (9 stream reaches). The headwater portion flows into a midreach stream at the confluence of another headwater stream complex (west fork Salmon River). The community is crossed by five small dirt logging roads (culverts, ford) in the first order part. The watershed is long (four miles) and narrow (one mile wide) totaling about 4500 acres. The watershed contains >99% natural communities (4 acres of logging landings), primarily forests but with many heavily logged areas. The stream banks are natural, primarily moist upland flats with intact forest cover. The stream flows through a valley glacial moraine in a north to south orientation. The site is centered in an area of about 121,000 acres and about 85% forested, unbisected by paved and publically accessible roads but with numerous dirt logging road intrusions. Nutrient loading is primarily from upland runoff and marshes bordering marshy sections. Scattered narrow high terrace floodplains line the community.

MANAGEMENT

Threats:

On-site threats include intensive impacts of road crossings such as impoundments, channel course alteration from clogged culverts, pollution at crossings in stream bed. Such threats are potential, but not strong. Threats also include any new impoundments and diversions. Off-site threats include intensive run-off causing siltation and erosion, especially at road crossings but also generally from adjacent uplands due to intensive logging activities; any septic run-off from hunting camps; acid rain impacts; and adjacent development.

Management Comments:
More carefully evaluate water temperature to determine if it is raised from canopy openings in nearby uplands. Monitor road crossings for seasonal impacts. Ideally, improve road crossings to allow more natural flow and erosion patterns (e.g., use wider culverts and bridges with wide spans to allow lateral channel movement and minimize unnatural log jams; allow roadside ditches to fully revegetate to minimize roadside siltation). Maintain or improve landscape integrity (maintain forested buffer ideally of 0.1 mile wide), and maintain broadscale forest cover. Avoid any chemical treatment of stream. Limit adjacent development. Re-evaluate state stream designation of "D" class.

ADDITIONAL COMMENTS

One 3 m X 3 m plot was sampled in pool, 1999. Size calculated as average width (3 m/10 feet) x total length (10.8 miles) equals 12.9 acres. Inventory needs: better evaluate fish populations including presence and abundance of native and exotic trout species, salmon, sculpin minnow and common shiner; better assess water quality; expand species list; refine identification of dominant biota; evaluate microhabitat abundance under different flow regimes. Native status and diversity needs to be evaluated at genus and species level. The southernmost portions of this element occurrence was altered in 2006 to match the adjoining floodplain forest and more recent aerial photography.

Rocky Headwater Stream

West Fork Salmon River
EO number CRIV000A00 3 EO ID 6603
STATUS Heritage Global Rank: G4 Heritage State Rank: S4
LOCATION
County: Lewis Towns: Lewis and Osceola
USGS topographic quadrangle maps: Florence and North Osceola
Survey site: West Fork Salmon River
OBSERVATION and QUALITY STATUS
Last observed: 2001-09-12
Occurrence quality: AB - Excellent or good estimated viability
Quality comments:
This is a moderately long but somewhat narrow, low-gradient, mostly undisturbed stream with good faunal diversity contained within a large, natural landscape and surounded by an intact forested buffer.

ECOLOGICAL DATA

This community consists of an assemblage of associated cool, clear, circumneutral, shallow and narrow streams. They are first to second order, low gradient headwater segments in the northern Appalachians. They have a moderate flow rate and low volume at low flow, rocky bottoms, slight lateral erosion, and are moderately shaded. The flow is permanent but fluctuates between low flow and bankfull conditions by more than 1 meter. Spring snowmelt is large. Low flow discharge varies along the length of the community from 0 to 0.23 m3/sec. Channel is 1 to 15 m wide (4 on average); low flow dimensions include a width of 1-7 m (3.3 on average) and depth of 0-1.5 m (24 cm average). The community is composed of 11 stream segments of 0.1-1.6 m long totaling 7.3 miles. These represent one main branch with three tributaries, 7 second order segments, and 4 first order segments. At most, segments are separated by 0.4 miles. The non-vascular layer ranges from <1% cover in pools to 5% cover in riffles. The submerged non-vascular layer ranges from 25% cover in runs to 50% cover in pools. Dominant flora include filamentous epilithic green algae (30%), Eurynchium riparioides (5%), Porella pinnata (2%), Scapania nemorea (2%), and Fontinalis dalecarlica 2%). Other characteristic plants include Dermatocarpon fluviatile and Hygrohypnum sp. Fauna is diverse and includes at least 4 fish, 13 caddisfly, 7 mayfly, 5 stonefly, 4 odonate, 4 true fly, 4 beetle, and 2 crayfish species. Dominant fauna include Agarodes (480/m2), Heptageniidae (217/m2), Goera and Neophylax (174/m2), Chironomidae (100/m2), Rhagovelia (23/m2), Hydropsyche (10/m2), Perlidae (19/m2), Rhinichthys atratulus (0.97/m2), Semotilus atromaculatus (1.9/m2), and Ephemera (6/m2). Other characteristic animals include Cambarus spp., Hexatoma, Psephenidae, Philopotamidae, Glossosoma, and Elmidae. Dominant neuston fauna in pools also include Gerris and Metrobates. Stream reaches might be classified as cascades dominated by riffles and pools, but there are also some riffle-dominated areas. The slope and flows vary among pools, runs, and riffles, with riffles averaging 43 cm/sec at low flow condition and 4 degree slope. Physical variation in microhabitats includes abundant cobble riffles, some cobble runs and pools, bedrock riffles, and sandy riffles and runs (1% of stream).

Morphometric features include undercut banks, cobble bars and islands, forested floodplain islands, small channel braids, log dams, lateral scour pools, and eddy pools. Other small features include coarse woody debris (overhanging and submerged logs), exposed rocks, and wrack.

Local areas that are surrounded by hemlock-northern hardwood forest are heavily stained with tannins and stretches at beaver meadow outlets are warm, odorus and anoxic. The stream classifies as a transition water fishery. Water quality is apparently high.

HABITAT DESCRIPTION

Size (acres): 11.61

This occurrence consists of a moderately long network of stream reaches that is somewhat narrow.

A confined, relatively fast flowing, rocky portion of a headwater stream complex bordered by upland forests on the Tug Hill Plateau. The stream complex consists of nearly equal portions of this stream type and marsh headwater stream interspersed in a mosaic over about 12 miles of stream length. The headwater streams eventually flow into a midreach section. The stream banks are low, natural, primarily moist upland terraces and hills of intact beech-maple mesic forest and hemlock-northern hardwood forest. Small, high terrace floodplains are scattered along the stream. The stream flows through a low, rolling glacial moraine in a N-S orientation. Nutrent loading is apparently coming from upland runoff and from the bordering marshes. The watershed is long (6 miles) and narrow (1 mile wide) totaling about 3,200 acres. It contains >99% natural communities (6 acres of logging landings), primarily forests but with some heavily logged areas. The stream is crossed by five small dirt logging roads (culverts, bridges and fords). It is centered within a large contiguous forest block estimated at about 121,000 acres that is unbisected by paved and publicly accessible roads. The block is about 85% forested but does contain numerous dirt logging road intrusions.

MANAGEMENT

Threats:

On-site threats include more intensive impacts at road crossings, especially those that cause larger impoundments and course alterations from clogged culverts; pollution; and new impoundments or water diversions. Off-site threats include more abundant upland run-off, especially at road crossings, causing severe siltation and erosion. There are also impacts from heavy logging activities in nearby uplands. Other threats include any septic run-off from hunting camps, acid rain impacts, and development adjacent to the stream.

Management Comments:

Ideally, improve road crossings to allow more natural flow and erosion patterns (e.g., use wider culverts and bridges with wider spans to allow lateral channel movement and minimize unnatural log jams; allow road ditches to fully revegetate to minimize siltation). Maintain or improve landscape integrity (maintain forested buffer ideally 0.1 mile wide), maintain broad scale forest cover in matrix block. Avoid any chemical treatment of stream. Limit adjacent development.

ADDITIONAL COMMENTS

Additional inventory is needed to better evaluate fish populations in lower reaches, especially for presence and abundance of native and exotic trout, salmon, sculpins and shiners. Other needs include a better assessment of water quality and an evaluation of microhabitat abundance under different flow regimes. More observations should be conducted in middle and lower reaches. Plots should be sampled in sand and bedrock areas. Size was calculated from average channel width (4 m) x length (7.3 miles). The southernmost portion was modified in 2006 to match the adjancent floodplain forest delineation.

Rocky Headwater Stream

Mill Stream System

EO number CRIV000A00 14 EO ID 11019

STATUS Heritage Global Rank: G4 Heritage State Rank: S4

LOCATION

Counties: Oswego and Lewis Towns: Montague, Redfield, and Osceola

USGS topographic quadrangle maps: Redfield, Sears Pond, North Osceola, and Worth Center

Survey site: Mill Stream System

OBSERVATION and QUALITY STATUS

Last observed: 2003-08-07 Occurrence quality: A - Excellent estimated viability

Quality comments:

The rocky headwater stream is very large with only few and minor disturbances, good habitat and species diversity, and intact hydrology located in a large natural landscape with nearly 100% forest cover and only a few minor road crossings.

ECOLOGICAL DATA

A 1st to 3rd order gently to moderately sloping, riffle-dominated stream with low sinuosity on the tug hill plateau. Water is circumneutral, cool, and clear. Reaches vary, most dominated by riffles, but with several riffle/pool sections. Physical habitats include abundant bedrock riffles, bedrock/cobble reaches, cobble reaches, wood riffles, and one area of sand/gravel reaches near the stream mouth. Hydrology also varies between stained segments and clearwater segments and between coldwater and coolwater segments. Pool types include abundant lateral scour pools, plunge pools, small eddy pools, a few log dam pools and confluence pools, and at least one deep mid-channel hole in sand and gravel. Riffle types include several small waterfalls. The channel averages 3.4 m wide (0.3 to 10 m range) at low flow condition. The flow is permanent but fluctuates between low flow and bankfull conditions by up to about 70 cm. Low flow discharge varies along the length of the community from 0 to 1.48 m3/sec. Low flow dimensions include a depth of 0 cm to 1 m (16 cm average). Riffles average 110 cm/sec at low flow. Physiognomic types include abundant riffles with dense cover of epilithic green algae, areas with moderate cover of bryophytes along 1st order reaches and in swift flowing current, and sparsely vegetated areas. No mussel beds were observed. Morphometric features include: several areas of channel braids and forested to herbaceous mid-channel cobble bars, stairstep cascades with abundant whitewater, and rocky chutes. Small-scale features include mossy shores, emergent rounded cobbles and jagged rocks, abundant coarse woody debris (including large overhanging and submergent dead trees), twig piles, fractured bedrock shelves, submergent bedrock overhangs, and local silt patches in impacted areas. The stream is about 31 miles long, roughly equally proportioned among 1st, 2nd and 3rd order segments. Flora consists primarily of submergent non-vascular species, ranging from 7% cover in pools to 35% cover in riffles, with 10% non-vascular species in riffles. Dominant species, mostly non-vascular, are epilithic green algae (20%), Eurynchium riparioides (22%), Carex torta (2%), Fissidens cristatus (1%), and Scapania nemorea (1%). Fauna is diverse and includes at least 3 fish, 3 mollusk, 12 caddisfly, 6 mayfly, 3 stonefly, 3 true fly, and 3 beetle species. Dominant fauna include Chironomidae (1410/m2), Goera and Neophylax (113/m2), Psilotreta (84/m2), Ferresia rivularis (80/m2), Psephenus (36/m2), Rhinichthys atratalus (0.28/m2), Ephemera (23/m2), and Cambarus robustus (0.69/m2). Other species include Cottus cognatus, Etheostoma flabellare, Hexatoma, Perlidae, Isonychia, Glossosomatidae, and Hydropsychidae.

HABITAT DESCRIPTION Size (acres): 42.00

The headwater stream is a very long and moderately wide system with larger (wider) lower reaches and dendritic upper reaches. There is low patchiness for this community type and low interspersion of marsh headwater stream except in extreme upper reaches. The size is stable, although the boundaries are dynamic, especially in the upper reaches from beaver activity.

A gently to moderately sloping, riffle-dominated headwater stream draining the southwest section of the Tug Hill Plateau. The associated shoreline is primarily a narrow band of cobble shore. The banks are vegetated and natural, averaging about 0.7 m tall. Stream banks are bordered by natural upland forest, with shale cliff and talus community abundant in the middle reaches and local areas of shallow emergent marsh. Stream buffer is mostly selectively logged upland forest including beech-maple mesic forest with smaller local areas of successional northern hardwoods, maple-basswood rich mesic forest, or, near the stream mouth, floodplain forest. The stream is fed by several small intermittent streams and feeds into a large stream transitional between midreach stream and main channel stream, shortly before emptying into a large reservoir. The watershed is about 8,000 acres and has about 99% cover of forest communities, primarily second growth beech-maple mesic forest, spruce-northern hardwood forest, and successional northern hardwoods, with clearing only in the lower 1 mile of the stream near its mouth. The core area of the stream is bisected only in 3 places by very small, private jeep trails. The stream is bisected by paved roads at 2 places, only along the lower 0.5 miles. The stream is at the southwest edge of a large contiguous forested area of about 120,000 acres with about 85% forest cover and unbisected by paved or publicly accessible roads.

MANAGEMENT

Threats:

Threats include increased impacts (exotic species introductions) at road crossings, especially those in the uppermost part of the watershed; fish stocking; unsustainable fish harvest; additional road crossings; bank stabilization; septic runoff from camps; intensive logging in forest buffer; impoundments. The largest imminent threat is the spread of Tussilago farfara throughout the lower 50% of the stream.

Management Comments:

Maintain the hydrologic and biotic integrity of the stream and the high quality of the forested watershed, especially in buffer. Minimize forest clearing in the watershed, selective logging in the buffer, additional road crossings, and shoreline development. Monitor distribution and abundance of Tussilago farfara. Monitor road crossings for new exotic introductions, especially Polygonum cuspidatum. Ideally restore road crossings: convert fords and culverts to higher and wider bridges that minimize impacts to flow and banks.

ADDITIONAL COMMENTS

Conduct more intensive surveys for additional reaches; sample plots in additional habitat types (stream orders, substrate type-flow combinations, physiognomic types, unusual features); quantify fish composition on a large scale (especially regarding trout); expand species lists; refine species abundances; examine seasonal differences; assess water quality; quantify suspected disturbances (all road crossings) and the extent of exotic species; more critically evaluate upstream and downstream boundaries, transitions to marsh headwater stream, and small 1st order rivulets; and refine map of special large scale habitat features. Refine collected biota identifications to finer level for algae and insects. Use biotic indices to evaluate water quality. Seek out expert knowledge from anglers.

Sand Dune Willow

(Salix cordata)

Selkirk Shores

EO number PDSAL020U0 7 EO ID 136

STATUS Heritage Global Rank: G5 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Selkirk Shores

OBSERVATION and QUALITY STATUS

Last observed: 2001-06-14

Occurrence quality: CD - Fair or poor estimated viability

Quality comments:

There are approximately 50 plants in an area with Phragmites and Lythrum salicaria.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 2.00

Scattered plants are found on the lower portions of a degraded Great Lakes dune and along the edge of a marsh area that may be the result of dredge deposits. This plant favors the wetter sandy soils, but it is not found near the rip wrack. This site is very disturbed and Phragmites is common in areas where there is standing water. Lake Ontario is located directly east of this site and the Salmon River is located directly north. As a result, there is a lot of boat and fishing activity at the river mouth and the river channel. Numerous gulls and terns were feeding nearby. Associated species: Acer saccharinum, Cercis canadensis, Gleditsia triacanthos, Pinus sylvestris, Amorpha fruticosa, Cornus sericea, Salix cf. pedunculata, Vitis riparia, Anemone canadense, Artemisia campestris ssp. caudata, Carex spp., Equisetum arvense, Festuca rubra, Glechoma hederacea, Iris pseudacorus, Juncus balticus, Juncus effusus var. pylaei, Leucanthemum vulgare, Lythrum salicaria, Phragmites australis, Polygonum persicaria, Potentilla anserina, Salsola sp., Verbascum blattaria.

MANAGEMENT

Threats:

Phragmites and Lythrum salicaria are common within this area that may represent a dredge material deposit.

ADDITIONAL COMMENTS

Sedge Meadow

Mad River Swamp and South Branch Mad River

EO number CPALOP0B00 5 EO ID 9346

STATUS Heritage Global Rank: G5 Heritage State Rank: S4

LOCATION

County: Lewis

Towns: Montague and Osceola

USGS topographic quadrangle map: Sears Pond

Survey sites: Mad River Swamp and South Branch Mad River

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-10

Occurrence quality: A - Excellent estimated viability

Quality comments:

This is a large sedge meadow of many patches in excellent condition with very good diversity and and within a large landscape with excellent connectivity among patches and to the landscape. Beaver activity maintains this community dynamically with the landscape.

ECOLOGICAL DATA

A large, open, sedge-dominated peatland along the margins of a meandering marsh headwater stream. This community occurs in two groups of patches, one along Mad River and a second group about 0.5 mile upstream along South Branch (a tributary). Overall, some patches are classic Carex stricta dominated peatlands, while in others the sedge meadow forms a mosaic with species indicative of other communities such as Myrica gale (medium fen), Calamagrostis canadensis (shallow emergent marsh), and Alnus incana spp. rugosa (shrub swamp). Flooding is dynamically tied to the periodicity of beaver impoundments and it is expected that this community type changes its location and size on the landscape depending on beaver activity. Scattered throughout these sedge meadows are shrubs such as Alnus rugosa, Spiraea latifolia, and Myrica gale. The herbaceous layer has Carex stricta (30-60%), Calamagrostis canadensis (15-65%), Potentilla palustris (= Comarum palustre) (10%), Calla palustris (2%), Carex utriculata, Carex cf. rostrata, Epilobium leptophyllum, and Carex interior. Sphagnum spp. (up to 15%) are present in the non-vascular layer. Beaver sign is common (dams and lodges); mink frog, tree swallows, green frog, and spring peepers are also present. The substrate is 0-25 cm deep of saturated peat/very fibrous root mat and 25-100 cm deep saturated muck.

HABITAT DESCRIPTION Size (acres): 131.00

This is a large occurrence. This occurrence may extend up other tributaries not yet visited and thus the full extent is not yet known. The size of this occurrence varies with beaver activity and beaver disturbance history. It is difficult to tell what the current trend is. The most irregular edges of the sedge meadow patches are along the meandering streamside. The mean shape index is 1.9 (Schumaker 1996). This occurrence consists of 29 patches in two clusters, one cluster along Mad River and the beginning of South Branch. The second cluster is about 0.5 mile upstream (south) along South Branch.

This natural community is part of an impressive and extensive wetland complex along a meandering marsh headwater stream. Communities along the stream vary from shrub swamp, shallow emergent marsh, and this occurrence of sedge meadow. Spruce-fir swamp borders the upland edge of the wetland and also occurs in patches among the upland beech-maple mesic forest. The wetland complex is very large, isolated, and appears undisturbed. The surrounding hills support a beech-maple mesic forest and spruce-northern hardwood forest that are both selectively logged. The broader landscape represents a very large area (tens of thousands of acres) of mostly intact forest cover unbisected by roads.

MANAGEMENT

Threats:

Skidder trails from logging activity and other roads passing through or nearby this community may be vectors for invasive species.

Management Comments:

Avoid logging in the adjacent upland forest.

ADDITIONAL COMMENTS

This occurrence may extend up other tributaries not yet visited and thus the full extent is not yet known.

Inventory needs: Conduct a canoe survey of all open areas along the Mad River to separate out patches of shallow emergent marsh from sedge meadow. This occurrence may be smaller than currently mapped but also this occurrence changes dynamically in size based on recent beaver activity.

Sedge Meadow

Hooker Brook

EO number CPALOP0B00 10 EO ID 11954

STATUS Heritage Global Rank: G5 Heritage State Rank: S4

LOCATION

County: Lewis

Town: Montague

USGS topographic quadrangle map: Sears Pond

Survey sites: Hooker Brook

OBSERVATION and QUALITY STATUS

Last observed: 2005-07-15

Occurrence quality: AB - Excellent or good estimated viability

Quality comments:

This is a relatively small occurrence in very good condition with minimal disturbance nested within an excellent landscape.

ECOLOGICAL DATA

This sedge meadow occurs along Hooker Brook, a tributary to Mad River, at two sections of the stream. Each section has expansive sedge meadow right along the meandering stream. The short shrub layer has about 2.5% cover and Spiraea alba (2.0%), Salix (0.5%), and Ilex verticillata (0.5%) as the most abundant species. The herbaceous layer (0.4 m) has 70% cover and Carex stricta (55%), Calamagrostis canadensis (20.0%), and Carex cf. aquatilis (17%), Glyceria striata (0.8%), Scutellaria galericulata (0.5%), Scirpus atrocinctus (0.3%), and Thalictrum pubescens (0.3%) as the most abundant species. Water is common in depressions between the sedge tussocks. The soil is made up of peat more than 1.5 m deep.

HABITAT DESCRIPTION Size (acres): 36.70

This is a relatively small occurrence of those currently mapped but many other smaller sedge meadows remain unmapped. There may be additional patches south and west, so the full extent of this occurrence is not yet known. Most patches are relatively long and narrow, as they occur along Hooker Brook. The mean shape index is 1.9 (Schumaker 1996). This size of this occurrence is dynamic, as influenced by recent beaver activity.

This community occurs at two sections in Hooker Brook with a total of 13 patches. The two sections are separated by about 0.3 miles of shrub swamp and upland forest. Other nearby communities include spruce-fir swamp, black spruce-tamarack bog, and the upland matrix forest: beech-maple mesic forest. Beaver activity is an integral component of fluvial dynamics along Hooker Brook and undoubtedly influences the structure and extent of this community. This community likely changes in size over time, depending on local beaver activity. This community occurs along a meandering stream and in wet soils. It floods periodically, and on a longer time span, is dynamically controlled by beaver activity.

MANAGEMENT

Threats:

Invasive species (namely purple loosestrife) may become an issue, particularly in the southern section.

Management Comments:

Managers should monitor and immediately remove any invasive species found along the road.

ADDITIONAL COMMENTS

Additional patches may be present up connected waterways.

Managed Area: East Branch Fish Creek Conservation Area.

Shale Cliff and Talus Community

Salmon River Falls and Salmon River Gorge

EO number CTEROC0Q03 7 EO ID 6544

STATUS Heritage Global Rank: G4 Heritage State Rank: S3

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey sites: Salmon River Falls and Salmon River Gorge

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-29

Occurrence quality: B - Good estimated viability

Quality comments:

This community is small to moderate-sized and occurs in three patches interspersed among a shale-talus slope woodland community. It is in very good condition, with good connectivity to the nearby landscape, and relatively inaccessible and undisturbed.

ECOLOGICAL DATA

This natural community is variable in its expression on the ground. All cliff faces are very steep with some even overhanging. Flowing water drips down the cliffs in many locations, but in other locations the rock is dry and exposed. Portions of the cliff are open and exposed while other portions are partially protected and often shaded by tall trees at the cliff base or overhanging trees from the cliff tops. The cliff faces are relatively diverse, with species such as Parnassia glauca, Eleocharis elliptica, Cystopteris fragilis, Saxifraga aizoides, Carex cryptolepis, Carex granularis, Primula mistassinica, Circaea alpina, Gymnocarpium dryopteris, and tallose liverworts. A very large talus slope sits at the base of the northernmost patch, just west of the falls. Here, tall forbs and a variety of shrubs and vines grow among the rocks. Common species include Rubus odoratus, Rubus ideaus, Parthenocissus vitacea, Clematis viginiana, Vitis riparia, Toxicodendron radicans, Apios americana, Ageratina altissima, Impatiens capensis, and Stachys palustris. Talus slopes in the wooded portions of this community have more shade-tolerant species.

HABITAT DESCRIPTION Size (acres): 9.60

The actual size (9.6 acres) of the occurrence was calculated using the following formula: actual size = horizontal acres/COS (average slope). The cliff height probably averages at about 10 meters. Overall, this is probably a small to moderate sized occurrence.

This Shale cliff and talus community occurs in three patches among a range of natural community types in and above the Salmon River Gorge. These communities include shale talus slope woodland, calcareous shoreline outcrop, floodplain forest, and calcareous cliff community. Successional northern hardwood forest and young beech-maple mesic forest occur outside of the gorge on both sides. Roads, pipelines, and other anthropogenic disturbances are nearby outside of the gorge. This section of the Salmon River is between two reservoirs: the Salmon River Reservoir is upstream approximately 1.1 mi, and the Lower Reservoir is approximately 1.8 mi downstream.

MANAGEMENT

Threats:

Excessive disturbance over the cliffs that would alter the hydrology or the quality of water cascading over the cliffs is a threat. Ice climbing occurs at a time that would only minimally impact this community.

Management Comments:

Excessive disturbance over the cliffs that would alter the hydrology or the quality of water cascading over the cliffs is a threat. Ice climbing occurs at a time that would only minimally impact this community.

ADDITIONAL COMMENTS

Plot data were collected in 1993. Additional data were collected in 2005. Additional work is needed to distinguish and separate this community type from the calcareous cliff community patches downstream.

It is not safe to walk below the falls unless dam operators know people are using the area, because water levels rise when dam gates are opened.

Shale Talus Slope Woodland

Salmon River Falls and Salmon River Gorge

EO number CTERBW0R04 5 EO ID 3836

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey sites: Salmon River Falls and Salmon River Gorge

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-24

Occurrence quality: AB - Excellent or good estimated viability

Quality comments:

A moderate-sized very rich expression of a talus slope woodland running along both gorge walls. Connectivity is excellent within the gorge

but less so outside of the gorge.

ECOLOGICAL DATA

A rich forest on the steep slopes of the Salmon River Gorge that ranges from a semi-closed canopy to open woodland with a dense understory. The tree canopy layer (20 m) has 65% cover and Acer saccharum (40%), Tsuga canadensis (21%), Betula alleghaniensis (20%), Tilia americana (6.0%), and Fagus grandifolia (5%) as the most abundant species. The tree subcanopy layer (14 m) has 20% cover and Fagus grandifolia (10%), Tsuga canadensis (10%), Acer pensylvanicum (2%),

Acer saccharum (2%), Fraxinus americana (2%), and Ostrya virginiana (1%) as the most abundant species. The tall shrub layer (3 m) has 40% cover and Acer spicatum (30%), Acer saccharum (5%), Hamamelis virginiana (1%), Fagus grandifolia (1%), Tilia americana (1%), and Tsuga canadensis (1%) as the most abundant species. The short shrub layer (1 m) has Taxus canadensis (15%), Rubus odoratus (10%), Acer spicatum (5%), Diervilla lonicera (3%), Viburnum lantanoides (3%), and Tsuga canadensis (1%) as the most abundant species. The vine layer has Toxicodendron radicans (5%) and Parthenocissus vitacea (2%) as the most abundant species. The herbaceous layer (0.3 m) has 30% cover and Dryopteris intermedia (10%), Carex plantaginea (5%), Adiantum pedatum (5%), Equisetum scirpoides (2%), Oclemena acuminata (2%), Tiarella

cordifolia (1%), Ageratina altissima (1%), Eurybia divaricata (0.4%), Asarum canadense (0.4%), Huperzia lucidula (0.3%), Polypodium virginianum (0.3%), Dryopteris marginalis (0.3%), Maianthemum canadense (0.3%), Oxalis montana (0.1%), and Polystichum acrostichoides (0.1%)

as the most abundant species. Soils are very organic and rich, but thin and generally over steep and loose talus. One cored hemlock has an estimated age greater than 260 years; one cored Tilia was estimated to be 130 years old.

HABITAT DESCRIPTION Size (acres): 81.60

Long and thin in shape, this community follows the gorge. The average shape index is 3.46 (shumaker 1996).

This is the very steep wooded to forested portion of the Salmon River Gorge. Below these slopes are floodplain forest, calcareous shoreline outcrop, and riverine communities. Alongside these slopes are calcareous cliff communities and shale cliff and talus slope communities. On the uplands outside of the gorge, forests are generally successional or logged. This section of the Salmon River is between two reservoirs: the Salmon River Reservoir is approximately 1.2 mi upstream, and the Lower Reservoir is approximately 1.7 mi downstream.

MANAGEMENT

Management Comments:

Prevent excessive trampling. It is not safe to walk below the falls unless dam operators know people are using the area, because water levels rise when dam gates are opened.

ADDITIONAL COMMENTS

Identification is uncertain because this is an unusual variant of this community and is intermediate between a hemlock-northern hardwood forest and a more typical hardwood-dominated shale talus slope woodland. Original boundaries were mostly drawn from 1967 air photos and only one small patch was surveyed. Boundaries were re-drawn in 2004 and again in 2005 using digital orthophotography and ground survey. More inventory of this community is needed to clarify the distinction among the potential rich forest and woodland types represented on these slopes.

Shallow Emergent Marsh

Salmon River Pulaski

EO number CPALOM0B00 15 EO ID 5778

STATUS Heritage Global Rank: G5 Heritage State Rank: S5

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Salmon River Pulaski

OBSERVATION and QUALITY STATUS

Last observed: 2001-08-07

Occurrence quality: B - Good estimated viability

Quality comments:

This is a moderate size, diverse marsh with localized exotics, partially protected by a state park, in a moderately fragmented landscape.

ECOLOGICAL DATA

A moderate size shallow emergent marsh with localized exotics. The marsh is relatively drier and more herbaceous upstream and includes patches with a cobble substrate. The short shrub layer has 4% cover. The most abundant short shrub species is Decodon verticillatus (5%). The herbaceous layer has 88% cover. The most abundant herbaceous species are Phalaris arundinacea (21%), Sagittaria latifolia (18%), Calamagrostis canadensis (14%), Leersia oryzoides (13%), Carex stricta (6%), Carex lacustris (5%), Eupatorium maculatum (5%), Eupatorium perfoliatum (5%), and Peltandra virginica (5%). Other characteristic species are Dulichium arundinaceum, Scirpus atrovirens, Scirpus cyperinus, and Glyceria canadensis. Other species at low abundance include Helenium autumnale, Verbena hastata, and Impatiens capensis.

HABITAT DESCRIPTION Size (acres): 81.79

AB.

A moderate size shallow emergent marsh at the mouth of the Salmon River where it flows into Lake Ontario. The shallow emergent marsh grades into and forms a mosaic with deep emergent marsh. The shallow emergent marsh tends to occur upstream of the deep emergent marsh as islands in the midreach stream and in patches near the upland. Shrub swamp and floodplain forest occur upstream of the shallow emergent marsh. A bridge crosses the river at Route 3, bisecting the wetland. The area beneath the bridge is most similar to an open successional upland. Shallow emergent marsh occurs west and east of the bridge. The landscape also includes a spit with a pier to the west, successional northern hardwoods and pine plantations to the south, and cropland and residences to the north and east. The marsh is partially contained within an approximately 425 acre area unbisected by paved roads that is approximately 70% natural area.

MANAGEMENT

Threats:

Disturbances: dredging of the channel opening to Lake Ontario. Construction of Route 3 bridge. Water level regulation of Lake Ontario. Invasive exotic plants including Lythrum salicaria and Hydrocharis morsus-ranae have about 5% cover. Threats: spread of exotic species. Further development in immediate landscape.

Management Comments:

Monitor and possibly control invasive plants.

ADDITIONAL COMMENTS

Inventory needs: releve plot.

Shallow Emergent Marsh

Pennock Bog

EO number CPALOM0B00 18 EO ID 11353

STATUS Heritage Global Rank: G5 Heritage State Rank: S5

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey site: Pennock Bog

OBSERVATION and QUALITY STATUS

Last observed: 2004-07-13

Occurrence quality: B - Good estimated viability

Quality comments:

This occurrence is a small example of this community type with no exotic species. The shallow emergent marsh lies adjacent to a good example of spruce-fir swamp that is also of statewide significance. It is embedded within a predominantly forested landscape that is managed for timber resources and multiple recreational uses.

ECOLOGICAL DATA

A single patch of grass- and sedge-dominated open wetland within the floodplain of Pennock Brook. The tall shrub layer (1.3 m) has 1% cover and Alnus incana (1%) as the most abundant species. The short shrub layer (0.6 m) has 6% cover and Spiraea alba (5%) with small, scattered areas of Spiraea tomentosa, Chamaedaphne calyculata, Alnus incana, Acer rubrum, Ilex verticillata, and Rubus idaeus (all <1%). as the most abundant species. The herbaceous layer (1.0 m) has 84% cover and Calamagrostis canadensis (28%), Scirpus cyperinus (14%), Carex stricta (10%), Phalaris arundinacea (7%), Sparganium erectum (3%), Euthamia graminifolia (2%), Eupatorium maculatum (2%), Lysimachia thyrsiflora (2%), Eupatorium perfoliatum (2%), Scirpus atrovirens (2%), Carex scoparia (2%), Lysimachia terrestris (2%), Impatiens capensis (1%), Mimulus ringens (1%), Solidago rugosa (1%), with Leersia oryzoides, Galium labradoricum, Hypericum canadense, Juncus effusus, Dulichium arundinaceum, Polygonum persicaria, Carex crinita, Phragmites australis, Cicuta bulbifera, Osmunda regalis, Osmunda cinnamomea, Thelypteris palustris, Viola , and Onoclea sensibilis (all <1%). as the most abundant species. The unvegetated surface has Water (2.0%) as the most abundant components.

HABITAT DESCRIPTION Size (acres): 31.57

31.6 acres is a small example of this community type. The marsh appears to be stable but may decrease in size over time as shrubs and trees invade it.

An herb-dominated open wetland located within the floodplain of Pennock Brook. The shallow emergent marsh grades into a spruce-fir swamp downstream. The wetland is surrounded by beech-maple mesic forest and conifer plantations. The larger landscape is a mix of post-agricultural successional communities, managed forests, and privately owned forests and farmland.

MANAGEMENT

Management Comments:

Provide a forested buffer between the wetland and logging activities. Buffers can prevent inadvertent invasions of exotic plant species which are sometimes introduced into areas disturbed by heavy equipment such as skidders. Forested buffers can also minimize or eliminate the potential for erosion and sedimentation into the wetland.

ADDITIONAL COMMENTS

Need releve plot data. Need to sample the very small, scattered population of phragmites in the deep south end of the marsh to determine its native versus non-native status.

Managed area: Chateaugay State Forest.

Shrub Swamp

Mad River Swamp

EO number CPALOM0C00 21 EO ID 40

STATUS Heritage Global Rank: G5 Heritage State Rank: S5

LOCATION

County: Lewis
Towns: Montague and Osceola
USGS topographic quadrangle map: Sears Pond
Survey site: Mad River Swamp

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-19
Occurrence quality: AB - Excellent or good estimated viability

Quality comments:
This is a moderate-sized shrub swamp in very good to excellent condition within an excellent, forested landscape.

ECOLOGICAL DATA

A medium to large sized shrub swamp currently documented as sixteen patches. Most patches occur along the Mad River, a few occur in slight depressions just south of the Mad River. Additional nearby patches fall into the Hooker Brook drainage and are not documented here as part of this occurrence. All of these patches are dominated by speckled alder (Alnus incana spp. Rugosa). Some areas consist of very dense, tall (2m) alder while other areas are more open with shorter (1m) shrubs and patches of Carex stricta/Calamagrostis sedge meadow or shallow emergent marsh. Scattered trees overtop the alder in some localities; these trees are typically Acer rubrum, Abies balsamea, and Picea rubens. The tall shrub layer (75% cover) consists of Alnus incana ssp. Rugosa (75%). The short shrub layer (60% cover) includes Alnus incana ssp. Rugosa, Spiraea latifolia (8%), Myrica gale (3%), Cornus amomum (2%), and Viburnum recognitum (1%). The herbaceous layer includes Calamagrostis canadensis (14%), Impatiens capensis (10%), Chelone glabra (5%), Lysimachia terrestris (2%), Caltha palustris (2%), Potentialla palustris (1%), and Aster puniceus (1%). Beaver are active in the area with dams and lodges observed in 1999.

HABITAT DESCRIPTION Size (acres): 181.00

This occurrence is made up of mostly long and thin, as well as relatively convoluted, patches. The mean shape index is 2.17 (Schumaker 1996). The size depends, in part, by the dynamic influence of beaver and would be expected to change over time depending on the relative intensity and recent history of beaver activity. This community occurrence is currently delineated as 16 polygons. The largest distance between any two patches is 0.16 mile.

This natural community is part of an impressive and extensive wetland complex along a meandering marsh headwater stream and in a few patches in the adjacent uplands. Communities along the stream vary from open sedge meadow, shallow emergent marsh, and this occurrence of alder shrub swamp. Spruce-fir swamp borders the upland edge of the wetland and also occurs in patches among the upland beech-maple mesic forest. The wetland complex is very large, isolated, and appears undisturbed. The surrounding hills support a beech-maple mesic forest and spruce-northern hardwood forest that are both selectively logged. The broader landscape represents a very large area (tens of thousands of acres) of mostly intact forest cover unbisected by roads.

MANAGEMENT

Threats:

Skidder trails from logging activity and other roads passing through or nearby this community may be vectors for invasive species.

Management Comments:
Avoid logging in the adjacent upland forest.

ADDITIONAL COMMENTS

Additional patches need to be visited and inventoried and the full extent needs to be assessed, relative to watershed boundaries and connectivity.

This is mostly an alder-dominated shrub swamp but some areas may be dominated by Nemopanthus adjacent to the patches of spruce-fir swamp. A canoe survey of all shrub areas along the Mad River would be appropriate to better understand this community. Separate possible Myrica gale dominated medium fen patches if they are significant.

Shrub Swamp

Hooker Brook

EO number CPALOM0C00 26 EO ID 12003

STATUS Heritage Global Rank: G5 Heritage State Rank: S5

LOCATION

County: Lewis
Town: Montague
USGS topographic quadrangle map: Sears Pond
Survey sites: Hooker Brook

OBSERVATION and QUALITY STATUS

Last observed: 2005-07-14
Occurrence quality: B - Good estimated viability

Quality comments:
A relatively small occurrence in very good condition in a very good landscape. The swamp is part of a dynamically changing beaver-influenced system.

ECOLOGICAL DATA

This shrub swamp is split by a meandering marsh headwater stream and flooded by beaver activity. The tall shrub layer (4 m) has 45% cover and is nearly monodominant with Alnus incana ssp. Rugosa (45.0%). At the border of this swamp with sedge meadow, the herbaceous layer (1.3 m) is relatively dense (up to 95% cover) with Calamagrostis canadensis (50.0%), Carex stricta (25.0%), and Glyceria canadensis (20%, usually emergent out of water) as the most abundant species. Shrubs are more dense with a less-dense herb layer in other locations of the swamp.

HABITAT DESCRIPTION Size (acres): 16.20

This is a small to moderate-sized shrub swamp occurring in two relatively convoluted and elongated patches. The average shape index is 2.19 (Schumaker 1996). The size changes dynamically depending on beaver activity.

This community occurs along a sections of Hooker Brook in two patches just upstream from an active beaver dam, with one patch on either side of the brook. Nearby communities include sedge meadow, spruce-fir swamp, black spruce-tamarack bog, and the upland matrix forest: beech-maple mesic forest. Beaver activity is an integral component of fluvial dynamics along Hooker Brook and undoubtedly influences the structure and extent of this community. This community likely changes in size over time, depending on local beaver activity. This community occurs along a meandering stream and in wet soils. It floods periodically, and on a longer time span, is dynamically controlled by beaver activity.

MANAGEMENT

Threats:

Invasive species (namely purple loosestrife) may become an issue, particularly in the southern section.

Management Comments:
Managers should monitor and immediately remove any invasive species found along the nearby roadways as this type of wetland is vulnerable to invasion.

ADDITIONAL COMMENTS

Managed Area: East Branch Fish Creek Conservation Area. Inventory needs: Additional inventory is needed, including releve plots, to further evaluate the composition of this community.

Spruce-Fir Swamp

Cottrell Creek Redfield

EO number CPALFM0G00 4 EO ID 2616

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Oswego

Town: Redfield

USGS topographic quadrangle maps: Boylston Center and Worth Center

Survey site: Cottrell Creek Redfield

OBSERVATION and QUALITY STATUS

Last observed: 1994-09-10

Occurrence quality: B - Good estimated viability

Quality comments:

Two relatively small patches of swamp, mid-late successional stage, no recent disturbance. Surrounded by large areas of relatively intact natural communities. It would need to be bigger and more mature to be an "A" ranked occurrence.

ECOLOGICAL DATA

Data from patch 1: The tree canopy (22 m) has 40% cover. The most abundant trees are Acer rubrum (25%) and Picea rubens (10%). The tree sub-canopy (7 m) has 15% cover. The most abundant trees are Picea rubens (10%) and Abies balsamea (8%). The tall shrub layer (2.5 m) has 65% cover. The most abundant shrubs are Alnus incana (30%) and Nemopanthus mucronata (15-20%). The short shrub layer (<0.5 m) has 3% cover of Vaccinium myrtilloides. The herb layer (<1 m) has 15% cover of Osmunda cinnamomea. The moss layer has 60-70% cover of Sphagnum spp. Data from patch 2: The tree canopy (4.5-10.0 m) has 85% cover. The most abundant trees are Abies balsamea (30%), Betula alleghaniensis (30%), Acer rubrum (25%). The tree sub-canopy (1-4.5 m) has 10% cover. The most abundant trees are Abies balsamea (5%), Picea rubens (10%). The tall shrub layer (1.8 m) has 2% cover of Viburnum cassinoides. The short shrub layer (0.3-1.8 m) has 3% cover Viburnum cassinoides. The herb layer (<1 m) has 20% cover. The most abundant herbs are Streptopus rosea (5%), Osmunda cinnamomea (5%), Maianthemum canadense (5%). The moss layer has 70% cover. The most abundant mosses are Sphagnum girgensohnii (60%) and Sphagnum centrale (5%).

HABITAT DESCRIPTION Size (acres): 51.00

Two patches of spruce-fir swamp <0.5 mile apart. Patch #1 is approximately 23 acres, and is a flat area on high ground. From the south it grades from dry hemlock-northern hardwoods to swamp with an increase of red spruce and balsam fir. Mountain holly and speckled alder are dense. The canopy varies greatly (30-90%). Herb layer has low diversity. Patch #2 is approximately 28 acres, and is a linear band running north to south grading into northern hardwoods on east side and hemlock-hardwood swamp to northwest. Sphagnum dominates large flat areas. The spruce-fir swamp forms a mosaic with shrub swamp to south.

MANAGEMENT

ADDITIONAL COMMENTS

Two releve plots surveyed in 1994. One 60' x 60' plot in patch 1, and one 10 m X 10 m in patch 2.

Spruce-Fir Swamp

Mad River Swamp and South Branch Mad River

EO number CPALFM0G00 11 EO ID 9476

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Lewis

Towns: Montague and Osceola

USGS topographic quadrangle map: Sears Pond

Survey sites: Mad River Swamp and South Branch Mad River

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-18

Occurrence quality: A - Excellent estimated viability

Quality comments:

This is a large spruce-fir swamp consisting of at least 25 patches in excellent condition mostly within a protected core forest of 14,300 acres and otherwise nestled within a very large landscape of mostly working forest.

ECOLOGICAL DATA

This spruce-fir swamp occurs in patches of varying canopy density and varying stand age. The patches occur along the upper Mad River and adjacent lands draining into this portion of the river. Most patches have typical hummock/hollow topography and blowdown trees are common. Some patches have an emergent layer with scattered Abies balsamea and Picea rubens. Overall, the tree canopy layer (about 10 m) has about 55% cover and Picea rubens (35%), Acer rubrum (15%), Abies balsamea (15%), Larix laricina (10%), and Betula alleghaniensis (1%) as the most abundant species. The tall shrub layer (2 m) has about 20% cover and Nemopanthus mucronatus (10%), Picea rubens (10%), and Abies balsamea (2%) as the most abundant species. The short shrub layer (1m) has about 5% cover and Nemopanthus mucronatus (1.4%), Viburnum nudum (1.4%), Picea rubens (0.9%), Vaccinium uliginosum (0.3%), Vaccinium myrtilloides (0.3%), and Abies balsamea (0.3%) as the most abundant species. The herbaceous layer (0.5 m) has Osmunda cinnamomea (20.7%), Maianthemum canadense (15%) Oxalis montana (7.1%), Coptis trifolia (2.6%), Aralia nudicaulis (2.1%), Clintonia borealis (2.1%), Uvularia sessilifolia (2.1%), Uvularia puberula (1.4%), Veratrum viride (1.4%), Carex trisperma (0.4%), Trientalis borealis (0.3%), and Dryopteris intermedia (0.1%) as the most abundant species. Sphagnum is common (about 50% cover) along the forest floor. Some patches are relatively young with evidence of cut stumps but others are older with sangs and coarse woody debris. In addition, trees cored in two patches were aged at >200 years and 213 years old.

HABITAT DESCRIPTION Size (acres): 339.00

This is a relatively large occurrence. The true size is likely larger than currently described; more patches need to be delineated and connectivity within and among sub-watersheds needs to be evaluated. The average shape index of the 25 polygons is 1.58 (Schumaker 1996). Many are relatively regular in shape, some are convoluted and with islands of different community types. This community is currently described by 25 polygons with 0.22 miles as the largest separation between polygons. These patches occur along the Mad River (15 polygons) and the adjoining South Branch tributary and the slopes feeding these streams (10 polygons).

This swamp is a part of an extensive wetland system along a meandering marsh headwater stream and nested within adjancent upland forests. Natural communities along the stream vary from open sedge meadow, shallow emergent marsh, and shrub swamp. Beaver activity is a strong influence in the region. Some patches of this swamp are nested within the upland beech-maple mesic forest. Patches from this drainage are very near patches from the adjacent Hooker Brook drainage where another spruce-fir swamp occurrence is documented. The wetland complex is very large and relatively undisturbed, some patches have evidence of cut stumps. The surrounding uplands of beech-maple mesic forest and spruce-northern hardwood forest are selectively logged. The broader landscape represents a very large area (tens of thousands of acres) of mostly intact forest cover unbisected by roads.

MANAGEMENT

Threats:

Skidder trails from logging activity and other roads passing through or nearby this community may be vectors for invasive species. Logging reduces stand age, the number of standing dead trees, and the number of logs on the ground, in turn reducing the species dependent on these community characteristics and the integrity of this community.

Management Comments:

Avoid logging in the adjacent upland forest and cease logging in the wetland.

ADDITIONAL COMMENTS

Some shrub swamp patches may be classified as (or, may slowly convert to) this community type. Nearby patches in adjacent watersheds may have higher hydrologic connectivity than currently assumed.

Additional patches to the northwest need to be surveyed. Inventory needs include refining the boundaries, especially distinghishing between this and shrub swamp, black spruce-tamarack bog and balsam flats; a better characterization of animals; and better estimates of plant percentage cover over a broader area.

Spruce-Fir Swamp

Pennock Bog

EO number CPALFM0G00 22 EO ID 11354

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Oswego
Town: Orwell
USGS topographic quadrangle map: Orwell
Survey site: Pennock Bog

OBSERVATION and QUALITY STATUS

Last observed: 2004-07-21
Occurrence quality: B - Good estimated viability

Quality comments:

This occurrence is an average size community with no exotic species. The spruce-fir swamp is embedded within a predominantly forested landscape that is managed for timber resources and multiple recreational uses.

ECOLOGICAL DATA

A single patch of red maple and red spruce dominated swamp located within the floodplain of Pennock Brook. The tree canopy layer (16 m) has 26% cover and Acer rubrum (18%), Picea rubens (6%), Tsuga canadensis (2%), and Pinus strobus (2%) are the most abundant species. The tree subcanopy layer (10.4 m) has 17% cover and Acer rubrum (7%), Picea rubens (6%), Betula alleghaniensis (2%), and Pinus strobus (1%), are most abundant, with Tsuga canadensis at less than 1% cover. The tall shrub layer (2.9 m) has 13% cover with Acer rubrum (4%), Picea rubens (4%), Betula alleghaniensis (4%) as the most abundant species. The short shrub layer (0.8 m) has 20% cover of Vaccinium angustifolium (7%), Ilex verticillata (5%), Picea rubens (3%), Betula alleghaniensis (2%), Acer rubrum (2%), and Lindera benzoin (1%). The herbaceous layer (6.2 m) has 54% cover. Osmunda cinnamomea (31%), Leersia oryzoides (4%), Maianthemum canadense (3%), Coptis trifolia (2%), Onoclea sensibilis (2%), Carex interior (2%), and Clintonia borealis and Uvularia sessilifolia (both 1%) are the most abundant species. Other herbs observed include Carex trisperma, Carex scoparia, Lycopus americanus, Sarracenia purpurea, Rubus pubescens, Carex folliculata, Asarum canadense, Lycopus uniflorus, Dryopteris carthusiana, Trientalis borealis, Carex leptalea, Dryopteris intermedia, Galium labradoricum, Thelypteris palustris, Symplocarpus foetidus, Platanthera clavellata, Polygonum sagittatum, and Eupatorium maculatum. The non-vascular layer (0 m) has 34% cover and Sphagnum (56%) is the most abundant genera. The unvegetated surface is most commonly water (6%) and litter (2.0%).

HABITAT DESCRIPTION Size (acres): 52.16

52 acres is average for this community type. The community is one patch which is centered in a larger wetland.

A red maple and red spruce dominated swamp located within the floodplain of Pennock Brook. The spruce-fir swamp grades into a red maple-hardwood swamp downstream and a large shallow emergent marsh is located immediately upstream. The wetland is surrounded by beech-maple mesic forest and conifer plantations. The larger landscape is a mix of post-agricultural successional communiities, managed forests, and privately owned forests and farmland.

MANAGEMENT

Management Comments:

Consider adding additional boardwalking to this moderately used hiking/ski trail. Several mucky, trampled areas were observed along the trails that cross the wetland and these would benefit from the addition of a boardwalk. Provide a forested buffer between the wetland and logging activities. Buffers can prevent inadvertent invasions of exotic plant species which are sometimes introduced into areas disturbed by heavy equipment such as skidders. Forested buffers can also minimize or eliminate the potential for erosion and sedimentation into the wetland.

ADDITIONAL COMMENTS

Need releve plot data.

Managed area: Chateaugay State Forest.

Spruce-Fir Swamp

South Branch Mad River

EO number CPALFM0G00 23 EO ID 11953

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Lewis
Town: Osceola
USGS topographic quadrangle map: North Osceola
Survey sites: South Branch Mad River

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-18
Occurrence quality: B - Good estimated viability

Quality comments:

This is a small occurrence that likely has more undocumented patches nearby in good condition within a very large working forest.

ECOLOGICAL DATA

This spruce-fir swamp is currently described by one polygon; adjoining and nearby wetlands should likely be included in the full expression of this element occurrence. The swamp, as delineated, varies in physiognomy from a very open-canopied swamp or peatland with scattered conifers (Abies and Picea) and very dense patches of Nemopanthus mucronatus to a more closed-canopy swamp with scattered Nemopanthus. On average, the tree canopy layer (9 m) has about 15% cover and Acer rubrum (5%), Picea rubens (10%), and Abies balsamea (10%) as the most abundant species. The tall shrub layer (1.5 m) has 25% cover and Nemopanthus mucronatus (20%), Picea rubens (3.0%), Acer rubrum (1.5%), Abies balsamea (1.5%), and Betula alleghaniensis (1%) as the most abundant species. The short shrub layer (0.8 m) has 30% cover and Nemopanthus mucronatus (25%), Vaccinium myrtilloides (10.0%), Acer rubrum (2.0%), Abies balsamea (1.0%), and Photinia melanocarpa (1.0%) as the most abundant species. The herbaceous layer has Osmunda cinnamomea (7.5%), Carex trisperma (7.5%), Eriophorum virginicum (6.0%), and Carex folliculata (0.5%) as the most abundant species. The non-vascular layer has Sphagnum (85.0%).

HABITAT DESCRIPTION Size (acres): 38.10

This is a small occurrence currently expressed as one polygon but the full extent is not known. This patch is regularly shaped, with a shape index of 1.45 (Shumaker 1996).

This natural community is mostly surrounded by a beech-maple mesic forest matrix forest but also is connected to nearby forested wetlands that still require inventory. A well-used (in 2005) logging road passes along the north side of the wetland and selective logging has occurred along this road in this area. Otherwise, the region is part of an extensive forested upland and wetland complex.

MANAGEMENT

Threats:

Logging at the edge of the wetland and in the wetland are the largest direct threats to this community.

Management Comments:

Buffer any logging activity by about 100 feet around the wetland and exclude logging from the community.

ADDITIONAL COMMENTS

Additional inventory is needed to determine the connectivity of this patch to nearby patches and the full extent of this occurrence.

Additional inventory is needed to fully understand the identification of this community type. This example may in part represent an undescribed community for New York, a shrubby peatland dominated by Nemopanthus.

Spruce-Fir Swamp

Hooker Brook
EO number CPALFM0G00 24 EO ID 11955

STATUS Heritage Global Rank: G3G4 Heritage State Rank: S3

LOCATION

County: Lewis
Towns: Osceola and Montague
USGS topographic quadrangle map: Sears Pond
Survey sites: Hooker Brook

OBSERVATION and QUALITY STATUS

Last observed: 2005-08-19
Occurrence quality: AB - Excellent or good estimated viability

Quality comments:

This is a large spruce-fir swamp consisting of many (15) patches of varying size, physiognomic structure, and species composition. This swamp is within a very large forested landscape in very good condition that is likely improving over time.

ECOLOGICAL DATA

This spruce-fir swamp occurs throughout the small watershed of Hooker Brook, a tributary to the Mad River. It consists of 15 patches; nearby patches in adjacent drainages (Cold Brook to the SW and Mad River to the NE) are not included as a part of this occurrence. Patches range from a dense canopy of Abies balsamea and Picea rubens to a more open canopy with dense shrubs, approaching the character of shrub swamp. Overall, the tree canopy layer (15 m) has 65% cover and Picea rubens (24.0%), Abies balsamea (23.0%), and Acer rubrum (16.2%) as the most abundant species. The tall shrub layer (2.5 m) has 5% cover and Alnus incana ssp. rugosa (up to 16.0% in some patches), Betula alleghaniensis (1.0%), Nemopanthus mucronatus (1.0%), Ilex verticillata (0.6%), and Picea rubens (0.4%) as the most abundant species. The short shrub layer (0.7 m) has 10% cover and Betula alleghaniensis (4.0%), Nemopanthus mucronatus (3.2%), Acer rubrum (1.0%), Alnus incana (1.0%), Picea rubens (1.0%), and Vaccinium myrtilloides (0.2%) as the most abundant species. The herbaceous layer (0.2 m) has 28% cover and Osmunda cinnamomea (29.6%), Clintonia borealis (5.0%), Oxalis montana (4.8%), Thelypteris palustris (4.0%), Maianthemum canadense (2.8%), Coptis trifolia (1.4%), and Carex trisperma (0.6%) as the most abundant species. Sphagnum is common in the non-vascular layer (45%); Bazzania trilobata (0.4%) is a present leafy liverwort.

HABITAT DESCRIPTION Size (acres): 229.50

This is a moderately-sized occurrence broken up into fifteen patches. Patches range from being quite regular and smooth-edged to convoluted. The average shape index is 1.94 (Schumaker 1996). A few shrub swamp patches may eventually succeed towards spruce-fir swamp, so the trend may be towards increasing in size.

This spruce-fir swamp occurs in many patches within a broad matrix of beech-maple mesic forest. Adjacent small patches include black spruce-tamarack bog, shrub swamp, and sedge meadow, and shallow emergent marsh. Beaver activity is an integral component of fluvial dynamics along Hooker Brook and may influence the hydrology within some of these spruce-fir swamp patches. Logging has been a very large component of this landscape in the past, however most of the adjancent upland forest is now under conservation protection and should improve in viability over time.

MANAGEMENT

Threats:

Skidder trails from logging activity in the unprotected southern patches and other roads passing through or nearby this community may be vectors for invasive species.

ADDITIONAL COMMENTS

Releve plots are needed to better quantify the character and quality of this community.

Managed Area: East Branch Fish Creek Conservation Area.

Three-toed Woodpecker

(Picoides dorsalis)

Mad River Swamp

EO number ABNYF07110 4 EO ID 6423

STATUS Heritage Global Rank: G5 Heritage State Rank: S2

LOCATION

County: Lewis

Town: Montague

USGS topographic quadrangle map: Sears Pond

Survey site: Mad River Swamp

OBSERVATION and QUALITY STATUS

Last observed: 1999-09-10

Occurrence quality: E - Verified extant (viability not assessed)

Quality comments:

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 1.00

MANAGEMENT

ADDITIONAL COMMENTS

Warm Water Fish Concentration Area

(Warm Water Fish Concentration Area)

Salmon River Mouth

EO number OWARMFISH1 17 EO ID 6890

STATUS Heritage Global Rank: GNR Heritage State Rank: S4

LOCATION

County: Oswego

Town: Richland

USGS topographic quadrangle map: Pulaski

Survey site: Salmon River Mouth

OBSERVATION and QUALITY STATUS

Last observed: 1977

Occurrence quality: U - Unrankable

Quality comments:

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 300.00

The lower 1-1.5 miles of the river are approximately at lake level, forming a wetland embayment. Extensive beds of emergent marsh vegetation and submergent aquatic vegetation are interspersed throughout the area.

MANAGEMENT

Threats:

Any activity that would seriously degrade water quality, increase temperature or turbidity, reduce flows or alter water depths, especially during spawning periods; permanent disturbance of wetland vegetation, including submergent beds; enhancement of motorboat access to Lake Ontario from this area.

ADDITIONAL COMMENTS

See the Heritage GMF for a map with boundary details. Significant Habitat Unit file: 38011.

Yellow Mountain-saxifrage

(Saxifraga aizoides)

Salmon River Falls

EO number PDSAX0U020 11 EO ID 6895

STATUS Heritage Global Rank: G5 Heritage State Rank: S2

LOCATION

County: Oswego

Town: Orwell

USGS topographic quadrangle map: Orwell

Survey site: Salmon River Falls

OBSERVATION and QUALITY STATUS

Last observed: 2005-06-29

Occurrence quality: B - Good estimated viability

Quality comments:

There is an estimate of 200-300 plants within a well-protected and good quality shale cliff and talus slope woodland.

ECOLOGICAL DATA

See Observation Data.

HABITAT DESCRIPTION Size (acres): 1.00

B: A few hundred individuals are present within this population.

These plants are located in seepage areas of a shale cliff community. The partially shaded wet cliffs rising 100 feet or more above the creek bottom below. Vegetation covers approximately 25-50% of the area where the plants are located. Elsewhere the vegetation cover may approach 100%. The wet seepage areas seem to have some calcium and other mineral influences. Associated species: Apios americana, Apocynum cannabinum, Aquilegia canadensis, Aster prenanthoides, Carex aurea, Carex disperma, Carex flava, Conocephalum (liverwort), Cystopteris bulbifera, Eupatorium maculatum, Eupatorium rugosum, Lobelia kalmii, Lysimachia ciliata, Parnassia glauca, Prenanthes, Primula mistassinica, Saxifraga virginiensis, and Thalictrum dioicum.

MANAGEMENT

ADDITIONAL COMMENTS

See the Heritage GMF for precise location.

Appendix 4. Landscape analysis data with tables of raw values, metrics, final rankings, and figures showing for metrics on the landscape.

Appendix 4 Figures:

(this page intentionally left blank)

CODE-NAME	Subwatershed	size (acres)	acres natural	% natural	acres within >300 acre roadless blocks	% within >300 acre roadless blocks	roadless block mean score	acres within >300 acre natural blocks	% within >300 acre natural blocks	area within 100m of streams (acres)	natural area within 100m of streams (acres)	% natural within 100m of streams	total stream length (meters)	steam length within natural land (m)	% streams in natural land	total stream length (miles)	stream length within natural land (miles)
BGWM	Beaver - Gillmore - Willow - McDougal	6962.51	6952.26	99.54	6962.48	100.00	54.45	6950.83	99.83	2438.99	2438.55	99.29	52384.66	52368.91	99.97	32.55	32.54
BBMC	Beaverdam Brk -Meadow Creek - Reservoir	19720.52	18055.28	81.65	19046.57	96.58	10.31	17994.05	91.25	7226.02	6750.77	66.95	111920.63	105816.75	94.55	69.54	65.75
COBR	Cold Brook	6557.72	6474.11	98.59	6557.69	100.00	61.10	6471.98	98.69	2347.81	2299.78	97.72	51423.85	50600.21	98.40	31.95	31.44
FBTT	Fall Brook - Twomile - Threemile	9861.72	9438.18	95.42	9861.69	100.00	34.46	9409.36	95.41	2302.67	2228.83	96.30	51610.24	50157.12	97.18	32.07	31.17
GRMM	Grindstone - Mill - Muddy	11183.28	11095.46	98.38	11041.30	98.73	53.99	11082.80	99.10	4275.52	4213.70	96.49	91034.83	89738.23	98.58	56.57	55.76
KESF	Keese-Smith-Finnegan	6418.87	6351.35	98.80	6326.66	98.56	17.71	6350.17	98.93	1893.68	1878.12	98.71	39665.81	39384.06	99.29	24.65	24.47
LSRM	Lower Salmon River - Mainstem	11544.44	7624.11	64.28	9328.00	80.80	2.14	7145.31	61.89	3046.35	2116.30	62.97	65150.30	51664.81	79.30	40.48	32.10
MARI	Mad River	21013.07	20693.54	98.17	21012.66	100.00	60.40	20684.60	98.44	7067.01	6940.03	97.64	158552.99	155872.93	98.31	98.52	96.85
NOBR	North Branch	17993.19	17392.32	96.53	17984.39	99.95	27.28	17351.09	96.43	5227.59	4986.96	95.02	111595.94	106343.66	95.29	69.34	66.08
ORPE	Orwell - Pekin	12991.61	10746.30	82.07	12098.43	93.13	8.54	10623.23	81.77	3842.30	3396.18	86.61	81461.04	75619.00	92.83	50.62	46.99
PECK	Pennock - Coey - Kenny	10879.96	10522.13	89.88	10790.90	99.18	13.04	10511.37	96.61	4204.14	4042.68	78.51	70830.76	68524.50	96.74	44.01	42.58
PMLB	Prince - Mulligan - Little Baker	7244.85	7028.76	96.97	7244.82	100.00	20.74	7020.36	96.90	2005.33	1950.84	97.09	45392.60	44102.91	97.16	28.21	27.40
SBLB	Stony Brook - Line Brook	4623.23	4564.19	98.63	4621.53	99.96	36.87	4558.99	98.61	1644.16	1619.70	98.30	35704.69	35219.82	98.64	22.19	21.88
TRBR	Trout Brook	12938.04	9927.00	76.32	12792.19	98.87	4.86	9780.74	75.60	4243.05	3565.42	82.88	89340.60	79397.61	88.87	55.51	49.34
UPSR	Upper Salmon River	16365.46	15928.97	96.96	16354.91	99.94	38.80	15905.64	97.19	4257.07	4162.10	96.92	93867.61	90931.59	96.87	58.33	56.50

Subwatershed	number of dams	total stream length (miles)	dam density	miles of roads	number of road/stream crossings	roads per watershed acre	road crossings per stream mile	Pollution points	# predicted rare animal species	# predicted rare plant species	# predicted rare animal species at any single hotspot	# predicted rare plant species at any single hotspot	# predicted rare species (p&a) at any single hotspot	# known rare animal occurrences	# known rare plant occurrences	# known significant natural community occurrences
BGWM	0	32.55	0	2.45	8	0.0004	0.2458	0	1	0	1	0	1	0	0	3
BBMC	11	69.54	0.16	43.8	46	0.0022	0.6615	1	3	5	2	4	5	3	3	9
COBR	0	31.95	0	3.51	6	0.0005	0.1878	0	1	2	1	1	2	0	0	3
FBTT	1	32.07	0.03	18.75	19	0.0019	0.5925	0	1	2	1	2	3	0	1	2
GRMM	0	56.57	0	12.3	14	0.0011	0.2475	0	1	2	1	1	1	0	0	3
KESF	2	24.65	0.08	8.86	10	0.0014	0.4057	0	1	1	1	1	1	0	0	4
LSRM	8	40.48	0.2	60.31	39	0.0052	0.9634	3	13	9	8	4	11	6	6	2
MARI	0	98.52	0	19.91	15	0.0009	0.1523	0	1	2	1	1	2	1	1	11
NOBR	1	69.34	0.01	29.59	33	0.0016	0.4759	0	3	2	2	1	2	0	0	5
ORPE	1	50.62	0.02	30.15	32	0.0023	0.6322	0	3	3	3	2	3	2	1	5
PECK	1	44.01	0.02	22.26	29	0.002	0.6589	0	1	4	1	1	2	0	0	0
PMLB	0	28.21	0	14.04	13	0.0019	0.4608	0	1	2	1	1	2	0	0	2
SBLB	0	22.19	0	5.74	7	0.0012	0.3155	0	1	2	1	1	2	0	0	1
TRBR	3	55.51	0.05	31.99	35	0.0025	0.6305	1	3	3	3	1	3	0	0	0
UPSR	1	58.33	0.02	19.95	8	0.0012	0.1372	0	1	1	1	1	2	0	0	10

	Land cover			Land cover in stream buffer			Stream barriers, point-source pollution			Roads				Biodiversity				
Subwatershed	% natural land	% within >300 acres roadless blocks	INDEX (avg previous 2)	% natural land within 100m of streams	% streams within natural land	INDEX (avg previous 2)	dam density index (100-100x)	pollution points index (100-10x)	INDEX (avg previous 2)	INDEX roadless block score	roads per watershed acre (relative)	road crossing per stream mile (relative)	INDEX (avg previous 2)	Predicted Rare Plant & Animal richness	Hotspot richness	Known Rare plant & Animal Richness	Known Significant natural communities	INDEX (relativized sum)
BGWM	99.54	99.83	99.69	99.29	99.97	99.63	100	100	100	54.45	7.69	25.51	16.60	1	1	0	3	10.64
BBMC	81.65	91.25	86.45	66.95	94.55	80.75	84	90	87	10.31	42.31	68.66	55.48	8	5	6	9	59.57
COBR	98.59	98.69	98.64	97.72	98.40	98.06	100	100	100	61.10	9.62	19.49	14.55	3	2	0	3	17.02
FBTT	95.42	95.41	95.42	96.30	97.18	96.74	97	100	98.5	34.46	36.54	61.50	49.02	3	3	1	2	19.15
GRMM	98.38	99.10	98.74	96.49	98.58	97.54	100	100	100	53.99	21.15	25.69	23.42	3	1	0	3	14.89
KESF	98.80	98.93	98.87	98.71	99.29	99.00	92	100	96	17.71	26.92	42.11	34.52	2	1	0	4	14.89
LSRM	64.28	61.89	63.09	62.97	79.30	71.14	80	70	75	2.14	100.00	100.00	100.00	22	11	12	2	100.00
MARI	98.17	98.44	98.31	97.64	98.31	97.98	100	100	100	60.40	17.31	15.80	16.56	3	2	2	11	38.30
NOBR	96.53	96.43	96.48	95.02	95.29	95.16	99	100	99.5	27.28	30.77	49.40	40.08	5	2	0	5	25.53
ORPE	82.07	81.77	81.92	86.61	92.83	89.72	98	100	99	8.54	44.23	65.62	54.92	6	3	3	5	36.17
PECK	89.88	96.61	93.25	78.51	96.74	87.63	98	100	99	13.04	38.46	68.40	53.43	5	2	0	0	14.89
PMLB	96.97	96.90	96.94	97.09	97.16	97.13	100	100	100	20.74	36.54	47.83	42.19	3	2	0	2	14.89
SBLB	98.63	98.61	98.62	98.30	98.64	98.47	100	100	100	36.87	23.08	32.74	27.91	3	2	0	1	12.77
TRBR	76.32	75.60	75.96	82.88	88.87	85.88	95	90	92.5	4.86	48.08	65.45	56.76	6	3	0	0	19.15
UPSR	96.96	97.19	97.08	96.92	96.87	96.90	98	100	99	38.80	23.08	14.24	18.66	2	2	0	10	29.79

			landscape context		condition			
Subwatershed	rank	overall index	land cover	RB score	stream buffers	dam, pollution index	100-road index	species diversity index
Mad River	1	79.74	98.31	60.40	97.98	100.00	83.44	38.30
Cold Brook	2	76.71	98.64	61.10	98.06	100.00	85.45	17.02
Beaver - Gillmore - Willow - McDougal	3	74.63	99.69	54.45	99.63	100.00	83.40	10.64
Upper Salmon River	4	73.82	97.08	38.80	96.90	99.00	81.34	29.79
Grindstone - Mill - Muddy	5	73.62	98.74	53.99	97.54	100.00	76.58	14.89
Stony Brook - Line Brook	6	69.80	98.62	36.87	98.47	100.00	72.09	12.77
North Branch	7	67.31	96.48	27.28	95.16	99.50	59.92	25.53
Fall Brook - Twomile - Threemile	8	65.87	95.42	34.46	96.74	98.50	50.98	19.15
Keese-Smith-Finnegan	9	65.33	98.87	17.71	99.00	96.00	65.48	14.89
Prince - Mulligan - Little Baker	10	64.58	96.94	20.74	97.13	100.00	57.81	14.89
Beaverdam Brk -Meadow Creek - Reservoir	11	61.43	86.45	10.31	80.75	87.00	44.52	59.57
Orwell - Pekin	12	60.07	81.92	8.54	89.72	99.00	45.08	36.17
Pennock - Coey - Kenny	13	59.06	93.25	13.04	87.63	99.00	46.57	14.89
Trout Brook	14	53.60	75.96	4.86	85.88	92.50	43.24	19.15
Lower Salmon River - Mainstem	15	51.89	63.09	2.14	71.14	75.00	0.00	100.00

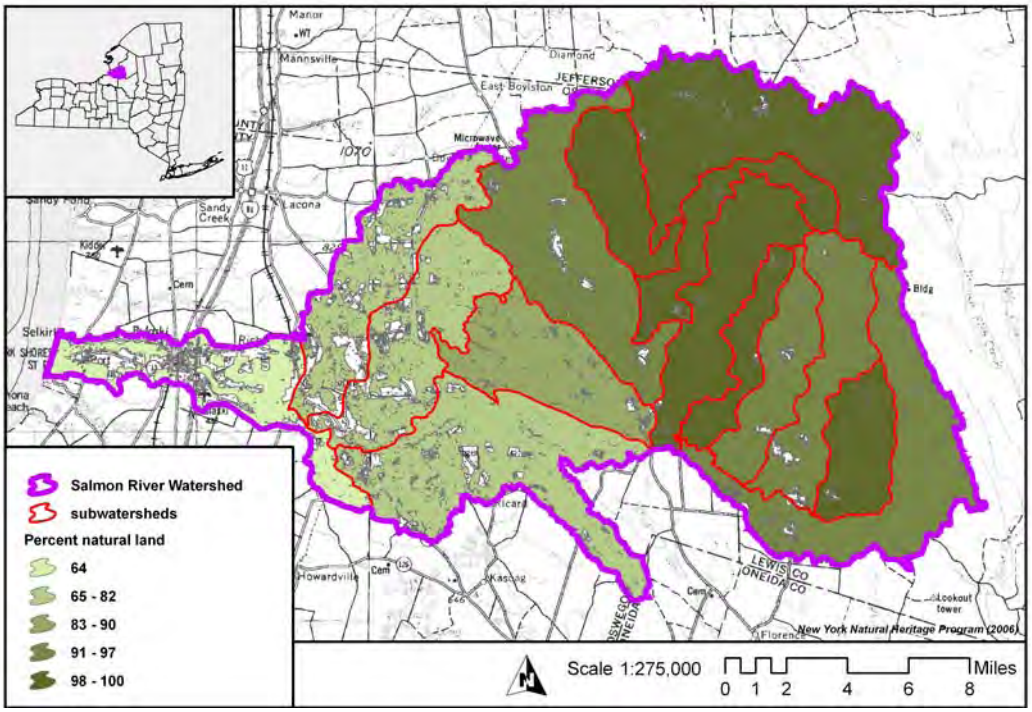


Figure A4.1. The percentage of natural land within each subwatershed, as defined by the MRLC land use/ land cover dataset.

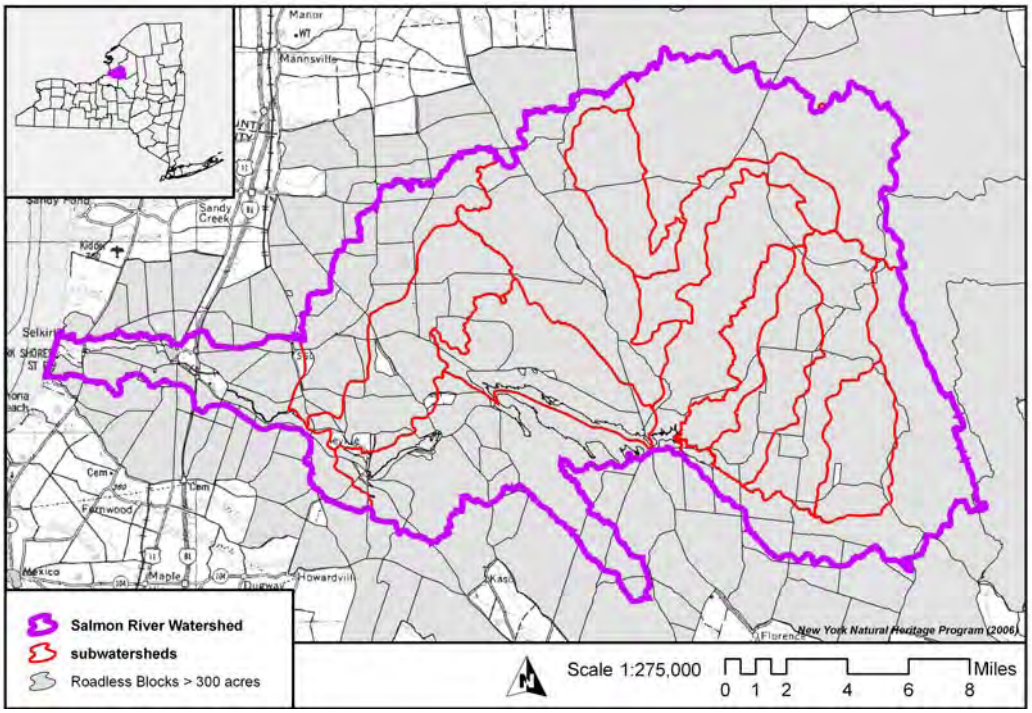


Figure A4.2. Roadless blocks greater than 300 acres.

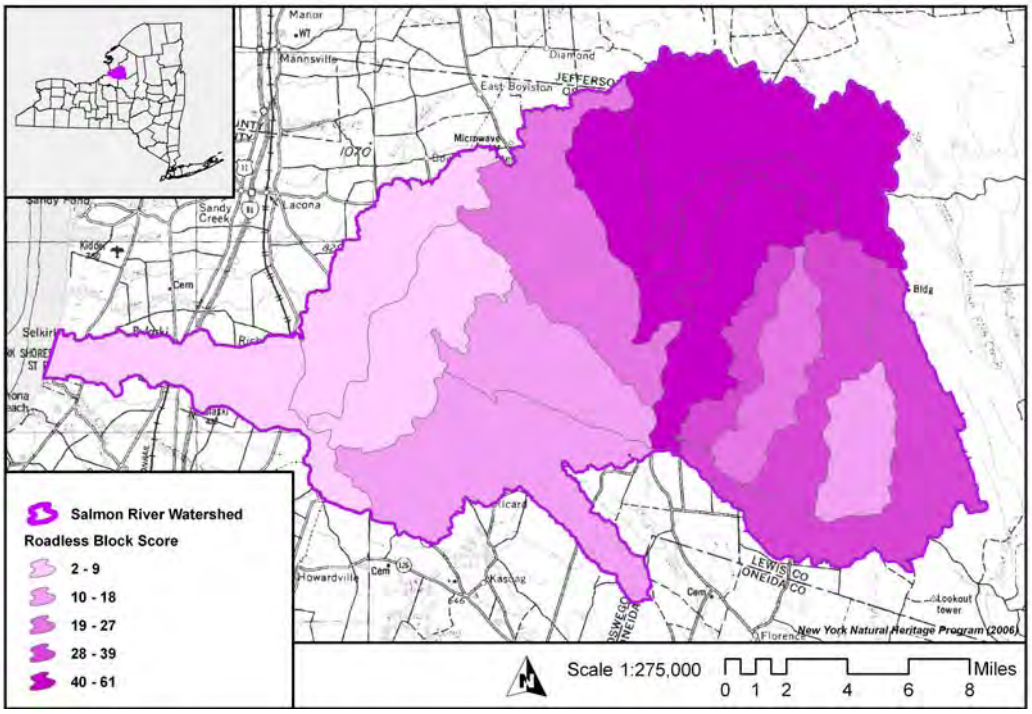


Figure A4.3. Roadless block score.

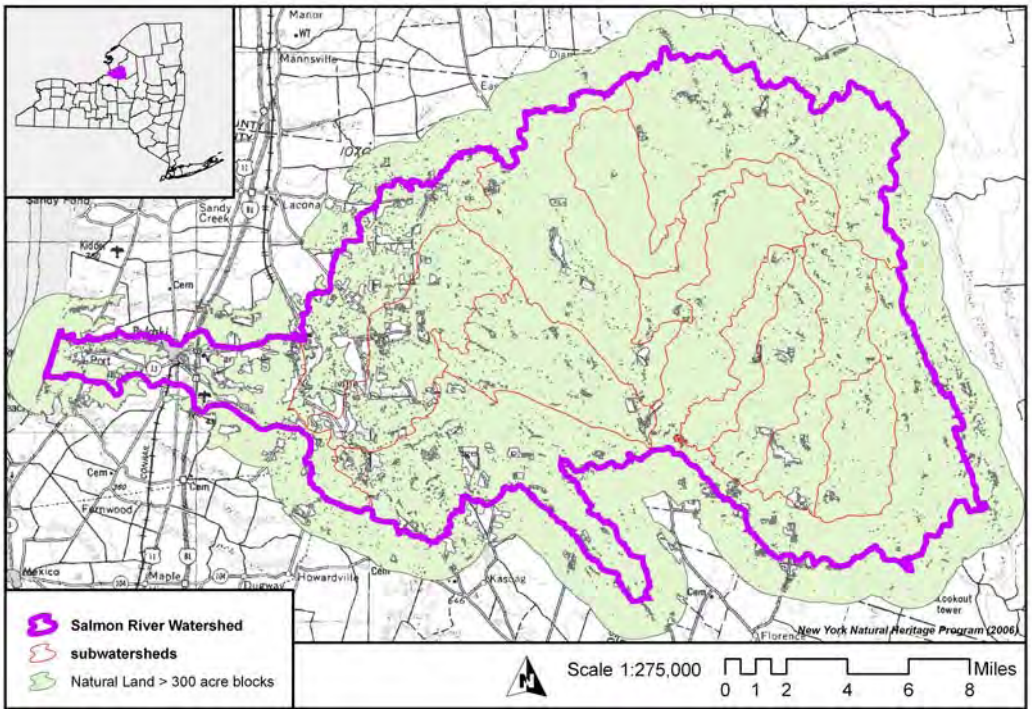


Figure A4.4. Natural land in continuous blocks greater than 300 acres.

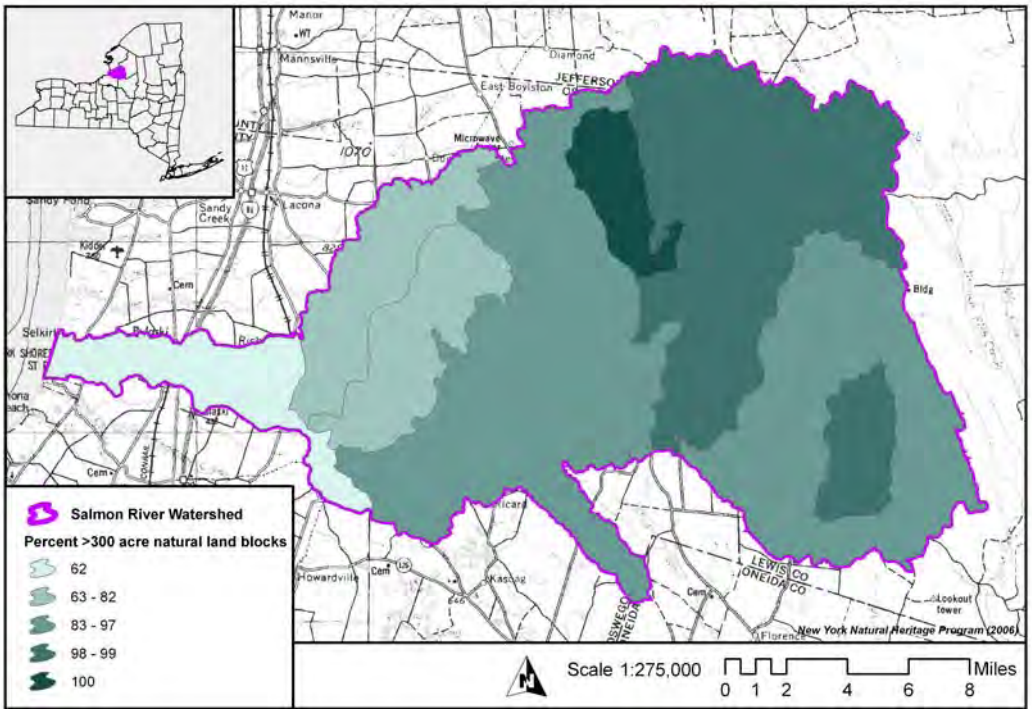


Figure A4.5. Percentage of total subwatershed area covered by 300 acre natural land blocks.

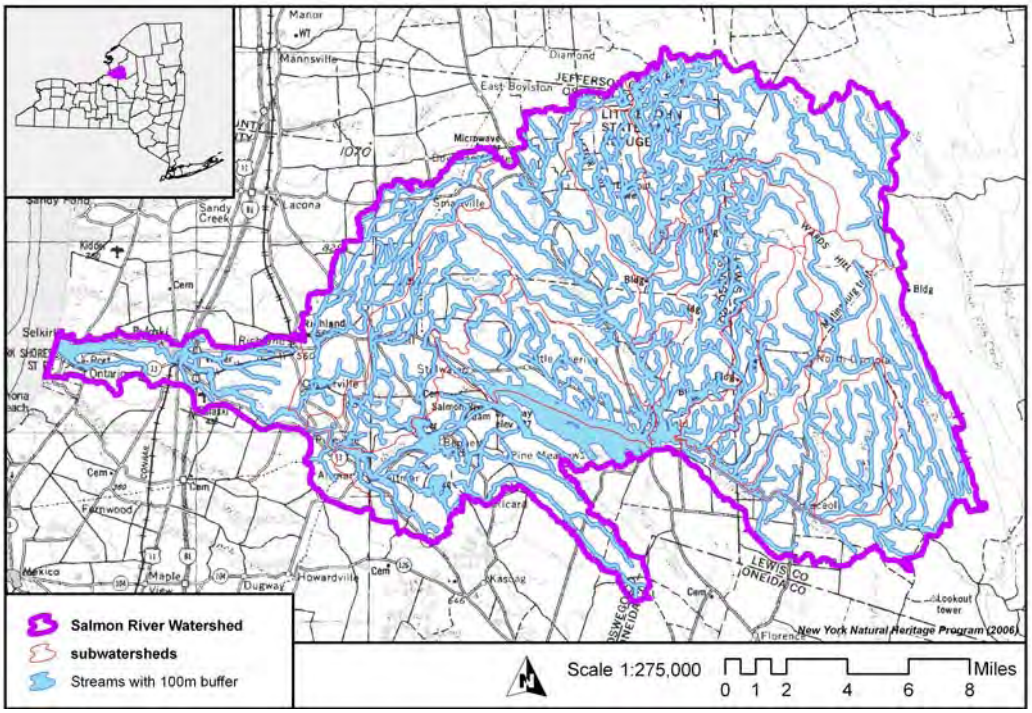


Figure A4.6. Streams and attached waterbodies with a 100m buffer applied.

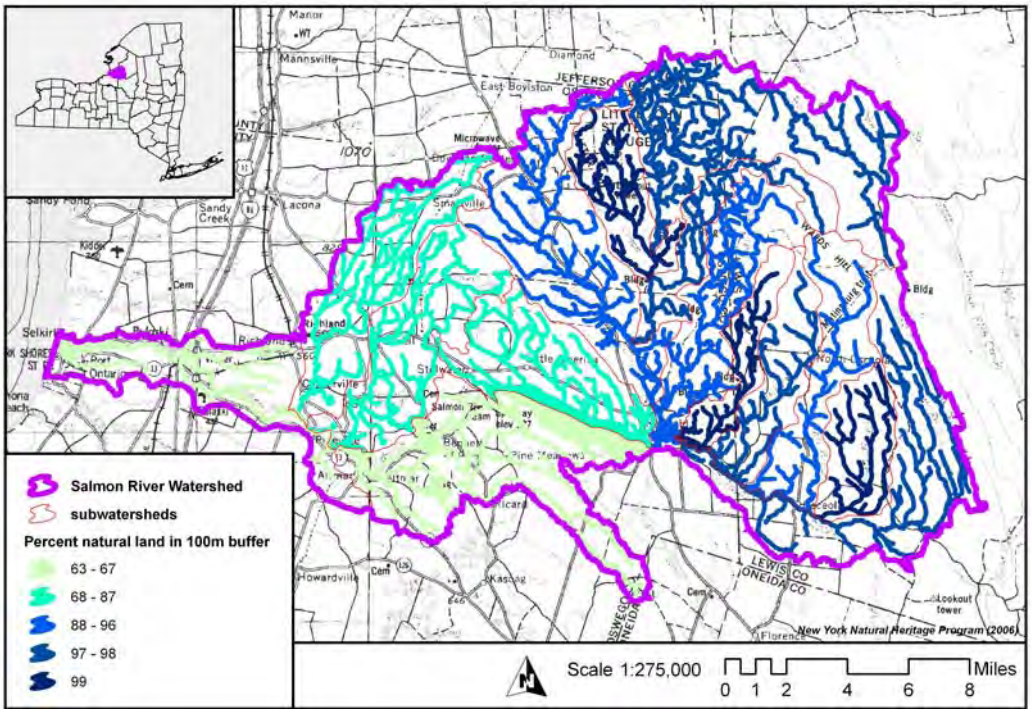


Figure A4.7. The percentage of natural land within 100m stream buffers, by subwatershed.

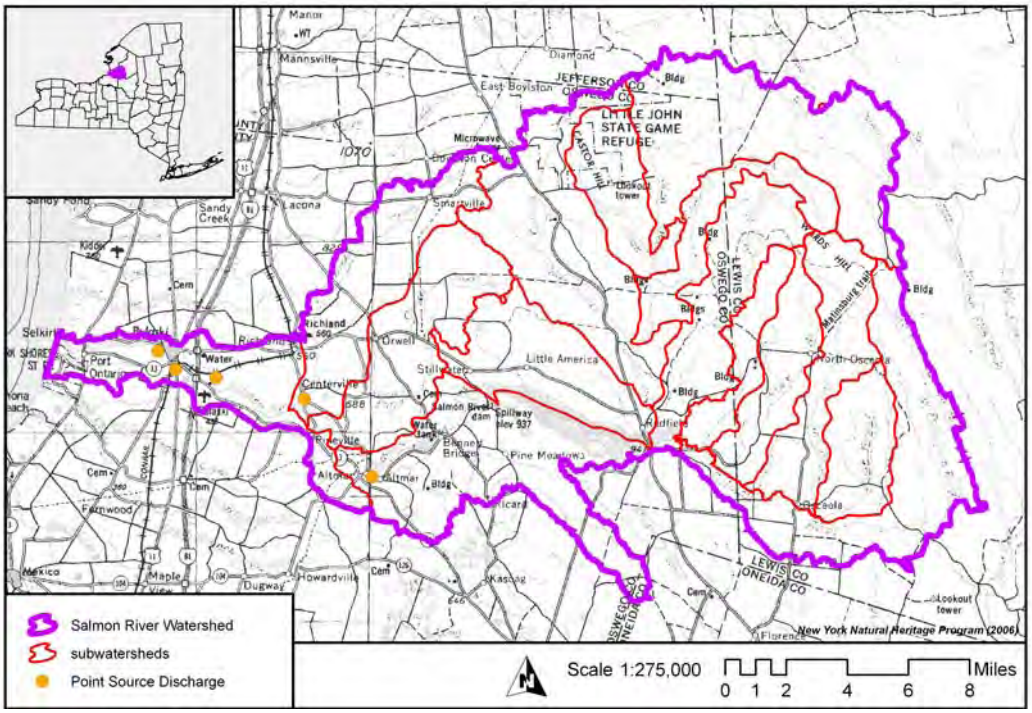


Figure A4.8. Point source discharge locations in the Salmon River Watershed.

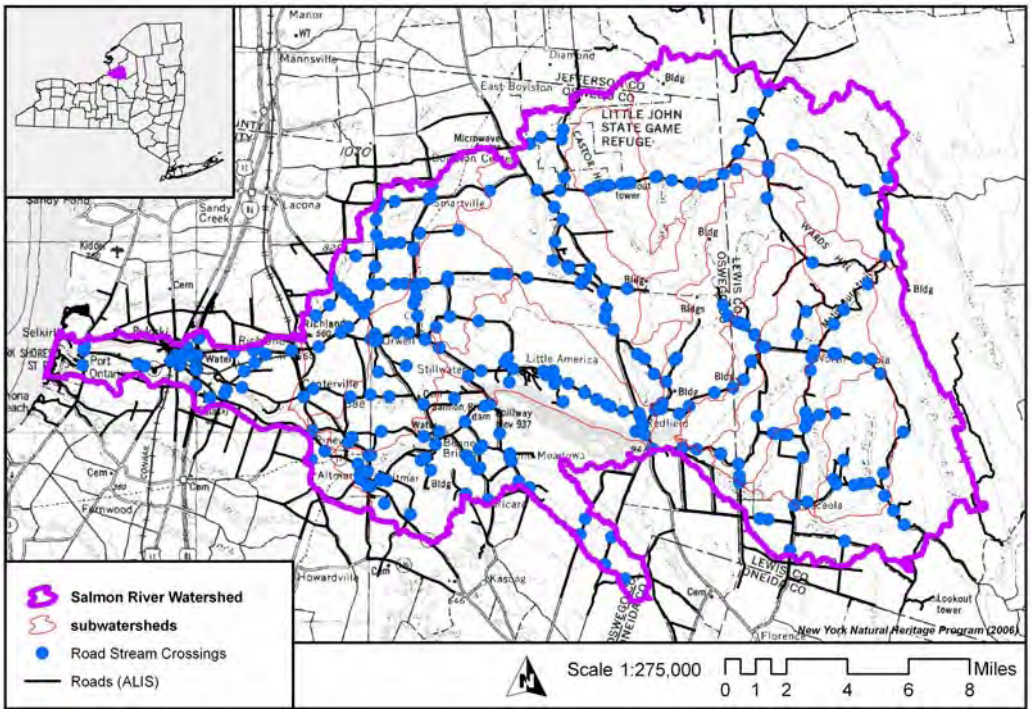


Figure A4.9. Locations where roads cross streams.

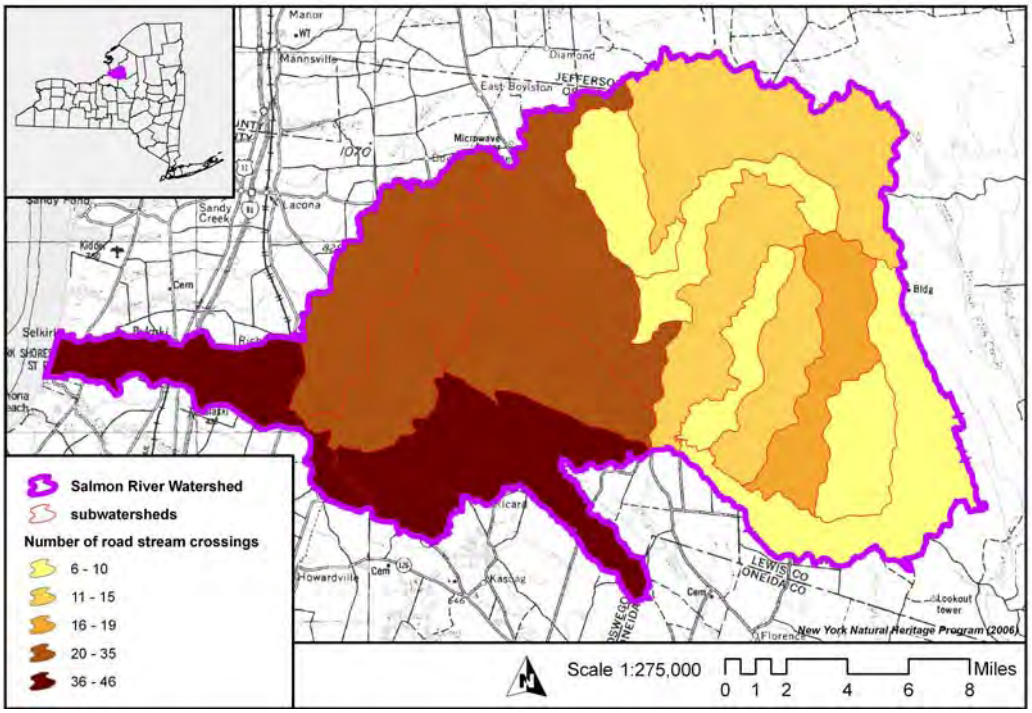


Figure A4.10. Number of road-stream crossings for each subwatershed.

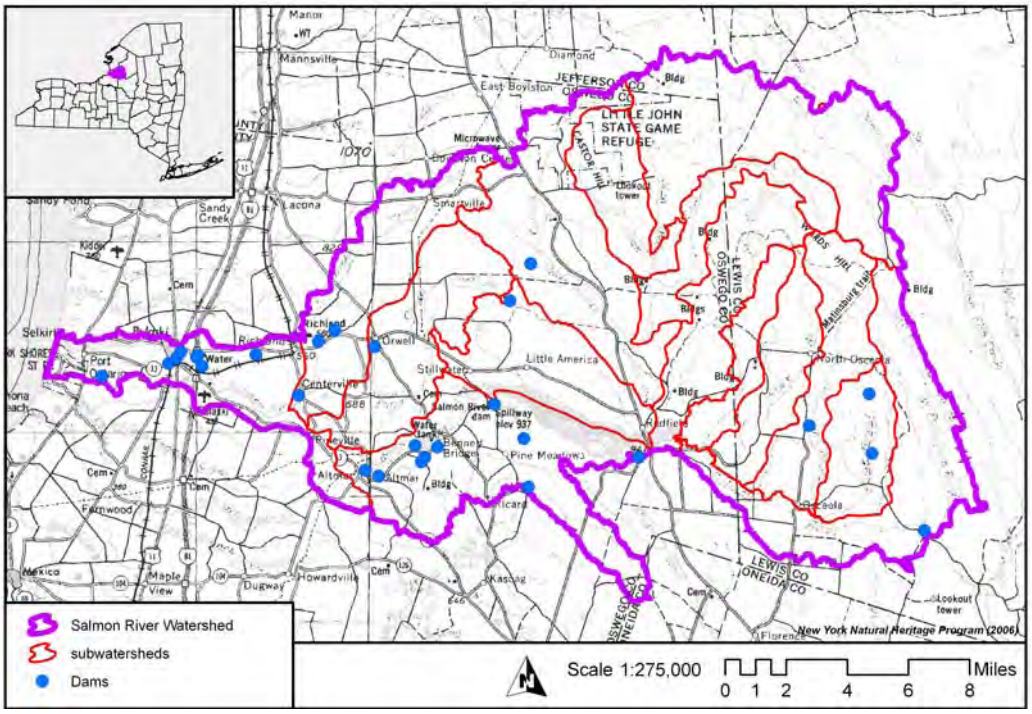


Figure A4.11. Dam locations in the Salmon River Watershed.

Appendix 5. Element distribution models for all modeled elements that showed at least some predicted habitat within the Salmon River Watershed. Figure numbers beginning with "A.a." designate models for rare animals, those beginning with "A.p." designate models for rare plants, and those beginning with "A.c." designate models for natural communities.

Table of contents for Appendix 5.

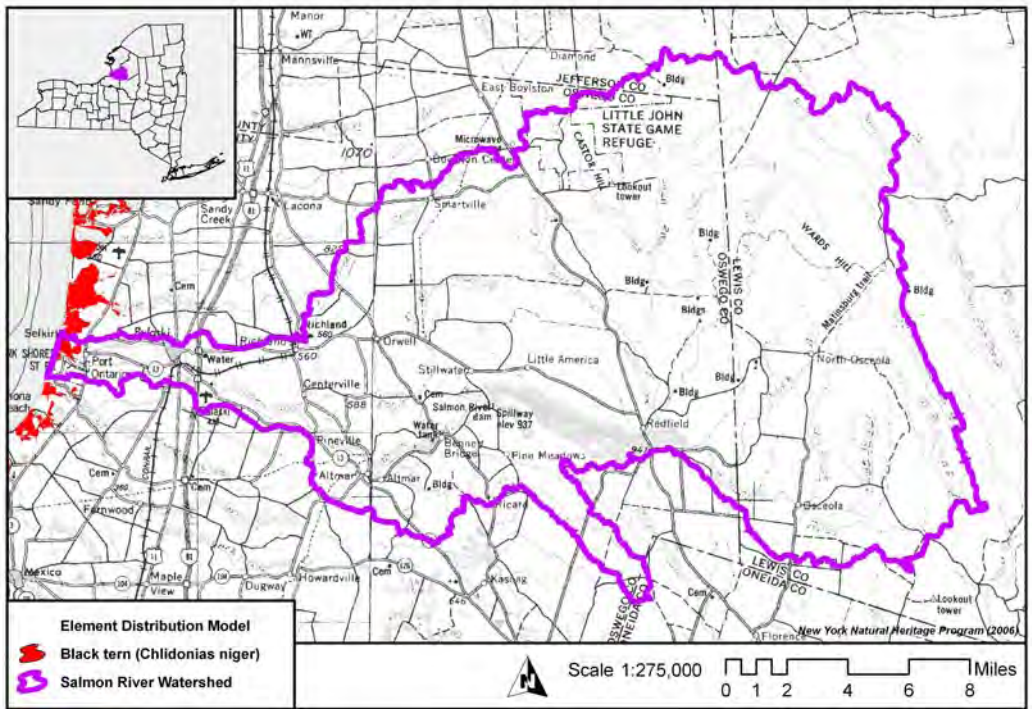


Figure A5.a.1. Element distribution model for black tern (*Chidonias niger*).

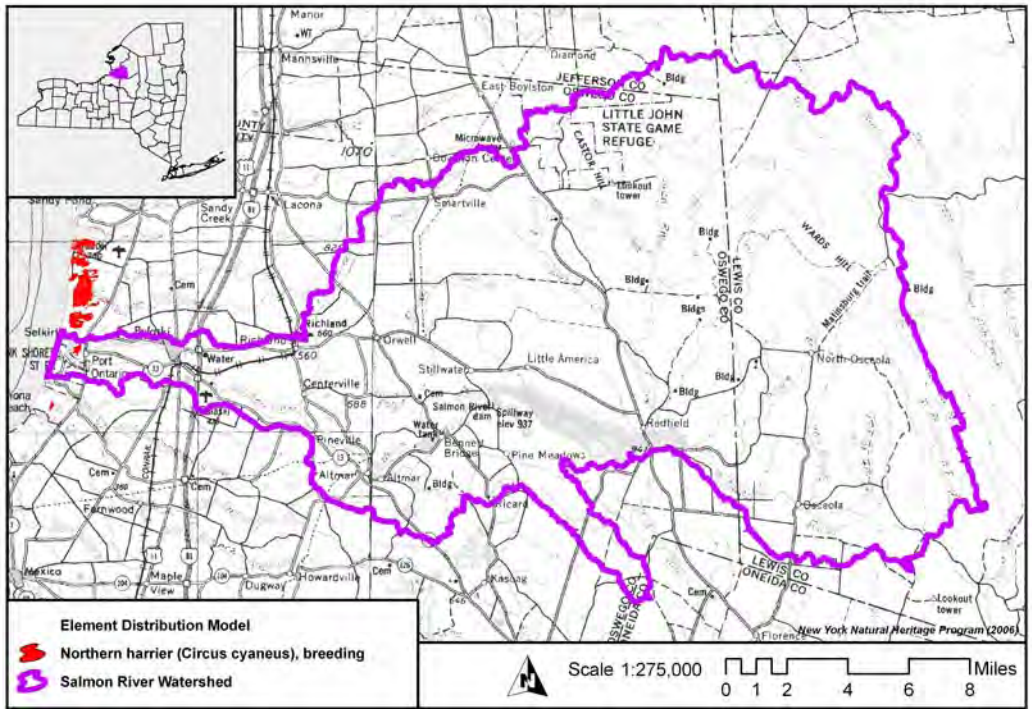


Figure A5.a.2. Element distribution model for northern harrier (*Circus cyanus*).

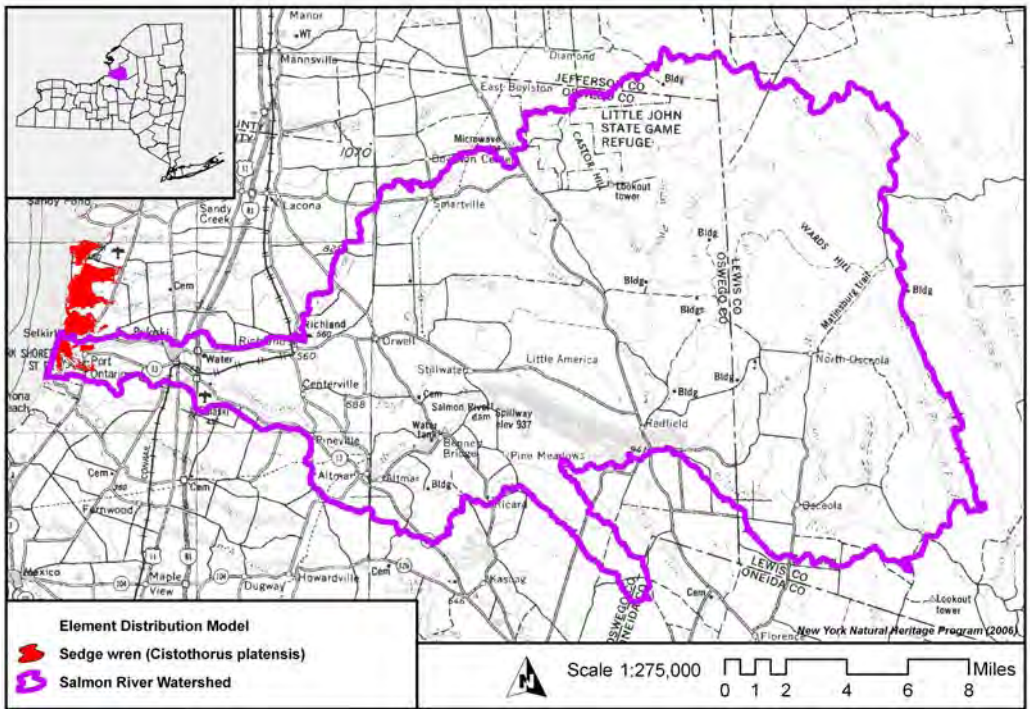


Figure A5.a.3. Element distribution model for sedge wren (*Cistothorus platensis*)

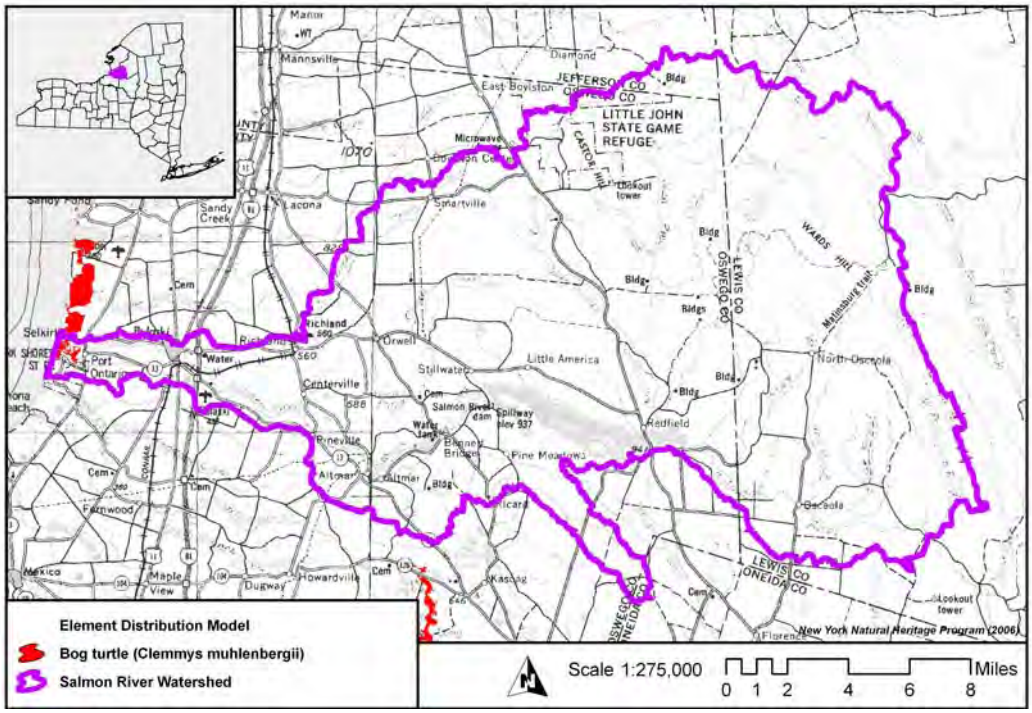


Figure A5.a.4. Element distribution model for bog turtle (*Clemmys muhlenbergii*)

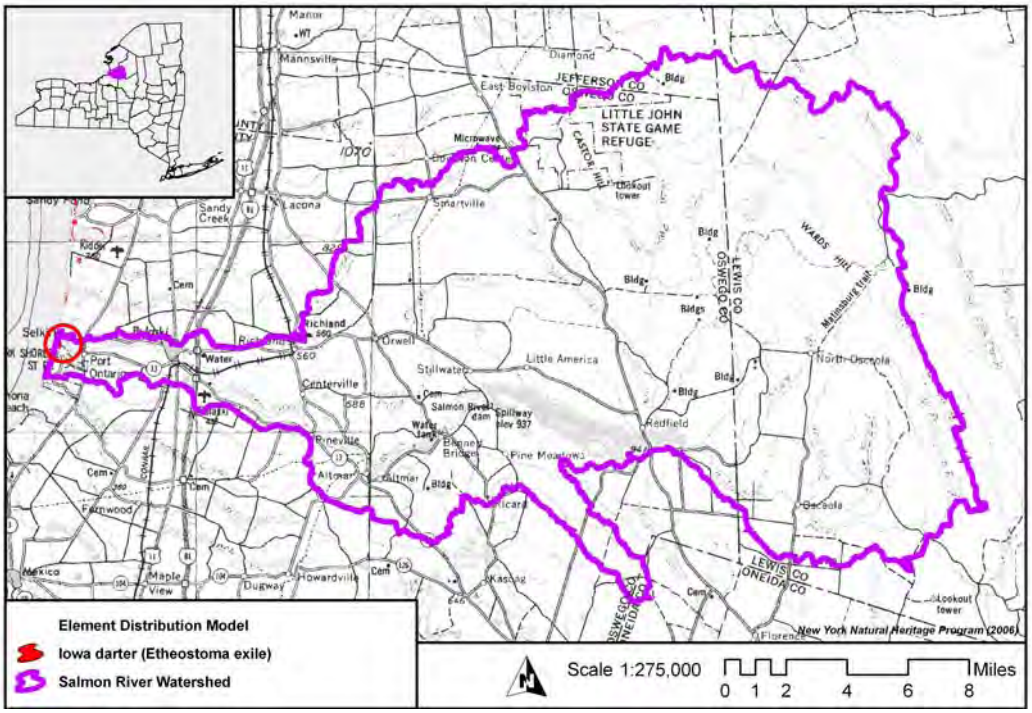


Figure A5.a.5. Element distribution model for Iowa darter (*Ethiostoma exile*)

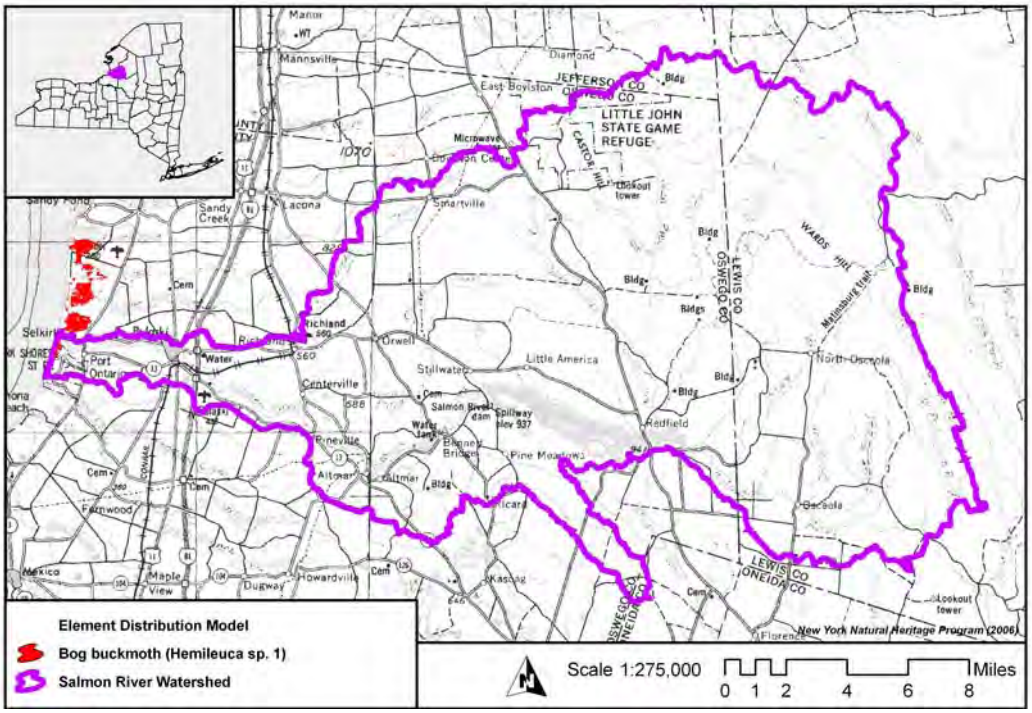


Figure A5.a.6. Element distribution model for Bog buckmoth (*Hemileuca sp. 1*)

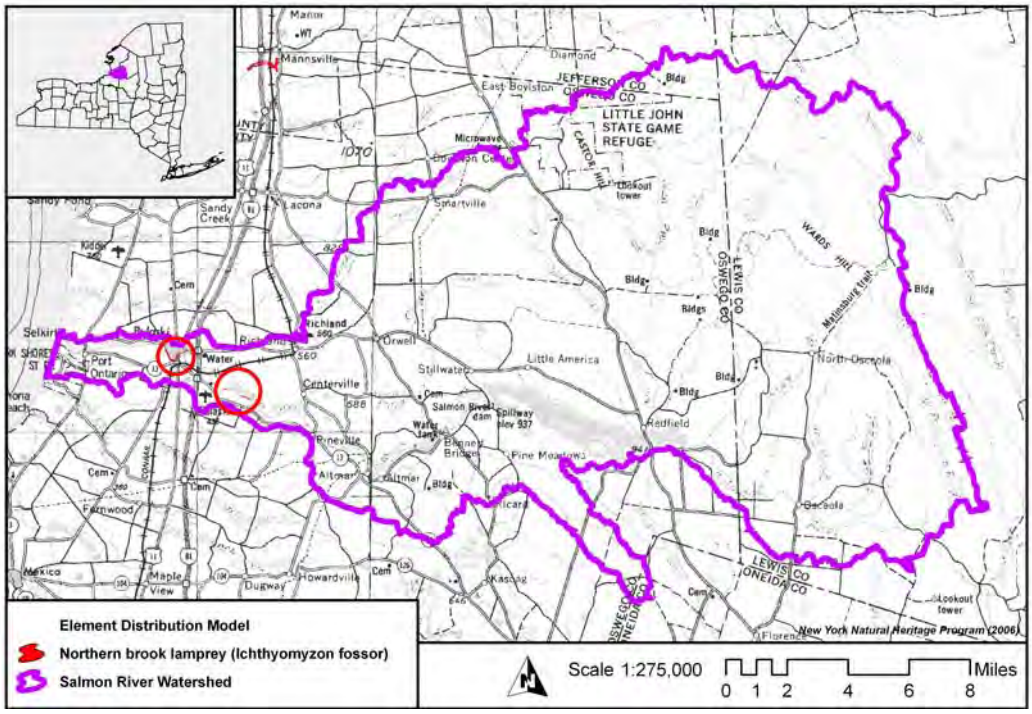


Figure A5.a.7. Element distribution model for northern brook lamprey (*Ichthyomyzon fossor*)

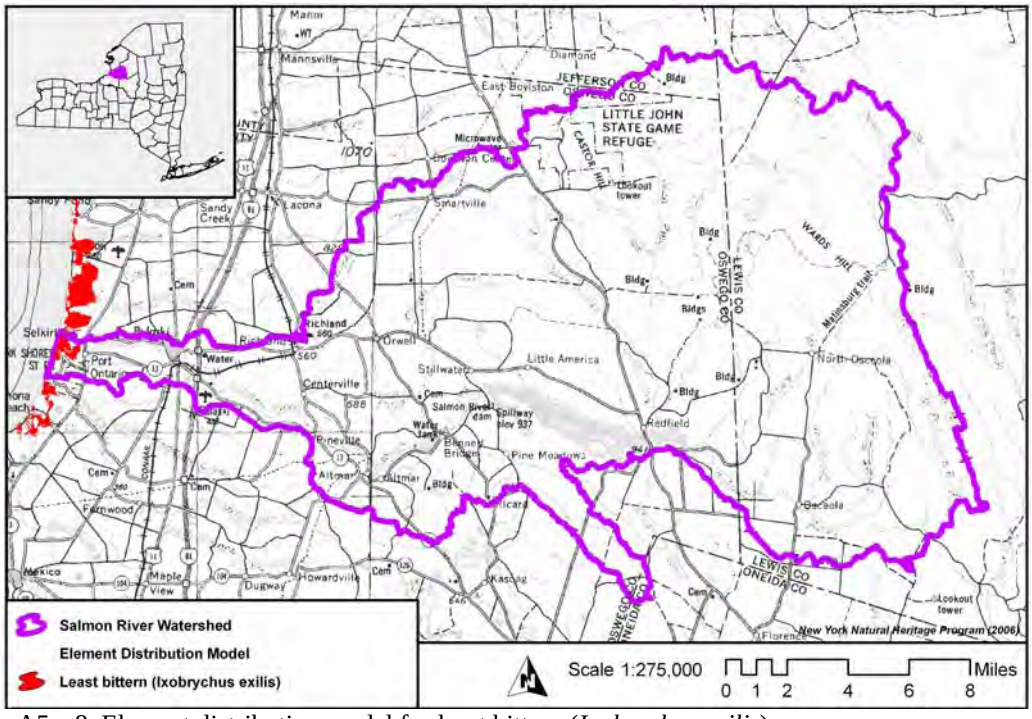


Figure A5.a.8. Element distribution model for least bittern (*Ixobrychus exilis*)

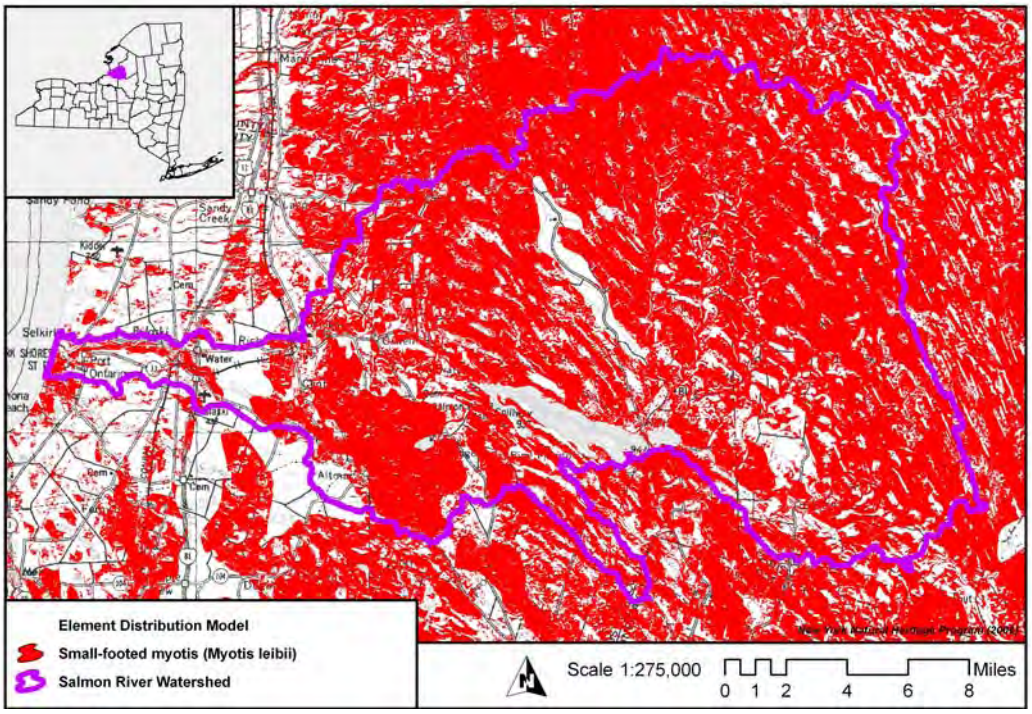


Figure A5.a.9. Element distribution model for small-footed myotis (*Myotis leibii*)

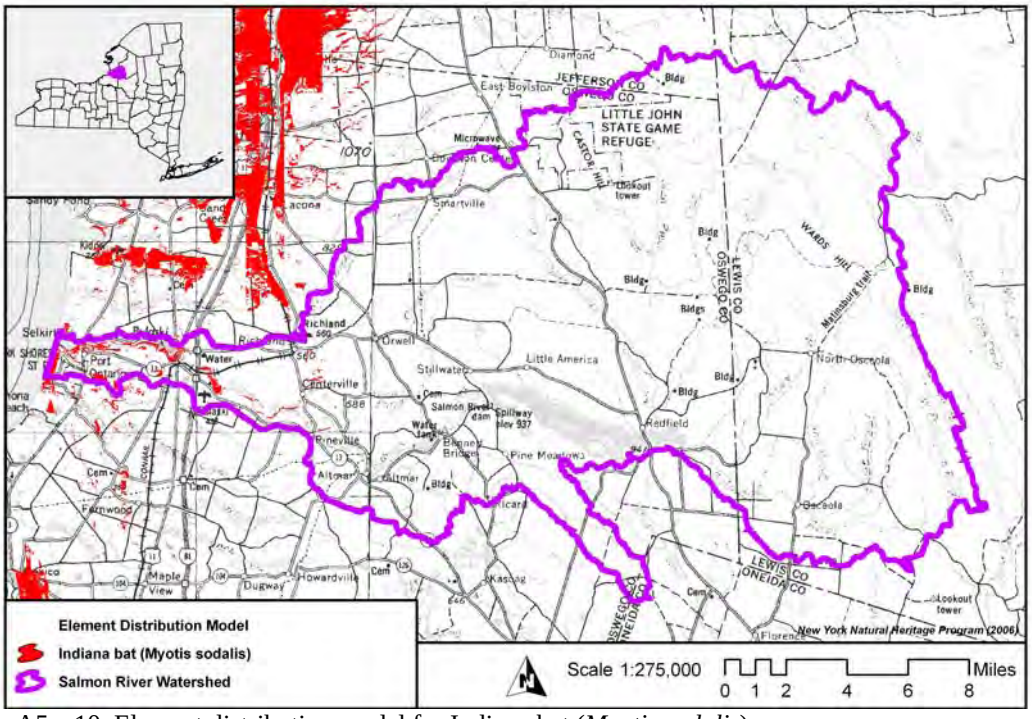


Figure A5.a.10. Element distribution model for Indiana bat (*Myotis sodalis*)

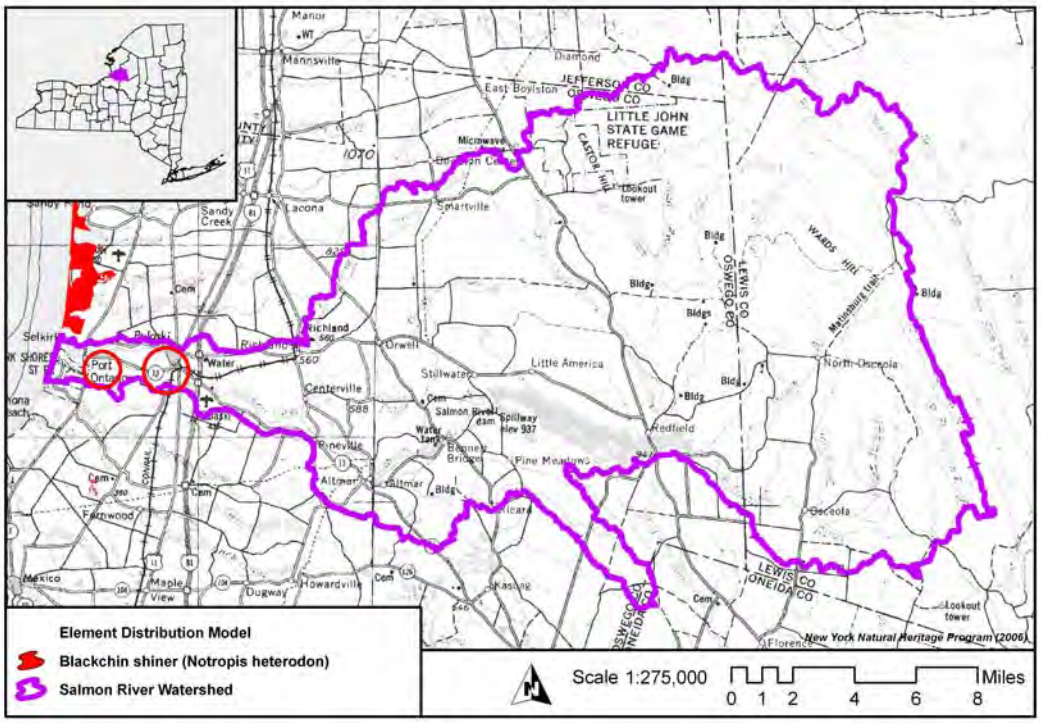


Figure A5.a.11. Element distribution model for blackchin shiner (*Notropis heterodon*)

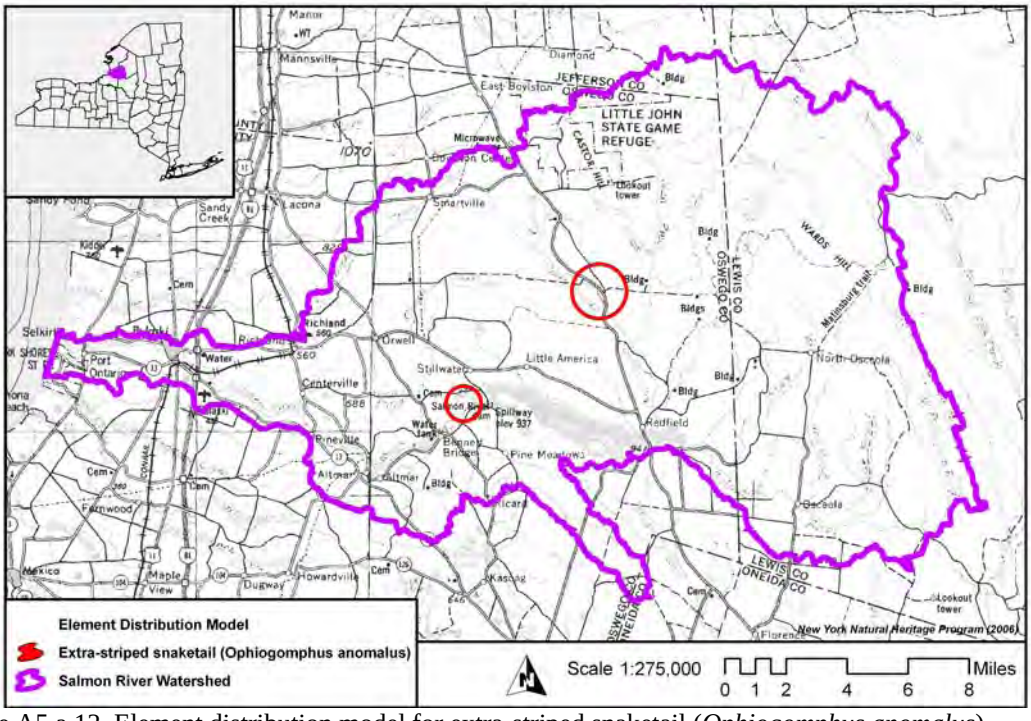


Figure A5.a.12. Element distribution model for extra-striped snaketail (*Ophiogomphus anomalus*)

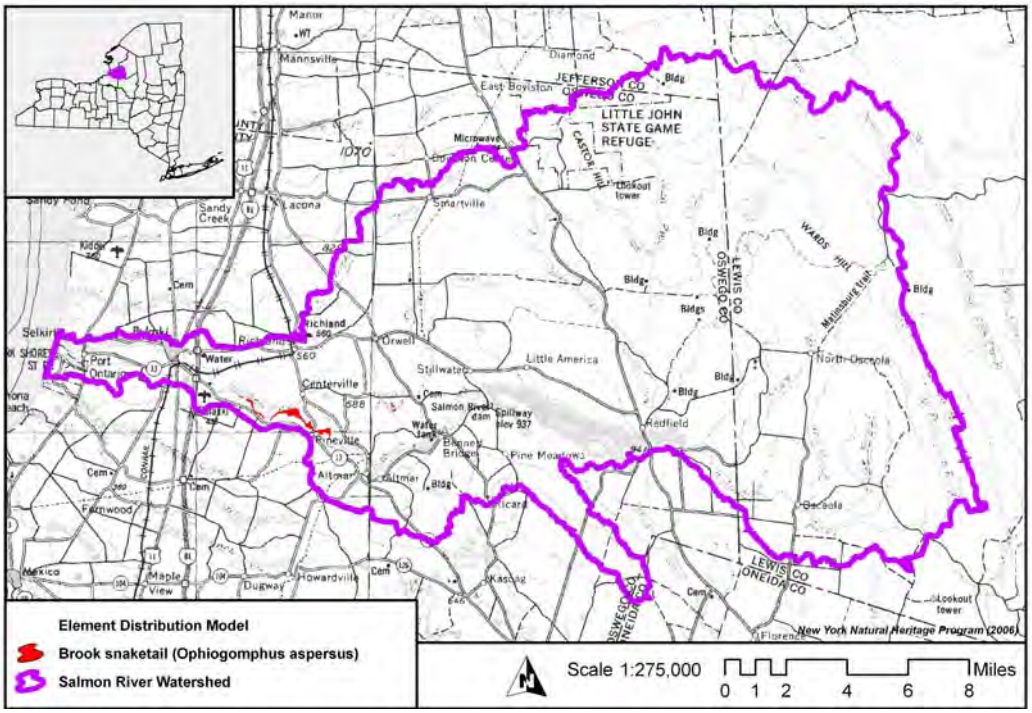


Figure A5.a.13. Element distribution model for brook snaketail (*Ophiogomphus aspersus*)

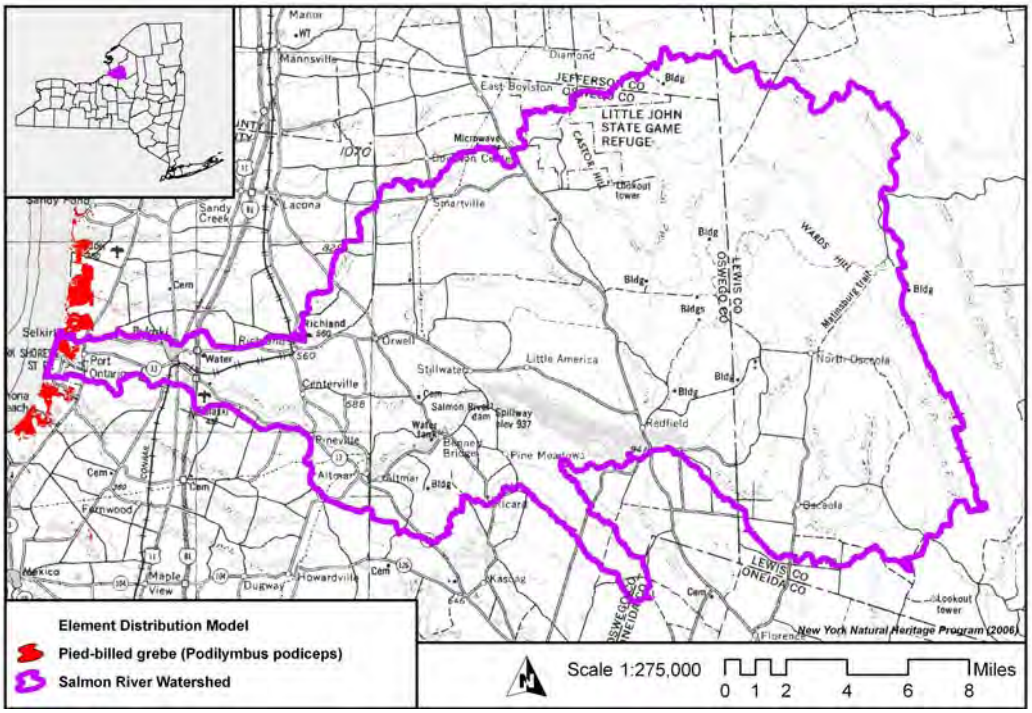


Figure A5.a.14. Element distribution model for pied-billed grebe (*Podilymbus podiceps*)

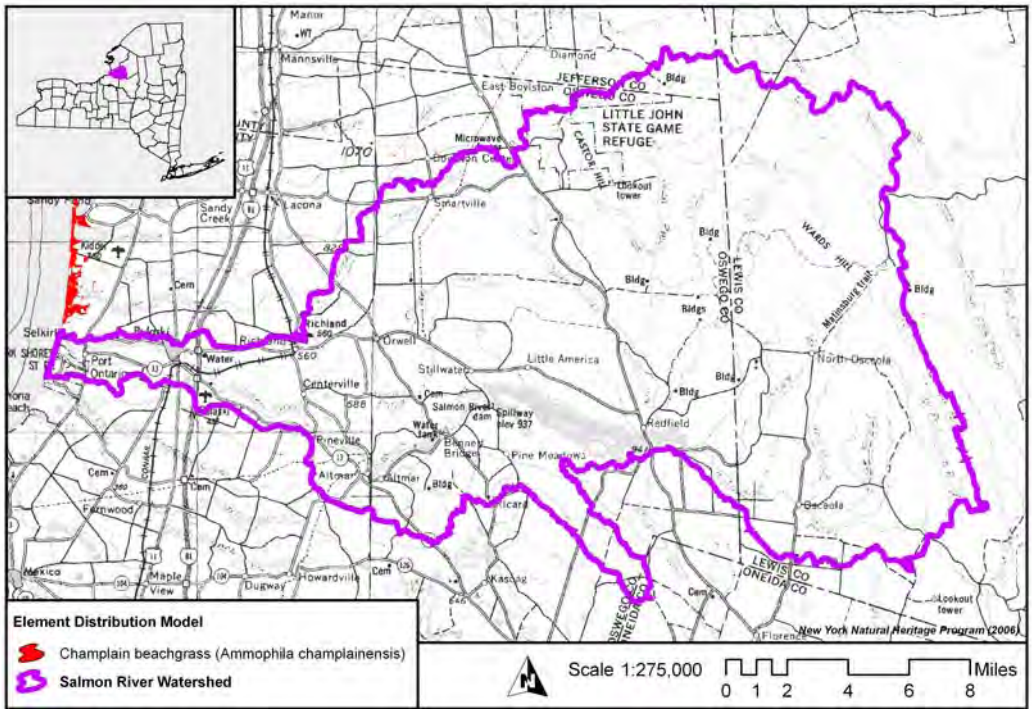


Figure A5.p.15. Element distribution model for Champlain beachgrass (*Ammophila champlainensis*)

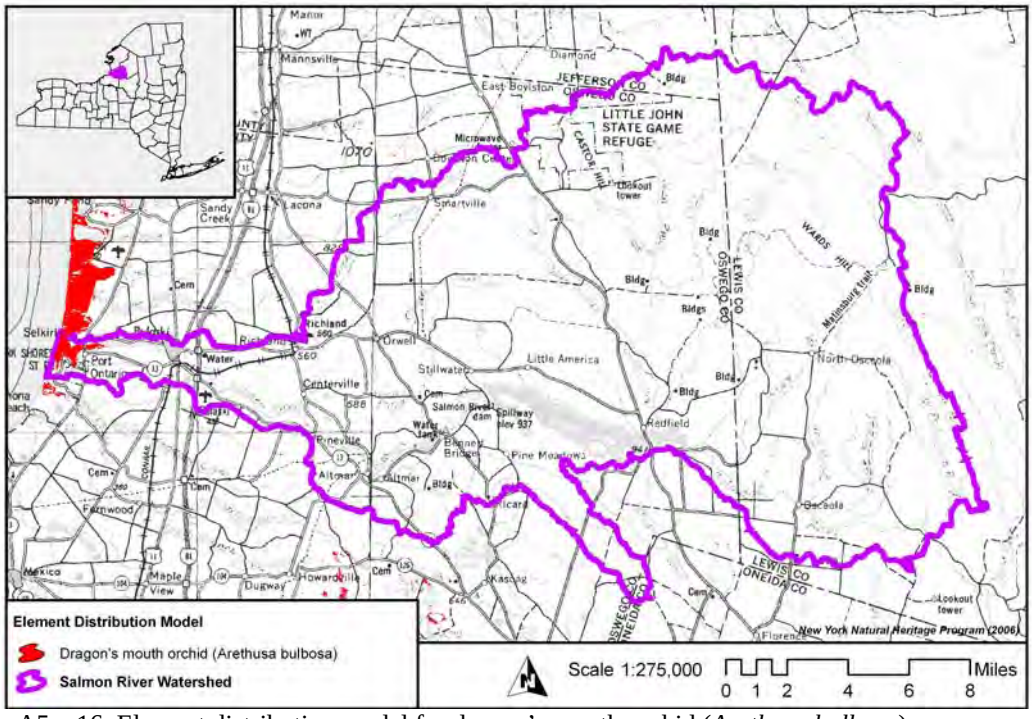


Figure A5.p.16. Element distribution model for dragon's mouth orchid (*Arethusa bulbosa*)

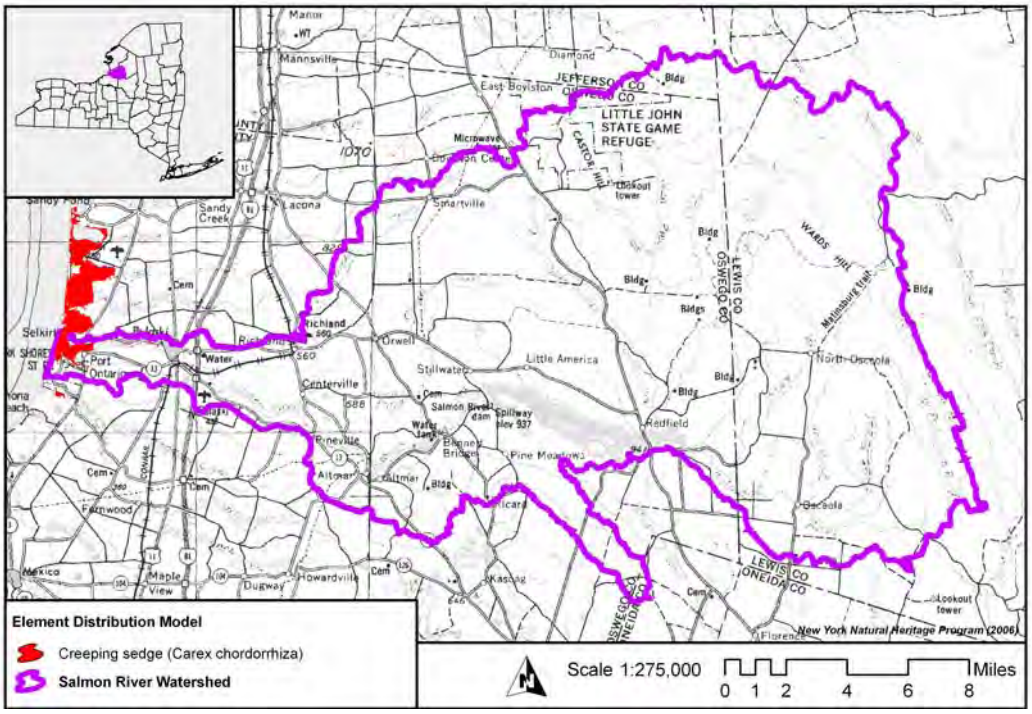


Figure A5.p.17. Element distribution model for creeping sedge (*Carex chordorrhiza*).

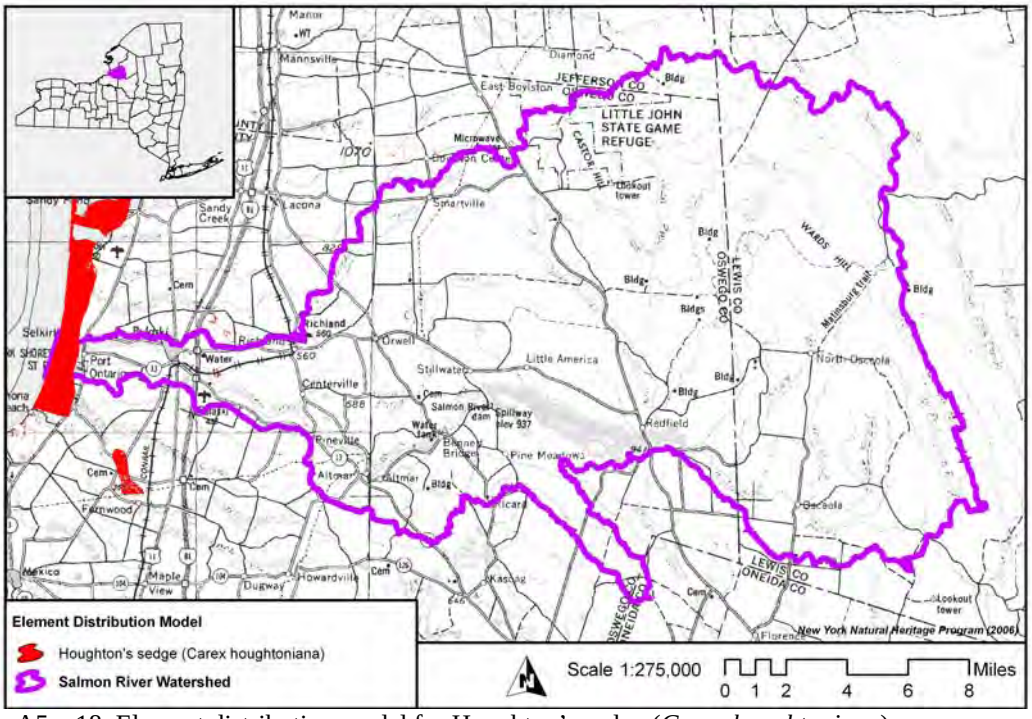


Figure A5.p.18. Element distribution model for Houghton's sedge (*Carex houghtoniana*).

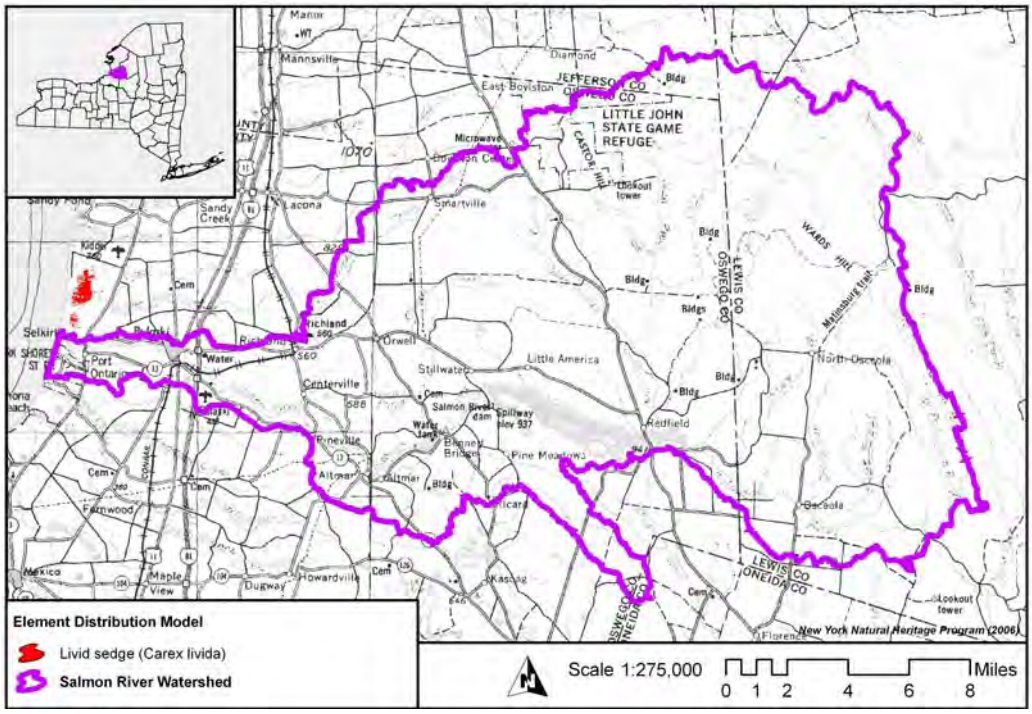


Figure A5.p.19. Element distribution model for livid sedge (*Carex livida*).

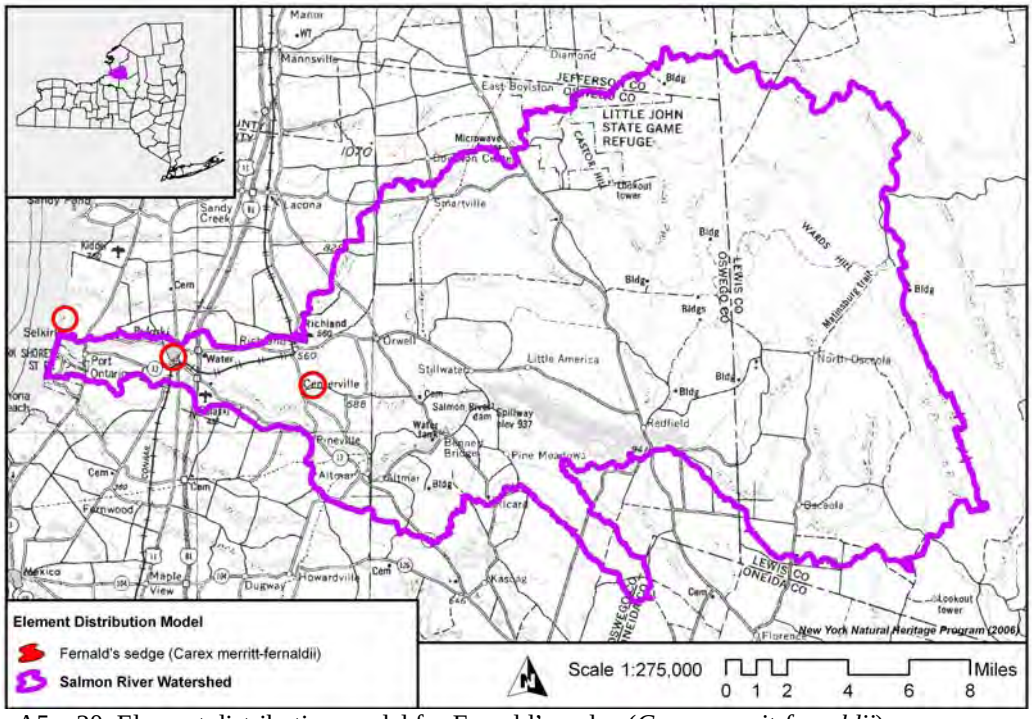


Figure A5.p.20. Element distribution model for Fernald's sedge (*Carex merrit-fernaldii*).

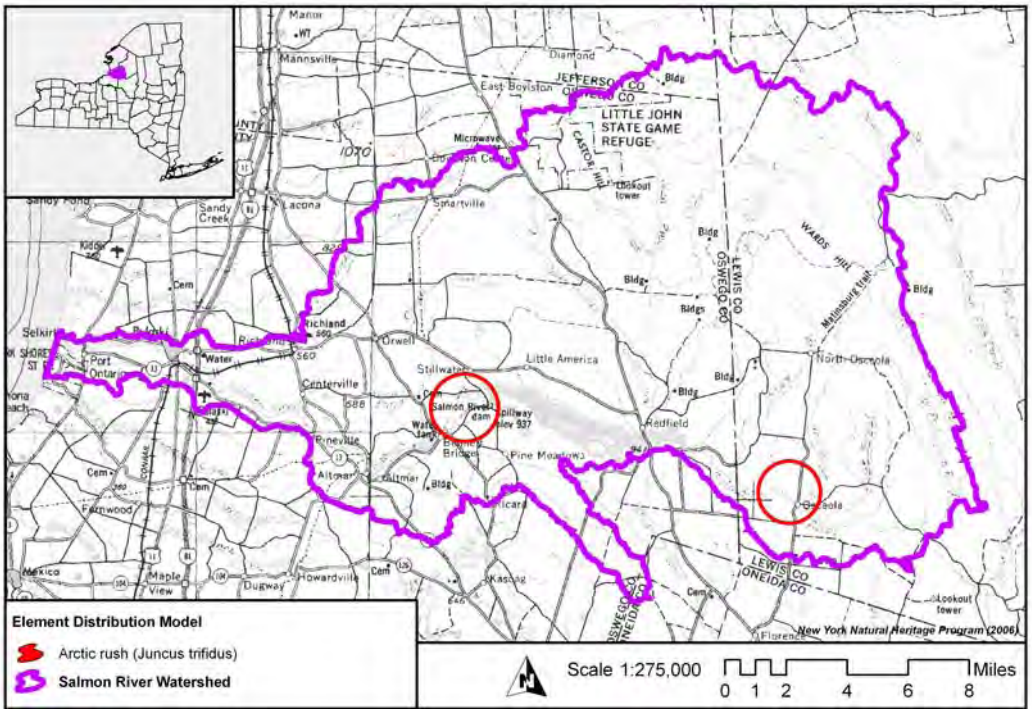


Figure A5.p.21. Element distribution model for arctic rush (*Juncus trifidus*).

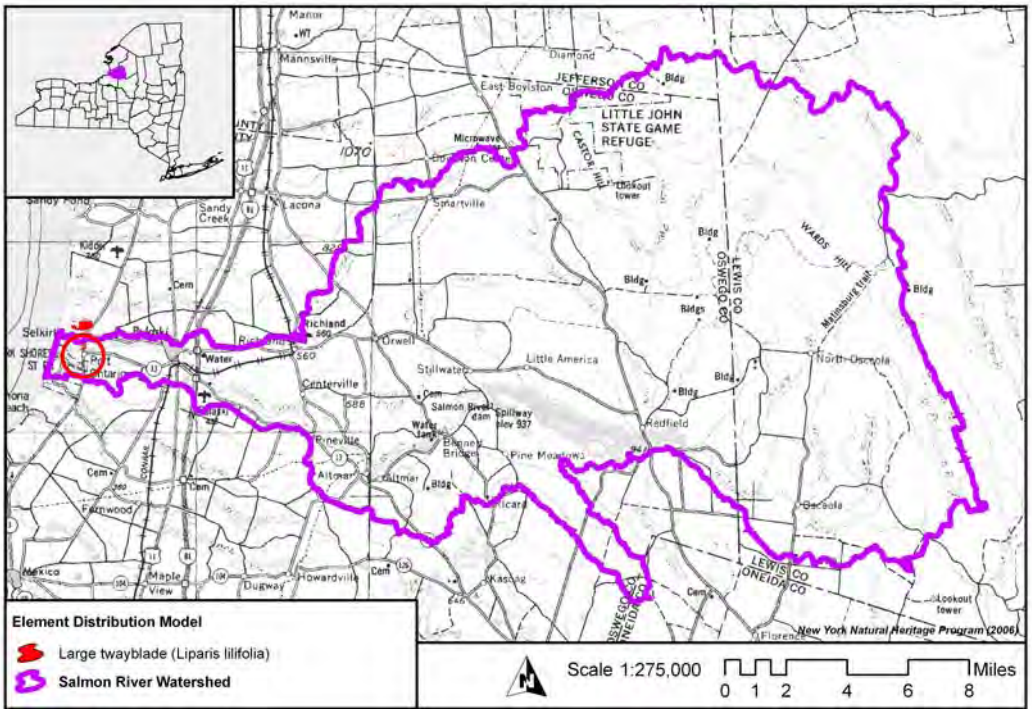


Figure A5.p.22. Element distribution model for large twayblade (*Liparis lilifolia*).

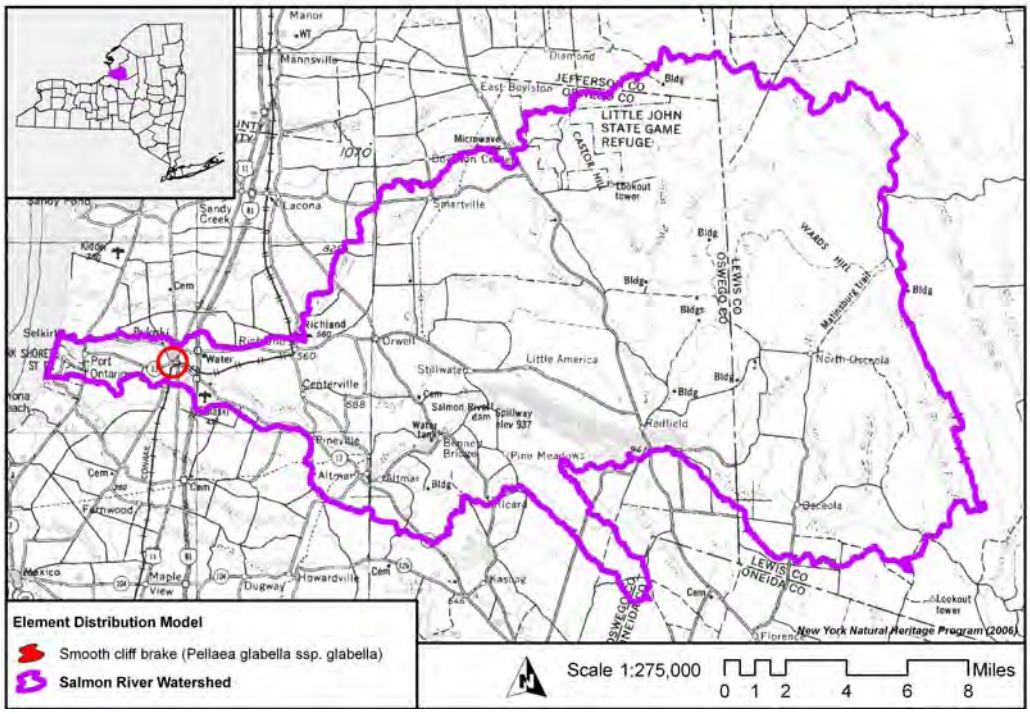


Figure A5.p.23. Element distribution model for smooth cliff brake (*Pellaea glabella* ssp. *glabella*).

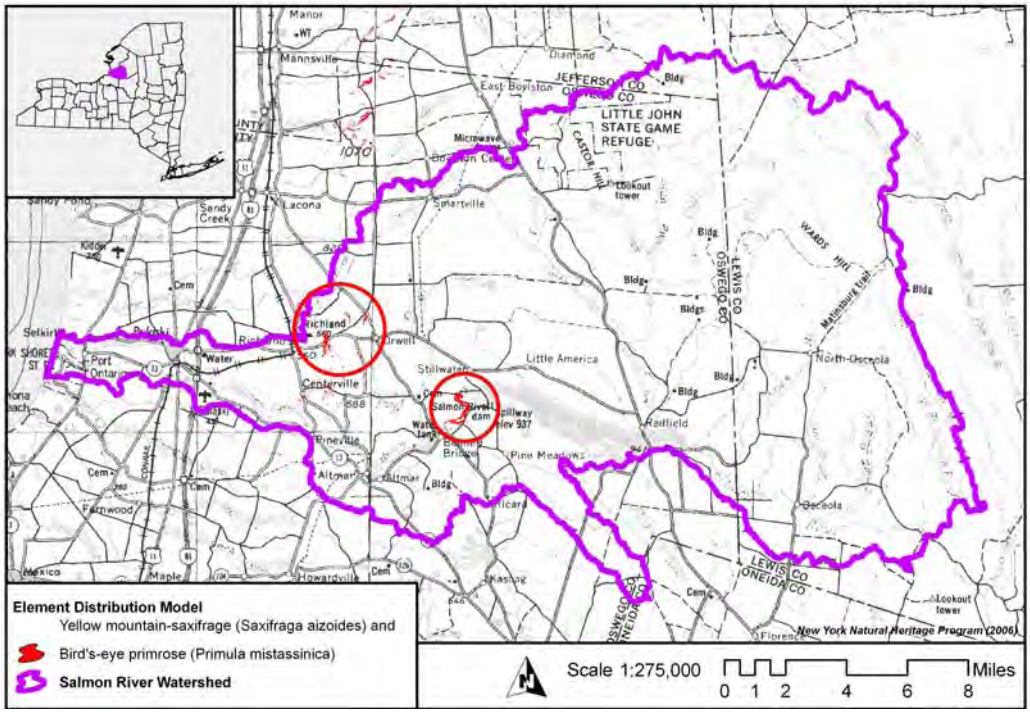


Figure A5.p.24. Element distribution model for yellow mountain saxifrage (*Saxifraga aizoides*) and bird's eye primrose (*Primula mistassinica*), modeled together as they occupy very similar habitats.

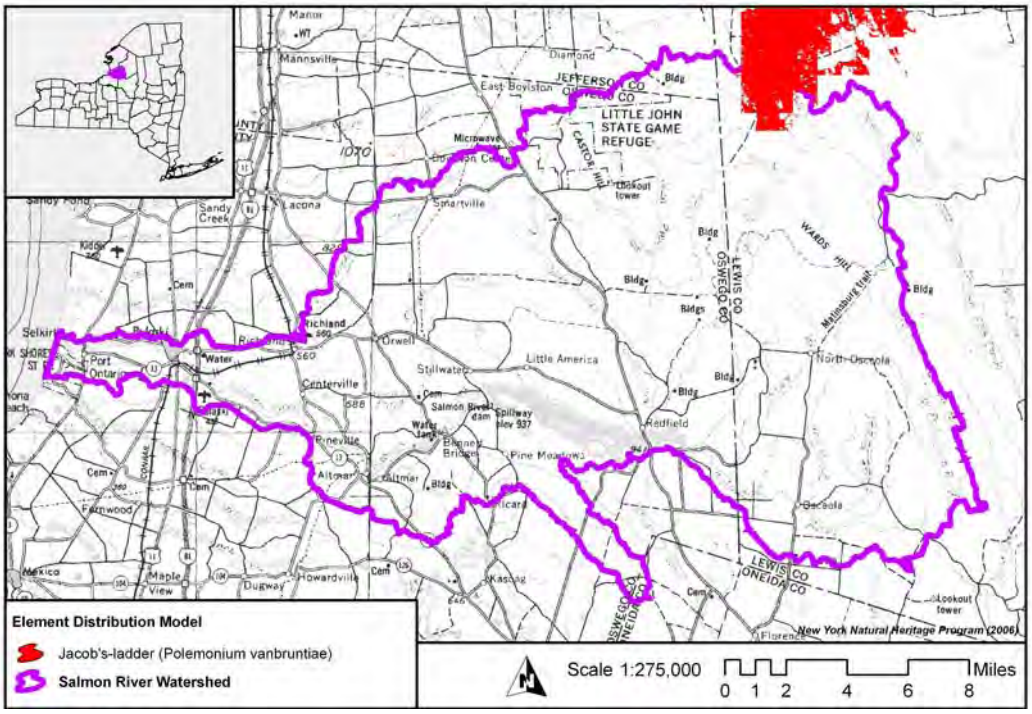


Figure A5.p.25. Element distribution model for jacob's-ladder (*Polemonium vanbruntiae*).

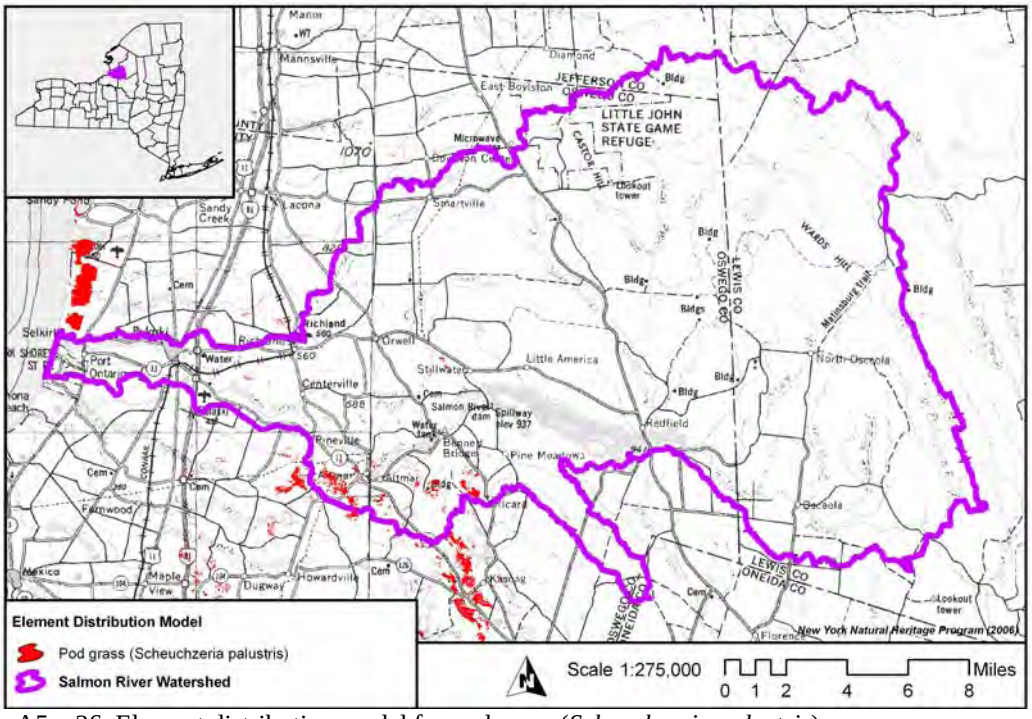


Figure A5.p.26. Element distribution model for pod grass (*Scheuchzeria palustris*).

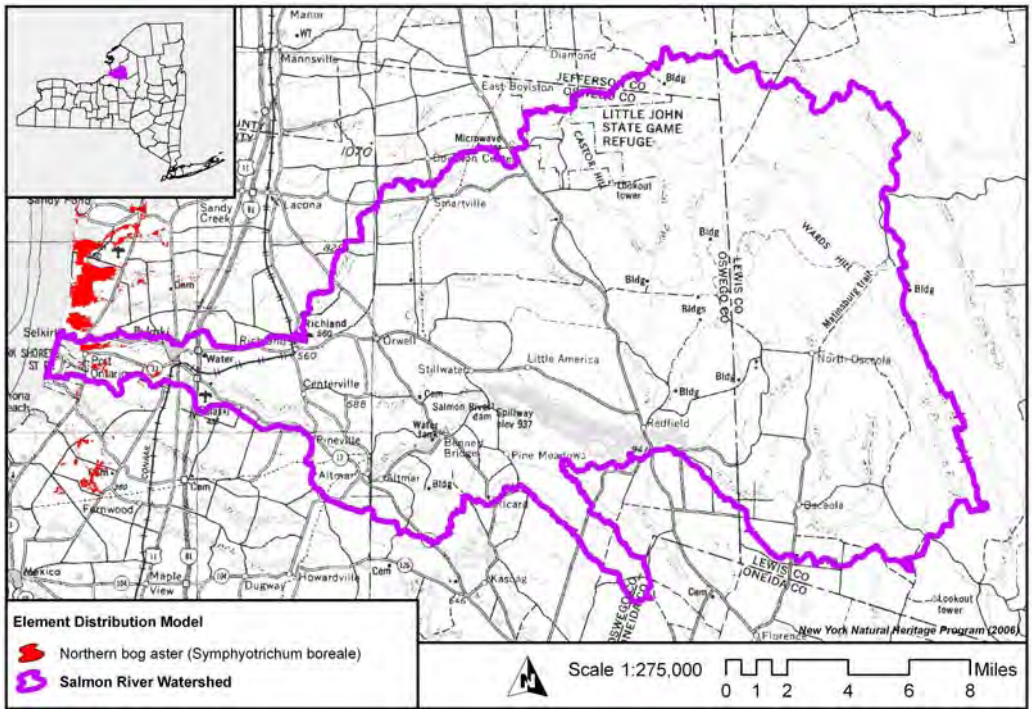


Figure A5.p.27. Element distribution model for northern bog aster (*Symphiotrichum boreale*).

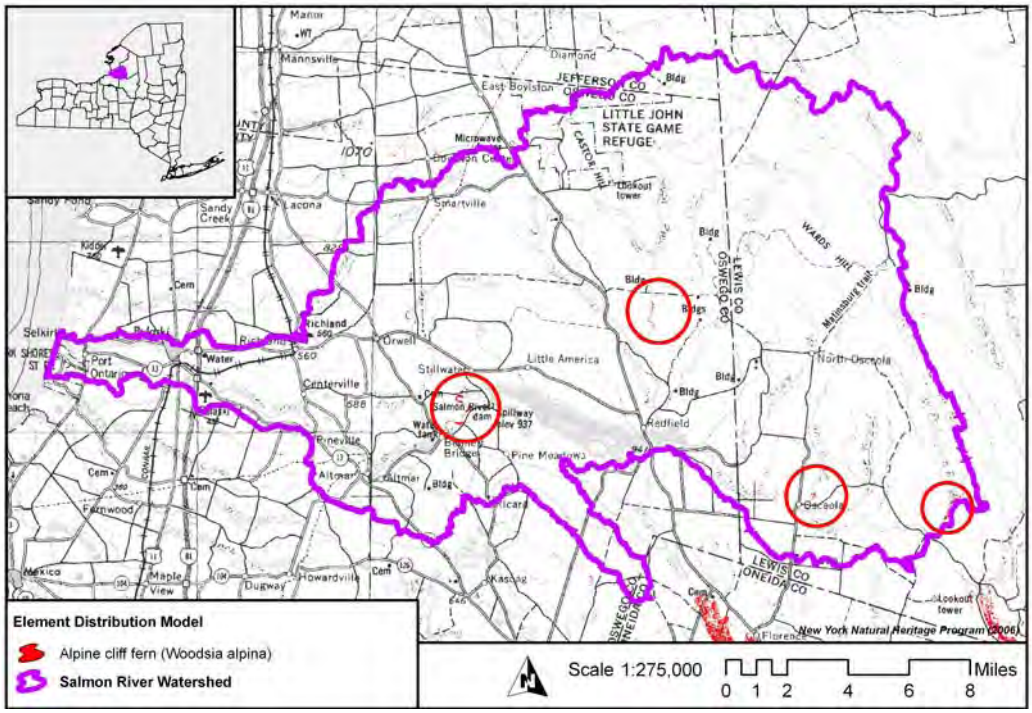


Figure A5.p.28. Element distribution model for alpine cliff fern (*Woodsia alpina*).

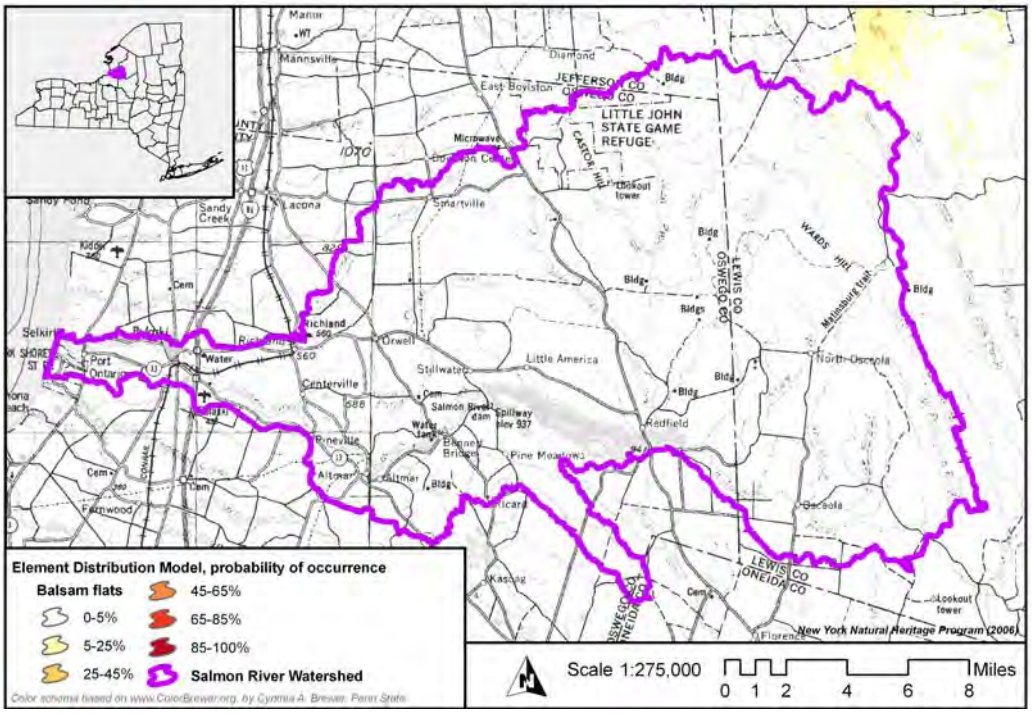


Figure A5.c.29. Element distribution model for balsam flats.

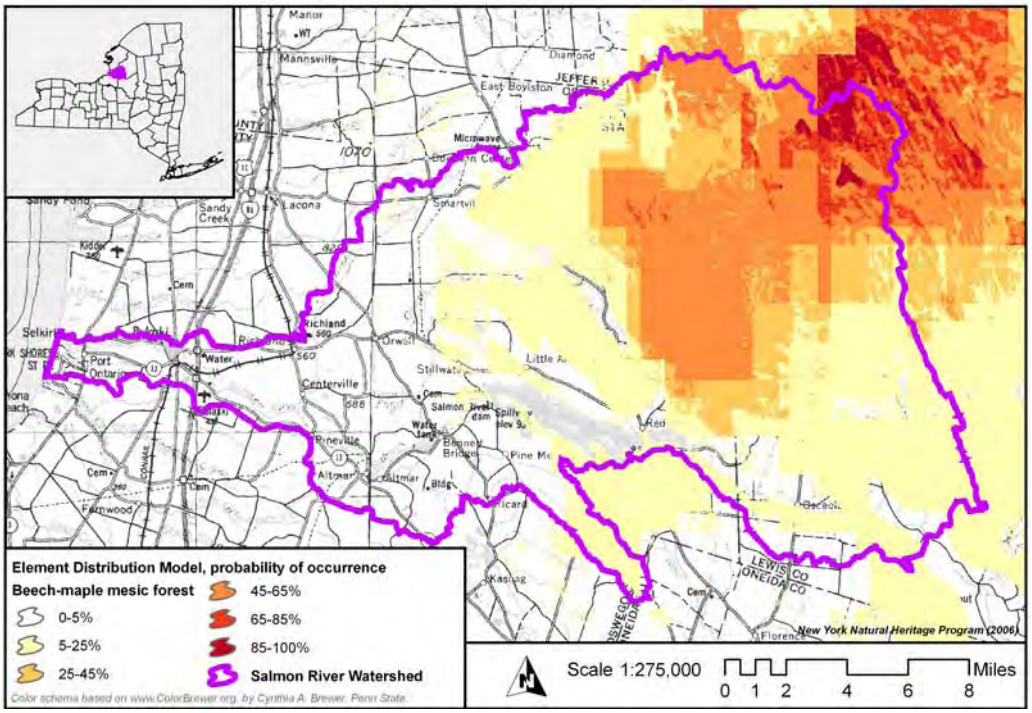


Figure A5.c.30. Element distribution model for beech-maple mesic forest.

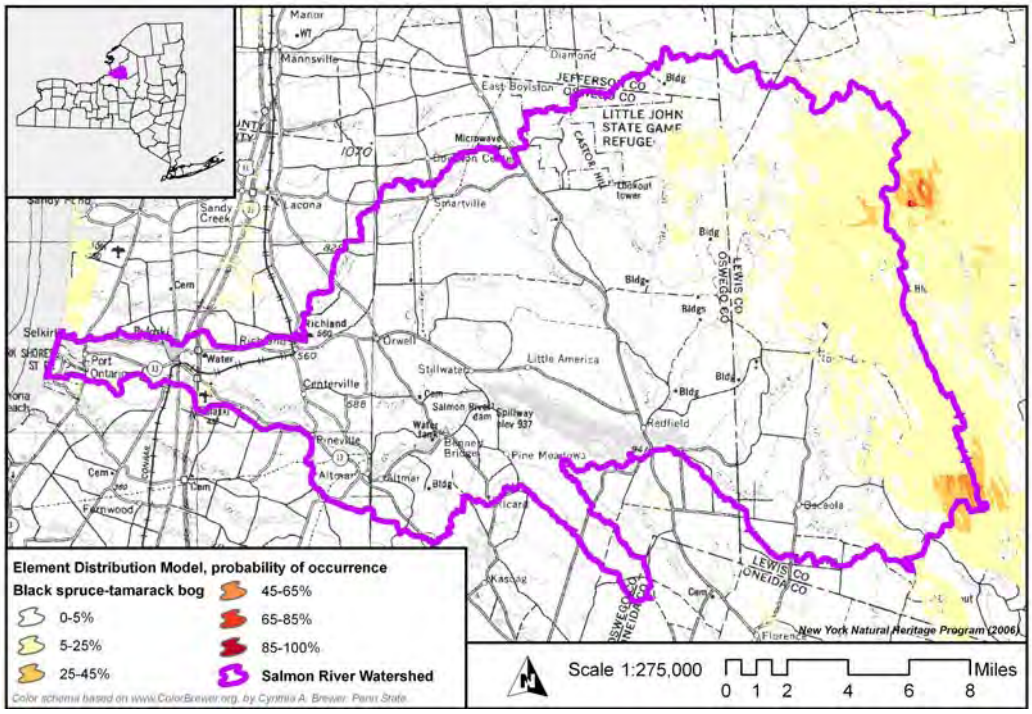


Figure A5.c.31. Element distribution model for black spruce-tamarack bog.

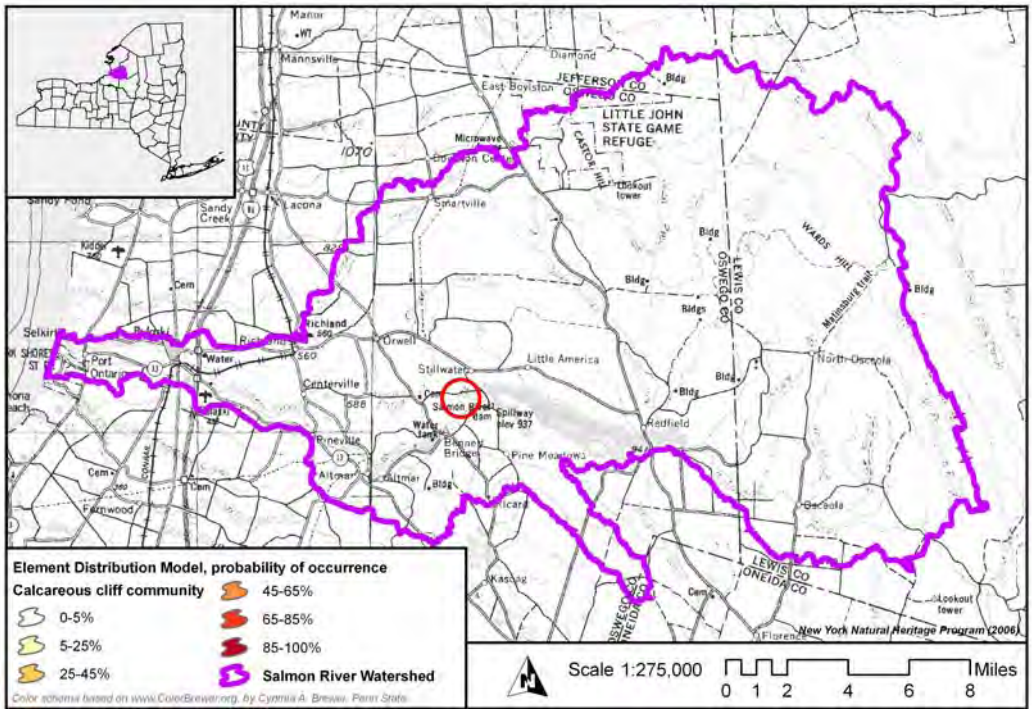


Figure A5.c.32. Element distribution model for calcareous cliff community.

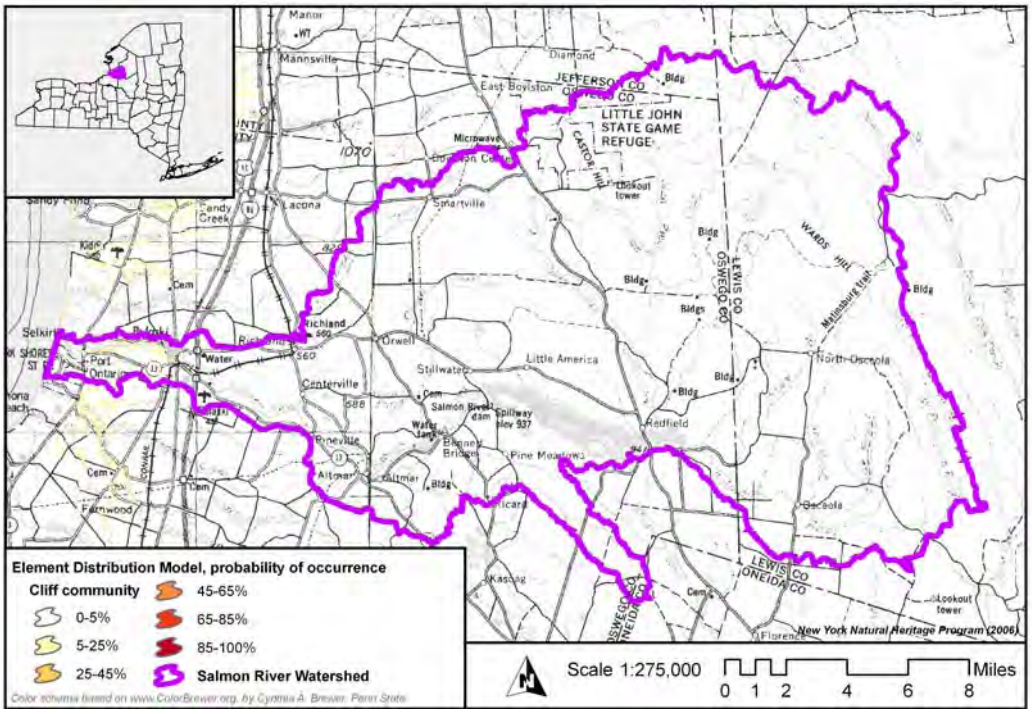


Figure A5.c.33. Element distribution model for cliff community.

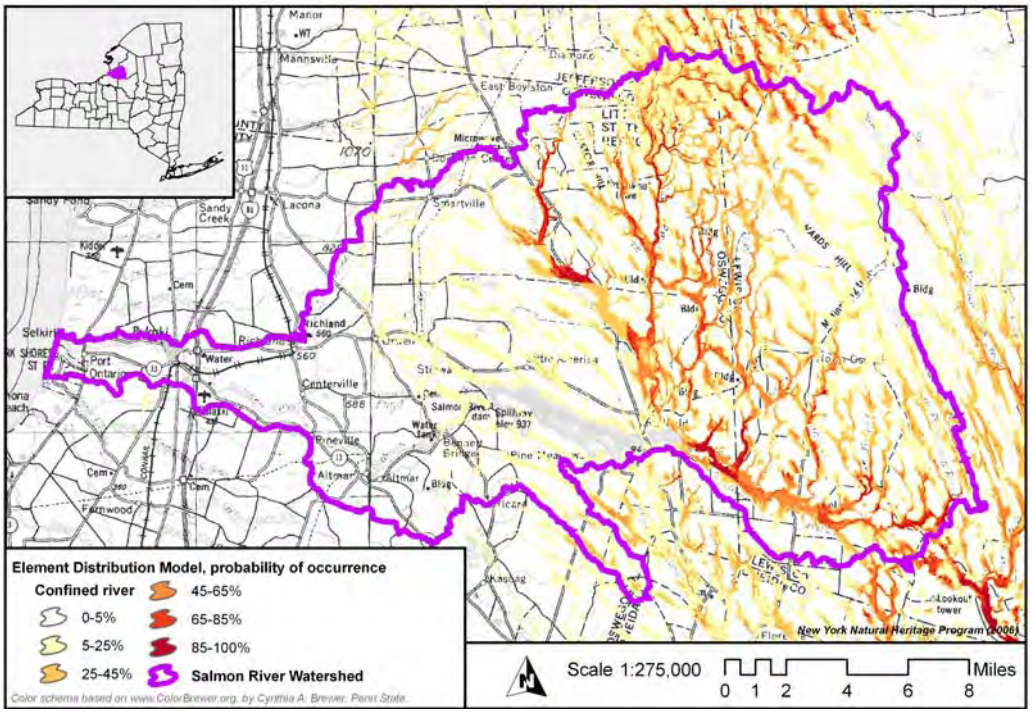


Figure A5.c.34. Element distribution model for confined river.

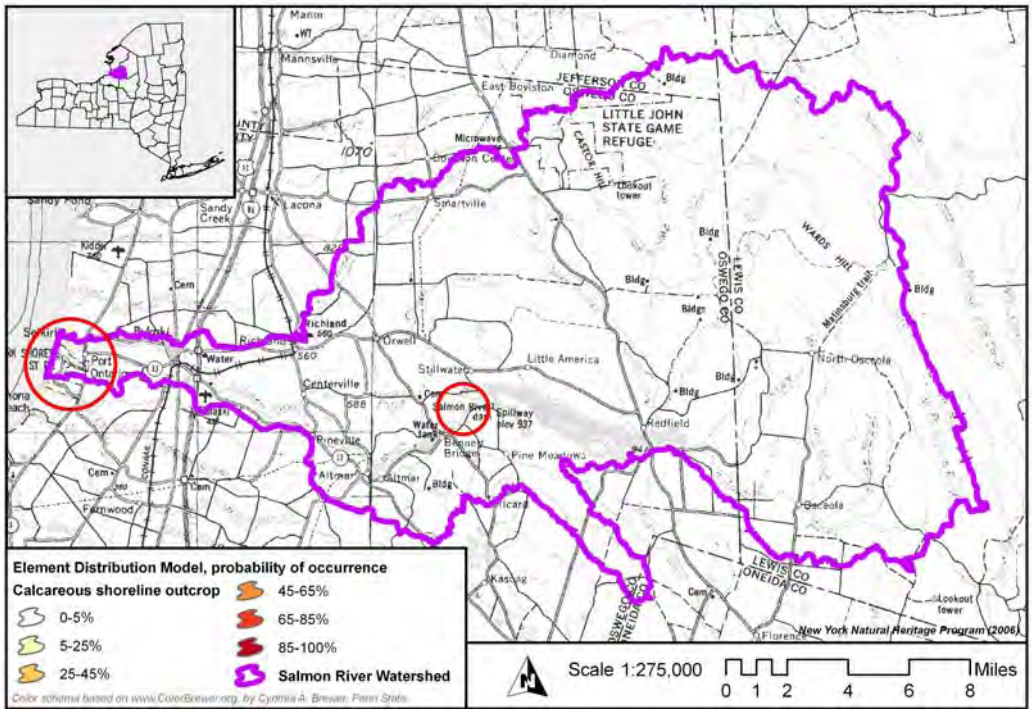


Figure A5.c.35. Element distribution model for calcareous shoreline outcrop.

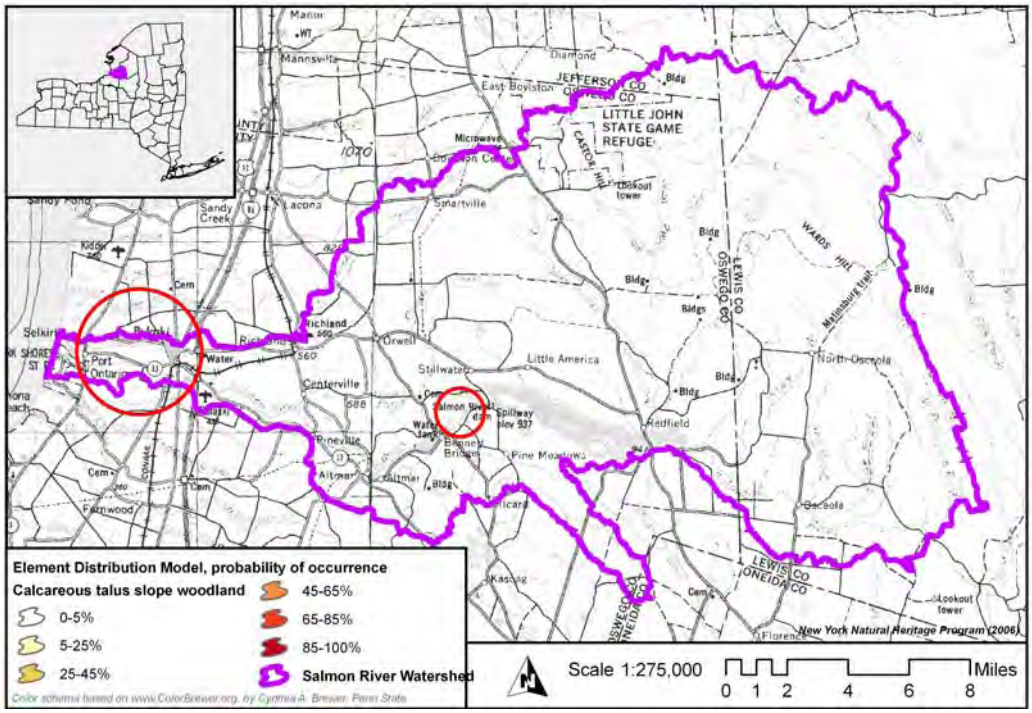


Figure A5.c.36. Element distribution model for calcareous talus slope woodland.

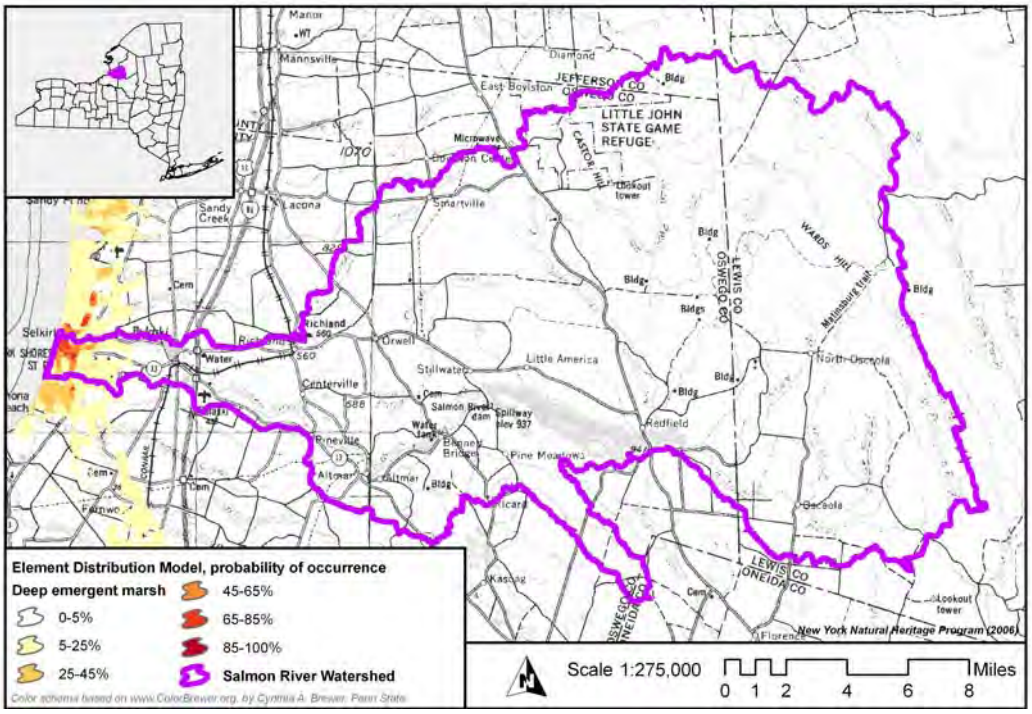


Figure A5.c.37. Element distribution model for deep emergent marsh.

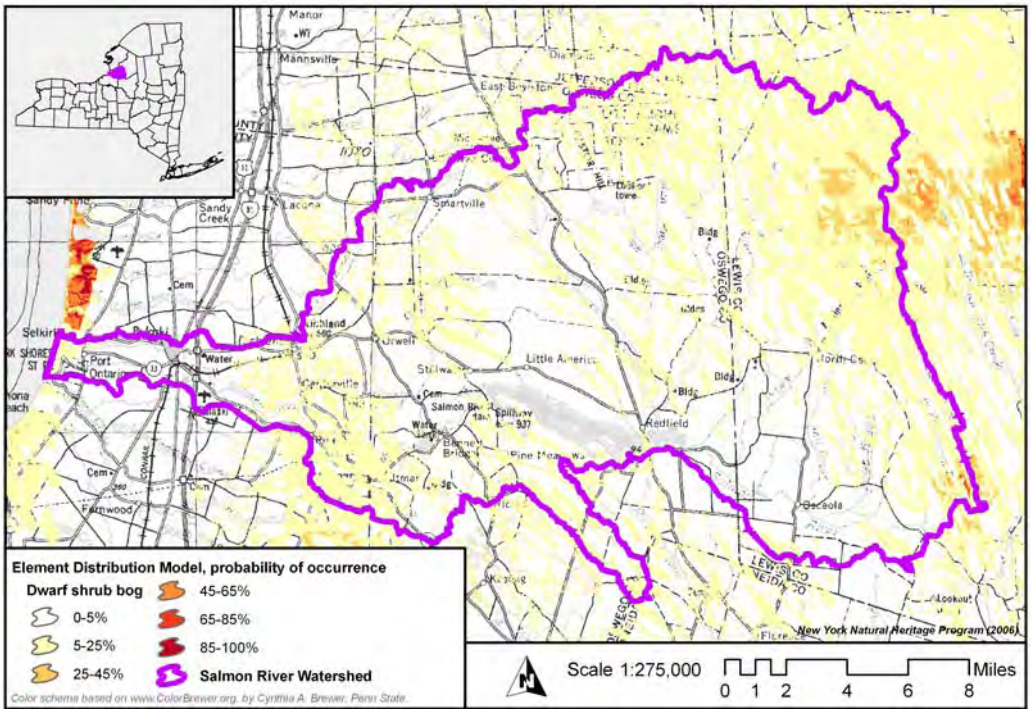


Figure A5.c.38. Element distribution model for dwarf shrub bog.

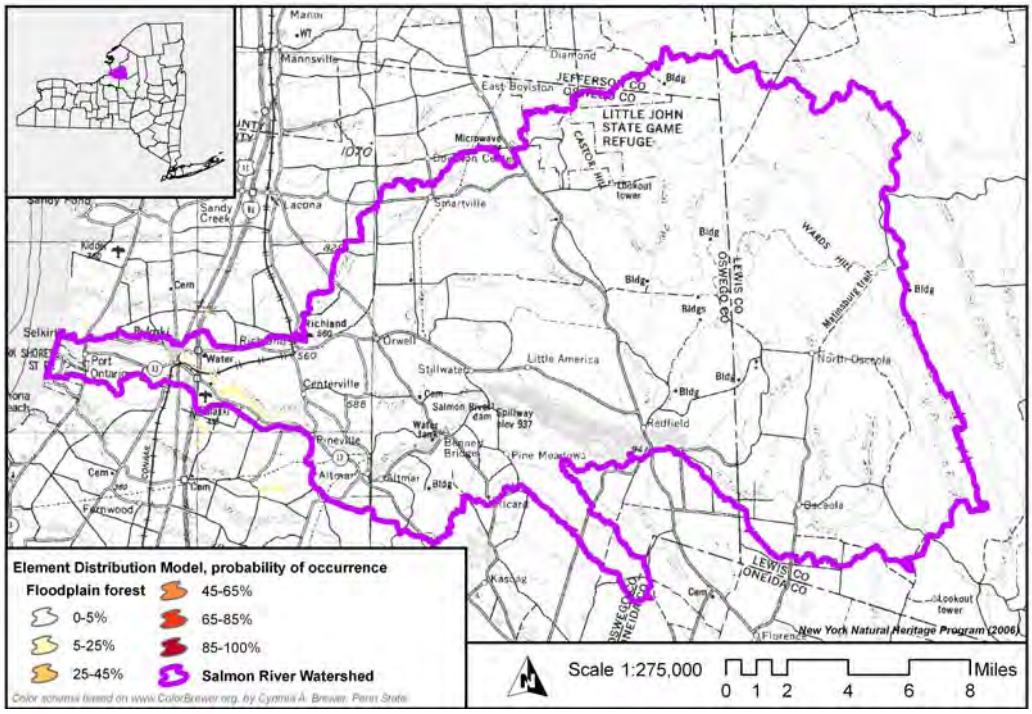


Figure A5.c.39. Element distribution model for floodplain forest.

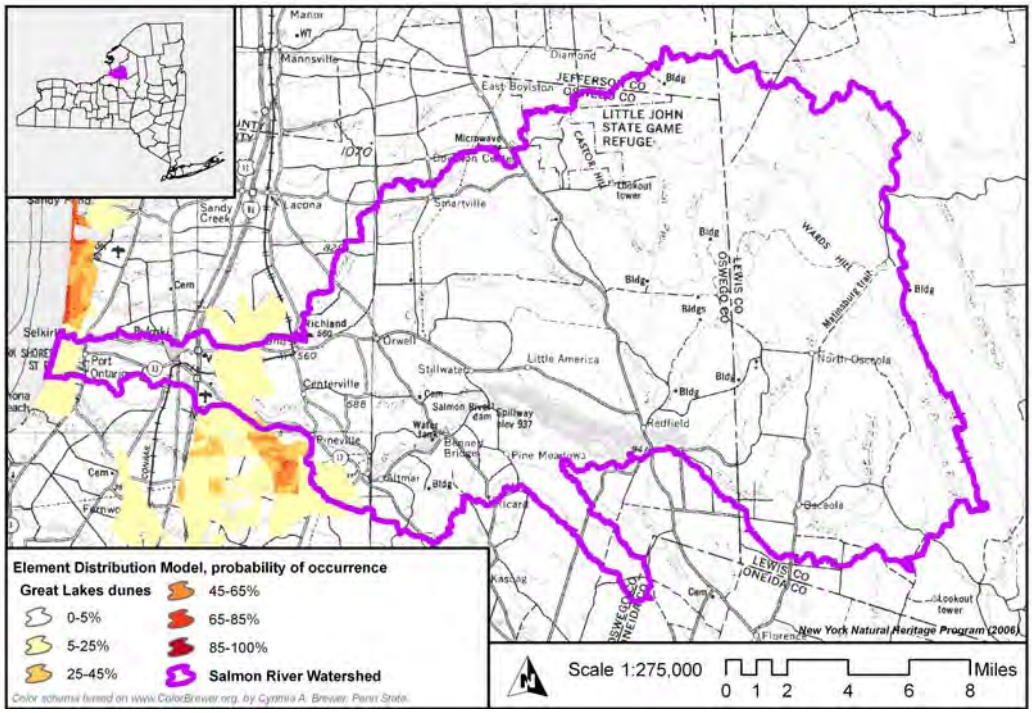


Figure A5.c.40. Element distribution model for Great Lakes dunes.

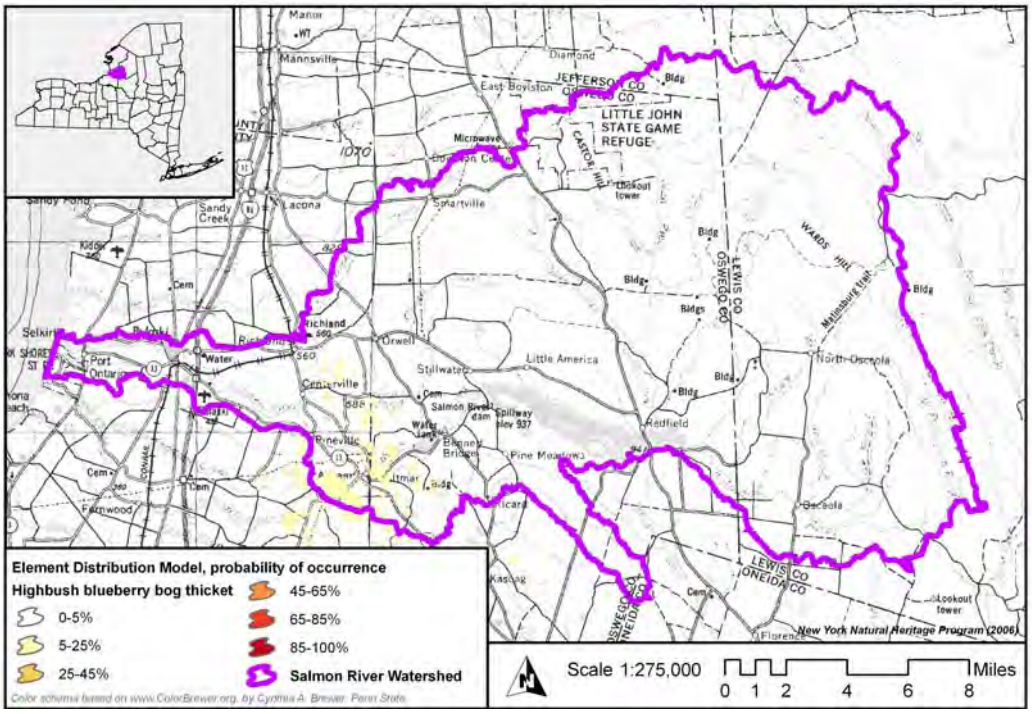


Figure A5.c.41. Element distribution model for highbush blueferry bog thicket.

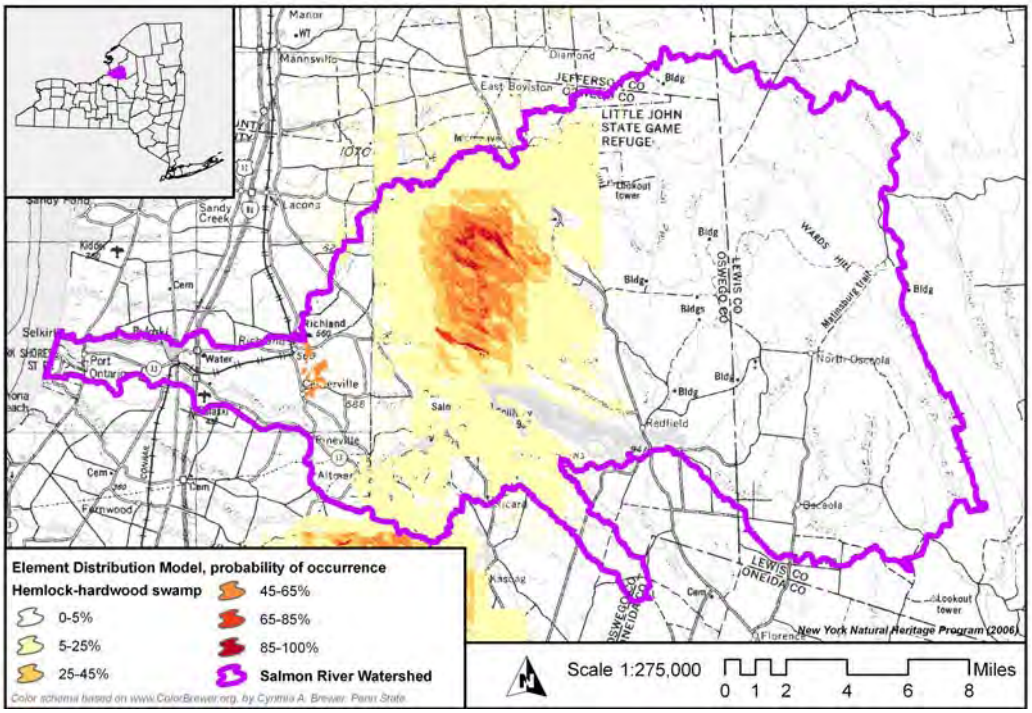


Figure A5.c.42. Element distribution model for hemlock-hardwood swamp.

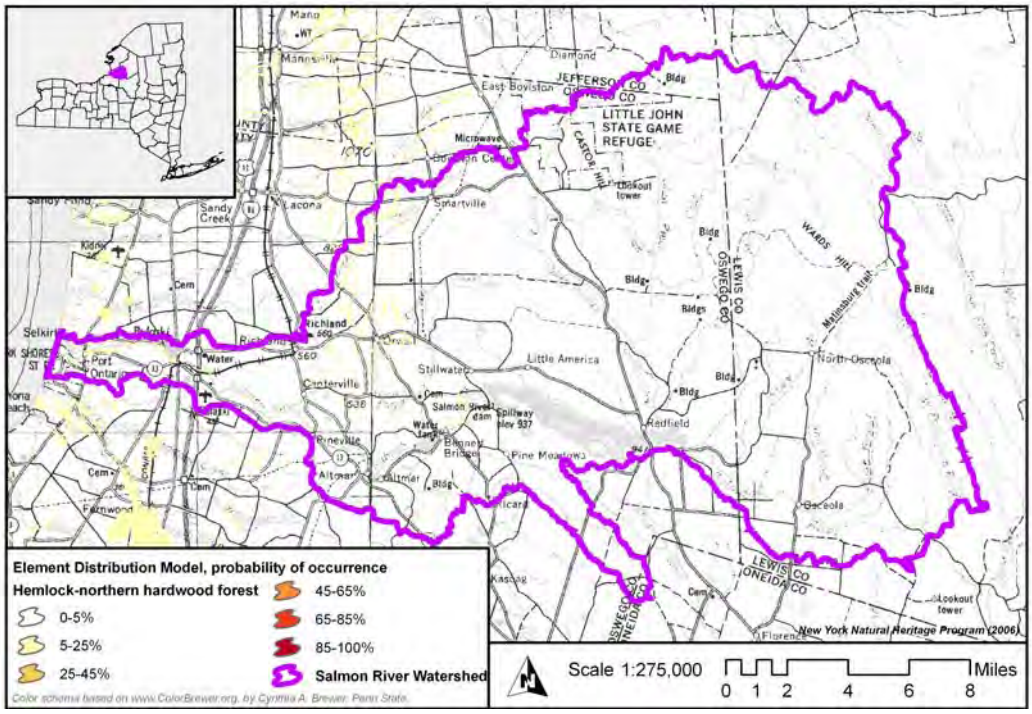


Figure A5.c.43. Element distribution model for hemlock-northern hardwood forest.

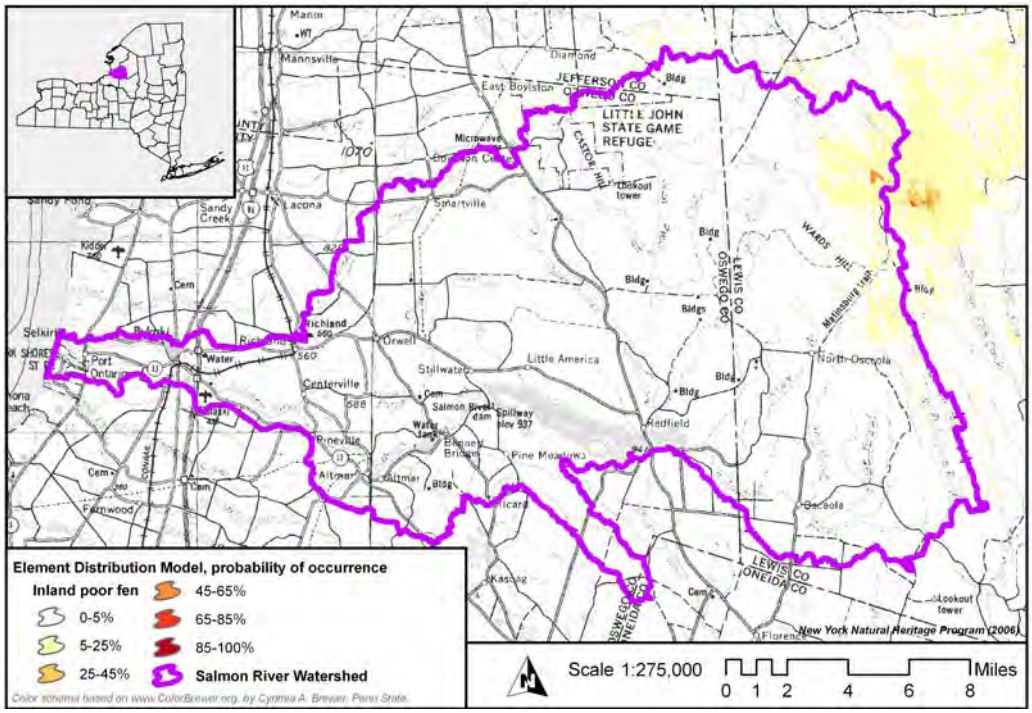


Figure A5.c.44. Element distribution model for inland poor fen.

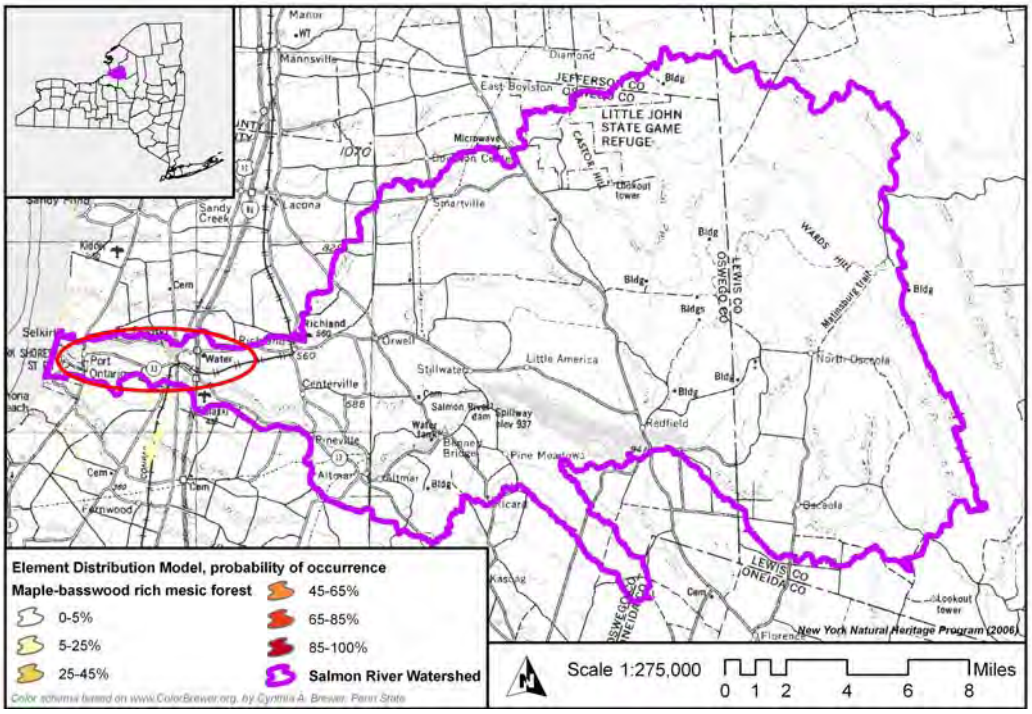


Figure A5.c.45. Element distribution model for maple-basswood rich mesic forest.

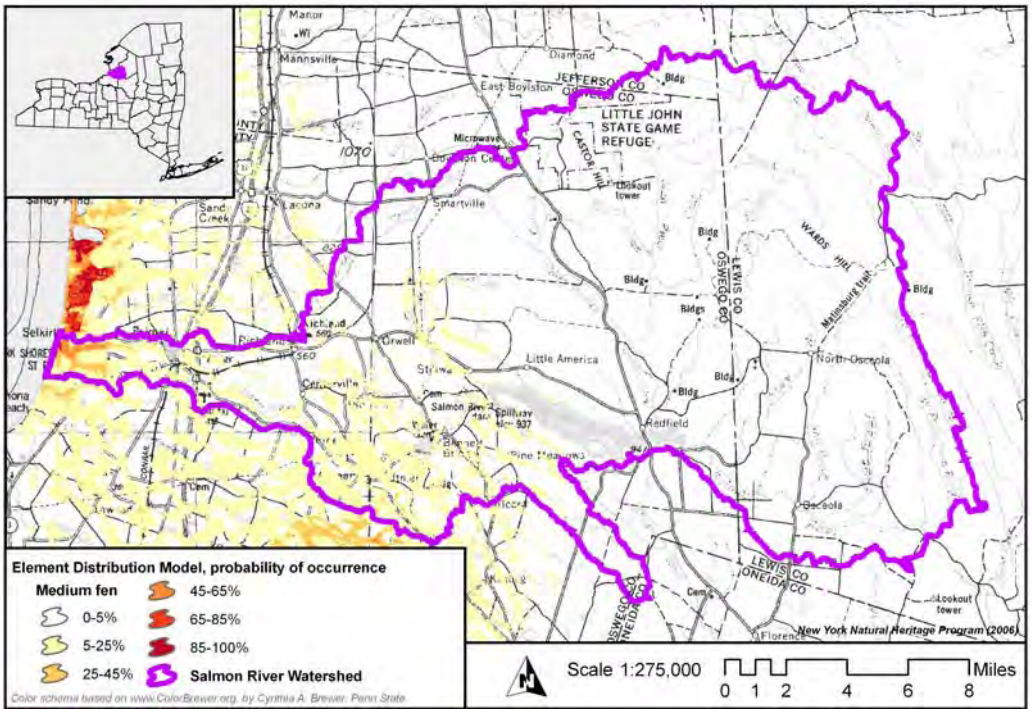


Figure A5.c.46. Element distribution model for medium fen.

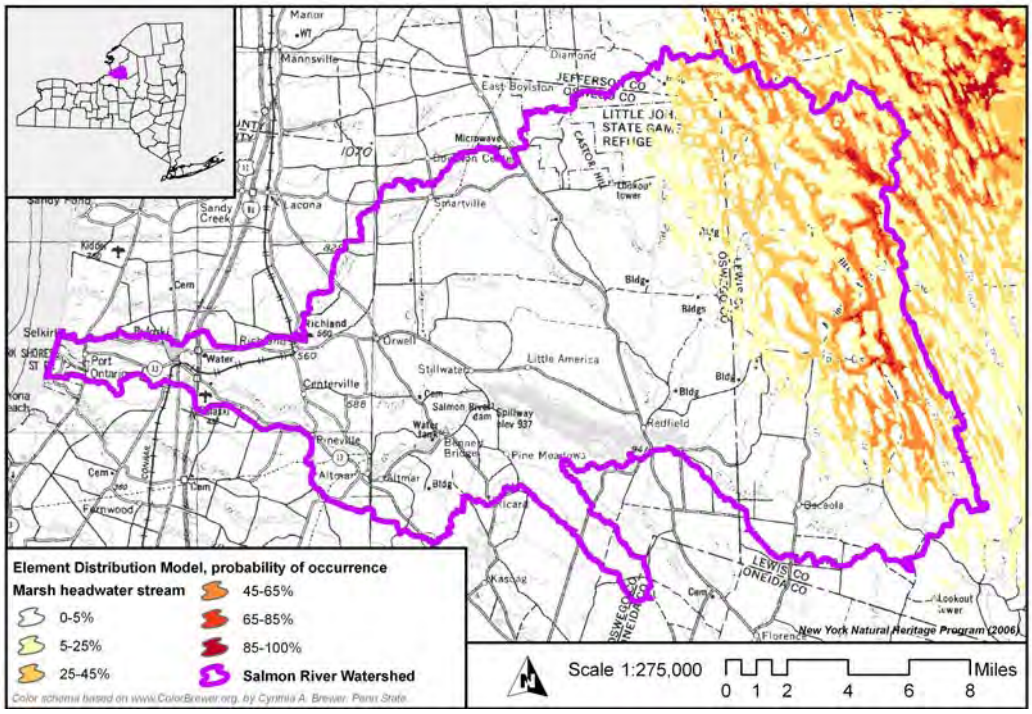


Figure A5.c.47. Element distribution model for marsh headwater stream.

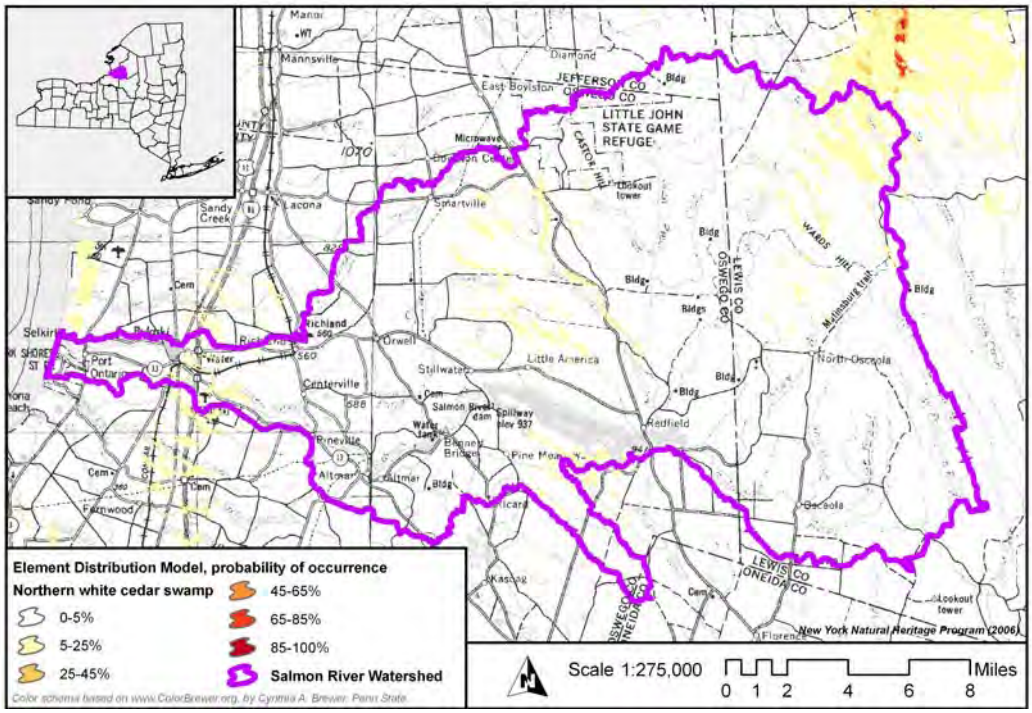


Figure A5.c.48. Element distribution model for northern white cedar swamp.

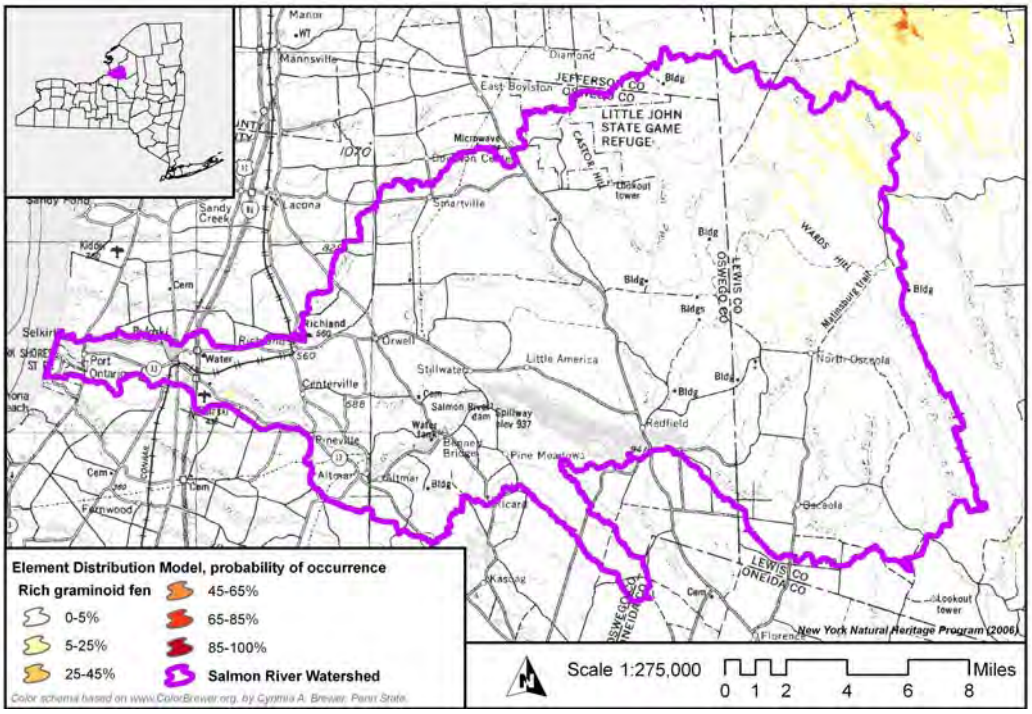


Figure A5.c.49. Element distribution model for rich graminoid fen.

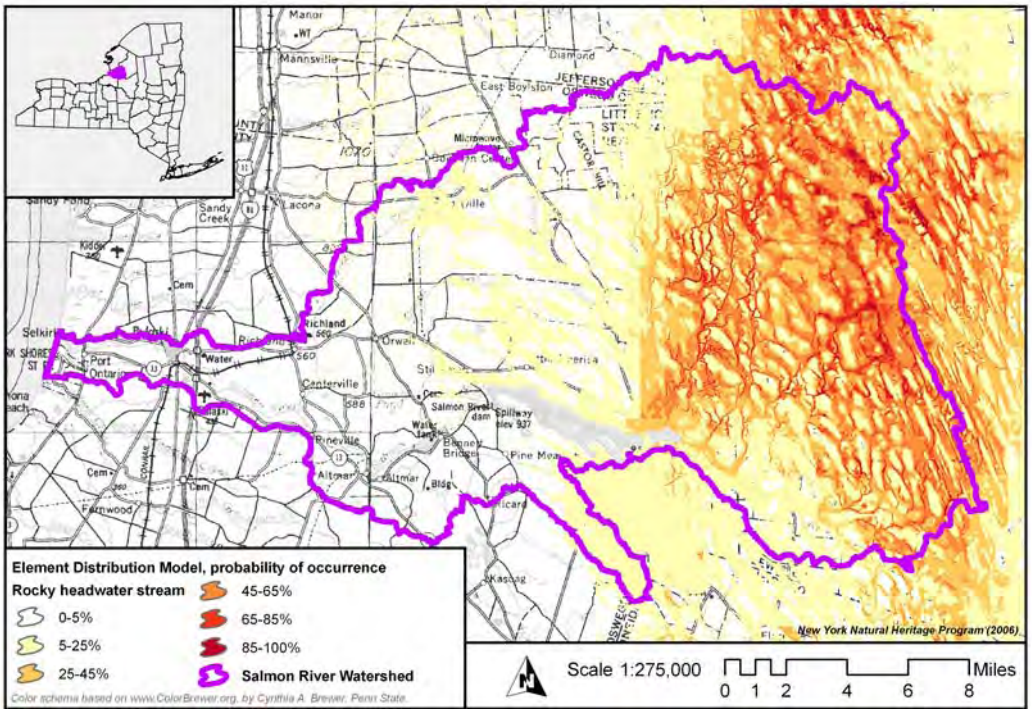


Figure A5.c.50. Element distribution model for rocky headwater stream.

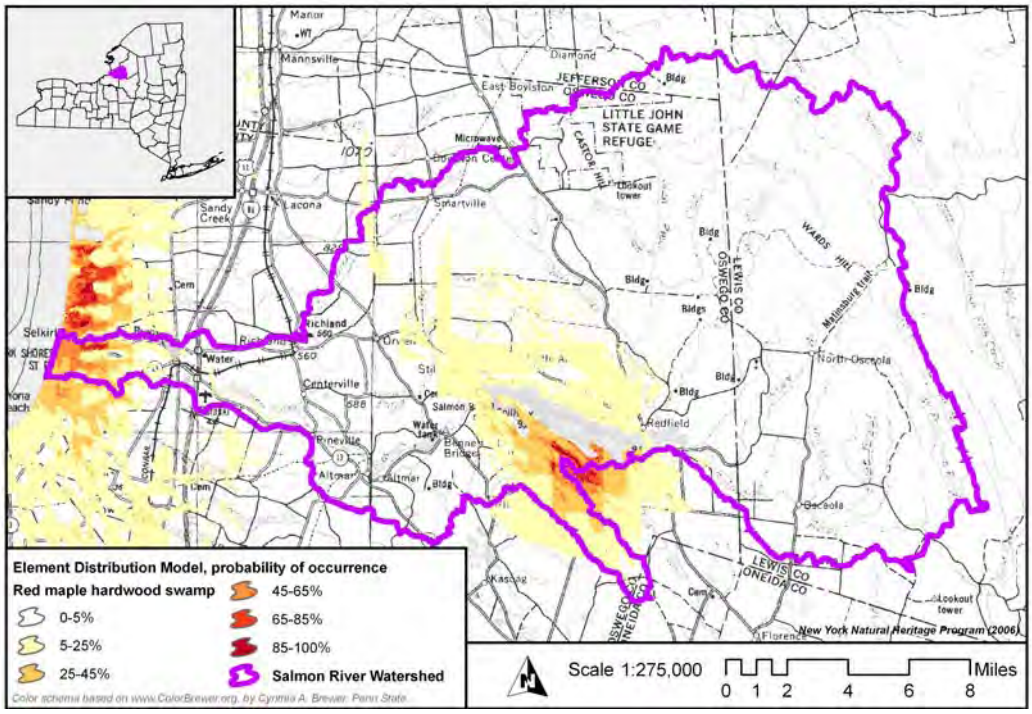


Figure A5.c.51. Element distribution model for red maple-hardwood swamp.

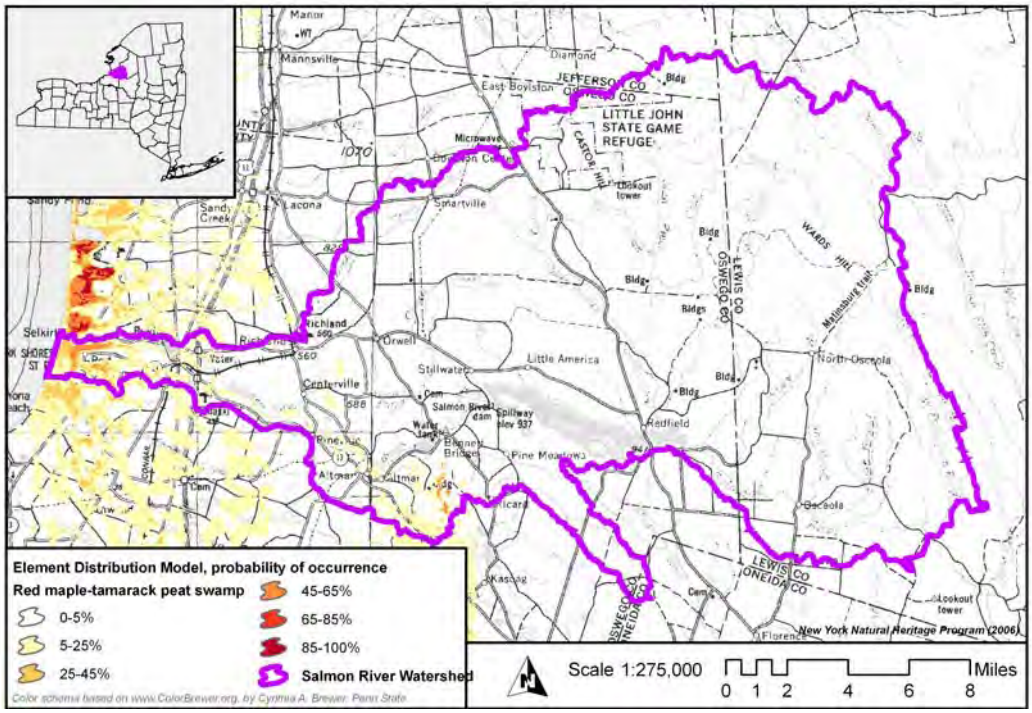


Figure A5.c.52. Element distribution model for red maple-tamarack peat swamp.

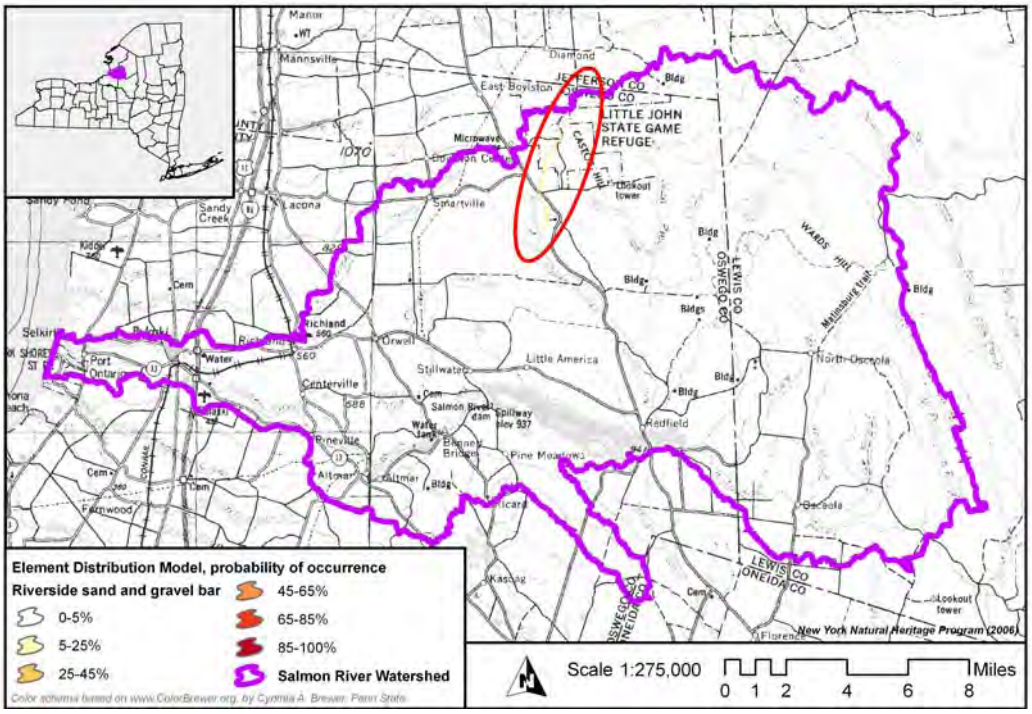


Figure A5.c.53. Element distribution model for riverside sand and gravel bar.

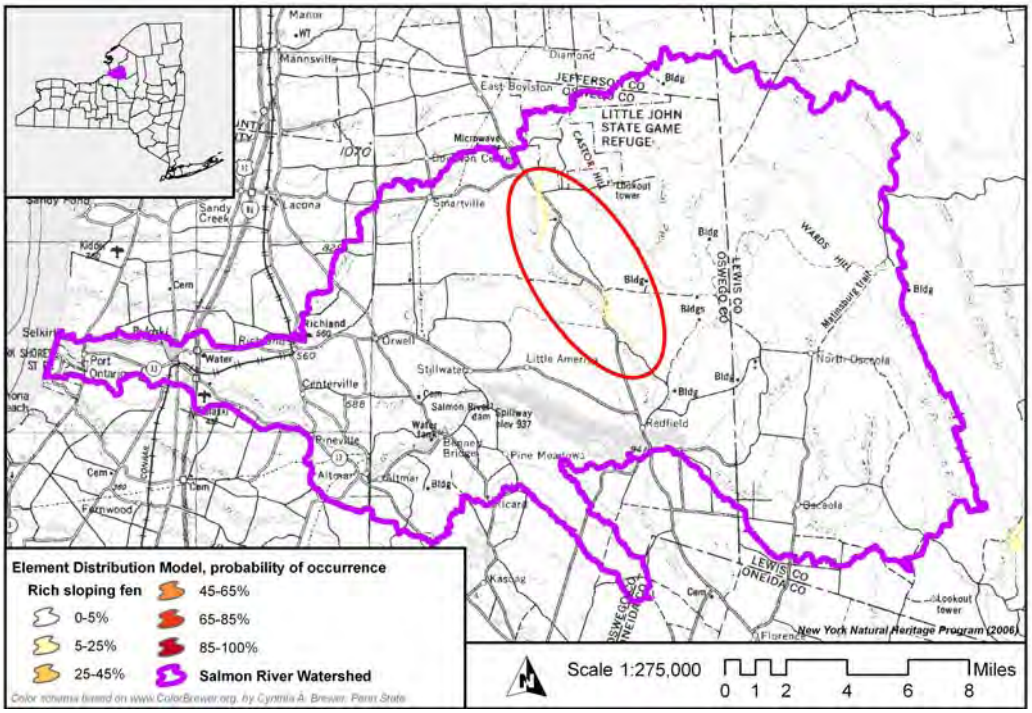


Figure A5.c.54. Element distribution model for rich sloping fen.

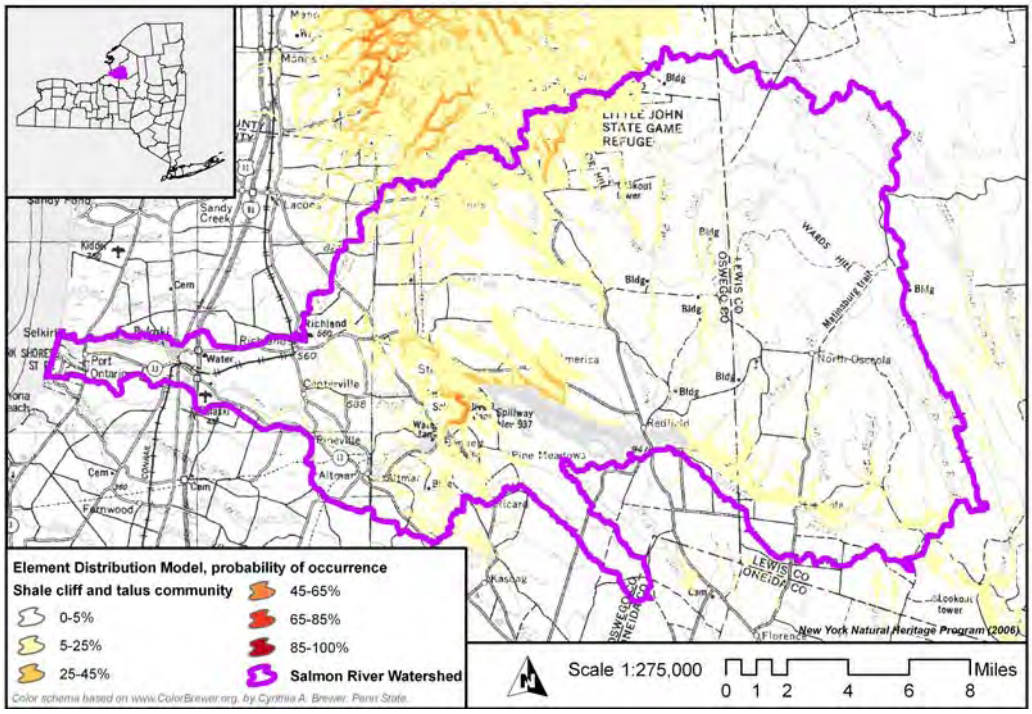


Figure A5.c.55. Element distribution model for shale cliff and talus community.

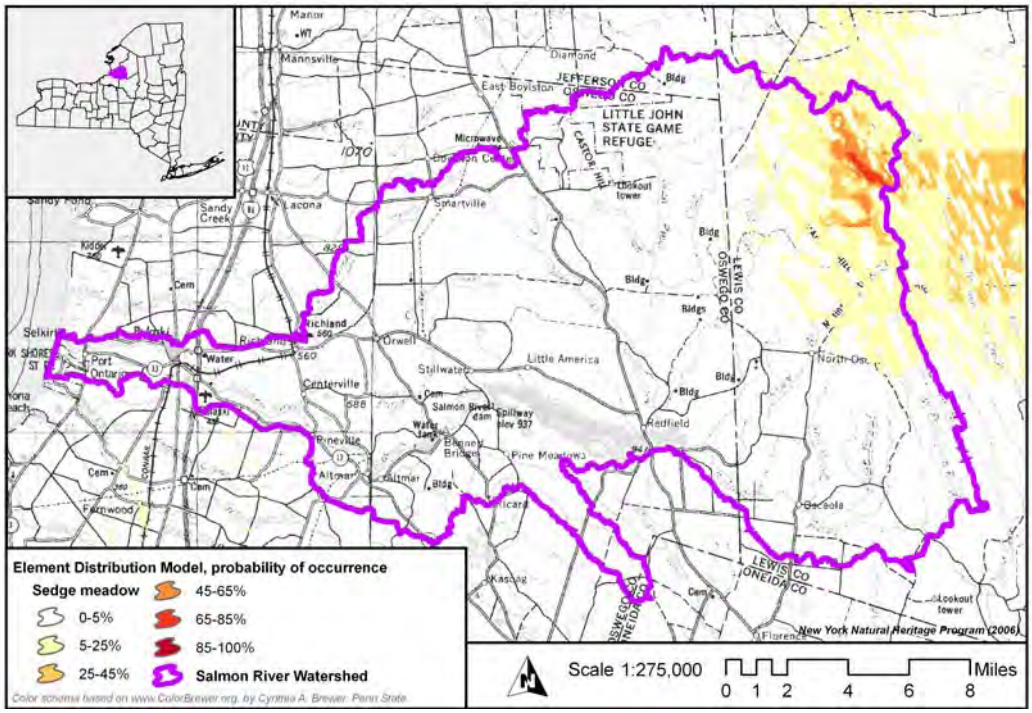


Figure A5.c.56. Element distribution model for sedge meadow.

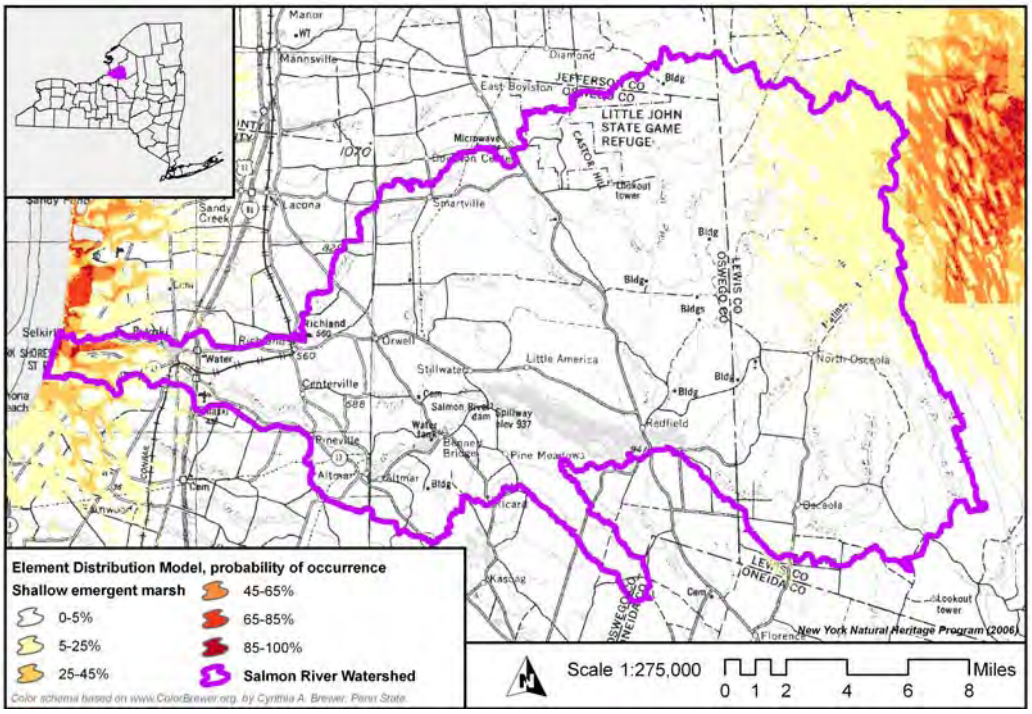


Figure A5.c.57. Element distribution model for shallow emergent marsh.

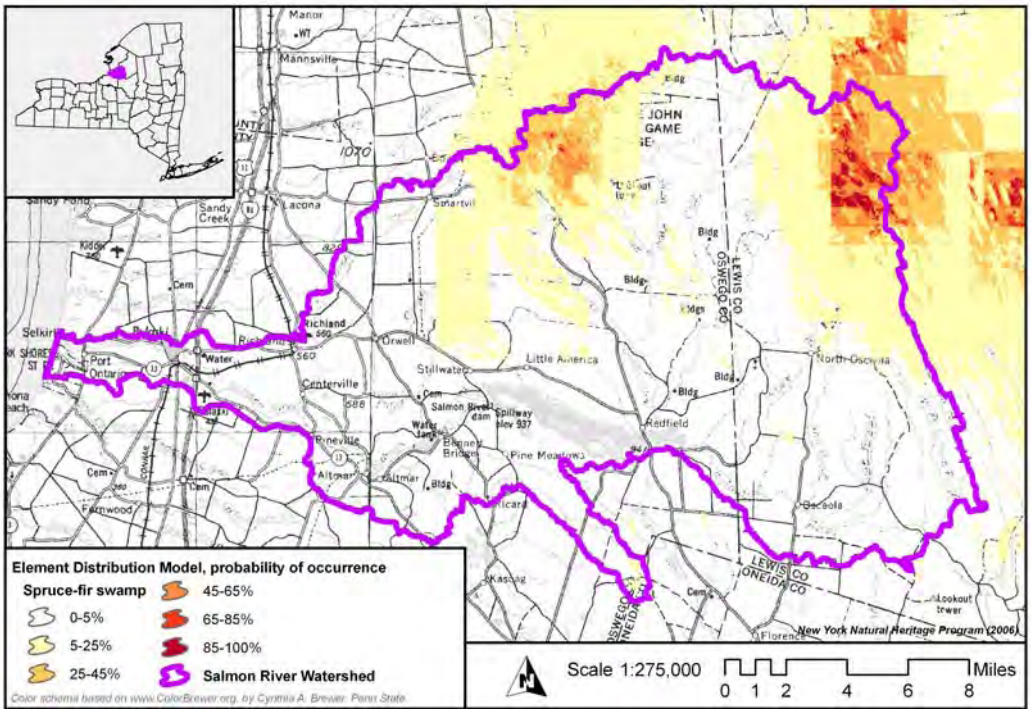


Figure A5.c.58. Element distribution model for spruce-fir swamp.

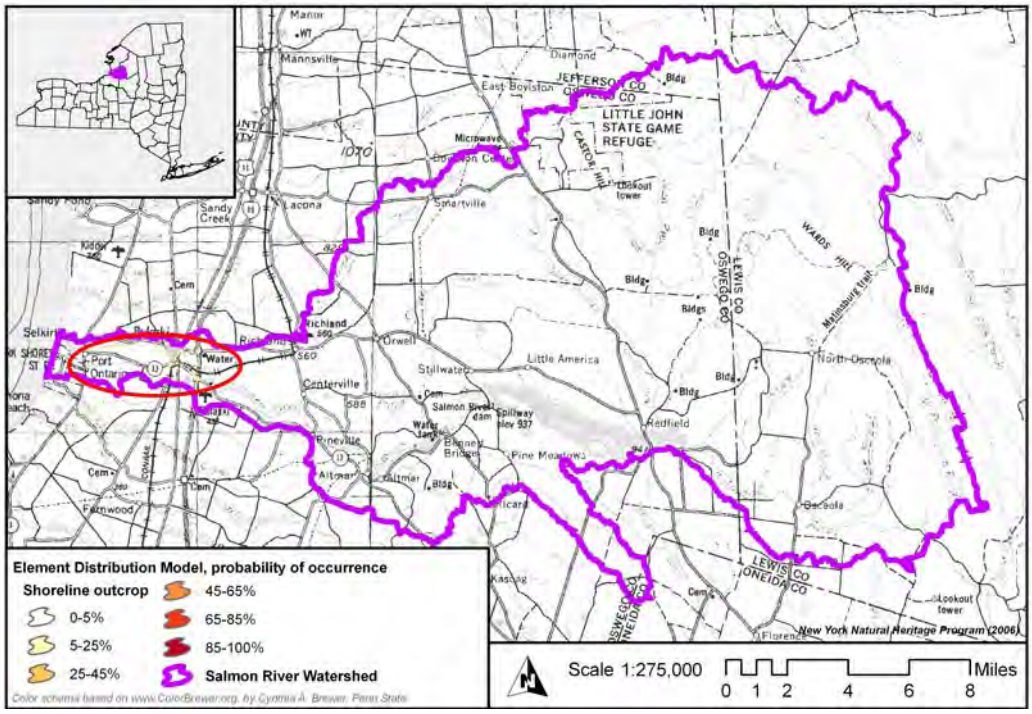


Figure A5.c.59. Element distribution model for shoreline outcrop.

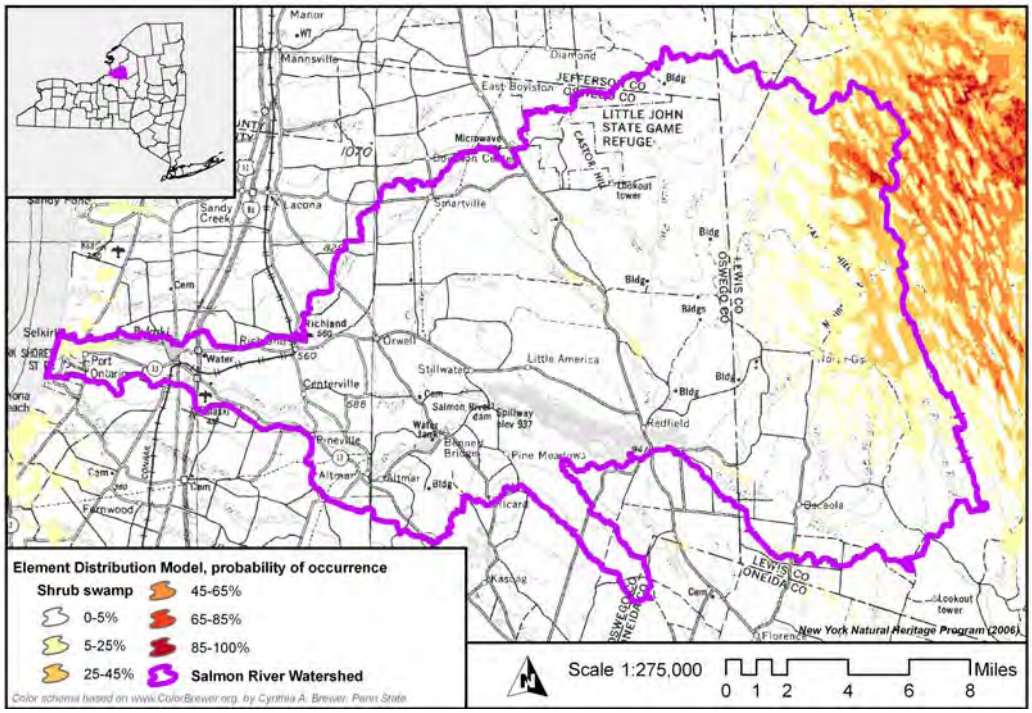


Figure A5.c.60. Element distribution model for shrub swamp.

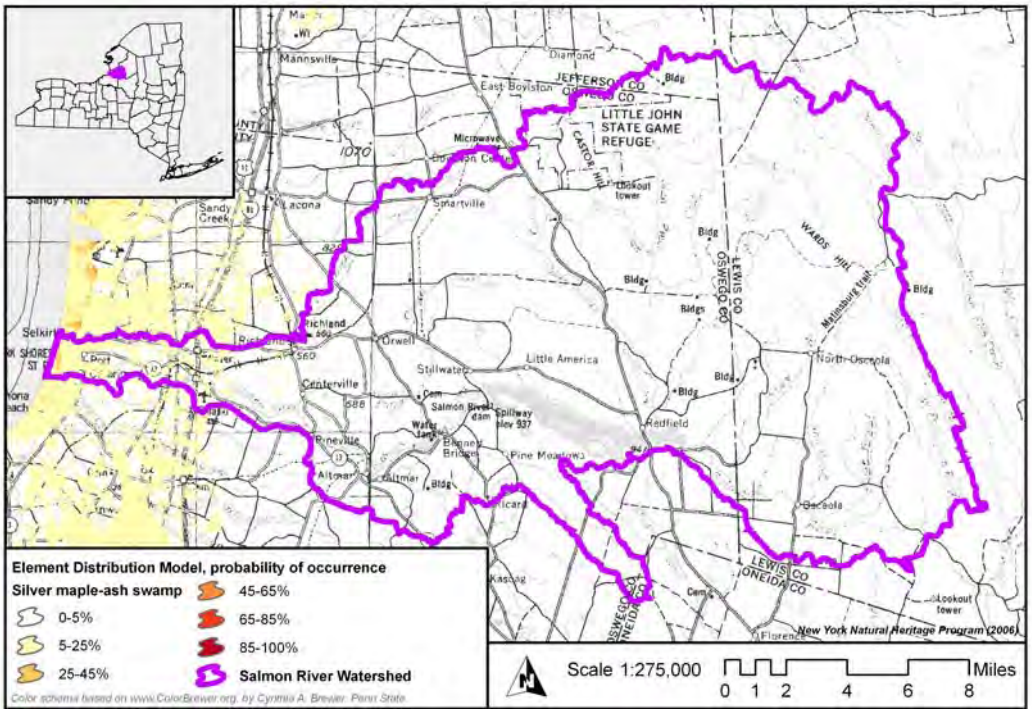


Figure A5.c.61. Element distribution model for silver maple-ash swamp.

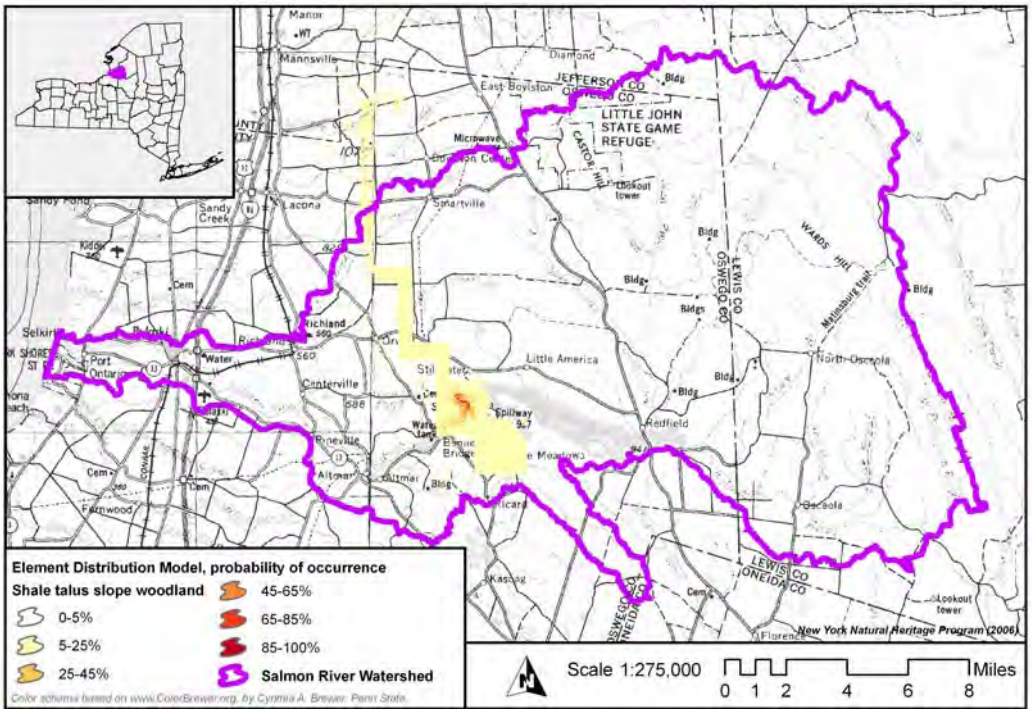


Figure A5.c.62. Element distribution model for shale talus slope woodland.

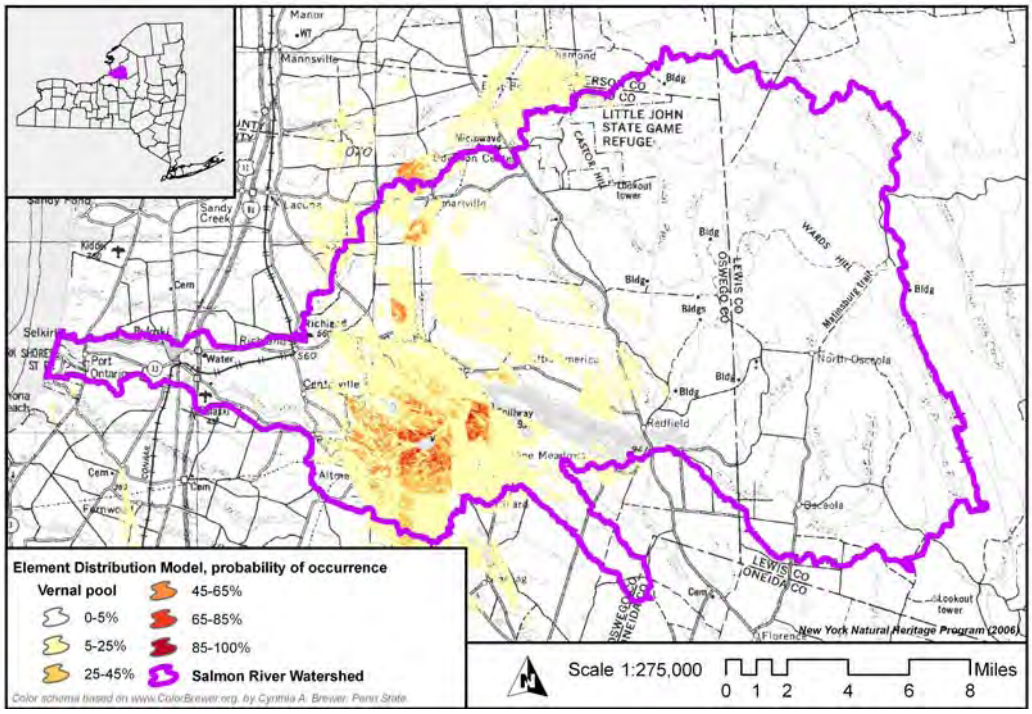


Figure A5.c.63. Element distribution model for vernal pool.

The New York Natural Heritage Program

625 Broadway, 5th Floor; Albany NY 12233-4757
518-402-8935 Fax 518-402-8925
www.nynhp.org

The NY Natural Heritage Program is a partnership between the NYS Department of Environmental Conservation (NYS DEC) and The Nature Conservancy. Our mission is to enable and enhance conservation of rare animals, rare plants, and significant ecosystems. We accomplish this mission by combining thorough field inventories, scientific analyses, expert interpretation, and the most comprehensive database on New York's distinctive biodiversity to deliver the highest quality information for natural resource planning, protection, and management.

NY Natural Heritage was established in 1985 and based in NYS DEC's Division of Fish, Wildlife, & Marine Resources. The program is staffed by more than 20 scientists and specialists with expertise in ecology, zoology, botany, information management, and computer mapping.

NY Natural Heritage maintains New York's most comprehensive database on the status and location of rare species and natural communities. We presently monitor the status of more than 165 natural community types, 750 rare plant species, and 415 rare animal species across New York, keeping track of more than 11,000 locations where these species and communities are found. The database also includes detailed information on the relative rareness of each species and community, the quality of their occurrences, and descriptions of sites. The information is used by public agencies, the environmental conservation community, developers, and others to aid in land-use decisions. Our data are essential for prioritizing those species and communities in need of protection and for guiding land-use and land-management decisions where these species and communities exist.

In 1990, NY Natural Heritage published *Ecological Communities of New York State*, an all inclusive classification of natural and human-influenced communities. From 40,000-acre beech-maple mesic forests to 40-acre maritime beech forests, sea-level salt marshes to alpine meadows, our classification quickly became the primary source for natural community classification in New York and a fundamental reference for natural community classifications in the northeastern United States and southeastern Canada. This classification, which has been continually updated as we gather new field data, has also been incorporated into the International Vegetation Classification that is being developed and refined by NatureServe, The Nature Conservancy, and Natural Heritage Programs throughout the United States (including New York).

NY Natural Heritage is an active participant in NatureServe – the international network of biodiversity data centers. There are currently Natural Heritage Programs in all 50 states and 21 Conservation Data Centers (the international equivalent of Natural Heritage Programs) in Canada, Latin America, and the Caribbean. These programs work with NatureServe to develop biodiversity data, maintain compatible standards for data management, and provide information about rare species and natural communities that is consistent across many geographic scales – from ¼-acre wetland sites to the North American continent.