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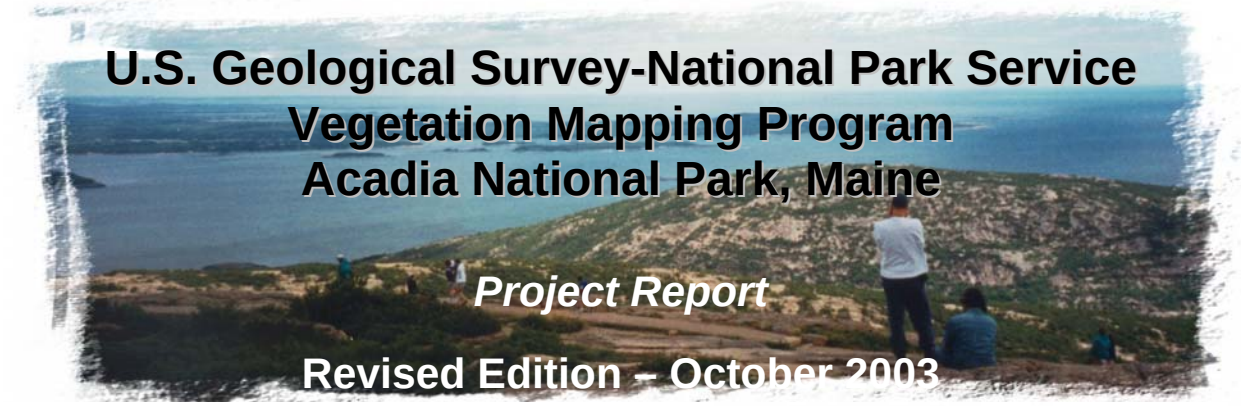
U.S. Geological Survey-National Park Service
Vegetation Mapping Program
Acadia National Park, Maine



Project Report

Revised Edition – October 2003

U.S. Geological Survey-National Park Service Vegetation Mapping Program Acadia National Park, Maine

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Upper Midwest Environmental Sciences Center

and

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Glen Mittelhauser gladly made his data from island forest sampling available to round out forest type descriptions.
Karen Anderson converted maps and other data to geographical information system (GIS) layers for analysis.
Linda Gregory provided botanical expertise, logistical support, and mighty fine Isle au Haut burritos.

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Mel Bower and Tom Owens devoted several intense days to help with gradsect (gradient directed transect sampling) analysis (see online glossary of terms <http://biology.usgs.gov/npsveg/glossary.html>).
Christine Calogero and Janis Boyd automated our interpreted polygons to produce the digital map coverage, and provided their skills in developing other geographic information system (GIS) data layers that support the mapping project.

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Brian Carlson tirelessly worked to convert field data into computer files accessible for analysis, and ensured attention to details. He also scanned slides and assisted with many tasks through the analysis phase of this project.
Sarah Evans converted the data into the proper format to match The Nature Conservancy (TNC) database and, along with Emily Pinkham, will be responsible for recording the presence of rare communities or selected examples of common communities into our Biological and Conservation Database. Emily also tracked the finances.
Ecologists Andy Cutko and Don Cameron contributed data from their independent field surveys in the region.
Curry Caputo and Keith Pearson assisted in final production of this report.
Molly Docherty, program director, administered the contract.
Dan Coker redesigned our plots database to agree with TNC plots database and helped with many database design and data handling questions.

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U.S. Geological Survey-National Park Service Vegetation Mapping Program Acadia National Park, Maine

by

Sara Lubinski, Kevin Hop, and Susan Gawler

Summary

The U.S. Geological Survey (USGS) is cooperating with the Inventory and Monitoring Program of the National Park Service (NPS) to classify, describe, and map vegetation for over 270 national park units. The USGS Upper Midwest Environmental Sciences Center (UMESC) in La Crosse, Wisconsin, The Nature Conservancy (TNC), and the NatureServe Eastern Regional Office, along with the Maine Natural Areas Program (MNAP), have completed mapping and classifying the existing vegetation in Acadia National Park (NP) and environs. The UMESC provided overall project coordination and compiled all project reports and data for distribution. The UMESC also organized the acquisition of aerial photographs; produced all digital spatial map coverages, including the interpretation of the aerial photographs and subsequent digital map automation; performed the accuracy assessment analysis of the vegetation map coverage; and prepared final project metadata and documentation discussing methods and results. TNC, NatureServe, and the MNAP provided ecological and vegetation support, vegetation field sampling (plot sampling and accuracy assessment), field data entry, and vegetation classification development (including association descriptions) based on the National Vegetation Classification System (NVCS). The USGS Center for Biological Informatics provided oversight to the project. Staff at Acadia NP contributed their botanical and ecological guidance, shared their management and research goals, and provided equipment support, housing, boat transportation, and personnel to help with field work.

The Federal Geographic Data Committee (FGDC) Vegetation Subcommittee has adopted the NVCS as the Federal standard for vegetation classification (FGDC 1997). The NVCS is used for describing the vegetation types and is the basis for mapping within the USGS-NPS Vegetation Mapping Program (VMP). It is an a priori classification that is continental in scope, and was chosen at the beginning of the program to ensure a balance between the needs of mapping local vegetation patterns within each park with the overall need to have consistency between parks. NatureServe and the Network of Natural Heritage Programs manage the NVCS, a system that emphasizes natural and existing vegetation.

Acadia NP was selected as one of several pilot parks to develop and refine the methodology and standards for the USGS-NPS Vegetation Mapping Program. The three basic components of this project are vegetation classification, vegetation mapping, and map accuracy assessment. Classifying and mapping the vegetation proceeded simultaneously as directed by the VMP, hoping to shorten the overall duration of

the project. Accuracy assessment followed classifying and mapping, and gives indication the shortcomings to classifying and mapping in a parallel method.

In Acadia NP, as in other national parks mapped for the VMP, extensive field sampling was conducted to understand the local expression of vegetation types of the park. Samples from 179 vegetation sampling plots were collected during 1997–99 field seasons throughout the project area and subsequently analyzed with previously collected plot data. Fifty-three natural/semi-natural vegetation communities (associations of the NVCS) are recognized and described in detail in this report.

The 53 vegetation communities are represented with 33 map classes. Fifty-eight map classes, including land use/land cover and park specific categories, were used to map Acadia NP and environs. Color infrared aerial photographs, collected in late May 1997 at a scale 1:15,840, were used for photointerpretation. Spring photography was chosen so fieldwork and mapping could begin that same year. Using spring photography limited the ability to map some NVCS vegetation types accurately. Photointerpretation data were manually transferred to orthophoto quadrangle maps (1:12,000-scale) and then digitally automated for use in geographic information systems (GIS).

The VMP standard for map accuracy of vegetation themes is 80%. Field data for accuracy assessment of the vegetation map were collected during the 1999 field season using a stratified random design based on map classes. Overall thematic map accuracy of the Acadia NP vegetation map is 80%; however, some individual map classes fell below the 80% accuracy requirement. Several factors contributed to low accuracy, of which the most critical were (1) map classes were developed before we had an understanding of corresponding vegetation types, resulting in confusing relations between the map classes and the vegetation associations; (2) not enough time in the field with the ecologists; (3) spring photography limited our ability to discern some vegetation types from others; and (4) Acadia NP abounds with compositionally heterogeneous communities with broad ecotones, and would be difficult to map regardless of the process. We provide several recommendations addressing these problems in the hope that future projects may proceed with greater efficiency and accuracy.

Products developed for the Acadia NP VMP include the following:

- This final project report, which includes methods, descriptions of vegetation types, vegetation key, map accuracy assessment results and contingency table, and map class description and visual guide
- Spatial database coverages of the vegetation map, observation points, vegetation field plots, accuracy assessment sites, flight line index, and other supportive GIS data
- Digital data files and hard copy data sheets of fieldwork including observation points, vegetation field plots, and accuracy assessment sites
- Aerial photographs of the project area (one transparency set and two contact print sets) and their corresponding interpreted overlays
- Hard copy flight line index of the project's aerial photographs
- Representative ground photos of each vegetation community
- Graphics of all spatial database coverages, and map composition of the vegetation map
- Federal Geographic Data Committee compliant metadata to National Biological Information Infrastructure standards for all vegetation spatial database coverages and field work data
- CD-ROM containing reports, metadata, keys, classification lists, fieldwork data, spatial data, map composition, graphics, and ground photos

Introduction

Objective of the U.S. Geological Survey-National Park Service Vegetation Mapping Program

The USGS-NPS Vegetation Mapping Program (VMP) is a cooperative effort by the U.S. Geological Survey (USGS) and the National Park Service (NPS) to classify, describe, and map vegetation communities in more than 270 national park units across the United States. The goal of the VMP is to meet specific information needs identified by the NPS. The VMP, managed by the USGS Center for Biological Informatics in Denver, Colorado, is part of the NPS Inventory and Monitoring Program, a long-term effort to acquire the information needed by park managers in their efforts to maintain ecosystem integrity for all national park units that have a significant natural resource component. Vegetation maps and associated information support a wide variety of resource assessment, park management, and planning needs, and provide a structure for framing and answering critical scientific questions about vegetation communities and their relation to environmental processes across the landscape.

Program scientists have developed procedures to use existing data and to collect new data for classification, mapping, and accuracy assessment. Three major components essential to every mapping project are vegetation classification, vegetation mapping, and map accuracy assessment. Ecology and mapping teams work together to share knowledge and data and to resolve issues to carry out the procedures. Program products meet Federal Geographic Data Committee (FGDC) standards for vegetation classification and metadata and national standards for spatial accuracy and data transfer. Standards include a minimum mapping unit of 0.5 hectares (ha) and classification accuracy of 80% for each map class. Spatial data products include aerial photography, map classification, map classification and description key (<http://biology.usgs.gov/npsveg/overview.html>), spatial database of vegetation communities, hardcopy maps of vegetation communities, metadata for spatial databases, and complete accuracy assessment of the vegetation map. Vegetation information includes vegetation classification, dichotomous field key of vegetation classes, formal description of each vegetation class, ground photos of vegetation classes, and field data in database format.

Acadia National Park (NP) was selected as one of several pilot parks to develop and refine the methodology and standards of the Vegetation Mapping Program. Work in Acadia NP began in 1997. The major collaborators in this project have been The Nature Conservancy (TNC), NatureServe Eastern Regional Office ecological staff, Acadia NP Natural Resources staff, Maine Natural Areas Program (MNAP) ecological staff and contractors, and USGS Upper Midwest Environmental Sciences Center (UMESC) national park mapping staff.

The National Vegetation Classification System

The VMP uses the National Vegetation Classification System (NVCS) for mapping all parks. The NVCS was developed and implemented primarily by The Nature Conservancy (TNC) and NatureServe, and the network of Natural Heritage programs over the past 20 years (Grossman et al.1998). Additional support has come from Federal agencies, the Federal Geographic Data Committee (FGDC), and the Ecological Society of America. The NVCS has been adopted as the National Standard by the FGDC for vegetation mapping to ensure consistent classification of vegetation resources across regions. The use of a standardized national vegetation classification system and mapping protocol facilitate effective resource

stewardship by ensuring compatibility and widespread use of the information throughout the NPS as well as by other Federal and state agencies.

The NVCS is a hierarchical system with physiognomic features at the highest levels of the hierarchy and floristic features at the lower levels. The physiognomic units have a broad geographic perspective and the floristic units have local and site-specific perspective (The Nature Conservancy and Environmental Systems Research Institute 1994a; Grossman et al. 1998).

The NVCS includes most existing vegetation, whether natural or cultural, but attention is focused on natural vegetation types. "Natural vegetation," as defined in The Nature Conservancy and Environmental Systems Research Institute (1994a), includes types that "occur spontaneously without regular management, maintenance, or planting and have a strong component of native species". "Cultural" vegetation includes planted/cultivated vegetation types such as orchards, pastures, and vineyards.

The physiognomic-floristic classification includes all upland terrestrial vegetation and all wetland vegetation with rooted vascular plants. The hierarchy has five physiognomic levels and two floristic levels (Table 1). The basic unit of the physiognomic portion of the classification is the "formation", a type defined by dominance of a given growth form in the uppermost stratum and characteristics of the environment (e.g., cold-deciduous alluvial forests). The physiognomic portion of the classification is based upon the United Nations Educational, Scientific, and Cultural Organization (UNESCO) world physiognomic classification of vegetation, which was modified to provide greater consistency at all hierarchical levels and to include additional types (Drake and Faber-Langendoen 1997).

Table 1. National Vegetation Classification System physiognomic-floristic hierarchy for terrestrial vegetation (from Grossman et al. 1998).

Level	Primary Basis For Classification	Example
Class	Growth form and structure of vegetation	Woodland
Subclass	Growth form characteristics (e.g., leaf phenology)	Deciduous woodland
Group	Leaf types, corresponding to climate	Cold-deciduous woodland
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Temporarily flooded cold-deciduous woodland
Alliance	Dominant/diagnostic species of uppermost or dominant stratum	*Populus deltoides* temporarily flooded woodland alliance
Association	Additional dominant/diagnostic species from any strata	*Populus deltoides* - (*Salix amygdaloides*) / *Salix exigua* woodland

The floristic levels include alliances and associations. The alliance is a physiognomically uniform group of plant associations that share dominant or diagnostic species, usually found in the uppermost strata of the vegetation. For forested types, the alliance is roughly equivalent to the "cover type" of the Society of American Foresters. Alliances also include non-forested types.

The association is the finest level of the NVCS. The association is defined as "a plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (see Flahault and Schroter 1910 in Moravec 1993). Most schools of floristic classification have used this concept.

Ecological Setting of Acadia National Park

Acadia NP, the first national park to be established east of the Mississippi, is on the coast of Maine primarily in Hancock County (with outlying areas in adjacent Knox County) and encompasses almost 48,000 acres of granite-domed mountains, woodlands, lakes and ponds, and ocean shoreline. The park consists of a large portion of Mount Desert Island as well as some adjacent mainland and island tracts. Acadia consists of approximately 35,000 acres in fee (land held by government authority): 30,000 acres on Mount Desert Island, 3,000 acres on Isle au Haut, and 2,000 acres on Schoodic Peninsula (Patterson et al. 1983). Additional lands are held in conservation easements. With 3 million visitors per year, Acadia is one of the most heavily visited national parks (Figures 1 and 2). Lands donated between 1916 and 1929 form the core of the park, and smaller additions are still being made to its landholdings and easements. Mount Desert Island has an almost 300-year history of settlement, including extensive land clearing, and the peninsulas and other islands in Penobscot Bay have been likewise settled or at least used for pasture and/or timber for centuries.

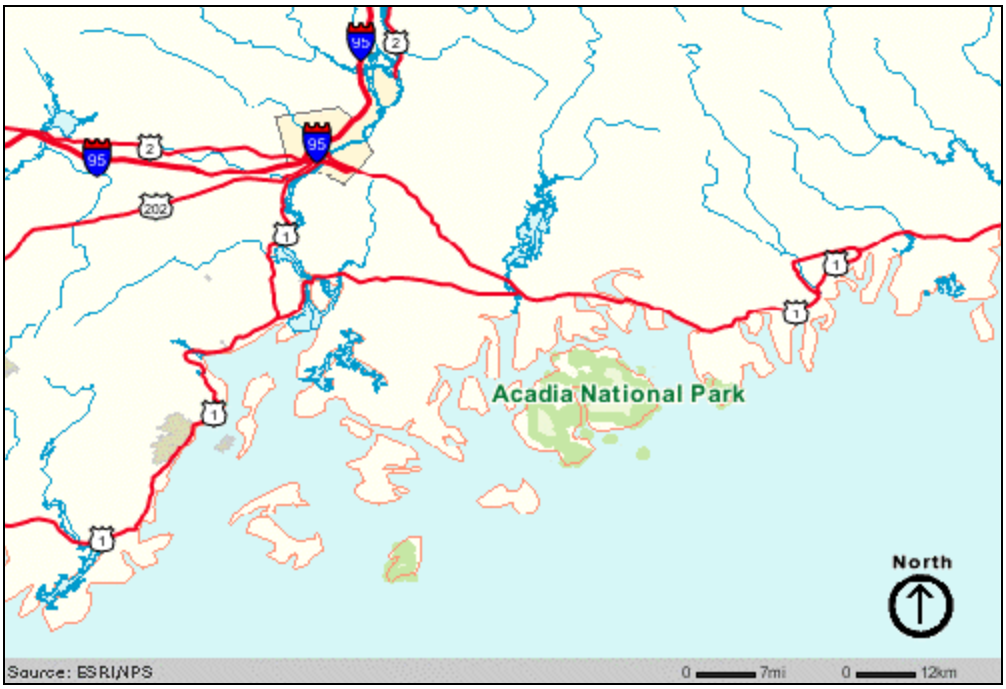

Figure 1. Acadia National Park with major highways marked on the mainland.

The lands within Acadia lie between 44º 12' and 44º 27' N latitude and between 68º 19' and 68º 27' W longitude. The maritime climate is cool and humid and fog is frequent, often lingering along the coast. At Bar Harbor, rain averages about 123 cm (49") annually, and snow about 1.5 m (5'); temperatures can range from -9º C (-16º F) in winter to 41º C (105º F) in summer, with a mean annual temperature (1940-1980) of 8º C (46º F; Patterson et al. 1983). The park lies at the western edge of the East Coastal biophysical region (McMahon 1990), which corresponds to the Maine Eastern Coastal subsection (in the Fundy Coastal and Interior section of the Laurentian Mixed Forest province) of the U.S. Forest Service ecoregion delineation (Keys et al. 1995).

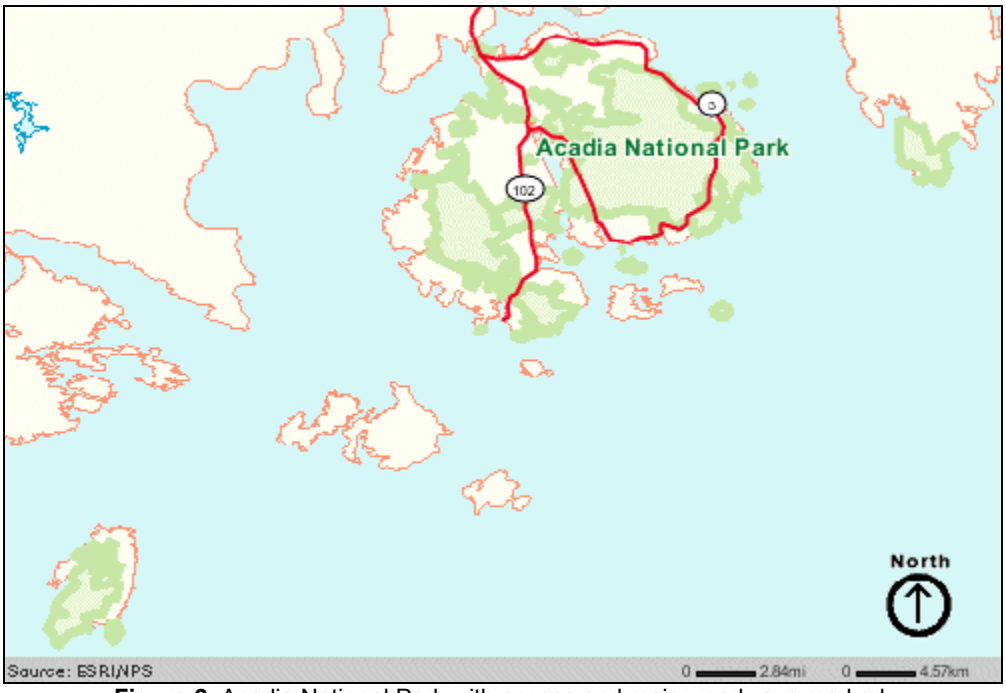

Figure 2. Acadia National Park with access and major roadways marked.

The landforms of Acadia NP are among the best-known features of the park and gave origin to the name Mount Desert Island (roughly, "Isle of the barren hills"). Glacial and post-glacial activity have left a series of north-south trending ridges separated by deep U-shaped valleys. (One of the valleys, Somes Sound, is the only fjord on the east coast of North America.) The ridges are rounded along their crests and extensive areas are treeless, standing out sharply above the predominant forest cover of the region. Areas of the park outside of Mount Desert Island have less rugged relief. Upland soils are mostly thin and granitic, with many areas of bedrock or talus where soil development is minimal at best. Wetlands are underlain by marine deposits or poorly drained tills and include both mineral soil and organic soil wetlands (Calhoun et al. 1994).

Acadia NP lies at the southern edge of Westveld's spruce-fir-northern hardwoods region (Westveld 1956). The vegetation reflects this transitional position with some areas more southern in character —pitch pine (*Pinus rigida*) woodlands, including areas of scrub oak on Acadia Mountain, at their northeastern range limit; or the *Ilex glabra* dominated fen on Isle au Haut reminiscent of Cape Cod and similar coastal plain areas. Other areas exhibit a boreal influence (headlands with *Rhodalia rosea* and *Iris setosa* or rocky woodlands with patchy cover of heaths and black spruce). Much of the undeveloped region is characterized by various expressions of spruce-fir forests or forests in transition toward spruce-fir forests. These have been described by Davis (1966) and Moore and Taylor (1927).

Fire is important to the Acadia NP vegetation. The famed 1947 fire (Figure 3) that burned most of the eastern side of Mount Desert Island is the most recent extensive fire, but evidence of past burns is present in trees and soils throughout the park (Patterson et al. 1983). Thus the present vegetation includes large areas of 50-year-old forest and woodland, as well as areas that have had a longer time since disturbance to develop. At Acadia, early- to mid-successional processes are superimposed on edaphic and topographic factors, all of which must be considered in dividing the vegetation into types and map classes.

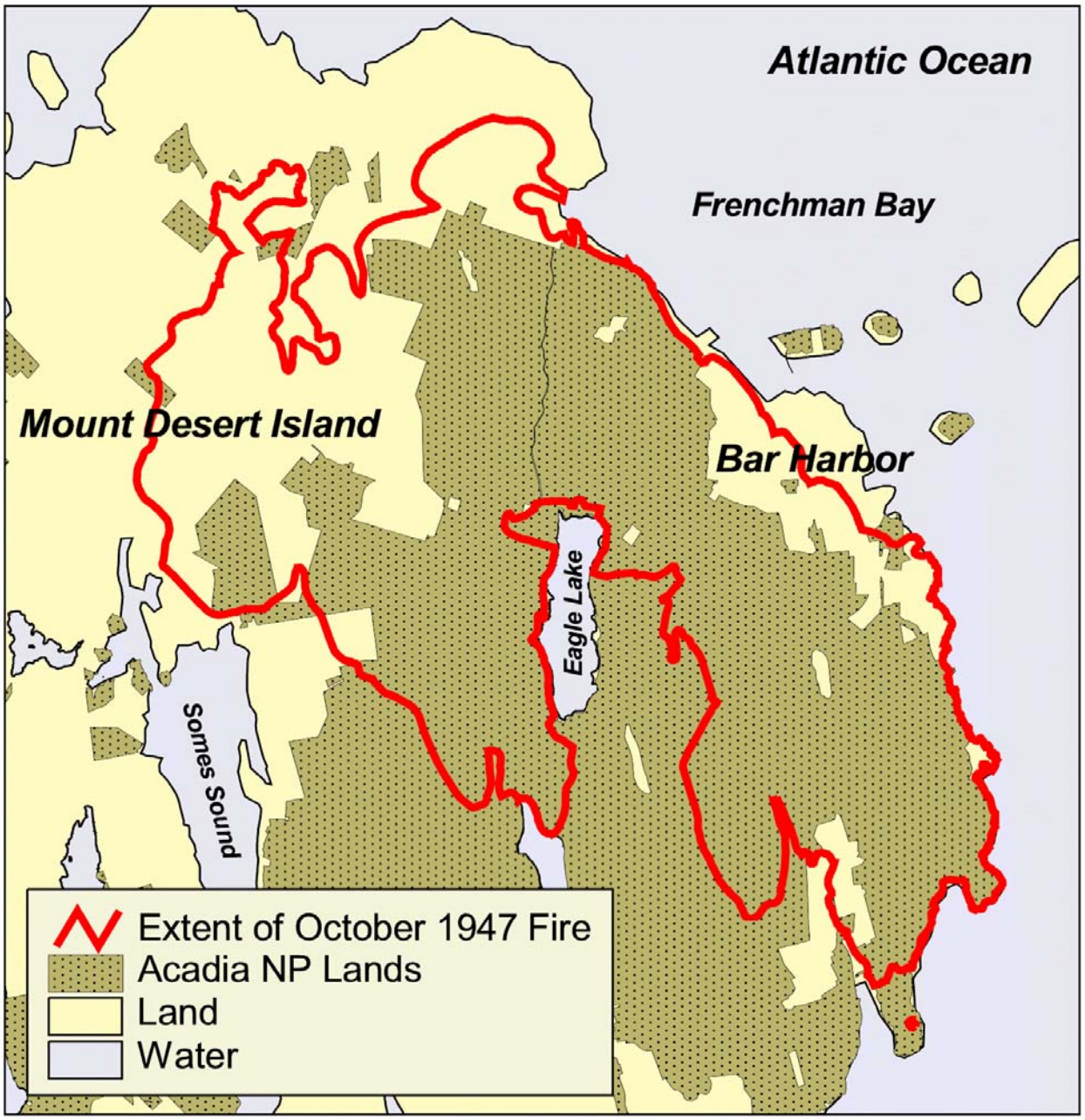

Figure 3. Mount Desert Island showing the extent of the October 1947 fire.

Previous Vegetation Studies

Acadia NP vegetation has long interested phytogeographers and ecologists, with published reports dating back over 100 years. The earliest publications are floras, notably those of Rand and Redfield (1894) and of Hill (1919). Hill (1923) subsequently went beyond the floristic approach to first describe the vegetation of the area, followed by Moore and Taylor's (1927) more extensive descriptions. These early descriptions reflect the prevailing Clementsian view of rather orderly vegetation development to a climax stage.

Kuchler (1956) mapped and described vegetation associations from the southeastern portion of Mount Desert Island (including areas that had burned in 1947) with dominant species and setting given for each. His work was instrumental in the earlier phases of this project, especially in developing the initial list of possible vegetation types for Acadia. Davis's monograph (1966 and references cited therein) on the spruce-fir forests of coastal Maine provides a useful picture of the predominant forests of the region, and remains a classic.

In the 1970s, Waggoner used aerial photos to map the vegetation of Mount Desert Island and developed a vegetation classification. Unfortunately, its utility was hampered by two factors: the emphasis on tree cover to the near exclusion of other layers, and the paucity of ground-truthing (on-site observation to verify and calibrate photointerpretation). Both are understandable, as this was the first attempt at a comprehensive map of the vegetation, and the scope of the task was perhaps not appreciated at the outset.

Recent vegetation work has focused on aspects of the park's flora or vegetation of particular interest. Patterson et al. (1983) spent many years studying fire regimes and fire-related vegetation on Acadia. Calhoun et al. (1994) mapped and described the wetlands of the region, using the U.S. Fish and Wildlife Service wetland classification methodology (Cowardin et al. 1979). Mittelhauser et al. (1996) studied the island flora, fauna, and forest composition. Aquatic plants have been inventoried throughout the park, although without detailed study of how the species are aggregated into vegetation types (Greene et al. 1997). These projects have provided useful compositional or ecological information on particular vegetation types described in this report.

The present report uses these previous works to inform the interpretation of our vegetation sampling, and in some cases, to provide information on types we did not sample. Resources allocated to this project were, however, insufficient to fully integrate the relevant pieces of these previous studies into this report and the type descriptions. Similarly, the geographic information system (GIS) based vegetation mapping presents an enticing opportunity for a more comprehensive analysis of vegetation patterns than in the past, but that was likewise not within the scope of this report.

Participants, Responsibilities, and Meeting Summary

The Acadia NP Vegetation Mapping Project is a cooperative effort among several agencies and organizations. The primary individuals and their roles are

USGS Center for Biological Informatics (CBI)
- Tom Owens - budgeting, program oversight (through December 2001)
- Karl Brown and Susan Stitt - budgeting, program oversight (beginning January 2001)

USGS Upper Midwest Environmental Sciences Center (UMESC)
- Kevin Hop - project management, map classification, quality control, and report writing and metadata
- Sara Lubinski - map classification, photointerpretation, accuracy assessment analysis, report writing
- Janis Boyd and Christine Calogero - digital spatial products

The National Park Service Inventory and Monitoring Program (NPS I&M)
Mike Story - budgeting, program oversight

Acadia National Park (ACAD)
David Manski - advisory re park management
Linda Gregory - botanist
Karen Anderson - advisory re digital spatial products

The Nature Conservancy, NatureServe and Maine Natural Areas Program (MNAP)
Jim Drake - project coordination
Mark Anderson and Lesley Sneddon - NVCS vegetation classification
Susan Gawler (MNAP) - vegetation sampling strategy, vegetation plots - vegetation data analysis, vegetation classification, primary field ecologist for UMESC mapping team
Jill Weber and Sally Rooney (contractors with MNAP) - vegetation plots and accuracy assessment data collection, and field assistants to UMESC mapping team.

The Acadia NP Vegetation Mapping Project formally began in March 1997 when personnel from Acadia NP, USGS CBI, USGS UMESC, TNC, and MNAP, in a planning (scoping) meeting at Acadia NP headquarters in Bar Harbor, Maine, organized the mapping project. Specific goals of the meeting were to review existing data, determine the mapping extent, discuss logistics and protocols, and assign tasks. Among the topics and tasks discussed were use of existing data, development of the classification and sampling strategy, data analysis, photointerpretation and digital map automation, determine extent of photography, and accuracy assessment process. Specific responsibilities and final products were assigned.

UMESC responsibilities and products:

- Facilitate project activities
- Perform field reconnaissance to learn photo signatures and local ecology, and to verify vegetation and land use/land cover appearances on the aerial photographs
- Develop map classes that link to the NVCS and other classification systems
- Assist TNC with information regarding the distribution and occurrence of vegetation types within the park
- Interpret and delineate vegetation and land use types using aerial photographs
- Transfer and automate interpreted information to produce a digital spatial database (in various formats) and hard copy vegetation maps
- Provide a photointerpretation mapping convention report and key
- Produce spatial coverages of all field data collection sites
- Provide accuracy assessment analysis and report results
- Provide a final report describing all aspects of the project
- Document FGDC compliant metadata for all vegetation data
- Provide a CD-ROM containing reports, metadata, keys, classification lists, fieldwork data, spatial data, map composition, graphics, and ground photos

TNC responsibilities and products:

- Develop a preliminary and final vegetation classification for the study area based on the NVCS
- Provide guidance to the photo interpreters regarding the ecology and floristic compositions of the vegetation types
- Design a sampling strategy to collect vegetation data
- Sample representative stands of the vegetation communities
- Provide vegetation descriptions and keys to vegetation communities

- Field test final classification, descriptions, and keys during accuracy assessment
- Collect accuracy assessment data
- Provide a PLOTS-generated database of vegetation field sample data and accuracy assessment field site data
- Provide documentation on field and analyses methodology and results

During the mapping project, ecologists and mappers held additional meetings and conducted fieldwork to collect the necessary information to classify the vegetation and interpret the aerial photographs. Table 2 summarizes these events.

Table 2. Summary of meetings and fieldwork for the Acadia National Park Vegetation Mapping Project.

Meeting/Field Trip	Locations	Purpose/outcomes	Participants
Scoping Meeting March 25-26, 1997	Acadia National Park Headquarters, Bar Harbor, Maine	Informed the park staff about the Vegetation Mapping Program. Learned about the park's management and science issues and concerns. Learned about existing data. Developed a preliminary schedule with assigned tasks. Started a process to define possible cooperation with neighbors. Defined a project boundary.	K. Anderson, M. Anderson, M. Blaney, T. Curtis, F. D'Erchia, S. Gawler, L. Gregory, K. Hop, D. Jones, D. Manski, T. Owens, N. Shaw, P. Super, G. Waggoner
Gradsect June 9-11, 1997	UMESC	GIS analysis using environmental data layers to determine biophysical diversity on MDI. Results used to plan vegetation sampling.	M. Bower, K. Hop, S. Gawler, L. Gregory, S. Lubinski, T. Owens
Field trip July 29-August 4, 1997	Schoodic Peninsula, Mount Desert Island, Isle au Haut	Confirmed existence of the vegetation types based on provisional community list, correlate the photo signatures with the appropriate vegetation types, and understand photo interpretation limitations. Forty-four vegetation types were visited.	M. Anderson, S. Gawler, L. Gregory, K. Hop, S. Lubinski, S. Rooney, J. Weber
September 1997	Mount Desert Island, Isle au Haut, Schoodic Peninsula	Continued correlation of photo signatures to appropriate vegetation types, verify earlier interpretation	S. Gawler, L. Gregory, K. Hop, S. Lubinski, S. Rooney, J. Weber
Field seasons 1997 and 1998	Acadia NP	Collected vegetation plot data for vegetation classification	S. Rooney, J. Weber
Spring 1998	UMESC	Reviewed and revised map classes to better align with vegetation types	M. Anderson, S. Gawler, K. Hop, S. Lubinski
June 22-July 2, 1998	Mount Desert Island, Bartlett Island	Continued correlation of photo signatures to appropriate vegetation types, verify earlier interpretation	S. Gawler, L. Gregory, S. Lubinski, S. Rooney, J. Weber
Field season 1999	Acadia NP	Finished collection of vegetation plot data and performed an accuracy assessment	S. Rooney, J. Weber

Methods

Aerial Photography Acquisition

Scoping meeting participants agreed to acquire aerial photography during spring 1997 so fieldwork and mapping could get underway the following summer and fall seasons. The UMESC and U.S. Army Corp of Engineers contracted with Aero-Metric, Inc. (Sheboygan, Wisconsin) to fly the photography mission and photos were collected May 27 and 28, 1997 (Figure 4, photo not to scale). An extended area was included in the photo mission to cover possible future easements. The photographs were 9 x 9-inch dia-positive transparencies from color infrared (CIR) film, collected with a 30% side lap (overlap between each flight line) and a 60% forward lap along each flight line to assure full area coverage and stereo viewing capability. Photo acquisition was at 7,920 feet above ground level with a lens focal length of 6 inches to obtain a scale of 1:15,840 (negative scale of 1 inch = 1,320 feet, or 4 inches = 1 mile). We collected 1,179 photos across 28 initial flight lines covering all park fee and easement lands and extended environs. An additional 37 photos were collected (a total of 1,216 photos) across 4 flight lines re-flown over the mountainous areas of Mount Desert Island to adjust the photo scale of the high mountain terrain. Two sets of contact prints were made from the original photo transparency film (one set for field sampling and one for mapping). The photo acquisition was successful in collecting all park fee and easement lands with extended environs (Figure 5). Two hundred thirty-nine aerial photographs were interpreted and used to produce the vegetation spatial database coverage for the Project.

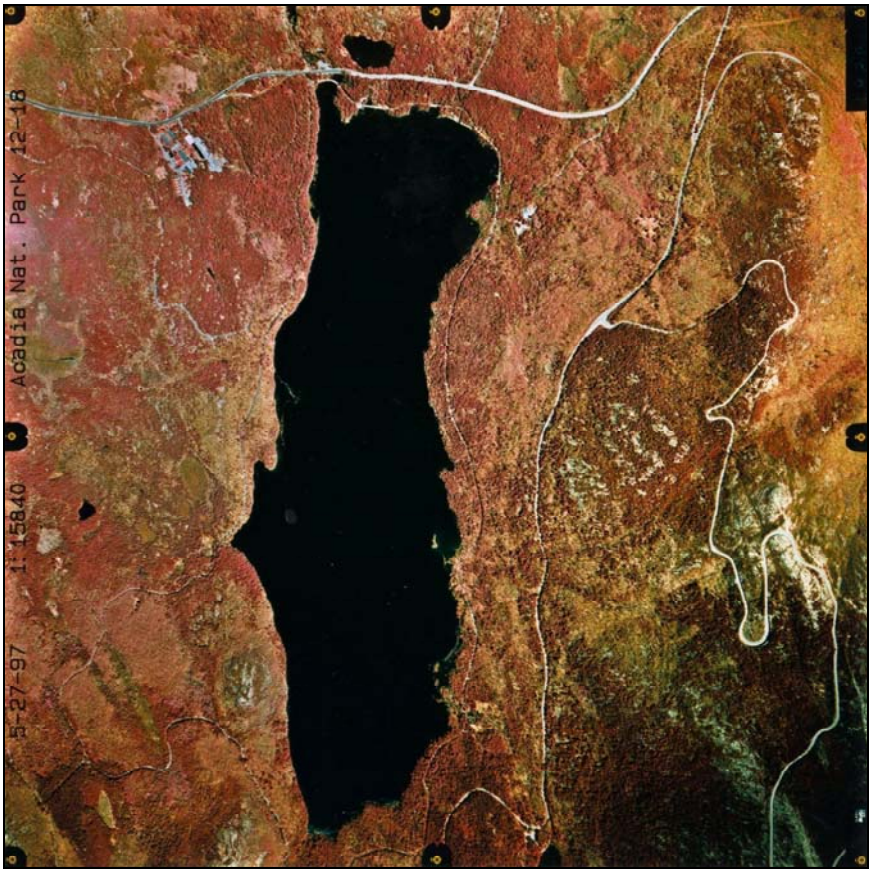

Figure 4. An aerial photograph collected for the Acadia National Park Vegetation Mapping Project.

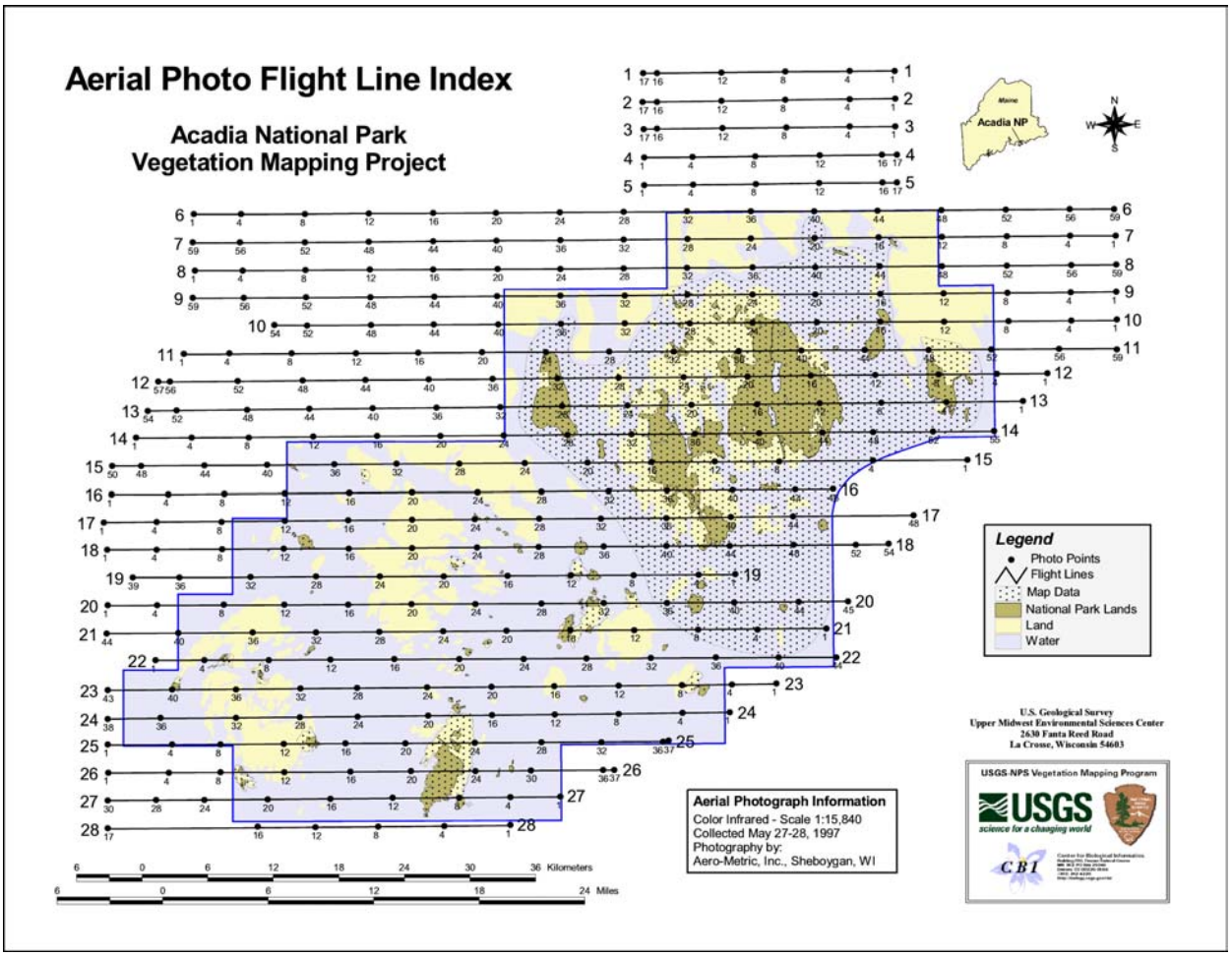

Figure 5. Flight lines flown for aerial photography of Acadia National Park and extended environs.

Fieldwork for Vegetation Classification Development

Vegetation samples were collected for subsequent analysis for defining and describing vegetation communities. Fieldwork planning to develop a strategy for vegetation sampling efforts at Acadia NP consisted of (1) developing a draft list of vegetation community elements for Acadia, (2) conducting a gradsect (gradient directed transect sampling) analysis of Mount Desert Island (MDI) to examine environmental gradients and help focus field efforts, and (3) a field reconnaissance visit (see online glossary of terms <http://biology.usgs.gov/npsveg/glossary.html>). Once a sound strategy was in place, vegetation sampling followed and strategy was adjusted as necessary.

Draft List of Vegetation Community Types

A draft list of 56 vegetation community elements (with cross-references between state and national names) was produced by ecologists from MNAP, TNC, and Acadia NP based on existing community records for MDI available at MNAP, an analysis of the 1956 Kuchler map and descriptions, and additional information and personal knowledge. We used the draft list of vegetation types primarily to grasp and understand the vegetation expressions at Acadia NP, providing a springboard to fieldwork planning and vegetation definitions. We also used environmental, topographic, and geologic information

to develop a list of 23 landforms and cross-referenced each draft type to the landforms with which it was associated. Stratified by two additional factors, coastal-inland and 1947 fire - no fire, this list of landforms provided a conceptual model to which we could compare the results of the gradsect analysis.

Gradient Directed Transect (Gradsect) Sampling Analysis

Gradsect analysis took place at the UMESC on June 9-11, 1997. Gradsect analysis, a GIS technique, uses computerized data layers for a particular area, in our case MDI, to determine areas of greater and lesser biophysical diversity. The basic idea is that areas of higher physical diversity should be areas of higher vegetational diversity, and that focusing limited field time for sampling on these areas increases efficiency when one is trying to sample as many vegetation types as possible.

The utility of the results naturally depends on which variables are chosen. We reviewed the 20 available data layers and settled on five to use as variables (Table 3). We divided each variable into a number of classes. Because of computational and display limitations, we attempted to minimize the number of classes for each variable without losing too much information.

Table 3. Variables used in gradient directed transect sampling analysis.

Fire 1947	Soil Type	Elevation	Slope	Geology
no	not available	0 – 200’ (0-60 m): lowland	<25% (0-15°): flat	undefined
yes	muck	201 – 600’ (61-182 m): low hills	26-100% (15 – 45°): moderate	beach
	silt loam	601-1000’ (183-303 m): medium hills	>100% (>45°): steep	salt marsh
	sandy loam	>1000’ (>304 m): higher summits		talus
	very stony sandy loam			freshwater wetland
	loamy sand			exposed bedrock
	fine sandy loam			water
	very stony fine sandy loam			coarse emerged marine sediments
	bouldery complex			fine emerged marine sediments
	outcrop complex			undifferentiated emerged marine sediments
				glacial stream sediments
				end moraine
				till

Each cell of the MDI grid (cell size 70 m) was assessed for each variable, resulting in 224 unique combinations, here called biophysical units (BPU). Focal diversity (F) of each cell was calculated as the number of BPUs within a radius of five cells; values ranged up to 23. Areas of high physical diversity are thus areas with high F values. Two sets of gradsect maps resulted: plotting areas with F ≥10 and plotting areas with F ≥ 15. The 1979 vegetation type was overlaid to generally characterize the areas.

The maps were used with $F \geq 15$ to translate the gradsect results into directions for field effort. This selected approximately 20 areas within the MDI portion of the park as areas of high focal diversity. We then used the BPU information accompanying the maps to determine which BPUs were not included within the selected areas, identifying conditions that should be sampled to assure representative coverage. These included saltmarsh; exposed bedrock on medium to high hills; near-coastal areas (emerged marine sediments); talus; and low, flat areas with muck or silt loam soils and without fire.

The areas highlighted by the gradsect analysis did not cover all of the characteristic ecological features of the MDI portion of Acadia. Had we restricted our field efforts to the gradsect-identified areas, we would have missed the bald summits of Acadia that, perhaps more than any other feature, characterize the park; we would have missed important wetlands, including saltmarshes; and we would have missed some interesting near-coastal areas that also support regionally characteristic vegetation. When gradsect is used as a screening tool, it also is essential to determine the conditions not included in the areas selected and adjust the field effort accordingly.

Field Reconnaissance

Reconnaissance in late July and early August 1997 allowed us to refine our efforts. We visited several dozen areas within the park to

- Refine the working vegetation classification system,
- Identify photo signatures for different communities,
- Check the gradsect-identified areas and determine where to sample, and
- Review the sampling protocol with the field ecologists.

Field Sampling

We sampled 179 areas, 63 in 1997, 107 in 1998, and 9 in 1999 during field data collection for accuracy assessment (Figure 6). Methods were derived from those in Section 5 of the Field Methods for Vegetation Mapping manual (The Nature Conservancy and Environmental Systems Research Institute 1994b). For Acadia NP, the plot sampling design was modified to make sampling congruent with other natural community sampling efforts in Maine while still compatible with the standards specified for this project (Table 4). The major difference was that rather than one large plot for a sample, we used four smaller subplots and nested subplots within those for the different vegetation layers. This we found to lessen plot location bias, incorporated more of the within-community variability, and reduced observer bias in cover estimates.

The initial step for a sample (hereafter referred to as a "plot" even though it consists of four subplots) is locating the center of the sampling area. This is the point at which the GPS reading is taken and from which the subplots radiate (Figure 7). For communities not dominated by trees, the layout is the same, with the largest subplot corresponding to the tallest layer. In a shrub swamp, for example, four 25-m^2 subplots with nested herb plots would be the sample. In a peatland community dominated by dwarf shrubs and herbs, the sample would be 16 1-m^2 subplots, 4 in each of the cardinal directions from the plot center point. Additional specifications are that, where possible, the outer edges of the subplots be at least 30 m from the edge of the community polygon; but in communities wherein the shape does not allow placing the four subplots in the cardinal directions, subplots may be placed four-in-line.

Recording of percent cover for each species also differs somewhat from the method recommended in the manual. For the tree layer, all diameters (dbh, diameter at breast height) are recorded by species, allowing calculation of basal area values. Relative dominance (RD) is calculated for each species as the percentage

of the total basal area made up of that species. Percent cover of each species is derived as the relative dominance of a species times the total cover of the canopy.

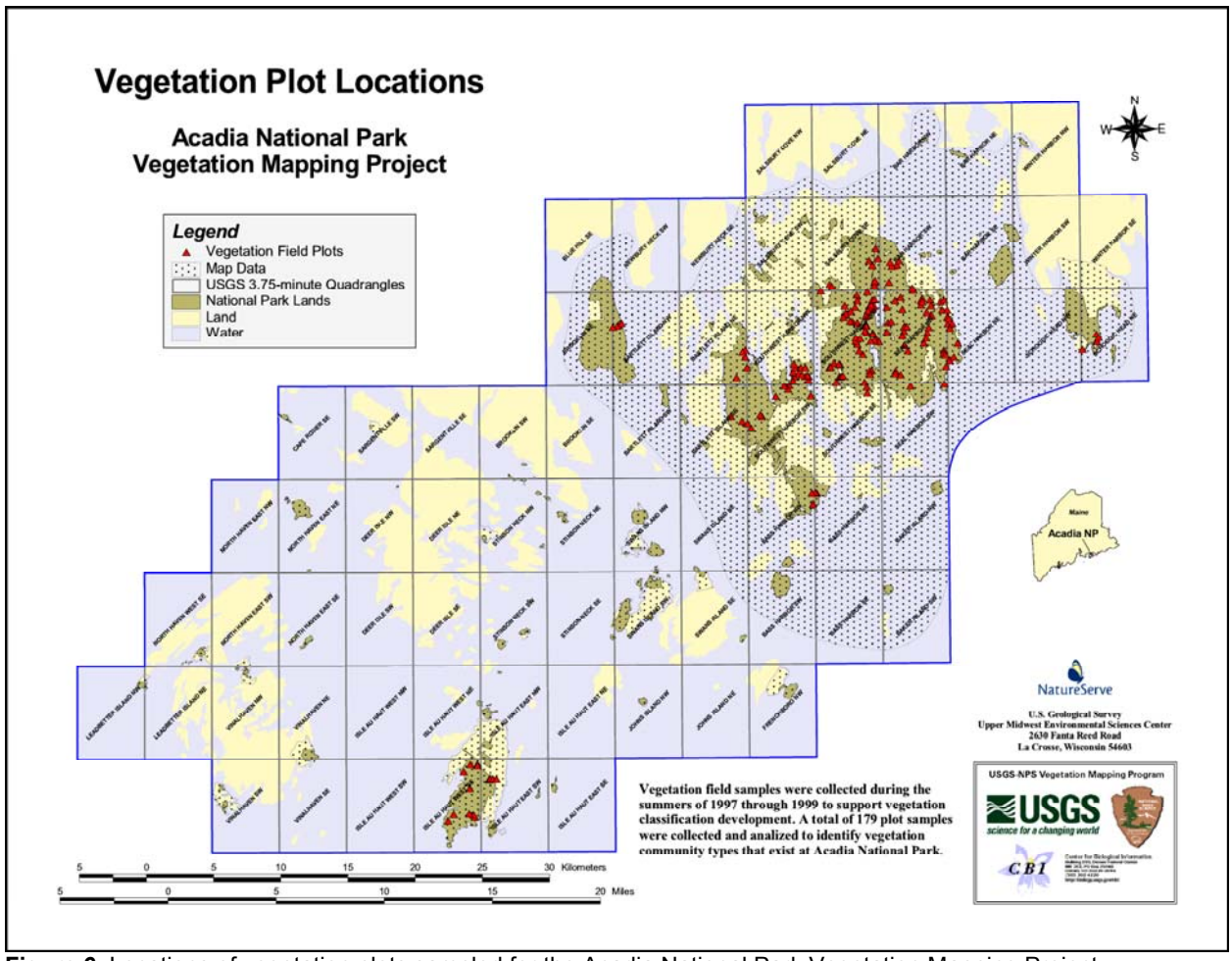

Figure 6. Locations of vegetation plots sampled for the Acadia National Park Vegetation Mapping Project.

Table 4. Vegetation data layers collected with each sample plot.

Layer	Description
Tree	woody stems ≥ 10 cm dbh (diameter at breast height)
Sapling / tall shrub	woody stems < 10 cm dbh and > 3 m tall
Shrub	all woody plants 1 – 3 m tall
Herb	all vascular plants < 1 m tall (segregating woody plants from herbs)
Bryoid	bryophytes and lichens on the ground

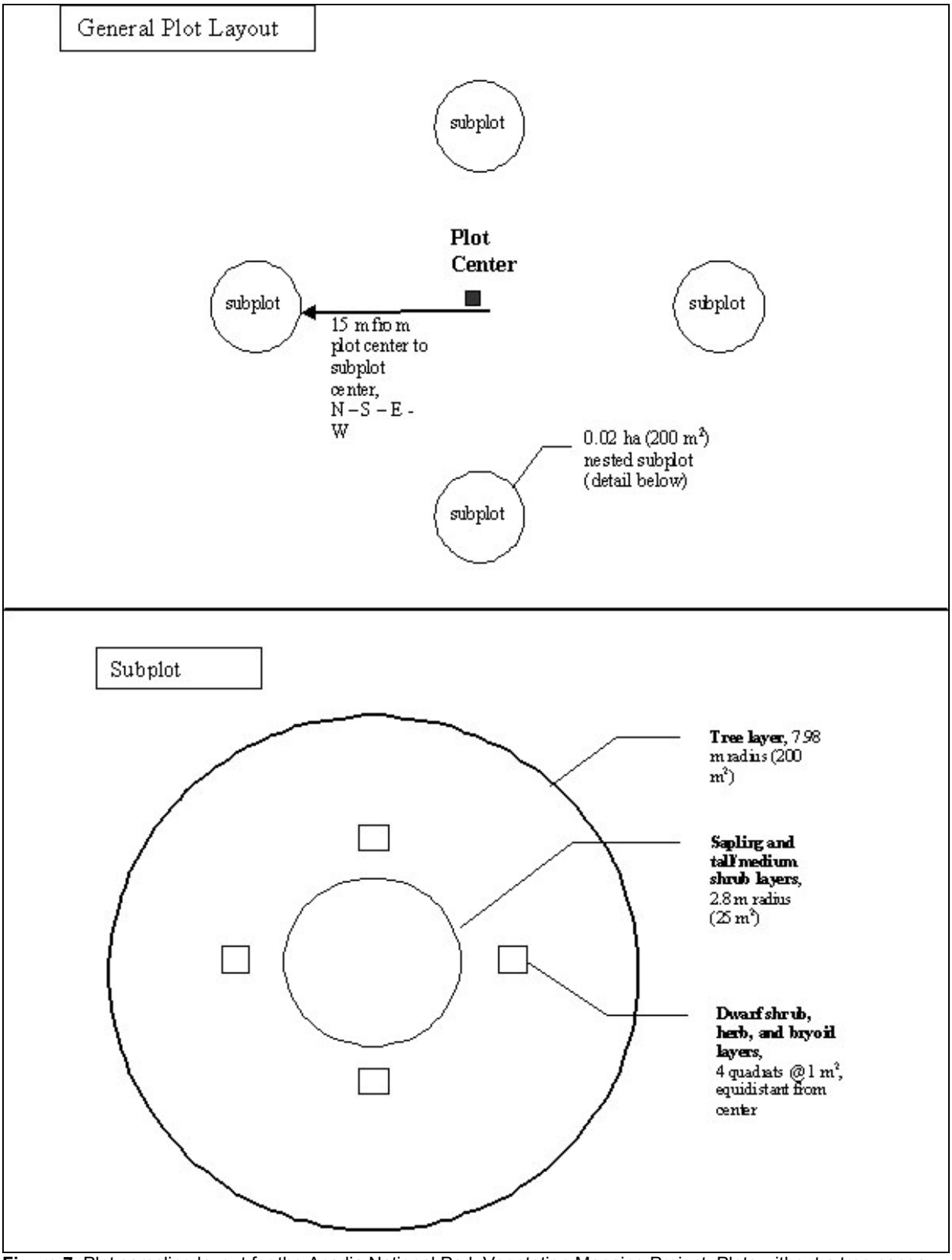

Figure 7. Plot sampling layout for the Acadia National Park.Vegetation Mapping Project. Plots without a tree canopy used the same design, but without the 200 m^2 outer subplot.

Within each layer below the tree layer, cover class midpoint is recorded in each subplot for each species (Table 5). After trying various cover estimations and permutations of classes, we settled on a 7-point cover scale with which our field crews were accustomed, similar to the Braun-Blanquet scale but omitting sociability.

Table 5. Cover class 7-point scale.

Percent cover	Cover class midpoint
<2	1
2–5	3
6–12	9
13–24	19
25–49	37
50–74	63
75–100	87

Subplot cover midpoints are averaged for the whole plot. Four values are averaged for tree, sapling, and shrub layers and 16 for herb and bryoid layers. Zeros are included for subplots wherein the species is absent. The species average can be used as a cover value on other scales (e.g., it can be entered as the nearest class midpoint on the 12-point scale in the mapping manual. Environmental data were collected in the vicinity of the overall plot center (the GPS point), following the methods given in the manual.

Vegetation Data Analysis for Vegetation Classification Development

Vegetation field sampling data were entered into a modified version of The PLOTS Database (The Nature Conservancy 1997) at the Maine Natural Areas Program, which (after checking the data for accuracy) was used to produce plot vegetation summaries and associated environmental information. Along with the 179 samples collected specifically for this project were 38 additional samples collected in 1995 as part of the Maine Ecological Reserves inventory (which followed a congruent data collection method) for a total of 216 complete plots. Tree layer information was available for an additional 33 plots sampled by Mittelhauser et al. (1994); these data were not used in the ordinations but were helpful in developing the descriptions.

Percent cover data for each plot were exported as matrices (species by samples) for multivariate analysis in PC-ORD 4.0 (McCune and Mefford 1999). MS Excel was used as an intermediate tool to prepare the matrices for compatibility with PC-ORD.

To analyze vegetation patterns and classify types, we used Detrended Correspondence Analysis (DCA), Two-Way Indicator Species Analysis (TWINSPAN), and Indicator Species Analysis (ISA) within PC-ORD. An ordination technique, DCA arranges samples along derived axes according to compositional similarity. A divisive polythetic technique, TWINSPAN classifies samples and species, using a similar algorithm to that for DCA. The ISA identifies indicator species for user-defined groups of samples (in this case vegetation types) by calculating an indicator value based on a species' abundance and frequency in each of several defined groups, then using a Monte Carlo test to determine those that are significantly allied with one group as opposed to randomly distributed. Further references for all techniques can be found in the PC-ORD documentation (McCune and Mefford 1999).

Data for each plot were relativized so that the cover values for the plot totaled 1 (relativization by the maximum by sample); this removed variation due to differences in total amount of vegetation among plots and resulted in clearer ordinations.

Different matrices were used for different subsets of the data, such as all upland forests and woodlands, all non-forested non-tidal wetlands, all tidal wetlands, etc. Progressive analyses, looking at a larger matrix for general patterns and then deriving submatrices for more detailed analyses, allowed the identification of larger and smaller groups of community types. For each samples-by-species matrix, a secondary matrix (samples by associated variables) contained additional information for interpreting the ordinations. These secondary variables included environmental measures such as slope, aspect, elevation, topographic position, hydrologic regime, soil texture and drainage, latitude, and longitude, as well as summary variables such as the total coverage of each vegetation layer in the sample, the relative importance of dwarf shrubs versus herbs, and the percent of conifer versus deciduous trees in the canopy.

Defining vegetation types was an iterative process with the following steps:

- Overlay DCA ordinations with vegetation type as assigned in the field;
- Use those to look for gross patterns, environmental gradients, and to look for possibly misassigned samples;
- Recode samples' vegetation type where needed and re-plot the DCA;
- Run TWINSPAN and plot results onto the DCA ordination to see how the major TWINSPAN breaks correspond to the evolving vegetation type differences;
- Further refine type assignments, and split data set for further ordinations, based on TWINSPAN distinctions and on review of compositional similarities of closely plotted samples;
- Run DCA on smaller data sets to try for better discrimination among the messy types, and use TWINSPAN to look for indicators;
- Recode samples' vegetation type as appropriate; and
- Re-run DCA and TWINSPAN with final vegetation type assignments and apply ISA.

A single technique such as TWINSPAN can give useful results when dealing with a relatively small group of vegetation types to classify and where reasonably comprehensive data are available. With a project of this scale, however, dealing with all vegetation types within the park, and with far fewer than the 10 samples per type average recommended in the manual, multiple techniques are combined to identify vegetation types. The vegetation types derived do not necessarily perfectly match those that TWINSPAN would produce from the data at hand. Instead, ordination and classification results are used to identify important gradients or factors in the data, which are then used to develop diagnostics for different vegetation types. Once types have thus been refined, DCA can be re-run to show the relations and overlaps between vegetation types, and ISA can be used to determine which species are most diagnostic for particular types.

Whereas vegetation types were being developed and refined from the sample data, reference to the NVCS (Anderson et al. 1998) had to be maintained. The required consultations with TNC regional ecologists to (1) determine if an existing NVCS type fit the Acadia type; (2) if no existing NVCS type matched, whether it made sense to refine an existing type or to create a new type; and (3) if a new type was indicated, to name and describe that type.

Mapping the Vegetation of Acadia National Park

The process of vegetation mapping involved four integrated primary steps, (1) field reconnaissance, (2) map classification, (3) photointerpretation, and (4) digital map automation.

Field Reconnaissance

Field reconnaissance helped us relate vegetative photo signatures (appearances of vegetation on the aerial photographs) to vegetation on the ground and become familiar with the local ecology, which is important when we apply ecological concepts to our photointerpretation mapping. This field effort required visiting numerous sites in the field to learn, test, and verify photo signatures. We collected 46 observation points (Figure 8) to verify vegetation communities and to document the relations between field and aerial photo perspectives. Ground coordinates were collected with Rockwell Precision Lightweight Global Positioning System Receiver (PLGR) GPS units. Formal data sheets were used to document the field participants, location information (including GPS coordinates), aerial photo relations (including photo signature), ground survey of plants, classification, and general observations and discussions about the site (Appendix A: Example of Observation Field Reconnaissance Form).

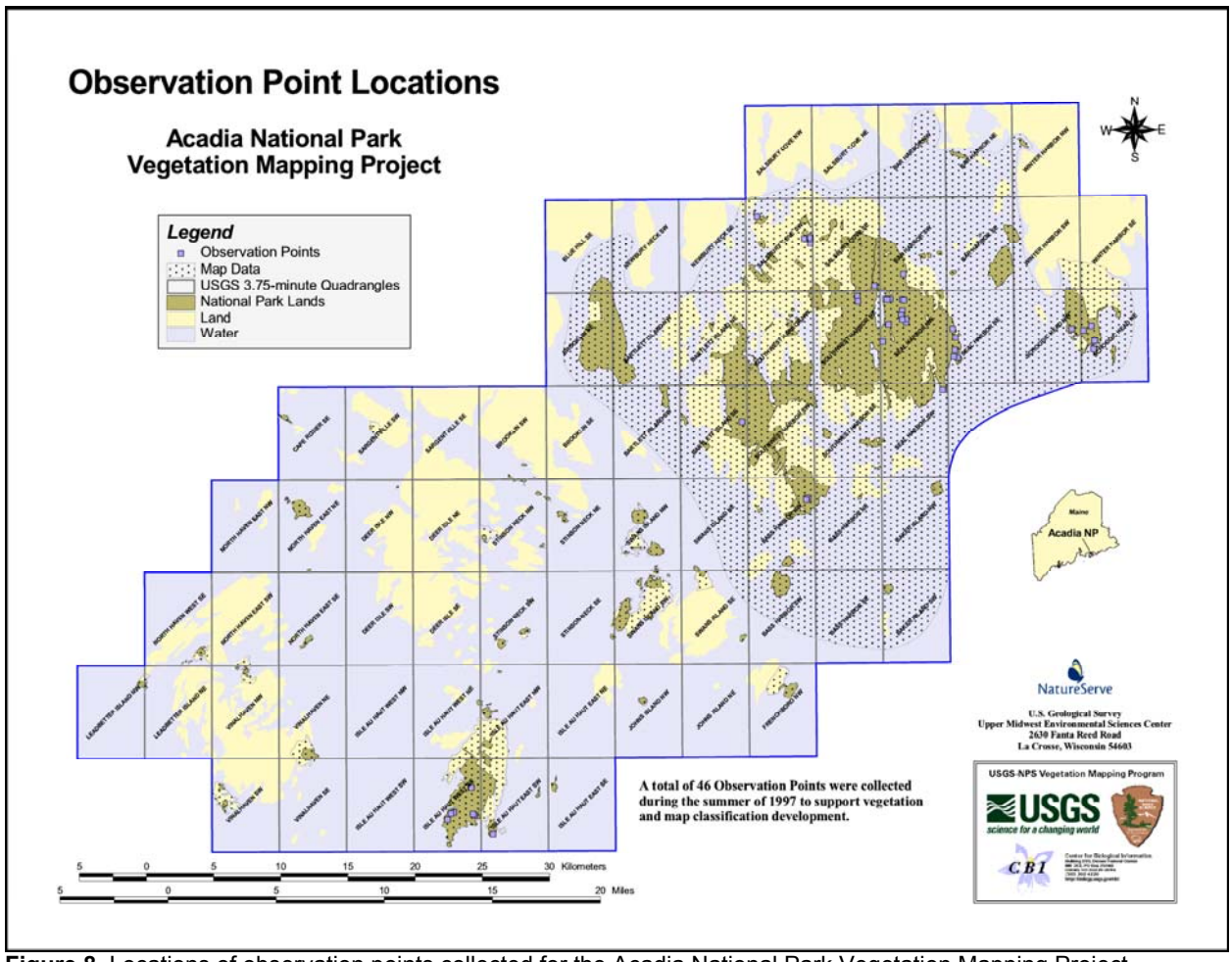

Figure 8. Locations of observation points collected for the Acadia National Park Vegetation Mapping Project.

Besides collecting formal reconnaissance data, we "ground-truthed" additional sites, documenting our discoveries on photo sleeves covering the print CIR photos and in field notebooks (Figure 9). Our field notes included dominant species (or the vegetation type, if known), tree heights, and other information that would help us link the photo signature to an appropriate map class. With the Acadia NP extensive trails and carriage roads, hiking was the primary mode of travel. However, some "ground-truthing" was done during frequent vehicle stops along roadsides with good vistas. Bicycles were another handy mode of travel on the carriage roads, with stops and short hikes to view signatures of interest. The park service also provided ferry service to Isle au Haut and Long Island, where we hiked to habitats of interest. The first reconnaissance trip was in June 1997, with two more trips in September 1997 and June 1998. During the last trip, we took some of the preliminary interpretation to validate in the field.

Figure 9. Field botanists and photointerpreters "ground-truthing" in Acadia National Park.

During our reconnaissance, we became familiar with the vegetation and local ecology, especially on days when we were accompanied by the ecologists. We discussed the structural, floristic, and habitat characteristics of the vegetation encountered in the field, and compared them to their appearances on the photos. We referred to the preliminary list of vegetation types, providing us some concept of their global (regional) characterization (local descriptions were developed after the mapping). Through this process, we built an understanding of how to map the vegetation types (or anticipated types). Two ecologists from TNC and NPS accompanied us on a few days of the fieldwork and were instrumental in helping us understand the vegetation patterns we encountered and their relations to the NVCS.

Map Classification

Following the initial reconnaissance trip, we began to define map classes (units that represent vegetation types or other ground features) based on further inspection of the aerial photographs. Using stereoscopes, we viewed photo signature characteristics to determine their relations to a list of vegetation types validated in the field. As determined from the initial scoping (planning) meeting, our fieldwork and photointerpretation mapping was to proceed simultaneously with vegetation sampling and subsequent analysis. We had to develop a map classification prior to having a complete understanding of the vegetation types. We relied on NVCS concepts and a draft list of vegetation communities as the basis for mapping vegetation of Acadia NP and environs.

During the early stages of photointerpretation, new questions surfaced regarding the map classes and we soon discovered that we could not always determine where to draw boundary lines between vegetation types. Thus, we organized a meeting at the UMESC with the mappers and ecologists in spring 1998 to help both parties understand the relations between photo signatures and vegetation types (Figure 10). This meeting was very helpful for all of us; the classifiers were able to better understand the challenges of applying the classification and the mappers were able to better understand how to interpret the vegetation types on the aerial photos. However, a final vegetation classification, key, and descriptions of each NVCS vegetation association were not available until after the mapping was completed.

Figure 10. Mappers and ecologists examine aerial photographs to understand vegetation appearance.

In addition to developing map classes to reflect NVCS types, we also developed map classes to represent other general land cover situations, such as urban areas and non-vegetated bodies of water. For these map classes, we used a combination of the USGS land use/land cover classification (Anderson et al. 1976) and some project-derived map classes.

Photointerpretation

Preparation of the aerial photographs for interpretation generally follows procedures of Owens and Hop (1995). We placed clear acetate overlays onto each aerial photograph transparency that would be used for mapping. We registered each overlay to the photos by demarking the fiducials and photo identification information. We viewed the aerial photo transparencies for interpretation using light tables and Bausch and Lomb Zoom 240 stereoscopes over a Richards MIM2 light table (Figure 11). We paired up each transparency photo with the adjacent photo so we could view the images 3-dimensionally. Only the middle portion of each photograph was used for photointerpretation to minimize edge distortion. We delineated feature polygons and scribed their corresponding map class codes onto the acetate overlays using Rapidograph ink pens.

Figure 11. Bausch and Lomb Zoom 240 stereoscope over a Richards MIM2 light table.

We delineated larger polygons first, with smaller polygons following, down to a minimum size of 0.5 ha (with the exception of small islands within wetlands and ocean, which were mapped to a minimum size of 0.1 ha). We applied standard photo signature characteristics, including texture, color, pattern, and position in the landscape to guide our polygon delineation placement. In addition to photo signature characteristics, knowledge of the environmental distribution of the types helped us to identify vegetation types and properly place polygon boundaries. For each polygon, the appropriate map class code and physiognomic modifier codes (Table 6) were applied.

Table 6. Physiognomic modifiers assigned to polygons during photointerpretation.

Catagory	Modifier	Meaning
Coverage density	1	Closed Canopy/Continuous (60-100% cover)
	2	Open Canopy/Discontinuous (25-60% cover)
	3	Dispersed-Sparse Canopy (10-25% cover)
Coverage pattern	A	Evenly Dispersed
	B	Clumped/Bunched
	C	Gradational/Transitional
	D	Regularly Alternating
Height	1	30-50 meters (98-162 feet)
	2	20-30 meters (65-98 feet)
	3	12-20 meters (40-65 feet)
	4	5-12 meters (16-40 feet)
	5	0.5-5 meters (1.5-16 feet)
	6	<0.5 meters (<1.5 feet)

Digital Map Automation

To geo-reference the photo interpreted data, we used Bausch and Lomb zoom transfer scopes to manually transfer the polygons onto drafting film over base maps (Figures 12–13). The transfer process removes much of the aerial photograph's inherent distortion and ties the interpreted data to real-world coordinates so it can be digitally automated. Sixty-five USGS 3.75-minute digital orthophoto quadrangles (DOQ) were used to plot hard copy (film acetate) orthophoto base maps at a scale of 1:12,000 (Figure 14). The polygons were manually transferred to overlays that were registered to the base maps. Map class attributes and appropriate physiognomic modifiers were added to a second overlay. The overlays were subsequently rechecked for accuracy. Each overlay of transferred data was scanned using a large format sheet fed scanner with a resolution of 400 dots per inch (Figure 15). The resulting Tagged Image File Format (TIFF) images were then converted to a grid format using ArcInfo (Version 7.2.1 Patch 2, Environmental Systems Research Institute, Redlands, California). The grid data was projected to Universal Transverse Mercator (UTM), Zone 19 with datum in North American Datum of 1983 (NAD83). Each individual grid was transformed to a geo-referenced boundary coverage to digitally reference the data to real-world coordinates. In ArcTools, the ArcScan utility was used to trace the referenced polygon data creating an ArcInfo coverage. Each individual coverage was then edited for errors, assigned attributes to polygons, checked against the hand-transferred overlays for line and attribute errors, and then joined to create a seamless coverage of the vegetation map.

We originally produced the map attribute table in spreadsheet format (dBASE IV) with the items listed in Table 7. The attribute table contains numerous items that, when linked to the coverage, offers a set of information for each polygon. We converted the dBASE IV table to an ArcInfo table using ArcInfo (Version 8.0.2, Environmental Systems Research Institute, Redlands, California). We then merged the table with the spatial database coverage. In addition to the items listed in Table 7, ArcInfo default items are also included in the final map coverage (e.g., perimeter, area, and polygon identification numbers). ArcInfo was used to produce the ArcInfo Export and Spatial Data Transfer Standard files of the map coverage.

Figure 12. Transferring photointerpreted data to base maps using a zoom transfer scope.

Figure 13. Closeup of zoom transfer mapping process.

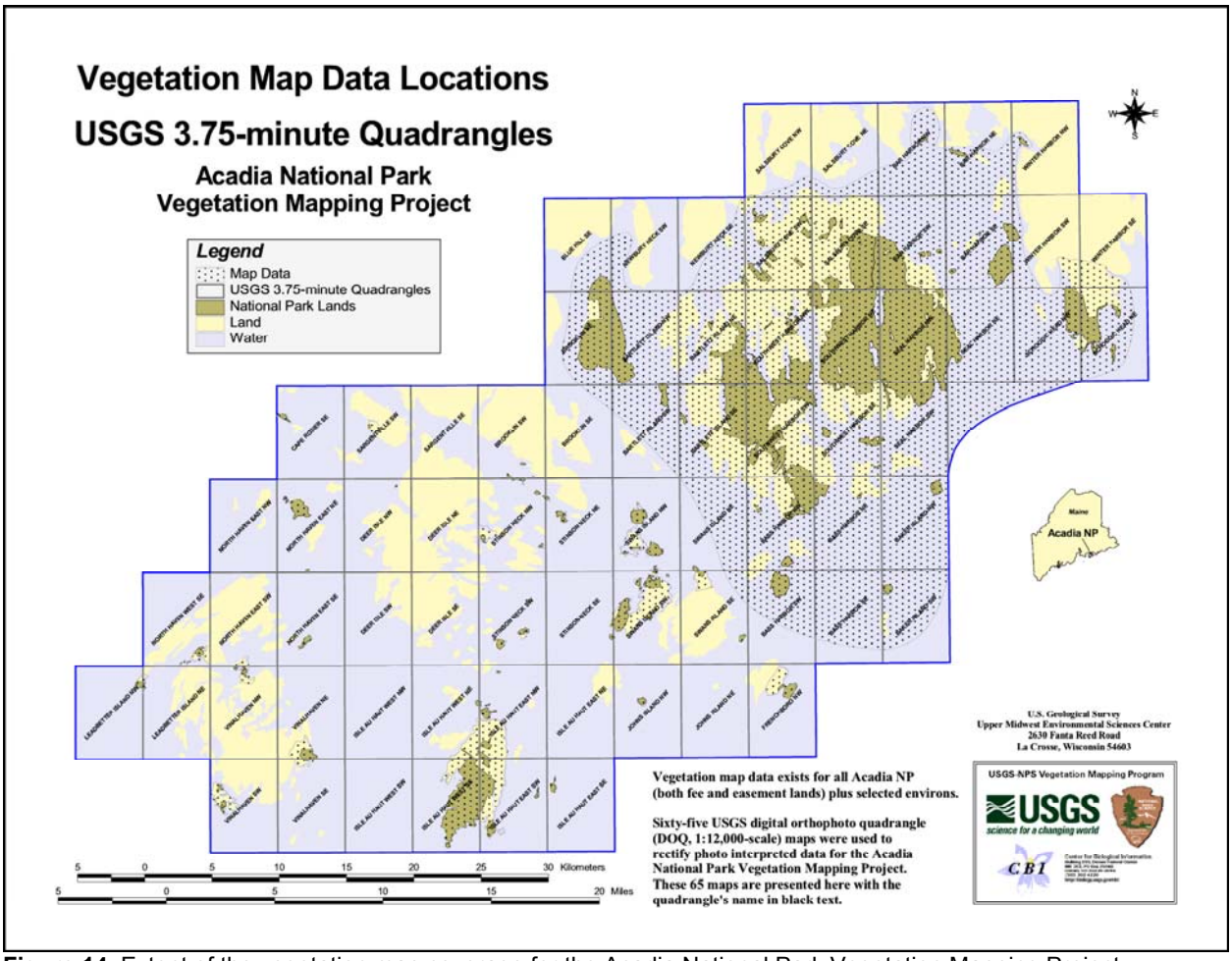

Figure 14. Extent of the vegetation map coverage for the Acadia National Park Vegetation Mapping Project.

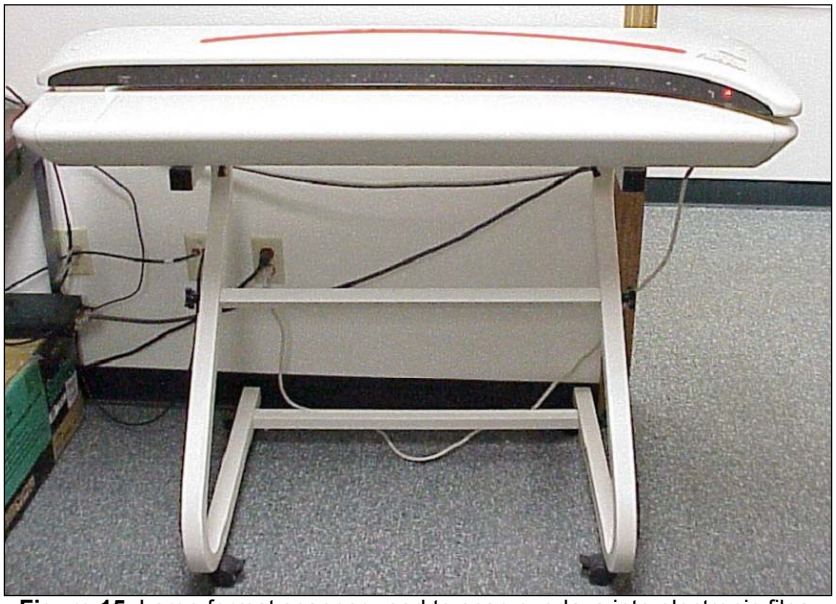

Figure 15. Large format scanner used to scan overlays into electronic files.

Table 7. Items included in the vegetation map coverage's attribute database table.

Code	Definition
MAP_CODE	Map Class Code - project derived
MAP_DESC	Map Class Description Name - project derived
MAP_ATT	Map Class Code with all applicable Physiognomic Modifier codes
DENS_MOD	Physiognomic Modifier - Coverage Density (all vegetation map classes)
PTRN_MOD	Physiognomic Modifier - Coverage Pattern (all vegetation map classes)
HT_MOD	Physiognomic Modifier - Height (woody terrestrial vegetation map classes)
PHYS_HYDR	Physiognomic - Hydrologic Category - Maine Natural Areas Program
MAINE_CLSF	Maine Natural Community Classification - Maine Natural Areas Program
ECO_SYSTEM	U.S. Terrestrial Ecological System Classification (name & code) - NatureServe
ASSN_SNAME	National Vegetation Classification System Association (scientific name) - NatureServe
ASSN_TNAME	NVCS Association (translated common name) - NatureServe
ASSN_CNAME	NVCS Association (synonym name) - NatureServe
ASSN_CEGL	Community Element Global Code (Elcode link to Association) - NatureServe
NVCS_CODE	NVCS Code (to Alliance level) - FGDC
CLASS	NVCS Formation Class (code & name) - FGDC
SUBCLASS	NVCS Formation Subclass (code & name) - FGDC
GROUP	NVCS Formation Group (code & name) - FGDC
SUBGROUP	NVCS Formation Subgroup (code & name) - FGDC
FORMATION	NVCS Formation (code & name) - FGDC
ALL_SNAME	NVCS Alliance Name (code & scientific name) - NatureServe
ALL_TNAME	NVCS Alliance Name (translated common name) - NatureServe
LUC_II	Land Use and Land Cover Classification System (code & name) - USGS

Accuracy Assessment

Purpose

The accuracy assessment estimates thematic errors in the data, providing users the information needed to assess data suitability for a particular application. At the same time, data producers are able to learn more about the nature of errors in the data. Thus, there are actually two views to an accuracy assessment: users' accuracy", which is the probability that an accuracy assessment point has been mapped correctly (also referred to as errors of commission) and "producers' accuracy," which checks to see if the map actually represents what was found on the ground (also referred to as errors of omission). With users' accuracy, the number of correctly classified samples of a map class is divided by the total number of field samples that were classified in that map class. The emphasis here is on the reliability of the map, or how well the map represents what is really on the ground. With producers' accuracy, the number of correctly classified samples of a map class is divided by the total number of field samples of that map class. The emphasis here is on the probability that the ground field samples have been correctly classified. Both users' and producers' accuracy can be obtained from the same set of data using different analyses. Errors occur when map classes are not the same as the classes observed in the field. A major assumption of accuracy assessment is that the process of mapping and the process of the assessment (i.e., the application of the classification system) are identical, so that a false error is not detected because of procedural differences.

Results of the accuracy assessment are presented in an error or misclassification matrix (also referred to as a contingency or confusion matrix). The accuracy numbers are interpreted as the probability of encountering a particular map class when visiting a particular spot, or point, not a particular polygon. Accuracy requirements for the project specify 80% overall (the proportion of correctly assessed sites) accuracy for each vegetation map class.

Sampling Design

The objectives of collecting samples for the accuracy assessment is to obtain a measure of the probability with which a particular location has been assigned its correct vegetation class. We used a stratified random sampling approach that covered most park fee areas (and some easement areas). For logistical reasons, we did not include in our sampling approach the numerous smaller islands within Penobscot Bay that encompass many of the Park's easement lands (discussed later in more detail). Because of access constraints, we did not include in the design areas mapped outside the park. Maximum and minimum number of samples per map class theme followed program recommendations (The Nature Conservancy et al. 1994), as suggested in the following scenarios:

Scenario A: The class is abundant. It covers more than 50 ha of the total area and consists of at least 30 polygons. In this case, the recommended sample size is 30.

Scenario B: The class is relatively abundant. It covers more than 50 ha of the total area but consists of fewer than 30 polygons. In this case, the recommended sample size is 20. The rationale for reducing the sample size for this type of class is that sample sites are more difficult to find because of the lower frequency of the class.

Scenario C: The class is relatively rare. It covers less than 50 ha of the total area but consists of more than 30 polygons. In this case, the recommended sample size is 20. The rationale for reducing the sample size is that the class occupies a small area. At the same time, however, the class consists of a considerable

number of distinct polygons that are possibly widely distributed. The number of samples therefore remains relatively high because of the high frequency of the class.

Scenario D: The class is rare. It has more than 5 but fewer than 30 polygons and covers less than 50 ha of the area. In this case, the recommended number of samples is 5. The rationale for reducing the sample size is that the class consists of small polygons and the frequency of the polygons is low. Specifying more than 5 sample sites will therefore probably result in multiple sample sites within the same (small) polygon. Collecting 5 sample sites will allow an accuracy estimate to be computed, although it will not be very precise.

Scenario E: The class is very rare. It has fewer than 5 polygons and occupies less than 50 ha of the total area. In this case, it is recommended that the existence of the class be confirmed by a visit to each sample site. The rationale for the recommendation is that with fewer than 5 sample sites (assuming 1 site per polygon), no estimate of level of confidence can be established for the sample (the existence of the class can only be confirmed through field checking).

The recommendations above take into account both the statistical and operational aspects of sampling. The accuracy estimate associated with rare classes cannot be stated with the same level of confidence as that associated with classes that are more abundant. For example, with a sample size of 5, the level of error in the estimate is closer to 25% at a 90% confidence level, as opposed to 10% with a sample size of 27. This has implications for our ability to accept a given point estimate as meeting accuracy requirements. Whether or not a given accuracy estimate is accepted as meeting requirements depends on the width of the confidence interval associated with the point estimate and the outcome of a hypothesis test that determines if a given point estimate is equivalent to or exceeds requirements.

We randomly stratified all accuracy assessment site locations across the vegetation map data that are within lands that could be accessed by the field crew. We determined accessible lands for accuracy assessment by park ownership and ease of access. We determined that all Acadia NP lands on Mount Desert Island, Schoodic Peninsula, Isle au Haut, and Long Island were accessible. In contrast, we determined that the numerous small islands in the ocean (most under Park easement) were too remote and difficult to access, requiring considerable more time and logistical maintenance. In consolation, these islands express vegetation communities that are quite extensive throughout the areas we determined accessible (e.g., maritime spruce-fir forest). We had determined areas for accuracy assessment early on in the mapping process, which allowed us to prioritize our mapping efforts for the accuracy assessment field season.

While we had completed our initial photointerpretation process prior to the field season, our subsequent digital mapping of the interpreted data extended into the field season. As we continued with our digital mapping, focusing on the areas for accuracy assessment, we provided the field crew locations (GPS coordinates and maps) in segments as we continued our mapping. We separated the park accessible lands into four major segments (phases), sending site location data to the field crew shortly after we completed them. These four phases are as follows:

- Phase I covered the western third of Mound Desert Island
- Phase II covered the Schoodic Peninsula, Isle au Haut, and Long Island
- Phase III covered the eastern third of Mound Desert Island
- Phase IV covered the central third of Mound Desert Island

As the field season continued, our digital mapping of the assessment area concluded. We were able to provide the field crew all site locations in time for successful data collection during the 1999 field season.

We had determined number of samples needed per map class (taking in account all phase areas) prior to the site selection process. We extrapolated the number of sample sites needed per phase area by analyzing area reports of map phase areas already complete coupled with the photo interpreter's knowledge of map class distribution for the phase areas that we were digitally mapping at the time. Based on these results, we distributed each map theme's number of samples across each of the four phase areas. Three times the number of sites needed was randomly generated using a software program. We did this for two reasons. One is that, in our experience, PLGR units often express up to 10 m in reading errors, particularly in dense conifer forests (a signature for Acadia NP). By eliminating random generated GPS coordinates that fall near polygon boundaries, we anticipated fewer GPS field collected coordinates displace into neighboring polygons. The second reason was to reduce any other accessibility issues that our pre-processing of access areas did not address. An example of this is a remote site distanced far from other sites or access points (e.g., roads, trails) requiring high investment of time, energy, and logistical planning to access. After reducing the over-selection back to the designated number of sites per theme (map class), we had selected 728 sites.

To prepare the field team with locating assessment sites, we plotted 1:12,000-scale orthophoto quadrangle hardcopy maps (from USGS 3.75-minute digital orthophoto quadrangle images) showing locations of the accuracy assessment sites, the unlabelled polygon boundaries of the vegetation map, and the park boundary. We sent Acadia NP staff the field site coordinates (projection in UTM, Zone 19, and datum in NAD83), which they in turn uploaded into a PLGR GPS unit. We also provided the field crew with written instructions for general navigational and data collection methods and with data sheets.

Data Collection Methods

The accuracy assessment team used the PLGR GPS unit to navigate to each site. They also used the hard copy orthophoto maps showing the accuracy assessment site, along with the Project's aerial photographs, to navigate around environmental barriers (e.g., lakes, ponds, deep marshes). Once the sampling site was reached, they evaluated the plant community within a 0.5-hectare radius (the minimum mapping unit or MMU) using the key to vegetation types (see Appendix B: Dichotomous Keys to the Vegetation Communities at Acadia National Park). They also assigned a provisional vegetation community name to the site and recorded the field GPS coordinate location, dominant species, environmental data, and pertinent comments (see Appendix C: Example of an Accuracy Assessment Form for a sample data sheet). If the area was not homogeneous (containing more than one vegetation association), the other associations were also listed on the data sheet. The field team collected data for 724 sites using this method (Figure 16), nearly all of the 728 selected sites (an outstanding achievement).

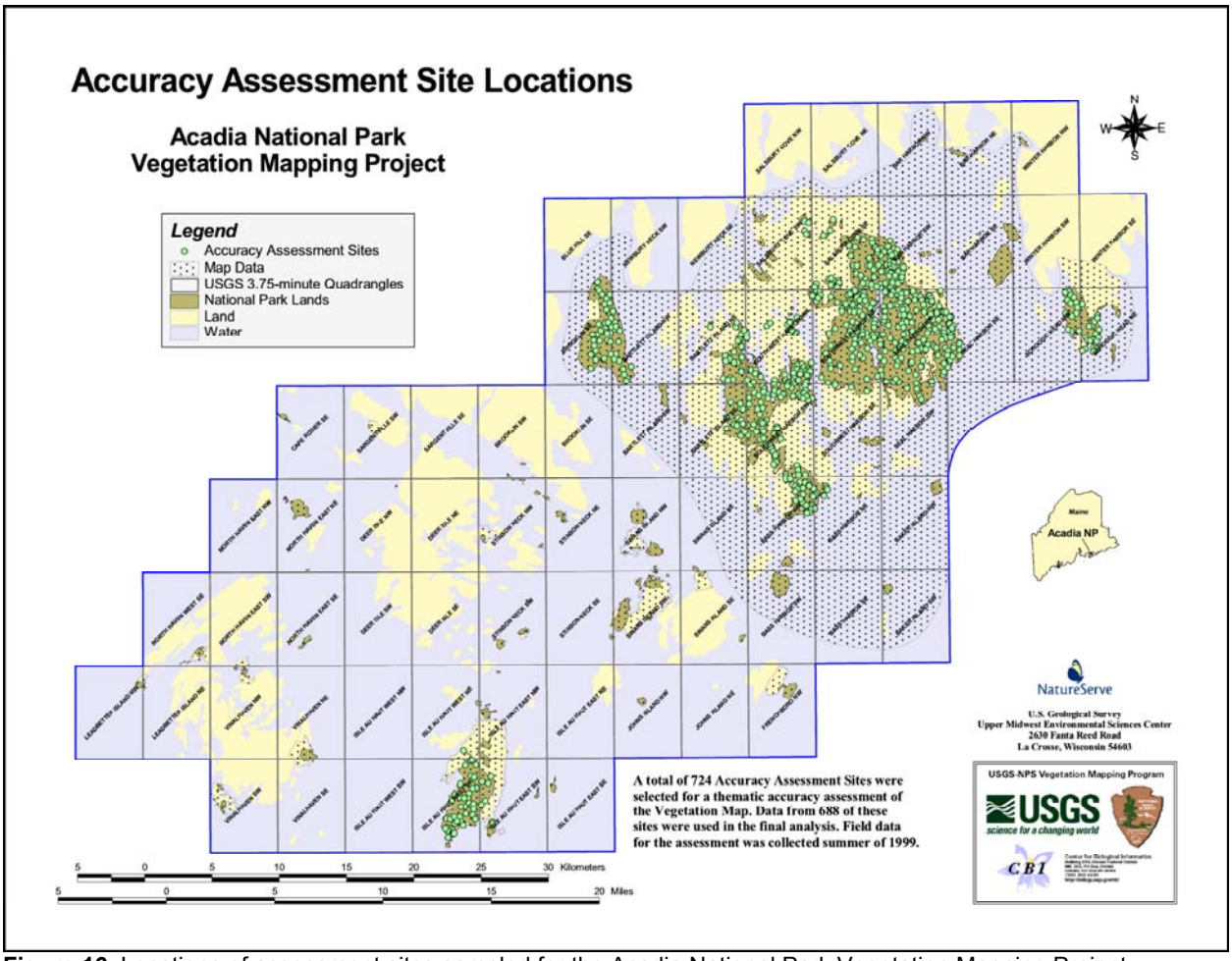

Figure 16. Locations of assessment sites sampled for the Acadia National Park Vegetation Mapping Project.

Data Analysis

The accuracy assessment data were entered into the PLOTS database (The Nature Conservancy 1997) and subsequently reviewed for data entry errors. The analysis of the map accuracy using the field data includes the following steps:

- Initial regrouping of vegetation types and map classes to make a 1:1 relation
- Initial comparison analysis of field and map data
- Initial review of all disagreements and making data adjustments as necessary
- Further classification adjustments and comparison analysis of field and map data
- Final output of results into a contingency matrix

Initial Classification Relations

Although some map classes and vegetation communities (associations) have a 1:1 relation to each other, some do not. Some map classes represent two or more vegetation types. In contrast, some vegetation types are represented with more than one map class (e.g., to map variations of a community, subtype). More on this is discussed in the Results and Discussion, Map Classification section. To properly compare the map class data with the field assessed vegetation types, we regrouped map classes and vegetation communities such that a 1:1 relation exists.

Initial Comparison Analysis
With the 1:1 relations between the two classifications in place, we intersected the field point data with the map polygon data. This allowed us to compare each field accuracy assessment call to the corresponding polygon map class code. PROC FREQ (SAS 1996) was used to compare and tabulate the total number of field assessment sites and map polygons that were in agreement.

Initial Review of Disagreements
All mismatches (disagreements) were subsequently reviewed to see if there were any "false errors." A false error is defined as a mismatch between the map polygon and an accuracy assessment call if caused by any of the following: (1) error in GPS field coordinate, (2) map agreement to an alternate field call, (3) misapplied field call (e.g., from misapplication of the vegetation key), or (4) field site assessment area smaller than the polygon minimum mapping unit (MMU). This review process involved looking at every polygon and its corresponding accuracy assessment site on the photos. We used both the accuracy assessment site and the vegetation map coverages in ArcView GIS to help us locate the sites on each photo. The field data sheet was usually reviewed to gain a fuller context of the ground data. From this process, disagreements that were deemed "false errors" were corrected, resulting in either a match or a true error.

(1) Spatial GPS coordinate errors occur when the field collected GPS coordinate has slight inaccuracies in geo-positional placement, moving the coordinate just inside an adjacent polygon and acquiring a map class different from that intended for the actual area assessed in the field. Through our sampling design (selecting sites more than 10 m from polygon edges), we were able to reduce these errors. There are limitations to the design approach, however, especially with narrow corridor shaped polygons. For sites determined to have spatial GPS field coordinate displacement, we adjusted accordingly for the analysis to reflect the intended polygon's map class. (We left the accuracy assessment database intact, preserving the actual field coordinate locations.)

Some GPS coordinate errors are due merely to incorrect database entry. We assessed these types of errors by reviewing the field data sheets, complimented with accessing the original selected site coordinates using GIS (as an additional measure to assertain proper site coordinate lcation). Some coordinates could not be successfully recovered and thus dropped from the analysis. Of those that could be recovered, the accuracy assessment database was updated to reflect the correction.

(2) Alternate vegetation communities were often recorded on the field data sheets when the site being assessed was not clear between closely related vegetation types. With these alternate calls entered into the database in a secondary field, they were not included with the comparison analysis (only the primary or initial field call was used). Upon manual review of the field data sheets, if the alternate vegetation community matched the vegetation map, the assessment was adjusted to give the map the benefit, an approach approved by the VMP. (In future, comparing the map data to both the primary field call and all subsequent alternate calls using computerized automation techniques might expedite the review process and reduce the tedious manual approach taken. However, this did encourage us to look deeper into vegetation community concepts, understand how they relate to other closely related types, or understand how those relations correspond to the vegetation map.)

(3) In some instances, the analysis team might question the field assessment call based on the final vegetation key and final community descriptions. During 1999, the vegetation key was in draft, and in one sense, being tested with the accuracy assessment. Vegetation community

descriptions of Acadia NP had not yet been written as the vegetation analyses was not yet complete. In these cases, vegetation classifiers reviewed the data sheets. We updated our analysis tables to reflect any changes in the classified community type in preparation for the second comparison analysis (the project's vegetation database was updated, too).

(4) The area of which some sites are assessed in the field might fall below the MMU for mapping (termed as an inclusion). We discovered instances where, after reviewing the aerial photographs, the site was found to be an inclusion to the surrounding vegetation type. Certain vegetative features can be quite apparent from each other while viewing the aerial photographs (e.g., sparse vegetation on rock outcrop versus dense stand of conifer trees), allowing easy assessment in the lab of site inclusions. In these cases, the map again was given the benefit.

Additional Classification Adjustments and Comparison Analysis

As a side benefit to the in depth review of all disagreements between the accuracy assessment sites and the vegetation map, we began to notice consistent diverging patterns between the map and field assessment data. At this point, we began adjusting the map through a series of "global" changes, digitally changing the classification in the map (that is, globally changing the classification of entire groups of like-classified map polygons) to better align with the final version of vegetation classification (final version of the classification was completed prior to final accuracy assessment). For example, we combined selected wetland forested map classes into one group to account for several conceptual differences between the vegetation classification and the map classes. Another example, we collapsed two alder map classes into one.

Also, from the detailed review, we recognized additional map classes that merely represent an expression (or, in part) of vegetation types. We wanted these expressions preserved in the vegetation map database, while at the same time combine the subtype mapping for the accuracy assessment. To do so, we combined those map classes only for this analysis, leaving the map classes intact in the spatial database. For example, with our analysis we combined the conifer dominant spruce - fir forest map class with that of the mixed conifer-deciduous expression (two map classes representing different expressions of the same vegetation types).

Of the 724 accuracy assessment sites originally collected, we dropped 36 from the analyses. 17 were due to irresolvable GPS errors. The other 19 were due to a disjointed map class that had to be eliminated (19 cases). We discovered at this time that our defining concepts for this map class were incompatible with its counterpart in the vegetation classification (we reinterpreted areas originally mapped with this class to other various other valid map classes). We considered another 72 sites to be inclusions and corrected these to reflect the surrounding area that was of mappable size (adjusted for this analysis only and not in the Project's accuracy assessment database). A total of 688 accuracy assessment sites were used for the final analysis.

With each "false" discrepancy now reflecting proper assignments (whether now a match, or remains a disagreement), and revisions made to the vegetation map to better reflect the vegetation classification, we once performed a comparison analysis of the field data and vegetation map data, once again using PROQ FREQ (SAS 1996).

Contingency Table

We transferred the final set of numbers generated from this last analysis into a contingency table (matrix), where we calculated user and producer accuracy percentages for each map class (theme). The matrix shows both the frequency of agreement and the placement (and frequency thereof) of disagreements.

Results and Discussion

Vegetation Classification

Our initial provisional list of 56 types was augmented, winnowed, and reshuffled into the 53 vegetation types here recognized and described for Acadia National Park.

10 upland forest types
13 upland woodland types
2 wetland forest types
3 wetland woodland types
6 non-forested upland types
6 shrub or dwarf shrub wetland types
13 herbaceous wetland types

Results of the vegetation data analyses along with ordination diagrams are presented in Appendix D: Ordination Diagrams and Results of the Vegetation Data Analysis. Table 8 provides a listing of the 53 vegetation associations identified and described at the Acadia NP vegetation mapping project.

Table 8. National Vegetation Classification System associations (vegetation communities) recognized at Acadia National Park.

NVCS Vegetation Community Name (NatureServe Association)	NVCS Common Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Upland Forest Types			
Pinus strobus - Tsuga canadensis - Picea rubens Forest	Eastern Hemlock - White Pine - Red Spruce	CEGL006324	I.A.8.N.b.13
Pinus strobus - Pinus resinosa / Cornus canadensis Forest	Red Pine - White Pine Forest	CEGL006253	I.A.8.N.b.14
Picea rubens - Picea glauca Forest	Maritime Spruce - Fir Forest	CEGL006151	I.A.8.N.c.15
Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides Forest	Northern Hardwood Forest	CEGL006252	I.B.2.N.a.4
Quercus rubra - Acer rubrum - Betula spp. *- Pinus strobus* Forest	Successional Oak - Pine Forest	CEGL006506	I.B.2.N.a.39
Picea rubens - Betula alleghaniensis / Dryopteris campyloptera Forest	Red Spruce - Hardwoods Forest	CEGL006267	I.C.3.N.a.4
Picea rubens - Abies balsamea - Betula spp. *- Acer rubrum* Forest	Successional Spruce - Fir Forest	CEGL006505	I.C.3.N.a.4
Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia Forest	White Pine - Oak Forest	CEGL006293	I.C.3.N.a.21
Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis Forest	Hemlock - Hardwood Forest	CEGL006129	I.C.3.N.a.32
Acer saccharum - Pinus strobus / Acer pensylvanicum Forest	Sugar Maple - White Pine Forest	CEGL005005	I.C.3.N.a.300
Upland Woodland Types			
Pinus banksiana / Kalmia angustifolia - Vaccinium spp. Woodland	Jack Pine Heath Barren	CEGL006041	II.A.4.N.a.9
Pinus rigida / Vaccinium spp. *- Gaylussacia baccata* Woodland	Pitch Pine / Blueberry spp. - Huckleberry Woodland	CEGL005046	II.A.4.N.a.26

NVCS Vegetation Community Name (NatureServe Association)	NVCS Common Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Pinus rigida / Photinia melanocarpa / Deschampsia flexuosa - Schizachyrium scoparium Woodland	Pitch Pine Rocky Summit	CEGL006116	II.A.4.N.a.26
Pinus rigida / Corema conradii Woodland	Coastal Pitch Pine Outcrop Woodland	CEGL006154	II.A.4.N.a.26
Thuja occidentalis / Gaylussacia baccata - Vaccinium angustifolium Woodland	White-cedar Woodland	CEGL006411	II.A.4.N.b.1
Thuja occidentalis - Fraxinus pennsylvanica / Acer pensylvanicum Woodland	Cedar Seepage Slope	CEGL006508	II.A.4.N.b.1
Picea rubens / Vaccinium angustifolium - Sibbaldiopsis tridentata Woodland	Spruce - Fir Rocky Summit	CEGL006053	II.A.4.N.b.3
Picea rubens / Ribes glandulosum Woodland	Red Spruce Talus Slope Woodland	CEGL006250	II.A.4.N.b.3
Picea mariana / Kalmia angustifolia Woodland	Black Spruce / Heath Rocky Woodland	CEGL006292	II.A.4.N.b.400
Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera) Woodland	Early Successional Woodland/Forest	CEGL006303	II.B.2.N.a.10
Quercus rubra - (Quercus prinus) / Vaccinium spp. / *Deschampsia flexuosa* Woodland	Central Appalachian High-Elevation Red Oak Woodland, Northern Variant	CEGL006134	II.B.2.N.a.24
Betula alleghaniensis - Quercus rubra / Polypodium virginianum Woodland	Red Oak Talus Slope Woodland	CEGL006320	II.B.2.N.a.24
(Pinus strobus, Quercus rubra) / Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation	White Pine - Oak Acid Bedrock Glade	CEGL005101	V.A.5.N.e.8
Wetland Forest Types			
Acer rubrum - Fraxinus spp. */ Nemopanthus mucronatus - Vaccinium corymbosum* Forest	Northern Hardwood Seepage Swamp	CEGL006220	I.B.2.N.e.1
Picea rubens - Acer rubrum / Nemopanthus mucronatus Forest	Red Maple - Conifer Acidic Swamp	CEGL006198	I.C.3.N.d.10
Wetland Woodland Types			
Thuja occidentalis - Abies balsamea / Ledum groenlandicum / Carex trisperma Woodland	Northern White-cedar Wooded Fen	CEGL006507	II.A.4.N.f.11
Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum sp. Woodland	Black Spruce Woodland Bog	CEGL006098	II.A.4.N.f.13
Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis Woodland	Red Maple Swamp Woodland	CEGL006395	II.B.2.N.e.1
Non-forested Upland Types			
Morella pensylvanica - Empetrum nigrum Dwarf-shrubland	Crowberry - Bayberry Maritime Shrubland	CEGL006510	IV.A.1.N.b.7
Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata Dwarf-shrubland	Blueberry Granite Barrens	CEGL005094	IV.B.2.N.a.1
Ammophila breviligulata - Lathyrus japonicus Herbaceous Vegetation	Northern Beachgrass Dune	CEGL006274	V.A.5.N.c.2
Polypodium (virginianum, appalachianum) / Lichen spp. Nonvascular Vegetation	Northern Lichen Talus Barrens	CEGL006534	VI.B.1.N.c.300
Solidago sempervirens - (Rhodiola rosea) - Juniperus horizontalis Sparse Vegetation	Northern Maritime Rocky Headlands	CEGL006529	VII.A.2.N.a.4

NVCS Vegetation Community Name (NatureServe Association)	NVCS Common Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Cakile edentula ssp. *edentula* - *Mertensia maritima* Sparse Vegetation	Sea-rocket - Oysterleaf Sparse Vegetation	CEGL006106	VII.C.2.N.a.2
Shrub or Swarf Shrub Wetland Types			
Alnus incana - *Cornus sericea / Clematis virginiana* Shrubland	Alluvial Alder Thicket	CEGL006062	III.B.2.N.d.9
Alnus incana ssp. *rugosa* - *Nemopanthus mucronatus / Sphagnum* spp. Shrubland	Northern Peatland Shrub Swamp	CEGL006158	III.B.2.N.e.9
Myrica gale - *Spiraea alba* - *Chamaedaphne calyculata* Shrubland	Sweetgale Mixed Shrub Swamp	CEGL006512	III.B.2.N.g.9
Kalmia angustifolia - *Chamaedaphne calyculata* - *(Picea mariana) / Cladina* spp. Dwarf-shrubland	Northern Dwarf-shrub Bog	CEGL006225	IV.A.1.N.g.1
Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum Dwarf-shrubland	Leatherleaf Acidic Fen	CEGL006513	IV.A.1.N.g.1
Empetrum nigrum - *Gaylussacia dumosa* - *Rubus chamaemorus / Sphagnum* spp. Dwarf-shrubland	Maritime Crowberry Bog	CEGL006248	IV.A.1.N.g.4
Herbaceous Wetland Types			
Trichophorum caespitosum - *Gaylussacia dumosa / Sphagnum (fuscum, rubellum, magellanicum)* Herbaceous Vegetation	Maritime Peatland Sedge Lawn	CEGL006260	V.A.5.N.h.1
Carex stricta - *Carex vesicaria* Seasonally Flooded Herbaceous Vegetation	Eastern Tussock Sedge Meadow	CEGL006412	V.A.5.N.k.36
Calamagrostis canadensis - *Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation	Seasonally Flooded Mixed Graminoid Meadow	CEGL006519	V.A.5.N.k.39
Schoenoplectus (tabernaemontani, acutus) Eastern Herbaceous Vegetation	Bulrush Deepwater Marsh	CEGL006275	V.A.5.N.l.16
Eriocaulon aquaticum - *Lobelia dortmanna* Herbaceous Vegetation	Seven-angle Pipewort - Dortmann's Cardinal-flower Herbaceous Vegetation	CEGL006346	V.A.5.N.l.2
Juncus militaris Herbaceous Vegetation	Bayonet Rush Herbaceous Vegetation	CEGL006345	V.A.5.N.l.3
Typha (angustifolia, latifolia) - *(Schoenoplectus* spp.) Eastern Herbaceous Vegetation	Eastern Cattail Marsh	CEGL006153	V.A.5.N.l.9
Carex (lasiocarpa, utriculata, canescens) Herbaceous Vegetation	Slender Sedge Fen	CEGL006521	V.A.5.N.m.7
Spartina patens - *Distichlis spicata* - *(Juncus gerardii)* Herbaceous Vegetation	Spartina High Salt Marsh	CEGL006006	V.A.5.N.n.11
Typha angustifolia - *Hibiscus moscheutos* Herbaceous Vegetation	Brackish Tidal Marsh, Cattail Variant	CEGL004201	V.A.5.N.n.2
Carex (oligosperma, exilis) - *Chamaedaphne calyculata* Shrub Herbaceous Vegetation	Few-seeded Sedge - Leatherleaf Fen	CEGL006524	V.A.7.N.o.3
Vallisneria americana - *Potamogeton perfoliatus* Herbaceous Vegetation	Open Water Marsh with Mixed Submergents/Emergents	CEGL006196	V.C.2.N.a.17
Nuphar lutea ssp. *advena* - *Nymphaea odorata* Herbaceous Vegetation	Water Lily Aquatic Wetland	CEGL002386	V.C.2.N.a.102

Map Classification

Map classes that represent nautral/semi-natural vegetation types of the NVCS reflect the vegetation classification as close as possible based on what we knew at the time of mapping (which was before the vegetation classification was developed) and what we learned through the accuracy assessment (which was after the vegetation classification was developed). Our original list of map classes was rearranged several times before we began the photointerpretation, and several adjustments to the map classification and mapping concepts were made as we proceeded with the mapping process.

We made our largest adjustment to the map classification during the accuracy assessment when we proceeded with an in depth review of field assessment sites and map data discrepancies. As discussed earlier, it was then we realized some consistent divergence between the map and vegetation classifications. (It was our conclusion that this was because of (1) mapping before the vegetation classification was developed and (2) using spring photography that hindered the interpretability of deciduous tree components and of herbaceous wetlands. For more discussion on this, see the Recommendations section of this report.) At this point, we combined several map classes to better align with the vegetation classification based on final vegetation community descriptions and results of the accuracy assessment.

We finalized the map classification with 33 map classes representing NVCS natural/semi-natural vegetation associations (NatureServe 2003) that we identified at Acadia NP with this mapping project (Appendix E: Vegetation Classification Matrix show the relations between vegetation map classes and NVCS vegetation communities). Including land use/land cover features and some park specific features, 57 map classes (58 including the class for no map data) were developed for the Acadia NP Vegetation Mapping Project (Table 9; Map Classification for Acadia Nationial Park Vegetation Mapping Project). Table 10 shows the number of map classes broken out by general categories.

Table 9. Map Classification for the Acadia National Park Vegetation Mapping Project.

MAP CLASS CODE	MAP CLASS NAME
Forest - Conifer - Upland	
SF	Spruce - Fir Forest (conifer phase)
WPC	White Pine - Mixed Conifer Forest
WRP	Red Pine - White Pine Forest
Forest - Deciduous - Upland	
MDF	Beech - Birch - Maple Forest
Forest - Mixed - Upland	
OPF	Oak - Pine Forest
SFM	Spruce - Fir Forest (mixed phase)
WPM	White Pine - Hardwood Forest
Woodland - Conifer - Upland	
MCW	Mixed Conifer Woodland
WCW	White Cedar Woodland
JPW	Jack Pine Woodland
PPB	Pitch Pine - Heath Barren

MAP CLASS CODE	MAP CLASS NAME
PPC	Pitch Pine - Corema Woodland
PPW	Pitch Pine Woodland
Woodland - Deciduous - Upland	
ABF	Aspen - Birch Woodland/Forest Complex (forest phase)
ABW	Aspen - Birch Woodland/Forest Complex (woodland phase)
ABS	Aspen - Birch Woodland/Forest Complex (shrubland phase)
ROW	Red Oak Woodland
Woodland - Mixed - Upland	
MW	Mixed Conifer - Deciduous Woodland
Forest - Deciduous - Wetland	
MAS	Red Maple - Hardwood Swamp
Woodland - Conifer - Wetland	
CSW	Conifer Swamp Woodland (spruce-mixed phase)
WCS	Conifer Swamp Woodland (white cedar phase)
Dwarf Shrubland - Evergreen - Upland	
CB	Crowberry - Bayberry Headland
Dwarf Shrubland - Deciduous - Upland	
BBSS	Blueberry Bald - Summit Shrubland Complex
Graminoid - Upland	
AM	Dune Grassland
Sparse Vascular - Upland	
SVH	Open Headland - Beach Strand
SVT	Sparsely Vegetated Talus
Shrubland - Deciduous - Wetland	
ASP	Alder Shrubland
SG	Sweetgale Mixed Shrub Fen
Dwarf Shrubland - Evergreen - Wetland	
DSB	Dwarf Shrub Bog
FX	Fen Complex
Graminoid - Wetland	
TG	Tidal Marsh
SMG	Graminoid Shallow Marsh
Forb - Wetland	
OWM	Open Water - Deep Marsh Complex
Tidal Zone	
TZ	Tidal Algal Zone

MAP CLASS CODE	MAP CLASS NAME
TB	Tidal Beach
TM	Tidal Mud Flat
Small Island with Vegetation	
SIT	Small Island with Trees
SIS	Small Island with Shrubs
SIG	Small Island with Grass
SIR	Small Island with Rock
Cultural Vegetation	
EPL	Evergreen Plantation
SMD	Mixed Deciduous Shrubland
MGF	Mixed Grass - Forb
PGCH	Perennial Grass Crops
PGCS	Perennial Grass Crops with Sparse Shrubs
Non-vegetated Water	
WBP	Beaver Pond (non-vegetated)
WNP	Natural Pond (non-vegetated)
WST	Stream (non-vegetated)
WLK	Lake (non-vegetated)
WO	Ocean - Bay - Estuary (non-vegetated)
Land Use	
UR	Residential
UC	Commercial and Services
UT	Transportation and Roads
UM	Mixed Urban or Built-up Land
UBL	Other Urban or Built-up Land
ARB	Other Agricultural Land
BLQ	Strip Mines, Quarries, and Gravel Pits
No Data	
ND	No Data

Table 10. Number of map classes by general category.

# Map classes	General category
33	Natural/Semi-natural Vegetation (NVCS association types)
3	Beach and Tidal Zone (NVCS natural/semi-natural vegetation alliance and formation types)
4	Small Island with Vegetation (small islands 0.1 ha > 0.5 ha, project-derived)
5	Cultural Vegetation (e.g., idle field, plantation, NVCS planted/cultivated types)
5	Non-vegetated Water (e.g., ocean, lake, river, pond, Anderson et al. 1976 and project-derived)
7	Land Use (developed land, Anderson et al. 1976)
1	No Data (defines areas not mapped with project, project-derived)

It is preferred that each vegetation type is mapped with its own unique map class. However, due to limitations inherent in using aerial photographs to identify floristic vegetation components, this is not always possible. Yet, some map classes do relate to vegetation associations on a 1:1 relation. For example, map class White Pine – Red Pine Forest (WPC) ties directly to the Red Pine - White Pine Forest association type. A polygon correctly mapped as WPC will always and only represent this association.

Many map classes represent more than one association. For example, the map class Mixed Conifer Woodland (MCW) includes 4 associations: Cedar Seepage Slope, Spruce - Fir Rocky Summit, Red Spruce Talus Slope Woodland, and Black Spruce / Heath Rocky Woodland. A polygon correctly mapped as MCW will represents one or more of these associations. Although we originally tried to map 3 of these associations separately, we discovered through the accuracy assessment process that we were not successful, mainly due to photo limitations. Black spruce, red spruce, and cedar were not always distinctive from one another, or they occurred together in mixed stands and we were just not able to consistently determine which species dominated the individual stands. We combined other original map classes for similar reasons.

Some of the map classes “share” associations. In other words, an association may be included in more than one map class. The sharing is due, in part, to the fact that not all associations always appear visible as separate entities on the photos. The aerial photographs limit our ability to map different vegetation types as seen and understood by the ecologists. For example, the association Cedar Seepage Slope occurs in the map class MCW and in the map class WCW because we could not consistently recognize cedar on the photographs when occurring on talus, nor could we see the seepage characteristic.

Another example of a map class that shares associations with other map classes is the Fen Complex (FX), which includes a suite of non-forested wetland types that either were not distinctive on the spring photography or occurred in patterns too small to practically delineate. The timing of the photo mission was too early in the season to capture many of the unique signature characteristics of wetland vegetation, and often these wetland types intermingle or grade together. The Fen Complex map class includes associations that were also mapped under other map classes in the wetland shrubland, dwarf-shrubland, and graminoid groups. These other map classes were used when we could clearly see the dominant vegetation in a pattern large enough to map.

Some of the map classes represent the same association. ABF is the forest phase of the Aspen - Birch Woodland/Forest Complex, ABW is the woodland phase, and ABS is the shrubland phase. These map classes were originally thought to be distinctive vegetation types from one another because their physiognomy is different. However, the vegetation classifiers identified all three as being compositionally

similar enough to regard as one vegetation community having different structures. MW, the Mixed Conifer - Deciduous Woodland also includes the Aspen - Birch Woodland/Forest Complex.

The difficulty in having compatible map classes with the vegetation classification is an artifact of the process combined with the challenges of mapping highly transitional vegetation with spring photography. As mentioned previously, vegetation classification work proceeded simultaneously with mapping, and we created map classes before having a complete understanding of the vegetation types and their variability. Although classifiers and mappers recognized that species assemblages change more or less gradually along environmental and geographical gradients, ecotones — especially broad ones between two distinctive types — are problematic in determining where to draw the line. As stated earlier in this report, "Acadia is characterized by a full suite of forest-to-woodland gradations, and it is not always obvious to which class a particular type should be assigned… Many types exhibit both forest and woodland characters: variable canopy closure, and sometimes but not always a well-developed understory." Thus, our attempts at creating map classes that were strongly linked to the ecology prior to knowing the ecology limited our success in mapping the vegetation communities non-ambiguously. As a result, some map classes share associations, and some associations share map classes. Indeed, once vegetation data analysis was completed and the vegetation descriptions written, we realized that many types are not distinctive from a photointerpretation perspective because of their inherent ecological variability. For specific details about each map class and detailed relations to the NVCS, see Appendix F: Map Class Descriptions and Visual Guide.

Non-vegetated map classes represent land use and land cover features not included within the NVCS, such as populated areas, roads, agricultural lands, quarries, and open water bodies that are <10% vegetated. To map these features, a land use and land cover classification system developed by Anderson et al. (1976) was used (to Level II). A few map classes were developed to represent some park specific situations such as small islands that are less than the minimum mapping unit of 0.5 ha but greater than 0.1 ha.

Vegetation Map Summary

Table 11 is an area report of the Acadia NP Vegetation Map. We mapped 96,693 ha (246,347 acres) mapped of Acadia NP and environs. Of this total, 34,174 ha (84,446 acres), or 35%, are NVCS natural/semi-natural vegetated map classes sampled by this mapping project. Other natural/semi-natural vegetation types that were not sampled (e.g., tidal zone communities), small islands with vegetation, and cultural vegetation together make up another 5% of the coverage (4,801 ha, or 11,864 acres). The remaining map classes are non-vegetated land use/land cover (e.g., residential lands, open water). Open water, especially the Ocean-Bay-Estuary and map classes, dominate these non-vegetated classes (over 90% of non-vegetated map classes). Of the total map coverage, 52,872 ha (130,650 acres) is non-vegetated ocean, bays, and estuaries (53% of coverage).

The Spruce - Fir Forests (SF and SFM, conifer and mixed phases) together are found the most extensive vegetated map classes. Indeed, these forests cover over 60% of natural vegetated classes and over half of all vegetated classes. They also have the greatest number of polygons and the largest average area per polygon.

Among the natural vegetated classes, the rarest types both in area and number of polygons are the Dune Grassland (AM), the Pitch Pine variants Pitch Pine - Heath Barren and Pitch Pine - Corema Woodland (PPB and PPC), and the Crowberry - Bayberry Headlands (CB).

Table 11. Area report of the vegetation map coverage, Acadia National Park Vegetetation Mapping Project.

Map code	Map class name	Polygons	Area hectares	Average area hectares
Forest - Conifer - Upland				
SF	Spruce - Fir Forest (conifer phase)	933	12,865	14
WPC	White Pine - Mixed Conifer Forest	111	545	5
WRP	Red Pine - White Pine Forest	9	17	2
	SubTotals	*1,053*	*13,426*	*13*
Forest - Deciduous - Upland				
MDF	Beech - Birch - Maple Forest	54	382	7
	SubTotals	*54*	*382*	*7*
Forest - Mixed - Upland				
OPF	Oak - Pine Forest	48	497	10
SFM	Spruce - Fir Forest (mixed phase)	686	8,371	12
WPM	White Pine - Hardwood Forest	191	1,787	9
	SubTotals	*925*	*10,656*	*12*
Woodland - Conifer - Upland				
MCW	Mixed Conifer Woodland	663	2,327	4
WCW	White Cedar Woodland	8	163	20
JPW	Jack Pine Woodland	40	84	2
PPB	Pitch Pine - Heath Barren	3	9	3
PPC	Pitch Pine - Corema Woodland	1	5	5
PPW	Pitch Pine Woodland	47	380	8
	SubTotals	*762*	*2,968*	*4*
Woodland - Deciduous - Upland				
ABF	Aspen - Birch Woodland/Forest Complex (forest phase)	172	1,184	7
ABW	Aspen - Birch Woodland/Forest Complex (woodland phase)	25	219	9
ABS	Aspen - Birch Woodland/Forest Complex (shrubland phase)	8	105	13
ROW	Red Oak Woodland	62	549	9
	SubTotals	*267*	*2,057*	*8*
Woodland - Mixed - Upland				
MW	Mixed Conifer - Deciduous Woodland	243	1,497	6
	SubTotals	*243*	*1,497*	*6*
Forest - Deciduous - Wetland				
MAS	Red Maple - Hardwood Swamp	80	142	2
	SubTotals	*80*	*142*	*2*
Woodland - Conifer - Wetland				
CSW	Conifer Swamp Woodland (spruce-mixed phase)	322	781	2

Map code	Map class name		Polygons	Area hectares	Average area hectares
WCS	Conifer Swamp Woodland (white cedar phase)		98	134	1
		SubTotals	*420*	*915*	*2*
Dwarf Shrubland - Evergreen - Upland					
CB	Crowberry - Bayberry Headland		4	14	4
		SubTotals	*4*	*14*	*4*
Dwarf Shrubland - Deciduous - Upland					
BBSS	Blueberry Bald - Summit Shrubland Complex		129	375	3
		SubTotals	*129*	*375*	*3*
Graminoid - Upland					
AM	Dune Grassland		1	1	1
		SubTotals	*1*	*1*	*1*
Sparse Vascular - Upland					
SVH	Open Headland - Beach Strand		255	372	1
SVT	Sparsely Vegetated Talus		12	11	1
		SubTotals	*267*	*383*	*1*
Shrubland - Deciduous - Wetland					
ASP	Alder Shrubland		146	162	1
SG	Sweetgale Mixed Shrub Fen		87	134	2
		SubTotals	*233*	*297*	*1*
Dwarf Shrubland - Evergreen - Wetland					
DSB	Dwarf Shrub Bog		6	93	15
FX	Fen Complex		169	476	3
		SubTotals	*175*	*569*	*3*
Graminoid - Wetland					
TG	Tidal Marsh		75	179	2
SMG	Graminoid Shallow Marsh		123	183	1
		SubTotals	*198*	*362*	*2*
Forb - Wetland					
OWM	Open Water - Deep Marsh Complex		71	131	2
		SubTotals	*71*	*131*	*2*
	Project Natural Vegetation Community Totals		***4,882***	***34,174***	*7*
Tidal Zone					
TZ	Tidal Algal Zone		411	2,744	7
TB	Tidal Beach		1	2	2
TM	Tidal Mud Flat		96	453	5
		SubTotals	*508*	*3,198*	*6*

Map code	Map class name	Polygons	Area hectares	Average area hectares
Small Island with Vegetation (map units of 0.1 - 0.5 ha)				
SIT	Small Island with Trees	54	10.0	0.2
SIS	Small Island with Shrubs	4	0.6	0.1
SIG	Small Island with Grass	4	0.7	0.2
SIR	Small Island with Rock	22	4.7	0.2
	SubTotals	*84*	*16.0*	*0.2*
Cultural Vegetation				
EPL	Evergeen Plantation	5	8	2
SMD	Mixed Deciduous Shrubland	251	726	3
MGF	Mixed Grass - Forb	208	369	2
PGCH	Perennial Grass Crops	166	481	3
PGCS	Perennial Grass Crops with Sparse Shrubs	3	4	1
	SubTotals	*633*	*1,587*	*3*
	All Vegetation Map Classes Totals	***6,107***	***38,976***	***6***
Non-vegetated Water				
WBP	Beaver Pond (non-vegetated)	4	3	1
WNP	Natural Pond (non-vegetated)	20	127	6
WST	Stream (non-vegetated)	1	0	0
WLK	Lake (non-vegetated)	9	930	103
WO	Ocean - Bay - Estuary (non-vegetated)	11	52,872	4,807
	SubTotals	*45*	*53,932*	*1,198*
Land Use				
UR	Residential	592	1,788	3
UC	Commercial and Services	82	384	5
UT	Transportation and Roads	29	123	4
UM	Mixed Urban or Built-up Land	71	1,027	14
UBL	Other Urban or Built-up Land	16	99	6
ARB	Other Agricultural Land	96	148	2
BLQ	Strip Mines, Quarries, and Gravel Pits	82	216	3
	SubTotals	*968*	*3,785*	*4*
	MAP DATA GRAND TOTALS	***7,120***	***96,693***	***14***
No Data				
ND	No Data	2	158,245	79,125
	SubTotals	*2*	*158,245*	*79,122*
	Map Data & No Data Totals	***7,122***	***254,938***	***36***

Accuracy Assessment

Of the 724 accuracy assessment sites originally collected, we dropped 36 from the analyses (for reasons discussed earlier in the Accuracy Assessment Methods section). A total of 688 accuracy assessment sites were used for the final analysis. Our initial run of the analysis revealed an overall accuracy of 73%, well below the acceptable program standard of 80% accuracy. Overall accuracy improved to 80% with subsequent analyses once the adjustments were made to better aligning map and vegetation classification concept (Discussed in detail in the Accuracy Assessment Methods section of this report). A Kappa index was applied to the overall 80% to adjust for chance agreements, resulting in an index of 79%.

The accuracy assessment contingency matrix can be found in Appendix G: Accuracy Assessment Contigency Table. The matrix is an array of numbers set out in rows and columns which reveal the number of polygons assigned to a particular vegetation association(s) relative to the actual vegetation association as verified on the ground. The columns represent the vegetation associations, and the rows represent the map class codes. The accuracies of each map class are described along with the users' accuracy reflecting errors of inclusion (commission errors) and producers' accuracy reflecting errors of exclusion (omission errors) present in the mapping. To reiterate what was written in the Methods section of this report, with users' accuracy, the number of correctly classified samples of a map class is divided by the total number of field samples that were classified in that map class. The emphasis here is on the *reliability* of the map, or how well the map represents what is really on the ground. With producers' accuracy, the number of correctly classified samples of a map class is divided by the total number of field samples of that map class. The emphasis here is on the *probability* that the ground field samples have been correctly classified. Confidence intervals are also given. The width of the confidence interval is affected by the sample size used to derive the point estimate. An example of how to use the matrix follows: map class White Pine – Red Pine Forest (WPC) has a producers' accuracy of 83%, meaning that 83% of the accuracy assessment points were also found to be classified as WPC. Users' accuracy is 79%, meaning that 79% of the polygons classified as WPC in the data can be expected to be WPC when visited on the ground.

Errors in the mapping occurred for a variety of reasons, and we attempted to group these reasons into 4 broad categories. Although some errors could be placed in more than one category, we nevertheless found that a quick estimate of the percent error by category provided a better understanding of the mapping problems.

About 20% of the errors were related to disagreements of percent canopy cover. The photo interpreter sees canopy crowns from above at a relatively small scale and large area, and the field crew has a relatively narrow view looking up from the ground. These different perspectives frequently lead to different estimates of percent cover, which in turn leads to different conclusions on determining the vegetation type. Canopy cover disagreements occurred most often when the actual cover of a site was closest to the percent that determines one vegetation type from another, such as conifer versus a deciduous type, or between the relative proportions of species present. For example, the difference between two closely related types, White Pine - Mixed Conifer Forest (WPC) and White Pine - Hardwood Forest relies on the estimate of the relative canopy of the deciduous tree species. When judging percent canopy cover, it is difficult to say which perspective provides the most accurate cover estimates. Regardless, this is a difficult problem to eliminate because major breaks within the classification are based on percent cover.

Approximately 25% of the errors were due to mapping mistakes. The majority of these errors were related to unmapped stands of minimum map unit size (0.5 ha). These unmapped areas were ecologically similar to the surrounding polygon's vegetation, but still should have been mapped in accordance to standard

minimum map unit. Other mistakes included drawing polygon boundaries that disagreed with the ground calls so that a small portion of a polygon where an assessment point fell should have been mapped with the adjacent polygon. Another type of error occurred when a polygon was mapped as a single association when it should have been mapped using one of the complex map classes. For example, some polygons were mapped as the Sweet Gale Mixed Shrub Fen, and the accuracy assessment team found other associations present within the same polygon.

More than 35% of the errors were related to photo limitations. In hindsight, the use of spring photography likely increased the error rate. Many deciduous types had little or no canopy at the time of photography, affecting our ability to discriminate within forest, woodland, and shrub alliances (e.g., birch-red maple and red oak woodlands) and in our ability to determine percent cover and tree height. Distinguishing vegetation types on the photographs is dependent on relative coverage, so where underdeveloped canopies existed, the interpreter needed to extrapolate to an expected full canopy. For example, oak trees in many places were lacking canopies so that the ground cover was easily viewed rather than the forest or woodland strata. We often attempted to extrapolate the percent canopy cover to later in the growing season, assuming we would be more successful identifying the vegetation type correctly. Unfortunately, we still had difficulty in mapping some stands; especially determining the percent canopy cover of deciduous trees to evergreens in mixed stands. Wetland vegetation types (e.g., tall-saturated grasslands, hydromorphic vegetation) were not discernable on the photos because it was too early in the growing season. Neither were other wetland types clearly expressed on the photos, confusing interpretation between several types. Cattails, bulrushes, and other emergent species were barely starting their seasonal growth, thus the photography revealed only the previous years' dead stalks. In addition, water lilies and submersed aquatic species such as pondweeds had not reached the surface of ponds and thus were not picked up on the photographs.

Other errors were simply problems inherent with the scale of the photography such as determining one species from one another. For example, short red maple trees in a wetland were confused with the alder signature. Jack pine and pitch pine had similar signatures, and we mapped these based on limited knowledge of their distributions. Cedar was especially difficult to tell from other conifers in most situations, but especially on angled slopes, in shadowed areas, and when mixed with other conifer species.

Some errors (~20%) were conceptual differences between map classes and vegetation associations. Conceptual differences occurred because the map classes were developed before the vegetation classification was completed, and although we adjusted many of the map classes to better fit the classification, we were still not able to reach complete compatibility. Several of the vegetation associations are highly variable in terms of their canopy closure and species composition and "stretch" beyond our map class definitions and beyond conventions of the USNVC hierarchy. We didn't anticipate some of the variability when we created the map classes. Thus, some of the map classes use narrower cover classes to separate physiognomic groups (e.g., shrub versus woodland) that are not consistent with the ecological perspectives. Appendix F: Map Class Descriptions and Visual Guide, presents results of the accuracy assessment for each map class, includes the percent of polygons mapped in agreement with the accuracy assessment calls, and report the types of errors.

Recommendations for Future Projects

Acadia NP was one of the earlier parks to be mapped under USGS-NPS Vegetation Mapping Program, and great care went into designing this initial effort. As with any complex task, however, we learned some important lessons with this project. We offer our perspective and several suggestions we believe will benefit the program as it continues its complex task at efficiently (time and funds) and accurately documenting the vegetation patterns of the National Parks.

Sequential rather than parallel timing of products

In this effort, classifying and mapping of the vegetation proceeded on parallel rather than sequential tracks and vegetation types were redefined several times as the learning process proceeded. Ongoing mapping efforts lost efficiency, therefore, as effort needed to be directed toward ensuring maps created under earlier classification schemes where brought into compliance with the newest classification approach. From a mapping perspective, greatest accuracy and cost-effectiveness would result from developing the vegetation types from the vegetation samples prior to mapping. Whereas the goal is to shorten the overall duration of the project, we suggest it would be more efficient to stack different parks rather than to stack the steps of the process for a single park. We believe it would be better to have the mappers and ecologists work together on reconnaissance and the draft classification, but allow mapping itself to wait until the vegetation samples have been analyzed. This philosophy is partially reflected in the updated VMP documentation that regards the entire process as iterative between classifiers and mappers, yet puts an emphasis on classifying first with mappers lending support, then mapping with classifiers lending support.

Careful selection of the timing of aerial photography

Spring 1997 aerial photography was decided upon at the initial scoping meeting (March 1997) with the hope of jump-starting the mapping effort into the present year and, optimistically, expediting the entire mapping process. Unfortunately, we found the selection of spring photography lengthened the mapping process and adversely affected mapping accuracy for several major vegetation types.

At the time of the photography flight, not all the vegetation had reached peak biomass and some had not yet begun. This greatly affected our ability to interpret percent canopy cover or species composition. Deciduous forest types, for example, became difficult to distinguish from each other. The contrast between deciduous and conifer species also was limited and misinterpretation of vegetation communities easily occurred. One of Acadia's prominent management concerns involves wetlands, which, at the time of photography, were not fully expressed in terms of photo signatures. The timing of the photo mission, therefore, should be carefully considered in relation to the objectives of the project and management issues.

Better planning to ensure adequate field time and information exchange between ecologists and mappers

We believe the time mappers, classification staff, and managers are together in the field is one of the most critical steps towards creating a successful relation of meaningful map classes to vegetation types. Certainly, scheduling such time with such a diverse and busy group is difficult. However, we feel our initial time together in the field for the Acadia NP product was insufficient in duration. Consequently, time in the field was inadequate to discover and learn the vegetation types and discuss how they best be mapped.

More vegetation samples for classification development

Whereas the sampling protocol (The Nature Conservancy and Environmental Systems Research Institute 1994b) calls for an average of 10 plots per vegetation type, funding limited us to an average <4 plots per type. This sample size was sufficient for many plant types, but it was inadequate for variable ones. Since at the start of a mapping effort, the exact nature of variability is unknown, we believe it best to come as close to the recommended allocation of effort (10 plots) as is financially feasible. Alternatively, if historical data exist to generally define variability of types, sample allocation may perhaps be reduced or more effectively allocated.

Incorporate accuracy assessment data into vegetation descriptions

Much potentially useful vegetation data was collected through the accuracy assessment process. We believe such data can be valuable in refining the vegetation descriptions for especially variable types for which we had few initial samples (see previous paragraph).

Incorporate data into Biological and Conservation Database for statewide and larger perspective

The USGS-NPS Vegetation Mapping Program is an exceptional source of new information on the presence of rare or exemplary communities. We strongly support entering data from such projects into the Natural Heritage Program's Biological and Conservation Database (e.g., Maine Natural Areas Program). Not only does this make the information available within the NatureServe and Natural Heritage Network standard data formats, but it also allows a statewide perspective on their presence, which is essential in conservation planning. Unfortunately our initial scoping and budgeting did not acknowledge this need and we were able to only partially complete this task.

Implement enhanced protocols and training for accuracy assessment

Accuracy assessment is a lengthy, expensive, and necessary part of the mapping project. In this project, accuracy assessment was problematic because a large portion of the errors was "false" errors. (A false error is a mismatch between a polygon and an accuracy assessment call if the disagreement was caused by either a GPS error or an inclusion error.) "False" errors, if included in the accuracy assessment, would have resulted in accuracy below 70%. Many false errors could be avoided through better training of field crews. In addition, the point selection process could include "cost surfacing," saving time from having to manually eliminate inaccessible points. To ensure a smooth process and more accurate data, therefore, we suggest standardized field training methods be developed and implemented for the program. Standardization, we also suggest, should include an Arc Macro Language (AML) or other GIS application for site selection, field training methods, and data analysis.

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Appendix A

Example of an Observation Field Reconnaissance Form

National Park Mapping ✓

Site ID # 6 National Park ACAD
Prepared By KEVIN D'AMP Agency _____ Date: 7-30-97
Other Field Personnel/Agency: 1) SARA ROGERS 2) SUE GAWLER
3) MARIA TRINH 4) JILL WEBER 5) SAL ROONY

1. Location:
USGS 7.5' Quadrangle SEAL HARBOR
Township N/A Range N/A Section N/A
GPS Location (UTM): Easting 560500 Northing 4913165
GPS Zone 19 GPS Type PLGR+96
Brief description of site relative to identifiable points on topographic map
JUST DOWN THE SLOPE WEST OF CORNER OF CADILLAC SUMMIT ROAD & PARK LOOP ROAD
Attach photocopy of field site from 7.5' quadrangle.

2. Aerial Photography:
Photo # 12-17 Date 5-22-97 Type CIR PRINT Scale 1:15,840
Brief description of photo signature LIGHT-PALE FLUFFY PINK & GREEN TREES W ROUND TOPPED CANOPY
Attach photocopy of aerial photo.

3. Ground Survey:
Description of Site (overstory-understory, upland/wetland, etc...)
DECIDUOUS FOREST ON WEST FACE SLOPE W LITTLE UNDERSTORY DEVELOPMENT
Dominant Plants: 1) BEECH 2) _____
3) _____ 4) _____ 5) _____
Common Plants: 1) SUGAR MAPLE 2) YELLOW BIRCH
3) _____ 4) _____ 5) _____
Less Common Plants: 1) ASPEN 2) HEMLOCK
3) STRIPED MAPLE 4) _____ 5) _____
Ground Photo Data: Roll # 1 Exp# 5 Direction E
Exp# _____ Direction _____ Exp# _____ Direction _____
Exp# _____ Direction _____ Exp# _____ Direction _____

4. Classification:
Initial Attribute: MAPLE-BIRCH-BEECH DECIDUOUS NORTHERN HARDWOOD FOREST (MDF)
Modifier Information:
% Closure 100% Composition EVENLY DISPERSED Tree Height 50-60'
Final Attribute: BEACH - BIRCH - MAPLE FOREST (MDF) CEGL006252 VAH 1-27-2003

5. Discussions/Other Observations:
Photo Interpretation SOME VARIATIONS IN SIGNATURE THROUGHOUT THIS DECIDUOUS FOREST. MAY BE DO TO PURER AREAS OF BEECH.
Other _____

Figure A-1. Reconnaissance field data sheet for photointerpretation mapping.

Appendix B

Dichotomous Keys to the Vegetation Communities at Acadia National Park

This is a key to vegetation community types (associations) of the National Vegetation Classification System that have been identified at Acadia National Park as a result of this mapping project. This key is a working document. Because it is based on limited samples for many types, it may not work as well for variations that did not appear in the samples.

Conventions:

- The layers are as defined in the plot sampling (see Methods). For example, "canopy" refers to the cover of trees over 10 cm dbh, and "subcanopy" to smaller trees over 3 m tall.
- The cutoff used for shrub versus dwarf shrub is about 1 m, but is not meant to be constrained to that exactly. Use your judgment in the field.
- Relative Dominance (RD) is the proportion of the total canopy occupied by a species. If *Picea rubens*'s cover value is 30%, in a setting in which the canopy cover totals 60%*, Picea rubens*'s relative dominance is 50%. This concept is used repeatedly in this key.
- Types that occur in the Park, but for which we have no samples, are marked with an asterisk.

Which Key To Use:

1. Trees forming ≥ 20% canopy, or if less (rarely), then canopy and subcanopy (everything > 3 m tall) total ≥ 30% cover: forests and woodlands.....2
1. Tree canopy ≤ 10%, or if slightly more, then canopy and subcanopy together total < 30% (these layers usually total < 10%): non-forested vegetation.....3

2. UPLAND: soils not saturated throughout season, *Sphagnum* < 10% of ground surface. Exception: sometimes in ledgy types such as Black Spruce / Heath Rocky Woodland, the "soil" is thin peat pockets over bedrock, and usually saturated; these are treated as uplands
.....**UPLAND FOREST AND WOODLAND KEY**
2. WETLAND: soils saturated throughout season and/or *Spahgnum* covering > 10% of ground surface (see note *re* exceptions in other half of couplet); usually basins or streamsides
.....**WETLAND FOREST AND WOODLAND KEY**

3. UPLAND: soils not saturated throughout season, *Sphagnum* < 10% of ground surface. Exception: sometimes in ledgy types such as Blueberry Granite Barrens, the "soil" is thin peat pockets over bedrock, and usually saturated; these are treated as uplands
.....**UPLAND NON-FORESTED VEGETATION KEY**
3. WETLAND: soils saturated throughout season and/or *Spahgnum* covering > 10% of ground surface (see note regarding exceptions in other half of couplet); usually basins or streamsides
.....**WETLAND NON-FORESTED VEGETATION KEY**

Upland Forest and Woodland Vegetation Key

1. Conifer forests and woodlands: deciduous trees < 20-25% RD 2
1. Deciduous forests and woodlands: coniferous trees < 20-25% RD 17
1. Mixed forests and woodlands: both conifers and deciduous spp > 25% RD 22

Conifer forests and woodlands: general

1. Conifer forests: tree cover usually > 65%, lower layers generally more sparse than canopy; area lacks a well-developed low shrub layer of *Vaccinium angustifolium, Gaylussacia baccata, Kalmia angustifolia*, and/or *Photinia melanocarpa*; substrate various, but often mineral soil, usually not a thin organic layer over bedrock 2
1. Conifer woodlands: tree cover usually < 65%, as low as 20% (but occasionally to ~80%), trees more-or-less open grown; low shrub layer of *Vaccinium angustifolium, Gaylussacia baccata, Kalmia angustifolia*, and/or *Photinia melanocarpa* prominent (>15% cover), or sometimes *Pteridium aquilinum* prominent (> 7% cover) instead; ground cover may feature fruticose lichens; substrate bedrock, with a thin layer of mostly organic soil material typically < 15 cm deep 8

Conifer forests

2. *Tsuga canadensis* the dominant conifer 3
2. Other conifer species dominant 4

3. Hardwoods typically including *Acer rubrum, Acer saccharum*, and/or *Fraxinus pennsylvanica* present, *Pinus strobus* usually very minor (type is usually mixed but some examples are heavy to hemlock and will key here) ..... **Hemlock - Hardwood Forest (CEGL006129)**
3. Hardwoods, other than *Quercus rubra* and *Betula*, absent or very sparse; *Pinus strobus* more abundant ..... **Eastern Hemlock - White Pine - Red Spruce (CEGL006324)**

4. *Thuja occidentalis* the dominant conifer 5
4. Other conifer species dominant 6

5. Somewhat open forest (canopy closure often < 65%), with *Thuja* generally at least twice as dominant as other conifers; *Fraxinus pennsylvanica* often present; heath shrubs lacking or very minor; seepage at soil surface ..... **Cedar Seepage Slope (CEGL006508)**
5. *Thuja* mixed with other conifers (*Pinus* and/or *Picea*), canopy closure more complete, and soils not seepy 6

6. *Pinus resinosa* ≥ 40% RD ..... **Red Pine - White Pine Forest (CEGL006253)**
6. *Pinus resinosa* absent or < 40% RD 7

7. *Pinus strobus* ≥ 25% RD, may be mixed with *Tsuga canadensis* or *Thuja occidentalis* (occasionally *Pinus resinosa* replaces some of the *P. strobus*) ..... **Eastern Hemlock - White Pine - Red Spruce (CEGL006324)**
7. *Picea rubens*, *P. glauca* and/or *Abies balsamea* dominant; *Pinus strobus* < 25% RD ..... **Maritime Spruce - Fir Forest (CEGL006151)**

Conifer woodlands

8. *Thuja occidentalis* the dominant tree species, usually twice as abundant as any other tree species ..... **White-cedar Woodland (CEGL006411)**
8. Other species dominate tree layer 9

9. Mixture of conifer species all < 50% RD; or woodlands dominated by *Pinus strobus* or *Picea rubens* (or, rarely, *Pinus resinosa*) 10
9. Pitch pine, jack pine, or black spruce woodlands: ≥ 60% RD of a single conifer species (other than *Pinus strobus* or *Picea rubens*) 11

10. Woodland dominated by *Picea rubens* (> 60% RD) ..... **Spruce - Fir Rocky Summit (CEGL006053)**
10. Woodland dominated by *Pinus strobus, P. resinosa* (only occasionally), or mixture of conifers ..... **Spruce - Fir Rocky Summit (CEGL006053)**

11. *Pinus rigida* dominates 12
11. Another conifer dominates 14

12. Pitch pine woodlands on ledge, trees often stunted 13
12. Pitch pine woodlands, or tending towards closed forest, on sandy soil, trees taller; known in Acadia NP only from Long Island ..... **Pitch Pine / Blueberry spp. - Huckleberry Woodland (CEGL005046)**

13. Understory features *Corema conradii*, with heaths and lichens ..... **Coastal Pitch Pine Outcrop Woodland (CEGL006154)**
13. Understory typical heath shrubs, lichens, etc., without *Corema* ..... **Pitch Pine Rocky Summit (CEGL006116)**

14. *Pinus banksiana* dominates ..... **Jack Pine Heath Barren (CEGL006041)**
14. *Picea* sp. dominates 15

15. *Picea rubens* dominates 16
15. *Picea mariana* dominates ..... **Black Spruce / Heath Rocky Woodland (CEGL006292)**

16. Woodlands on bedrock ..... **Spruce - Fir Rocky Summit (CEGL006053)**
16. Woodlands on talus; trees may be more sparse ..... **Red Spruce Talus Slope Woodland (CEGL006250)**

Deciduous forests and woodlands

17. Northern hardwood species (*Fagus grandifolia, Betula alleghaniensis*, &/or *Acer saccharum or A. rubrum)* dominate 18
17. Oak, birch, and/or aspen, rather than northern hardwood species, dominate 19

18. Forest (> 65% canopy), soil more or less well developed; *Fagus grandifolia, Betula alleghaniensis*, &/or *Acer saccharum or A. rubrum* total > 50% RD; occasionally one of those replaced by *Fraxinus pennsylvanica*; conifers may be up to 25% RD, usually much < 20%; *Quercus rubra*, if present, < 30% RD ..... **Northern Hardwood Forest (CEGL006252)**
18. Woodland (< 60% canopy); *Betula alleghaniensis* dominant or at least co-dominant; on talus, soil very limited ..... **Red Oak Talus Slope Woodland (CEGL006320)**

19. *Quercus rubra* dominant 20
19. *Betula* spp. (other than *alleghaniensis*) and/or *Populus* spp. dominant 21

20. Woodland: Canopy < 50%; on bedrock, or glacial till soils.....
.. **Central Appalachian High-Elevation Red Oak Woodland, Northern Variant (CEGL006134)**
20. ..... Forest: Canopy ≥ 60%; on soil, not bedrock
.....**Successional Oak - Pine Forest (CEGL006506)**

21. Canopy ≥ 60%, with subcanopy/tall shrub cover less than canopy cover, creating a forest character; *Populus grandidentata* often dominant, sometimes with *Quercus rubra* subdominant, *Betula populifolia* typically absent or unimportant .....
.....**Early Successional Woodland/Forest (CEGL006303)**
21. Canopy cover ≤ 50%, with subcanopy/tall shrub cover usually greater than canopy cover; *Populus tremuloides, Betula populifolia, B. papyrifera*, and/or *B. caerulea* most commonly dominant, although some examples are dominated by sapling-size *Betula alleghaniensis* .....
.....**Early Successional Woodland/Forest (CEGL006303)**

Mixed forests and woodlands

22. *Thuja occidentalis* dominant (usually a conifer type, can be mixed).....
..... **Cedar Seepage Slope (CEGL006508)**
22. *Thuja occidentalis* not dominant 23

23. *Tsuga canadensis* the dominant conifer and usually the dominant tree, growing with *Quercus rubra* and northern hardwood species ..... **Hemlock - Hardwood Forest (CEGL006129)**
23. *Pinus*, *Picea*, or *Abies* sp. the dominant conifer 24

24. Woodlands: trees with "woodland" form and canopy cover typically < 50%, may be up to 60%; heath shrubs > 15% (except on talus), often > 25%..... 25
24. Forests: canopy cover ≥60%, trees taller, more forest-like; heath shrubs < 15% 28

25. Talus woodland with *Picea rubens* the dominant conifer .....
.....**Red Spruce Talus Slope Woodland (CEGL006250)**
25. Woodlands not on talus 26

26. *Quercus rubra* the dominant deciduous species, with *Pinus strobus* or *Picea rubens* the most common canopy conifers..... **White Pine - Oak Acid Bedrock Glade (CEGL005101)**
26. *Quercus rubra* not the most common deciduous species, most commonly it is a heterogeneous mix of *Acer rubrum*, *Betula* spp., *Populus* spp., etc 27

27. Mixed woodland with more than 50% of the canopy plus subcanopy coniferous .....
..... **Spruce - Fir Rocky Summit (CEGL006053)**
27. Mixed woodland with more than 50% of the canopy plus subcanopy deciduous.....
.....**Early Successional Woodland/Forest (CEGL006303)**

28. *Quercus rubra* the dominant deciduous species, with *Pinus strobus* or *Picea rubens* the most common canopy conifers.....**White Pine - Oak Forest (CEGL006293)**
28. *Quercus rubra* not the most common deciduous species, most commonly it is *Acer rubrum*, and sometimes *Betula papyrifera, Betula alleghaniensis*, or (rarely) *Populus grandidentata* 29

29. *Pinus strobus* the most abundant canopy conifer, ≥25% RD 30
29. *Pinus strobus* < 25% RD, typically *Picea rubens* (or, less commonly, another conifer) is more dominant 31

30. Deciduous component is more northern hardwood species (*Acer saccharum, Betula alleghaniensis, Fagus grandifolia*) than early successional species (*Betula papyrifera, B. populifolia, Acer rubrum, Populus* spp.) ..... **Sugar Maple - White Pine Forest (CEGL005005)**
30. Deciduous component is more early successional species than northern hardwood species ..... **Successional Oak - Pine Forest (CEGL006506)**

31. *Acer rubrum, Betula papyrifera*, or *Populus grandidentata* the most common deciduous species, northern hardwood species very minor (totaling << 20% RD); conifer component typically features *Picea rubens* mixed with varying amounts of *Abies balsamea, Picea glauca, Thuja occidentalis*, and/or *Pinus strobus* ..... **Successional Spruce - Fir Forest (CEGL006505)**
31. *Betula alleghaniensis* the most common deciduous species, usually ≥ 20% RD (occasionally *Acer rubrum* will be common *but Betula alleghaniensis, Acer saccharum*, *Fagus grandifolia*, and *Fraxinus pennsylvanica* combined will exceed *Acer rubrum*); conifer component typically less diverse, featuring *Picea rubens*, sometimes with *Thuja occidentalis* ..... **Red Spruce - Hardwoods Forest (CEGL006267)**

Wetland Forest and Woodland Vegetation Key

1. Wetland forest (canopy may grade towards woodland) in drainages or on gentle slopes with mineral soil rather than peat substrate; *Sphagnum* often present on ground surface but generally < 20% cover; canopy deciduous to mixed, *Acer rubrum* and/or *Fraxinus* prominent 2
1. Canopy closure and composition various; substrate is peat, with *Spahgnum* often > 25% of ground surface; not on slopes 3

2. Canopy deciduous (conifers < 25% RD), *Fraxinus* spp. (*pennsylvanica* or *americana)* plus *Betula alleghaniensis* more abundant than *Acer rubrum* ..... **Northern Hardwood Seepage Swamp (CEGL006220)**
2. Canopy mixed, or if occasionally with < 25% conifer RD, then conifers (usually *Picea* and *Abies*) well-represented in subcanopy and shrub layers (>15% cover); *Acer rubrum* the dominant deciduous tree, mixed with *Picea rubens*, *Abies balsamea*, and sometimes *Thuja* ..... **Red Maple - Conifer Acidic Swamp (CEGL006198)**

3. Conifers make up > 75% RD of canopy and subcanopy 4
3. Tree layer mixed (both conifers and deciduous > 25% RD) or deciduous 7

4. *Picea mariana* and/or *Larix laricina* the dominant conifer 5
4. *Thuja occidentalis* the dominant conifer 6

5. ≥ 50% canopy; heath shrubs usually < 10% (up to 15%); *Larix, Acer rubrum*, and/or *Thuja* totalling > 30% RD (rarely less) ..... **Black Spruce Woodland Bog (CEGL006098)**
5. ≤ 40% canopy; heath shrubs > 25% ..... **Black Spruce Woodland Bog (CEGL006098)**

6. More closed-forest character, with canopy > 50% (*Thuja* may be strongly dominant or mixed with other conifers); heath shrubs ≤ 10%; *Carex trisperma* characteristically a dominant sedge ..... **Northern White-cedar Wooded Fen (CEGL006507)**
6. Bog woodland character, canopy ≤ 40%, heath shrubs > 20%, *Carex trisperma* absent or very minor (*Carex stricta* dominant in the one sample) ..... **Northern White-cedar Wooded Fen (CEGL006507)**

7. Canopy at least 60% *Picea mariana* and/or *Larix laricina* (slightly mixed) ..... **Black Spruce Woodland Bog (CEGL006098)**
7. Canopy at least half *Acer rubrum* 8

8. *Acer rubrum* dominates canopy, conifers < 25% RD ..... **Red Maple Swamp Woodland (CEGL006395)**
8. *Acer rubrum* mixed with *Picea mariana* (≥ 25% RD) ..... **Red Maple Swamp Woodland (mixed variant, CEGL006395)**

Upland Non-Forested Vegetation Types Key

1. Herbaceous or dwarf shrub – herbaceous (occasionally sparse) vegetation at the immediate coast (tree islands may be present in rocky headland communities) 2
1. Shrub/herb occasionally sparse) vegetation on summits and rocky upper slopes; scattered stunted *Picea rubens* and *Quercus rubra* may be present (< 15% cover overall) 5

2. Dune and tidal-edge vegetation on sand, dominated by *Ammophila breviligulata*; limited extent in Acadia NP..... **Northern Beachgrass Dune (CEGL006274)**
2. Graminoids not dominant; near-shore vegetation in patches on bedrock or cobble..... 3

3. Vegetation sparse (< 25%, often < 10%)..... 4
3. Vegetation forming nearly continuous cover (or at least there is more vegetated surface than bare rock surface); *Empetrum* mats may be extensive; *Myrica pensylvanica* characteristic..... **Crowberry - Bayberry Maritime Shrubland (CEGL006510)**

4. Vegetation forming scattered patches in rock crevices; *Solidago sempervirens, Sedum rosea, Plantago maritima, Euphrasia randii,* etc. are typical..... **Northern Maritime Rocky Headlands (CEGL006529)**
4. Vegetation on loose cobble near and above the high tide line; *Cakile edentula* and *Lathyrus japonicus* characteristic..... **Sea-rocket - Oysterleaf Sparse Vegetation (CEGL006106)***

5. Vegetation sparse (< 25%, often < 10% cover), on talus..... **Northern Lichen Talus Barrens (CEGL006534)***
5. Vegetation with higher cover (usually) and not on talus..... 6

6. Vegetation forming patches across bare rock; mosaics of dwarf (< 0.5 m tall) *Vaccinium angustifolium* patches and somewhat taller *Gaylussacia baccata* patches, heath species dominate the shrub vegetation; shrubs > 1 m tall absent in the *Vaccinium angustifolium* patches, up to 25% cover in the taller vegetation patches; *Kalmia angustifolia, Sibbaldiopsis tridentata,* and *Deschampsia flexuosa* characteristic associated species..... **Blueberry Granite Barrens (CEGL005094)**
6. Vegetation more uniformly shrubby, shrubs > 1 m tall form > 25% cover, often > 50% cover; non-heath shrubs exceed heath shrubs in total shrub cover..... 7

7. Summit shrublands with shrub layer characterized by some combination of *Viburnum nudum, Nemopanthus mucronata*, and *Ilex verticillata*; Betula spp. and/or *Sorbus americana* often present, but not dominant; shrub layer (1-3 m) usually < 50% cover..... **Blueberry Granite Barrens (CEGL005094)**
7. Shrublands of upper ridges and sometimes summits with *Betula* spp. strongly dominating the shrub layer (1-3 m), that layer usually forming > 50% cover; *Picea rubens* an associate in some locations; other shrubs typical of the Blueberry Granite Barrens type may be present but at much lower abundance..... **Early Successional Woodland/Forest (CEGL006303)**

Wetland Non-Forested Vegetation Types Key

1. Tidal marshes 2
1. Non-tidal marshes and wetlands 3

2. Brackish tidal marshes with mixed tall sedges and often with *Typha angustifolia* ..... **Brackish Tidal Marsh, Cattail Variant (CEGL004201)***
2. Saltmarshes: vegetation varies, but *Spartina alterniflora* usually present if not a major component; dominants include *Carex paleacea, Juncus gerardi*, etc. ..... **Spartina High Salt Marsh (CEGL006006)**

3. Saturated or only seasonally flooded wetlands and marshes, with persistent emergent vegetation 4
3. Open-water marshes, permanently (or, rarely semipermanently) ...flooded, vegetation not persistent over winter ..... **see below**

- Floating-leaved vegetation with *Nuphar lutea* a characteristic species ..... **Water Lily Aquatic Wetland (CEGL002386)***
- Seasonally emergent tall rushes (*Scirpus validus*, etc.) dominate ..... **Bulrush Deepwater Marsh (CEGL006275)***
- Submerged vegetation dominated by *Vallisneria* and *Potamogeton* spp. ..... **Open Water Marsh with Mixed Submergents/Emergents (CEGL006196)***
- Submerged vegetation in shallow waters, rosette plants dominate, typical species *Eriocaulon aquaticum* and *Lobelia dortmanna* ..... **Seven-angle Pipewort - Dortmann's Cardinal-flower Herbaceous Vegetation (CEGL006346)***

4. Seasonally flooded wetlands and marshes, without *Sphagnum* peat base; *Sphagnum* ground cover < 50%; *Alnus* spp., *Calamagrostis canadensis, Carex stricta, Juncus* spp. and/or *Scirpus*-types (excluding *Trichophorum*) dominant; *Myrica gale*, if present, is less abundant than alders 5
4. *Sphagnum* peatlands, with dwarf shrubs or graminoids dominant; *Sphagnum* > 50% cover, or, if *Sphagnum* cover < 50% then heath shrubs (occasionally *Empetrum*) or *Myrica gale* (sometimes with *Spiraea* spp.) are the dominant shrubs (regardless of whether the overall vegetation is dwarf-shrub-dominated or graminoid-dominated) 10

5. Alder wetlands; shrubs over 1 m tall > 35% cover, usually > 50%; *Alnus* spp. dominate 6
5. Graminoid-dominated, shrubs over 1 m tall sparse < 25%, usually < 10% (SMG) 7

6. Alder wetlands along streamsides or in narrow valleys ..... **Alluvial Alder Thicket (CEGL006062)**
6. Basin wetlands dominated by *Alnus* spp., often forming a zone near the perimeter of a peatland; *Nemopanthus* often present ..... **Northern Peatland Shrub Swamp (CEGL006158)**

7. *Typha latifolia* dominant ..... **Eastern Cattail Marsh (CEGL006153)**
7. Other graminoids dominant 8

8. *Carex stricta* or *Juncus militaris* dominant 9
8. *Carex stricta or Juncus militaris* not dominant, although may be present; *Calamagrostis canadensis* characteristic, sometimes dominant; other graminoids such as *Scirpus cyperinus, Dulichium arundinaceum* occur as part of the mixture and may exceed cover of *Calamagrostis* ..... **Seasonally Flooded Mixed Graminoid Meadow (CEGL006519)**

9. Tussocks of *Carex stricta* dominate; wetland often flooded or at least saturated to surface through season ..... **Eastern Tussock Sedge Meadow (CEGL006412)**
9. *Juncus militaris* dominates at least central portion; dense shrubs (e.g., *Ilex verticillata*) typical around perimeter; seasonally flooded drawdown wetlands whose ground surface may be dry by late summer .....**Bayonet Rush Herbaceous Vegetation (CEGL006345)**

10. Total coverage by *Myrica gale* and *Spiraea* spp exceeds total coverage by heath shrubs; vegetation usually strongly shrub-dominated ..... **Sweetgale Mixed Shrub Swamp (CEGL006512)**
10. Total coverage by heath shrubs exceeds total coverage by *Myrica* and *Spiraea*; vegetation may be shrub-, herb-, or bryophyte-dominated..... 11

11. Fens: minerotrophic peatlands with or without drainage 12
11. Bogs: ombrotrophic peatlands, vegetation surface raised; fen vegetation may occur around perimeter but most of peatland is raised 13

12. Fens along streams or in peatlands with drainage into and out of the peatland .....**see vegetation key following**
12. Fens in closed drainages (small outlet drainage may be present, but no inlet stream), often with transitional fen-bog vegetation.....**see vegetation key following**

13. Coastal bogs with central plateau featuring *Trichophorum cespitosum* "lawn" community; Big Heath the only known example in Acadia NP .....**see vegetation key following**
13. Coastal or inland bogs with vegetation dominated by dwarf heath shrubs, graminoids patchy and often sparse and *Trichophorum cespitosum* absent or infrequent.....**see vegetation key following**

Vegetation-type Key for Bog and Fen Types

a. *Carex lasiocarpa* dominates, with other tall sedges such as *Carex utriculata* characteristic; heath shrubs may be present but are typically minor; fen community, usually in open fen ....**Slender Sedge Fen (CEGL006521)**
a. Other sedges or dwarf shrubs dominate, or vascular vegetation sparse; fens or bogs..... b

b. Graminoid cover exceeds dwarf shrub cover c
b. Dwarf shrub cover exceeds graminoid cover ..... d

c. *Trichophorum cespitosum* the dominant graminoid species; lawn community of coastal raised bogs, known from Acadia NP only at Big Heath..... **Maritime Peatland Sedge Lawn (CEGL006260)**
c. Other sedges more abundant than *Tricophorum cespitosum*, *Carex oligosperma* and/or *C. exilis* characteristic; *Chamaedaphne* a characteristic shrub..... .....**Few-seeded Sedge - Leatherleaf Fen (CEGL006524)**

d. Heath shrub cover > 60% <u>or</u> *Gaylussacia dumosa* and *Empetrum nigrum* present; *Chamaedaphne* usually less common than other heath shrubs; ombrotrophic..... e
d. Heath shrub cover < 50% <u>and</u> *Gaylussacia dumosa* and *Empetrum nigrum* absent; *Chamaedaphne* often the most common heath shrub; basically minerotrophic..... .....**Leatherleaf Acidic Fen (CEGL006513)**

NOTE: the Few-seeded Sedge - Leatherleaf Fen and Leatherleaf Acidic Fen vegetation communities are very closely related and hard to tease apart in the samples and ordinations. But in Maine peatland

work and in regional reviews, there's a clear concept of how they're separated (supposedly the proportion of sedges/shrubs, with moderate to high cover of *Carex exilis* the classic feature for Few-seeded Sedge - Leatherleaf Fen).

e. *Gaylussacia dumosa* the most abundant shrub, or at least dominates extensive patches; *Empetrum nigrum* almost always present though not necessarily at high cover; graminoid cover may be relatively high (often > 25%) ..... **Maritime Crowberry Bog (CEGL006248)**

e. Other heath species, typically *Kalmia angustifolia* and/or *Rhododendron canadense*, more abundant than *Gaylussacia dumosa*; graminoid cover typically low (< 10%) **Northern Dwarf-shrub Bog (CEGL006225)**

Appendix C

Example of an Accuracy Assessment Form

USGS-NPS Vegetation Mapping Program 333

ACCURACY ASSESSMENT FORM
ACADIA NATIONAL PARK, 1999

[redacted] DR COB

Plot #: WP 381 1327	Park code: *ACAD*	Date: 99-08-19	Observers: SCR JEW
Datum: NAD 83	Accuracy: 4.2	UTM Zone: *19*	
UTM Easting 560.930		UTM Northing 4,914,891	
Offset from pt. Easting: ±0 m		Offset from pt. Northing: +1 m	

SETTING

Topography: Slope = -35, +22%. Transitional rocky shrubland between bald & forest. Bedrock outcrops + surface deposits (not huge erratics though)			
Elevation: 126 (m) OR ft		Aspect: 240°	
Soil texture: gravelly sand.	Soil depth: 20cm	Stoniness: Small stones (1.5cm)	Drainage: ek. well
Setting comments: Huge charcoal chunks. Soil full of charcoal.			

STRUCTURE & COMPOSITION

stratum	Major Species Present	% evergreen:decid 0 : 100	% Cover of Layer	Cover Patchy or ~Uniform?
TREE	Bet pap		<5	P
SAPLING	Bet pap Bet pap Ame sp.		40	~U
SHRUB (1-3 m)	Bet pap.		50	U
DWARF SHRUB	Vac ang Die ton Ame sp. Acer rub		30	U
HERB	Dan spi*, Sol rand, Pte aqu. Ory asp		10-15	~U
BRYOID	Pol pil, Clas/ Cla sp.		10	P

Indicator spp:	Rare spp:

VEGETATION TYPE and MAP UNIT

Veg. Type Code:	ABW	Map Unit Code:	SB
Alternate Veg Type:	ABW	Alternate Map Unit:	MDW
Veg Type #2 w/in 50 m of Pt.:	ABW	Veg. Type #3 w/in 50 m of Pt.:	BBSS

Rationale for Classification:
Keys well. Downslope (i.e. Veg type #2 w/in 50m) = more ABW/ABF
This is SB.

Comments:

Figure C-1. Accuracy assessment field data form.

Appendix D

Ordination Diagrams and Results of the Vegetation Data Analysis

The following discussions and diagrams provide a detailed explanation of the analysis performed on vegetation sample data collected at Acadia National Park (NP; see Data Analysis section in Methods section). The purpose of the analysis is to elucidate vegetation patterns and vegetation types. The data from these analyses are built upon vegetation sampled at Acadia NP.

The results of the analyses are shown as ordination diagrams in Figures D-1–D-12, which may be unfamiliar to some readers. The diagrams plot samples according to their compositional similarity: samples close to each other are similar and those father apart less so. The data are first and second axis ordination scores for the samples. These axes reflect compositional gradients related to environmental factors; however, they are not direct scales of certain factors. Ordination diagrams are useful in two major ways. First, they give a graphical picture of the relations among groups of samples. Groups may be classes (forest, woodland, shrubland [e.g., Figure D-1]), hydrologic group (upland, wetland, etc. [e.g., Figure D-4]), or vegetation types (e.g., Figures D-5–D-8 and D-10–D-12). Second, one can overlay or correlate values of environmental factors to deduce influential environmental gradients (See Figure 7 in Field Sampling of Methods for example). If hydrologic regime shows a relation to the first axis, for example (Figure D-3), it is a more important determinant in vegetation composition than if it shows a relation only to the second or third axis, or none at all.

Preliminary Analyses

Vegetation was analyzed first with reference to physiognomic class and hydrologic regime. To see how vegetation differences corresponded to physiognomic class, we ran Detrended Correspondence Analysis (DCA) on forests, woodlands, and shrublands together. Wetland shrublands were strongly different from all other samples and the ordination was re-run without them. The two major gradients were forests and woodlands on the first axis (with considerable overlap), and uplands to wetlands on the second axis (Figures D-1 and D-2). The upland shrublands separated from the woodlands to some degree on the third axis, but it is apparent that physiognomic differences between woodlands and shrublands in Acadia do not translate into strong compositional differences. TWINSPAN of this same data set echoed these two gradients.

Looking at forests only, certain types, the “easy” ones, fell out clearly. Of the 12 forest types with more than one sample, six showed reasonably good separation in the ordination and the other six formed a largely undifferentiated mass in the center. Forest types that separated well included two wetland types, the closed expression of the Black Spruce Woodland Bog (CEGL006098) and the closed-canopy expression of the Northern White-cedar Wooded Fen (CEGL006507), and four upland types: Hemlock - Hardwood Forest (CEGL006129), Red Pine - White Pine Forest (CEGL006253), Northern Hardwood Forest (CEGL006252), and White Pine - Oak Forest (CEGL006293). The messy types, Sugar Maple - White Pine Forest (CEGL005005), Eastern Hemlock - White Pine - Red Spruce (CEGL006324), Maritime Spruce - Fir Forest (CEGL006151), Successional Spruce - Fir Forest (CEGL006505), Red Spruce - Hardwoods Forest (CEGL006267), and Red Maple - Conifer Acidic (CEGL006198), are those that are characterized by red spruce, balsam fir, and/or red maple. The wide ecological amplitudes of these three species can obscure differentiation of community types.

Woodland samples paralleled the forest samples. Detrended Correspondence Analysis separated half the types well, with the other half initially failing to separate. The first axis separated the boggy woodland types, Red Maple Swamp Woodland (CEGL006395) and Black Spruce Woodland Bog (CEGL006098), from the remainder. The second axis reflected a conifer to deciduous gradient. (It was also significantly correlated with introduced species, but only because of high values in one sample, a rather spurious relation). The third axis provided little additional information beyond separating out those woodlands with a strong white cedar component.

Woodland types that separated easily were those dominated by pitch pine or jack pine, black spruce or red maple bog woodlands, and white cedar woodlands. Those that remained, reflecting an indistinct identity within the full data set, were those with red spruce, red oak, or with both conifers and deciduous trees making up at least 25%. Within this group, the red spruce woodlands were at one end of the gradient and the mixed deciduous woodlands at the other end.

Samples dominated by dwarf shrubs or herbs segregated first by hydrology and saltwater influence. Salt marshes, dune, and beach vegetation pulled out strongly on the first axis (Figure D-3). Once those were removed, the strongest gradient remained the upland – wetland split, with class (shrub, dwarf shrub, herb) showing gradations but no clear separations between the three physiognomic types (Figure D-4).

Based on these preliminary analyses, the complete data set was divided into the following subsets for further refining the vegetation types:

- Upland forests and woodlands
- Wetland forests and woodlands
- Non-forested uplands
- Non-forested wetlands

Wetland shrublands were included in the non-forested data sets; upland shrublands were included in both forested and non-forested sets (because of overlap with both types), and then pulled out entirely. In some cases, we extracted smaller data sets to look at particular types.

By analyzing these smaller sets with better resolution, we assessed how the rough assignment of vegetation type, usually done in the field, corresponded to actual compositional differences. Our concept of vegetation types was evolving based on both field observations and photointerpretation, and these analyses were useful for identifying gross vegetational patterns and highlighting where the characteristics on which we discriminated vegetation types were not sufficiently refined to result in consistent assignment.

Dendrograms constructed from the TWINSPAN analyses, ordination diagrams coded by field vegetation type, and the summaries of each sample point provided the material for two important, and iterative, steps: determining which samples did not classify well or were misclassified, and determining what suite of structural characters and dominant species were most useful in segregating the vegetation types.

We then assigned each sample to a vegetation type based on these revised diagnostics, and re-ran DCA. These ordinations show the relations and overlap of the vegetation types as best as we can distinguish them with the available data. Indicator Species Analyses identified species that might be diagnostic in discriminating between closely related types.

All species found during the sampling effort are listed in Appendix H: Plant Species List of Acadia National Park.

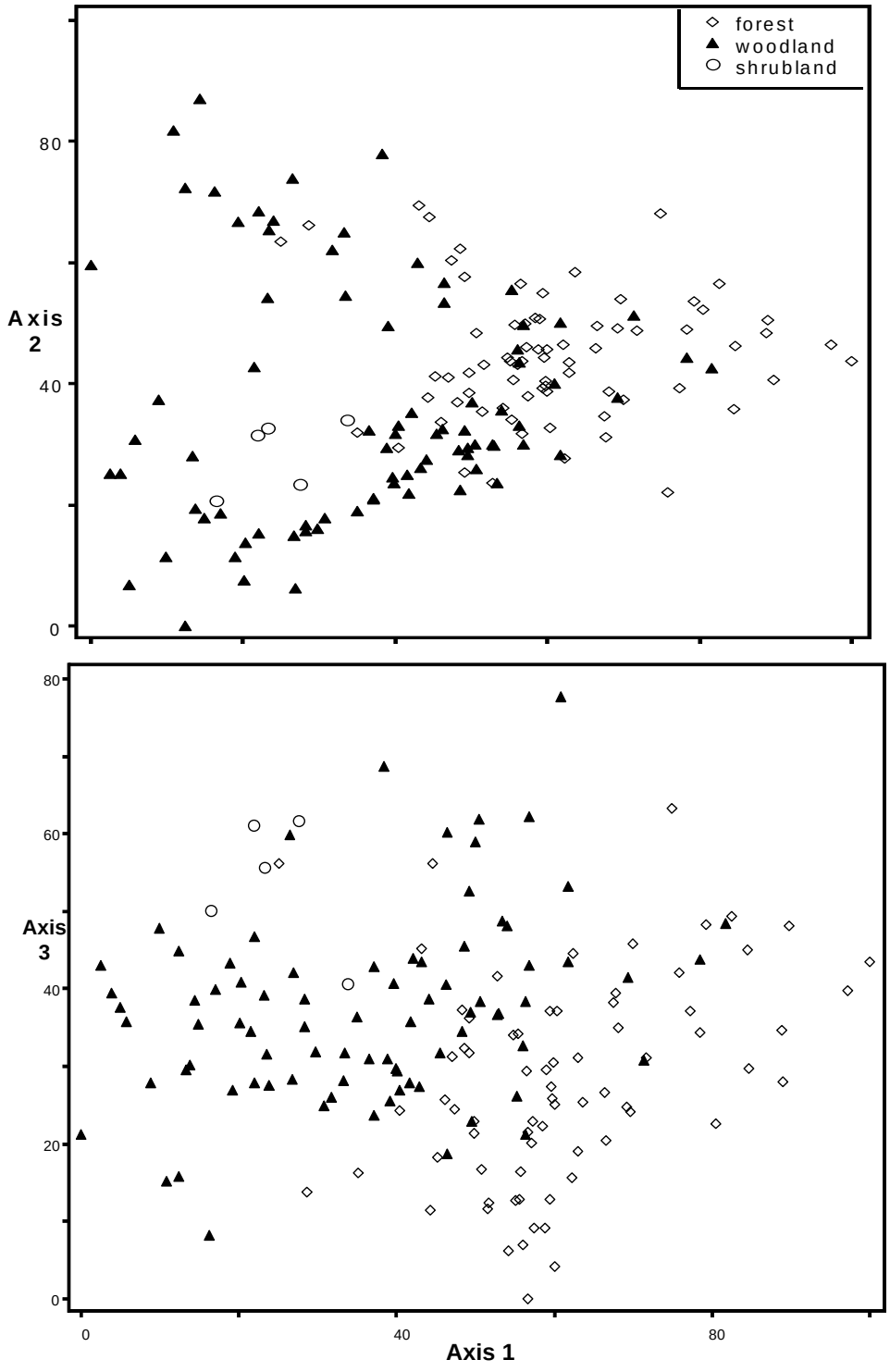


Figure D-1. Detrended Correspondence Analysis ordination of all forests, woodlands, and upland shrublands, by vegetation class. The first axis is plotted against the second axis (top figure) and the third axis (bottom figure). These axes accounted for 38% of the variance in the data. Axes are scaled to percent of the maximum score on axis 1.

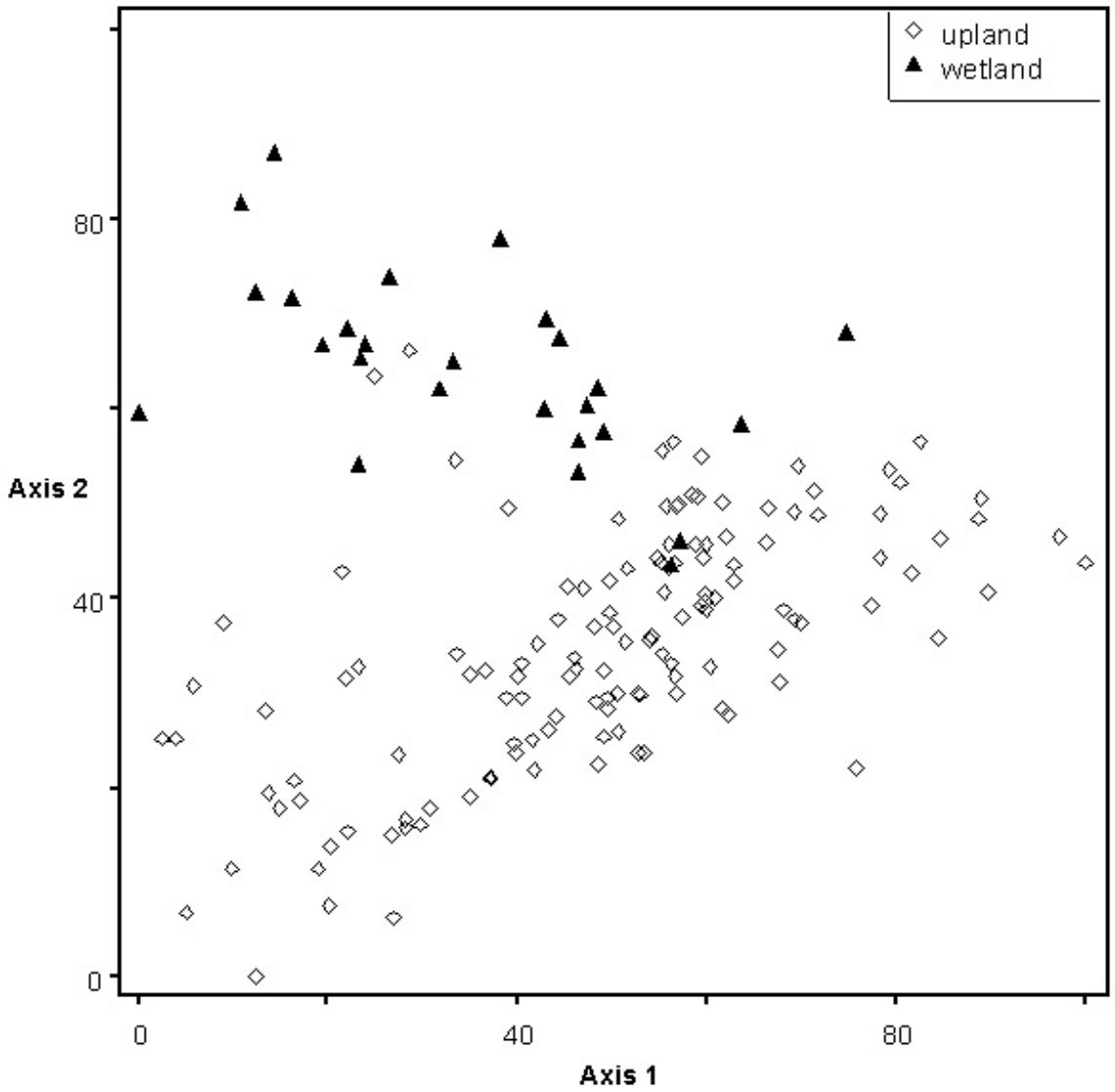


Figure D-2. Detrended Correspondence Analysis ordination of all forests, woodlands, and upland shrublands, plotted by hydrologic regime. Note the strong separation of wetland samples on the second axis. Axes are scaled to percent of the maximum score on axis 1.

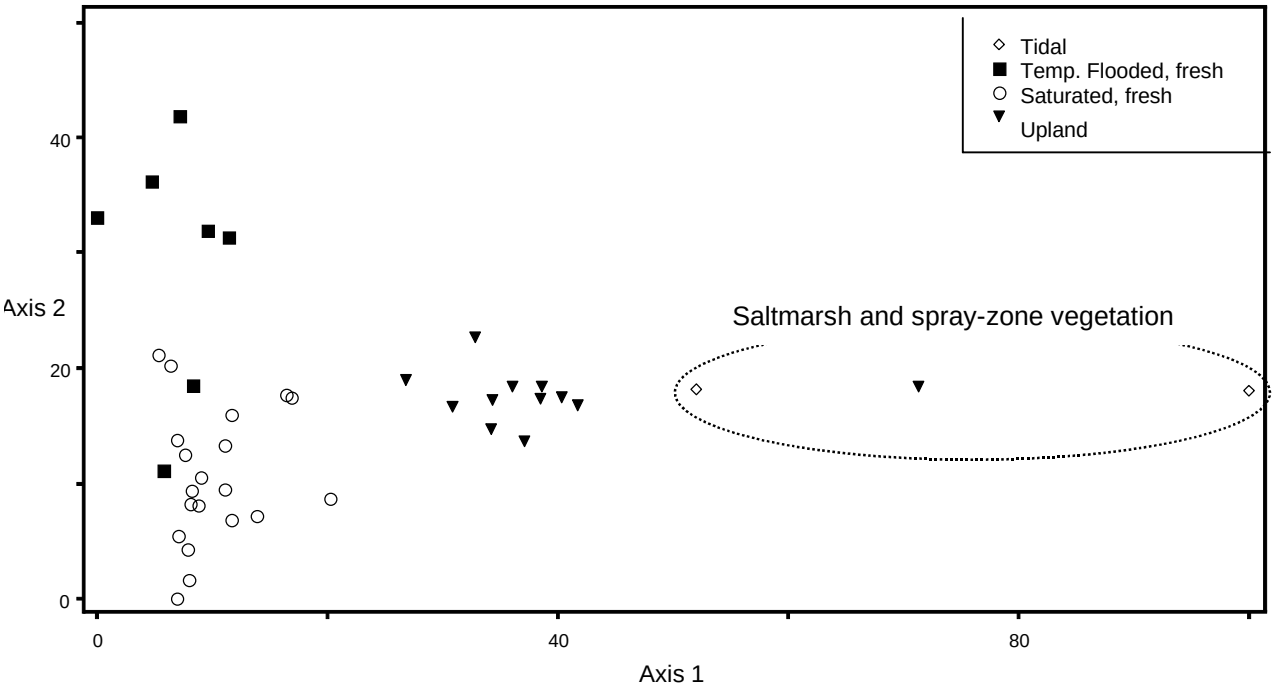


Figure D-3. Non-forested vegetation showing the strong influence of salt-spray vegetation types (removed for subsequent analysis). Axes are scaled to percent of the maximum score on axis 1.

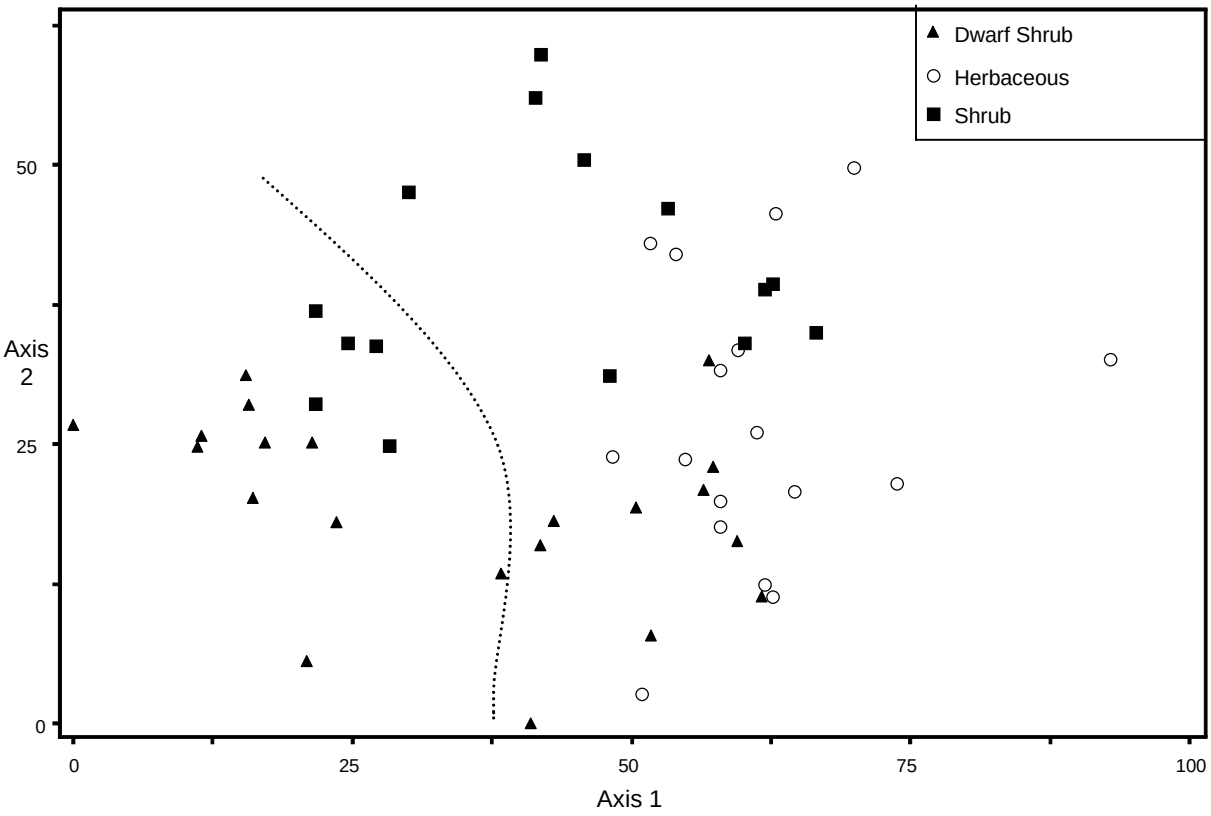


Figure D-4. Non-forested vegetation by physiognomic class. Note upland to wetland gradient on Axis 1: points to the left of the dashed line are upland. Axes are scaled to percent of the maximum score. R2 for the first three axes = .382. Axes are scaled to percent of the maximum score on axis 1.

Upland Forests and Woodlands

Twenty-three types of upland forests and woodlands are defined for Acadia. Analysis of the 133 samples showed the primary gradient (first axis) to be a forest-woodland transition (Figure D-6), with an element of nutrient status. Northern hardwood forests are at the left end of the axis, followed by spruce/fir and oak forests, then by oak, spruce or mixed pine woodlands, then by the most nutrient poor pitch pine / jack pine / black spruce woodlands (see Figures D-7 and D-8). Superimposed on the forest-to-woodland gradient is a deciduous-to-coniferous gradient, with deciduous forests and woodlands in the upper left quadrant of the ordination diagram, grading to coniferous samples in the lower right (Figure D-6).

The environmental and vegetation summary variables' correlations with the DCA axes mirrored forest-to-woodland and deciduous-to-coniferous gradients. First axis scores were positively correlated with the percent of conifer cover in the canopy and with the total cover of dwarf shrubs, herbs, and bryoids (i.e., cover of the lower layers increases as one moves from forest to woodland). The axis was negatively correlated with the total canopy percent, total basal area, number of canopy species, and number of herbaceous species. The second axis was positively correlated with both cover and richness of herbs and dwarf shrubs, and negatively correlated with canopy conifer percentage, basal area, canopy closure, and bryoid cover.

TWINSPAN of these data showed a clear separation (1st split; Figures D-7 and D-8) into forests and oak woodlands versus spruce/pine woodlands, with the spruce/pine woodlands characterized by *Kalmia angustifolia*, *Vaccinium angustifolium*, and *Gaylussacia baccata*. A few types in the middle of the ordination diagram, Early Successional Woodland/Forest (CEGL006303), White Pine - Oak Acid Bedrock Glade (CEGL005101), White-cedar Woodland (CEGL006411), Eastern Hemlock - White Pine - Red Spruce (CEGL006324), and Red Pine - White Pine Forest (CEGL006253), were divided by this first split. (A characteristic of TWINSPAN is that groups in the middle—the area of least definition-- can get split "artificially" in an early iteration.) In the case of the woodland types, Early Successional Woodland/Forest (CEGL006303) and White Pine - Oak Acid Bedrock Glade (CEGL005101), the split relates to their rather broad amplitude in canopy closure and overall character: both can range from almost-closed-canopy forests to quite open woodlands, with associated understory variation. In the case of the white pine forest types, Red Pine - White Pine Forest (CEGL006253) and Eastern Hemlock - White Pine - Red Spruce (CEGL006324), and the White-cedar Woodland (CEGL006411) type, the same forest-woodland gradation may be a factor, but these are also types that are not well represented in Acadia and thus with few samples (N=3 for each).

The first TWINSPAN split also reveals how the forest-to-woodland distinction relates both to canopy closure and the development of understory vegetation. When samples dominated by red spruce were assigned to forest or woodland type based only on the canopy closure, the "woodland" (< 70% canopy) samples were divided by the first TWINSPAN split; but when the < 70% canopy samples without the heath shrub layer were put back with the Maritime Spruce - Fir Forest (CEGL006151) type, the split was clean (Figure D-7). This supports the field observations that whether an area is best typed as "forest" or "woodland" depends both on the dwarf shrub and herb layer development as well as canopy closure.

The difficulties in separating some forests and woodlands vegetationally are consistent with difficulties in separating them during photointerpretation. Acadia is characterized by a full suite of forest-to-woodland gradations, and it is not always obvious to which class a particular type should be assigned. For example, Cedar Seepage Slope (CEGL006508) and White-cedar Woodland (CEGL006411) types exhibit both forest and woodland characters: variable canopy closure, and sometimes but not always a well-developed understory; and the DCA showed them to have the greatest overlap with the forested types of any woodland types (Figure D-8). Similarly, two of the three samples for the Red Pine - White Pine Forest

(CEGL006253) type appear on the "woodland" side of the ordination diagram, and this forest type does have characters intermediate between forest and woodland.

TWINSPAN produced four major groups of forest types, plotted onto the DCA diagram in Figure D-7. Group "A", with the largest number of samples, are the spruce-fir forests. The three major components of this group are the Maritime Spruce - Fir Forest (CEGL006151) type and two variants of it. The Successional Spruce - Fir Forest (CEGL006505) type is an earlier successional version of the Maritime Spruce - Fir Forest (CEGL006151) type, and is common in the portion of the park that burned in 1947. The Eastern Hemlock - White Pine - Red Spruce (CEGL006324) type is similar to the spruce-fir stands but with a white pine supercanopy component. Group "B" are samples intermediate between heavily coniferous spruce-fir and heavily deciduous northern hardwoods. This includes the Red Spruce - Hardwoods Forest (CEGL006267) type, two of the three samples of the Hemlock - Hardwood Forest (CEGL006129) type, and those of the Northern Hardwood Forest (CEGL006252) type that have 5-20% of the canopy made up of spruce and/or fir. Group "C" is primarily beech-birch-maple forests without spruce and fir, but also includes the third sample of the Hemlock - Hardwood Forest (CEGL006129) type. Group "D", the "oak" group, has the largest range of variation of the four groups, and includes both forests and deciduous-to-mixed woodlands. Types that fall here are most of the Early Successional Woodland/Forest (CEGL006303) type and all of the red oak types: White Pine - Oak Forest (CEGL006293), Successional Oak - Pine Forest (CEGL006506), Central Appalachian High-Elevation Red Oak Woodland, Northern Variant (CEGL006134), and White Pine - Oak Acid Bedrock Glade (CEGL005101).

On the other side of the first TWINSPAN division, four groups of conifer woodlands can be identified (Figure D-8). Group "A", Jack Pine Heath Barren (CEGL006041) type and most of the CEGL006041 (CEGL006292) type are those in the most low-nutrient and cool microclimate habitats, Acadia's closest approach to boreal conditions. The other groups are more temperate in character. Group "B" are woodlands mostly featuring red spruce, including the Spruce - Fir Rocky Summit (CEGL006053) type, the Red Spruce Talus Slope Woodland (CEGL006250), two of the three samples of Red Pine - White Pine Forest (CEGL006253) type, and the two samples of the Pitch Pine / Blueberry spp. - Huckleberry Woodland (CEGL005046) type. Groups "C" and "D" are characterized by pitch pine. The wide amplitude of pitch pine woodlands on the first axis, resulting in this split into two groups, reflects the extensive development of this type in Acadia. Pitch pine woodlands range from those more closely allied with oak-pine woodlands (Group "C") to those in more extreme habitats that show similarities to the black spruce or jack pine types. The one sample of the Coastal Pitch Pine Outcrop Woodland (CEGL006154) type, a type known from only one location in Acadia, is at the extreme right end of the pitch pine woodland range of variation, and occurs on a foggy and cool headland on the immediate coast. (Pitch pine - Corema woodlands elsewhere in the state occur in more temperate settings as well, and are not considered vegetationally distinct from straight pitch pine woodlands in the state classification.)

A description of each upland forest and woodland type is given in Appendix I: Vegetation Descriptions of this report.

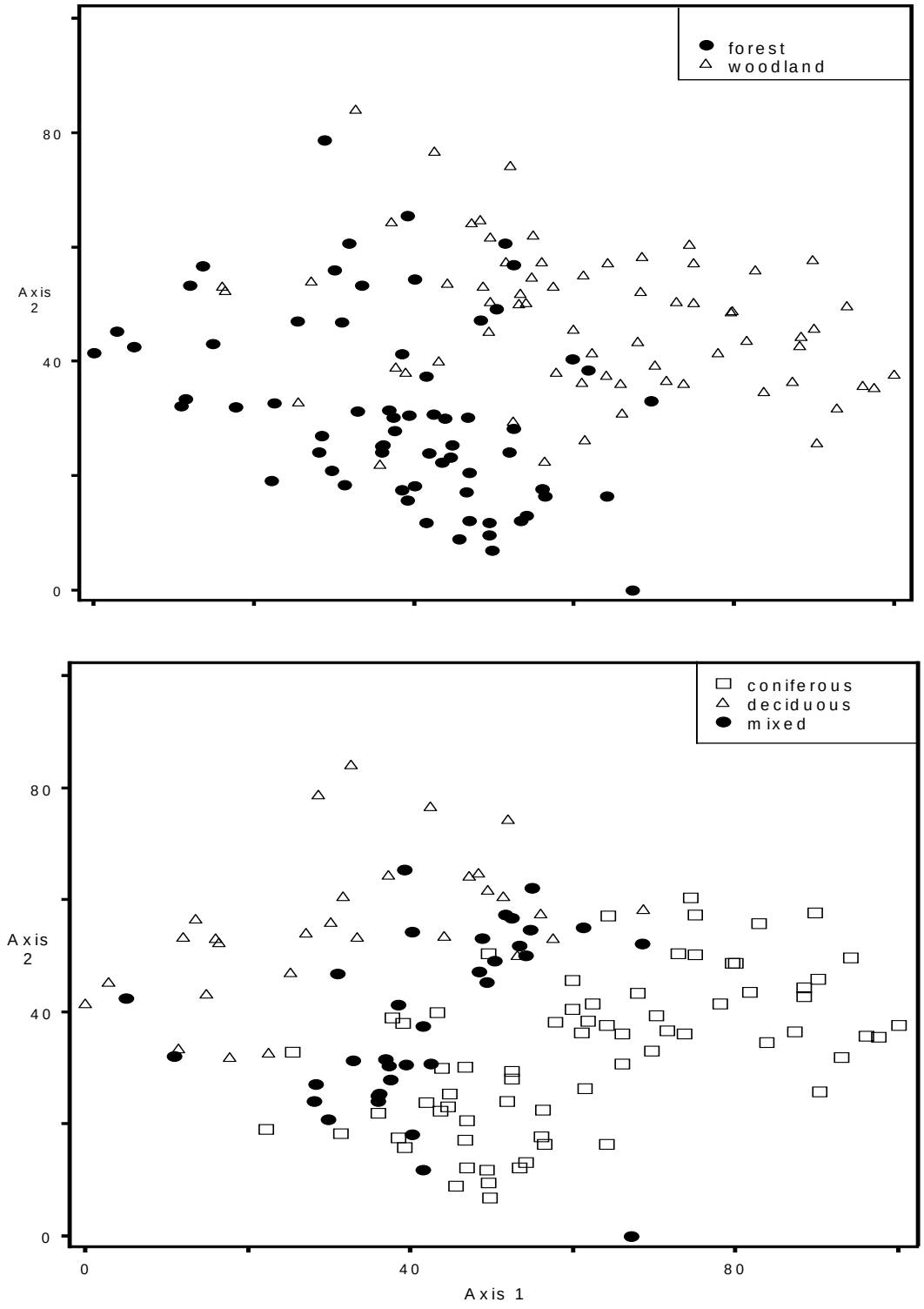


Figure D-6. Upland forests and woodlands by class and subclass, showing gradients on both axes from forest to woodland and from deciduous to coniferous. Axes are scaled to the percent of the maximum score on axis 1.

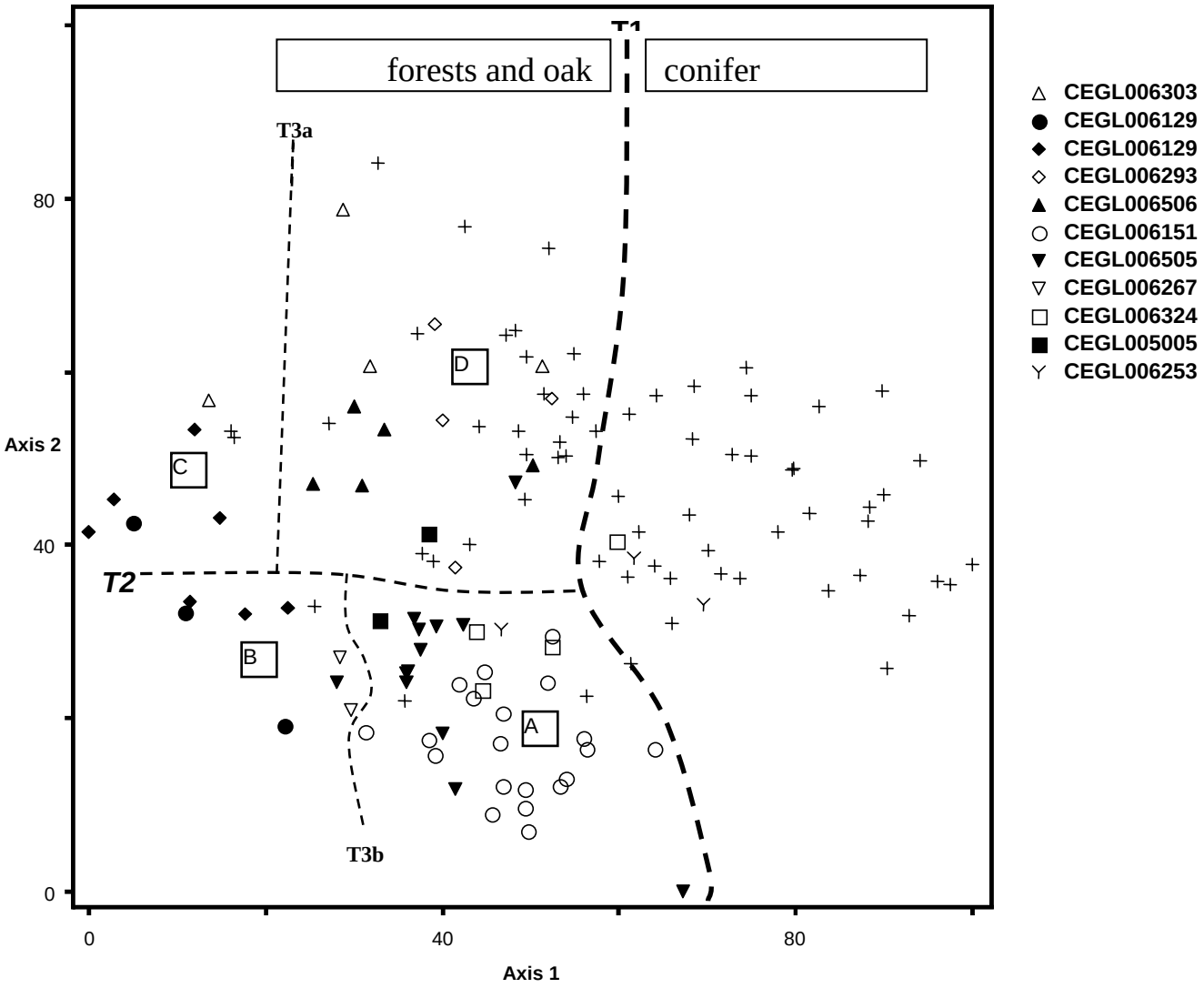


Figure D-7. Detrended Correspondence Analysis ordination of upland forest and woodland samples, coded by forest type. Twinspan divisions are shown as heavier to lighter lines; "T1" refers to the first Twinspan division, etc. (Divisions on the "conifer woodland" side of the first division are shown in Figure D-11.) Woodland types are included for reference and marked with a cross; Figure D-11 shows those by type. Boxed letters A-D refer to groups discussed in the text. Axes are scaled to percent of the maximum score on axis 1.

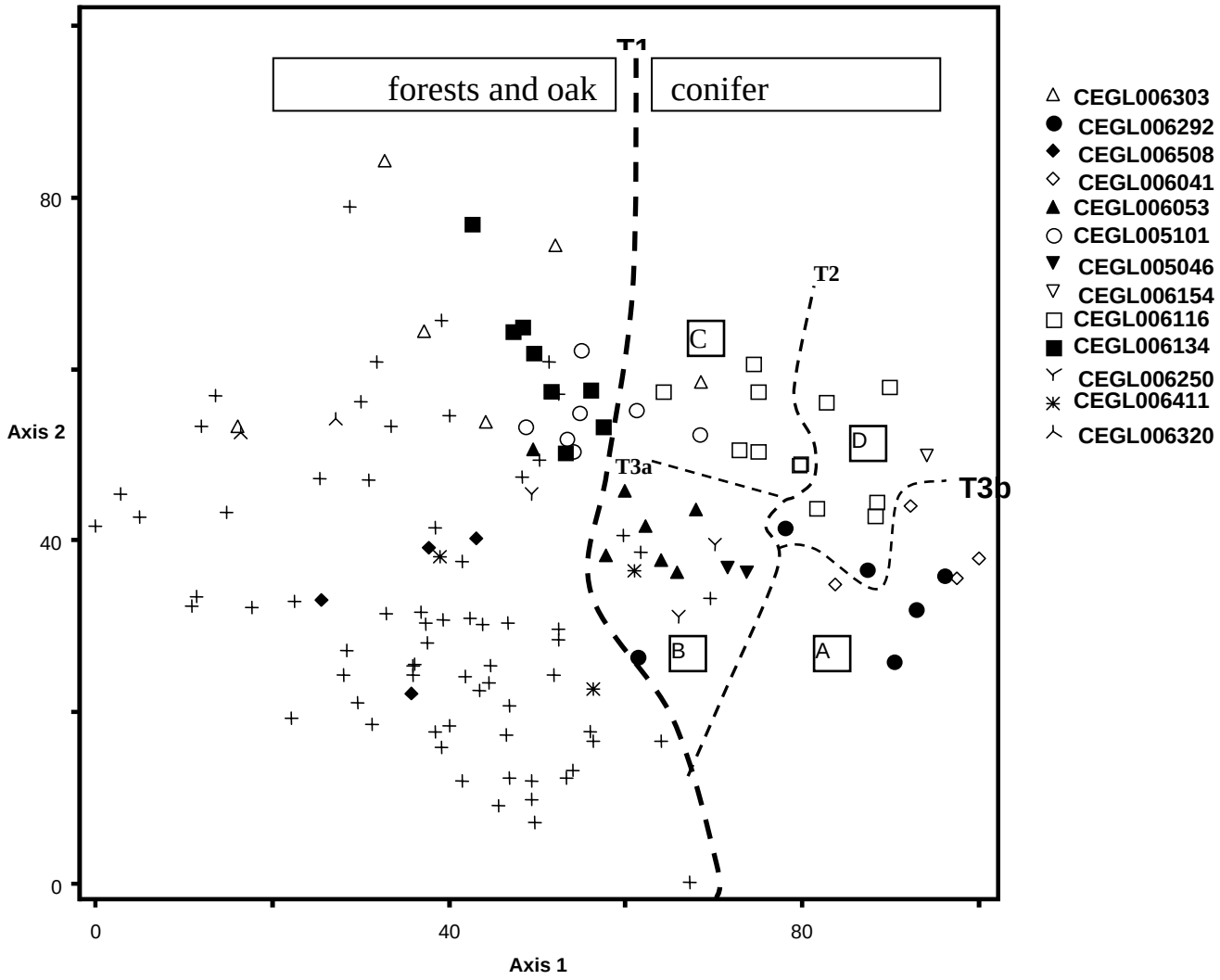


Figure D-8. Detrended Correspondence Analysis ordination of upland forest and woodland samples, coded by woodland type. Twinspan divisions are shown as heavier to lighter lines; "T1" refers to the first Twinspan division, etc. (Divisions on the "forest" side of the first division are shown in Figure D-10.) Forest samples are marked with a cross. Boxed letters A-D refer to groups discussed in the text. Axes are scaled to percent of the maximum score on axis 1.

Wetland Forests and Woodlands

Five types of wetland forests and woodlands were differentiated, with one type, the Red Maple Swamp Woodland (CEGL006395), subdivided into a deciduous phase and a mixed phase. Detrended Correspondence Analysis ordination of the 26 samples revealed a first axis gradient related to nutrient availability and substrate (Figure D-9): boggy samples at the left end, and mineral soil wetlands with few bryophytes and somewhat higher pH at the right. The second axis showed a strong coniferous to deciduous gradient. The species plot of these data placed the heath shrubs conspicuously in the lower left corner (boggy samples), corresponding with the most acidic and nutrient poor conditions where black spruce dominates.

Figure D-9 demonstrates the continuous gradation from one type to another; intermediates among types, especially the peatland types Black Spruce Woodland Bog (CEGL006098), Northern White-cedar Wooded Fen (CEGL006507), and Red Maple Swamp Woodland (CEGL006395), are common. Northern white cedar, in particular, displays the wide amplitude seen also in the upland samples. Northern white cedar wetlands range from those closely allied with black spruce bog woodlands, to typical cedar fens, to those in a more minerotrophic setting with red spruce.

Woodlands dominated by red maple are mapped as only one type but separated in both DCA and TWINSPAN analyses. Those with strong dominance of red maple tend to be in higher nutrient conditions and may be on either shallow peat or mineral soil. On the islands, the red maple woodlands have a strong black spruce component (technically mixed), and a more nutrient-limited character. In analyses of statewide vegetation patterns, red maple woodland fens likewise grade from all deciduous canopies to those mixed with black spruce or larch, although red maple is always the most abundant tree. Red maple wetlands on mineral soils are a different type statewide; the closest ally in Acadia are the Red Maple - Conifer Acidic Swamp (CEGL006198) type along fairly small drainages.

A description of each wetland forest and woodland type is given in Appendix I: Vegetation Descriptions of this report.

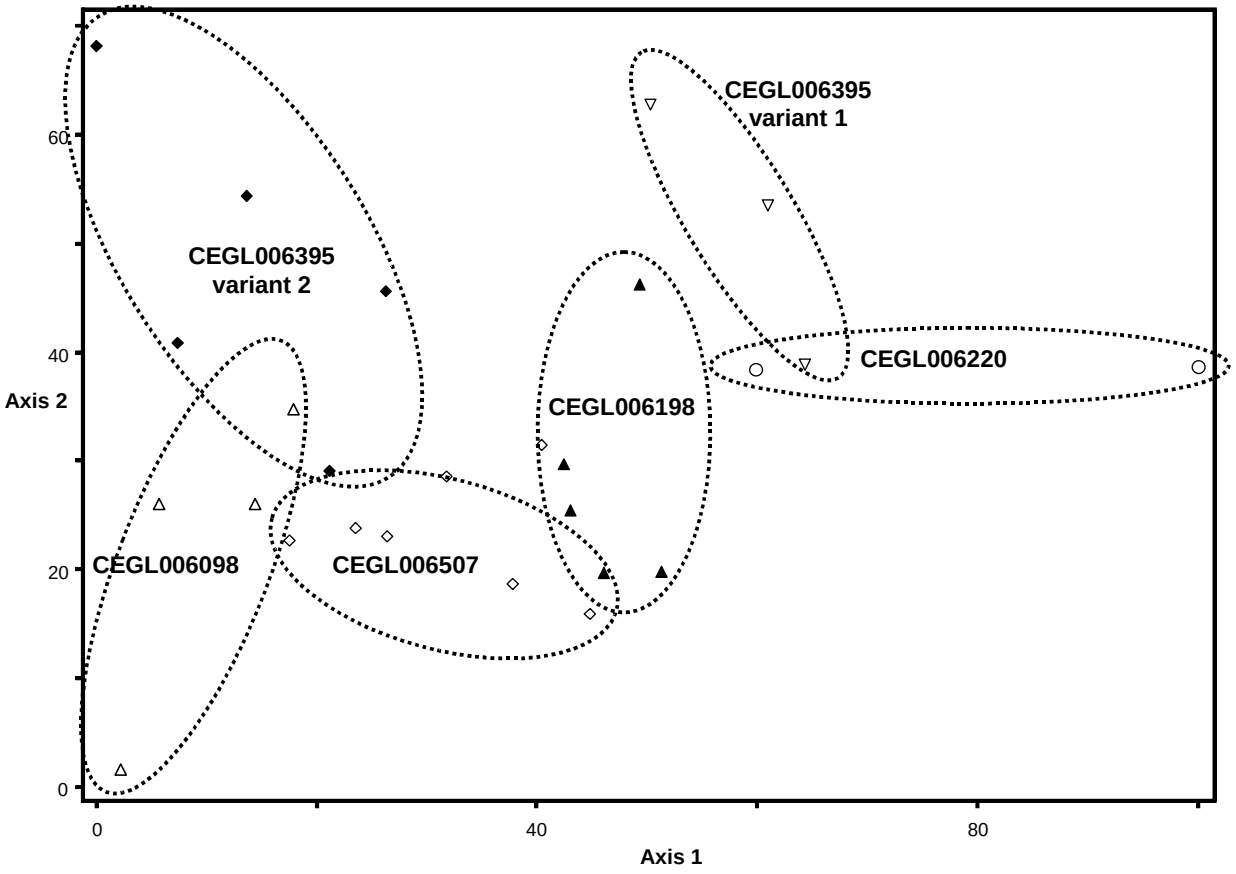


Figure D-9. Detrended Correspondence Analysis ordination of wetland forests and woodland samples, coded by vegetation type. Note that one of the CEGL006507 (Northern White-cedar Wooded Fen) samples falls into the CEGL006198 (Red Maple - Conifer Acidic Swamp) oval rather than the CEGL006507 oval. CEGL006395 variant 1 is the deciduous phase of CEGL006395 (Red Maple Swamp Woodland); CEGL006395 variant 2 is the mixed phase (see text). R2 for the first three axes = .625. Axes are scaled to the percent of the maximum score on axis 1.

Non-forested Uplands

Whereas Acadia is known for its bald summits, non-forested uplands are generally scarce in heavily forested Maine. Six non-forested upland vegetation types were distinguished for Acadia. Detrended Correspondence Analysis ordination of the samples showed the types to divide up fairly neatly, albeit with too few samples for most of the types (Figure D-10). In some cases the low sample numbers are due to natural scarcity of these types in Acadia.

Near the immediate shore, Northern Beachgrass Dune (CEGL006274) and Northern Maritime Rocky Headlands (CEGL006529) are distinctive as herbaceous-dominated types whose composition reflects the constant exposure to salt. The only dune grassland documented in Acadia is at Sand Beach, and this shows the typical dune grassland composition of Ammophila breviligulata dominance. Northern Maritime Rocky Headlands (CEGL006529) is a distinctive coastal type in which the sparse vegetation includes species with floristic alliances to subarctic coastal environments: Rhodalia rosea, Iris setosa var. canadensis, etc. This vegetation extends east from Acadia along the Maine and Canadian Maritime coastline, but Acadia represents its westernmost extent.

Most of the upland vegetation samples fall into the summit complex vegetation (lower left corner of Figure D-10), where the shrub form of the Early Successional Woodland/Forest (CEGL006303) grades into mixed summit shrublands and sparsely vegetated areas of blueberry and three-toothed cinquefoil (together typed as Blueberry Granite Barrens (CEGL005094), but variable). This complex of vegetation includes areas of low sparse vegetation with blueberry, herbs, and lichens, areas of taller (>1 m) non-heath shrubs with scattered spruce, and intermediate areas with huckleberry and other heaths (0.5 – 1 m tall) dotted with low spruce. These three subtypes often form mosaics on summits with extensive open areas.

The remaining open upland type, Crowberry - Bayberry Maritime Shrubland (CEGL006510), combines characteristics of dwarf shrubland vegetation with those of spray-zone vegetation. Like the open summit vegetation, it has a strong dwarf shrub component and features three-toothed cinquefoil, but the prominence of Myrica pensylvanica reveals its near-coastal location. Like the Northern Maritime Rocky Headlands (CEGL006529) type, this is typical of extreme coastal environments from Mount Desert Island east into the Canadian maritimes.

A description of each upland non-forested type is given in Appendix I: Vegetation Descriptions of this report.

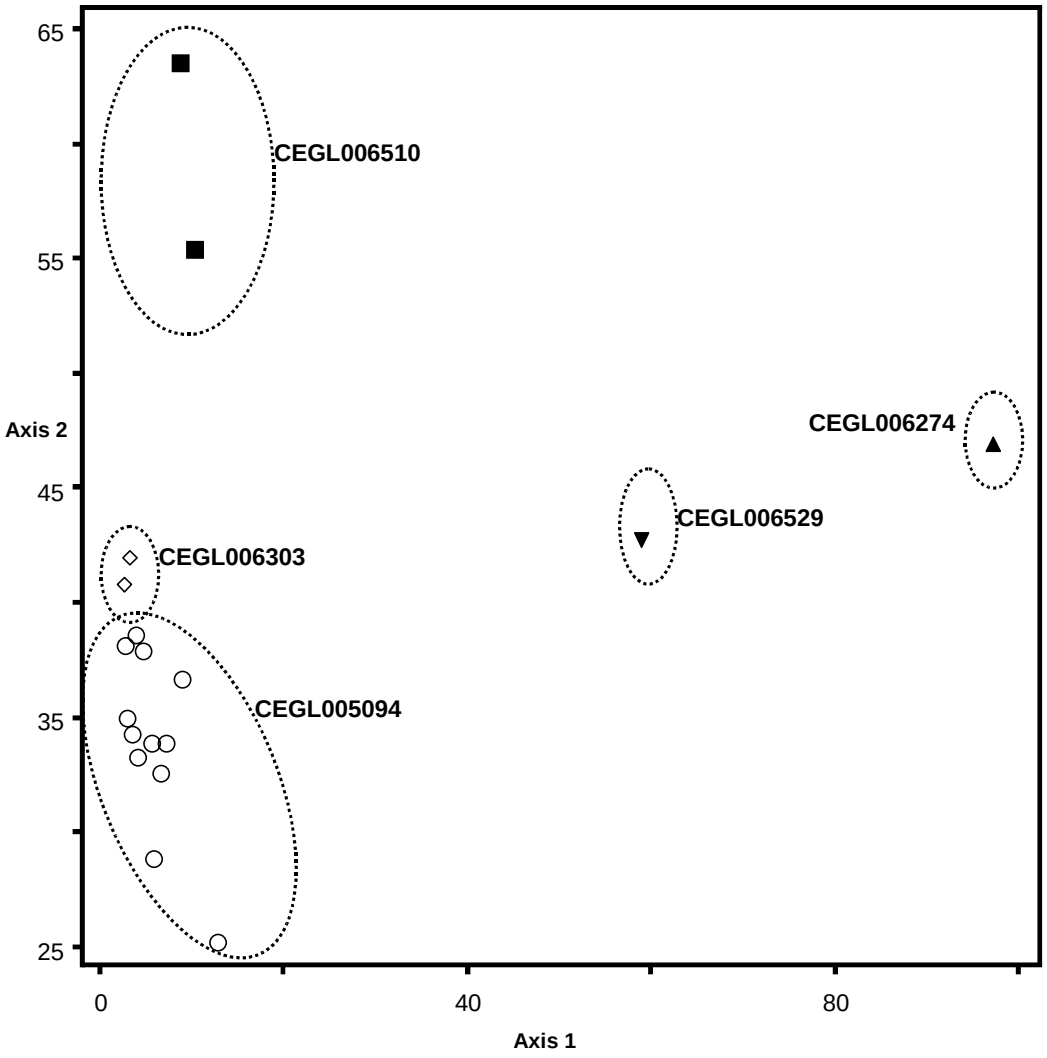


Figure D-10. Upland non-forested vegetation types. The CEGL006303 (Early Successional Woodland/Forest) samples are the two shrubland samples of that physiognomically variable type. Two types, CEGL006106 (Sea-rocket - Oysterleaf Sparse Vegetation) and CEGL006534 (Northern Lichen Talus Barrens had no samples. Axes are scaled to percent of the maximum score on axis 1. R2 for the first three axes = .877.

Non-forested Wetlands

Non-forested wetlands in Acadia include a full array of peatland to marsh to open water wetlands, from freshwater to brackish and saline marshes. Open water marshes (i.e., those that lack persistent emergent vegetation, and these appear as open water on the May aerial photos, but support aquatic plant associations during the growing season) were not sampled; saltmarshes and brackish habitats were minimally sampled (N=2). Of the 19 vegetation types distinguished, we had samples for 13 of those (N=39); however, 9 of those 13 types had 3 or fewer samples. In some cases, this was due to natural scarcity (e.g., Bayonet Rush Herbaceous Vegetation [CEGL006345] type); in others, to lack of sufficient sampling effort (e.g., saline and brackish marshes). The two saltmarsh samples were omitted from the DCA because their marked differences from freshwater wetlands obscured the variation in the latter.

DCA of the 37 non-forested freshwater wetland samples revealed a gradient on the first axis running from dwarf-shrub dominated ombrotrophic peatlands through mineral soil graminoid-shrub marshes, to tall shrub alder wetlands, reflecting elements of nutrient availability, hydrologic regime, and substrate type (Figure D-11). The second axis was dominated by the strongly different Juncus militaris drawdown wetlands, clearly different from all of the other graminoid shallow marsh types (at least based on the two samples of this naturally scarce type).

The mineral-soil wetland samples segregated reasonably well into vegetation types, except for the two alder-dominated shrub wetland types, the Northern Peatland Shrub Swamp (CEGL006158) and the Alluvial Alder Thicket (CEGL006062), which were vegetationally indistinguishable with the 5 samples analyzed. Certain vegetation types are intermediate between clearly mineral-soil wetlands and clearly peatlands. The Eastern Tussock Sedge Meadow (CEGL006412) and the Sweetgale Mixed Shrub Swamp (CEGL006512) types can occur on either organic substrates, or on mineral substrates with a relatively thin organic layer on top. These transitional types fall in the middle of the first ordination axis.

Differences among the various bog and fen (organic soil) vegetation types were expressed on the third axis, after the more dramatic vegetation differences accounted for on the first two axes. The two apparent major gradients here are from ombrotrophy to minerotrophy on the first axis, and from graminoid dominance to dwarf-shrub dominance on the third axis (Figure D-12). The two types with the strongest affinity to near-coastal environments, the Maritime Crowberry Bog (CEGL006248) and the Maritime Peatland Sedge Lawn (CEGL006260), appear at the left side of the ordination diagram, with the other low-nutrient type, Northern Dwarf-shrub Bog (CEGL006225), at the top of the diagram. With more samples, one would likely see overlaps between these types as are seen between the other types in Figure D-12. The four fen vegetation types, Few-seeded Sedge - Leatherleaf Fen (CEGL006524), Leatherleaf Acidic Fen (CEGL006513), Slender Sedge Fen (CEGL006521), and Sweetgale Mixed Shrub Swamp (CEGL006512), show overlap as expected, but all but Slender Sedge Fen (CEGL006521) at least show sufficient separation to support the differences between the concepts for each type. The three Slender Sedge Fen (CEGL006521) samples span the gradient from Few-seeded Sedge - Leatherleaf Fen (CEGL006524) to Sweetgale Mixed Shrub Swamp (CEGL006512) types; however, the Slender Sedge Fen (CEGL006521) type is not well represented in Acadia, and analyses of samples statewide indicate that this is indeed a reasonably well-defined type (Anderson and Davis 1997, Gawler 1998).

A description of each non-forested wetland type is given in Appendix I: Vegetation Descriptions of this report.

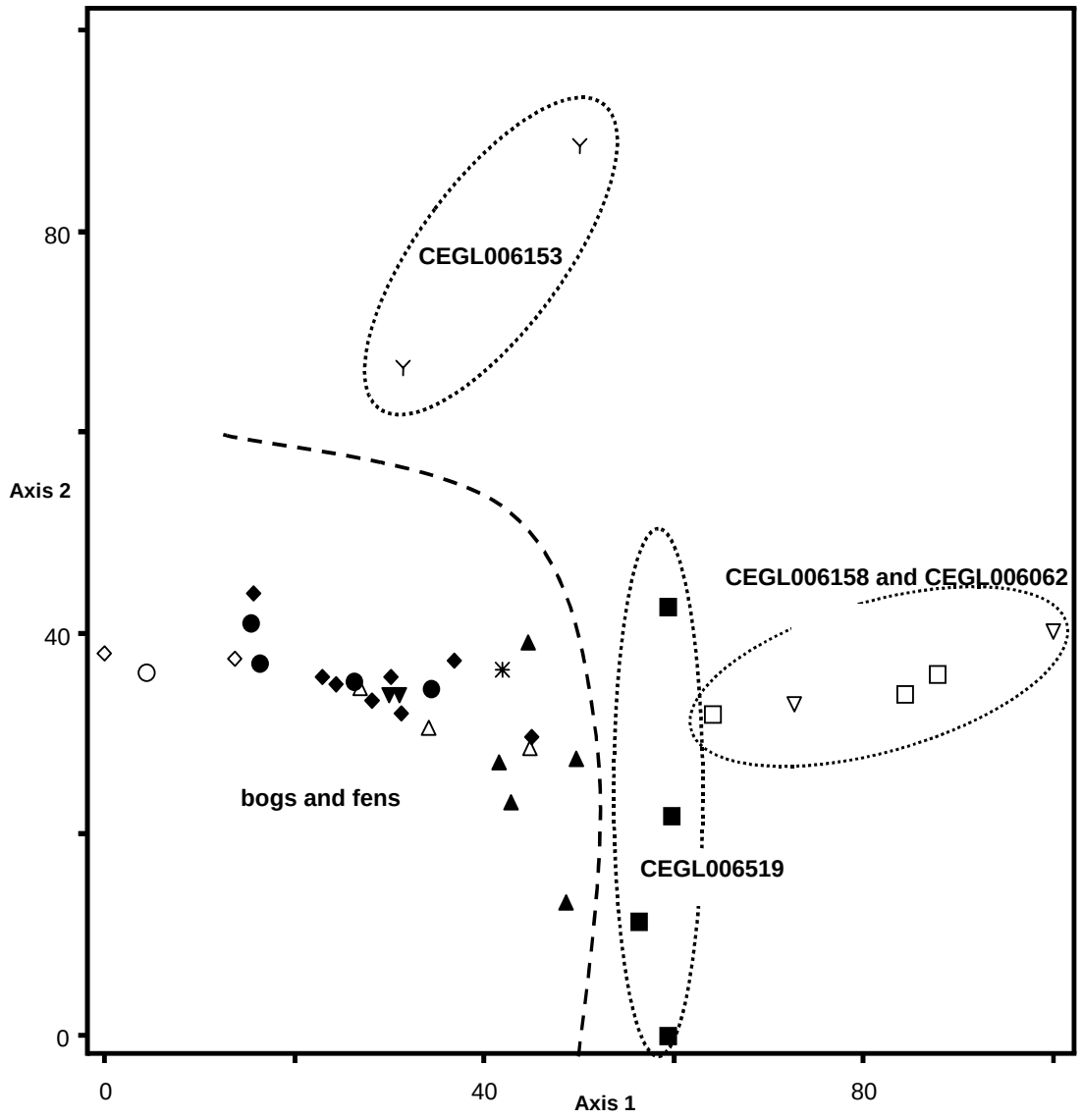


Figure D-11. Non-forested wetland vegetation, excluding saltmarshes: general patterns, with different symbols for different vegetation types. Dashed line separates bogs and fens from mineral-soil wetlands, which are labeled by type. See Figure D-12 for better resolution of bog and fen types. Axes are scaled to percent of the maximum score on axis 1. R2 for the first three axes = .504.

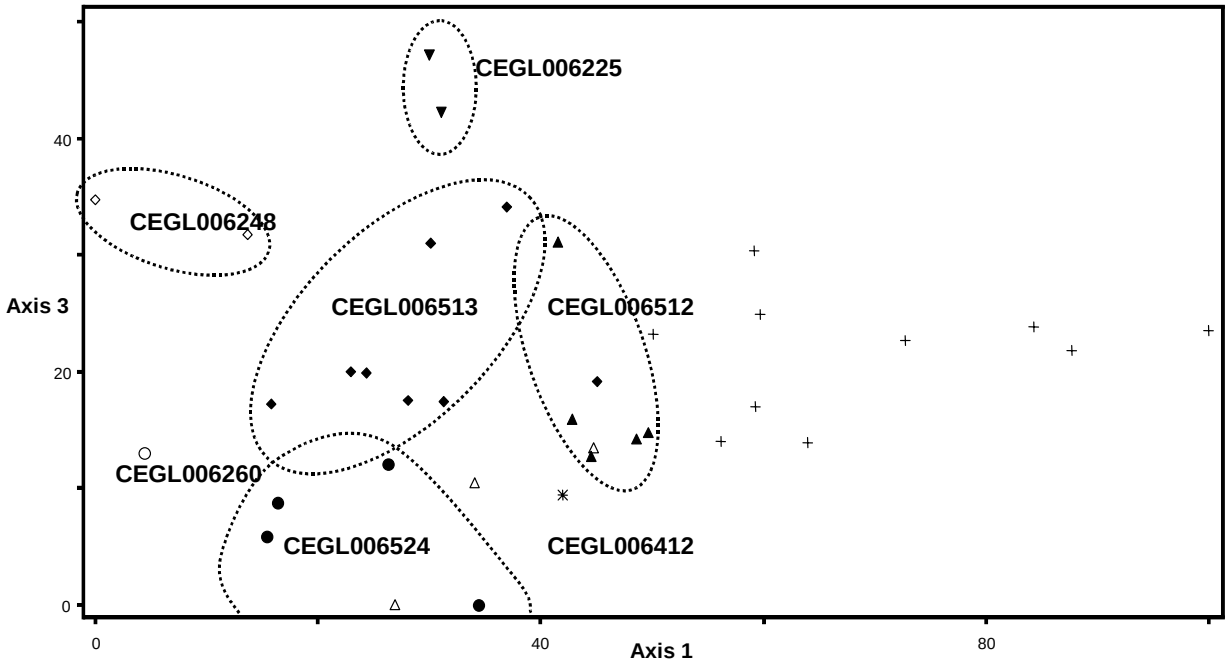


Figure D-12. Axes 1 and 3 of non-forested wetland vegetation ordination (see Figure D-11), showing bog and fen vegetation patterns. Symbols represent different vegetation types, labeled. "+" are mineral-soil wetland samples; see Figure D-11 for those vegetation types. Open triangles are the three CEGL006521 (Slender Sedge Fen) vegetation samples that overlap with CEGL006524 (Few-seeded Sedge - Leatherleaf Fen)and CEGL006512 (Sweetgale Mixed Shrub Swamp)types; also note one CEGL006513 (Leatherleaf Acidic Fen)sample in the CEGL006512 (Sweetgale Mixed Shrub Swamp)oval. CEGL006260 (Maritime Peatland Sedge Lawn) and CEGL006412 (Eastern Tussock Sedge Meadow) types had only one sample each. Axes are scaled to percent of the maximum score on axis 1.

Appendix E

Vegetation Classification Matrix

(National Vegetation Classification System Vegetation Communities – Vegetation Map Classes)

How to use the Vegetation Classification Matrix

In the electronic version, the classification matrix is a separate spreadsheet. The matrix is designed to show the relations between the National Vegetation Classification System association types (vegetation communities) as per NatureServe (2003) and the map classes used in the Acadia National Park vegetation mapping project. The associations are listed in rows and the map class codes are listed in columns. A key to the map class codes is listed to the right of the matrix.

Blue squares signified with an "x" indicate a match or link between associations and map classes. In most instances, there is one blue square where a map class links to an association, signifying a one-to-one relation between a given map class and its corresponding vegetation association.

Some map classes have more than one blue square in their columns. This means that map classes sometimes include more than one association. For example, map class White Pine - Mixed Conifer Forest (WPC) includes two associations: the Eastern Hemlock - White Pine - Red Spruce Forest and the Hemlock - Hardwood Forest associations.

Likewise, some associations have more than one blue square in their rows. This means that some associations are mapped in more than one map class. For example, the Eastern Cattail Marsh association is mapped with two map classes: the Graminoid Shallow Marsh (SMG) and the Open Water - Deep Marsh Complex (OWM).

The numbers at the left of each row (listing the vegetation association) signify the frequency of shared occurances of the vegetation type with other map classes. Likewise, the numbers at the top of each column (listing the map class) signify the frequency of shared occurances of map class of that column with other vegetation types.

A key to map class names is on the right side of the matrix table.

U.S. Geological Survey-National Park Service
Vegetation Mapping Program
Acadia National Park, Maine

Appendix F
Map Class Descriptions and Visual Guide
Revised Edition – October 2003

Introduction

Purpose

This document provides descriptions of map classes used for the Acadia National Park Vegetation Mapping Project. Its purpose is to

- Provide a ground photo image for vegetated map classes,
- Describe each map class from a photointerpretation perspective so that the user may better understand how and why the map coverage was created,
- Describe the link between each map class and the vegetation communities of the National Vegetation Classification System (NVCS),
- Provide an area report for each map class, and
- Provide accuracy assessment results for each map class.

Organization

This document presents descriptions and ground photos of map classes used in the Acadia National Park Vegetation Mapping Project. Map classes that represent a NVCS natural/semi-natural vegetation type(s) are each presented in a uniform format covering one or two pages. Each map class description has the name of the map class and at least one representative ground photo. We discuss the map class from a photointerpreter's perspective, and describe the link between the map class and the vegetation type(s) within the NVCS. We describe map classes that represent cultural types (of NVCS), land use situations, and park specific elements more collectively within their groups.

For each map class representing NVCS types, we provide an area report as per the project's vegetation map describing polygon frequency, area in hectares, and average polygon size (in hectares). The full version of the area report can be found in the main section of the project report. At the bottom of each description, we provide results from the project's accuracy assessment. We report results for producers' and users' accuracy and the confidence intervals, along with detailed information on the types of errors that occurred. The accuracy assessment contingency table can be found in Appendix G: Accuracy Assessment Contingency Matrix.

The map class descriptions are arranged according to physiognomic and hydrologic categories, land use and land cover, and park specific groups. To save space in the report and for readability, the map class codes are used throughout the descriptions. Map class names and codes are found below in Table F-1.

Map Classes and Photointerpretation Mapping

Photointerpretation is discussed in the main report. However, it might be worth reiterating portions of that discussion here. We performed photointerpretation using spring 1997 color infrared (CIR) film transparencies. Ground features were interpreted and delineated onto overlays using stereoscopes. We used each photograph with its matching stereo pairs for 3-dimensional viewing. We then delineated polygons on the overlays defining ground features, assigning classification to each polygon.

We used texture, height, pattern, life form, and position in the landscape in the decision process of delineating polygons and assigning map classes. When applicable, we assigned physiognomic modifiers in conjunction with the map class to describe physiognomic characteristics of the vegetation. Our standard approach is delineating larger polygons first, then continue delineating smaller polygons down to the USGS-NPS Vegetation Mapping Program's standard minimum mapping unit (MMU) of 0.5 hectares (1.25 acres). We mapped small upland islands with vegetation to 0.1 hectares (0.25 acres). The photointerpreted and classified polygon data are represented in the project's vegetation spatial database coverage (vegetation map) for use in geographic information systems.

Table F-1. Map class codes and names used in the Acadia NP Vegetation Mapping Project.

Map Class Code	Map Class Name
Forest - Conifer - Upland	
SF	Spruce - Fir Forest (conifer phase)
WPC	White Pine - Mixed Conifer Forest
WRP	Red Pine - White Pine Forest
Forest - Deciduous - Upland	
MDF	Beech - Birch - Maple Forest
Forest - Mixed - Upland	
OPF	Oak - Pine Forest
SFM	Spruce - Fir Forest (mixed phase)
WPM	White Pine - Hardwood Forest
Woodland - Conifer - Upland	
MCW	Mixed Conifer Woodland
WCW	White Cedar Woodland
JPW	Jack Pine Woodland
PPB	Pitch Pine - Heath Barren
PPC	Pitch Pine - Corema Woodland
PPW	Pitch Pine Woodland
Woodland - Deciduous - Upland	
ABF	Aspen - Birch Woodland/Forest Complex (forest phase)
ABW	Aspen - Birch Woodland/Forest Complex (woodland phase)
ABS	Aspen - Birch Woodland/Forest Complex (shrubland phase)
ROW	Red Oak Woodland
Woodland - Mixed - Upland	
MW	Mixed Conifer - Deciduous Woodland
Forest - Deciduous - Wetland	
MAS	Red Maple - Hardwood Swamp
Woodland - Conifer - Wetland	
CSW	Conifer Swamp Woodland (spruce-mixed phase)
WCS	Conifer Swamp Woodland (white cedar phase)
Dwarf Shrubland - Evergreen - Upland	
CB	Crowberry - Bayberry Headland
Dwarf Shrubland - Deciduous - Upland	
BBSS	Blueberry Bald - Summit Shrubland Complex
Graminoid - Upland	
AM	Dune Grassland
Sparse Vascular - Upland	
SVH	Open Headland - Beach Strand
SVT	Sparsely Vegetated Talus
Shrubland - Deciduous - Wetland	
ASP	Alder Shrubland
SG	Sweetgale Mixed Shrub Fen
Dwarf Shrubland - Evergreen - Wetland	
DSB	Dwarf Shrub Bog
FX	Fen Complex
Graminoid - Wetland	
TG	Tidal Marsh
SMG	Graminoid Shallow Marsh
Forb - Wetland	
OWM	Open Water - Deep Marsh Complex
Tidal Zone	
TZ	Tidal Algal Zone
TB	Tidal Beach
TM	Tidal Mud Flat
Small Island with Vegetation	
SIT	Small Island with Trees
SIS	Small Island with Shrubs
SIG	Small Island with Grass

Map Class Code	Map Class Name
SIR	Small Island with Rock
Cultural Vegetation	
EPL	Evergreen Plantation
SMD	Mixed Deciduous Shrubland
MGF	Mixed Grass - Forb
PGCH	Perennial Grass Crops
PGCS	Perennial Grass Crops with Sparse Shrubs
Non-vegetated Water	
WBP	Beaver Pond (non-vegetated)
WNP	Natural Pond (non-vegetated)
WST	Stream (non-vegetated)
WLK	Lake (non-vegetated)
WO	Ocean - Bay - Estuary (non-vegetated)
Land Use	
UR	Residential
UC	Commercial and Services
UT	Transportation and Roads
UM	Mixed Urban or Built-up Land
UBL	Other Urban or Built-up Land
ARB	Other Agricultural Land
BLQ	Strip Mines, Quarries, and Gravel Pits
No Data	
ND	No Data

Aerial Photographs

General Information about Color Infrared Film

Vegetation reflects more infrared than visible light, and this helps subtle differences in physical characteristics of species to show up as large differences on CIR film. CIR imagery presents a “false color” picture that combines infrared reflectance with green and red visible bands. The differences in reflectance create differences in color that allow the photointerpreter to see the distinguishing features of different plant species and vegetation communities. Reflectance is influenced by structure of the canopy, the orientation of the plants and their leaves, and the thickness and pigment content of leaves. For example, needle foliage of conifers creates internal shadows and the leaves themselves reflect less infrared radiation than hardwoods. This gives them a darker appearance in the CIR than hardwoods such as oak and aspen (Hershey and Befort 1995).

Texture is also important to the photointerpreter for identification. For trees, texture is influenced by type and orientation of leaves, crown size and shape, and branch structure. An uneven canopy height will appear more broken than an even canopy. Similarly, trees having small crowns will appear a finer texture than trees that have large crowns. Depending on the tree species, the texture can be rough or smooth, fine, lacy, billowy, compact, or any number of other descriptors. These are imprecise terms, but nonetheless important visual elements of the imagery. In contrast, herbaceous vegetation, including wetland and upland communities, generally tend to appear much smoother in texture than forests or woodlands (Hershey and Befort 1995).

Color infrared photography is not consistent enough to allow a species or type to be described precisely. Film batch, printing process, sun angle, light intensity, shadow, and exposure can all affect the appearance of CIR photography (Hershey and Befort 1995). Thus, ground verification of every set of photos is imperative to successful interpretation.

Aerial Photography of Acadia National Park

Participants at the project's scoping meeting agreed to acquire aerial photography during spring 1997 so that fieldwork and mapping could get underway during the following summer and fall seasons. CIR photographs were collected May 27 and 28, 1997 at a scale of 1:15,840. More details on the project's aerial photography is provided in the main body of the project report.

In hindsight, spring photography challenged the ability to map the vegetation classification system. Many deciduous types had little or no canopy at the time of photography, affecting our ability to discriminate within forest, woodland, and shrub alliances (e.g., birch-red maple and red oak woodlands) and in our ability to determine percent cover and tree height. Distinguishing vegetation types on the photographs is dependent on relative coverage, so where underdeveloped canopies existed, the interpreter needed to extrapolate to an expected full canopy. For example, oak trees in many places were lacking canopies so that the ground cover was easily viewed rather than the forest or woodland strata. We often attempted to extrapolate the percent canopy cover to later in the growing season, assuming we would be more successful identifying the vegetation type correctly. Unfortunately, we still had difficulty in mapping some stands, especially in determining the relative canopy cover of deciduous trees to evergreens in mixed stands, and in determining the relative canopy cover of individual species in deciduous stands.

Wetland vegetation types (e.g., tall-saturated grasslands, hydromorphic vegetation) were not discernable on the aerial photographs because it was too early in the growing season. Cattails, bulrushes, and other emergent species were barely starting their seasonal growth, thus the photographs revealed only the previous year's dead stalks. In addition, water lilies and submersed aquatic species such as pondweeds had not reached the surface of ponds and thus were not picked up on the photographs.

An example of an aerial photograph is presented below in Figure F-1. A prominent feature is the dark colored water of Eagle Lake. The road to Cadillac Mountain is seen winding up the hill on the east side of the lake (right side of photo). Acadia NP Headquarters can be seen northwest of Eagle Lake (top left corner). This photo exhibits several vegetation types that the map classes define, including upland deciduous and conifer forests, upland and wetland conifer woodlands, bald summits, and dwarf-shrub fen complexes. For purposes of general insight to how vegetation types are presented by the vegetation map, Figure F-2 shows an example of the map coverage in the same area. The vegetation displayed in this example is grouped into physiognomic and hydrologic categories (groups of vegetation types that share similar physiological and hydrological characteristics).

Figure F-1. Example of an aerial photograph collected for the project (not to scale).

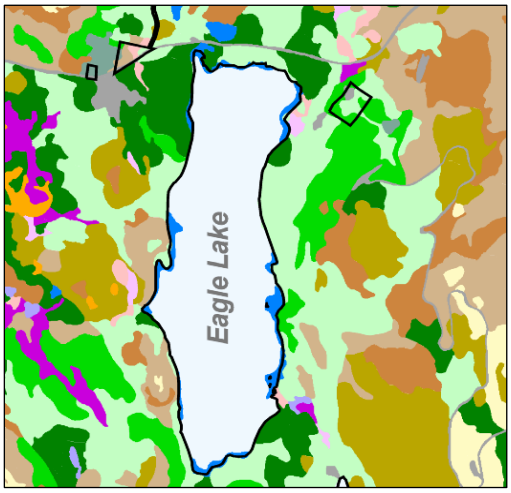


Figure F-2. Example of the project's vegetation map with groups of vegetation communities.

The Role of Fire

Fire is an important factor with Acadia NP's vegetation. The famed 1947 fire that burned most of the eastern side of Mount Desert Island is the most recent extensive fire (Figure F-3), but evidence of past burns is present in trees and soils throughout the park (Patterson et al.1983). Thus, the present vegetation includes areas of 50-year old forest and woodland as well as areas of older mature forest and woodland long-ago disturbance. At Acadia NP, early- to mid-successional processes are superimposed on edaphic and topographic factors, all of which must be considered in assessing the vegetation into community types and map classes.

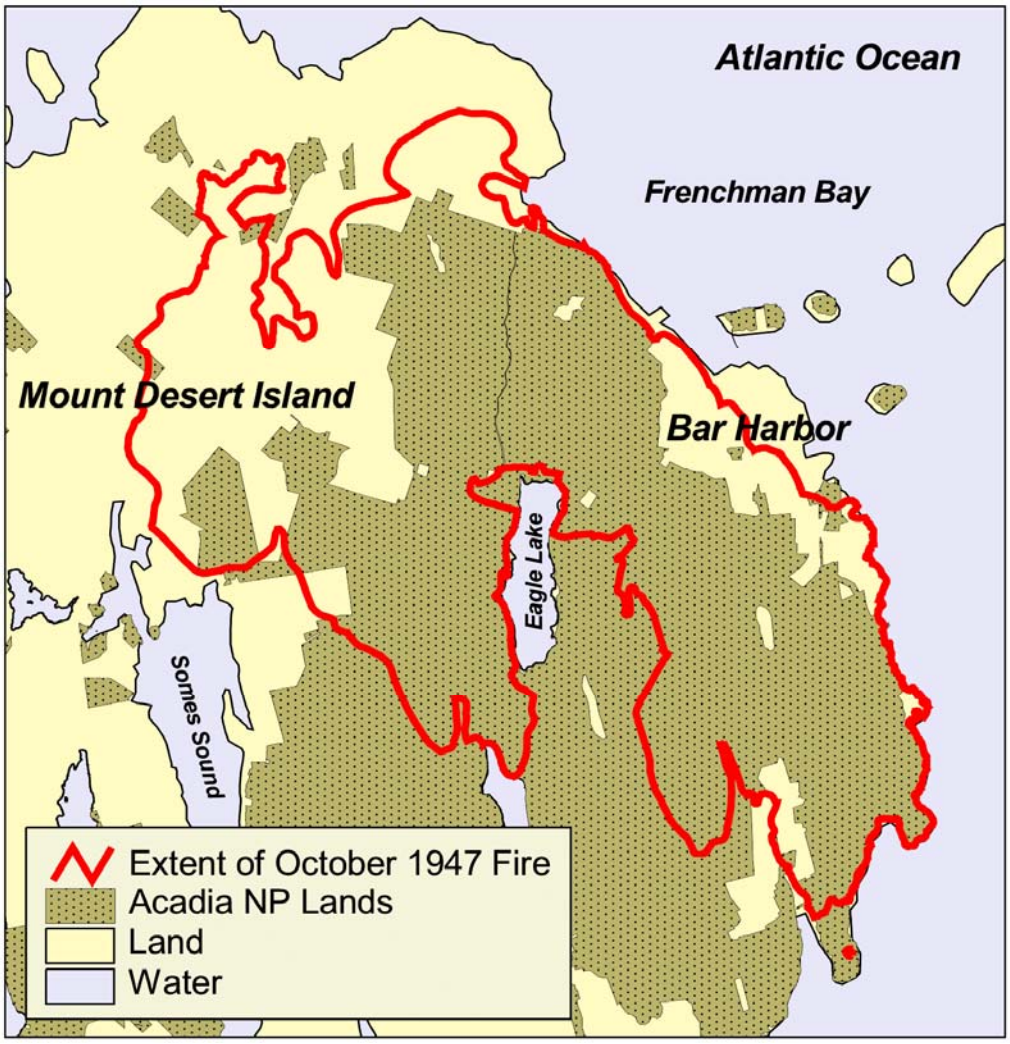


Figure F-3. 1947 fire extent on Mount Desert Island.

Classification

The National Vegetation Classification System

The National Vegetation Classification System (NVCS) is a vegetation-based system that emphasizes natural and existing vegetation. The classification system has been primarily developed and implemented by The Nature Conservancy and their network of Natural Heritage programs over the past twenty years. The classification system is based on and well integrated with the major scientific efforts in the classification of vegetation. For example, the upper levels of the classification hierarchy are a modification of the systems proposed by UNESCO (1973) and Driscoll et al. (1984). The Nature Conservancy and the Natural Heritage Programs have further refined these systems by relating the repeating vegetation associations that occur on the landscape to these earlier systems. The system uses a combined physiognomic and floristic hierarchy. Table F-2 provides an example of the classification hierarchy.

Table F-2. The physiognomic-floristic hierarchy for terrestrial vegetation (from Grossman et al. 1998).

Level	Primary Basis For Classification	Example
Class	Growth form and structure of vegetation	Woodland
Subclass	Growth form characteristics, e.g., leaf phenology	Deciduous woodland
Group	Leaf types, corresponding to climate	Cold-deciduous woodland
Subgroup	Relative human impact (natural/semi-natural or cultural)	Natural/semi-natural
Formation	Additional physiognomic and environmental factors, including hydrology	Temporarily flooded cold-deciduous woodland
Alliance	Dominant/diagnostic species of uppermost or dominant stratum	Populus deltoids temporarily flooded woodland alliance
Association	Additional dominant/diagnostic species from any strata	*Populus deltoides - (Salix amygdaloides) / Salix exigua* woodland

Map Classification

We have devised 58 map classes to describe the vegetation and land features of Acadia NP and environs, as represented in the project's vegetation map. Of these, 33 map classes represent the 53 NVCS natural/semi-natural associations (vegetation communities) identified with this project, as defined by NatureServe. Another three map classes represent NVCS natural/semi-natural types at the alliance or formation level (not the association level), describing beach and tidal zone vegetation. There are five map classes describing cultural vegetation, representing NVCS vegetation at the formation level, three of which fall under the cultivated/planted subgroup. Another four map classes represent variations of small islands with vegetation (project-derived to map islands >0.1 hectares but less than the standard MMU of 0.5 hectares). Level II of the USGS land use and land cover classification (Anderson et al. 1976) is used to define seven land use map classes and three non-vegetated water map classes. Another two map classes are project-derived to map other non-vegetated bodies of water that did not fit into the USGS land use and land cover classification. One last map class describes areas of no map data; areas purposely not mapped, yet fall within the overlying extent of the project boundary. (Again, a listing of the 58 map classes is given in Table F-1.)

Map classes presented in this guide representing natural/semi-natural NVCS types are those defined by the mapping and ecology teams from the Upper Midwest Environmental Sciences Center, The Nature Conservancy, NatureServe, and Maine Natural Areas Program. In some cases, map classes represent one specified NVCS association level type (vegetation community). In other cases, map classes represents groups of vegetation communities. The USGS-NPS Vegetation Mapping Program promotes mapping at

the finest level of the NVCS (the association level) when possible. However, some important distinctions in the vegetation are not always visible on the aerial photograph for interpreting vegetation to the finest classification level. The environmental conditions or diagnostic species that distinguish closely related vegetation types are not always discernible on the imagery. Consequently, some map classes are aggregates of vegetation communities (associations). Table F-3 shows the 33 vegetation map classes with their link to the NVCS natural/semi-natural associations of Acadia NP.

To offer a point of clarification, a map polygon assigned with a map class that represents an aggregate of vegetation communities might characterize simply one of the vegetation communities or a mix of some or all of the communities. For example, let us assume Map Class A represents as a whole Vegetation Types 1, 2, and 3 (e.g., grouped together because of a mapping limitation). A particular map polygon classified as Map Class A might characterize Vegetation Types 1 and 3 at that location, where another polygon mapped elsewhere, again classified as Map Class A, might characterize Vegetation Type 2. When we describe on the following pages that a map class represents more than one vegetation community, we wish the reader to know that a particular map polygon may characterize one, some, or all vegetation types listed.

Table F-3. Map class crosswalk to NVCS natural/semi-natural vegetation communities (associations) of Acadia National Park.

Vegetation Map Classes (Map Class Code - Map Class Name)	NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Note: not all vegetation communities and map classes have a 1:1 relationship.				
Forest - Conifer - Upland				
SF - Spruce - Fir Forest (conifer phase)	*Picea rubens - Picea glauca* Forest	Maritime Spruce - Fir Forest	CEGL006151	I.A.8.N.c.15
WPC - White Pine - Mixed Conifer Forest	*Pinus strobus - Tsuga canadensis - Picea rubens* Forest AND/OR *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest	Eastern Hemlock - White Pine - Red Spruce Forest AND/OR Hemlock - Hardwood Forest	CEGL006324 AND/OR CEGL006129	I.A.8.N.b.13 AND/OR I.C.3.N.a.32
WRP - Red Pine - White Pine Forest	*Pinus strobus - Pinus resinosa / Cornus canadensis* Forest	Red Pine - White Pine Forest	CEGL006253	I.A.8.N.b.14
Forest - Deciduous - Upland				
MDF - Beech - Birch - Maple Forest	*Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest	Northern Hardwood Forest	CEGL006252	I.B.2.N.a.4
Forest - Mixed - Upland				
OPF - Oak - Pine Forest	*Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest, *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest, *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest, *Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland, AND/OR *(Pinus strobus, Quercus rubra) / Danthonia spicata* Acid Bedrock Wooded Herbaceous Vegetation	Successional Oak - Pine Forest, White Pine - Oak Forest, Sugar Maple - White Pine Forest, Central Appalachian High-Elevation Red Oak Woodland, Northern Variant, AND/OR White Pine - Red Oak Bedrock Glade	CEGL006506, CEGL006293, CEGL005005, CEGL006134, AND/OR CEGL005101	I.B.2.N.a.39, I.C.3.N.a.21, I.C.3.N.a.300, II.B.2.N.a.24, AND/OR V.A.5.N.e.8
SFM - Spruce - Fir Forest (mixed phase)	*Picea rubens - Abies balsamea - Betula* spp. - *Acer rubrum* Forest AND/OR *Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forest	Successional Spruce - Fir Forest AND/OR Red Spruce - Hardwoods Forest	CEGL006505 AND/OR CEGL006267	I.C.3.N.a.4
WPM - White Pine - Hardwood Forest	*Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest, *Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest, AND/OR *Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest	Successional Oak - Pine Forest, Hemlock - Hardwood Forest, AND/OR Sugar Maple - White Pine Forest	CEGL006506, CEGL006129, AND/OR CEGL005005	I.B.2.N.a.39, I.C.3.N.a.32, AND/OR I.C.3.N.a.300

Vegetation Map Classes (Map Class Code - Map Class Name)	NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Woodland - Conifer - Upland				
MCW - Mixed Conifer Woodland	*Thuja occidentalis - Fraxinus pennsylvanica / Acer pensylvanicum* Woodland, *Picea rubens / Vaccinium angustifolium - Sibbaldiopsis tridentata* Woodland, *Picea rubens / Ribes glandulosum* Woodland, AND/OR *Picea mariana / Kalmia angustifolia* Woodland	Cedar Seepage Slope, Spruce - Fir Rocky Summit, Red Spruce Talus Slope Woodland, AND/OR Black Spruce / Heath Rocky Woodland	CEGL006508, CEGL006053, CEGL006250, AND/OR CEGL006292	II.A.4.N.b.1, II.A.4.N.b.3, AND/OR II.A.4.N.b.400
WCW - White Cedar Woodland	*Thuja occidentalis / Gaylussacia baccata - Vaccinium angustifolium* Woodland AND/OR *Thuja occidentalis - Fraxinus pennsylvanica / Acer pensylvanicum* Woodland	White-cedar Woodland AND/OR Cedar Seepage Slope	CEGL006411 AND/OR CEGL006508	II.A.4.N.b.1
JPW - Jack Pine Woodland	*Pinus banksiana / Kalmia angustifolia - Vaccinium* spp. Woodland	Jack Pine Heath Barren	CEGL006041	II.A.4.N.a.9
PPB - Pitch Pine - Heath Barren	*Pinus rigida / Vaccinium* spp. - *Gaylussacia baccata* Woodland	Pitch Pine / Blueberry spp. - Huckleberry Woodland	CEGL005046	II.A.4.N.a.26
PPC - Pitch Pine - Corema Woodland	*Pinus rigida / Corema conradii* Woodland	Coastal Pitch Pine Outcrop Woodland	CEGL006154	II.A.4.N.a.26
PPW - Pitch Pine Woodland	*Pinus rigida / Photinia melanocarpa / Deschampsia flexuosa - Schizachyrium scoparium* Woodland	Pitch Pine Rocky Summit	CEGL006116	II.A.4.N.a.26
Woodland - Deciduous - Upland				
ABF - Aspen - Birch Woodland/Forest Complex (forest phase)	*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland	Early Successional Woodland/Forest	CEGL006303	II.B.2.N.a.10
ABW - Aspen - Birch Woodland/Forest Complex (woodland phase)	*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland AND/OR *Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland	Early Successional Woodland/Forest AND/OR Red Oak Talus Slope Woodland	CEGL006303 AND/OR CEGL006320	II.B.2.N.a.10 AND/OR II.B.2.N.a.24
ABS - Aspen - Birch Woodland/Forest Complex (shrubland phase)	*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland	Early Successional Woodland/Forest	CEGL006303	II.B.2.N.a.10
ROW - Red Oak Woodland	*Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest AND/OR *Quercus rubra - (Quercus prinus) / Vaccinium* spp. / *Deschampsia flexuosa* Woodland	Successional Oak - Pine Forest AND/OR Central Appalachian High-Elevation Red Oak Woodland, Northern Variant	CEGL006506 AND/OR CEGL006134	I.B.2.N.a.39 AND/OR II.B.2.N.a.24

Vegetation Map Classes (Map Class Code - Map Class Name)	NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Woodland - Mixed - Upland				
MW - Mixed Conifer - Deciduous Woodland	*Picea rubens / Vaccinium angustifolium - Sibbaldiopsis tridentata* Woodland, *Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland, AND/OR *(Pinus strobus, Quercus rubra) / Danthonia spicata* Acid Bedrock Wooded Herbaceous Vegetation	Spruce - Fir Rocky Summit, Early Successional Woodland/Forest, AND/OR White Pine - Red Oak Bedrock Glade	CEGL006053, CEGL006303, AND/OR CEGL005101	II.A.4.N.b.3, II.B.2.N.a.10, AND/OR V.A.5.N.e.8
Forest - Deciduous - Wetland				
MAS - Red Maple - Hardwood Swamp	*Acer rubrum - Fraxinus* spp. */ Nemopanthus mucronatus - Vaccinium corymbosum* Forest AND/OR *Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis* Woodland	Northern Hardwood Seepage Swamp AND/OR Red Maple Swamp Woodland	CEGL006220 AND/OR CEGL006395	I.B.2.N.e.1 AND/OR II.B.2.N.e.1
Woodland - Conifer - Wetland				
CSW - Conifer Swamp Woodland (spruce-mixed phase)	*Picea rubens - Acer rubrum / Nemopanthus mucronatus* Forest AND/OR *Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum* sp. Woodland	Red Maple - Conifer Acidic Swamp AND/OR Black Spruce Woodland Bog	CEGL006198 AND/OR CEGL006098	I.C.3.N.d.10 AND/OR II.A.4.N.f.13
WCS - Conifer Swamp Woodland (white cedar phase)	*Thuja occidentalis - Abies balsamea / Ledum groenlandicum / Carex trisperma* Woodland AND/OR *Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum* sp. Woodland	Northern White-cedar Wooded Fen AND/OR Black Spruce Woodland Bog	CEGL006507 AND/OR CEGL006098	II.A.4.N.f.11 AND/OR II.A.4.N.f.13
Dwarf Shrubland - Evergreen - Upland				
CB - Crowberry - Bayberry Headland	*Morella pensylvanica - Empetrum nigrum* Dwarf-shrubland	Crowberry - Bayberry Maritime Shrubland	CEGL006510	IV.A.1.N.b.7
Dwarf Shrubland - Deciduous - Upland				
BBSS - Blueberry Bald - Summit Shrubland Complex	*Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland	Blueberry Granite Barrens	CEGL005094	IV.B.2.N.a.1
Graminoid - Upland				
AM - Dune Grassland	*Ammophila breviligulata - Lathyrus japonicus* Herbaceous Vegetation	Northern Beachgrass Dune	CEGL006274	V.A.5.N.c.2

Vegetation Map Classes (Map Class Code - Map Class Name)	NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Sparse Vascular - Upland				
SVH - Open Headland - Beach Strand	*Solidago sempervirens - (Rhodiola rosea) - Juniperus horizontalis* Sparse Vegetation AND/OR *Cakile edentula* ssp. *edentula - Mertensia maritima* Sparse Vegetation	Northern Maritime Rocky Headlands AND/OR Sea-rocket - Oysterleaf Sparse Vegetation	CEGL006529 AND/OR CEGL006106	VII.A.2.N.a.4 AND/OR VII.C.2.N.a.2
SVT - Sparsely Vegetated Talus	*Polypodium (virginianum, appalachianum) / Lichen* spp. Nonvascular Vegetation	Northern Lichen Talus Barrens	CEGL006534	VI.B.1.N.c.300
Shrubland - Deciduous - Wetland				
ASP - Alder Shrubland	*Alnus incana - Cornus sericea / Clematis virginiana* Shrubland AND/OR *Alnus incana* ssp. *rugosa - Nemopanthus mucronatus / Sphagnum* spp. Shrubland	Alluvial Alder Thicket AND/OR Northern Peatland Shrub Swamp	CEGL006062 AND/OR CEGL006158	III.B.2.N.d.9 AND/OR III.B.2.N.e.9
SG - Sweetgale Mixed Shrub Fen	*Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland	Sweetgale Mixed Shrub Swamp	CEGL006512	III.B.2.N.g.9
Dwarf Shrubland - Evergreen - Wetland				
DSB - Dwarf Shrub Bog	*Kalmia angustifolia - Chamaedaphne calyculata - (Picea mariana) / Cladina* spp. Dwarf-shrubland AND/OR *Trichophorum caespitosum - Gaylussacia dumosa / Sphagnum (fuscum, rubellum, magellanicum)* Herbaceous Vegetation	Northern Dwarf-shrub Bog AND/OR Maritime Peatland Sedge Lawn	CEGL006225 AND/OR CEGL006260	IV.A.1.N.g.1 AND/OR V.A.5.N.h.1
FX - Fen Complex	*Alnus incana - Cornus sericea / Clematis virginiana* Shrubland, *Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland, *Kalmia angustifolia - Chamaedaphne calyculata - (Picea mariana) / Cladina* spp. Dwarf-shrubland, *Empetrum nigrum - Gaylussacia dumosa - Rubus chamaemorus / Sphagnum* spp. Dwarf-shrubland, *Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland, *Carex stricta - Carex vesicaria* Seasonally Flooded Herbaceous Vegetation, *Calamagrostis canadensis - Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation, *Carex (lasiocarpa, utriculata, canescens)* Herbaceous Vegetation, AND/OR *Carex (oligosperma, exilis) - Chamaedaphne calyculata* Shrub Herbaceous Vegetation	Northern Peatland Shrub Swamp, Sweetgale Mixed Shrub Swamp, Northern Dwarf-shrub Bog, Maritime Crowberry Bog, Leatherleaf Acidic Fen, Eastern Tussock Sedge Meadow, Seasonally Flooded Mixed Graminoid Meadow, Slender Sedge Fen, AND/OR Few-seeded Sedge - Leatherleaf Fen	CEGL006158, CEGL006512, CEGL006225, CEGL006248, CEGL006513, CEGL006412, CEGL006519, CEGL006521, AND/OR CEGL006524	III.B.2.N.e.9, III.B.2.N.g.9, IV.A.1.N.g.1, IV.A.1.N.g.4, V.A.5.N.k.36, V.A.5.N.k.39, V.A.5.N.m.7, AND/OR V.A.7.N.o.3

Vegetation Map Classes (Map Class Code - Map Class Name)	NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code
Graminoid - Wetland				
TG - Tidal Marsh	*Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation AND/OR *Spartina patens - Distichlis spicata - (Juncus gerardii)* Herbaceous Vegetation	Brackish Tidal Marsh, Cattail Variant AND/OR Spartina High Salt Marsh	CEGL004201 AND/OR CEGL006006	V.A.5.N.n.2 AND/OR V.A.5.N.n.11
SMG - Graminoid Shallow Marsh	*Carex stricta - Carex vesicaria* Seasonally Flooded Herbaceous Vegetation, *Calamagrostis canadensis - Scirpus* spp. - *Dulichium arundinaceum* Herbaceous Vegetation, *Juncus militaris* Herbaceous Vegetation, *Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation, AND/OR *Carex (lasiocarpa, utriculata, canescens)* Herbaceous Vegetation	Eastern Tussock Sedge Meadow, Seasonally Flooded Mixed Graminoid Meadow, Bayonet Rush Herbaceous Vegetation, Eastern Cattail Marsh, AND/OR Slender Sedge Fen	CEGL006412, CEGL006519, CEGL006345, CEGL006153, AND/OR CEGL006521	V.A.5.N.k.36, V.A.5.N.k.39, V.A.5.N.l.3, V.A.5.N.l.9, AND/OR V.A.5.N.m.7
Forb - Wetland				
OWM - Open Water - Deep Marsh Complex	*Eriocaulon aquaticum - Lobelia dortmanna* Herbaceous Vegetation, *Typha (angustifolia, latifolia) - (Schoenoplectus* spp.) Eastern Herbaceous Vegetation, *Schoenoplectus (tabernaemontani, acutus)* Eastern Herbaceous Vegetation, *Vallisneria americana - Potamogeton perfoliatus* Herbaceous Vegetation, AND/OR *Nuphar lutea* ssp. *advena - Nymphaea odorata* Herbaceous Vegetation	Seven-angle Pipewort - Dortmann's Cardinal-flower Herbaceous Vegetation, Eastern Cattail Marsh, Bulrush Deepwater Marsh, Open Water Marsh with Mixed Submergents/Emergents, AND/OR Water Lily Aquatic Wetland	CEGL006346, CEGL006153, CEGL006275, CEGL006196, AND/OR CEGL002386	V.A.5.N.l.2, V.A.5.N.l.9, V.A.5.N.l.16, V.C.2.N.a.17, AND/OR V.C.2.N.a.102

Map Attribute Codes and Conventions

In addition to applying map classes to polygon mapping, we interpreted the physiognomic features of the vegetation of that polygon. We added physiognomic modifier classes to the map classes for all polygons defining vegetation (whether natural or cultural). These physiognomic classes describe the growth structure of the vegetation within a polygon (Table F-4).

To ascribe map class and physiognomic modifier information to interpreted polygons, we assigned map attribute codes. A map attribute code is made up of a map class code and a physiognomic modifier code. The following briefly explains the conventional practice for applying map attribute codes to polygons. The format first applies the map class, and then (separated by a hyphen) a combination of alternating alpha and numeric codes for the physiognomic modifiers. The result is a string of codes to describe in detail the features of a mapped polygon.

The attribute code begins with the ***map class code***, which represents either a vegetation type(s) or a land use or land cover feature. The map class code is made up of 2 to 4 ***alpha*** characters. *Examples:*

SF, PPW, MW, BBSS, MAS

A series of physiognomic modifier codes follow the map class code when applicable. A ***hyphen*** is placed between the map class code and the string of physiognomic modifier codes. All vegetation map class codes receive physiognomic modifier codes.

The first physiognomic modifier code represents ***Coverage Density***. It describes the coverage (a percent range) of the vegetation that the map class is representing within the polygon. Typically, the modifier defines the coverage of the higher plant life form (e.g., density of tree canopy, not density of tree canopy and shrub layer). The modifier is a single ***numeric*** code. All vegetation map class codes receive this modifier. *Examples:*

SF-**1,** PPW-**2**, MW-**2**, BBSS-**2**, MAS-**1**

The second physiognomic code represents ***Coverage Pattern***. It describes the pattern or distribution of the vegetation that the map class is representing within the polygon. Like the density modifier, the pattern modifier typically defines the growth pattern of the higher plant life form. This modifier is a single ***alpha*** code and follows the Coverage Density numeric code. All vegetation map class codes receive this modifier. *Examples:*

SF-1**A** PPW-2**B**, MW-2**B**, BBSS-2**C**, MAS-1**A**

The third physiognomic code represents ***Height***. It describes the average height of woody terrestrial vegetation that the map class is representing within the polygon. There is no representation within the map code of whether the height is indicative of average or super-canopy. The modifier is a single ***numeric*** code and follows the Coverage Pattern alpha code. Only map classes representing vegetation types under the NVCS forest, woodland, shrubland, and dwarf-shrubland Formation classes receive this modifier. *Examples:*

SF-1A**3** PPW-2B**4**, MW-2B**4**, MAS-1A**3**

More information about the Acadia NP Vegetation Mapping Project and the USGS-NPS Vegetation Mapping Program can be found on the Internet at http://biology.usgs.gov/npsveg.

Table F-4. Key to physiognomic modifier codes.

Coverage Density (all vegetation map classes)
1 - Closed Canopy/Continuous (60-100% coverage)
2 - Open Canopy/Discontinuous (25-60% coverage)
3 - Dispersed-Sparse Canopy (10-25% coverage)
Coverage Pattern (all vegetation map classes)
A - Evenly Dispersed
B - Clumped/Bunched
C - Gradational/Transitional
D - Regularly Alternating
Height (forest, woodland, shrubland, & dwarf-shrubland map classes)
1 - 30-50 meters (98-162 feet)*
2 - 20-30 meters (65-98 feet)
3 - 12-20 meters (40-65 feet)
4 - 5-12 meters (16-40 feet)
5 - 0.5-5 meters (1.5-16 feet)
6 - <0.5 meters (<1.5 feet)
** Height code "1" was not used for ACAD vegetation mapping*

Map Classification Descriptions

The following pages are descriptions to map classes that we used for the Acadia NP Vegetation Mapping Project.

Spruce - Fir Forest (conifer phase, SF)

The Spruce - Fir Forest (conifer phase) map class (SF) is a red spruce dominated forest with varying proportions of balsam fir and other conifers at relatively low abundance. Deciduous species are sometimes present but together comprise <25% of the relative cover. The canopy cover ranges from closed to sometimes patchy in areas with blowdown openings.

SF has a dark to medium red conifer signature. The texture varies from somewhat fine in areas of continuous cover to a choppier, more open cover in patchy areas. SF grades into SFM, which is the mixed phase (>25% deciduous). It also grades into WPC when white pine reaches about 25% relative cover.

SF was mapped at various landscape positions, aspects, and all elevations, although less frequent at the highest elevations. It is most common outside the 1947 fire area.

The SF map class represents one NVCS association: Maritime Spruce - Fir Forest.

Polygons: 933, Hectares: 12,865, Average size (h): 14

Accuracy Assessment Results

SF was assessed with SFM (mixed phase) for accuracy assessment. From a mapping perspective, SF and SFM are clearly expressed as separate types in some instances, but also grade into one another to such an extent that we allowed inclusions of either one in the other.

Producers' accuracy: 71% (Confidence interval 61% - 81%)
Users' accuracy: 73% (Confidence interval 63% - 83%)

Errors in **producers' accuracy** were associated with map classes White Pine - Mixed Conifer Forest (WPC, 1 error), Mixed Conifer Woodland (MCW, 7 errors), White Pine - Hardwood Forest (WPM, 7 errors), Beech – Birch - Maple Forest (MDF, 1 error), White Cedar Woodland (WCW, 1 error), Aspen - Birch Woodland/Forest Complex (forest phase, ABF, 1 error), Red Maple - Hardwood Swamp (MAS, 1 error), Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 1 error). Errors in **users' accuracy** were associated with map classes Mixed Conifer Woodland (MCW, 6 errors), Aspen - Birch Woodland/Forest Complex (forest phase, ABF, 4 errors), Beech - Birch - Maple Forest (MDF, 2 errors), Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 4 errors), and Red Pine - White Pine Forest (WRP, 1 error).

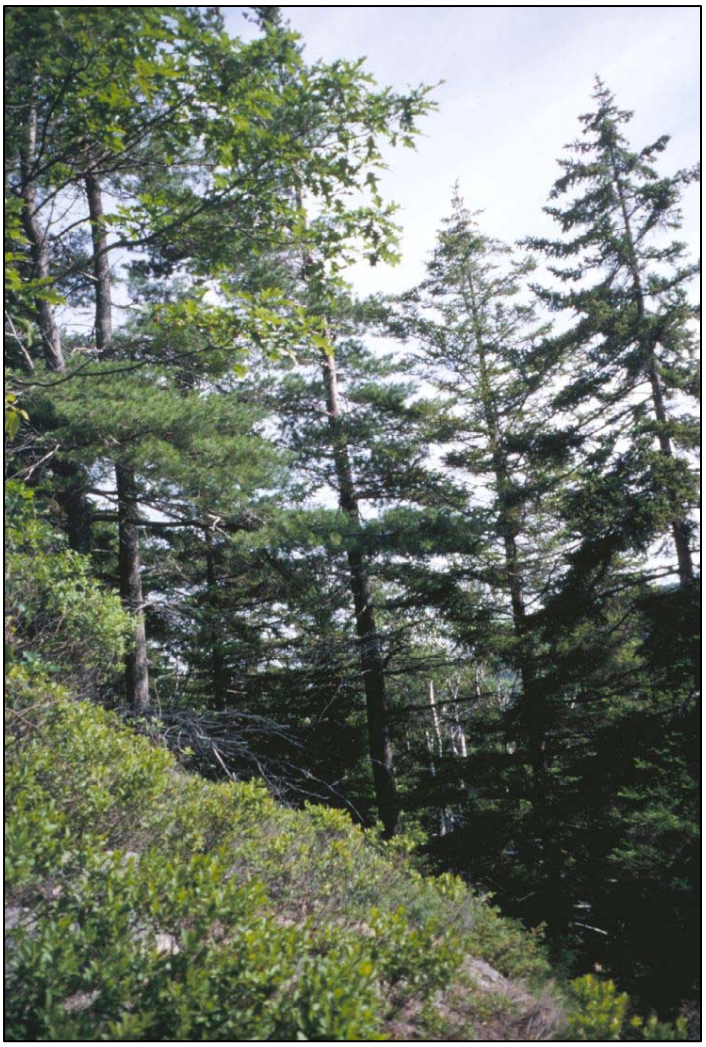
Spruce - Fir Forest (conifer phase, SF)

Accuracy Assessment Results, cont.

Special Notes:

Many mapping errors were caused by disagreements of "forest" versus "woodland" between the mappers and AA team, and to the closely associated WPM. In addition, mapped stands of SFM were occasionally assessed as the deciduous type ABF even though there was 30 to 50% relative cover of evergreen in the canopy or subcanopy. Polygons missed to CSW/WCS and to WRP were due to photo limitations, or in one case, the interpreter overlooked a black spruce stand.

White Pine - Mixed Conifer Forest (WPC)



The White Pine - Mixed Conifer Forest map class (WPC) is a conifer forest with at least 25% relative canopy cover of white pine. Red spruce is also dominant, and may occupy up to 75% relative canopy cover. Balsam fir, cedar, and hemlock are also often present, but at relatively low abundance. Deciduous species are sometimes present but together comprise <25% of the relative cover. The canopy cover ranges from closed to somewhat open.

WPC has a medium to dark red conifer signature. Its chief characteristic is the distinctive star-shaped branching pattern of the white pines. The texture of the map class tends to be somewhat choppy, as often the white pines are taller than the other tree species. WPC grades into SF when white pine drops to <25% relative canopy and into MCW when exposed bedrock is apparent on the photos. It also grades into WPM when the deciduous component reaches >25% relative cover.

WPC was mapped mostly at lower elevations and slopes. It is most common outside the 1947 fire area.

The WPC map class represents two NVCS associations: Eastern Hemlock - White Pine - Red Spruce Forest and Hemlock - Hardwood Forest.

Polygons: 111, Hectares: 545, Average size (h): 5

Accuracy Assessment Results

Producers' accuracy: 83% (Confidence interval 66% - 101%)
Users' accuracy: 79% (Confidence interval 61% - 97%)

Errors in **producers' accuracy** were associated with map classes White Pine - Hardwood Forest (WPM, 2 errors). Errors in **users' accuracy** were associated with map classes Mixed Conifer Woodland (MCW, 3 errors), and Spruce - Fir Forest (mixed phase, SFM, 1 error).

Special Notes:
Errors in accuracy assessment are all related to closely associated vegetation types. Nearly all errors were due to "lumping" smaller polygons of related vegetation types in with larger polygons of WPC.

Red Pine - White Pine Forest (WRP)

The Red Pine - White Pine Forest map class (WRP) is relatively uncommon map class dominated by red pine. White pine, red spruce, and deciduous species may also be present, but together comprise <25% of the relative canopy cover. The canopy cover varies from closed to somewhat open.

WRP has an orange-red conifer signature. The texture is fine in closed stands, and coarser in stands that are more open. If present, white pine has a noticeable star-shaped branching pattern.

WRP was mapped mostly on dryer slopes or mid elevation ridges. It is similar to WPC but has more red pine in the canopy (>75% relative cover). It grades into MCW when the canopy opens up and exposed bedrock is visible on the photos. It grades into WPC when red pine drops to <75% relative cover.

The WRP map class represents one NVCS association: Red Pine - White Pine Forest.

Polygons: 9, Hectares: 17, Average size (h): 2

Accuracy Assessment Results

Producers' accuracy: 83% (Confidence interval 50% - 117%)
Users' accuracy: 100% (Confidence interval 90% - 110%)

Errors in **producers' accuracy** were associated with map class Spruce - Fir Forest (conifer phase, SF, 1 error).

Special Notes:
Stands dominated by red pine were easy to map because of the distinctive signature color. The one WRP mapped as SF was not at all recognizable on the photo as WRP.

Beech - Birch - Maple Forest (MDF)

The Beech - Birch - Maple Forest map class (MDF) is a deciduous forest with <25% relative canopy cover of conifers. The dominant species are beech, sugar maple, and yellow birch. The canopy cover is closed once the leaves have fully grown.

MDF has a light pink, fluffy signature with a soft texture. The signature is created primarily by the beech trees, which were just leafing out when the aerial photos were taken. This characteristic was used as the primary cue for recognizing MDF from other deciduous forest types. MDF grades into SFM when conifers reach 25% relative cover. It also grades into ABF where birch and aspen dominate rather than beech.

MDF was mapped typically at low to mid elevations and slopes throughout the park.

The MDF map class represents one NVCS association: Northern Hardwood Forest.

Polygons: 54, Hectares: 382, Average size (h): 7

Accuracy Assessment Results

Producers' accuracy: 78% (Confidence interval 62% - 95%)
Users' accuracy: 69% (Confidence interval 52% - 86%)

Errors in **producers' accuracy** were associated with map class Spruce - Fir Forest (conifer phase, SF, 2 errors), White Pine - Hardwood Forest (WPM, 1 error), and Mixed Conifer - Deciduous Woodland (MW, 2 errors). Errors in **users' accuracy** were associated with map class Aspen - Birch Woodland/Forest Complex (forest phase, ABF, 7 errors) and Spruce - Fir Forest (mixed phase, SFM, 1 error).

Special Notes:
Spring photography often created difficulties in confidently separating ABF from MDF. Stands assessed as ABF and incorrectly mapped as MDF were stands where birch co-dominated. Birch, which is often a component in both map classes, resembles beech in color but has less of beech's fluffy character.

Oak - Pine Forest (OPF)

The Oak Pine Forest map class (OPF) is a broad map class characterized by forest stands dominated by white pine and red oak, or by a forest consisting of a mix of white pine, red spruce, red oak, and early successional tree species. OPF generally has a relative cover >25% of both white pine and red oak or successional deciduous species.

OPF has two primary signatures. In some of the polygons, especially in the burned area of MDI where the trees are relatively young, OPF appears as a mosaic pattern of oak and pine. In the non-burned areas of MDI, the pines and oaks tend to be mature forests and are more evenly mixed. Oak trees were just beginning to leaf out at the time of photography, and much of the tan, grassy understory is visible.

OPF was typically mapped at low to mid elevations and slopes. This map class grades into ROW, and MW (where oak and pine co-dominate) when occurring on bedrock. It also grades into SFM where pine becomes less common.

The OPF map class represents five NVCS associations: Successional Oak - Pine Forest (which occurs in the burned area of MDI), White Pine - Oak Forest, Sugar Maple - White Pine Forest, Central Appalachian High-Elevation Red Oak Woodland, Northern Variant, and the White Pine - Red Oak Bedrock Glade.

Polygons: 48, Hectares: 497, Average size (h): 10

Accuracy Assessment Results

Producers' accuracy: 70 (Confidence interval 52 - 88%)
Users' accuracy: 89% (Confidence interval 74% - 104%)

Errors in **producers' accuracy** were associated with the following map classes: Aspen - Birch Woodland/Forest Complex (forest phase, ABF, 4 errors), White Pine - Hardwood Forest (WPM, 1 error), and the Mixed Conifer - Deciduous Woodland (MW, 2 errors). Errors in **users' accuracy** were associated with Mixed Conifer Woodland (MCW, 1 error) and the Aspen - Birch Woodland/Forest Complex (woodland phase, ABW, 1 error).

Special Notes:
OPF is a broad class that includes several related associations. These associations have signatures on the aerial photos that often overlap in appearance with each other, especially in transitional areas.

Spruce - Fir Forest (mixed phase, SFM)

The Spruce - Fir Forest (mixed phase) map class (SFM) is characterized by a red spruce dominated forest in which the canopy is >25% deciduous. Red maple is usually the dominant deciduous tree, and red oak, bigtooth aspen, or paper birch are often present. Varying proportions of balsam fir and other conifers are also associates. The canopy cover ranges from closed to sometimes patchy in areas with blowdown openings.

SFM has a dark to medium red conifer signature, mixed with the lighter tones of deciduous species. The texture varies from somewhat fine in areas of continuous cover to a choppier, more open cover in patchy areas.

SFM was mapped at various landscape positions, aspects, and all elevations, although less frequent at the highest elevations. SFM grades into SF, the conifer phase. It also grades into WPC when white pine reaches about 25% relative cover.

The SFM map class represents two NVCS associations: Successional Spruce - Fir Forest and Red Spruce Hardwood Forest.

Polygons: 686, Hectares: 8371, Average size (h): 12

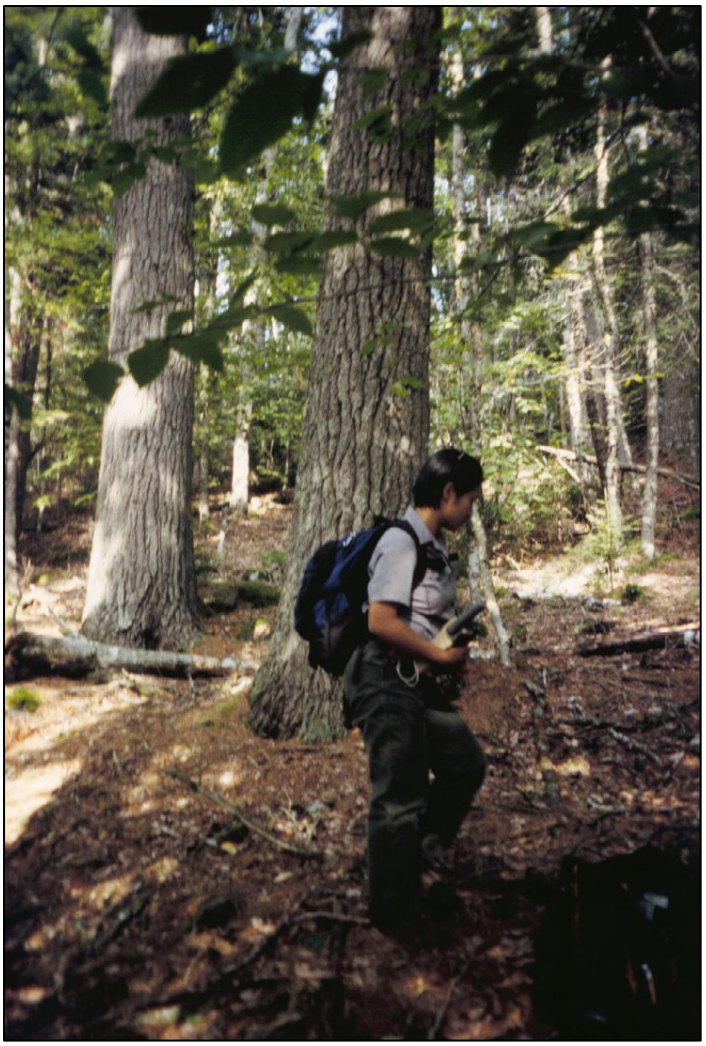
Accuracy Assessment Results

SFM was assessed with SF (conifer phase) for accuracy assessment. From a mapping perspective, SFM and SF are clearly expressed as separate types in some instances, but also grade into one another to such an extent that we allowed inclusions of either one in the other.

Producers' accuracy: 71% (Confidence interval 61% - 81%)
Users' accuracy: 73% (Confidence interval 63% - 83%)

See Spruce - Fir Forest (conifer phase) map class (SF) for details.

White Pine - Hardwood Forest (WPM)



The White Pine - Hardwood Forest map class (WPM) is a mixed forest type in which white pine or hemlock co-dominates with early successional species or with northern hardwoods. The pine and deciduous components each have >25% of the relative canopy cover. Red spruce is a common associate. The canopy cover ranges from closed to somewhat open.

WPM has a medium to dark red conifer signature mixed with the lighter tones of the deciduous species. The texture tends to be somewhat choppy, as often the white pines are taller than the other tree species. WPM grades into SFM when white pine drops to <25% relative canopy. It grades into MW when exposed bedrock is apparent on the photos. It also grades into WPC when the deciduous component reaches <25% relative cover or to MDF when conifers become <25% relative cover.

WPM was mapped mostly at lower elevations and slopes. It is most common outside the 1947 fire area.

The WPM map class represents three NVCS associations: Successional Oak - Pine Forest, Hemlock - Hardwood Forest and Sugar Maple - White Pine Forest.

Polygons: 191, Hectares: 1,787, Average size (h): 9

Accuracy Assessment Results

Producers' accuracy: 86% (Confidence interval 72% - 101%)
Users' accuracy: 54% (Confidence interval 39% - 70%)

Errors in **producers' accuracy** were associated with the following map classes: Aspen - Birch Woodland/Forest Complex (forest phase, ABF, 1error) and Mixed Conifer - Deciduous Woodland (MW, 2 errors). Errors in **users' accuracy** were associated with the following map classes: Spruce - Fir Forest (mixed phase, SFM, 7 errors), White Pine - Mixed Conifer Forest (WPC, 2 errors), Beech - Birch - Maple Forest (MDF, 1 error), Oak - Pine Forest (OPF, 1 error), Aspen Birch Woodland/Forest Complex (forest phase, ABF, 1 error), and Oak Pine Mixed Conifer - Deciduous Woodland (MW, 4 errors).

Special Notes:

Several polygons mapped as WPM were identified as SFM on the ground. Most of these errors occurred because of transitional areas were more closely related to SFM, or in some cases, patches of SFM that were large enough to map were not "pulled out" of larger WPM polygons. The 1 error to MDF is related to the Hemlock - Hardwood Forest association (which falls in the WPM map class) and can be transitional to MDF.

Mixed Conifer Woodland (MCW)

The Mixed Conifer Woodland map class (MCW) is a variable class encompassing woodlands dominated by red spruce, white pine, or a mixture of conifers. Canopy cover is generally <60%. Bare rock and heath shrubs are evident.

MCW has a dark red conifer signature with a rough texture. The canopy is open with patches of bare rock and sometimes heath shrubs showing. Often, individual conifer species are identifiable, and some stands are clearly dominated by red spruce or white pine. Other stands may be dominated by cedar or black spruce, but these two species are often unrecognizable from other conifers. These woodlands are similar to, and can grade into PPW and, as canopy increases, SF.

Mixed conifer woodlands were mapped throughout the park. They occur as relatively small polygons at most elevations on slopes, ridge tops, and all aspects.

The MCW map class represents four NVCS associations: Cedar Seepage Slope, Spruce - Fir Rocky Summit, Red Spruce Talus Slope Woodland, and Black Spruce / Heath Rocky Woodland. Cedar Seepage Slope is a vegetation type that is not mappable because its characteristics are not visible on the photos. The black and red spruce types are both included within this map class because black spruce is difficult to tell from red spruce in an upland setting.

Polygons: 663, Hectares: 2327, Average size (h): 4

Accuracy Assessment Results

Producers' accuracy: 75% (Confidence interval 65% - 84%)
Users' accuracy: 81% (Confidence interval 72% - 90%)

Errors in **producers' accuracy** were associated with the map class Spruce - Fir Forest (conifer and mixed phases, SF and SFM, 6 errors), Pitch Pine Woodland (PPW, 2 errors), Mixed conifer - Deciduous Woodland (MW, 1 error). Errors in **users' accuracy** were associated with map classes Spruce Fir Forest (conifer and mixed phases, SF and SFM, 7 errors), White Cedar Woodland (WCW, 1 error), Pitch Pine Woodland (PPW, 1 error), Aspen Birch Woodland Forest complex (woodland phase, ABW, 1error), Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 1 error), and Blueberry Bald - Summit Shrubland Complex (BBSS, 1 error).

Special Notes:
As noted above, 6 polygons mapped as MCW were actually found to be Spruce - Fir Forest on the ground. The reason these errors occurred were because the canopy cover was borderline between forest and woodland, and mapper interpreted the canopy cover to be less than interpretation by the AA team.

White Cedar Woodland (WCW)

The White Cedar Woodland map class (WCW) is dominated by cedar in an upland setting.

Canopy cover is generally < 60%, but may be as high as 80%. Bare rock and heath shrubs are usually evident, especially when canopy cover is low. The closed version appears very similar to SF, especially on steep slopes where the angle obscures the shapes of the trees.

WCW has a dark red conifer signature. Distinguishing WCW from Mixed Conifer Woodland and from SF was difficult at best because the signature of cedars is usually not distinct from other conifers, especially small spruce and fir. Thus, cedar woodlands are likely under represented. Many were mapped based on knowledge gained from ground-truthing.

WCW occurs at most elevations on slopes, ridge tops, and at all aspects.

The WCW map class represents two NVCS associations: White-cedar Woodland and Cedar Seepage Slope.

Polygons: 8, Hectares: 163, Average size (h): 20

Accuracy Assessment Results

Producers' accuracy: 75% (Confidence interval 27% - 123%)
Users' accuracy: 60% (Confidence interval 14% - 106%)

Errors in **producers' accuracy** were associated with the Mixed Conifer Woodland map class (MCW, 1 error). Errors in **users' accuracy** were associated with map classes Spruce - Fir Forest (conifer phase, SF, 1 error) and Aspen - Birch Woodland/Forest Complex (forest phase, ABF, 1 error).

Special Notes:
Confidence intervals are very wide due to low number of accuracy assessment points.

Jack Pine Woodland (JPW)

The Jack Pine Woodland map class (JPW) is dominated by jack pine. Canopy cover is generally <60%. Bare rock and heath shrubs are evident. JPW occur on bedrock at low to mid elevations. Most occur near the coast, but one polygon was mapped on Cadillac Mountain.

JPW has a brownish conifer signature with a popcorn ball like texture. The signature is undistinguishable from pitch pine signatures. Rock outcrops and heath shrubs are visible through the open canopy.

JPW was mapped very near the coast, on Schoodic Peninsula. One exception is a stand on Cadillac Mountain, which also contains pitch pine. Many of the stands mapped were previously located during ground excursions to Schoodic Peninsula.

The JPW map class represents one NVCS association: Jack Pine Heath Barren.

Polygons: 40, Hectares: 84, Average size (h): 2

Accuracy Assessment Results

Producers' accuracy: 100% (Confidence interval 90% - 110%)
Users' accuracy: 71% (Confidence interval 36% - 107%)

Errors in **users' accuracy** were associated with map classes Pitch Pine Woodland (PPW, 1 error) and Mixed Woodland (MW, 1 error).

Special Notes:
Mapping of JPW was based on knowledge of known stands.

Pitch Pine Heath Barren (PPB)

The Pitch Pine Heath Barren map class (PPB) is dominated by pitch pine over a dense layer of heath shrubs. Canopy cover is below <60%. PPB is a rare map class, found only on Long Island.

PPB has a brownish conifer signature with a popcorn ball-like texture. The heath shrub understory is visible between the trees. Red spruce is also visible as scattered dark red conifers. Unlike other pitch pine woodlands, rock outcrops are not visible on the photos. The canopy is very open.

The PPB map class represents one NVCS association: Pitch Pine / Blueberry spp. - Huckleberry Woodland.

Polygons: 3, Hectares: 9, Average size (h): 3

Accuracy Assessment Results

Producers' accuracy: 100% (Confidence interval 50% - 150%)
Users' accuracy: 100% (Confidence interval 50 - 150%)

Special Notes:
Only one accuracy assessment point was collected for PPB, thus the especially wide confidence intervals.

Pitch Pine - Corema Woodland (PPC)

The Pitch Pine - Corema Woodland map class (PPC) is dominated by pitch pine with a prominent dwarf shrub layer. PPC is a variant of the PPW distinguished by the presence of broom crowberry in the dwarf shrub layer. Canopy cover is <60%. PPC woodlands occur on bedrock in close proximity to the coast.
Only one polygon of PPC was mapped near Wonderland on Mount Desert Island.

PPC has a brownish conifer signature with a popcorn ball-like texture. The understory of heath shrubs is visible. PPC is indistinguishable from PPW, but was mapped based on field knowledge. Other stands of PPC likely occur, but may be mapped as PPW.

The PPC map class represents one NVCS association: Coastal Pitch Pine Outcrop Woodland.

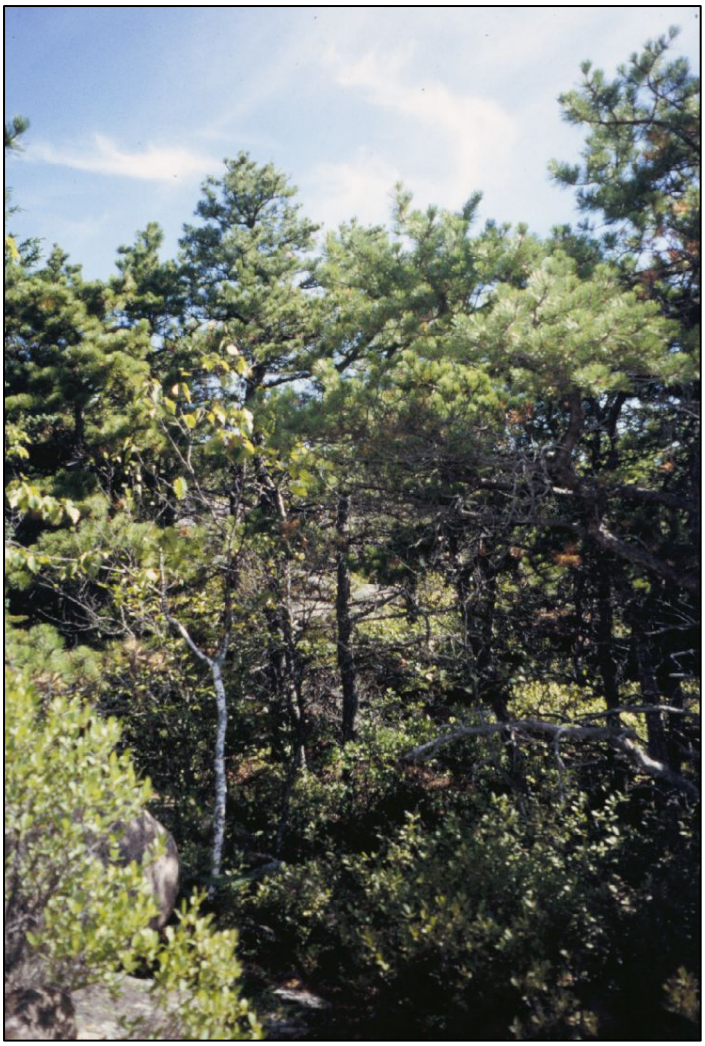
Polygons: 1, Hectares: 5, Average size (h): 5

Accuracy Assessment Results

Producers' accuracy: 100 %(Confidence interval 50% - 150%)
Users' accuracy: 100% (Confidence interval 50% - 150%)

Special notes:
Only one accuracy assessment point was collected for PPC, thus the especially wide confidence intervals.

Pitch Pine Rocky Summit (PPW)



The Pitch Pine Woodland map class (PPW) is dominated by pitch pine. Canopy cover is generally <60%. Bedrock is usually exposed, and dwarf shrubs are usually visible between the trees.

PPW has a brownish conifer signature with a popcorn ball-like texture. Rock outcrops and heath shrubs are visible through the open canopy. PPW can grade into MCW when pitch pine becomes <60% of the relative canopy cover. However, judging relative canopy cover among a stand of conifers was difficult at best.

PPW was mapped on middle to upper slopes and crests.

The PPW map class represents one NVCS association: Pitch Pine Rocky Summit.

Polygons: 47, Hectares: 380, Average size (h): 8

Accuracy Assessment Results

Producers' accuracy: 84% (Confidence interval 70% - 98%)
Users' accuracy: 84% (Confidence interval 70% - 98%)

Errors in **producers' accuracy** were associated with map classes Mixed Conifer Woodland (MCW, 1 error), Jack Pine Woodland (JPW, 1 error), and Mixed Conifer - Deciduous Woodland (MW, 2 errors). Errors in **users' accuracy** were associated with map classes Aspen - Birch Woodland/Forest Complex (woodland phase, ABW, 1 error), Mixed Conifer - Deciduous Woodland (MW, 1 error), and Mixed Conifer Woodland (MCW, 2 errors).

Aspen - Birch Woodland/Forest Complex (forest phase, ABF)

The Aspen - Birch Woodland/Forest Complex (forest phase) map class (ABF) is the forest phase of three compositionally similar map classes that are mapped separately because of their different physiognomic characteristics. ABF has a forest appearance with a somewhat closed-canopy and a tree height that averages around 50 - 60 feet (16 - 20 m). ABF is dominated by aspen species (either trembling or bigtooth) and to some extent, red maple. Birches are often present.

ABF has a light yellow to pink deciduous tree signature with a somewhat smooth texture. The canopy was just beginning to leaf out at the time of the photography and thus is variable in color.

ABF occurs at low elevations and at all aspects. It is mostly found within the 1947 fire area.

The ABF map class represents one NVCS association: Early Successional Woodland/Forest. This association has three physiognomic subtypes that blend into each other with all intermediate variations present. At the time of mapping, ABF was considered a distinct vegetation type from ABW and ABS. Nevertheless, it was a difficult type to map because all three phases blend into one another. In addition, ABF grades into ROW and OPF map classes when oak becomes dominant, and into MDF when beech becomes dominant. It also grades into SFM when spruce reaches >25%.

Polygons: 172, Hectares: 1,184, Average size (h): 7

Accuracy Assessment Results

The ABF map class was assessed with the two other map class phases within the complex (ABW and ABS) because the three map classes share the same vegetation community.

Producers' accuracy: 68% (Confidence interval 58% - 78%)
Users' accuracy: 86% (Confidence interval 78% - 94%)

Errors in **producers' accuracy** are associated with map classes Beech - Birch - Maple Forest (MDF, 7 errors), Spruce - Fir Forest (mixed phase, SFM, 5 errors), White Pine - Hardwood Forest (WPM, 1 error), the Mixed Conifer Woodland (MCW, 1 error), White Cedar Woodland (WCW, 1 error), Red Oak Woodland (ROW, 2 errors), Red Maple - Hardwood Swamp (MAS, 2 errors), Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 1 error), and Blueberry Bald - Summit Shrubland Complex (BBSS, 1 error).

Aspen - Birch Woodland/Forest Complex (forest phase, ABF), cont.

Accuracy Assessment Results, cont.

Errors in **users' accuracy** are associated with Spruce - Fir Forest (conifer phase, SF, 1 error), Oak - Pine Forest (OPF, 4 errors), White Pine - Hardwood Mix (WPM, 1 error), Red Maple - Hardwood Swamp (MAS, 1 error), Blueberry Bald - Summit Shrubland Complex (BBSS, 1 error), and Sparsely Vegetated Talus map class (SVT, 1 error).

Special Notes:

Spring photography often created difficulties in confidently separating ABF from MDF. Stands assessed as MDF and incorrectly mapped as ABF were stands where birch co-dominated, or where beech was proportionally higher than mapper realized. Birch, which is often a component in both map classes, resembles beech in color but has less of beech's fluffy character. In addition, two MDT slopes, which are wooded, were mistaken for forest because of photo angle, which obscured mapper's ability to see the woodland character.

Aspen - Birch Woodland/Forest Complex (woodland phase, ABW)

The Aspen - Birch Woodland/Forest Complex (woodland phase) map class (ABW) is the woodland phase of three compositionally similar map classes that are mapped separately because of their different physiognomic characteristics. ABW has a woodland appearance with an open canopy. Tree height is generally less than ABF. ABW is similar in composition to ABF, dominated by aspen species (either trembling or bigtooth) and to some extent, red maple. Birches are often present.

ABW has a light yellow to pink deciduous tree signature with a somewhat smooth texture. The canopy is open, and rock outcrops are visible.

ABW occurs at low elevations and at all aspects. It is mostly found within the 1947 fire area.

The ABW map class represents two NVCS associations: Early Successional Woodland/Forest and Birch - Oak Talus Woodland. The Early Successional Woodland/Forest association has three physiognomic subtypes that blend into each other with all intermediate variations present. At the time of mapping, ABW was considered a distinct vegetation type from ABF and ABS. Nevertheless, it was a difficult type to map because all three phases blend into one another. In addition, ABW grades into the Mixed Conifer - Deciduous Woodland when spruce reach >25%, and to ROW when oak becomes dominant.

Polygons: 25, Hectares: 219, Average size (h): 9

Accuracy Assessment Results

The ABW map class was assessed with the two other map class phases within the complex (ABF and ABS) because the three map classes share the same vegetation community.

Producers' accuracy: 68% (Confidence interval 58% - 78%)
Users' accuracy: 86% (Confidence interval 78% - 94%)

See Aspen - Birch Woodland/Forest Complex (forest phase) map class (ABF) for details.

Aspen - Birch Woodland/Forest Complex (shrubland phase, ABS)

The Aspen - Birch Woodland/Forest Complex map class (ABS) is the shrubland phase of three compositionally similar map classes that are mapped separately because of their physiognomic characteristics. ABS is dominated by stunted gray birch and red spruce, each reaching canopy cover > 25%.

ABS has a light yellow to pink deciduous tree signature mixed with a somewhat smooth texture. The dark red conifer signature of red spruce is mixed throughout the deciduous signature. The proportion of red spruce to the deciduous tree species is highly variable. The canopy is open, and rock outcrops are visible.

ABS was mapped mostly found within the 1947 fire area. It occurs at low elevations and at all aspects.

The ABS map class represents one NVCS association: Early Successional Woodland/Forest. This association has 3 physiognomic subtypes that blend into each other with all intermediate variations present. At the time of mapping, ABS was considered a distinct vegetation type from ABF and ABW. Nevertheless, it was a difficult type to map because the phases blend into one another. In addition, ABS grades into the Mixed Conifer - Deciduous Woodland as tree height increases, and to ROW when oak dominates.

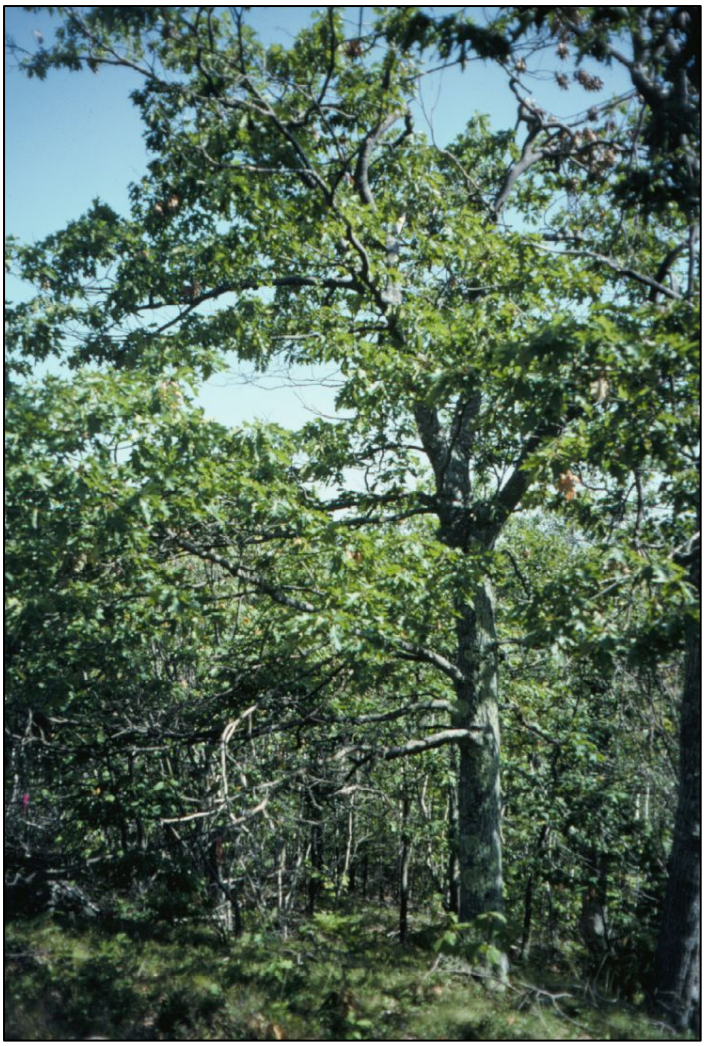
Polygons: 8, Hectares: 105, Average size (h): 13

Accuracy Assessment Results
The ABS map class was assessed with the two other map class phases within the complex (ABF and ABW) because the three map classes share the same vegetation community.

Producers' accuracy: 68% (Confidence interval 58% - 78%)
Users' accuracy: 86% (Confidence interval 78% - 94%)

See Aspen - Birch Woodland/Forest Complex (forest phase) map class (ABF) for details.

Red Oak Woodland (ROW)



The Red Oak Woodland map class (ROW) is dominated by red oak. Other species often present include bigtooth aspen, birch, and red maple. Canopy cover varies from below <60% to more closed.

ROW has a yellowish signature that is primarily the understory grasses. The oak canopy was not leafed out when the aerial photos were taken, so canopy cover is minimal. The canopy cover was estimated from the distance between trees, which appeared as dark lines on the photos. In places, a partial canopy of bigtooth aspen and birch trees is scattered within the oak signature. Bedrock is visible in many polygons where the environment is most woodland-like. In other polygons, ROW reaches near forest appearance, with trees growing close together and no evidence of rock.

ROW occurs primarily on slopes within the portion of the park burned in the 1947 fire, although some stands occur outside the burned area as well.

The ROW map class represents two NVCS associations: Successional Oak - Pine Forest (where pine is lacking) and Central Appalachian High-Elevation Red Oak Woodland, Northern Variant.

Polygons: 62, Hectares: 549, Average size (h): 9

Accuracy Assessment Results

Producers' accuracy: 100% (Confidence interval 98% - 102%)
Users' accuracy: 92% (Confidence interval 82% - 103%)

Errors in **users' accuracy** are associated with the Aspen - Birch Woodland/Forest Complex map class (woodland phase, ABW, 2 errors).

Mixed Conifer - Deciduous Woodland (MW)

The Mixed Conifer - Deciduous Woodland map class (MW) is a highly variable map class encompassing woodlands with a mixture of conifers and deciduous species, each reaching >25% relative canopy. Canopy cover is <60%. MW occurs on bedrock.

MW was mapped throughout the area on lower to upper slopes and ridge tops.

MW has a dark red conifer signature interspersed with lighter deciduous tree signatures, usually oak and/or birch. The canopy is open with patches of bare rock and sometimes heath shrubs showing. Most stands include red spruce or white pine representing the conifer element. These woodlands are similar to, and can grade into MCW when deciduous tree species become <25%. MW can also grade into SF.

The MW map class represents three NVCS associations: Spruce - Fir Rocky Summit, Early Successional Woodland/Forest, and White Pine - Red Oak Bedrock Glade.

Polygons: 243, Hectares: 1497, Average size (h): 6

Accuracy Assessment Results

Producers' accuracy: 69% (Confidence interval 54% - 84%)
Users' accuracy: 69% (Confidence interval 54% - 84%)

Errors in **producers' accuracy** were associated with map classes White Pine - Mixed Conifer Forest (WPC, 3 errors), Oak - Pine Forest (1 error), White Pine - Hardwood Forest (WPM, 4 errors), Jack Pine Woodland (JPW, 1 error), and Pitch Pine Woodland (1 error). Errors in **users' accuracy** were associated with White Pine - Mixed Conifer Forest (WPC, 1 error), Beech - Birch - Maple Forest (MDF, 2 errors), Oak - Pine Forest (OPF, 2 errors), White Pine - Hardwood Forest (WPM, 2 errors), Mixed Conifer Woodland (MCW, 1 error), and Pitch Pine Woodland (PPW, 2 errors).

Mixed Conifer - Deciduous Woodland (MW), cont.

Accuracy Assessment Results, cont.

Special Notes:

MW proved to be a more difficult concept to map than expected, in part because the map class is highly variable; almost any combination of conifer and deciduous species could have been mapped as MW, providing canopy cover was <60% and rock outcrops were visible on the photos.

In some cases, problems occurred where total canopy cover straddled the forest/woodland continuum, and the accuracy assessment team saw higher cover than the mapper. Because of the patchy nature of woodlands and the variable canopy cover within, the mapper in some situations, "lumped" patches of denser trees that should have been made into separate forest polygons. Polygons mapped as MW missed to specific conifer woodlands were due to overestimation of deciduous component.

Red Maple - Hardwood Swamp (MAS)

The Red Maple - Hardwood Swamp map class (MAS) is dominated by red maple, green ash, and yellow birch. Canopy cover is either open (25 - 60%) or closed (>60%).

MAS has a greenish-tan signature of wetland deciduous trees. The canopy was just beginning to leaf out when the aerial photos were taken, so canopy cover is minimal. Canopy cover was estimated from the distance between trees, which appeared as dark lines on the photos. Often, a whitish signature indicating wetland herbaceous species can be seen through the trees.

MAS occurs on poorly drained basins. Polygon size is generally small. It grades into MDF or ABF and ABW as it transitions to upland. MAS also grades into CSW when red spruce becomes >25% relative cover.

The MAS map class represents two NVCS associations: Northern Hardwood Seepage Swamp and Red Maple Swamp Woodland.

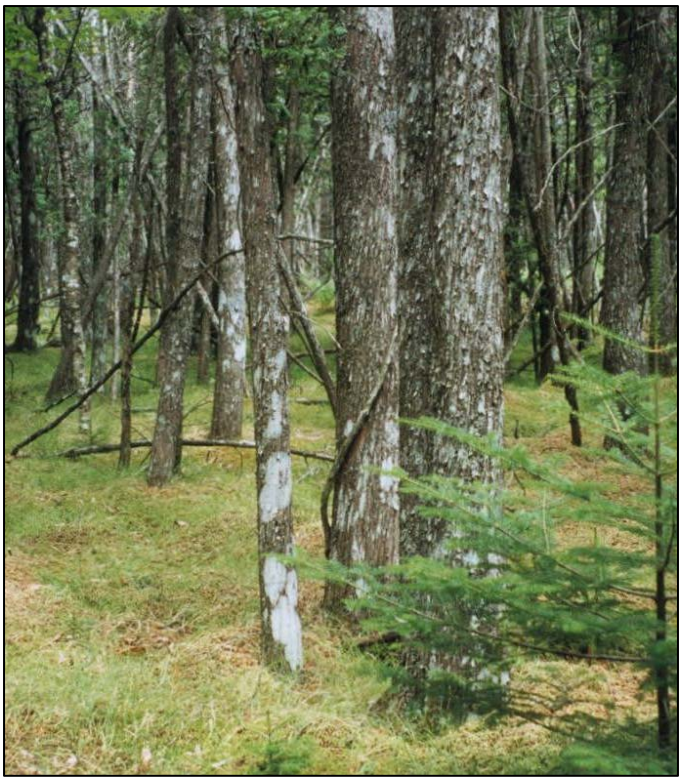
Polygons: 80, Hectares: 142, Average size (h): 2

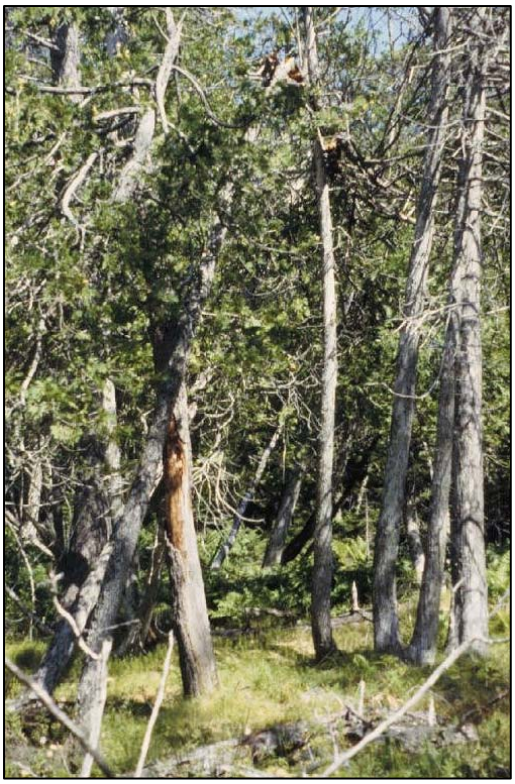
Accuracy Assessment Results

Producers' accuracy: 78% (Confidence interval 49% - 106%)
Users' accuracy: 50% (Confidence interval 24% - 76%)

Errors in **producers' accuracy** are associated with map classes Aspen - Birch Woodland/Forest Complex (forest or woodland phase, ABF or ABW, 1 error), and Alder Shrubland (ASP, 1 error).
Errors in **users' accuracy** are associated with map classes Spruce Fir Forest (mixed phase, SFM, 1 error), Aspen - Birch Woodland/Forest Complex (woodland phase, ABW, 2 errors), Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 1 error), and Alder Shrubland (ASP, 3 errors).

Conifer Swamp Woodland (spruce-mixed phase, CSW)





The Conifer Swamp Woodland (spruce-mixed phase) map class (CSW) is a broad map class encompassing several variations of conifer swamps. It is considered one of two map phases within the Woodland Conifer Wetlands group. Either red or black spruce dominates, sometimes mixed with cedar and deciduous species. CSW stands dominated by red spruce include red maple, green ash, and often yellow birch, balsam fir, and cedar. Stands dominated by black spruce may contain tamarack, cedar, and red maple.

CSW has several signatures. It either appears as a mix of red to brown conifer signatures with a choppy texture, interspersed with the lighter, softer deciduous tree signature (in drainages and slopes), or it appears as a mixed stand of black spruce (often with tamarack or cedar), with or without red maple, occurring in peat basins. CSW can grade into WCS, the white cedar phase of the Conifer Swamp Woodland.

CSW occurs in poorly drained shallow or deep basins and in short linear drainages.

The CSW map class represents two NVCS associations: Red Maple - Conifer Acidic Swamp and Black Spruce Woodland Bog.

Polygons: 322, Hectares: 781, Average size (h): 2

Accuracy Assessment Results, cont.
CSW was assessed with WCS for accuracy assessment because the two map classes share similar settings, species, signatures, and a vegetation community.

Producers' accuracy: 91% (Confidence interval 86% - 97%)
Users' accuracy: 87% (Confidence interval 81% - 94%)

Conifer Swamp Woodland (spruce-mixed phase, CSW), cont.

Accuracy Assessment Results, cont.

Errors in **producers' accuracy** are associated with map classes Spruce - Fir Forest (conifer phase, SF, 4 errors), Mixed Conifer Woodland (MCW, 1 error), Red Maple - Hardwood Swamp (MAS, 1 error), and Fen Complex (FX, 2 errors). Errors in **users' accuracy** are associated with map classes: Spruce - Fir Forest (mixed phase, SFM, 1 error), Aspen Birch Woodland/Forest Complex (woodland phase, ABW, 1 error), and Mixed Conifer Woodland (MCW, 4 errors), Alder Shrubland (ASP, 1 error), Sweetgale Mixed Shrub Fen (SG, 1 error), and Fen Complex (FX, 4 errors).

Conifer Swamp Woodland (white cedar phase, WCS)

The Conifer Swamp Woodland (white cedar phase) map class (WCS) is a broad map class encompassing several variations of conifer swamps. It is considered one of two map phases of the Wooded Conifer Wetlands. WCS is dominated by white cedar, sometimes mixed with black spruce and/or tamarack, birch, and red maple. Canopy cover is variable, from about 25%- to full cover.

WCS has several signatures. Cedar, with its small crowned dark signature usually dominates, but can also be mixed with black spruce, white pine, or red spruce. Mixed stands were difficult to determine the proportion of cedar. Some polygons also have the softer deciduous tree signature mixed in with the conifers. WCS can grade into the CSW phase of the Conifer Swamp Woodland map class.

WCS occurs in poorly drained shallow or deep basins on peat.

The WCS map class represents two NVCS associations: Northern White-cedar Wooded Fen and Black Spruce Woodland Bog.

Polygons: 98, Hectares: 134, Average size (h): 1

Accuracy Assessment Results
Note: WCS was assessed with CSW for accuracy assessment because the two map classes share similar settings, species, signatures, and a vegetation community.

Producers' accuracy: 91% (Confidence interval 86% - 97%)
Users' accuracy: 87% (Confidence interval 81% - 94%)

See Conifer Swamp Woodland (conifer-mixed phase) map class (CSW) for details.

Crowberry - Bayberry Headland (CB)

The Crowberry - Bayberry Headland map class (CB) is dominated by a prominent dwarf shrub cover of crowberry and bayberry, with scattered clumps of taller shrubs and stunted conifers. CB is a rare map class confined to exposed headlands.

CB is limited in distribution to Schoodic Peninsula and Little Moose Island.

The CB map class represents one NVCS association: Crowberry - Bayberry Maritime Shrubland.

Polygons: 4, Hectares: 14, Average size (h): 4

Accuracy Assessment Results

Producers' accuracy: 75% (Confidence interval 27% - 123%)
Users' accuracy: 100% (Confidence interval 83% - 117%)

Errors in **producers' accuracy** are associated with Blueberry Bald - Summit Shrubland Complex (BBSS, 1 error).

Blueberry Bald - Summit Shrubland Complex (BBSS)

The Blueberry Bald Summit Shrubland Complex map class (BBSS) is dominated by dwarf heath shrub vegetation with patches of red spruce, balsam fir, and dense, taller deciduous shrubs. Patches of bare rock are one of the most obvious features.

BBSS occurs on summits and high gentle slopes, both inside and outside the 1947 fire area.

BBSS appears as an orangey low heath shrub signature, with darker red speckles of short conifers and lighter colors of scattered deciduous shrubs. Patches of bare rock are a prominent feature on the photos. BBSS grades into ABS down slope. It also grades into MCW as tree cover increases.

The BBSS map class represents one NVCS association: Blueberry Granite Barrens.

Polygons: 129, Hectares: 375, Average size (h): 3

Accuracy Assessment Results

Producers' accuracy: 94% (Confidence interval 85% - 102%)
Users' accuracy: 83% (Confidence interval 71% - 95%)

Errors in **producers' accuracy** are associated with Aspen-Birch Woodland/Forest Complex map class (shrubland phase, ABS, 1 error) and Mixed Conifer Woodland map class (MCW, 1 error).
Errors in **users' accuracy** are associated with Aspen-Birch Woodland/Forest Complex map class (shrubland phase, ABS, 1 error), Mixed Conifer Woodland map class (MCW, 4 errors), and Crowberry - Bayberry Headland map class (CB, 1 error).

Dune Grassland (AM)

The Dune Grassland map class (AM) is entirely dominated by beachgrass.

Only one stand of AM exists within the park, adjacent to Sand Beach.

AM has a pale, pinkish tan herbaceous signature.

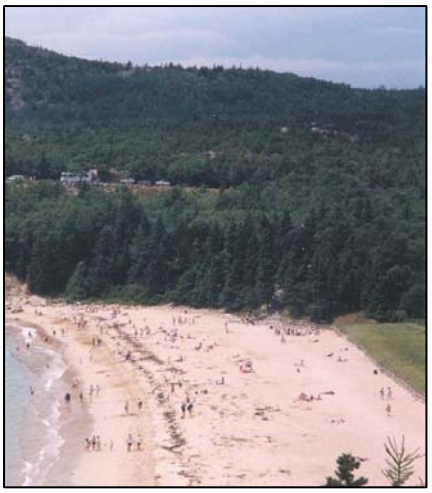
The AM map class represents one NVCS association: Beachgrass Dune. This association is disjunct or at its northeastern range limit at Acadia NP.

Polygons: 1, Hectares: 1, Average size (h): 1

Accuracy Assessment Results

Producers' accuracy: 100% (Confidence interval 50% - 150%)
Users' accuracy: 100% (Confidence interval 50% - 150%)

Open Headland - Beach Strand (SVH)



The Open Headland - Beach Strand map class (SVH) is a sparsely vegetated map class (<25% total cover) occurring in patches in rock crevices of headlands, or on upper portions of beaches, just above the tidal zone. Polygons of SVH are typically linear, following the shoreline.

SVH has a whitish, unvegetated appearing signature. Sometimes, small patches of herbaceous vegetation, appearing orange or red, are apparent on the aerial photos.

The SVH map class represents two NVCS associations: Northern Maritime Rocky Headlands and Sea-rocket - Oysterleaf Beach Vegetation.

Polygons: 253, Hectares: 372, Average size (h): 1

Accuracy Assessment Results

Producers' accuracy: 100% (Confidence interval 98% - 102%)
Users' accuracy: 96% (Confidence interval 87% - 105%)

Errors in **users' accuracy** were associated with Sparsely Vegetated Talus (SVT). Note: SVT is not shown in the contingency table because it was not sampled for accuracy assessment.

Special notes:
SVH was an easy class to map because of its' unmistakable signature and its obvious landscape position. The map class represents two associations because discrimination between cobble beach and rocky headland was not possible with the scale of aerial photography used for the project.

Sparsely Vegetated Talus (SVT)

The Sparsely Vegetated Talus map class (SVT) occurs on steep slopes. Patches of conifers, usually red spruce, and aspen or birch may occur, but at <25% total cover.

SVT has a whitish rock signature. Patches of conifer or deciduous trees are often apparent on the aerial photos. SVT grades into the MCW or MW map classes when tree cover increases to >25%.

The SVT map class represents one NVCS association: Northern Lichen Talus Barrens.

Polygons: 12, Hectares: 11, Average size: 1

Accuracy Assessment Results

SVT was not sampled for accuracy assessment.

Alder Shrubland (ASP)

The Alder Shrubland map class (ASP) is an alder dominated shrubland. The alder canopy can be completely closed (100%) to somewhat open (60%). When open, graminoid vegetation can usually be seen amongst the shrubs.

ASP occurs as small stands at the edges of peatlands and along streamsides.

ASP has greenish to brown tall shrub signature. The color is dependent on the relative proportion of alder with other shrubs. When alder dominates, the signature has as a brownish color with a finely toothed texture. When mixed with sweet gale, the color becomes greener, and can often appear more similar to the sweet gale signature.

ASP occurs in flat basins, in peatlands, and along stream channels. ASP grades into the SMG map class when graminoids reach >25%.

The ASP map class represents two NVCS associations: Alluvial Alder Thicket and Northern Peatland Shrub Swamp.

Polygons: 146, Hectares: 162, Average size (h): 1

Accuracy Assessment Results

Producers' accuracy: 75% (Confidence interval 58% - 92%)
Users' accuracy: 69% (Confidence interval 52% - 86%)

Errors in **producers' accuracy** are associated with map classes Red Maple - Hardwood Swamp (MAS, 3 errors), Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 1 error), and Sweetgale Mixed Shrub Fen (SG, 1 error).

Alder Shrubland (ASP), cont.

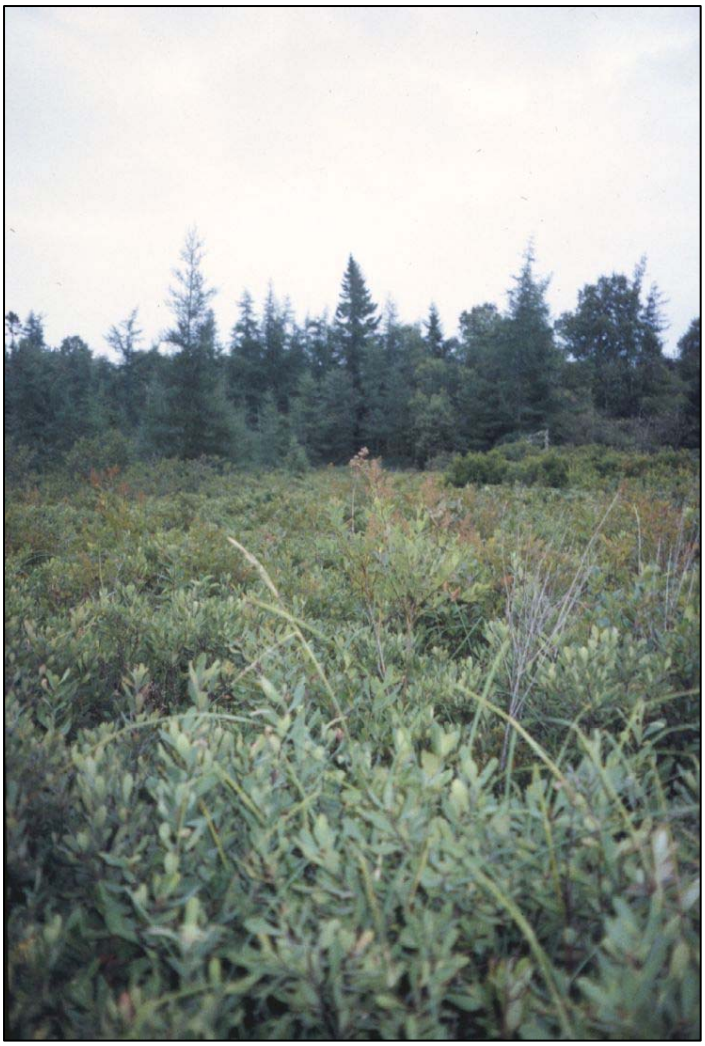
Accuracy Assessment Results, cont.

Errors in **users' accuracy** are associated with map classes Red Maple - Hardwood Swamp (MAS, 1 error), Fen Complex (FX, 2 errors), and Graminoid Shallow Marsh (SMG, 5 errors).

Special Notes:

FX map class contains several vegetation associations. Two of these associations are alder types. When an AA point was assigned to another vegetation type other than one of the alder types, it was considered an error.

Sweetgale Mixed Shrub Fen (SG)



The Sweetgale Mixed Shrub Fen map class (SG) is a sweetgale dominated shrubland. The sweetgale canopy can be completely closed to somewhat open.

SG has greenish, tall to medium shrub signature. The color of the signature is dependent on the relative proportion of sweetgale to other shrubs. When sweetgale dominates, the signature has as a dark olive green color with a fine texture. When mixed with alder, the color becomes greenish brown, and can often resemble the alder signature.

SG was mapped in flat basins, often along peatland edges. SG can be confused with ASP, and some stands are co-dominated by both sweetgale and alder. SG can grade into the Fen Complex Map Class when bluejoint and other graminoid species reach >75%, or into the DSB when leatherleaf reaches >25%. SG is a component of FX when it occurs in a mosaic pattern with other vegetation types and is too small to map individually.

The SG map class represents one NVCS association: Sweet Gale Mixed Shrub Swamp.

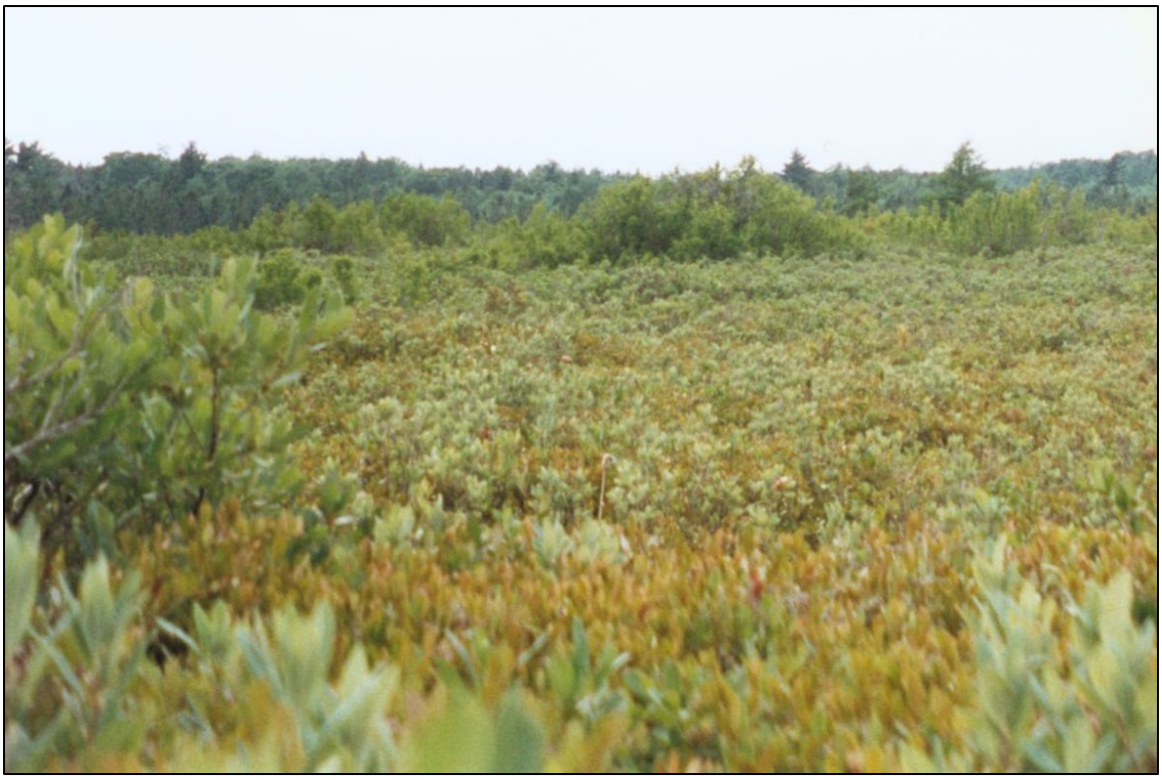
Polygons: 87, Hectares: 134, Average size (h): 2

Accuracy Assessment Results

Producers' accuracy: 71% (Confidence interval 49% - 92%)
Users' accuracy: 67% (Confidence interval 46% - 88%)

Errors in **producers' accuracy** were associated with map classes Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 1 error), Graminoid Shallow Marsh (SMG, 4 errors). Errors in **users' accuracy** were associated with map classes Alder Shrubland (ASP, 2 errors), the Fen Complex (FX, 3 errors) and the Dwarf Shrub Bog (DSB, 1 error).

Dwarf Shrub Bog (DSB)



The Dwarf Shrub Bog map class (DSB) is dominated by heath shrubs or a combination of dwarf shrubs and mixed herb fen vegetation.

DSB has a finely mottled orange signature with a smooth texture.

DSB was mapped at low elevations over peat substrates, in raised bog environments, or bordering raised bogs. DSB grades into the HSB map class, which is the mixed phase.

The DSB map class represents two NVCS associations: Northern Dwarf-shrub Bog and Maritime Peatland Sedge Lawn.

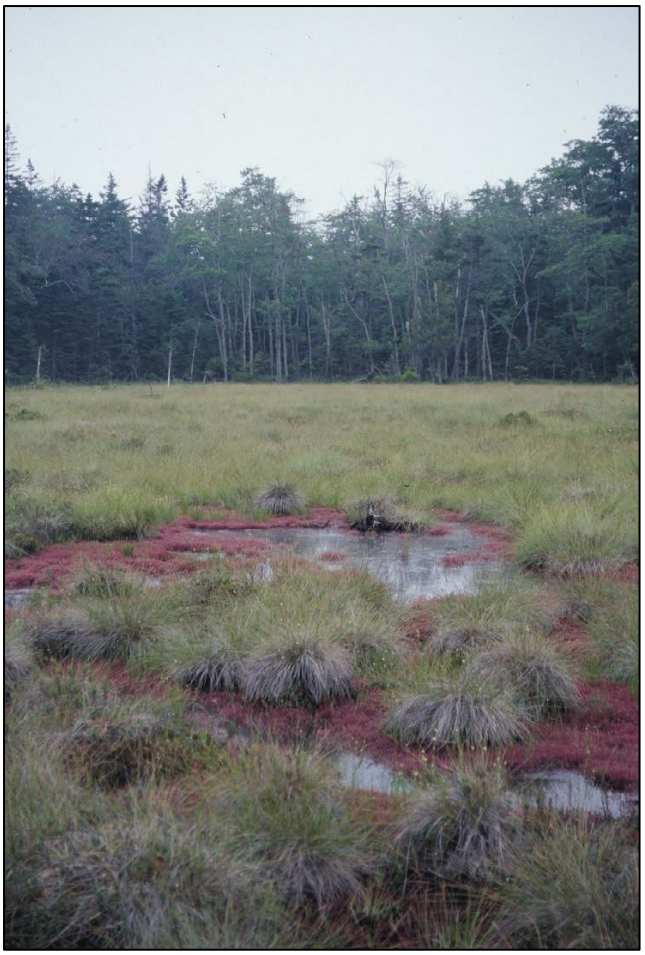
Polygons: 6, Hectares: 93, Average size (h): 15

Accuracy Assessment Results

Producers' accuracy: 75% (Confidence interval 27% - 123%)
Users' accuracy: 100% (Confidence interval 83% - 117%)

Errors in **producers' accuracy** were associated with map class Sweetgale Mixed Shrub Fen (SG, 1 error).

Fen Complex (FX)



The Fen Complex map class (FX) is a broad map class encompassing fens that occur along streams, in peatlands with drainage, and in peatlands with no inlet streams (closed fens). The fen communities were not mapped separately because they were either too similar in signature to one another or because they occur in a mosaic pattern that is too fine to discern individually on the aerial photographs. Included in this map class are other non-forested wetland types that may occur in patches such as alder, sweetgale, and mixed graminoid meadows. These types are often found mixed in with the fen communities. (These types were also mapped individually when they could be confidently recognized on the photos.) Wetland tall shrubs of alder or sweetgale, dwarf shrubs such as leatherleaf, sheep laurel, black crowberry, and dwarf huckleberry and a mix of graminoid and dwarf shrub species may be present in any polygon of FX.

The signature of FX is typically a mottled pattern of oranges, greens, and white representing the various vegetation types. Together, they form a mosaic, with each too small (< MMU) or too intertwined to map separately.

FX was mapped in low elevation basins throughout the map area.

The FX map class represents nine NVCS associations: Northern Peatland Shrub Swamp, Sweetgale Mixed Shrub Swamp, Northern Dwarf-shrub Bog, Maritime Crowberry Bog, Leatherleaf Acidic Fen, Eastern Tussock Sedge Meadow, Seasonally Flooded Mixed Graminoid Meadow, Slender Sedge Fen, and Few-seeded Sedge - Leatherleaf Fen. A mix of two or more of these associations may be present within a polygon of FX.

Polygons: 169, Hectares: 476, Average size (h): 3

Fen Complex (FX), cont.

Accuracy Assessment Results

Producers' accuracy: 70% (Confidence interval 57% - 82%)
Users' accuracy: 88% (Confidence interval 78% - 99%)

Errors in **producers' accuracy** were associated with map classes Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 4 errors), Alder Shrubland (ASP, 2 errors), Sweetgale Mixed Shrub Fen (3 errors), Graminoid Shallow Marsh (SMG, 3 errors), and Open Water - Deep Marsh Complex (OWM, 1 error). Errors in **users' accuracy** were associated with map classes Conifer Swamp Woodland (spruce-mixed or white cedar phases, CSW or WCS, 2 errors) and Open Water - Deep Marsh Complex (OWM, 2 errors).

Special Notes:
Errors in producer's accuracy to CSW/WCS were caused by disagreement between mapper's and ground crew's view in the total canopy cover of trees.

Tidal Marsh (TG)

The Tidal Marsh map class (TG) is a map class dominated by various graminoid and forb vegetation, occurring at and just below the high tide line.

TG has a greenish smooth signature, often marbled with white, olive, orange, and brown.

TG was mapped throughout the project area along tidal stream marshes, and embayments and coves.

The TG map class represents two NVCS associations: Brackish Tidal Marsh, Cattail Variant, and Spartina High Salt Marsh.

Polygons: 75, Hectares: 179, Average size: 2

Accuracy Assessment Results

Producers' accuracy: 100% (Confidence interval 90% - 110%)
Users' accuracy: 100% (Confidence interval 90% - 110%)

Graminoid Shallow Marsh (SMG)

The Graminoid Shallow Marsh map class (SMG) is a broad map class encompassing various graminoid vegetation, particularly sedge and grass meadows and cattail marshes.

SMG has a white smooth signature, often marbled with olive, orange, and brown.

SMG was mapped throughout the project area in shallow basins at low elevations. In addition to being mapped as its own class, it is often a component of FX when it occurs in a mosaic with other vegetation types that are too small to map individually.

The SMG map class represents five NVCS associations: Eastern Tussock Sedge Meadow, Seasonally Flooded Mixed Graminoid Meadow, Bayonet Rush Herbaceous Vegetation, Eastern Cattail Marsh, and Slender Sedge Fen.

Polygons: 123, Hectares: 183, Average size (h): 1

Accuracy Assessment Results

Producers' accuracy: 80% (Confidence interval 65% - 95%)
Users' accuracy: 74% (Confidence interval 58% - 90%)

Errors in **producers' accuracy** were associated with map class Alder Shrubland (ASP, 5 errors). Errors in **users' accuracy** were associated with map classes Sweetgale Mixed Shrub Fen (SG, 4 errors) and Fen Complex (FX, 3 errors).

Special Notes:
Errors to SG and DSB were due to photo scale: small patterns of vegetation types mingled together and the mapper chose the wrong one.

Open Water - Deep Marsh Complex (OWM)

The Open Water - Deep Marsh Complex map class (OWM) is a broad map class encompassing shallow emergent marsh vegetation such as sedges, cattails, grasses, and deep marsh floating and submersed vegetation such as water lilies and pondweeds.

OWM has two primary signatures, either appearing as mostly water with small patches of surface vegetation, or as pale patches of standing dead emergents. Timing of the photography precluded differentiating the vegetation types from one another because it was too early in the growing season.

OWM was mapped throughout the project area in quiet waters of shallow ponds and streams.

OWM represents five NVCS associations: Seven-angle Pipewort - Dortmann's Cardinal-flower Herbaceous Vegetation, Eastern Cattail Marsh, Bulrush Deepwater Marsh, Open Water Marsh with Mixed Submergents/Emergents, and Water Lily Aquatic Wetland.

Polygons: 71, Hectares: 131, Average size: 2h

Accuracy Assessment Results

Producers' accuracy: 89% (Confidence interval 74% - 104%)
Users' accuracy: 94% (Confidence interval 74% - 106%)

Errors in **producers' accuracy** were associated with the Fen Complex (FX, 2 errors). Errors in **users' accuracy** were associated with the Fen Complex (FX, 1 error).

Tidal Algal Zone (TZ)

Tidal Algal Zone map class (TZ) characterizes algal beds along the shorelines. This map class was not sampled as part of the project nor assessed for accuracy.

TZ polygons are dominated by distinctive bright orange signature. The bluish signature of rock is also a prominent component of the signature.

The TZ map class represents two NVCS alliances: Yellow Tang - Black Tang Tidal Algal Vegetation and Common Southern Kelp - Irish moss Tidal Algal Nonvascular.

Polygons: 411, Hectares: 2,744, Average size (h): 7

Tidal Beach (TB)

The Tidal Beach map class (TB) is a rare map class, used only for one polygon, Sand Beach, in Acadia NP. This map class was not sampled as part of the project nor assessed for accuracy (we got it right, though).

TB appears as a smooth, whitish signature.

The TB map class represents one NVCS formation: Tidal sand flats.

Polygons: 1, Hectares: 2, Average size (h): 2

Tidal Mud Flat (TM)

The Tidal Mud Flat map class (TM) characterizes exposed mud flats in the tidal zone. This map class was not sampled as part of the project nor assessed for accuracy.

The TM map class represents one NVCS alliance: Estuarine Tidal Mudflats Sparsely Vegetated

Polygons: 96, Hectares: 453, Average size (h): 5

Cultural Vegetation Map Classes

Five map classes represent formation level types within the NVCS describing culturally influenced vegetation. Three of these are listed under planted/cultivated subgroup of the NVCS. The other two remain listed under natural/semi-natural subgroups of the NVCS, yet are listed here because they are disturbed enough by human influence that no floristic level classes could be identified. These map classes were not sampled as part of the project nor assessed for accuracy.

Evergreen Plantation (EPL)

The EPL map class represents one NVCS formation: Evergreen Plantation. This map class describes evergreen plantations near the park consisting mainly of pine. Only five polygons of EPL were mapped, all on private lands outside the park. EPL appears as a dark red with a nubby texture. The rows of conifer trees are evident on the aerial photos with stereoscope viewing.

Polygons: 5, Hectares: 8, Average size (h): 2

Mixed Deciduous Shrubland (SMD)

The SMD map class represents one NVCS formation: Temperate Cold-deciduous Shrubland. This map class describes old fields that are overgrown with >25% shrubs.

Polygons: 251, Hectares: 726 Average size (h): 3

Mixed Grass - Forb (MGF)

The MGF map class represents one NVCS formation: Medium-tall Sod Temperate or Subpolar Grassland. This map class describes overgrown fields dominated by herbaceous vegetation (<25% shrub component) and not used for hay or pastureland when the photos were taken.

Polygons: 208, Hectares: 369 Average size (h): 2

Perennial Grass Crops (PGCH)

The PGCH map class represents one NVCS formation: Perennial Grass Crops (hayland, pastureland). This map class describes lands that consist of perennial grasses and forbs that are allowed to grow naturally and either cut for hay or used for pasture. Scattered shrubs and trees may be present, but with <10% total cover of each. All polygons mapped as PGCH are located outside the park. PGCH appears a grayish-pink to orange color with a smooth texture.

Polygons 166, Hectares: 481, Average size (h): 3

Perennial Grass Crops with Sparse Shrubs (PGCS)

The PGCS map class represents one NVCS formation: Perennial Grass Crops with a Sparse Shrub Layer (hayland, pastureland). PGCS is similar to that of PGCH, but with scattered shrubs covering 10-25% of the area. This map class is relatively rare, with only three polygons mapped. PGCS appears as grayish-pink to orange color with darker dots of shrubs scattered throughout each polygon.

Polygons 3, Hectares: 4, Average size (h): 1

Land Use and Land Cover Map Classes

Nine map classes represent classes within the USGS land use and land cover (LUC) classification system developed by Anderson et al. (1976). This classification was designed to meet the needs of federal and state agencies for a uniform categorization of data from satellite and aircraft remote sensors. It uses a hierarchical system of four levels to fit the classifying needs from satellite type sensor data (Level I) to low-altitude photo imagery data (Level IV; <1:20,000-scale).

The USGS-NPS Vegetation Mapping Program uses Level II of this LUC classification system to classify general land cover conditions not classified by the NVCS natural/semi-natural or planted/cultivated types. These include populated areas, roads, quarries, and open water bodies that are <10% vegetated. Definitions on Level II classes are defined in the USGS LUC publication.

Table F-5 lists the project's map classes that are used to map general land use and land cover. The table provides a crosswalk to the USGS LUC Level II classification.

Table F-5. Map classes and their link to USGS LUC used for general land use and land cover mapping.

Map Class (Code)	Description	Link to USGS LUC Level II Class (Code)
Residential (UR)	Lands used primarily for residential purposed (populated areas or rural settings)	Residential (11)
Commercial and Services (UC)	Lands used primarily for commercial purposes (populated areas or rural settings)	Commercial and Services (12)
Transportation and Roads (UT)	Lands used primarily for transportation (roads and right-of-ways, railroads, roadside parking)	Transportation, Communications, Utilities (14)
Mixed Urban or Built-up Land (UM)	Lands used for both residential and commercial purposes (e.g., mix of residential and tourism)	Mixed Urban or Built-up Land (16)
Other Urban or Built-up Land (UBL)	Lands primarily developed for other purposes such as golf courses, cemeteries, and parks.	Other Urban or Built-up Land (17)
Other Agricultural Land (ARB)	Lands primarily used by farmsteads (includes out buildings and farm ponds)	Other Agricultural Land (21)
Stream (non-vegetated) (WST)	Streams that are <10% vegetated (vegetated portions are mapped with vegetation class)	Streams and Canals (51)
Lake (non-vegetated) (WLK)	Lakes that are <10% vegetated (vegetated portions are mapped with vegetation class)	Lakes (52)
Ocean - Bay - Estuary (non-vegetated) (WO)	Ocean, bays, and estuaries < 10% vegetated (vegetated portions are mapped with vegetation class)	Bays and Estuaries (54)
Strip Mines, Quarries, and Gravel Pits (BLQ)	Lands used for extractive mining purposes (active and non-active quarries)	Strip Mines, Quarries, and Gravel Pits (75)

For polygon frequency and area information of each land cover and land use map class, refer to the full area report provided in the main report.

Park Specific Map Classes

Seven map classes were developed to represent specific conditions that did not represent well by the other standardized classifications. They include small upland islands, small natural ponds, and no data.

For polygon frequency and area information of each park specific map class, refer to the full area report provided in the main report.

Small Islands

Four map classes represent small upland islands that are >0.1 h in size, but less than the standard minimum mapping unit of 0.5 h. These islands are located within the open water span of ocean, bays, estuaries, and lakes, or within shallow wetlands and peatlands with emergent herbaceous vegetation and shrubs. Because of their small size, these lands do not describe well by natural vegetation communities.

The Small Islands map classes are

- Small Island with Grass (SIG),
- Small Island with Rock (SIR),
- Small Island with Shrubs (SIS), and
- Small Island with Trees (SIT).

Small Natural Ponds

Two map classes represent small natural ponds. These ponds are water bodies that are both <10% vegetated and <16 h in size. These small ponds do not fall within the USGS land use and land cover system (Anderson et al. 1976) definition of Lakes (>16 h) but rather within the Nonforested Wetland (62) class. The Nonforested Wetland class was not used to define these two map classed because it includes vegetated wetlands (which is described by vegetation map classes already discussed).

The 2 map classes were created to separate ponds that are affected by beaver activity from ponds that are not. Because of limitations in seeing vegetation on the project's set of aerial photographs, some of these small ponds may indeed have >10% vegetation.

The Small Natural Ponds map classes are

- Beaver Pond (non-vegetated, WBP),
- Natural Pond (non-vegetated, WNP).

For clarification, the Beaver Pond (non-vegetated) map class (WBP) is not intended to suggest that all beaver ponds are mapped, but rather only those portions that are <10% vegetated. Vegetated portions of beaver ponds (whether all or part) are mapped in their corresponding vegetation map class. The same can be said of Natural Pond (non-vegetated) map class (WNP).

No Data

One map class, No Data (ND), represents areas purposely not mapped for the project. However, these areas are within the outer reach of the project area. All Acadia NP fee and easement lands plus additional surroundings are mapped, leaving large expanses of area left untouched to mapping. For geo-spatial map development, it was necessary to code these areas.

Appendix G

Accuracy Assessment Contingency Matrix

Using the Accuracy Assessment Contingency Matrix

In the electronic version, the accuracy assessment matrix is a separate spreadsheet. The accuracy assessment contingency matrix is an array of numbers set out in rows and columns which reveal the number of polygons assigned to a particular vegetation type(s) relative to the actual vegetation type as verified on the ground. The columns represent National Vegetation Classification System (NVCS) associations (vegetation community) as per NatureServe (2003) listed by their Community Global Element (CEGL), and the rows represent the map classes (listed by their map class codes). The accuracies of each map class are described as both producers' accuracy with errors of inclusion (commission errors), and users' accuracy with errors of exclusion (omission errors) present in the mapping.

A key to the names of map class codes and vegetation association CEGL codes are listed below the matrix table.

Appendix H

Plant Species List of Acadia National Park

More than 400 plant species were identified and documented in 179 vegetation samples collected for the Acadia National Park Vegetation Mapping Project. Plant species, along with other sample data, were entered into the PLOTS Database System (The Nature Conservancy 1997) to produce the Project's vegetation database. The following list of plant species was generated from the vegetation database. The list is not intended to be comprehensive of every species in the Park. Plant species are organized alphabetically within plant families. Nomenclature follows the PLANTS database (U.S. Department of Agriculture 1996).

Table H-1. Plant species list of Acadia National Park summarized by family.

Family	Scientific Name	Common Name
Aceraceae	*Acer pensylvanicum* L.	striped maple
	Acer rubrum L.	red maple
	Acer saccharum Marsh.	sugar maple
	Acer spicatum Lam.	mountain maple
Adelanthaceae	*Odontoschisma* (Dum.) Dum.	odontoschisma
Alismataceae	*Sagittaria latifolia* Willd.	broadleaf arrowhead
Amblystegiaceae	Drepanocladus *(C. Müll.) G. Roth*	drepanocladus moss
Anacardiaceae	Rhus hirta *(L.) Sudworth*	staghorn sumac
	Toxicodendron radicans ssp. radicans (L.) Kuntze	eastern poison ivy
Apiaceae	*Angelica atropurpurea* L.	purplestem angelica
	Ligusticum scoticum L.	Scottish licoriceroot
Apocynaceae	*Apocynum androsaemifolium* L.	spreading dogbane
Aquifoliaceae	*Ilex glabra* (L.) Gray	inkberry
	Ilex verticillata (L.) Gray	common winterberry
	Nemopanthus mucronatus (L.) Loes.	catberry
Araceae	*Arisaema triphyllum* (L.) Schott	Jack in the pulpit
	Symplocarpus foetidus (L.) Salisb. ex Nutt.	skunk cabbage
Araliaceae	*Aralia nudicaulis* L.	wild sarsaparilla
Asteraceae	*Achillea millefolium* L.	common yarrow
	Aster cordifolius L.	common blue wood aster
	Aster L.	aster
	Aster lateriflorus (L.) Britt.	calico aster
	Aster macrophyllus L.	bigleaf aster
	Aster puniceus L.	purplestem aster
	Aster X blakei (Porter) House (pro sp.)	Blake's aster
	Bidens connata Muhl. ex Willd.	purplestem beggarticks
	Bidens L.	beggartick
	Doellingeria umbellata (P. Mill.) Nees	
	Euthamia graminifolia (L.) Nutt.	flattop goldentop
	Hieracium canadense Michx.	Canadian hawkweed

Family	Scientific Name	Common Name
	Hieracium L.	hawkweed
	Hieracium paniculatum L.	Allegheny hawkweed
	Hieracium pilosella L.	mouseear hawkweed
	Oclemena acuminata (Michx.) Greene	
	Oclemena nemoralis (Ait.) Greene	
	Prenanthes alba L.	white rattlesnakeroot
	Prenanthes trifoliolata (Cass.) Fern.	gall of the earth
	Solidago bicolor L.	white goldenrod
	Solidago L.	goldenrod
	Solidago puberula Nutt.	downy goldenrod
	Solidago rugosa P. Mill.	wrinkleleaf goldenrod
	Solidago sempervirens L.	seaside goldenrod
	Solidago simplex ssp. randii (Porter) Ringius	Rand's goldenrod
	Solidago uliginosa Nutt.	bog goldenrod
	Solidago uliginosa var. linoides (Torr. & Gray) Fern.	bog goldenrod
Aulacomniaceae	*Aulacomnium palustre* (Hedw.) Schwaegr.	aulacomnium moss
	Aulacomnium Schwaegr.	aulacomnium moss
Balsaminaceae	*Impatiens capensis* Meerb.	jewelweed
	Bartramia pomiformis Hedw.	bartramia moss
Berberidaceae	*Berberis thunbergii* DC.	Japanese barberry
Betulaceae	*Alnus incana* (L.) Moench	mountain alder
	Alnus serrulata (Ait.) Willd.	hazel alder
	Alnus viridis ssp. crispa (Ait.) Turrill	American green alder
	Betula alleghaniensis Britt.	yellow birch
	Betula L.	birch
	Betula papyrifera Marsh.	paper birch
	Betula papyrifera var. cordifolia (Regel) Fern.	mountain paper birch
	Betula populifolia Marsh.	gray birch
	Betula X caerulea Blanch. (pro sp.)	birch
	Betula X sargentii *Dugle*	Sargent’s birch
	Corylus cornuta Marsh.	beaked hazelnut
	Ostrya virginiana (P. Mill.) K. Koch	eastern hophornbeam
Blechnaceae	*Woodwardia virginica* (L.) Sm.	Virginia chainfern
Brachytheciaceae	*Brachythecium* Schimp. in B.S.G.	brachythecium moss
Bryaceae	*Bryum argenteum* Hedw.	silvergreen bryum moss
	Bryum Hedw.	bryum moss
	Pohlia Hedw.	pohlia moss
Campanulaceae	*Campanula rotundifolia* L.	bluebell bellflower
Caprifoliaceae	*Diervilla lonicera* P. Mill.	northern bush honeysuckle
	Linnaea borealis L.	twinflower
	Lonicera canadensis Bartr. ex Marsh.	American fly honeysuckle
	Lonicera villosa (Michx.) J.A. Schultes	mountain fly honeysuckle
	Viburnum acerifolium L.	mapleleaf viburnum
	Viburnum lantanoides Michx.	hobblebush
	Viburnum lentago L.	nannyberry
	Viburnum nudum var. cassinoides (L.) Torr. & Gray	possumhaw
Caryophyllaceae	*Cerastium arvense* L.	field chickweed

Family	Scientific Name	Common Name
	Minuartia glabra (Michx.) Mattf.	Appalachian stitchwort
	Minuartia groenlandica (Retz.) Ostenf.	Greenland stitchwort
	Sagina nodosa ssp. nodosa (L.) Fenzl	knotted pearlwort
Cephaloziellaceae	*Cephaloziella* (Spruce) Steph.	cephaloziella
Chenopodiaceae	*Atriplex patula* L.	spear saltbush
Cistaceae	*Lechea intermedia* Leggett ex Britt.	largepod pinweed
Cladoniaceae	*Cladina* (Nyl.) Nyl.	reindeer lichen
	Cladina arbuscula (Wallr.) Hale & Culb.	reindeer lichen
	Cladina rangiferina (L.) Nyl.	greygreen reindeer lichen
	Cladina stellaris (Opiz) Brodo	star reindeer lichen
	Cladonia cristatella Tuck.	cup lichen
	Cladonia P. Browne	cup lichen
	Cladonia pyxidata (L.) Hoffm.	cup lichen
Clusiaceae	*Hypericum boreale* (Britt.) Bickn.	northern St. Johnswort
	Hypericum gentianoides (L.) B.S.P.	orangegrass
	Triadenum fraseri (Spach) Gleason	Fraser's marsh St. Johnswort
Conocephalaceae	*Conocephalum* Wigg.	conocephalum
Convolvulaceae	*Calystegia sepium* (L.) R. Br.	hedge false bindweed
Cornaceae	*Cornus canadensis* L.	bunchberry dogwood
Crassulaceae	*Sedum rosea* (L.) Scop.	roseroot stonecrop
Cupressaceae	*Juniperus communis* L.	common juniper
	Juniperus horizontalis Moench	creeping juniper
	Thuja occidentalis L.	eastern arborvitae
Cyperaceae	*Carex arctata* Boott ex Hook.	drooping woodland sedge
	Carex atlantica ssp. atlantica Bailey	Atlantic sedge
	Carex atlantica ssp. capillacea (Bailey) Reznicek	prickly bog sedge
	Carex brunnescens (Pers.) Poir.	brownish sedge
	Carex canescens L.	silvery sedge
	Carex communis Bailey	fibrousroot sedge
	Carex debilis Michx.	white edge sedge
	Carex echinata Murr.	prickley sedge
	Carex exilis Dewey	coastal sedge
	Carex folliculata L.	northern long sedge
	Carex gracillima Schwein.	graceful sedge
	Carex gynandra Schwein.	nodding sedge
	Carex gynocrates Wormsk. ex Drej.	northern bog sedge
	Carex hormathodes Fern.	marsh straw sedge
	Carex intumescens Rudge	greater bladder sedge
	Carex L.	sedge
	Carex lacustris Willd.	hairy sedge
	Carex lasiocarpa Ehrh.	woollyfruit sedge
	Carex laxiflora Lam.	broad looseflower sedge
	Carex leptalea Wahlenb.	bristlystalked sedge
	Carex leptonervia (Fern.) Fern.	nerveless woodland sedge
	Carex lucorum Willd. ex Link	Blue Ridge sedge
	Carex lurida Wahlenb.	shallow sedge
	Carex magellanica ssp. irrigua (Wahlenb.) Hulten	boreal bog sedge

Family	Scientific Name	Common Name
	Carex magellanica ssp. magellanica Lam.	little sedge
	Carex nigra (L.) Reichard	smooth black sedge
	Carex novae-angliae Schwein.	New England sedge
	Carex oligosperma Michx.	fewseed sedge
	Carex ovalis Goodenough	sedge
	Carex paleacea Schreb. ex Wahlenb.	chaffy sedge
	Carex pallescens L.	pale sedge
	Carex pedunculata Muhl. ex Willd.	longstalk sedge
	Carex projecta Mackenzie	necklace sedge
	Carex rosea Schkuhr ex Willd.	rosy sedge
	Carex rugosperma Mackenzie	parachute sedge
	Carex scabrata Schwein	eastern rough sedge
	Carex scoparia Schkuhr ex Willd.	broom sedge
	Carex stricta Lam.	uptight sedge
	Carex tonsa (Fern.) Bickn.	shaved sedge
	Carex tribuloides Wahlenb.	blunt broom sedge
	Carex trisperma Dewey	threeseeded sedge
	Carex utriculata Boott	Northwest Territory sedge
	Carex wiegandii Mackenzie	Wiegand's sedge
	Dulichium arundinaceum (L.) Britt.	threeway sedge
	Eleocharis acicularis (L.) Roemer & J.A. Schultes	needle spikerush
	Eleocharis obtusa (Willd.) J.A. Schultes	blunt spikesedge
	Eriophorum angustifolium Honckeny	tall cottongrass
	Eriophorum tenellum Nutt.	fewnerved cottongrass
	Eriophorum vaginatum var. spissum (Fern.) Boivin	tussock cottongrass
	Eriophorum virginicum L.	tawny cottongrass
	Rhynchospora alba (L.) Vahl	whitebeaked rush
	Scirpus atrocinctus Fern.	blackgirdle bulrush
	Scirpus cyperinus (L.) Kunth	woolgrass
	Trichophorum cespitosum (L.) Hartman	
Dennstaedtiaceae	*Dennstaedtia punctilobula* (Michx.) T. Moore	eastern hayscented fern
	Pteridium aquilinum (L.) Kuhn	western brackenfern
Dicranaceae	*Dicranella* (C. M□ll.) Schimp.	dicranella moss
	Dicranum flagellare Hedw.	dicranum moss
	Dicranum fulvum Hook.	dicranum moss
	Dicranum fuscescens Turn.	dicranum moss
	Dicranum Hedw.	dicranum moss
	Dicranum polysetum Sw.	dicranum moss
	Dicranum scoparium Hedw.	dicranum moss
	Dicranum undulatum Brid.	undulate dicranum moss
	Paraleucobryum (Lindb.) Loeske	paraleucobryum moss
	Paraleucobryum longifolium (Hedw.) Loeske	longleaf paraleucobryum moss
Droseraceae	*Drosera intermedia* Hayne	spoonleaf sundew
	Drosera rotundifolia L.	roundleaf sundew
Dryopteridaceae	*Athyrium filix-femina* (L.) Roth	common ladyfern
	Dryopteris carthusiana (Vill.) H.P. Fuchs	spinulose woodfern
	Dryopteris cristata (L.) Gray	crested woodfern

Family	Scientific Name	Common Name
	Dryopteris intermedia (Muhl. ex Willd.) Gray	intermediate woodfern
	Dryopteris marginalis (L.) Gray	marginal woodfern
	Gymnocarpium dryopteris (L.) Newman	western oakfern
	Onoclea sensibilis L.	sensitive fern
	Polystichum acrostichoides (Michx.) Schott	Christmas fern
Empetraceae	*Corema conradii* (Torr.) Torr. ex Loud.	broom crowberry
	Empetrum nigrum L.	black crowberry
Equisetaceae	*Equisetum sylvaticum* L.	woodland horsetail
Ericaceae	*Andromeda polifolia* L.	bog rosemary
	Chamaedaphne calyculata (L.) Moench	leatherleaf
	Epigaea repens L.	trailing arbutus
	Gaultheria hispidula (L.) Muhl. ex Bigelow	creeping snowberry
	Gaultheria procumbens L.	eastern teaberry
	Gaylussacia baccata (Wangenh.) K. Koch	black huckleberry
	Gaylussacia dumosa (Andr.) Torr. & Gray	dwarf huckleberry
	Kalmia angustifolia L.	sheep laurel
	Kalmia polifolia Wangenh.	bog laurel
	Ledum groenlandicum Oeder	bog Labradortea
	Rhododendron canadense (L.) Torr.	rhodora
	Vaccinium angustifolium Ait.	lowbush blueberry
	Vaccinium boreale Hall & Aalders	northern blueberry
	Vaccinium corymbosum L.	highbush blueberry
	Vaccinium macrocarpon Ait.	cranberry
	Vaccinium myrtilloides Michx.	velvetleaf huckleberry
	Vaccinium oxycoccos L.	small cranberry
	Vaccinium vitis-idaea L.	lingonberry
Fabaceae	*Lathyrus japonicus* Willd.	sea peavine
	Trifolium L.	clover
Fagaceae	*Fagus grandifolia* Ehrh.	American beech
	Quercus ilicifolia Wangenh.	bear oak
	Quercus L.	oak
	Quercus rubra L.	northern red oak
Fissidentaceae	*Fissidens* Hedw.	fissidens moss
Fontinalaceae	*Fontinalis* Hedw.	fontinalis moss
Gentianaceae	*Bartonia paniculata* (Michx.) Muhl.	twining screwstem
Grimmiaceae	*Grimmia* Hedw.	grimmia dry rock moss
Grossulariaceae	*Ribes triste* Pallas	red currant
Haloragaceae	*Proserpinaca pectinata* Lam.	combleaf mermaidweed
Hamamelidaceae	*Hamamelis virginiana* L.	American witchhazel
Hylocomiaceae	*Hylocomium* Schimp. in B.S.G.	hylocomium feather moss
	Hylocomium splendens (Hedw.) Schimp. in B.S.G.	splendid feather moss
	Pleurozium schreberi (Brid.) Mitt.	Schreber's big red stem moss
	Rhytidiadelphus triquetrus (Hedw.) Warnst.	rough goose neck moss
Hypnaceae	*Callicladium haldanianum* (Grev.) Crum	callicladium moss
	Hypnum Hedw.	hypnum moss
	Hypnum imponens Hedw.	hypnum moss
	Ptilium crista-castrensis (Hedw.) De Not.	knights plume moss

Family	Scientific Name	Common Name
Iridaceae	*Iris setosa var. canadensis* M. Foster ex B.L. Robins. & Fern.	Canada beachhead iris
	Iris versicolor L.	harlequin blueflag
	Sisyrinchium montanum Greene	mountain blueeyed grass
Jubulaceae	Frullania *Raddi*	frullania
Juncaceae	*Juncus balticus* Willd.	Baltic rush
	Juncus brevicaudatus (Engelm.) Fern.	narrowpanicle rush
	Juncus bufonius L.	toad rush
	Juncus canadensis J. Gay ex Laharpe	Canadian rush
	Juncus effusus L.	common rush
	Juncus filiformis L.	thread rush
	Juncus gerardii Loisel.	saltmeadow rush
	Juncus militaris Bigelow	bayonet rush
	Juncus pelocarpus E. Mey.	brownfruit rush
	Luzula DC.	woodrush
	Luzula luzuloides (Lam.) Dandy & Wilmott	oakforest woodrush
Juncaginaceae	*Triglochin maritimum* L.	seaside arrowgrass
Lamiaceae	*Lycopus americanus* Muhl. ex W. Bart.	American waterhorehound
	Lycopus L.	waterhorehound
	Lycopus uniflorus Michx.	northern bugleweed
	Lycopus virginicus L.	Virginia waterhorehound
	Prunella vulgaris L.	common selfheal
	Scutellaria galericulata L.	marsh skullcap
Lentibulariaceae	*Utricularia cornuta* Michx.	horned bladderwort
	Utricularia purpurea Walt.	eastern purple bladderwort
Lepidoziaceae	*Bazzania trilobata* (L.) S. Gray	threelobed bazzania
Leucobryaceae	*Leucobryum glaucum* (Hedw.) □ngstr. in Fries	leucobryum moss
	Leucobryum Hampe	leucobryum moss
Liliaceae	*Clintonia borealis* (Ait.) Raf.	yellow bluebeadlily
	Maianthemum canadense Desf.	Canada beadruby
	Maianthemum trifolium (L.) Sloboda	threeleaf false Solomon's seal
	Medeola virginiana L.	Indian cucumberroot
	Trillium erectum L.	red trillium
	Trillium undulatum Willd.	painted trillium
	Uvularia sessilifolia L.	sessileleaf bellwort
Lycopodiaceae	*Huperzia appalachiana* Beitel & Mickel	
	Lycopodium annotinum L.	stiff clubmoss
	Lycopodium dendroideum Michx.	tree groundpine
	Lycopodium L.	clubmoss
	Lycopodium obscurum L.	rare clubmoss
Mniaceae	*Mnium* Hedw.	mnium calcareous moss
Monotropaceae	*Monotropa uniflora* L.	Indianpipe
Myricaceae	*Comptonia peregrina* (L.) Coult.	sweet fern
	Morella pensylvanica (Mirbel) Kartesz, comb. nov. ined.	
	Myrica gale L.	sweetgale
Oleaceae	*Fraxinus americana* L.	white ash
	Fraxinus pennsylvanica Marsh.	green ash
Onagraceae	*Epilobium leptophyllum* Raf.	bog willowherb

Family	Scientific Name	Common Name
Orchidaceae	*Arethusa bulbosa* L.	dragon's mouth
	Calopogon tuberosus (L.) B.S.P.	tuberous grasspink
	Cypripedium acaule Ait.	pink lady's slipper
	Goodyera pubescens (Willd.) R. Br. ex Ait. f.	downy rattlesnake plantain
	Goodyera repens (L.) R. Br. ex Ait. f.	lesser rattlesnake plantain
	Malaxis unifolia Michx.	green addersmouth orchid
	Platanthera L.C. Rich.	bog orchid
	Pogonia ophioglossoides (L.) Ker-Gawl.	snakemouth orchid
Orobanchaceae	*Epifagus virginiana* (L.) W. Bart.	beechdrops
Osmundaceae	*Osmunda cinnamomea* L.	cinnamon fern
	Osmunda claytoniana L.	interrupted fern
	Osmunda regalis L.	royal fern
Oxalidaceae	*Oxalis montana* Raf.	mountain woodsorrel
	Oxalis stricta L.	common yellow oxalis
Parmeliaceae	*Cetraria islandica* (L.) Ach.	island cetraria lichen
	Parmelia Ach.	shield lichen
Pelliaceae	*Pellia* Raddi	pellia
Pinaceae	*Abies balsamea* (L.) P. Mill.	balsam fir
	Larix laricina (Du Roi) K. Koch	tamarack
	Picea glauca (Moench) Voss	white spruce
	Picea mariana (P. Mill.) B.S.P.	black spruce
	Picea rubens Sarg.	red spruce
	Pinus banksiana Lamb.	jack pine
	Pinus resinosa Soland.	red pine
	Pinus rigida P. Mill.	pitch pine
	Pinus strobus L.	eastern white pine
	Tsuga canadensis (L.) Carr.	eastern hemlock
Plantaginaceae	*Plantago maritima var. juncoides* (Lam.) Gray	goose tongue
Plumbaginaceae	*Limonium carolinianum* (Walt.) Britt.	Carolina sealavender
Poaceae	*Agrostis gigantea* Roth	redtop
	Agrostis hyemalis (Walt.) B.S.P.	winter bentgrass
	Agrostis L.	bentgrass
	Agrostis scabra Willd.	rough bentgrass
	Agrostis stolonifera L.	creeping bentgrass
	Ammophila breviligulata Fern.	American beachgrass
	Anthoxanthum odoratum L.	sweet vernalgrass
	Brachyelytrum septentrionale (Babel) G. Tucker	northern shorthusk
	Calamagrostis canadensis (Michx.) Beauv.	bluejoint
	Danthonia spicata (L.) Beauv. ex Roemer & J.A. Schultes	poverty danthonia
	Deschampsia flexuosa (L.) Trin.	wavy hairgrass
	Dichanthelium (A.S. Hitchc. & Chase) Gould	rosette grass
	Distichlis spicata (L.) Greene	inland saltgrass
	Festuca L.	fescue
	Festuca ovina L.	sheep fescue
	Festuca rubra L.	red fescue
	Glyceria borealis (Nash) Batchelder	northern mannagrass
	Glyceria canadensis (Michx.) Trin.	rattlesnake mannagrass

Family	Scientific Name	Common Name
	Glyceria grandis S. Wats.	American mannagrass
	Glyceria melicaria (Michx.) F.T. Hubbard	melic mannagrass
	Glyceria obtusa (Muhl.) Trin.	Atlantic mannagrass
	Glyceria R. Br.	mannagrass
	Glyceria striata (Lam.) A.S. Hitchc.	fowl mannagrass
	Leersia oryzoides (L.) Sw.	rice cutgrass
	Muhlenbergia glomerata (Willd.) Trin.	spiked muhly
	Muhlenbergia Schreb.	muhly
	Muhlenbergia uniflora (Muhl.) Fern.	bog muhly
	Oryzopsis asperifolia Michx.	roughleaf ricegrass
	Oryzopsis Michx.	ricegrass
	Panicum L.	panicum
	Spartina alterniflora Loisel.	smooth cordgrass
Polygonaceae	*Polygonum achoreum* Blake	leathery knotweed
	Polygonum sagittatum L.	arrowleaf tearthumb
	Rumex orbiculatus Gray	greater water dock
Polypodiaceae	*Polypodium virginianum* L.	rock polypody
	Atrichum P. Beauv.	atrichum moss
	Atrichum undulatum (Hedw.) P. Beauv.	undulate atrichum moss
	Polytrichum commune Hedw.	polytrichum moss
	Polytrichum Hedw.	polytrichum moss
	Polytrichum juniperinum Hedw.	juniper polytrichum moss
	Polytrichum piliferum Hedw.	polytrichum moss
	Polytrichum strictum Brid.	polytrichum moss
Pontederiaceae	*Pontederia cordata* L.	pickerelweed
Potamogetonaceae	*Potamogeton* L.	pondweed
Primulaceae	*Glaux maritima* L.	sea milkwort
	Lysimachia quadrifolia L.	whorled yellow loosestrife
	Lysimachia terrestris (L.) B.S.P.	earth loosestrife
	Trientalis borealis Raf.	American starflower
	Ptilidium Nees	ptilidium
Pyrolaceae	*Orthilia secunda* (L.) House	sidebells wintergreen
	Pyrola americana Sweet	American wintergreen
	Pyrola elliptica Nutt.	waxflower shinleaf
Ranunculaceae	*Anemone virginiana* L.	tall thimbleweed
	Clematis virginiana L.	devil's darning needles
	Coptis trifolia (L.) Salisb.	threeleaf goldthread
	Ranunculus acris L.	tall buttercup
	Ranunculus L.	buttercup
	Thalictrum pubescens Pursh	king of the meadow
Rhamnaceae	*Frangula alnus* P. Mill.	buckthorn
Rhizocarpaceae	*Rhizocarpon geographicum* (L.) DC.	world map lichen
Rosaceae	*Amelanchier arborea* (Michx. f.) Fern.	common serviceberry
	Amelanchier canadensis (L.) Medik.	Canadian serviceberry
	Amelanchier laevis Wieg.	Allegheny serviceberry
	Amelanchier Medik.	serviceberry
	Amelanchier stolonifera Wieg.	running serviceberry

Family	Scientific Name	Common Name
	Aronia melanocarpa (Michx.) Ell.	black chokeberry
	Comarum palustre L.	purple marshlocks
	Dalibarda repens L.	robin runaway
	Fragaria virginiana Duchesne	Virginia strawberry
	Physocarpus opulifolius (L.) Maxim.	common ninebark
	Potentilla simplex Michx.	common cinquefoil
	Prunus pensylvanica L. f.	pin cherry
	Prunus virginiana L.	common chokecherry
	Rosa carolina L.	Carolina rose
	Rosa L.	rose
	Rosa nitida Willd.	shining rose
	Rosa rugosa Thunb.	rugosa rose
	Rosa virginiana P. Mill.	Virginia rose
	Rubus allegheniensis Porter	Allegheny blackberry
	Rubus flagellaris Willd.	northern dewberry
	Rubus hispidus L.	bristly dewberry
	Rubus idaeus L.	American red raspberry
	Rubus L.	blackberry
	Rubus pubescens Raf.	dwarf red blackberry
	Sibbaldiopsis tridentata (Ait.) Rydb.	shrubby fivefingers
	Sorbus americana Marsh.	American mountainash
	Spiraea alba Du Roi	white meadowsweet
	Spiraea tomentosa L.	steeplebush
Rubiaceae	*Galium asprellum* Michx.	rough bedstraw
	Galium L.	bedstraw
	Galium labradoricum (Wieg.) Wieg.	northern bog bedstraw
	Mitchella repens L.	partridgeberry
Salicaceae	*Populus grandidentata* Michx.	bigtooth aspen
	Populus tremuloides Michx.	quaking aspen
	Salix L.	willow
	Salix sericea Marsh.	silky willow
Sarraceniaceae	*Sarracenia purpurea* L.	purple pitcherplant
Scapaniaceae	*Scapania* (Dum.) Dum.	scapania
Scrophulariaceae	*Euphrasia randii* B.L. Robins.	small eyebright
	Melampyrum lineare Desr.	narrowleaf cowwheat
	Veronica officinalis L.	common gypsyweed
Sparganiaceae	*Sparganium americanum* Nutt.	American burreed
	Sparganium L.	burreed
Sphagnaceae	*Sphagnum angustifolium* (C. Jens. ex Russ.) C. Jens. in Tolf	sphagnum
	Sphagnum capillifolium (Ehrh.) Hedw.	sphagnum
	Sphagnum compactum DC. in Lam. & DC.	low sphagnum
	Sphagnum cuspidatum Ehrh. ex Hoffm.	toothed sphagnum
	Sphagnum fimbriatum Wils. in Wils. & Hook. f. in Hook. f.	sphagnum
	Sphagnum flavicomans (Card.) Warnst.	sphagnum
	Sphagnum fuscum (Schimp.) Klinggr.	sphagnum
	Sphagnum girgensohnii Russ.	Girgensohn's sphagnum
	Sphagnum L.	sphagnum

Family	Scientific Name	Common Name
	Sphagnum magellanicum Brid.	Magellan's sphagnum
	Sphagnum majus (Russ.) C. Jens.	sphagnum
	Sphagnum palustre L.	prairie sphagnum
	Sphagnum papillosum Lindb.	papillose sphagnum
	Sphagnum pylaesii Brid.	Pylaes' sphagnum
	Sphagnum recurvum P. Beauv.	recurved sphagnum
	Sphagnum rubellum Wils.	sphagnum
	Sphagnum russowii Warnst.	Russow's sphagnum
	Sphagnum squarrosum Crome	sphagnum
	Sphagnum subsecundum Nees in Sturm	sphagnum
	Sphagnum tenellum (Brid.) Bory	sphagnum
	Sphagnum wulfianum Girg.	Wulf's sphagnum
Thelypteridaceae	*Phegopteris connectilis* (Michx.) Watt	long beechfern
	Thelypteris noveboracensis (L.) Nieuwl.	New York fern
	Thelypteris palustris Schott	eastern marsh fern
Thuidiaceae	*Thuidium delicatulum* (Hedw.) Schimp. in B.S.G.	delicate thuidium moss
Umbilicariaceae	*Umbilicaria* Hoffm.	navel lichen
Violaceae	*Viola cucullata* Ait.	marsh blue violet
	Viola L.	violet
Xyridaceae	*Xyris difformis* Chapman	bog yelloweyed grass

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U.S. Geological Survey-National Park Service
Vegetation Mapping Program
Acadia National Park, Maine

Appendix I
Vegetation Community Descriptions
Revised Edition – October 2003

Vegetation Community Descriptions of Acadia National Park

As a result of this vegetation mapping project, we identified 53 vegetation community types (associations) of the National Vegetation Classification System (NVCS) at Acadia National Park (NP). Essential for recognizing floristic vegetation types (association and alliance levels of the NVCS), detailed vegetation descriptions are derived to "provide specific information on the geographical distribution, level of acceptable physiognomic and compositional variation, and the key ecological processes and environmental/abiotic factors that are associated with a type" (Grossman et al.1998). For mapping projects within the USGS-NPS Vegetation Mapping Program, vegetation descriptions not only supply the global (regional) information of vegetation communities, but also local information that deals directly with the plant characterization typical of the national park unit.

With the following pages, we provide vegetation descriptions for each vegetation community identified at Acadia NP with this project. In Appendix B, we provide a dicothomous key to vegetation communities. By using the key in combination with these vegetation descriptions, one can determine the correct vegetation community.

These descriptions are a combination of information from exisiting community descriptions from NatureServe and Maine Natural Areas Program, and from newly acquired and analyzed vegetation sample data from this vegetation mapping project. Because some vegetation community types are based on limited samples, there may be some variations in vegetation characteristizations not captured by this project.

List of Vegetation Community Types (NVCS Associations)

Organized by NVCS structure.

Mapping the NVCS Vegetation Community Classification

Our mapping of natural/semi-natural vegetation is based on NVCS associations (vegetation communities) identified at Acadia NP as a result of this project. Table I-1 on the following pages show the relationships between vegetation communities and the map classification used with the mapping.

To view the relationships in a matrix table format, see Appendix E: Vegetation Classication Matrix. To understand more fully how vegetation communities are mapped, see Appendix F: Map Class Descriptions and Visual Guide.

Table I-1. NVCS vegetation communities (associations) with linkage to map classes.

NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code	Vegetation Map Classes (Map Class Code - Map Class Name)
Note: not all vegetation communities and map classes have a 1:1 relationship.				
Pinus strobus - Tsuga canadensis - Picea rubens Forest	Eastern Hemlock - White Pine - Red Spruce	CEGL006324	I.A.8.N.b.13	WPC - White Pine - Mixed Conifer Forest
Pinus strobus - Pinus resinosa / Cornus canadensis Forest	Red Pine - White Pine Forest	CEGL006253	I.A.8.N.b.14	WRP - Red Pine - White Pine Forest
Picea rubens - Picea glauca Forest	Maritime Spruce - Fir Forest	CEGL006151	I.A.8.N.c.15	SF - Spruce - Fir Forest (conifer phase)
Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides Forest	Northern Hardwood Forest	CEGL006252	I.B.2.N.a.4	MDF - Beech - Birch - Maple Forest
Quercus rubra - Acer rubrum - Betula spp. *- Pinus strobus* Forest	Successional Oak - Pine Forest	CEGL006506	I.B.2.N.a.39	OPF - Oak - Pine Forest WPM - White Pine - Hardwood Forest ROW - Red Oak Woodland
Acer rubrum - Fraxinus spp. */ Nemopanthus mucronatus - Vaccinium corymbosum* Forest	Northern Hardwood Seepage Swamp	CEGL006220	I.B.2.N.e.1	MAS - Red Maple - Hardwood Swamp
Picea rubens - Betula alleghaniensis / Dryopteris campyloptera Forest	Red Spruce - Hardwoods Forest	CEGL006267	I.C.3.N.a.4	SFM - Spruce - Fir Forest (mixed phase)
Picea rubens - Abies balsamea - Betula spp. *- Acer rubrum* Forest	Successional Spruce - Fir Forest	CEGL006505	I.C.3.N.a.4	SFM - Spruce - Fir Forest (mixed phase)
Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia Forest	White Pine - Oak Forest	CEGL006293	I.C.3.N.a.21	OPF - Oak - Pine Forest
Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis Forest	Hemlock - Hardwood Forest	CEGL006129	I.C.3.N.a.32	WPC - White Pine - Mixed Conifer Forest WPM - White Pine - Hardwood Forest
Acer saccharum - Pinus strobus / Acer pensylvanicum Forest	Sugar Maple - White Pine Forest	CEGL005005	I.C.3.N.a.300	OPF - Oak - Pine Forest WPM - White Pine - Hardwood Forest
Picea rubens - Acer rubrum / Nemopanthus mucronatus Forest	Red Maple - Conifer Acidic Swamp	CEGL006198	I.C.3.N.d.10	CSW - Conifer Swamp Woodland (spruce-mixed phase)
Pinus banksiana / Kalmia angustifolia - Vaccinium spp. Woodland	Jack Pine Heath Barren	CEGL006041	II.A.4.N.a.9	JPW - Jack Pine Woodland
Pinus rigida / Vaccinium spp. *- Gaylussacia baccata* Woodland	Pitch Pine / Blueberry spp. - Huckleberry Woodland	CEGL005046	II.A.4.N.a.26	PPB - Pitch Pine - Heath Barren
Pinus rigida / Photinia melanocarpa / Deschampsia flexuosa - Schizachyrium scoparium Woodland	Pitch Pine Rocky Summit	CEGL006116	II.A.4.N.a.26	PPW - Pitch Pine Woodland
Pinus rigida / Corema conradii Woodland	Coastal Pitch Pine Outcrop Woodland	CEGL006154	II.A.4.N.a.26	PPC - Pitch Pine - Corema Woodland
Thuja occidentalis / Gaylussacia baccata - Vaccinium angustifolium Woodland	White-cedar Woodland	CEGL006411	II.A.4.N.b.1	WCW - White Cedar Woodland

NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code	Vegetation Map Classes (Map Class Code - Map Class Name)
Thuja occidentalis - Fraxinus pennsylvanica / Acer pensylvanicum Woodland	Cedar Seepage Slope	CEGL006508	II.A.4.N.b.1	MCW - Mixed Conifer Woodland WCW - White Cedar Woodland
Picea rubens / Vaccinium angustifolium - Sibbaldiopsis tridentata Woodland	Spruce - Fir Rocky Summit	CEGL006053	II.A.4.N.b.3	MCW - Mixed Conifer Woodland MW - Mixed Conifer - Deciduous Woodland
Picea rubens / Ribes glandulosum Woodland	Red Spruce Talus Slope Woodland	CEGL006250	II.A.4.N.b.3	MCW - Mixed Conifer Woodland
Picea mariana / Kalmia angustifolia Woodland	Black Spruce / Heath Rocky Woodland	CEGL006292	II.A.4.N.b.400	MCW - Mixed Conifer Woodland
Thuja occidentalis - Abies balsamea / Ledum groenlandicum / Carex trisperma Woodland	Northern White-cedar Wooded Fen	CEGL006507	II.A.4.N.f.11	WCS - Conifer Swamp Woodland (white cedar phase)
Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum sp. Woodland	Black Spruce Woodland Bog	CEGL006098	II.A.4.N.f.13	CSW - Conifer Swamp Woodland (spruce-mixed phase) WCS - Conifer Swamp Woodland (white cedar phase)
Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera) Woodland	Early Successional Woodland/Forest	CEGL006303	II.B.2.N.a.10	ABF - Aspen - Birch Woodland/Forest Complex (forest phase) ABW - Aspen - Birch Woodland/Forest Complex (woodland phase) ABS - Aspen - Birch Woodland/Forest Complex (shrubland phase) MW - Mixed Conifer - Deciduous Woodland
Quercus rubra - (Quercus prinus) / Vaccinium spp. / *Deschampsia flexuosa* Woodland	Central Appalachian High-Elevation Red Oak Woodland, Northern Variant	CEGL006134	II.B.2.N.a.24	OPF - Oak - Pine Forest ROW - Red Oak Woodland
Betula alleghaniensis - Quercus rubra / Polypodium virginianum Woodland	Red Oak Talus Slope Woodland	CEGL006320	II.B.2.N.a.24	ABW - Aspen - Birch Woodland/Forest Complex (woodland phase)
Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis Woodland	Red Maple Swamp Woodland	CEGL006395	II.B.2.N.e.1	MAS - Red Maple - Hardwood Swamp
Alnus incana - Cornus sericea / Clematis virginiana Shrubland	Alluvial Alder Thicket	CEGL006062	III.B.2.N.d.9	ASP - Alder Shrubland
Alnus incana ssp. *rugosa - Nemopanthus mucronatus / Sphagnum* spp. Shrubland	Northern Peatland Shrub Swamp	CEGL006158	III.B.2.N.e.9	ASP - Alder Shrubland FX - Fen Complex
Myrica gale - Spiraea alba - Chamaedaphne calyculata Shrubland	Sweetgale Mixed Shrub Swamp	CEGL006512	III.B.2.N.g.9	SG - Sweetgale Mixed Shrub Fen FX - Fen Complex
Morella pensylvanica - Empetrum nigrum Dwarf-shrubland	Crowberry - Bayberry Maritime Shrubland	CEGL006510	IV.A.1.N.b.7	CB - Crowberry - Bayberry Headland
Kalmia angustifolia - Chamaedaphne calyculata - (Picea mariana) / Cladina spp. Dwarf-shrubland	Northern Dwarf-shrub Bog	CEGL006225	IV.A.1.N.g.1	DSB - Dwarf Shrub Bog FX - Fen Complex

NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code	Vegetation Map Classes (Map Class Code - Map Class Name)
Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum Dwarf-shrubland	Leatherleaf Acidic Fen	CEGL006513	IV.A.1.N.g.1	FX - Fen Complex
Empetrum nigrum - Gaylussacia dumosa - Rubus chamaemorus / Sphagnum spp. Dwarf-shrubland	Maritime Crowberry Bog	CEGL006248	IV.A.1.N.g.4	FX - Fen Complex
Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata Dwarf-shrubland	Blueberry Granite Barrens	CEGL005094	IV.B.2.N.a.1	BBSS - Blueberry Bald - Summit Shrubland Complex
Ammophila breviligulata - Lathyrus japonicus Herbaceous Vegetation	Northern Beachgrass Dune	CEGL006274	V.A.5.N.c.2	AM - Dune Grassland
(Pinus strobus, Quercus rubra) / Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation	White Pine - Oak Acid Bedrock Glade	CEGL005101	V.A.5.N.e.8	OPF - Oak - Pine Forest MW - Mixed Conifer - Deciduous Woodland
Trichophorum caespitosum - Gaylussacia dumosa / Sphagnum (fuscum, rubellum, magellanicum) Herbaceous Vegetation	Maritime Peatland Sedge Lawn	CEGL006260	V.A.5.N.h.1	DSB - Dwarf Shrub Bog
Carex stricta - Carex vesicaria Seasonally Flooded Herbaceous Vegetation	Eastern Tussock Sedge Meadow	CEGL006412	V.A.5.N.k.36	FX - Fen ComplexSMG - Graminoid Shallow Marsh
Calamagrostis canadensis - Scirpus spp. - *Dulichium arundinaceum* Herbaceous Vegetation	Seasonally Flooded Mixed Graminoid Meadow	CEGL006519	V.A.5.N.k.39	FX - Fen Complex SMG - Graminoid Shallow Marsh
Eriocaulon aquaticum - Lobelia dortmanna Herbaceous Vegetation	Seven-angle Pipewort - Dortmann's Cardinal-flower Herbaceous Vegetation	CEGL006346	V.A.5.N.l.2	OWM - Open Water - Deep Marsh Complex
Juncus militaris Herbaceous Vegetation	Bayonet Rush Herbaceous Vegetation	CEGL006345	V.A.5.N.l.3	SMG - Graminoid Shallow Marsh
Typha (angustifolia, latifolia) - (Schoenoplectus spp.*)* Eastern Herbaceous Vegetation	Eastern Cattail Marsh	CEGL006153	V.A.5.N.l.9	SMG - Graminoid Shallow Marsh OWM - Open Water - Deep Marsh Complex
Schoenoplectus (tabernaemontani, acutus) Eastern Herbaceous Vegetation	Bulrush Deepwater Marsh	CEGL006275	V.A.5.N.l.16	OWM - Open Water - Deep Marsh Complex
Carex (lasiocarpa, utriculata, canescens) Herbaceous Vegetation	Slender Sedge Fen	CEGL006521	V.A.5.N.m.7	FX - Fen Complex SMG - Graminoid Shallow Marsh
Typha angustifolia - Hibiscus moscheutos Herbaceous Vegetation	Brackish Tidal Marsh, Cattail Variant	CEGL004201	V.A.5.N.n.2	TG - Tidal Marsh
Spartina patens - Distichlis spicata - (Juncus gerardii) Herbaceous Vegetation	Spartina High Salt Marsh	CEGL006006	V.A.5.N.n.11	TG - Tidal Marsh
Carex (oligosperma, exilis) - Chamaedaphne calyculata Shrub Herbaceous Vegetation	Few-seeded Sedge - Leatherleaf Fen	CEGL006524	V.A.7.N.o.3	FX - Fen Complex
Vallisneria americana - Potamogeton perfoliatus Herbaceous Vegetation	Open Water Marsh with Mixed Submergents/Emergents	CEGL006196	V.C.2.N.a.17	OWM - Open Water - Deep Marsh Complex
Nuphar lutea ssp. *advena - Nymphaea odorata* Herbaceous Vegetation	Water Lily Aquatic Wetland	CEGL002386	V.C.2.N.a.102	OWM - Open Water - Deep Marsh Complex

NVCS Vegetation Community Name (NatureServe Association)	NVCS Synonym Community Name (NatureServe Association)	NatureServe CEGL Code	NVCS Code	Vegetation Map Classes (Map Class Code - Map Class Name)
Polypodium (virginianum, appalachianum) / Lichen spp. Nonvascular Vegetation	Northern Lichen Talus Barrens	CEGL006534	VI.B.1.N.c.300	SVT - Sparsely Vegetated Talus
Solidago sempervirens - (Rhodiola rosea) - Juniperus horizontalis Sparse Vegetation	Northern Maritime Rocky Headlands	CEGL006529	VII.A.2.N.a.4	SVH - Open Headland - Beach Strand
Cakile edentula ssp. *edentula - Mertensia maritima* Sparse Vegetation	Sea-rocket - Oysterleaf Sparse Vegetation	CEGL006106	VII.C.2.N.a.2	SVH - Open Headland - Beach Strand

Pinus strobus - Tsuga canadensis - Picea rubens Forest

COMMON NAME	Eastern White Pine - Eastern Hemlock - Red Spruce Forest
SYNONYM	Eastern Hemlock - White Pine-Red Spruce
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.A.8.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b)
ALLIANCE	PINUS STROBUS - TSUGA CANADENSIS FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is most common on the west side of Mount Desert Island.

Globally

This association occurs in Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

A forest of lower elevations (generally under 100 m) and lower slopes in Acadia. The samples faced northwesterly to northeasterly on 20 - 40% slopes. Soils were thin over bedrock or talus and well-drained, pH 4.8 - 5.2. One sample was within the area burned in 1947, and contained evidence of fire; the others were outside of the 1947 fire area and recent fire was not evident.

Globally

This dry hemlock - white pine forest of northern New England occurs on dry sheltered slopes with thin sandy or stony soils overlying bedrock or talus.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus strobus, Picea rubens, Abies balsamea, Thuja occidentalis, Pinus resinosa*
Dwarf Shrub	*Vaccinium angustifolia, Vaccinium myrtilloides*
Herbaceous	*Pteridium aquilinum, Maianthemum canadense, Trientalis borealis, Gaultheria procumbens*
Non-vascular	*Cladina* spp., *Dicranum undulatum, Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Pinus strobus, Tsuga canadensis*
Dwarf Shrub	*Gaylussacia baccata, Kalmia angustifolia, Viburnum nudum* var. c*assinoides, Vaccinium angustifolium, Vaccinium myrtilloides*
Herbaceous	*Pteridium aquilinum, Polypodium virginianum, Aralia nudicaulis, Maianthemum canadense, Gaultheria procumbens, Aster acuminatus, Aster macrophyllus, Cornus canadensis, Trientalis borealis, Clintonia borealis*

CHARACTERISTIC SPECIES

Acadia National Park

Pinus strobus as a canopy dominant and < 25% deciduous cover.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Coniferous forest with *Pinus strobus* as the dominant tree, sometimes with almost equal amounts of *Picea rubens* or (though not in these samples) *Tsuga canadensis*. *Abies balsamea* is present as a canopy species but with far less basal area. *Thuja occidentalis, Pinus resinosa*, or *Quercus rubra* are well represented in some stands. Below the canopy, vegetation is very sparse. Tree regeneration (mostly spruce and fir) is patchy, and there may be scattered *Vaccinium angustifolium* or *V. myrtilloides* in the ground layer. Herbs and bryoids are sparse. Typical herb species include *Gaultheria procumbens, Trientalis borealis, Maianthemum canadense*, and *Pteridium aquilinum*. The bryoid layer is a smattering of species including *Cladina* lichens, *Dicranum undulatum*, and *Leucobryum glaucum*.

The basal area ranged from 22 - 50 m^2/ha. Canopy heights were 12 - 22 m (supercanopy).

Globally
The closed coniferous canopy is comprised of substantial *Pinus strobus* and *Tsuga canadensis*. *Picea rubens* and *Abies balsamea* are characteristic of this vegetation, and although they may not be abundant, presence of these species indicates a cool climatic regime. Minor deciduous associates may include *Quercus rubra, Acer rubrum, Betula alleghaniensis,* or *Betula populifolia*. The shrub layer is patchy and sparse. Characteristic species include *Gaylussacia baccata, Kalmia angustifolia, Viburnum nudum* var. *cassinoides (= Viburnum cassinoides), Vaccinium angustifolium, Vaccinium myrtilloides,* or, less commonly, *Comptonia peregrina, Diervilla lonicera, Nemopanthus mucronatus, Rubus hispidus,* or others. Dense needle accumulation and dry conditions appear to limit understory growth to a sparse herbaceous layer of ferns and herbs. Characteristic species include *Pteridium aquilinum, Polypodium virginianum, Aralia nudicaulis, Maianthemum canadense, Gaultheria procumbens, Aster acuminatus, Aster macrophyllus, Cornus canadensis, Trientalis borealis, and Clintonia borealis.* The bryophyte layer is sparse and may include *Dicranum undulatum, Leucobryum glaucum,* and species of *Cladina*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006324

COMMENTS
Acadia National Park
This community compositionally can grade into oak - pine types but is more strongly coniferous. Can also be similar to spruce - fir forests, except that *Pinus strobus* will be more dominant than *Picea rubens*. The conifer component other than white pine is variable.

Globally
This community is less xeric than the Red Pine - White Pine Forest (*Pinus strobus - Pinus resinosa / Cornus canadensis* Forest) and less mesic than the Hemlock - Hardwood Forest (*Tsuga canadensis - Betula alleghaniensis - Picea rubens / Cornus canadensis* Forest). This community shares many understory species with associations of the *Pinus strobus - Quercus (alba, rubra, velutina)* Forest Alliance, but in contrast, oaks are unimportant.

Pinus strobus - Pinus resinosa / Cornus canadensis Forest

COMMON NAME	Eastern White Pine - Red Pine / Canadian Bunchberry Forest
SYNONYM	Red Pine - White Pine Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.A.8.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.b)
ALLIANCE	PINUS STROBUS FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

These forests are not common in Acadia and are found both in the area of the 1947 burn and outside of that area.

Globally

This association occurs in Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Forests of mid elevations and moderate to somewhat steep (10 - 40%) slopes. Soils are thin (12 cm) sandy loams or loamy sands over granitic bedrock, very well drained to somewhat excessively drained; soil pH 4.8-5.0.

Globally

This dry pine forest occurs on well- to rapidly drained, coarse-textured sand and gravel deposits on flats, such as outwash sands, delta sands, eskers, kames, kame terraces, dry lake sands, as well as some upper slopes.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus resinosa, Pinus strobus, Abies balsamea, Picea rubens, Acer rubrum*
Tree Subcanopy	*Picea rubens, Abies balsamea*
Dwarf Shrub	*Vaccinium angustifolia, Gaylussacia baccata, Kalmia angustifolia, Vaccinium myrtilloides*
Herbaceous	*Pteridium aquilinum, Gaultheria procumbens, Maianthemum canadense, Trientalis borealis, Mitchella repens*
Non-vascular	*Dicranum undulatum, Polytrichum juniperinum, Pleurozium schreberi*

Globally

Stratum	Species
Tree Canopy	*Pinus strobus, Pinus resinosa*
Dwarf Shrub	*Kalmia angustifolia, Vaccinium angustifolium, Vaccinium myrtilloides, Gaylussacia baccata*
Herbaceous	*Pteridium aquilinum, Oryzopsis asperifolia, Carex pensylvanica, Mitchella repens, Maianthemum canadense, Gaultheria procumbens, Cornus canadensis, Trientalis borealis, Clintonia borealis*

CHARACTERISTIC SPECIES

Acadia National Park

Pinus resinosa as a co-dominant canopy species

Globally

VEGETATION DESCRIPTION

Acadia National Park

Forests dominated by *Pinus strobus* and *Pinus resinosa* forming an incomplete canopy (but not so open as to be typed as woodland). *Picea rubens* or *Acer rubrum* may, as in so many Acadia types, be a prominent canopy associate. *Abies balsamea* is common, though not abundant. Pines are generally absent from the spruce and fir subcanopy, although small *Pinus strobus* may be present in the ground layer. Dwarf shrubs typically include *Vaccinium angustifolium*, *Gaylussacia baccata*, and/or *Kalmia angustifolia*; the dwarf shrub cover in the samples varied from very sparse (3%) to almost 50%.

The basal area ranged from 35 - 51 m^2/ha. Canopy heights were 16 - 22m.

Globally

The canopy is dominated by *Pinus strobus* and *Pinus resinosa*, with scattered minor associates including *Quercus rubra, Betula alleghaniensis, Abies balsamea, Picea rubens*, and *Acer rubrum*. The sparse shrub layer includes *Kalmia angustifolia, Viburnum*

nudum var. *cassinoides* (= *Viburnum cassinoides*), *Vaccinium angustifolium, Vaccinium myrtilloides, Gaylussacia baccata, Amelanchier canadensis*, and *Acer pensylvanicum*. Characteristic herbs include *Pteridium aquilinum, Oryzopsis asperifolia, Carex pensylvanica, Mitchella repens, Maianthemum canadense, Gaultheria procumbens, Cornus canadensis, Trientalis borealis*, and *Clintonia borealis*. The herbaceous layer may be sparse due to needle accumulation and dry conditions. This forest type does not exhibit a well-developed moss layer, although species such as *Dicranum polysetum, Dicranum undulatum, Polytrichum juniperinum, Pleurozium schreberi*, and *Brachythecium* spp. may be abundant.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006253

COMMENTS

Acadia National Park

Eastern Hemlock - White Pine - Red Spruce Forest *(Pinus stobus - Tsuga canadensis - Picea rubens* Forest) can be similar but will have less *Pinus resinosa* in the canopy (<< 40% relative dominance) and is typically on somewhat more mesic sites. Mixed Conifer Woodlands can also be very similar but are distinguished by their more open canopy, their more well developed heath shrub layer (although one of the Red Pine - White Pine Forests sampled has a well-developed heath shrub layer), and they generally will have a greater extent of exposed bedrock.

Heath shrub and herb cover are highly variable. Those on the east side of Mount Desert Island have more of a woodland character while the west side examples are more forest-like.

Globally

This community probably requires periodic fires for maintenance. This association is less mesic and dependent on fire when compared to the Eastern Hemlock - White Pine - Red Spruce (*Pinus strobus - Tsuga canadensis - Picea rubens* Forest) and occurs farther north in a cooler climate than do mixed pine - oak forests or pitch pine woodland communities. *Picea rubens, Viburnum nudum* var. *cassinoides, Betula* papyrifera, and *Vaccinium myrtilloides* differentiate this community from dry pine forests at lower latitudes.

Picea rubens - Picea glauca Forest

COMMON NAME	Red Spruce - White Spruce Forest
SYNONYM	Maritime Spruce - Fir Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.A.8.N)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c)
ALLIANCE	PICEA RUBENS - ABIES BALSAMEA FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs abundantly throughout the park. On Mount Desert Island, most of these forests occur on the west and southeast portions. This is the most extensive forest type on Schoodic peninsula, Isle au Haut, Long Island, and other smaller islands.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

At various landscape positions, aspects, and all elevations within the Park, although less frequent on hill crests than on slopes and low flats. Slopes are genrally low to moderate, up to 30%. Most occur on till soils, though some occur on thin soil over bedrock. Most sites have loamy to sandy soils that are moderately well drained; pH is in the 4.8 - 5.2 range (occasionally slightly higher). Though shallow (10 - 40 cm), the soils are generally deeper than those supporting conifer woodlands. Most of the spruce - fir forests sampled were in portions of the Park that were not burned in 1947, although a few stands contain evidence of past fire nonetheless; of the three samples within the 1947 fire area, only one actually contained evidence of fire. Historic fires have played a role over most of this area, but this vegetation type appears to take longer after fire to develop than some of the other upland forest and woodland types.

Globally

This community is a spruce - fir forest of maritime regions on the coast of northern New England and the maritime provinces of Canada. Soils are well-drained to moderately well-drained, often with a thick organic mat over a thin mineral layer. Occurrences are associated with cool and fog-laden maritime winds and are mostly found within 1/2 mile (occasionally 3 miles) of the coast. Cool temperatures and frequent fogs create comparatively mesic conditions. These coniferous forests are efficient at intercepting cloud moisture, creating local conditions with elevated humidity and water flux.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea rubens, Picea glauca, Abies balsamea, Thuja occidentalis, Picea mariana, Larix laricina, Tsuga canadensis, Pinus strobus*
Tree Subcanopy	*Picea rubens, Abies balsamea*
Short Shrub	*Alnus viridis, Betula cordifolia*
Herbaceous	*Trientalis borealis, Maianthemum canadense, Coptis trifolia, Rubus pubescens, Aster umbellatum, Cornus canadensis*
Non-vascular	*Pleurozium schreberi, Bazzania trilobata, Ptilidium ciliare, Dicranum* spp., *Leucobryum glaucum, Hypnum imponens, Dicranum polysetum, Cladina sylvatica, Hylocomium splendens, Sphagnum palustre, Sphagnum girgensohnii*

Globally

Stratum	Species
Tree Canopy	*Picea rubens, Abies balsamea*
Short Shrub	*Vaccinium angustifolium*
Herbaceous	*Trientalis borealis, Coptis trifolia*
Non-vascular	*Pleurozium schreberi, Bazzania trilobata, Dicranum* spp., *Hylocomium splendens, Hypnum imponens, Sphagnum palustre, Sphagnum girgensohnii, Ptilium* spp.

CHARACTERISTIC SPECIES

Acadia National Park

Picea glauca or *Vaccinium vitis-idaea*, where present; *Pleurozium schreberi* or *Ptilidium ciliare* as bryoids.

Globally

VEGETATION DESCRIPTION

Acadia National Park

The most extensive original forest type along the Maine coast. *Picea rubens* is strongly dominant in the canopy and present in the lower layers. *Picea glauca* (present in half the samples) may be locally concentrated, particularly near the shoreward forest edge. *Abies balsamea* is present in the canopy and lower layers of most stands (60% of the samples), but at much lower abundance than spruce. Certain other conifers, though infrequent, may be common in occasional stands: *Thuja occidentalis*, *Picea mariana, Larix laricina, Tsuga canadensis*, and *Pinus strobus*. The canopy is sometimes fairly open, or patchy with blowdown openings, with a patchy layer below of regenerating spruce or fir or, less commonly, *Alnus* spp. with or without *Sorbus americana*. The dwarf shrub stratum is noticeably sparse, if present at all. *Vaccinium angustfolium* is the most frequent (60%) low shrub; *Kalmia angustifolia* and *Vaccinium vitis-idaea* are also characteristic, though less frequent (20%). The herb stratum is variable in cover and species composition, and includes the common tree species as well as the standard boreal herbs *Maianthemum canadense*, *Trientalis borealis*, and (less frequently) *Coptis trifolia*. One of the distinguishing features of these forests is the well developed bryoid layer. At most sites it exceeds 15% cover, and ranges up to 90% (average 34%). The most frequent and abundant species are *Pleurozium schreberi*, *Bazzania trilobata*, *Ptilidium ciliare*, and *Dicranum* spp. *Hypnum imponens* is frequent but at lower cover; locally abundant but less frequent mosses include *Hylocomium splendens*, *Sphagnum palustre*, and *S. girgensohnii*. Bryoid species richness almost always exceeds that of herbs, shrubs, or trees.

The basal area ranged from 16 - 64 m^2/ha.. Canopy heights were 10 - 24 m (avg. 17 m).

Globally

The tree canopy ranges from closed to partially open as a result of blowdowns. *Picea rubens* and/or *Abies balsamea* are dominant. In many locations *Picea glauca* is a prominent canopy component, especially along the shore where it populates blowdowns and extensive openings. However, white spruce may die off locally under prolonged closed-canopy conditions. Other minor associate canopy species may include *Picea mariana, Betula papyrifera, Betula alleghaniensis* var. *alleghaniensis (= Betula lutea), Acer rubrum, Populus tremuloides, Pinus strobus, Tsuga canadensis, Thuja occidentalis, Larix laricina*, and occasionally *Betula populifolia*. Shrubs and herbs are sparse but typically include *Vaccinium angustifolium, Vaccinium vitis-idaea, Viburnum nudum* var. *cassinoides, Nemopanthus mucronatus, Kalmia angustifolia, Maianthemum canadense, Trientalis borealis, Cornus canadensis, Coptis trifolia* ssp. *groenlandica (= Coptis groenlandica), Gaultheria hispidula, Aralia nudicaulis*, and *Clintonia borealis*. The well-developed mossy ground layer is dominated by *Pleurozium schreberi*, *Bazzania trilobata, Dicranum* spp., *Hylocomium splendens, Hypnum imponens, Sphagnum palustre*, *Sphagnum girgensohnii*, and *Ptilium* spp. On coastal islands and outer peninsulas, where salt spray is a factor, trees may be contorted or short.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4G5.

DATABASE CODE CEGL006151

COMMENTS

Acadia National Park

Spruce - fir forests along the immediate coast best express the maritime influence, but all coniferous spruce - fir forests in Acadia are mapped as this type. Some of the more interior stands in Acadia could conceivably fit into a different state type, the Spruce - Fir - Broom-moss forest, which is characterized by an absence of maritime indicators and an extremely depauperate herb and bryoid layer.

The Red Spruce - Hardwoods Forest *(Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forest) and Successional Spruce - Fir Forest (*Picea rubens - Abies balsamea - Betula spp. - Acer rubrum* Forest) are variations of this type which are mixed forests rather than strongly coniferous, although there is a continuum from one to the other. Mixed conifer woodlands dominated by spruce can also grade into open-canopy versions of this forest type; generally, the presence of a heath shrub layer is used to distinguish the two.

Globally

This association is differentiated from inland spruce-fir forests by the abundance of *Vaccinium vitis-idaea* and bryophyte species *Pleurozium schreberi* and *Ptilidium ciliare*.

Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides Forest

COMMON NAME	Sugar Maple - Yellow Birch - American Beech / Hobblebush Forest
SYNONYM	Northern Hardwood Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.B.2.N)
FORMATION	Lowland or submontane cold-deciduous forest (I.B.2.N.a)
ALLIANCE	ACER SACCHARUM - BETULA ALLEGHANIENSIS - (FAGUS GRANDIFOLIA) FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs in patches throughout the Park, in both the burned and unburned areas.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Mixed deciduous forests typically occur at low to middle elevations (up to 150 m AMSL). They are found on the lower to middle portion of hillslopes (slopes generally 10-50%), facing north to southeast. The soils are generally sandy loams to loamy sands formed over glacial; some occur on stabilized talus. Soil pH is in the 5.0 - 5.6 range.

Globally

This forest occurs most commonly on acid, moderate to well-drained tills at elevations generally below 2500 feet.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Fagus grandifolia, Acer saccharum, Betula allegheniensis, Betula papyrifera, Picea rubens, Acer pensylvanicum, Tsuga canadensis*
Tree Subcanopy	*Fagus grandifolia, Acer pensylvanicum, Picea rubens*
Herbaceous	*Trientalis borealis, Carex gracilisillima, Carex lucorum*
Non-vascular	*Dicranum* spp., *Hypnum* spp., *Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Acer saccharum, Fagus grandifolia, Betula alleghaniensis*
Tall Shrub	*Viburnum lantanoides, Acer spicatum, Acer pensylvanicum*
Herbaceous	*Dryopteris intermedia, Dryopteris campyloptera, Huperzia lucidula, Maianthemum canadense, Clintonia borealis, Oxalis montana, Trientalis borealis, Aster acuminatus, Uvularia sessilifolia*
Non-vascular	

CHARACTERISTIC SPECIES

Acadia National Park

Combination of *Fagus grandifolia* with *Acer saccharum* and/or *Betula alleghaniensis* (usually both); *Picea* spp. is minor.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Closed-canopy forest dominated by a combination of *Fagus grandifolia* (usually prominent), *Betula alleghaniensis* and *Acer saccharum.* Early successional *Betula papyrifera* and *Acer rubrum* often present but at low cover. Conifers (*Picea rubens* and/or *Tsuga canadensis*) present in some samples, but forming < 25% of the canopy; *Quercus rubra* likewise. *Acer pensylvanicum* is a common subcanopy/understory species. The shrub layer is typically sparse and dominated by tree regeneration. Dwarf shrubs are almost absent (*Vaccinium angustifolium* occasional), and herbs sparse, up to 15% cover. Typical herbaceous species are *Trientalis borealis, Carex gracilisillimaillima, C. lucorum, Epifagus virginiana*, and *Oclomena acuminata*. The bryoid layer is

patchy, with cover usually less than 20%. *Dicranum* species and *Leucobryum glaucum* are the most comon mosses.

The basal area ranged from 11 - 39 m^2/ha. Canopy heights were 14 - 21 m (avg. 18 m).

Globally
The closed canopy is dominated by *Acer saccharum, Fagus grandifolia,* and *Betula alleghaniensis* with associated hardwood species including *Betula papyrifera* and *Fraxinus americana*. Conifers are usually present at low abundance. Characteristic species include *Pinus strobus, Tsuga canadensis,* and in the northern portion of the range, *Picea rubens*. Oaks are generally not present, although *Quercus rubra* and *Quercus alba* may be present in low numbers. Characteristic understory shrubs or subcanopy trees include *Viburnum lantanoides, Acer spicatum,* and *Acer pensylvanicum.* The patchy herbaceous layer is a mix of ferns, rhizomatous herbs and clubmosses. Characteristic species include *Dryopteris intermedia, Dryopteris campyloptera, Huperzia lucidula, Maianthemum canadense, Clintonia borealis, Oxalis montana (= Oxalis acetosella), Trientalis borealis, Aster acuminatus, Uvularia sessilifolia*. Occasional species include *Aralia nudicaulis, Trillium erectum, Trillium undulatum, Streptopus roseus, Cinna latifolia, Thelypteris noveboracensis, Solidago macrophylla,* and *Medeola virginiana*. The bryophyte layer is of variable cover and may include *Dicranum* spp. and *Leucobryum glaucum*. At higher elevations any of the understory herbs characteristic of montane spruce - fir forests may be present and abundant. Sugar maple leaf litter is high in nitrogen relative to lignin and thus decomposes rapidly increasing the nutrient pool in the soil organic layer. Structure and composition of the forest are maintained primarily by single small tree-fall gaps. Yellow birch is maintained in the system by mineral soils on "tip up mounds."

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5. Widespread throughout the state; a matrix-forming type in the northern two-thirds of the state.

DATABASE CODE CEGL006252

COMMENTS
Acadia National Park
Two samples, on talus, grade to deciduous talus woodland.

Hemlock or green ash can be an important constituent in some stands.

This type can grade into Red Spruce - Hardwoods Forest *(Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forest). Some stands on talus can grade Red Oak Talus Slope Woodland (*Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland). Some stands of Hemlock - Hardwood Forest *(Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forests) are strongly deciduous but will feature *Tsuga canadensis* as the most common conifer and will not have the beech-birch-maple combination of deciduous trees. *Betula papyrifera* can be an important tree both in this type and in the Early Successional Woodland/Forest *{Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland complex}.

Globally

Quercus rubra - Acer rubrum - Betula spp. - *Pinus strobus* Forest

COMMON NAME	Northern Red Oak - Red Maple - Birch species - Eastern White Pine Forest
SYNONYM	Successional Oak - Pine Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.B.2.N)
FORMATION	Lowland or submontane cold-deciduous forest (I.B.2.N.a)
ALLIANCE	QUERCUS RUBRA - (ACER SACCHARUM) FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs primarily in the area of Mount Desert Island burned in the 1947 fire.

Globally

This association occurs in Maine and New York.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These forests typically occur on gentle to moderate slopes at low to mid elevations. Aspect of sampled stands was NNW - E. The glacial till underlying these forests yields loamy soils, moderately well drained to somewhat poorly drained, with a pH of 5.0 - 5.2.

Globally

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Quercus rubra, Acer rubrum, Betula papyrifera, Picea rubens, Acer pensylvanicum*
Tree Subcanopy	*Fagus grandifolia, Acer pensylvanicum, Picea rubens*
Short Shrub	*Gaylussacia baccata, Vaccinium corymbosum* or *Hamamelis virginiana*
Dwarf Shrub	*Kalmia angustifolia, Vaccinium angustifolia*
Herbaceous	*Trientalis borealis, Pteridium aquilinum, Aralia nudifolia*
Non-vascular	*Polytrichum commune, Dicranum polysetum*

Globally

Stratum	Species
Tree Canopy	*Quercus rubra, Fagus grandifolia*
Short Shrub	*Gaylussacia baccata, Hamamelis virginiana*
Herbaceous	*Trientalis borealis, Aralia nudicaulis, Pteridium aquilinum*

CHARACTERISTIC SPECIES

Acadia National Park

Oak dominance plus absence (or minor occurrence) of *Pinus strobus* in the canopy; *Acer pensylvanicum* and *Fagus* more abundant in OPS than in OPF. *Vaccinium angustifolia*, though often present, is less important in OPS than in other oak types.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Forests dominated by *Quercus rubra* and *Acer rubrum* or, less commonly, *Pinus strobus* and *Acer rubrum*. Although included in a mixed Alliance, in Acadia most of these forests are strongly deciduous. The canopy tends to be somewhat open; *Picea rubens, Betula papyrifera,* and *Acer pensylvanicum* consistently occur with the oak and red maple although contributing much less to the canopy composition. The shrub layer is sparse and mostly composed of tree species regeneration. Herbs and dwarf shrubs are spotty: *Kalmia angustifolia, Vaccinium angustifolium, Pteridium aquilinum, Trientalis borealis,* and oak seedlings are typical. The bryoid layer, also patchy, most commonly features *Polytrichum commune* and *Dicranum polysetum.* Herb species richness usually, but not always, exceeds that of trees, shrubs, or bryoids.

The basal area ranged from 11 - 31 m^2/ha. Canopy heights were 14 - 22 m (avg. 16 m).

Globally
The canopy is characterized by a heterogeneous mixture of *Quercus rubra* and *Fagus grandifolia* in association with light-requiring, wind-dispersed trees such as *Populus tremuloides, Populus grandidentata, Betula papyrifera, Betula populifolia, Acer rubrum, Acer pensylvanicum*, and *Prunus serotina*. Minor associates include *Picea rubens* and *Acer saccharum*. Temperate conifers, such as *Pinus strobus* or occasionally *Pinus banksiana*, are often admixed. Composition is variable depending on site history. Despite disturbance, however, understory species tend to reflect predisturbance conditions and may include *Gaylussacia baccata* or *Hamamelis virginiana* in the shrub layer, and *Trientalis borealis, Aralia nudicaulis* or *Pteridium aquilinum* in the herbaceous layer. The bryophyte layer is of variable cover and may include *Polytrichum commune* and *Dicranum polysetum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006506

COMMENTS
Acadia National Park
This type is used for red oak forests without much pine or for pine-early successional forests without much red oak. Whether this really is an early successional version of the standard Oak - Pine Forest is questionable, at least here. Successional Oak - Pine Forest, and most of the White Pine - Oak Forest (*Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest), have fire evidence or are within the area burned in 1947. As currently defined in NVCS, this type includes forests that are dominated by red oak OR white pine, but not both, with *Acer rubrum* as the second most abundant canopy species. *Fagus grandifolia* is subdominant in some stands and absent from others.

"Mature" Oak-pine forest (White Pine - Oak Forest, *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest) is very similar but typically is mixed, while the Successional Oak - Pine Forest *(Quercus rubra - Acer rubrum - Betula spp. - Pinus strobus* Forest) is strongly deciduous or strongly coniferous. Successional Oak - Pine Forest *(Quercus rubra - (Quercus prinus) / Vaccinium spp. / Deschampsia flexuosa* Woodland) stands are also very similar compositionally but have an even more open canopy (generally < 50%) and usually occur on bedrock rather than till soils.

This type is widespread in Acadia NP, though oak-dominated stands are more common as woodland rather than forest.

Globally
This successional forest of northern New England is a broadly defined community developing after severe disturbance including clearing, pasturing, logging, fires, severe hurricanes, or simply heavily fragmented residential development.

Acer rubrum - Fraxinus spp. */ Nemopanthus mucronatus - Vaccinium corymbosum* Forest

COMMON NAME	Red Maple - Ash species / Mountain-holly - Highbush Blueberry Forest
SYNONYM	Northern Hardwood Seepage Swamp
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.B.2.N)
FORMATION	Seasonally flooded cold-deciduous forest (I.B.2.N.e)
ALLIANCE	ACER RUBRUM - FRAXINUS PENNSYLVANICA SEASONALLY FLOODED FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs as small patches throughout the Park.

Globally

This association occurs in Maine, New Hampshire, New York, and possibly Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These forests typically occupy small patches on hillside drainages, and sometimes on poorly drained basins or lower slopes. Soils are silt loams to clay loams. The pH of the single sampled site was 7.0, very high for Acadia NP forests. The one sample was in the portion of the Park that burned in 1947, but did not contain easily found evidence of fire.

Globally

This forest of stream drainages and wetland borders occurs in northern New England, generally on mineral soils with little or no organic accumulation. The hydrologic regime is variable among occurrences, generally influenced both by groundwater seepage and seasonal flooding.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Fraxinus pennsylvanica, Betula allegheniensis*
Tree Subcanopy	*Fagus grandifolia, Acer rubrum, Picea rubens, Fraxinus pennsylvanica*
Herbaceous	*Calamagrostis canadensis, Dryopteris carthusiana, Glyceria striata, Carex gynanadra, Arisaema triphyllum*

Globally

Stratum	Species
Tree Canopy	*Acer rubrum*
Short Shrub	*Lindera benzoin, Ilex verticillata, Nemopanthus mucronatus, Viburnum nudum* var. *cassinoides, Viburnum recognitum*
Herbaceous	*Osmunda cinnamomea, Osmunda regalis, Osmunda claytoniana, Onoclea sensibilis*

CHARACTERISTIC SPECIES

Acadia National Park

Fraxinus pennsylvanica in the canopy and herb layers; *Acer rubrum* less abundant; *Glyceria striata, Arisaema triphyllum, Dryopteris carthusiana* in the herb layer.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A patchy-canopy forest dominated by hardwood species including *Fraxinus pennsylvanica* with *Betula alleghaniensis*, and sometimes with smaller amounts of *Acer rubrum*. *Abies balsamea* and *Picea rubens* may be minor canopy components; deciduous trees make up at least 75% of the canopy. The subcanopy species include *Acer rubrum*, *Betula populifolia*, *Fagus grandifolia*, and *Picea rubens*. Shrubs, both medium shrub and dwarf shrub layers, were sparse (< 10%), mostly *Rubus ideaus*. The herb stratum is fairly extensive, with *Calamagrostis canadensis*, *Dryopteris carthusiana*, and *Glyceria striata* the most abundant. *Arisaema triphyllum* is an indicator of this seepage type. The bryoid layer is sparse, with *Thuidium delicatulum* common and *Sphagnum* conspicuously absent.

The basal area ranged from 9 m^2/ha. Canopy heights were 15 m.

Globally
The closed deciduous canopy characteristically dominated by *Acer rubrum* with associates of *Fraxinus pennsylvanica, Fraxinus nigra, Fraxinus americana, Betula alleghaniensis, Ulmus americana, Ulmus rubra*. *Tsuga canadensis, Picea rubens*, and *Abies balsamea*, while not dominant, characterize this association as one of cooler climates. The shrub understory is often well-developed, with characteristic species including *Lindera benzoin, Ilex verticillata, Nemopanthus mucronatus, Viburnum nudum* var. *cassinoides, Viburnum recognitum*, and *Vaccinium corymbosum*. The herbaceous layer is often dominated by ferns, including *Osmunda cinnamomea, Osmunda regalis, Osmunda claytoniana*, and *Onoclea sensibilis*. Other characteristic species of the herbaceous layer include *Symplocarpus foetidus, Impatiens capensis, Scutellaria galericulata, Saxifraga pensylvanica, Carex intumescens, Carex lacustris*, and *Arisaema triphyllum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006220

COMMENTS
Acadia National Park
Comparison to a known site nearby suggests moderate variability in the canopy dominants but constancy of ash, yellow birch, and seepage indicators in the herb layer. At least one site mapped as this type was better classified as Red Maple - Conifer Acidic Swamp (*Picea rubens - Acer rubrum / Nemopanthus mucronatus* Forest).

The single stand sampled in Acadia NP is similar to upland forests in its canopy composition, but its hydrology types it as wetland. It showed similarities to the Hemlock - Hardwood Forest *(Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest), differing most obviously in the lack of hemlock here, and to some degree also resembled a seepy version of Northern Hardwood Forest *(Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest). The most closely related wetland type is the Red Maple - Conifer Acidic Swamp (*Picea rubens - Acer rubrum / Nemopanthus mucronatus* Forest), which differs in having red maple as the predominant deciduous tree and in having a greater conifer component (>25% RD).

Globally

Picea rubens - Betula alleghaniensis / Dryopteris campyloptera Forest

COMMON NAME	Red Spruce - Yellow Birch / Mountain Woodfern Forest
SYNONYM	Red Spruce - Hardwoods Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Mixed evergreen-deciduous forest (I.C)
PHYSIOGNOMIC GROUP	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.C.3.N)
FORMATION	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
ALLIANCE	PICEA RUBENS - BETULA ALLEGHANIENSIS FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs on Mount Desert Island, but outside the burned area.

Globally

This association occurs in Massachusetts, Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

(Difficult to generalize with two samples.) The spruce - yellow birch forests sampled occurred at lower elevations (40-170 m) and faced northerly to southeasterly. Slope and position varied from from a 25% slope hillside to a 9% lower slope/flat. Soils were silty or sandy loams of pH 5.0. Occurs outside of the area burned in the 1947 fire, and neither sample showed recent fire evidence.

Globally

This transitional hardwood - spruce forest occurs in montane regions of northern New England, the northern Appalachians, and in adjacent Canada. This forest is most extensive at middle elevations, between 2000-2500 feet, occurring on shallow, rocky, nutrient-poor till soils.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea rubens, Betula allegheniensis, Acer rubrum, Acer saccharum, Abies balsamea*
Herbaceous	*Trientalis borealis, Dryopteris carthusiana, Oxalis montana, Maianthemum canadense, Coptis trifolia, Equisetum sylvaticum*
Non-vascular	*Bazzania trilobata, Dicranum scoparium, Hypnum imponens, Sphagnum girgensohnii, Hylocomium splendens, Leucobryum glaucum, Polytrichum commune*

Globally

Stratum	Species
Tree Canopy	*Acer saccharum, Fagus grandifolia, Picea rubens, Abies balsamea*
Tall Shrub	*Sorbus americana, Sorbus decora, Acer pensylvanicum, Acer spicatum*
Short Shrub	*Viburnum lantanoides*
Herbaceous	*Dryopteris intermedia, Dryopteris campyloptera, Clintonia borealis*

CHARACTERISTIC SPECIES

Acadia National Park

A mixed spruce-dominated forest with *Betula alleghaniensis* as a prominent deciduous component. *Hylocomium splendens* is restricted to this and the other two spruce - fir types.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A northern-character mixed forest dominated by *Picea rubens* and *Betula alleghaniensis*. *Acer saccharum* may co-dominate the deciduous component. *Acer rubrum* is often present but at lower cover than the "northern hardwood" species, *Abies balsamea* is also typically present but in very small amounts. Small amounts of *Betula papyrifera, Thuja occidentalis, Fraxinus pennsylvanica, Acer pensylvanicum,* and *Fagus grandifolia* occur in some stands. Shrubs are virtually absent except for small amounts of *Sorbus americana* or *Amelanchier* spp; there may be *Picea* regeneration in the shrub layer. Dwarf shrubs are virtually absent, and both the herb and bryoid layers are sparse and patchy. Typical herbs include the ubiquitous *Maianthemum*

canadense and *Trientalis borealis*, as well as the more indicative *Dryopteris carthusiana, Equisetum sylvaticum, Oxalis montana*, and *Coptis trifolia*. The most common bryoids are *Bazzania trilobata, Dicranum scoparium, Hypnum imponens, Hylocomium splendens, Sphagnum girgensohnii, Leucobryum glaucum*, and *Polytrichum commune*.

The basal area ranged from 31 - 45 m^2/ha. Canopy heights were estimated at 15 - 22 m.

Globally
This association forms a relatively broad transitional zone between northern hardwood forests and montane spruce - fir forests. The closed canopy is dominated by *Acer saccharum* and *Fagus grandifolia* mixed with *Picea rubens* and *Abies balsamea*. Other canopy associates include *Acer rubrum, Betula alleghaniensis, Thuja occidentalis*, and *Betula papyrifera*. Shrub and herbaceous layers contain species common to both northern hardwood and spruce - fir forests. Characteristic shrubs include *Sorbus americana, Sorbus decora, Acer pensylvanicum, Acer spicatum*, and *Viburnum lantanoides (= Viburnum alnifolium)*. Characteristic herbs include *Dryopteris intermedia, Dryopteris campyloptera, Clintonia borealis, Oxalis montana, Linnaea borealis, Maianthemum canadense*, and *Aralia nudicaulis*. The bryophyte layer is of variable cover and may include *Bazzania trilobata, Dicranum scoparium, Hypnum imponens, Hylocomium splendens, Leucobryum glaucum*, and *Polytrichum commune*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006267

COMMENTS
Acadia National Park
Successional Spruce - Fir Forest *(Picea rubens - Abies balsamea - Betula spp. - Acer rubrum* Forest) is closest, but differs in its preponderance of *Acer rubrum* rather than *Betula alleghaniensis* (sometimes with *Acer saccharum*) as deciduous canopy species. The types do intergrade compositionally. The northern hardwood species ally this type with the Northern Hardwood Forest *(Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest) as well, but those typically have a far less strong component of *Picea rubens*, although again, the compositional gradient is continuous. The Hemlock - Hardwood Forest (*Tsuga canadensis - (Betula alleghaniensis) - Picea rubens / Cornus canadensis* Forest) can also be compositionally similar; Red Spruce - Hardwoods Forests generally lack any significant amount of hemlock.

Globally

Picea rubens - Abies balsamea - Betula spp. *- Acer rubrum* Forest

COMMON NAME	Red Spruce - Balsam Fir - Birch species - Red Maple Forest
SYNONYM	Successional Spruce - Fir Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Mixed evergreen-deciduous forest (I.C)
PHYSIOGNOMIC GROUP	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.C.3.N)
FORMATION	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
ALLIANCE	PICEA RUBENS - BETULA ALLEGHANIENSIS FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association is a mixed forest of northern New England and New York.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Like the straight spruce - fir forests, these are found at various landscape positions, aspects, and all elevations within the Park, although less frequent on hill crests than on slopes and low flats. Slopes are genrally low to moderate, up to 30%. Most occur on till soils, though some occur on thin soil over bedrock or on gently sloped stabilized talus. Most sites have loamy to sandy soils that are moderately well drained; some occur on silty or clayey soils that are more poorly drained. pH is usually about 5.0. Though shallow (10 - 40 cm), the soils are generally deeper than those supporting conifer woodlands. Most of the spruce - fir - maple forests sampled were in portions of the Park that were not burned in 1947, although a few stands contain evidence of past fire. Nonetheless; of the three samples within the 1947 fire area, none actually contained evidence of fire. Historic fires have played a role over most of this area, but this vegetation type appears to take longer after fire to develop than some of the other upland forest and woodland types.

Globally

This forest occurs at various landscape positions and aspects but in general is more common on gentle to moderate slopes and low flats. Soils are loamy to sandy till and, in general, are deeper than those of pure spruce - fir forests.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea rubens, Acer rubrum, Abies balsamea, Betula papyrifera, Thuja occidentalis, Picea glauca, Quercus rubra, Populus grandidentata*
Tree Subcanopy	*Picea rubens, Abies balsamea, Acer pensylvanicum, Acer rubrum, Picea mariana, Betula papyrifera*
Herbaceous	*Carex trisperma, Pteridium aquilinum, Trientalis borealis, Maianthemum canadense, Symplocarpus foetidus, Osmunda cinnamomea, Carex gracilisillima*
.Non-vascular	*Bazzania trilobata, Dicranum polysetum, Leucobryum glaucum, Hypnum imponens, Sphagnum girgensohnii, Pleurozium schreberi, Polytrichum commune, Cladina* spp., *Sphagnum magellanicum, Sphagnum palustre, Thuidium delicatulum*

Globally

Stratum	Species
Tree Canopy	*Picea rubens, Abies balsamea, Acer rubrum, Populus tremuloides, Betula papyrifera*
Tall Shrub	*Picea rubens, Abies balsamea, Acer pensylvanicum*
Herbaceous	*Carex trisperma, Pteridium aquilinum, Trientalis borealis*

CHARACTERISTIC SPECIES

Acadia National Park

No strong indicator species

Globally

VEGETATION DESCRIPTION

Acadia National Park

A variation of the widespread spruce - fir forest type in which the canopy is > 25% deciduous. *Picea rubens* (rarely *P. glauca*) is

the major canopy tree. *Thuja occidentalis* and *Abies balsamea* are frequent, and occasionally dominant, associates. *Acer rubrum* is usually the dominant deciduous tree; occasionally, *Quercus rubra* or *Populus grandidentata*. *Betula papyrifera* is common in the canopy, though usually at lower cover. The subcanopy ranges from absent to 40% cover, and, where present, typically includes *Picea rubens, Abies balsamea*, and *Acer pensylvanicum*. The shrub stratum is variable in cover and, where present, consists entirely of tree regeneration. (A higher percentage of the Successional Spruce - Fir Forest samples have a definite-- > 15%-- shrub layer than do related forest types.) Herb layer cover and composition are variable, but it usually is dominated by tree regeneration, fequently with small amounts of *Carex trisperma, Pteridium aqulinum, Trientalis borealis*, or *Maianthemum canadense*. In some sites, *Osmunda cinnamomea* or *Symplocarpus foetidus* are common. The bryoid layer is sparse to moderate, with the most frequent and abundant species being *Bazzania trilobata, Dicranum* spp. (incl. *polysetum*), *Leucobryum glaucum, Hypnum imponens*, or *Sphagnum girgensohnii*. *Pleurozium schreberi, Polytrichum commune*, and *Cladina* lichens are also frequent but at lower cover.

The basal area ranged from 25 - 66 m^2/ha. Canopy heights were 11 - 21 m (avg. 16 m).

Globally
The boreal conifers *Picea rubens* and/or *Abies balsamea* form a mixed canopy with *Acer rubrum* and other trees such as *Populus tremuloides, Populus grandidentata, Betula papyrifera, Pinus strobus*, or *Betula populifolia*. Less common associates may include *Quercus rubra, Acer saccharum*, or *Prunus serotina*. The subcanopy and shrub layers are of variable cover, comprised of *Picea rubens, Abies balsamea*, and *Acer pensylvanicum*. Dwarf shrubs are typically absent. The herbaceous layer is dominated by tree seedlings with herbs including *Carex trisperma, Pteridium aquilinum, Trientalis borealis*, and *Maianthemum canadense*. *Osmunda cinnamomea* and *Symplocarpus foetidus* may also be present. The bryophyte layer is of variable cover and includes *Bazzania trilobata, Dicranum polysetum, Leucobryum glaucum, Hypnum imponens, Pleurozium schreberi*, and *Sphagnum girghensonii*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006505

COMMENTS
Acadia National Park
The proportion of deciduous:coniferous canopy varies. Dominant species are fairly consistent, although occasional sites will have some tree other than *Acer rubrum* as the deciduous dominant. Associated species are highly variable.

Maritime Spruce - Fir Forests *(Picea rubens - Picea glauca* Forests) are similar, and form a continuum with this type; by definition, these are coniferous rather than mixed, and they typically also have a more well developed bryoid layer. Successional Spruce - Fir Forests can also approach Red Spruce - Hardwoods Forests *(Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forests), but in the latter *Betula alleghaniensis* is a more important deciduous species than is *Acer rubrum* (and fir is a less important conifer).

Globally
This association has relatively deeper soils and is more mesic than the *Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forest (CEGL006267).

Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia Forest

COMMON NAME	Eastern White Pine - (Northern Red Oak, Black Oak) - American Beech Forest
SYNONYM	White Pine - Oak Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Mixed evergreen-deciduous forest (I.C)
PHYSIOGNOMIC GROUP	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.C.3.N)
FORMATION	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
ALLIANCE	PINUS STROBUS - QUERCUS (ALBA, RUBRA, VELUTINA) FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is scattered throughout Mount Desert Island. Oldest stands occur on Acadia Mountain.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, New York, Pennsylvania, Rhode Island, Vermont, West Virginia, and possibly New Jersey.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Oak - pine forests typically occur on lower to middle slopes and loamy, well-drained soils with a pH of around 5.0. Sites sampled were on east to southwest facing slopes (one northwest-facing) of 7 - 25 %. They are common in somewhat dry but not strongly xeric habitats.

Globally

This dry-mesic to mesic white pine - oak forest of northeastern states occurs on acidic, nutrient-poor, sandy loam to sandy soils. In the northern glaciated portion of the range, the forest occurs on outwash plains or moraines, as well as mid and lower slopes, protected ravines, and protected ridges of shale, sandstone, or other sedimentary rock at elevations below 3000 feet throughout the range.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Quercus rubra, Pinus strobus, Acer rubrum, Picea rubens, Populus grandidentata*
Tree Subcanopy	*Betula papyrifera, Abies balsamea, Acer pensylvanicum*
Short Shrub	*Viburnum acerifolium*
Dwarf Shrub	*Gaylussacia baccata, Vaccinium angustifolia, Kalmia angustifolia, Amelanchier* spp
Herbaceous	*Pteridium aquilinum, Carex lucorum, Carex debilis, Trientalis borealis, Gaultheria procumbens, Melampyrum lineare*
Non-vascular	*Polytrichum commune, Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Pinus strobus, Quercus* spp.
Tall Shrub	*Hamamelis virginiana*
Dwarf Shrub	*Gaylussacia* spp., *Kalmia latifolia, Vaccinium* spp., *Rubus* spp.
Herbaceous	*Aralia nudicaulis, Carex* spp.

CHARACTERISTIC SPECIES

Acadia National Park

Apocynum androsaemifolium, Melampyrum lineare (neither present in all samples)

Globally

VEGETATION DESCRIPTION

Acadia National Park

Mature forest with a mixture of *Quercus rubra* and *Pinus strobus* dominating the canopy. Earlier successional trees such as *Betula* spp. may be present but will be less dominant than the oak and pine. The understory layers are somewhat sparse, with tree regeneration and sometimes *Viburnum acerifolium* in the medium-shrub layer and a spotty, though present, dwarf shrub layer of *Vaccinium angustifolium* and/or *Gaylussacia baccata*. The herb layer features *Pteridium aquilinum* and may include *Carex*

lucorumrum, C. debilis, Oryzopsis asperifolia, and/or *Melampyrum lineare* as well as the ubiquitous *Gaultheria procumbens, Mitchella repens*, and *Trientalis borealis.* Bryophytes are patchy and typically include *Leucobryum glaucum* and *Polytrichum commune*. Herb species richness exceeds that of trees, shrubs, or bryoids.

The basal area ranged from 12 - 38 m^2/ha. Canopy heights were 13 - 24 m (avg. 19 m).

Globally
The tree canopy is dominated by *Pinus strobus* with a mixture of oaks including *Quercus velutina, Quercus rubra, Quercus alba, Quercus prinus*, and in the southern portions of the range, *Quercus coccinea*. *Fagus grandifolia* is characteristic but not always present. Other less frequent canopy associates may include *Acer rubrum, Carya alba, Populus tremuloides, Tsuga canadensis*, and at the northern range limit may include *Betula papyrifera, Picea rubens*, and *Populus grandidentata*. The variable subcanopy may include *Hamamelis virginiana*, with other species such as *Carpinus caroliniana, Cornus florida, Oxydendrum arboreum*, and *Nyssa sylvatica* more frequent in the central and southern portions of the range. The sparse to well-developed, generally ericaceous shrub layer includes *Gaylussacia* spp., *Kalmia latifolia, Vaccinium* spp., as well as *Rubus* spp., *Corylus americana, Gaultheria procumbens, Sassafras albidum, Viburnum prunifolium*. The herb layer ranges from sparse to moderately dense cover and includes *Aralia nudicaulis, Ageratina altissima, Amphicarpaea bracteata, Brachyelytrum erectum, Carex communis, Carex platyphylla, Carex woodii, Carex pensylvanica, Carex lucorumrum, Carex debilislis, Melampyrum lineare, Pteridium aquilinum, Trientalis borealis, Gaultheria procumbens, Chimaphila maculata, Desmodium nudiflorum, Galium latifolium, Galium circaezans, Geranium maculatum, Goodyera pubescens, Hieracium venosum, Houstonia purpurea, Maianthemum racemosum, Maianthemum canadense, Medeola virginiana, Mitchella repens, Monotropa uniflora, Poa cuspidata, Polygonatum biflorum, Polystichum acrostichoides, Viola hastata.* The bryophyte layer is not well documented but supports *Leucobryum glaucum* and *Polytrichum commune* in occurrences in the northern portion of the range (Acadia National Park).

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5.

DATABASE CODE CEGL006293

COMMENTS
Acadia National Park
Canopy closure and percent of *Acer rubrum* can vary. Successional Oak - Pine Forest *(Quercus rubra - Acer rubrum - Betula spp. - Pinus strobus* Forest) is very similar but usually has little or no pine and has a higher proportion of early successional species such as *Betula* spp, *Populus grandidentata*, and *Acer rubrum*. Oak - pine woodlands are also very similar compositionally but have an even more open canopy and occur on bedrock rather than till soils.

Globally
This association is differentiated from mixed oak - pine forests to the south by *Fagus grandifolia* and the absence of southern ranging species *Liriodendron tulipifera, Galax urceolata, Trillium catesbaei, Halesia tetraptera*, and others. The absence of *Ilex glabra* and the unimportance of *Quercus alba* differentiates this from a closely related association of northeastern coastal areas, *Pinus strobus - Quercus alba / Ilex glabra* Forest (CEGL006382).

Tsuga canadensis - Betula alleghaniensis - Picea rubens / Cornus canadensis Forest

COMMON NAME	Eastern Hemlock - Yellow Birch - Red Spruce / Canadian Bunchberry Forest
SYNONYM	Hemlock - Hardwood Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Mixed evergreen-deciduous forest (I.C)
PHYSIOGNOMIC GROUP	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.C.3.N)
FORMATION	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
ALLIANCE	TSUGA CANADENSIS - BETULA ALLEGHANIENSIS FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is relatively uncommon, occurring in scattered patches on Mount Desert Island.

Globally

This association occurs in Massachusetts, Maine, New Hampshire, Nova Scotia, New York, Vermont, and possibly Ontario and New Brunswick.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These forests typically occur at lower elevations, on gentle slopes or in stream valleys. Soils are typically loams, fairly well drained, with a pH of around 5.0.

Globally

This mesic hemlock forest of northern and central New England occurs on gentle slopes, stream valleys, ravines, river and kame terraces of moderate elevation (1000-2000 feet). Soils are mesic, well-drained tills.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Tsuga canadensis, Quercus rubra, Fraxinus pennsylvanica, Acer rubrum, Betula allegheniensis, Fagus grandifolia*
Tree Subcanopy	*Tsuga canadensis, Acer rubrum*
Herbaceous	*Maianthemum canadense*
Non-vascular	*Bazzania trilobata, Dicranum* spp.

Globally

Stratum	Species
Tree Canopy	*Tsuga canadensis, Betula alleghaniensis, B. papyrifera, Fagus grandifolia, Acer saccharum*
Herbaceous	*Dryopteris intermedia, Dryopteris campyloptera, Maianthemum canadense, Oxalis montana, Thelypteris noveboracensis*

CHARACTERISTIC SPECIES

Acadia National Park

Tsuga canadensis in both canopy and herb layers; *Betula alleghaniensis* characteristic although not necessarily in large amounts.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Closed-canopy forests featuring *Tsuga canadensis* with a mixture of northern hardwood species. *Picea rubens*, *Pinus strobus* or *Thuja occidentalis* may be minor components, but the predominant conifer is hemlock. Hardwood species usually include *Acer rubrum* and *Fagus grandifolia*; *Betula alleghaniensis, Quercus rubra*, and *Fraxinus pennsylvanica* are important in some stands. The shrub layer is sparse and consists of tree species regeneration. Dwarf shrubs are virtually absent. The herb layer is patchy and features tree seedlings as well as common northern herbs such as *Maianthemum canadense, Trientalis borealis, Thelypteris novaboracensis, Uvularia sessilifolia*, and *Aster macrophyllus*. Bryophytes, also patchy, include *Bazzania trilobata* and *Dicranum* species.

The basal area ranged from 24 - 60 m^2/ha. Canopy heights were 15 - 21 m (avg. 18 m).

Globally
On average, the canopy is a mixture of conifers and deciduous trees, although conifer dominance can sometimes reach 80%. *Tsuga canadensis* is the dominant conifer, occurring with northern hardwoods. Particularly characteristic, although not always abundant, are *Betula alleghaniensis* and *Betula papyrifera, Picea rubens, Fagus grandifolia,* and *Acer saccharum.* Scattered subcanopy and shrub layers consist of *Acer pensylvanicum* and *Viburnum lantanoides (= Viburnum alnifolium).* Canopy cover is typically dense, resulting in low light levels near the forest floor and a correspondingly sparse herb layer. Characteristic species include *Dryopteris intermedia, Dryopteris campyloptera, Huperzia lucidula, Maianthemum canadense, Oxalis montana (= Oxalis acetosella), Thelypteris noveboracensis, Trillium undulatum,* and *Trientalis borealis.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006129

COMMENTS
Acadia National Park
Classed as a mixed forest, but the dominance of *Tsuga canadensis* can range from 15 - 85%. Other conifers minor. Hemlock - Hardwood Forests can be transitional to Northern Hardwood Forest *(Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest), which is strictly a deciduous type (< 25% conifers in the canopy) though it may have some hemlock and spruce. Some stands classified as Hemlock - Hardwood Forest are only about 20% conifer; those have *Fraxinus pennsylvanica* as the dominant tree species rather than the beech-birch-maple combination typical of *Acer saccharum - Betula alleghaniensis - Fagus grandifolia / Viburnum lantanoides* Forest. Especially when featuring *Fraxinus,* Hemlock - Hardwood Forests can also be transitional to Red Maple - Conifer Acidic Swamps (*Acer rubrum - Fraxinus spp. / Nemopanthus mucronatus* Forests), but those lack any significant proportion of hemlock and have wetter soils.

Globally

Acer saccharum - Pinus strobus / Acer pensylvanicum Forest

COMMON NAME	Sugar Maple - Eastern White Pine / Striped Maple Forest
SYNONYM	Sugar Maple - White Pine Forest
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Mixed evergreen-deciduous forest (I.C)
PHYSIOGNOMIC GROUP	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.C.3.N)
FORMATION	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a)
ALLIANCE	PINUS STROBUS - ACER SACCHARUM FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is found primarily in the western portion of Mount Desert Island,but also occurs elsewhere in the Park.

Globally

This dry white pine – northern hardwood forest occurs widely throughout the upper midwestern and northeastern United States and eastern Canada in Massachusetts, Maine, Michigan, New Hampshire, Ontario, Pennsylvania, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Typically on lower to mid slopes on well-drained soils over glacial till, shallow to moderately deep for Acadia upland habitats (30 cm), pH around 5.0. Aspect varies.

Globally

The typical environmental setting is well-drained acidic sandy or gravelly soil over glacial till, in general a less mesic setting than northern hardwoods lacking white pine. In the northern Appalachian region, stands occur on sandy-gravelly soils, eskers in Adirondacks, and also in a narrow band along lakeshores.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus strobus, Picea rubens, Thuja occidentalis, Quercus rubra, Betula allegheniensis*
Tree Subcanopy	*Betula allegheniensis, Acer pensylvanicum*
Herbaceous	*Trientalis borealis, Maianthemum canadense, Pteridium aquilinum, Gaultheria procumbens*
Non-vascular	*Dicranum* spp., *Polytrichum commune, Pleurozium schreberi, Bazzania trilobata, Hypnum imponens, Hylocomium splendens*

Globally

Stratum	Species
Tree Canopy	*Acer saccharum, Betula alleghaniensis, Fagus grandifolia, Pinus strobus*
Tall Shrub	*Acer penyslvanicum*
Dwarf Shrub	*Gaultheria procumbens,Vaccinium angustifolium, Gaylussacia baccata*
Herbaceous	*Trientalis borealis, Maianthemum canadense, Pteridium aquilinum, Oryzopsis asperifolia*

CHARACTERISTIC SPECIES

Acadia National Park

Pinus strobus or *Thuja occidentalis* prominent in the canopy and combined with *Picea rubens* and northern hardwoods or *Quercus rubra*.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A mixed forest type in which *Pinus strobus* or *Thuja occidentalis* co-dominates with *Picea rubens* and hardwoods *Betula alleghaniensis, Acer saccharum, Fagus grandifolia,* and/or *Quercus rubra*. In some cases, the white pine forms a supercanopy; in others, the height is not distinctly different from that of the red spruce. Early successional trees (*Betula papyrifera, Populus grandidentata*, or *Acer rubrum*) may be among the canopy dominants but are not diagnostic. *Acer pensylvanicum* is common in the canopy, subcanopy, and/or high shrub layers. Dwarf shrubs are scarce; if present, they typically include *Gaylussacia baccata* or *Vaccinium angustifolium*. The herb and bryoid strata are also sparse. The herb layer includes tree regeneration, the widespread herbs *Maianthemum canadense, Trientalis borealis, Pteridium aquilinum,* and *Gaultheria procumbens*, and may

include more hardwood-indicative herb species (*Dryopteris carthusiana, Epigaea repens*, or *Carex lucorumrum*, for example). Similarly, most of the bryoids are common mosses (*Dicranum* spp., *Polytrichum commune, Bazzania trilobata, Pleurozium schreberi*, and *Hypnum imponens*), but species that indicate the more boreal nature of this type, such as *Hylocomium splendens*, can also occur.

The basal area ranged from 25 - 40 m^2/ha. Canopy heights were 18 - 25 m (incl. supercanopy).

Globally
Stands are characterized by the northern hardwood species *Acer saccharum, Betula alleghaniensis*, and in the northeast, *Fagus grandifolia* with an admixture of *Pinus strobus*, often occurring as a supercanopy. Other canopy associates may include *Tsuga canadensis* and *Quercus rubra*.. In the northeast at the northern edge of the range, *Abies balsamea, Picea rubens* and *Thuja occidentalis* may also occur sparingly. The subcanopy is dominated by *Acer penyslvanicum*. The herbaceous layer is characterized by *Trientalis borealis, Maianthemum canadense, Pteridium aquilinum, Oryzopsis asperifolia*, intermixed with the dwarf shrubs *Gaultheria procumbens,Vaccinium angustifolium*, and *Gaylussacia baccata*. The nonvascular layer is poorly developed and may include *Polytrichum commune, Pleurozium schreberi, Bazzania trilobata, Hylocomium splendens* or *Hypnum imponens.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL005005

COMMENTS
Acadia National Park
Although the type is described as having northern hardwoods more common than early successional species as the deciduous component, areas may include *Pinus strobus* with successional deciduous species.

Thuja occidentalis replaces *Pinus strobus* as a canopy dominant in some stands. The hardwood dominants also vary, with early successional trees like *Populus grandidentata* dominant in some stands and more tolerant hardwoods, e.g. *Acer saccharum*, in others.

Closely related to Red Spruce - Hardwoods Forest *(Picea rubens - Betula alleghaniensis / Dryopteris campyloptera* Forest), but with the addition of *Pinus strobus* or *Thuja occidentalis* in the canopy (with at least 25% relative dominance). This type maps with some pine-dominated early successional oak - pine forests (*Quercus rubra - Acer rubrum - Betula spp. - Pinus strobus* Forest), but those are distinguished by early successional trees as the deciduous component, rather than northern hardwoods. The distinction can be hard to call, as both types may feature *Betula papyrifera* and *Acer rubrum* as deciduous components. In concept, Sugar Maple - White Pine Forest *(Acer saccharum - Pinus strobus / Acer pensylvanicum* Forest) will have northern hardwood species (*Fagus grandifolia, Betula alleghaniensis, Acer saccharum*) more abundant than *Acer rubrum, Betula papyrifera*, and earlier successional tree species, and will also have herb composition indicating more mesic conditions than Successional Oak - Pine Forest *(Quercus rubra - Acer rubrum - Betula spp. - Pinus strobus* Forest). This type can also be similar to Successional Spruce - Fir Forest *(Picea rubens - Abies balsamea - Betula spp. - Acer rubrum* Forest), but that type has less than 25% pine in the canopy.

Globally

Picea rubens - Acer rubrum / Nemopanthus mucronatus Forest

COMMON NAME	Red Spruce - Red Maple / Mountain-holly Forest
SYNONYM	Red Maple - Conifer Acidic Swamp
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Mixed evergreen-deciduous forest (I.C)
PHYSIOGNOMIC GROUP	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (I.C.3.N)
FORMATION	Saturated mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.d)
ALLIANCE	PICEA RUBENS – ACER RUBRUM SATURATED FOREST ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs as relatively small stands throughout the Park.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

At low elevations (< 100 m), usually in small basins or short linear drainages; sometimes on gentle slopes adjacent to flats. Often dissected with drainage channels. Soils are clay loams or muck, poorly to very poorly drained, with a pH of 5.0 - 5.4. There may be a thin layer of peat (< 0.5 m) overlying the mineral soil.

Globally

It occurs most commonly in basins or low flats with poor drainage, characterized by soils that are poorly drained organic muck or peat over clay loam. The substrate is characterized by hummocks-and-hollow microtopography with abundant slowly decomposing leaf/needle litter.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Acer rubrum, Thuja occidentalis, Abies balsamea, Picea rubens, Betula allegheniensis, Betula papyrifera*
Tree Subcanopy	*Abies balsamea, Picea rubens, Acer rubrum*
Short Shrub	*Picea rubens, Abies balsamea, Alnus incana, Ilex verticillata*
Herbaceous	*Carex gynanadra, Aster umbellatum, Trientalis borealis, Osmunda cinnamomea, Thelypteris novaboracensis, Cornus canadensis, Carex stricta, Carex trisperma, Equisetum sylvaticum*
Non-vascular	*Sphagnum girgensohnii, Hypnum imponens, Dicranum polysetum, Leucobryum glaucum, Sphagnum magellanicum*

Globally

Stratum	Species
Tree Canopy	*Picea rubens, Acer rubrum*
Tall Shrub	*Vaccinium corymbosum, Nemopanthus mucronatus, Ilex verticillata, Alnus incana*
Herbaceous	*Osmunda cinnamomea, Osmunda regalis, Onoclea sensibilis, Thelypteris palustris, Symplocarpus foetidus, Carex trisperma, Cornus canadensis, Trientalis borealis, Aster acuminatus, Carex intumescens*
Non-vascular	

CHARACTERISTIC SPECIES

Acadia National Park

Acer rubrum and *Betula alleghaniensis* in the canopy; deciduous trees > 25% relative dominance; fairly closed canopy; on muck or mineral soil, not part of a peatland.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A deciduous to mixed forest with *Acer rubrum* the dominant deciduous tree, and *Thuja occidentalis* or *Picea rubens* the dominant conifer. *Betula alleghaniensis, Fraxinus pennsylvanica, Abies balsamea*, and *Tsuga canadensis* can be locally important. The subcanopy usually features *Abies balsamea*. The shrub layer is variable (< 40%), and may include tree regeneration and/or patches of *Alnus.* Dwarf shrubs are absent or almost so; herbs are usually sparse. Common herbs include *Oclomena acuminata,*

Maianthemum canadense, and *Trientalis borealis*, as well as *Osmunda cinnamomea, O. regalis, Onoclea sensibilis, Thelypteris novaboracensis, Cornus canadensis, Carex trisperma, Symplocarpus foetidus*, and occasionally *Equisetum sylvaticum*. In stands strongly dominated by *Acer rubrum, Carex intumescens, C. gynandra*, and *Calamagrostis canadensis* are typical. The ground layer is dominated by a carpet of *Sphagnum* mosses, usually including *S. girgensohnii* and with *S. magellanicum* a major species in some stands.

The basal area ranged from 19 - 47 m^2/ha. Canopy heights were 14 - 21 m.

Globally
The tree canopy is codominated by *Picea rubens* and *Acer rubrum*, in association with other trees such as *Betula alleghaniensis, Betula populifolia, Thuja occidentalis, Abies balsamea*, and *Tsuga canadensis*. The well-developed tall-shrub layer is characterized by *Vaccinium corymbosum, Nemopanthus mucronatus, Ilex verticillata*, and *Alnus incana*. The herbaceous layer is of variable cover and is generally dominated by the ferns *Osmunda cinnamomea, Osmunda regalis, Onoclea sensibilis, Thelypteris palustris*, and forbs, such as *Symplocarpus foetidus, Carex trisperma, Cornus canadensis, Trientalis borealis, Aster acuminatus, Carex intumescens*, and others. The bryophyte layer is generally well-developed, dominated by *Sphagnum* spp. including *Sphagnum girghensonii* and *Sphagnum magellanicum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?

DATABASE CODE CEGL006198

COMMENTS
Acadia National Park
Canopy varies in the amount of conifers present. Red maple is constant. Herbaceous flora will vary depending on the degree of peat accumulation over the mineral soil.

Hardwood seepage forests are similar in that they occur on mineral soil and may have red maple as a prominent component; however, they typically are more strongly deciduous (< 25% conifer relative dominance) and have a more extensive and species-rich herb layer. Red maple wooded fens, which usually are on a peat substrate, will either lack a conifer component or have *Picea mariana* as the conifer component, and typically have a more open canopy (often < 50%). Northern white cedar wooded fens, also usually on peat, can contain many of the same species but are more strongly coniferous (>75%) in the canopy.

Globally
This association is differentiated from the *Picea rubens - Acer rubrum / Ilex verticillata* Forest [Provisional] (CEGL006556) of the central Appalachians by the presence of *Thuja occidentalis* and *Cornus canadensis*. Although *Nyssa sylvatica* may be present in some occurrences of the southern range limit, this species is not characteristic of this type. This association is differentiated from those of the *Thuja occidentalis - Acer rubrum* Saturated Forest Alliance (A.446) by its restriction to acidic peatlands.

Pinus banksiana / Kalmia angustifolia - Vaccinium spp. Woodland

COMMON NAME	Jack Pine / Sheep Laurel - Blueberry species Woodland
SYNONYM	Jack Pine Heath Barren
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
ALLIANCE	PINUS (BANKSIANA, RESINOSA) WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs mostly very near the coast (Schoodic Penisula); the area near the top of Cadillac Mountain being the farthest from the ocean.

Globally

This association occurs in Maine and New Hampshire.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Jack pine woodlands are almost always on bedrock, with thin and very well drained soils of around pH 5.0. Peaty pockets may develop locally; mineral soil tends to be gravelly. They are typically on moderate slopes (5 - 15%) and at low to mid elevations (up to 300 m or so). Areas sampled were all either within the 1947 fire area or showed evidence of fire.

Globally

The jack pine woodland community of northern New England and the Canadian maritime provinces occurs on dry rocky summits, ridges, outcrops and lakeshores. Soils are shallow, well-drained, dry, acidic, coarse sands. Soil development is typically restricted to crevices or shelter areas interspersed with significant amounts of exposed bedrock. Elevations of known examples range from 1000-4000 feet.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus banksiana* (*Picea mariana, Picea rubens*)
Short Shrub	*Nemopanthus mucronata*
Dwarf Shrub	*Gaylussacia baccata, Kalmia angustifolia, Vaccinium angustifolia, Photinia melanocarpa, Nemopanthus mucronata, Empetrum nigrum, Rhododendron canadense, Vaccinium vitis-idaea*
Herbaceous	*Sibbaldiopsis tridentata, Cornus canadensis, Maianthemum canadense, Trientalis borealis, Deschampsia flexuosa*
Non-vascular	*Cladina* spp.

Globally

Stratum	Species
Tree Canopy	*Pinus banksiana*
Dwarf Shrub	*Vaccinium angustifolium, V. myrtilloides, Gaylussacia baccata, Kalmia angustifolia, Chamaedaphne calyculata*
Herbaceous	*Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Carex lucorumrum, Oryzopsis pungens, Cornus canadensis, Trientalis borealis, Maianthemum canadense*

CHARACTERISTIC SPECIES

Acadia National Park

Pinus banksiana, upland

Globally

VEGETATION DESCRIPTION

Acadia National Park

Open woodlands (usually < 40% canopy) of short *Pinus banksiana* (canopy height usually 5 m or less, trees short and wide) and a well developed heath shrub layer. Prominent heaths are *Gaylussacia baccata*, *Kalmia angustifolia*, and *Vaccinium angustifolium*; *Rhododendron canadense, Empetrum nigrum*, and *Vaccinium vitis-idaea* may be locally important. *Photinia melanocarpa* and *Nemopanthus mucronata* are characteristic deciduous shrubs. Herbs are sparse; frequent species include

Sibbaldiopsis tridentata, Cornus canadensis, and the ubiquitous *Maianthemum canadense* and *Trientalis borealis.* Unlike some other woodlands, all samples were strongly dominated by *Cladina* lichens in the bryoid layer, and mosses were unimportant.

The basal area ranged from 3 - 5 (20) m^2/ha. Canopy heights were 3 - 5 m (avg. 4 m).

Globally
The scattered open canopy of *Pinus banksiana* may also occur with *Picea rubens, Betula papyrifera* var. *papyrifera, Betula papyrifera* var. *cordifolia*, and *Abies balsamea*. A sparse tall-shrub layer may include *Sorbus americana, Viburnum nudum* var. *cassinoides, Nemopanthus mucronatus, Aronia melanocarpa,* or *Amelanchier* spp. The low heath layer is well developed and is comprised of *Vaccinium angustifolium, Vaccinium myrtilloides, Gaylussacia baccata, Kalmia angustifolia, Chamaedaphne calyculata*. Forbs and graminoids include *Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Carex lucorumrum, Oryzopsis pungens, Sibbaldiopsis tridentata, Cornus canadensis, Trientalis borealis, Solidago simplex* var. *randii*, and *Maianthemum canadense*. Near the coast, *Empetrum nigrum* and *Vaccinium vitis-idaea* are common associates. The bryophyte layer is dominated by lichens such as *Cladonia alpestris, Cladonia rangiferina, Rhizocarpon geographicum,* and *Umbilicaria* spp. Mosses include *Pleurozium schreberi, Polytrichum juniperinum,* and *Polytrichum piliferum*. Ground cover is sparse needle litter and exposed bedrock.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006041

COMMENTS
Acadia National Park
Black spruce upland woodlands and some pitch pine woodlands are very similar compositionally.

Globally

Pinus rigida / Vaccinium spp. - *Gaylussacia baccata* Woodland

COMMON NAME	Pitch Pine / Blueberry species - Black Huckleberry Woodland
SYNONYM	Pitch Pine / Blueberry spp. - Huckleberry Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
ALLIANCE	PINUS RIGIDA WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association was found only on Long island in Acadia NP.

Globally

This association occurs in Massachusetts, Maine, New York, Ontario, Rhode Island, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Unlike standard pitch pine woodlands, which occur on exposed bedrock of crests or upper slopes, these woodlands occur on rocky/sandy soils and gentle lower slopes. Elevation is about 70 m, and aspect northeast. The substrate is rock interspersed with soil pockets. Soil varies from sandy to peaty, 10 - 12 cm in depth, with associated variations in drainage; pH is around 5.0. No evidence of fire was found in the two stands sampled.

Globally

This association is a pitch pine - heath barren of nutrient-poor, dry sandy soils occurring at low elevations in New England and adjacent Canada.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus rigida, Picea rubens, Pinus strobus, Acer rubrum*
Dwarf Shrub	*Gaylussacia baccata, Vaccinium angustifolia, Kalmia angustifolia*
Herbaceous	*Melampyrum lineare*
Non-vascular	*Cladina sylvatica, Dicranum polysetum, Pleurozium schreberi, Cladonia pyxidata, Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Pinus rigida*
Dwarf Shrub	*Vaccinium angustifolium, V. pallidum, V. myrtilloides, Gaylussacia baccata, Kalmia angustifolia*
Herbaceous	*Pteridium aquilinum, Carex pensylvanica, Gaultheria procumbens, Aralia nudicaulis, Maianthemum canadense, Melampyrum lineare*

CHARACTERISTIC SPECIES

Acadia National Park

Picea rubens an important canopy associate (> 30% RD); *Cladina sylvatica*; absence of *Pinus rigida* in the herb layer.

Globally

VEGETATION DESCRIPTION

Acadia National Park

These woodlands consist of *Pinus rigida* and *Picea rubens* forming an open canopy (about 40%) over a dense shrub layer of *Gaylussacia baccata*, *Vaccinium angustifolium*, and *Kalmia angustifolia*, with almost nothing in between. The herb layer is sparse; *Melampyrum lineare* is indicative (but occurs in some standard pitch pine woodlands as well). The bryoid layer is well developed and dominated by *Cladina sylvatica* and *Dicranum polysetum*; *Pleurozium schreberi*, *Cladonia pyxidata*, and *Leucobryum glaucum* are occasional associates.

The basal area ranged from 31 - 36 m^2/ha and canopy heights were 8 - 10 m.

Globally
The open canopy is dominated by *Pinus rigida* with a variable mixture of associates, including *Pinus strobus* or *Populus grandidentata*. In the northern part of the range, *Pinus banksiana* or *Picea rubens* may also be present. The tall-shrub layer is absent, although a few scrub oaks (*Quercus ilicifolia, Quercus prinoides*) may be present. The well-developed heath layer is comprised largely of dwarf-shrubs, including *Vaccinium angustifolium, Vaccinium pallidum, Vaccinium myrtilloides, Gaylussacia baccata*, and *Kalmia angustifolia*. The herbaceous layer is of variable cover and often includes *Pteridium aquilinum, Carex pensylvanica, Gaultheria procumbens, Aralia nudicaulis, Maianthemum canadense, Melampyrum lineare, Fragaria virginiana*, and *Cypripedium acaule*. The bryophyte layer is of variable cover and is characterized by *Cladina sylvatica, Dicranum polysetum, Pleurozium schreberi, Cladonia pyxidata*, and *Leucobryum glaucum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL005046

COMMENTS
Acadia National Park
A cored pitch pine from this site was aged at 240+ yr.

Closely related to standard pitch pine woodlands, but differentiated by its setting on soils rather than on rock, the co-dominance of *Picea rubens*, and the extensive bryoid layer.

Globally

Pinus rigida / Photinia melanocarpa / Deschampsia flexuosa - Schizachyrium scoparium Woodland

COMMON NAME	Pitch Pine / Black Chokeberry / Wavy Hairgrass - Little Bluestem Woodland
SYNONYM	Pitch Pine Rocky Summit
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
ALLIANCE	PINUS RIGIDA WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Connecticut, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, Vermont, and West Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Pitch pine woodlands occur in xeric environments, bedrock exposures of middle to upper hillslopes and crests. Slopes range up to 25%; aspect from east to northwest. They occur at all elevations within the Park. Soils are thin (rarely over 20 cm to rock), moderately well drained to excessively drained, and usually coarse-textured. Soil pH is usually around 5.0, ranging from 4.8 - 5.6. They occur throughtout the Park, inside and outside of the 1947 fire area, but most contain evidence of fire regardless of their location.

Globally

This northeastern pitch pine community occurs on dry rocky ridges and summits of low to moderate elevations. Soils are derived from acidic bedrock and are typically shallow, well-drained, coarse sands or gravels. In the northern Appalachian Mountains, this community generally occurs at elevations from 100 to 1265 feet and in the central Appalachians this community occurs at elevations up to 4400 feet.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus rigida, Picea rubens, Thuja occidentalis*
Tree Subcanopy	variable (*Pinus rigida, Picea rubens*)
Dwarf Shrub	*Gaylussacia baccata, Vaccinium angustifolia, Kalmia angustifolia, Photinia melanocarpa, Juniperus communis, Amelanchier* spp., *Rhododendron canadense*
Herbaceous	*Pteridium aquilinum, Deschampsia flexuosa, Sibbaldiopsis tridentata, Gaultheria procumbens, Minuatia glabra, Melampyrum lineare*
Non-vascular	*Cladina* spp., *Rhizocarpon geographicum, Grimmia* spp.

Globally

Stratum	Species
Tree Canopy	*Pinus rigida*
Dwarf Shrub	*Vaccinium angustifolium, Vaccinium pallidum, Vaccinium myrtilloides, Gaylussacia baccata*
Herbaceous	*Pteridium aquilinum, Schizachyrium scoparium, Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Maianthemum canadense*

CHARACTERISTIC SPECIES

Acadia National Park

Pinus rigida in all layers, woodland structure.

Globally

VEGETATION DESCRIPTION

Acadia National Park

If one had to pick one vegetation type that best characterized Acadia, it would likely be pitch pine woodlands. They are

extensive and well developed here and show a range of compositional and environmental variation. These are woodlands in which *Pinus rigida* is the strong canopy dominant. Canopy cover varies over the woodland range, from open woodlands with about 20% canopy to almost forest-like stands with around 65% coverage. Canopy height may be as low as 4 m, with stands rarely over 15 m. The subcanopy and high shrub strata are variable. *Picea rubens* is a frequent constituent. *Quercus ilicifolia* is an important associate in some stands. The shrub layer varies widely from almost absent to moderately dense (60%). *Pinus rigida* and *Picea rubens* are typical; some stands may have large amounts of *Quercus ilicifolia, Viburnum nudum*, or *Betula papyrifera*. A characteristic feature of these woodlands is the dwarf shrub stratum: it is consistently over 30% cover (up to 70%) and is dominated by the heaths *Gaylussacia baccata, Vaccinium angustifolium*, and *Kalmia angustifolia*. Other common shrubs (usually lower cover) are *Photinia melanocarpa, Rhododendron canadense, Juniperus communis*, and *Amelanchier* spp. The herb layer is sparse and variable in composition. *Pteridium aquilinum* and low *Pinus rigida* most commonly occur; *Deschampsia flexuosa, Sibbaldiopsis tridentata, Minuartia glabra*, and *Melampyrum lineare* are among the occasional species. The bryoid layer, likewise sparse, features *Cladina lichens, Rhizocarpon geographicum*, and *Grimmia* mosses, with only scattered larger bryophyte species.

The basal area ranged from 5 - 30 m^2/ha. Canopy heights were 4 - 14 m (avg. 8 m).

Globally
The open canopy is dominated by *Pinus rigida* with a variable mixture of associates, such as *Betula populifolia, Quercus rubra, Pinus strobus, Betula lenta, Acer rubrum*, and *Prunus serotina*. The tall-shrub layer is absent or, if present, is poorly developed and comprised of scattered *Quercus ilicifolia* or *Quercus prinoides*. The shrub layer is well-developed, dominated by heaths, such as *Vaccinium angustifolium, Vaccinium pallidum, Vaccinium myrtilloides*, and *Gaylussacia baccata*, as well as other shrubs, such as *Comptonia peregrina* and *Aronia melanocarpa*. The herbaceous layer is of variable cover, and may include *Pteridium aquilinum, Schizachyrium scoparium, Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Maianthemum canadense, Melampyrum lineare, Fragaria virginiana*, and *Cypripedium acaule*. In the northern Appalachian Mountains, this community may include species of northern affinity, such as *Viburnum nudum, Kalmia angustifolia, Betula papyrifera, Picea rubens*, and *Rhododendron canadense*, while in the central Appalachians, this community has occasional associates including *Pinus pungens* and *Ilex montana*.

OTHER NOTEWORTHY SPECIES Minuartia glabra

CONSERVATION RANK G?.

DATABASE CODE CEGL006116

COMMENTS
Acadia National Park
All gradations of pitch pine - other conifer mixtures seem to occur in Acadia. For classification, we consider Pitch Pine Rocky Summit to be those woodlands where *Pinus rigida* makes up at least 60% of the tree canopy (relative dominance). The addition of *Quercus ilicifolia* on Acadia Mountain is interesting; usually this species is associated with sandy pitch pine barrens.

Dominance of *Pinus rigida* in the canopy and of *Gaylussacia baccata* and *Vaccinium angustifolium* in the dwarf shrub layer are consistent; associated species can be quite variable.

This typic variant of pitch pine woodlands is closely related to two other types in Acadia. Coastal Pitch Pine Outcrop Woodland *(Pinus rigida / Corema conradii* Woodland, known in Acadia only from Wonderland and Isle au Haut) is very similar except that *Corema conradii* accompanies *Gaylussacia baccata* and *Vaccinium angustifolium* in their dominance of the dwarf shrub layer. Pitch Pine / Blueberry spp. - Huckleberry Woodland *(Pinus rigida / Vaccinium spp. - Gaylussacia baccata* Woodland, known in Acadia only from Long Island) grows on sandy soils on gentle slopes, rather than on bedrock; have somewhat taller, straighter trees, and a more well developed bryophyte layer. Pitch pine woodlands can also grade to mixed conifer woodlands.

Globally
Periodic fires are probably necessary for persistence of this association. This association is differentiated from other *Pinus rigida*-dominated woodlands of rocky habitats by the absence or very low cover of scrub oak *Quercus ilicifolia*.

Pinus rigida / Corema conradii Woodland

COMMON NAME	Pitch Pine / Broom Crowberry Woodland
SYNONYM	Coastal Pitch Pine Outcrop Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a)
ALLIANCE	PINUS RIGIDA WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs in a few locations within the Park, on Isle au Haut, and near Wonderland on Mount Desert Island.

Globally

This association is restricted to southern Maine with disjunct occurrences in eastern New York and Cape Cod, Massachusetts, and possibly in Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These woodlands occur on bare rock along the immediate coast and are influenced by fog. Small patches of gravelly soil, only a few cm deep, have developed over the granite substrate. What soils there are are excessively drained, with a pH of about 5.2.

Globally

This pitch pine woodland community occurs primarily on coastal acidic rock outcrops and rocky summits of southern Maine.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Pinus rigida (Picea mariana*)
Dwarf Shrub	*Gaylussacia baccata, Corema conradii, Vaccinium angustifolia*
Herbaceous	*Sibbaldiopsis tridentata*
Non-vascular	*Cladina rangiferina*

Globally

Stratum	Species
Tree Canopy	*Pinus rigida*
Short Shrub	*Comptonia peregrina, Aronia arbutifolia, Aronia melanocarpa, Myrica pensylvanica*
Dwarf Shrub	*Vaccinium angustifolium, Gaylussacia baccata, Kalmia angustifolia, Corema conradii*
Herbaceous	*Deschampsia flexuosa, Danthonia spicata, Gaultheria procumbens, Melampyrum lineare*

CHARACTERISTIC SPECIES

Acadia National Park

Corema conradii

Globally

VEGETATION DESCRIPTION

Acadia National Park

Pitch pine woodlands with a variable canopy dominated by stunted *Pinus rigida* (canopy about 5 m tall) and a prominent dwarf shrub layer dominated by patches of *Gaylussacia baccata, Corema conradii*, and *Vaccinium angustifolium*. Herbs are very sparse; *Sibbaldiopsis tridentata* is characteristic. Patches of Cladina-type and crustose lichens cover the rock substrate, with scattered mosses including *Polytrichum piliferum, Leucobryum glaucum, Dicranum undulatum*, and *Dicranum polysetum.*

The basal area ranged from 11 m^2/ha. Canopy heights were 5 m.

Globally

The canopy is dominated by *Pinus rigida (Pinus banksiana* is dominant in one northern occurrence). Associated canopy species of low cover include *Quercus rubra, Betula papyrifera, Picea rubens, Tsuga canadensis, Pinus strobus, Abies balsamea, Acer rubrum*, and occasionally *Thuja occidentalis.* A low-shrub layer is characterized by *Vaccinium angustifolium, Gaylussacia baccata, Aronia arbutifolia, Aronia melanocarpa, Myrica pensylvanica, Kalmia angustifolia, Comptonia peregrina, Viburnum*

nudum var. *cassinoides*, and *Vaccinium pallidum*. *Corema conradii* is a characteristic dwarf-shrub. Other associated herbs and dwarf-shrubs include *Juniperus communis, Arctostaphylos uva-ursi, Deschampsia flexuosa, Danthonia spicata, Gaultheria procumbens, Melampyrum lineare, Solidago puberula, Trientalis borealis, Maianthemum canadense, Epigaea repens, Sibbaldiopsis tridentata (= Potentilla tridentata),* and *Carex deflexa*. Lichens and mosses form a prominent bryophyte layer, and include *Cladonia stellaria* and other *Cladonia* spp., *Polytrichum piliferum, Polytrichum juniperinum, Leucobryum glaucum, Hylocomium splendens,* and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G2.

DATABASE CODE CEGL006154

COMMENTS

Acadia National Park

Documented only from Wonderland and Isle au Haut.

A variant of Pitch Pine Rocky Summit *(Pinus rigida / Photinia melanocarpa / Deschampsia flexuosa - Schizachyrium scoparium* Woodland) distinguished by the presence of *Corema conradii* in the dwarf shrub layer.

Globally

Scattered occurrences on sandy outwash deposits in Massachusetts and a single occurrence in the Shawungunk Mountains of New York may also be classified as this type.

Thuja occidentalis / Gaylussacia baccata - Vaccinium angustifolium Woodland

COMMON NAME	Northern White-cedar / Black Huckleberry - Northern Lowbush Blueberry Woodland
SYNONYM	White-cedar Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b)
ALLIANCE	THUJA OCCIDENTALIS WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs most extensively in the central portion of Mount Desert Island.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Usually on bedrock, occasionally on coarse glacial till. Slope position varies from lower to upper slopes, up to about 300 m. Sites sampled faced west to northwest and were on moderate to steep slopes (10 - 52%). The soils are thin, as in most upland woodlands (10 - 25 cm, 0 locally), sand to sandy loam in texture, with a pH of about 5.0.

Globally

This northern white-cedar woodland ccurs on acidic bedrock or coarse glacial till in coastal settings.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Thuja occidentalis, Pinus strobus, Acer rubrum, Picea rubens, Betula papyrifera*
Tree Subcanopy	*Thuja occidentalis*
Dwarf Shrub	*Gaylussacia baccata, Vaccinium angustifolia, Kalmia angustifolia, Photinia melanocarpa*
Herbaceous	*Pteridium aquilinum*
Non-vascular	variable (*Pleurozium schreberi, Hypnum imponens, Dicranum undulatum, Dicranum polysetum, Cladina* spp.)

Globally

Stratum	Species
Tree Canopy	*Thuja occidentalis*
Dwarf Shrub	*Gaylussacia baccata, Vaccinium angustifolium, Kalmia angustifolia*
Herbaceous	*Pteridium aquilinum, Trientalis borealis, Maianthemum canadense, Gaultheria procumbens*

CHARACTERISTIC SPECIES

Acadia National Park

Gaylussacia baccata; upland *Thuja occidentalis* with a heath shrub layer.

Globally

VEGETATION DESCRIPTION

Acadia National Park

These woodlands resemble mixed conifer woodlands in their physiognomy and layer structure, and are characterized by *Thuja occidentalis* (in the canopy and lower layers) in an upland setting, with a distinct heath shrub layer. They can vary in canopy coverage from very open, obviously woodland, to a more closed forest canopy appearance. *Thuja occidentalis* is strongly dominant. Other tree species, including *Acer rubrum, Pinus strobus, Picea rubens,* and *Betula papyrifera,* may occur but usually contribute little to the cover. Subcanopy and medium shrub layers tend to be sparse, with *Thuja occidentalis* the main constituent. The dwarf shrub layer is clearly present (though not always forming high cover, inverse to the herb layer) and composed of heaths, principally *Gaylussacia baccata* and *Vaccinium angustifolium*. Herbs are usually sparse, except for *Pteridium aquilinum* which can form locally high cover. The ubiquitous *Maianthemum canadense, Trientalis borealis,* and *Gaultheria procumbens* are often present but at low cover. The bryophyte layer is variable both in cover and in species composition. *Cladina* lichens are relatively important at some sites but bryophytes dominate at others.

The basal area ranged from 29 - 65 m^2/ha. Canopy heights were 6 - 14 m (avg. 10 m).

Globally
The canopy is open and dominated by stunted *Thuja occidentalis*. Associated canopy species include *Pinus strobus, Acer rubrum, Betula papyrifera*, and *Picea rubens*. The understory is characterized by low heath shrubs including *Gaylussacia baccata, Vaccinium angustifolium, Kalmia angustifolia*, and *Aronia melanocarpa*. The herbaceous layer is sparse and of low diversity, comprised of *Pteridium aquilinum, Trientalis borealis, Maianthemum canadense*, and *Gaultheria procumbens*. The bryophyte layer is of variable cover and includes *Pleurozium schreberi, Hypnum imponens, Dicranum undulatum, Dicranum polysetum* and *Cladina* spp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006411

COMMENTS
Acadia National Park
A distinct type at Acadia. This new type is for xeric upland cedar woodlands on acidic bedrock. Best identified with ground-truthing; distinguishing between this type and other upland conifer woodlands on the aerial photos was difficult at best.

Canopy cover varies within and among sites. The bryoid layer can vary from Cladina-lichen type on drier sites to Sphagnum patches on wetter sites.

Cedar Seepage Slope (*Thuja occidentalis - Fraxinus pennsylvanica / Acer pensylvanicum* Woodland) is the only other upland vegetation type dominated by *Thuja occidentalis*. It is distinguished by its lack of a heath shrub understory and its more mesic setting, but intermediate examples do occur. White-Cedar Upland Woodlands (*Thuja occidentalis / Gaylussacia baccata - Vaccinium angustifolium* Woodland) are also compositionally similar to Mixed Conifer Woodlands but the prevalence of *Thuja occidentalis* is used to distinguish the two. In some locations in Acadia, woodlands with a mixture of *Pinus rigida* and *Thuja occidentalis* occur; these have been classified as Pitch Pine Rocky Summit (*Pinus rigida / Photinia melanocarpa / Deschampsia flexuosa - Schizachyrium scoparium* Woodland).

Globally

Thuja occidentalis - Fraxinus pennsylvanica / Acer pensylvanicum Woodland

COMMON NAME	Northern White-cedar - Green Ash / Striped Maple Woodland
SYNONYM	Cedar Seepage Slope
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b)
ALLIANCE	THUJA OCCIDENTALIS WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs in both the burned and unburned (1947) areas of the Park.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These forests/woodlands occur on gentle to moderately steep slopes (8-53%), usually at a lower slope to midslope position. Elevation ranges from 90 m to about 250 m. Some occur on talus, others on glacial till; they are rarely on bedrock and, if so, only where seepage water runs over the bedrock. Soils are loamy, with a pH of about 5.0, and frequently with seepage water or its evidence present.

Globally

It occurs on gentle to moderately steep slopes over acidic talus, glacial till, or occasionally bedrock where seepage emerges.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Thuja occidentalis, Betula papyrifera, Fraxinus pennsylvanica, Picea rubens, Pinus strobus, Tsuga canadensis, Abies balsamea*
Short Shrub	*Abies balsamea, Acer pensylvanicum*
Herbaceous	*Thuja occidentalis, Aster macrophyllus, Dryopteris marginalis, Maianthemum canadense*
Non-vascular	*Dicranum* spp., *Leucobryum glaucum, Hylocomium splendens, Pleurozium schreberi*

Globally

Stratum	Species
Tree Canopy	*Thuja occidentalis*
Herbaceous	*Aster macrophyllus, Dryopteris marginalis, Maianthemum canadense, Trientalis borealis, Danthonia spicata, Carex pedunculata, Carex gracilisillimaillima, Carex laxiflora*

CHARACTERISTIC SPECIES

Acadia National Park

Thuja occidentalis in a somewhat mesic upland setting, without a heath shrub layer; *Gaylussacia baccata* absent (cf. WCW)

Globally

VEGETATION DESCRIPTION

Acadia National Park

Cedar seepage slopes grade from forest to woodland in canopy cover, uniformly dominated by *Thuja occidentalis.* Occasional canopy species include *Betula papyrifera, Fraxinus pennsylvanica* (a good indicator), and/or *Acer saccharum*. *Picea rubens* may occur, but at low dominance. Basal area can be locally high. The subcanopy and shrub strata are sparse. The herb layer includes *Thuja occidentalis* regeneration; herb species composition varies from site to site but can include *Dryopteris marginalis, Aster macrophyllus, Carex pedunculata, C. gracillima, C. laxiflora, Danthonia spicata,* etc., (as well as the ubiquitous *Maianthemum canadense* and *Trientalis borealis*). The bryoid layer is sparse and variable, with lichens generally minor and *Dicranum* species, *Leucobryum glaucum, Pleurozium schreberi*, and *Hylocomium splendens* the most frequent mosses.

The basal area ranged from 22 - 80 m^2/ha. Canopy heights were 10 - 18 m (avg. 14 m).

Globally
Canopy closure is variable from closed to quite open, strongly dominated by *Thuja occidentalis*. Associated canopy trees include *Betula papyrifera, Fraxinus pennsylvanica, Picea rubens, Pinus strobus, Tsuga canadensis, Abies balsamea* or *Acer saccharum*. The shrub layer is sparse and may include *Abies balsamea, Acer pensylvanicum, Diervilla lonicera*, or *Amelanchier* spp. The herbaceous layer is variable and includes *Aster macrophyllus, Dryopteris marginalis, Maianthemum canadense, Trientalis borealis, Danthonia spicata, Carex pedunculata, Carex gracilisillimaillima*, and *Carex laxiflora*. The bryophyte layer is not well developed but may include *Dicranum* spp., *Leucobryum glaucum, Pleurozium schreberi*, and *Hylocomium splendens*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006508

COMMENTS
Acadia National Park
Canopy closure is quite variable. Species composition below the canopy layer also varies.

White Cedar Woodlands (*Thuja occidentalis / Gaylussacia baccata - Vaccinium angustifolium* Woodland) are the other upland cedar type in Acadia. These are more xeric, have heath shrubs in the ground layer, and typically occur on bedrock.

Globally

Picea rubens / Vaccinium angustifolium - Sibbaldiopsis tridentata Woodland

COMMON NAME	Red Spruce / Northern Lowbush Blueberry - Mountain-cinquefoil Woodland
SYNONYM	Spruce - Fir Rocky Summit
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b)
ALLIANCE	PICEA RUBENS WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is widespread throughout the Park.

Globally

This association occurs in Massachusetts, Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Like most other woodlands in Acadia, mixed conifer woodlands almost always occur on bare rock with only patches of soil development. What soil there is (up to 25 cm deep, generally 10 cm or less) tends to be sandy or gravelly, somewhat excessively well drained, with an acidic pH of 4.6 - 5.0 (one site, on a hillside bench, has a silt loam soil with a slightly higher pH, 5.2). They occur throughout the Park, some showing evidence of fire and others without. These mixed woodlands tend to be on somewhat less exposed sites than some of the other woodland types (e.g. pitch pine, black spruce), occuring at low to middle elevations (20 - 250 m), on slopes of 8 - 12 % (rarely 20%), and with aspects covering the southeast to true north range. The current hypothesis is that they can be thought of as representing environments of moderate stress as opposed to relatively extreme stress.

Globally

This red spruce woodland occurs primarily on acidic bedrock outcrops or summits. Soils are shallow, well-drained, dry, acidic, coarse sands. Soil development is restricted to crevices or sheltered areas interspersed with significant amounts of exposed bedrock. Elevations of known examples range from 1000-2700 feet.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea rubens, Pinus strobus, Pinus resinosa, Picea glauca, Abies balsamea, Populus grandidentata*
Tree Subcanopy	*Picea rubens, Betula papyrifera, Abies balsamea, Picea glauca, Betula populifolia*
Short Shrub	*Myrica pensylvanica, Viburnum nudum*
Dwarf Shrub	*Vaccinium angustifolia, Gaylussacia baccata, Kalmia angustifolia, Amelanchier* spp.
Herbaceous	*Pteridium aquilinum, Deschampsia flexuosa, Acer rubrum, Danthonia spicata, Maianthemum canadense*
Non-vascular	*Cladina* spp. (incl. *C. rangiferina, C. sylvatica), Pleurozium schreberi, Dicranum polysetum, Polytrichum juniperinum, Polytrichum piliferum, Polytrichum commune*

Globally

Stratum	Species
Tree Canopy	*Picea rubens, Abies balsamea*
Dwarf Shrub	*Vaccinium angustifolium, Vaccinium myrtilloides, Gaylussacia baccata, Kalmia angustifolia*
Herbaceous	*Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Carex lucorumrum, Oryzopsis pungens, Sibbaldiopsis tridentata*

CHARACTERISTIC SPECIES

Acadia National Park

Picea rubens &/or *Pinus strobus* dominant; heath shrub layer prominent. Note that *Sibbaldiopsis tridentata* (in the type's name) is in only 25% of the samples.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A variable type encompassing woodlands dominated by *Picea rubens* and/or *Pinus strobus*, or a mixture of conifers including those that rarely form "pure" conifer woodlands (e.g. *Picea glauca, Abies balsamea*). *Picea rubens* and/or *Pinus strobus* are present, and usually dominant, in almost all examples. Canopy closure is typically in the 20 - 50% range, with heights of 6 - 13 m. The subcanopy varies from absent to 55%, usually features *Picea rubens*, but may feature *Betula papyrifera, Abies balsamea*, or *Picea glauca*. The shrub stratum, usually at least minimally present, is variable in cover (up to 45%) and species. *Picea rubens* is frequent; *Myrica pensylvanica, Viburnum nudum, Betula papyrifera*, and *Betula populifolia* may be locally important. The dwarf shrub layer is usually fairly well developed (median cover 33%, up to 65%) and usually dominated by *Vaccinium angustifolium, Gaylussacia baccata*, and/or *Kalmia angustifolia*. Herbs are sparse; the most frequent and abundant species are *Pteridium aquilinum* and *Deschampsia flexuosa*. *Danthonia spicata, Maianthemum canadense*, and small *Picea rubens, Pinus strobus*, and *Acer rubrum* are commonly present, but at very low cover. The bryoid layer is always present (at least 15% cover) and may be extensive (up to 65%). At most sites, *Cladina* lichens dominate the bryoid layer (and they are present at all sites), but mosses such as *Polytrichum juniperinum, Polytrichum piliferum, Polytrichum commune*, and *Dicranum polysetum* may be important at some sites.

The basal area ranged from 4 - 25 m^2/ha. Canopy heights were 6 - 13 m (avg. 9 m).

Globally

The scattered open canopy consists of *Picea rubens* and *Abies balsamea* in association with *Betula papyrifera* var. *papyrifera, Betula papyrifera* var. *cordifolia, Pinus rigida*, and *Pinus strobus*. The tall-shrub layer is generally sparse, consisting of *Sorbus americana, Viburnum nudum* var. *cassinoides, Nemopanthus mucronatus, Aronia melanocarpa*, or *Amelanchier* spp. *Myrica pensylvanica* may be present in this community near the seacoast. The low heath layer is made up of *Vaccinium angustifolium, Vaccinium myrtilloides, Gaylussacia baccata*, and *Kalmia angustifolia*. Forbs and graminoids occur in low abundance, including *Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Carex lucorumrum, Oryzopsis pungens, Sibbaldiopsis tridentata, Solidago simplex* var. *randii, Maianthemum canadense*. The bryophyte layer includes *Cladina* spp., *Pleurozium schreberi, Dicranum polysetum, Polytrichum juniperinum, Polytrichum piliferum*, and *Polytrichum commune*. Ground cover is sparse needle litter and exposed bedrock.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006053

COMMENTS

Acadia National Park

Species diversity is high, may be dominated by *Picea rubens, Pinus strobus*, or a mixture of conifers (often including *Thuja occidentalis*) with none especially dominant. One sample was a mixture of *Pinus resinosa* and *Pinus rigida*.

Because this is the catch-all type for mixed woodlands, intermediates between this and "single-species-named" woodlands abound. At Acadia, mixed conifer woodlands can grade into, or are most similar to, some pitch pine woodlands, some white cedar woodlands, and some black spruce woodlands. Red Spruce Talus Slope Woodlands (*Picea rubens / Ribes glandulosum* Woodland) are compositionally similar but occur on talus and often have an even more sparse canopy. A woodland - forest continuum also exists, with all gradations from very open red spruce woodlands to red spruce dominated spruce-fir forests. Some samples can be difficult to classify.

Globally

This association occurs at lower elevations relative to *Picea rubens / Ribes glandulosum* Woodland (CEGL006250).

Picea rubens / Ribes glandulosum Woodland

COMMON NAME	Red Spruce / Skunk Currant Woodland
SYNONYM	Red Spruce Talus Slope Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b)
ALLIANCE	PICEA RUBENS WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs in scattered locations throughout the Park.

Globally

This association occurs in Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Talus slopes below cliffs. Slopes can be very steep (up to 85%), aspects are various, and elevations are anywhere above 120 m. Soils are patchy and thin, well drained to excessively well drained, with a pH of around 5.0.

Globally

This association is a red spruce woodland of acidic talus slopes in the northern Appalachians. The community occurs at moderate to high elevations, on cobble to large boulder-sized talus generally within spruce - fir forests. There is variable soil development depending on the periodicity and intensity of rockslides.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea rubens, Pinus strobus, Pinus rigida, Thuja occidentalis, Betula cordifolia*
Tree Subcanopy	*Picea rubens, Acer rubrum, Betula papyrifera*
Short Shrub	*Picea rubens, Betula papyrifera, Nemopanthus mucronata*
Dwarf Shrub	*Vaccinium angustifolia, Gaylussacia baccata, Kalmia angustifolia, Viburnum nudum, Diervilla lonicera, Sorbus americana, Vaccinium vitis-idaea*
Herbaceous	*Deschampsia flexuosa, Danthonia spicata, Polypodium virginianum*
Non-vascular	*Umbilicaria* spp., *Dicranum* spp., *Ptilidium ciliare, Grimmia* spp., *Leucobryum glaucum, Cladina* spp., *Polytrichum piliferum, Polytrichum juniperinum, Polytrichum commune*

Globally

Stratum	Species
Tree Canopy	*Picea rubens*
Tall Shrub	*Acer spicatum, Sorbus americana, Sorbus decora*
Dwarf Shrub	*Kalmia angustifolia, Vaccinium angustifolium, Vaccinium myrtilloides*
Herbaceous	*Parthenocissus quinquefolia, Ribes glandulosum, Polypodium virginianum, Polygonum cilinode*

CHARACTERISTIC SPECIES

Acadia National Park

Picea rubens on talus; *Diervilla lonicera* characteristic.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Spruce Talus Woodland varies from strongly conifer dominated to mixed occurrences. *Picea rubens* is always the major conifer, occurring virtually alone or in mixtures with other conifers (*Pinus strobus, P. rigida, Thuja occidentalis*), or *Betula* spp. (*B. papyrifera, B. cordifolia*, and/or *B. alleghaniensis*) and Acer rubrum. Tree cover can be as low as 10% in some areas but will generally run 40 - 50%. The shrub stratum is usually sparse and composed of low *Picea* and *Betula*; at some sites, *Nemopanthus mucronata* can be important. Dwarf shrubs are present and form a patchy cover (usually less than 25%, up to 35%), with *Vaccinium angustifolium* and *Gaylussacia baccata* constant and usually dominant. *Kalmia angustifolia* or *Viburnum nudum* may

have relatively high cover at some sites. *Diervilla lonicera, Sorbus americana,* and *Vaccinium vitis-idaea* are occasional. Herbs are sparse: *Deschampsia flexuosa* and *Danthonia spicata* are common, though low in cover. *Polypodium virginianum* is dominant at some sites but absent from others. Lichens dominate the bryoid stratum, which varies in total cover according to how much *Umbilicaria* lichen is present. Cladina lichens are also characteristic, as are *Grimmia* spp., *Ptilidium ciliare*, and *Dicranum polysetum* and other *Dicranum* spp. Bryoid species richess usually far exceeds that of trees, shrubs, or herbs.

The basal area ranged from 4 - 12 m^2/ha. Canopy heights were 8 - 13 m.

Globally
The canopy varies from very open to almost closed and is dominated by *Picea rubens*, in association with *Abies balsamea, Betula papyrifera* var. *papyrifera, Betula papyrifera* var. *cordifolia*, and *Betula alleghaniensis*. The variable and clumped tall-shrub cover is comprised of *Acer spicatum, Sorbus americana*, and *Sorbus decora*. Scattered low heaths include *Kalmia angustifolia, Vaccinium angustifolium*, and *Vaccinium myrtilloides*. The herbaceous layer is made up of vines and forbs confined to crevices and may include *Parthenocissus quinquefolia, Ribes glandulosum, Polypodium virginianum, Polygonum cilinode, Solidago simplex* var. *randii, Deschampsia flexuosa*, and *Juncus trifidus*. The bryophyte layer may be well-developed and is made up of *Umbilicaria* spp., *Cladina* spp., *Grimmia* spp., *Ptilidium ciliare, Dicranum polysetum*, and other *Dicranum* spp. Ground cover is talus with variable litter accumulation.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006250

COMMENTS
Acadia National Park
Samples are mostly from the less steep sites because of sampling difficulties on very steep talus.

Variable in the proportion of conifers although always at least 50% coniferous.

Compositionally similar to mixed conifer woodlands, but occurs on talus, and dwarf shrub cover is generally lower in this type than in bedrock woodlands. Mixed occurrences, especially those with *Betula alleghaniensis*, grade towards Red Oak Talus Slope Woodlands (*Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland). There is a continuous gradation in canopy cover between this type and Northern Lichen Talus Barrens (*Polypodium (virginianum, appalachianum*) / *Lichen spp*. Nonvascular Vegetation).

Globally
This association is differentiated from other red spruce woodlands in its occurrence on talus on steep slopes, and in general has a lower cover of heath shrubs.

Picea mariana / Kalmia angustifolia Woodland

COMMON NAME	Black Spruce / Sheep Laurel Woodland
SYNONYM	Black Spruce / Heath Rocky Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b)
ALLIANCE	PICEA MARIANA WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs in scattered stands very near the coast.

Globally

This association occurs in Maine, Newfoundland, and possibly Nova Scotia and Pennsylvania.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These woodlands occur on bedrock at elevations up to 100 m and mostly very near the coast. Slopes range from 0 - 15%. Mineral soil tends to be thin, patchy and sandy to loamy, with a pH of around 5.0. In some places, the only so-called soils are pockets of peaty or poorly drained mineral soil in bedrock depressions.

Globally

This black spruce woodland occurs on rock outcrops and headlands. Soils are acidic, thin and patchy, comprised of sand or loam, with exposed bedrock common.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea mariana*
Tree Subcanopy	*Picea mariana*
Dwarf Shrub	*Kalmia angustifolia, Gaylussacia baccata, Vaccinium angustifolia, Photinia melanocarpa, Empetrum nigrum, Vaccinium vitis-idaea*
Herbaceous	*Pteridium aquilinum*
Non-vascular	*Pleurozium schreberi, Cladina* spp., *Polytrichum commune, Dicranum polysetum* (& other spp), *Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Picea mariana*
Dwarf Shrub	*Kalmia angustifolia*
Herbaceous	*Pteridium aquilinum*, *Cornus canadensis*

CHARACTERISTIC SPECIES

Acadia National Park

Picea mariana in an upland setting.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Upland black spruce woodlands. *Picea mariana* almost exclusively dominates the tree layer, which is a ragged combination of canopy and subcanopy trees. Openings among the trees fill with smaller black spruce, and there is usually a well developed dwarf shrub layer dominated by *Kalmia angustifolia, Gaylussacia baccata*, and/or *Vaccinium angustifolium*. *Photinia melanocarpa* is a frequent but low-cover shrub. In some samples, *Empetrum nigrum, Vaccinium vitis-idaea*, and/or *Myrica pensylvanica* show the boreal-maritime influence. The herb layer is spotty, with *Pteridium aquilinum* the only consistent species. Bryoids are also patchy, and typically feature both bryophytes and *Cladina* lichens. Species richness of bryoids (and sometimes of shrubs) is higher than that of trees or herbs.

The basal area ranged from 4 - 17 m^2/ha. Canopy heights were 7 - 14 m (avg. 10 m).

Globally
The open tree canopy is strongly dominated by *Picea mariana*, with occasional associates including *Pinus strobus* or *Abies balsamea*. The dwarf-shrub layer is well-developed and characterized by *Kalmia angustifolia* with other associates including *Picea mariana, Gaylussacia baccata, Vaccinium angustifolium*, and *Aronia melanocarpa*. Other dwarf shrubs may include *Empetrum nigrum, Vaccinium vitis-idaea, Gaultheria hispidula*, or *Myrica pensylvanica* (coastal examples). The herbaceous layer is patchy, comprised of *Pteridium aquilinum* and *Cornus canadensis*. The bryophyte layer is patchy and characterized by *Cladonia* lichens as well as *Pleurozium schreberi, Polytrichum commune, Dicranum polysetum*, and *Leucobryum glaucum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?.

DATABASE CODE CEGL006292

COMMENTS
Acadia National Park
Black spruce in uplands can be difficult to distinguish from red spruce on aerial photography.Canopy coverage variable; some stands are almost closed canopy (no vegetation samples of this). *Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum sp.* Woodland is compositionally similar in woody species but occurs in a peatland setting.

Globally

Thuja occidentalis - Abies balsamea / Ledum groenlandicum / Carex trisperma Woodland

COMMON NAME	Northern White-cedar - Balsam Fir / Labrador-tea / Three-seeded Sedge Woodland
SYNONYM	Northern White-cedar Wooded Fen
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Saturated temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.f)
ALLIANCE	THUJA OCCIDENTALIS SATURATED WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These cedar woodlands occur in basins formed over glacial till. Elevations are generally under 100 m. (One sample differed in being at slightly higher elevation and in a drainage channel rather than a basin.) The substrate is peat, or occasionally thin peat overlaying poorly drained mineral soil. Mineral soils, where they occur, are generally less than 25 cm deep; peat depth can range to over a meter. Soil pH was more variable than in many communities, ranging from 4.6 to 5.6.

Globally

This northern white-cedar bog woodland occurs on shallow peat over mineral soils in depressional wetlands in glacial till.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Thuja occidentalis, Picea mariana, Picea rubens, Pinus strobus, Acer rubrum, Betula papyrifera*
Tree Subcanopy	*Thuja occidentalis, Picea rubens, Larix laricina, Acer rubrum*
Short Shrub	*Picea rubens, Myrica pensylvanica, Thuja occidentalis*
Dwarf Shrub	*Vaccinium angustifolia, Kalmia angustifolia, Gaylussacia baccata, Myrica gale, Viburnum nudum, Ilex verticillata*
Herbaceous	*Carex trisperma, Thuja occidentalis, Picea rubens, Carex stricta, Carex gynanadra, Carex magellanica, Carex exilis, Maianthemum trifolium, Osmunda regalis, Osmunda cinnamomea, Coptis trifolia, Abies balsamea, Trientalis borealis, Acer rubrum, Cornus canadensis, Aster umbellatum, Larix laricina*
Non-vascular	*Sphagnum magellanicum, Sphagnum girgensohnii, Sphagnum palustre, Sphagnum papillosum, Bazzania trilobata, Sphagnum capillifolium, Hypnum imponens, Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Thuja occidentalis*
Short Shrub	*Alnus incana, Ilex verticillata, , Viburnum nudum,*
Dwarf Shrub	*Vaccinium angustifolium, Kalmia angustifolia, Gaylussacia baccata*
Herbaceous	*Onoclea sensibilis, Carex trisperma, Carex stricta, Carex gynandra, Coptis trifolia, Cornus canadensis, Trientalis borealis, Maianthemum canadense, Osmunda regalis*
Non-vascular	*Sphagnum magellanicum, Sphagnum girgensohnii, Sphagnum papillosum, Sphagnum wulfianum, Sphagnum capillifolium, Sphagnum recurvum, Sphagnum compactum, Sphagnum flavicomans*

CHARACTERISTIC SPECIES

Acadia National Park

Thuja occidentalis canopy in a wetland setting.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Fen woodlands with a partial canopy strongly dominated by *Thuja occidentalis*. Less frequent associates that can have high cover at some sites include *Picea rubens, Picea mariana*, and *Pinus strobus*. At lower cover *Acer rubrum* and *Betula papyrifera* are frequent canopy associates. The subcanopy and shrub layers are variable: absent at some sites, patchy at others. The species composition mirrors the canopy, with the addition of *Larix laricina* or *Myrica pensylvanica* at several sites. The dwarf shrub layer is sparse, featuring *Vaccinium angustifolium* and *Kalmia angustifolia*; *Gaylussacia baccata* or *Myrica gale* can be important at some sites, and *Viburnum nudum* and *Ilex verticillata* are frequent but at low cover. *Vaccinium corymbosum, V. oxycoccos, V. myrtilloides*, and *Chamaedaphne calyculata* are present (but not abundant) at a few sites. Herbs and herb-sized trees have higher cover than dwarf shrubs; along with tree regeneration, *Carex trisperma* is the most representative species. Frequent, but with low cover, are *Osmunda cinnamomea, Coptis trifolia, Cornus canadensis*, and of course *Trientalis borealis* and *Maianthemum canadense*. Locally common herbs include *Carex stricta, C. gynandra, C. magellanica, C. exilis, Maianthemum trifolium*, and *Osmunda regalis*. Sphagnum mosses strongly dominate the ground layer. *Sphagnum girgenshonii* is ubiquitous and usually dominant, *S. magellanicum* is usually present and sometimes dominant, and *S. palustre* is common at most sites. Beyond these, Sphagnum species varied site-to-site, with species including *S. papillosum, S. wulfianum, S. capillifolium* (both varieties, *capillifolium* and *tenellum*), *S. recurvum, S. compactum, S. russowi*, and *S. flavicomans*.

The basal area ranged from 21 - 65 m^2/ha. Canopy heights were 5 - 17 m.

Globally

The open canopy is dominated by *Thuja occidentalis*, in association with *Picea mariana, Picea rubens, Pinus strobus, Abies balsamea*, and *Acer rubrum*. The subcanopy is of low cover and may include *Thuja occidentalis, Picea rubens, Larix laricina*, and *Acer rubrum*. The shrub layer is characterized by *Alnus incana, Ilex verticillata, Vaccinium angustifolium, Kalmia angustifolia, Viburnum nudum*, and *Gaylussacia baccata*. *Myrica pensylvanica* is also an associate on the coast. The herbaceous layer includes *Onoclea sensibilis, Carex trisperma, Carex stricta, Carex gynandra, Coptis trifolia, Cornus canadensis, Trientalis borealis, Maianthemum canadense*, and *Osmunda regalis*. The bryophyte layer is well-developed and characterized by *Sphagnum magellanicum, Sphagnum girgensohnii, Sphagnum papillosum, Sphagnum wulfianum, Sphagnum capillifolium, Sphagnum recurvum, Sphagnum compactum*, and *Sphagnum flavicomans*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006507

COMMENTS

Acadia National Park

Canopy varies in the identity and importance of subdominants.

Can grade into Red Maple - Conifer Acidic Swamp (*Picea rubens - Acer rubrum / Nemopanthus mucronatus* Forest), Red Maple Swamp Woodland (*Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis* Woodland) or Black Spruce Woodland Bog (*Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata)* / Sphagnum sp. Woodland), but the predominance of *Thuja occidentalis* is used as the diagnostic feature.

Globally

Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum sp. Woodland

COMMON NAME	Black Spruce / (Highbush Blueberry, Black Huckleberry) / Peatmoss species Woodland
SYNONYM	Black Spruce Woodland Bog
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.A.4.N)
FORMATION	Saturated temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.f)
ALLIANCE	PICEA MARIANA SATURATED WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Characteristic of ombrotrophic peatland settings, in shallow or deep basins. Soils are peaty, with pH around 4.8. Most occur at low elevations; some (Isle au Haut) show the maritime influence by the presence of *Symplocarpus foetidus* and *Vaccinium vitis-idaea*.

Globally

This vegetation generally occurs in kettlehole basins and other well-defined topographic depressions and is characterized by relatively deep peat accumulation, indicating acidic, nutrient-poor conditions.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Picea mariana, Larix laricina, Thuja occidentalis, Acer rubrum*
Tree Subcanopy	*Picea mariana, Betula populifolia*
Short Shrub	*Picea mariana*
Dwarf Shrub	*Gaylussacia baccata, Rhododendron groenlandicum, Kalmia angustifolia, Nemopanthus mucronata, Vaccinium corymbosum, Vaccinium angustifolia, Vaccinium vitis-idaea*
Herbaceous	*Picea mariana, Carex trisperma, Maianthemum trifolium, Osmunda cinnamomea, Symplocarpus foetidus*
Non-vascular	*Sphagnum palustre, Sphagnum magellanicumellanicum, Sphagnum girgensohnii, Bazzania trilobata, Pleurozium schreberi, Cladina* spp.

Globally

Stratum	Species
Tree Canopy	*Picea mariana*
Tall Shrub	*Vaccinium corymbosum, Nemopanthus mucronatus*
Dwarf Shrub	*Chamaedaphne calyculata, Gaylussacia baccata, Kalmia angustifolia, Vaccinium angustifolium*
Herbaceous	*Carex trisperma, Rhynchospora alba, Eriophorum virginicum, Coptis trifolia, Maianthemum trifolium*
Non-vascular	*Sphagnum magellanicum, S. girgensohnii, Bazzania trilobata, Aulacomnium palustre, Pleurozium schreberi*

CHARACTERISTIC SPECIES

Acadia National Park

Picea mariana in all layers; no other wetland woodland type features *Rhododendron groenlandicum*, except for some RMWs with black spruce that are transitional to this type.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Partly forested peatland dominated by *Picea mariana* growing in thick *Sphagnum*. The tree canopy ranges from about 30% to (rarely) almost closed canopy (75%). *Picea mariana* is constant in the tree, shrub, and herb strata and the dominant tree. *Larix laricina* may be co-dominant; *Thuja occidentalis* or *Acer rubrum* may be important constituents although not dominant. The shrub layer (1 - 3 m) usually features *Picea mariana* as well, and otherwise varies from site to site: typical species can include *Vaccinium corymbosum, Viburnum nudum, Alnus incana,* or *Ilex verticillata*. Dwarf shrubs are patchy and include the usual bog heaths: *Gaylussacia baccata, Rhododendron groenlandicum,* and *Kalmia angustifolia*. *Vaccinium vitis-idaea* was present in 2 of the 4 samples, on drier hummocks around tree trunks. The bryoid layer is an almost continuous carpet of *Sphagnum* mosses, usually including *S. palustre, S. magellanicum,* and *S. girgensohnii*. In all but one sample, the number of bryoid species far exceeded the number of tree, shrub, or herb species. This vegetation often occurs as part of a peatland complex and grades from more forested to less forested and then into dwarf shrub bog vegetation, to which it is closely related.

The basal area ranged from 22 - 37 m^2/ha. Canopy heights were 8 - 14 m.

Globally

The tree canopy ranges widely in closure. The dominant tree is *Picea mariana*, with associates including *Larix laricina* and *Abies balsamea*. The shrubs *Vaccinium corymbosum* and *Nemopanthus mucronatus* form a patchy tall-shrub layer. The dwarf-shrub layer is well-developed and characterized by a number of heaths including *Chamaedaphne calyculata, Gaylussacia baccata, Kalmia angustifolia,* and *Vaccinium angustifolium*. Common herbs may include *Carex trisperma, Rhynchospora alba, Drosera rotundifolia, Sarracenia purpurea, Eriophorum virginicum, Coptis trifolia,* and *Maianthemum trifolium*. The well-developed bryophyte layer is dominated by *Sphagnum magellanicum, Sphagnum girgensohnii, Bazzania trilobata, Aulacomnium palustre,* and *Pleurozium schreberi*. This association is further characterized by the presence of one or more tree or shrub species of more southern distribution, including *Betula populifolia, Tsuga canadensis, Pinus rigida, Alnus incana, Rhododendron viscosum, Aronia* spp., or *Lyonia ligustrina*. Additional species that further indicate southern range affinity or the influence of slightly higher nutrient levels from adjacent uplands may be present, including *Carex folliculata, Carex crinita, Carex stricta, Osmunda cinnamomea, Symplocarpus foetidus, Iris versicolor,* or *Calla palustris*. Northern species, such as *Rhododendron canadense* or *Eriophorum vaginatum* var. *spissum (= Eriophorum spissum),* are generally lacking.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006098

COMMENTS

Acadia National Park

Co-dominance of larch can vary widely. Cover varies continuously from this type into shrubland with scattered trees (dwarf shrub bog veg type).

Grades to the red maple bog woodland variant (red maple and black spruce, on islands). The proportion of *Picea mariana* vs. *Thuja occidentalis* determines whether a particular site is classed as this type or the cedar type, but actually there is a continuous gradient between the two types. There is also a gradient, in tree cover, between this bog vegetation and that classed as dwarf shrub bog.

Globally

Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera) Woodland

COMMON NAME	(Quaking Aspen, Bigtooth Aspen) - (Gray Birch, Paper Birch) Woodland
SYNONYM	Early Successional Woodland/Forest
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.B.2.N)
FORMATION	Cold-deciduous woodland (II.B.2.N.a)
ALLIANCE	POPULUS TREMULOIDES WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs primarily in the 1947 fire area of Mount Desert Island.

Globally

This association occurs in Maine, New York, and possibly New Hampshire.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

The three subtypes form an elevational gradient, with forest physiognomy typical of the lowest elevations (below 75 m), woodlands at intermediate elevations (approximately 50 - 300 m), grading into stunted shrubland above 300 m. Aspect spans the compass. They typically occur on moderate to somewhat steep slopes (10 - 50%), on thin glacial till or bare granite. Soil, where present, is usually less than 25 cm deep, and most sites are moderately well drained to somewhat excessively drained (occasional on somewhat poorly drained soils), with a pH of 5.0 - 5.4. All of the sampled aspen - birch complex areas are within the 1947 fire area (although at least one AA point was outside of the fire area), and most contain direct evidence of fire.

Globally

This successional deciduous northern hardwood forests occurs on moderate to steeply sloping granite bedrock or thin glacial till.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Populus tremuloides, Populus grandidentata, Betula papyrifera, Acer rubrum, Quercus rubra* (locally)
Tree Subcanopy	*Betula papyrifera, Betula populifolia, Acer pensylvanicum, Quercus rubra, Fraxinus americana*
Short Shrub	*Betula populifolia*
Dwarf Shrub	*Vaccinium angustifolia*
Herbaceous	*Pteridium aquilinum, Deschampsia flexuosa, Festuca ovina, Aster umbellatum, Aster macrophyllum, Danthonia spicata, Carex lucorum, Maianthemum canadense*
Non-vascular	*Polytrichum commune, Polytrichum juniperinum, Cladonia pyxidata*

Globally

Stratum	Species
Tree Canopy	*Populus tremuloides, P. grandidentata, Betula papyrifera, B. populifolia, Acer rubrum, Prunus serotina*
Dwarf Shrub	*Vaccinium angustifolium, Kalmia angustifolia, Comptonia peregrina*
Herbaceous	*Pteridium aquilinum, Deschampsia flexuosa, Festuca ovina, Aster umbellatus, Aster macrophyllus, Danthonia spicata, Carex lucorumrum, Maianthemum canadense*

CHARACTERISTIC SPECIES

Acadia National Park

Deciduous tree cover with early successional species dominant. *Quercus rubra* often present but less abundant.

Globally

VEGETATION DESCRIPTION

Acadia National Park

FOREST & WOODLAND SUBTYPES: The tree canopy is dominated by *Populus grandidentata* (in the forest subtype) or *P. tremuloides* and, to a lesser extent, *Acer rubrum* (in the woodland subtype). Rarely are both *Populus tremuloides* and *P. grandidentata* present in the canopy. *Acer pensylvanicum*, *Betula caerulea* and *Betula papyrifera* are frequent but at low cover; *Betula populifolia* is occasional in the subcanopy but prominent in the 1 - 3 m shrub layer. The composition of the shrub layer is otherwise variable; at four sites, *Viburnum acerifolium*, *Betula alleghaniensis*, *Physocarpus opulifolius*, or *Hamamelis virginiana* dominated instead of *B. populifolia* in that layer. The low shrub layer is variable in extent and composition, except for the

presence in half of the samples of *Vaccinium angustifolium*; *Kalmia angustifolia* and *Comptonia peregrina* were important in some samples. Dominant herbs include *Pteridium aquilinum* and *Festuca ovina/filiformis*; *Aster macrophyllus*, *Deschampsia flexuosa*, and *Carex lucorumrum* are frequent associates. The bryoid layer is sparse and features *Polytrichum* mosses. SHRUBLAND SUBTYPE: The dominant growth is *Betula populifolia* and (lesser) *Sorbus americana* of about 2 - 3 tall, sometimes with scattered *Picea rubens* or *Alnus viridis*, with a dense low shrub understory of *Vaccinium angustifolium*, *Kalmia angustifolia*, and *Viburnum nudum* (with *Photinia melanocarpa* and *Spiraea alba* present at lower cover); *Rhododendron canadense* and *Ilex verticillata* were important in one sample. The herb layer, while not extensive, contains several species common to the woodland and forest subtypes, as well as some species not usually present in those variants, such as *Calamagrostis canadensis* and *Carex debilis*. Introduced species are more prevalent in this type than in other forest and woodland types, although (as in other types) they generally contribute less than 5% of the vegetation cover even where they are present.

The basal area ranged from 8 - 35 m^2/ha. Canopy heights were none (shr) - 20 m (forest).

Globally
The community is broadly defined, and includes vegetation developing after severe disturbance such as logging, fires, severe hurricanes, or simply heavily fragmented residential development. The tree canopy is a heterogeneous mixture of light-requiring, wind-dispersed trees usually composed of several codominant species including *Populus tremuloides, Populus grandidentata, Betula papyrifera, Betula populifolia, Acer rubrum, Prunus serotina*, typically with minor components of *Pinus strobus, Picea rubens, Acer saccharum, Quercus rubra*, or *Fraxinus americana*. The shrub layer is sparse to absent, and may include *Sorbus americana, Acer pensylvanicum*, or *Hamamelis virginiana*. *Vaccinium angustifolium, Kalmia angustifolia,* and *Comptonia peregrina* form a dwarf-shrub layer, and associated herbs include *Pteridium aquilinum, Deschampsia flexuosa, Festuca ovina, Aster umbellatus, Aster macrophyllus, Danthonia spicata, Carex lucorumrum*, and *Maianthemum canadense*. The bryophyte layer is generally of low cover but may include *Polytrichum commune, Polytrichum juniperinum*, and *Cladonia* spp.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5.

DATABASE CODE CEGL006303

COMMENTS
Acadia National Park
Physiognomic gradient as described. A broad type spanning a wide array of compositional variety. Proportion of spruce in the shrubland type can vary. *Acer rubrum* and *Populus* spp. are inversely abundant in the woodland subtype.

Red Oak Talus Slope Woodland (*Betula alleghaniensis - Quercus rubra / Polypodium virginianum* Woodland) is segregated as a separate type and has *Betula alleghaniensis* dominant at least in the sapling-sized trees. The high-slope shrubland variants grades into the summit vegetation complex Blueberry Granite Barrens *(Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata* Dwarf-shrubland). Mixed summit shrublands share many of the same species but have more spruce, less grey birch, and greater cover of deciduous shrub species. The forest and woodland types grade into oak types, the prevalence of *Quercus rubra* is used as the diagnostic character but is not always easy to apply in the field.

Globally

Quercus rubra - (Quercus prinus) / Vaccinium spp. / Deschampsia flexuosa Woodland

COMMON NAME	Northern Red Oak - (Rock Chestnut Oak) / Blueberry species / Wavy Hairgrass Woodland
SYNONYM	Central Appalachian High Elevation Red Oak Woodland, Northern Varient
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.B.2.N)
FORMATION	Cold-deciduous woodland (II.B.2.N.a)
ALLIANCE	QUERCUS RUBRA - QUERCUS PRINUS WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs primarily in the 1947 burned area of Mount Desert Island.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, New York, Pennsylvania, Vermont, West Virginia, and possibly Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Red oak woodlands occurred primarily in the portion of the Park burned in the 1947 fire, although they can be locally extensive on the west side of Mount Desert Island as well. Topographic position varies from upper to lower slopes (7-25%); they are rarely found on lower, more gentle rocky slopes but not on summits. Elevation range is 30 - 200 m, and aspect ranges from northeast- to south-facing. Most occur on bedrock, a few are found on thin soils over glacial till. Soils are loamy and moderately well drained to somewhat excessively drained (the occasional odd site on silty-clay soils, more poorly drained), with a pH of 5.0 - 5.2.

Globally

This red oak rocky summit community occurs on low- to mid-elevation summits and south-facing, steep upper slopes. Soils are shallow, well-drained, nutrient-poor gravels and coarse sands, with prominent exposed bedrock. Elevations of know occurrences range from 1000 to 2620 feet in New England, to 4500 feet in West Virginia.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Quercus rubra, Acer rubrum, Betula* spp. (*caerulea, papyrifera, populifolia*), *Populus grandidentata*
Tree Subcanopy	*Betula* spp. (*papyrifera* or *populifolia*), *Acer rubrum*
Dwarf Shrub	*Vaccinium angustifolia, Gaylussacia baccata, Kalmia angustifolia, Vaccinium myrtilloides, Amelanchier* spp., *Comptonia peregrina*
Herbaceous	*Pteridium aquilinum, Festuca ovina, Quercus rubra, Gaultheria procumbens, Deschampsia flexuosa, Aster umbellatum, Acer rubrum, Acer pensylvanicum, Carex lucorum, Danthonia spicata*
Non-vascular	*Polytrichum commune, Leucobryum glaucum, Dicranum* spp.

Globally

Stratum	Species
Tree Canopy	*Quercus rubra*
Dwarf Shrub	*Vaccinium angustifolium, V. pallidum, V. myrtilloides, Gaylussacia baccata, Kalmia angustifolia*
Herbaceous	*Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Pteridium aquilinum, Gaultheria procumbens, Aralia nudicaulis*
Non-vascular	*Polytrichum commune, Leucobryum glaucum*

CHARACTERISTIC SPECIES

Acadia National Park

Deschampsia flexuosa, Doellingeria umbellata

Globally

VEGETATION DESCRIPTION

Acadia National Park

Partial to very open canopy woodlands strongly dominated by *Quercus rubra* forming a 20% - 50% canopy. The most common associated tree is *Acer rubrum* (which occasionally approaches 30% relative dominance); other associated trees, as minor components, include *Betula populifolia, caerulea, papyrifera,* or *cordifolia,* and *Populus grandidentata. Picea rubens,* if present at all, is very minor. The lower tree stratum is variable. The shrub layer includes tree regeneration, varying in species from site to site. The importance of dwarf shrubs also varies from site to site: half of the sites had a noticeable dwarf shrub layer (20 - 50%), and the other half 15% cover or less. *Vaccinium angustifolium* and *Gaylussacia baccata* are the dominant dwarf shrubs; other typical species include *Kalmia angustifolia, Vaccinium myrtilloides, Amelanchier* spp., and/or *Comptonia peregrina*. In the herb layer, the dominant and constant species is *Pteridium aquilinum*. Some sites also feature *Festuca ovina*. Frequent, but lower cover, herbs include *Quercus rubra* seedlings, *Gaultheria procumbens, Deschampsia flexuosa, Doellingeria umbellata, Acer rubrum, Acer pensylvanicum, Carex lucorumrum,* and *Danthonia spicata*. Bryoids are patchy and typically include *Polytrichum commune* and *Dicranum* spp. Herb species richness usually noticeably exceeds that of trees, shrubs, or bryoids.

The basal area ranged from 9 - 23 m^2/ha. Canopy heights were 9 - 12 m (avg. 11 m).

Globally

The open canopy is dominated by scattered, often stunted *Quercus rubra* with minor associates including *Quercus velutina, Quercus prinus, Betula populifolia, Betula papyrifera,* and *Acer rubrum.* A tall shrub layer is generally lacking. The low shrub stratum may be well-developed, and is characterized by *Vaccinium angustifolium, Vaccinium pallidum, Vaccinium myrtilloides, Gaylussacia baccata,* or *Kalmia angustifolia*. The herbaceous layer is comprised of *Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Pteridium aquilinum, Gaultheria procumbens,* and *Aralia nudicaulis.* The bryophyte layer may be patchy and includes *Polytrichum commune, Leucobryum glaucum,* and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006134

COMMENTS

Acadia National Park

True oak woodlands, those with less than about 60% canopy, are assigned to this vegetation type. More closed-canopy oak woodlands fit into the Successional Oak - Pine Forests (*Quercus rubra - Acer rubrum - Betula spp. - Pinus strobus* Forest).

Half of the samples fit the NVCS type well; the others were more compositionally similar to standard oak - pine woodlands except for the absence or paucity of pine in the tree layer. *Gaultheria procumbens* was present in the latter but not the former.

Grades to White Pine - Red Oak Bedrock Glade (*Pinus strobus, Quercus rubra) / Danthonia spicata* Acid Bedrock Wooded Herbaceous Vegetation); technically, that is mixed and this is not. Red oak woodlands with *Betula* and *Populus* grade into the ubiquitous Early Successional Woodland/Forest *(Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland).

Globally

Betula alleghaniensis - Quercus rubra / Polypodium virginianum Woodland

COMMON NAME	Yellow Birch - Northern Red Oak / Rock Polypody Woodland
SYNONYM	Red Oak Talus Slope Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.B.2.N)
FORMATION	Cold-deciduous woodland (II.B.2.N.a)
ALLIANCE	QUERCUS RUBRA - QUERCUS PRINUS WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs in scattered locations, primarily in the burned area of Mount Desert Island.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Talus slopes. Vascular vegetation grows in patchy coarse-textured soil 20 - 30 cm deep. Both areas sampled are within the 1947 fires area, betweeb 150 - 250 m elevation.

Globally

This woodland occurs on a substrate of acidic large boulder talus slopes, with vascular plants confined to coarse-textured soils in crevices.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Betula caerulea, Betula papyrifera, Betula allegheniensis, Populus grandidentata, Acer pensylvanicum, Acer rubrum*
Tree Subcanopy	*Betula allegheniensis, Betula papyrifera, Acer pensylvanicum, Acer rubrum*
Short Shrub	*Betula allegheniensis*
Herbaceous	*Deschampsia flexuosa, Betula allegheniensis, Carex leptonervia*
Non-vascular	*Polytrichum commune, Leucobryum glaucum*

Globally

Stratum	Species
Tree Canopy	*Quercus rubra, Betula alleghaniensis*
Tall Shrub	*Acer spicatum, Acer pensylvanicum*
Short Shrub	*Rubus* spp., *Viburnum acerifolium, Ribes* spp.
Herbaceous	*Parthenocissus quinquefolia, Parthenocissus vitacea, Toxicodendron radicans, Celastrus scandens, Polygonum cilinode, Dryopteris marginalis, Polypodium virginianum, Pteridium aquilinum, Carex pensylvanica, Corydalis sempervirens*

CHARACTERISTIC SPECIES

Acadia National Park

Betula alleghaniensis on talus

Globally

VEGETATION DESCRIPTION

Acadia National Park

Open woodlands on talus, strongly dominated by *Betula* spp. In the two samples (both within the 1947 fire are), tree-sized *Betula* are primarily *B. caerulea* and *B. papyrifera*, but the greatest cover is provided by sapling-sized and shrub sized *B. alleghaniensis*. Other layers are sparse: dwarf shrubs almost absent (small amounts of *Vaccinium angustifolium* usually present), and herbs and bryoids likewise sparse. Composition of the herb layer varies (more samples needed to adequately characterize); *Betula alleghaniensis*, *Acer pensylvanicum*, *Carex leptonervia*, and *Deschampsia flexuosa* were present in both samples, and species in one of the two samples included *Solidago simplex* ssp. *randii*, *Dryopteris marginalis*, *Aster macrophyllus*, and *Danthonia spicata*. The bryoid layer was sparse and limited to *Polytrichum commune*, *Leucobryum glaucum*, *Cladina* sp., and *Dicranum* spp; *Umbilicaria* lichens were absent.

The basal area ranged from 6 m^2/ha. Canopy heights were 12 - 14 m.

Globally
The tree canopy is dominated by *Quercus rubra* and *Betula alleghaniensis.* Other canopy associates include *Acer saccharum, Betula papyrifera, Betula populifolia, Fagus grandifolia, Acer rubrum, Tsuga canadensis,* and *Pinus strobus*. At the northern end of the range, *Betula X caerulea* and *Betula papyrifera* are also associated. The understory is comprised of scattered and clumped tall shrubs and small trees, including *Acer spicatum, Acer pensylvanicum, Rubus* spp., *Viburnum acerifolium,* and *Ribes* spp. Ericaceous shrubs are not generally prevalent, but when present may include *Vaccinium angustifolium, Gaylussacia baccata* or *Kalmia angustifolia*. Vines are particularly characteristic, and include *Parthenocissus quinquefolia, Parthenocissus vitacea, Toxicodendron radicans, Celastrus scandens, Polygonum cilinode.* Scattered ferns and herbs are *Dryopteris marginalis, Polypodium virginianum, Pteridium aquilinum, Carex pensylvanica, Corydalis sempervirens, Solidago bicolor, Solidago caesia,* and others. Bryophytes are of sparse cover and may include *Polytrichum commune, Leucobryum glaucum,* and *Cladina* spp.

OTHER NOTEWORTHY SPECIES *Betula caerulea* is uncommon statewide

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006320

COMMENTS
Acadia National Park
This was recognized as a type late in the process, and so not targeted for sampling as a type. The state type will include red oak talus woodlands as well, but none of these were sampled in Acadia.

The dominance of *Betula alleghaniensis* allies this type with mixed deciduous forests, but the setting, canopy cover, and herb layer are of course quite different. Some sites within the highly variable aspen - birch woodland complex (*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera*) Woodland) will be similar in the dominance of *Betula* species other than *B. alleghaniensis*. Red oak woodlands may also be similar but will lack any appreciable amount of *Betula alleghaniensis.*

Globally

Acer rubrum / Alnus incana - Ilex verticillata / Osmunda regalis Woodland

COMMON NAME	Red Maple / Speckled Alder - Winterberry / Royal Fern Woodland
SYNONYM	Red Maple Swamp Woodland
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (II.B.2.N)
FORMATION	Saturated cold-deciduous woodland (II.B.2.N.e)
ALLIANCE	ACER RUBRUM SATURATED WOODLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Low-elevation sites in drainage basins, with peat or muck soils of pH 5.0 - 5.2 (one sample was on a clay soil). Most are saturated throughout the growing season, and some are seasonally flooded. The mixed variant is restricted to the islands in Penobscot Bay (e.g. Isle au Haut, Placentia), not Mt. Desert Island.

Globally

This open-canopy red maple swamp of peatlands occurs at low elevations.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Acer rubrum, Picea mariana Betula populifolia*
Tree Subcanopy	*Acer rubrum, Picea mariana* (in variant), *Betula populifolia, Larix laricina*
Short Shrub	*Alnus incana, Betula populifolia, Ilex verticillata, Picea mariana* (in variant)
Dwarf Shrub	*Vaccinium angustifolia, Ilex verticillata, Rubus hispidus, Spiraea alba, Gaylussacia baccata and Chamaedaphne calyculata* (in mixed variant)
Herbaceous	*Calamagrostis canadensis, Carex stricta, Symplocarpus foetidus, Rhynchospora alba, Osmunda cinnamomea, Thelypteris palustris, Acer rubrum, Iris verticillata, Dryopteris cristata*
Non-vascular	*Sphagnum palustre, Sphagnum magellanicum, Sphagnum girgensohnii*

Globally

Stratum	Species
Tree Canopy	*Acer rubrum*
Tall Shrub	*Alnus incana, Ilex verticillata*
Herbaceous	*Osmunda regalis, Osmunda cinnamomea, Coptis trifolia, Thelypteris palustris, Onoclea sensibilis. Carex trisperma*
Non-vascular	*Sphagnum magellanicum, Sphagnum fimbriatum, Sphagnum centrale*

CHARACTERISTIC SPECIES

Acadia National Park

Acer rubrum canopy without *Picea rubens* or *Thuja occidentalis. Symplocarpus foetidus* is a good indicator in the mixed variant, and absent from the typic one.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A fen woodland with a patchy canopy over a well developed herb layer dominated by *Calamagrostis canadensis* and *Carex stricta*. Two distinct phases occur in the Park: the typical phase, with the canopy strongly dominated by *Acer rubrum* and with conifers essentially absent (N=3), and the mixed variant, with canopy *Picea mariana* well represented or even co-dominant with the *Acer rubrum* (N=5). *Betula populifolia* and *Larix laricina* are occasional associates. Shrubs, which may form a fairly dense layer (up to 60% cover) feature *Alnus incana* and *Ilex verticillata*, along with small trees. The dwarf shrub layer is sparse, rarely over 10% cover (cf. other bog woodlands), and often includes *Vaccinium angustifolium, Rubus hispidus,* or *Spiraea alba*; in the

mixed variant, *Gaylussacia baccata* and *Chamaedaphne calyculata* are frequent. The herb layer is usually well developed and dominated by graminoids. At some sites, *Osmunda cinnamomea, Symplocarpus foetidus*, or *Rhynchospora alba* may be important. *Thelypteris palustris, Iris versicolor*, and *Dryopteris cristata* are frequent but at low cover. The bryoid layer is usually, but not always, extensive. *Sphagnum* spp. dominate, including *S. magellancium, S. palustre*, and *S. girgensohnii*. Species richness of herbs is typically far higher than that of trees, shrubs, or bryoids.

The basal area ranged from 5 - 33 m^2/ha. Canopy heights were 8 - 13 m.

Globally
Acer rubrum is the dominant tree; associates may include *Abies balsamea* and *Larix laricina*. The shrub layer is well-developed and is dominated by *Alnus incana* or *Ilex verticillata*, in variable association with other species such as *Nemopanthus mucronatus, Viburnum nudum* var. *cassinoides, Myrica gale*, and *Spiraea alba* var. *latifolia (= Spiraea latifolia)*. The herbaceous layer is variable, generally including *Osmunda regalis, Osmunda cinnamomea, Coptis trifolia, Thelypteris palustris*, and *Onoclea sensibilis*. *Carex trisperma* is the most frequent and abundant sedge. The bryophyte layer is well-developed, characterized by *Sphagnum magellanicum, Sphagnum fimbriatum, Sphagnum centrale*, and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006395

COMMENTS
Acadia National Park
The mixed stands, intermediate between Northern Hardwood Seepage Swamp *(Acer rubrum - Fraxinus spp. / Nemopanthus mucronatus - Vaccinium corymbosum* Fores) and Black Spruce Woodland Bog (*Picea mariana / (Vaccinium corymbosum, Gaylussacia baccata) / Sphagnum* sp. Woodland) in canopy composition, are classed as variants of the red maple type because the associated species showed them to be more similar to the red maple type samples than to the black spruce type samples.

The two phases, with or without black spruce, are fairly distinct.

The typical variant is distinct. It is most similar to Eastern Tussock Sedge Meadow (*Carex stricta - Carex vesicaria* Seasonally Flooded Herbaceous Vegetation), but has greater tree cover. The mixed variant can grade into the Northern White-cedar Wooded Fen (*Thuja occidentalis - Abies balsamea / Ledum groenlandicum / Carex trisperma* Woodland).

Globally

Alnus incana - Cornus sericea / Clematis virginiana Shrubland

COMMON NAME	Speckled Alder - Red-osier Dogwood / Virgin's-bower Shrubland
SYNONYM	Alluvial Alder Thicket
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (III.B.2.N)
FORMATION	Temporarily flooded cold-deciduous shrubland (III.B.2.N.d)
ALLIANCE	ALNUS INCANA TEMPORARILY FLOODED SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

Maine, New Hampshire, New York, Vermont

ENVIRONMENTAL DESCRIPTION

Acadia National Park

This vegetation typically forms narrow bands along stream channels at lower to mid elevatioins. Slopes are up to 10%, soils are generally poorly-drained muck, with pH 5.2 - 5.4 (one site was on well drained sand).

Globally

This shrub swamp of low-energy stream channels occurs on poorly drained muck, peat or peaty muck, and rarely on sand.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Subcanopy	*Betula populifolia, Betula allegheniensis*
Short Shrub	*Alnus incana*
Dwarf Shrub	*Alnus incana, Spiraea tomentosa, Spiraea alba, Rubus hispidus, Rubus allegheniensis, Rubus ideaus*
Herbaceous	*Calamagrostis canadensis, Onoclea sensibilis, Aster umbellatum, Lycopus uniflorus*

Globally

Stratum	Species
Tall Shrub	*Alnus incana, Nemopanthus mucronata*
Short Shrub	*Spiraea tomentosa, Spiraea alba, Cornus sericea, Viburnum dentatum, V. lentago, V. nudum*
Herbaceous	*Calamagrostis canadensis, Smilacina trifolia, Carex canenscens, Carex trisperma, Onoclea sensibilis, Aster umbellatus, Carex atlantica, Lycopus* spp.

CHARACTERISTIC SPECIES

Acadia National Park

Alnus-dominated shrublands along stream channels.

Globally

VEGETATION DESCRIPTION

Acadia National Park

(Description based on three samples.) *Alder*-dominated shrublands typically associated with stream channels. *Alnus incana* (or rarely another *Alnus* sp.) forms a shrub layer 1.5 - 3 m high. *Betula populifolia* or *B. alleghaniensis* may be scattered and taller than the alders. Lower layers are less extensive than the alder "canopy", with the low shrub and herb layers running 10 - 50% and the bryoid layer less than 30% (60% in one sample). Low shrubs include *Spiraea tomentosa, S. alba, Rubus hispidus, R. alleghaniensis*, and/or *R. idaeus*. *Calamagrostis canadensis, Onoclea sensibilis, Doellingeria umbellata*, and *Lycopus uniflorus* were common to the herb layer of all three samples; at particular sites, *Solidago puberula, Carex atlantica*, or *Euthamia graminifolia* was common. Bryophyte cover was either very limited or fairly well developed mats of *Sphagnum magellanicum*.

Globally

The shrub stratum is dominated by *Alnus incana*, occurring in association with *Spiraea tomentosa, Spiraea alba, Cornus sericea, Viburnum dentatum, Viburnum lentago, Viburnum nudum, Nemopanthus mucronata, Rubus hispidus*, and other *Rubus* spp. Occasional stunted tree saplings may include *Betula populifolia, Betula alleghaniensis, Acer rubrum* and others, depending on the surrounding vegetation. The herbaceous layer is variable and may include *Calamagrostis canadensis, Smilacina trifolia,*

Carex canenscens, Carex trisperma, Onoclea sensibilis, Aster umbellatus, Solidago puberula, Euthamia graminifolia, Carex atlantica and *Lycopus* spp. Although common, this association is little studied and comprehensive surveys have yet to be undertaken.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4G5.

DATABASE CODE CEGL006062

COMMENTS

Acadia National Park

The difference in setting between Northern Peatland Shrub Swamp (*Alnus incana ssp. rugosa - Nemopanthus mucronatus / Sphagnum spp.* Shrubland) and Alluvial Alder Thicket (*Alnus incana - Cornus sericea / Clematis virginiana* Shrubland) is clear but differences in vegetation are not; more samples (or analysis of the AA samples) might help. Alder thickets are also common in wet abandoned fields, which can confuse the situation further.

Alluvial Alder Thickets are vegetationally similar but in flat basins, not linear.

Globally

Alnus incana ssp. *rugosa - Nemopanthus mucronatus / Sphagnum* spp. Shrubland

COMMON NAME	Speckled Alder - Mountain-holly / Peatmoss species Shrubland
SYNONYM	Northern Peatland Shrub Swamp
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (III.B.2.N)
FORMATION	Seasonally flooded cold-deciduous shrubland (III.B.2.N.e)
ALLIANCE	ALNUS SERRULATA SEASONALLY FLOODED SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine and New York.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

In flat basins at low elevations, often forming a narrow band along peatland margins. Soils are very poorly drained, with pH of 5.0 to 5.4.

Globally

This peatland lagg community of northern New England and adjacent Canada is an alder-dominated community occurring at the edge of peat mats, where it receives slightly more enriched waters than those of the adjacent oligotrophic or ombrotrophic peatland community.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Short Shrub	*Alnus incana, Alnus viridis*
Dwarf Shrub	*Rubus allegheniensis, Nemopanthus mucronata, Spiraea tomentosa*
Herbaceous	*Rubus pubescens, Lysimachia terrestris*
Non-vascular	*Sphagnum palustre*

Globally

Stratum	Species
Tree Subcanopy	*Alnus incana* ssp. *rugosa, Alnus viridis, Viburnum nudum* var. *cassinoides, Ilex verticillata, Nemopanthus mucronatus*
Short Shrub	*Spiraea tomentosa*
Herbaceous	*Carex trisperma, Calla palustris, Triadenum virginicum, Carex paupercula, Iris versicolor, Gaultheria hispidula, Lysimachia terrestris, Trientalis borealis*
Non-vascular	*Sphagnum recurvum, Sphagnum palustre, Sphagnum fallax, Sphagnum magellanicum*

CHARACTERISTIC SPECIES

Acadia National Park

Alnus spp. dominate in a flat basin or peatland setting.

Globally

VEGETATION DESCRIPTION

Acadia National Park

(Description based on two samples.) Alder-dominated shrublands typically associated with peatlands, usually at the edges. *Alnus incana* or *A. viridis* forms a shrub layer 1.5 - 3 m high. *Acer rubrum, Spiraea alba,* and *Ilex verticillata* may have patchy cover. Lower layers are less extensive than the alder "canopy", with the low shrub and herb layers running 25 - 50% and the bryoid layer less than 30%. Low shrubs include *Nemopanthus mucronatus, Rubus alleghaniensis,* and/or *Spiraea tomentosa*. *Rubus pubescens* and *Lysimachia terrestris* occurred in both samples; aside from these, there was no overlap in herb composition. One sample had *Carex gynandra, Calamagrostis canadensis,* and *Doellingeria umbellata* as the most common herbs; in the other, *Aralia nudicaulis, Thalictrum pubescens, Solidago puberula,* and *Oclomena acuminata* were most common. Bryophytes are very limited, with *Sphagnum palustre* the common species.

Globally
Alnus incana ssp. *rugosa (= Alnus rugosa)* is the dominant or characteristic shrub. Associated shrubs may include *Alnus viridis*, *Viburnum nudum* var. *cassinoides (= Viburnum cassinoides)*, *Ilex verticillata*, *Nemopanthus mucronatus*, or *Spiraea tomentosa*. A tree canopy is lacking, but there may be scattered trees of *Acer rubrum*, *Thuja occidentalis*, or *Abies balsamea*. The herb layer may include *Carex trisperma*, *Calla palustris*, *Triadenum virginicum*, *Carex paupercula*, *Iris versicolor*, *Gaultheria hispidula*, *Lysimachia terrestris*, and *Trientalis borealis*. Ground layer consists of *Sphagnum recurvum*, *Sphagnum palustre*, *Sphagnum fallax*, and *Sphagnum magellanicum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5.

DATABASE CODE CEGL006158

COMMENTS
Acadia National Park
The difference in setting between alder types is clear but differences in vegetation are not; more samples (or analysis of the AA samples) might help. Alder thickets are also common in abandoned fields, which can confuse the situation further.

Streamside alder thickets, temporarily flooded, are very similar vegetationally (based on very limited sampling) but differ in setting. No other vegetation type is dominated by *Alnus* spp. Some areas have both alder and sweetgale, however, showing transitions to Sweetgale Mixed Shrub Swamp *(Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland).

Globally

Myrica gale - Spiraea alba - Chamaedaphne calyculata Shrubland

COMMON NAME	Sweet Gale - White Meadowsweet - Leatherleaf Shrubland
SYNONYM	Sweetgale Mixed Shrub Swamp
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (III.B.2.N)
FORMATION	Saturated cold-deciduous shrubland (III.B.2.N.g)
ALLIANCE	MYRICA GALE SATURATED SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine and New Hampshire.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Flat basins at low elevations, often associated with peatland edges or peaty edges of lakeshores. The substrate pH varied widely (three samples), from 4.8 to 6.5. The two samples over 6.0 were in the portion of the Park burned in the 1947 fire while the more acidic sample came from a site outside of the 1947 fire area.

Globally

This weakly to moderately minerotrophic mixed shrub swamp of northern New England occurs on stream, lake or pond margins, adjacent to marshes or swamps, or on wet acidic colluvium at the base of slopes. The substrate is well-decomposed peat or muck overlying mineral soils.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Short Shrub	*Myrica gale, Alnus incana*
Dwarf Shrub	*Myrica gale, Chamaedaphne calyculata, Spiraea tomentosa, Spiraea alba, Rhododendron canadense*
Herbaceous	*Calamagrostis canadensis, Carex stricta, Triadenum fraseri, Dulichium arundinaceum, Lysimachia terrestris, Carex oligosperma*
Non-vascular	*Sphagnum magellanicum, Sphagnum palustre, Sphagnum girgensohnii*

Globally

Stratum	Species
Short Shrub	*Myrica gale, Spiraea alba, Spiraea tomentosa, Alnus incana*
Dwarf Shrub	*Chamaedaphne calyculata*
Herbaceous	*Calamagrostis canadensis, Carex stricta, Carex utriculata, Carex canescens, Carex oligosperma, Typha latifolia, Triadenum virginicum, Triadenum fraseri, Dulichium arundinaceum, Juncus canadensis, Lysimachia terrestris*
Non-vascular	*Sphagnum fimbriatum, Sphagnum magellanicum*

CHARACTERISTIC SPECIES

Acadia National Park

Dominance of *Myrica gale* or, less frequently, *Spiraea* sp.; *Gaylussacia baccata* absent and *Kalmia angustifolia* absent or very minor. *Alnus incana* may be present but is less abundant than *Myrica gale.*

Globally

VEGETATION DESCRIPTION

Acadia National Park

A shrubby, Sphagnum-based fen with *Myrica gale* strongly dominant in either the >1 m shrub layer or the < 1 m shrub layer. *Alnus incana, Spiraea alba,* and *S. tomentosa,* and usually relatively small amounts of *Chamaedaphne calyculata* are frequent associates. *Rhododendron canadense* occasionally contributes a large percentage of the shrub cover. Nutrient-rich areas have taller shrubs; dominants include the above as well as *Nemopanthus mucronata, Vaccinium corymbosum*, or *Viburnum nudum* var. *cassinoides*. The herb cover, often more-or-less the inverse of the shrub cover, is dominated by *Calamagrostis canadensis* and/or *Carex stricta,* with occasionally large amounts of *Triadenum fraseri* or, less often, *Oclomena nemoralis* or *Carex oligosperma*.

Dulichium arundinaceum, Juncus canadensis, and *Lysimachia terrestris* are frequent but less abundant associates. The coverage of the bryoid layer varies, but is always Sphagnum-dominated. Some combination of *S. magellanicum, S. fimbriatum*, and *S. palustre* is usually dominant. At some sites, *S. girgensohnii* or *S. squarrosum* may be well represented.

Globally
The shrub stratum is characterized by *Myrica gale, Spiraea alba, Spiraea tomentosa, Alnus incana, Chamaedaphne calyculata* in association with others such as *Rhododendron canadense* and saplings of *Acer rubrum*. The herbaceous layer is relatively diverse and variable, and may include *Calamagrostis canadensis, Carex stricta, Carex utriculata, Carex canescens, Carex oligosperma, Typha latifolia, Triadenum virginicum, Triadenum fraseri, Solidago nemoralis, Dulichium arundinaceum, Juncus canadensis*, and *Lysimachia terrestris*. The bryophyte layer is characterized by *Sphagnum fimbriatum, Sphagnum magellanicum,* and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006512

COMMENTS
Acadia National Park
Sites with a large amount of *Chamaedaphne calyculata* (> 20%) can resemble the Leatherleaf Acidic Fen (Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum Dwarf-shrubland). Otherwise, the dominance of *Myrica* and *Spiraea* is distinctive.

Globally

Morella pensylvanica - Empetrum nigrum Shrubland

COMMON NAME	Northern Bayberry - Black Crowberry Shrubland
SYNONYM	Crowberry - Bayberry Maritime Shrubland
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A)
PHYSIOGNOMIC GROUP	Needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (IV.A.1.N)
FORMATION	Creeping or matted needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.b)
ALLIANCE	EMPETRUM NIGRUM DWARF-SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association has been observed on Little Moose Island.

Globally

This association occurs in Maine and possibly Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Extremely exposed headlands, with vegetation carpeting the bedrock. Typically with very little slope, and with pockets of peaty soli developing in shelered rock hollows. Salt spray, fog, and wind are nearly constant elements.

Globally

This boreal dwarf-shrubland community of coastal headlands occurs on acidic rock substrate with little to no soil development.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Empetrum nigrum, Myrica pensylvanica, Rubus hispidus, Vaccinium macrocarpon, Juniperus communis, Photinia melanocarpa*
Herbaceous	*Sibbaldiopsis tridentata, Carex nigra, Prenanthes trifoliata*
Non-vascular	*Cladina sylvatica*

Globally

Stratum	Species
Short Shrub	*Myrica pensylvanica*
Dwarf Shrub	*Empetrum nigrum*
Herbaceous	*Campanula rotundifolia, Juncus greenei, Trisetum spicatum, Danthonia compressa, Deschampsia flexuosa, Plantago maritima, Ligusticum scothicum, Sibbaldiopsis tridentata, Carex nigra*

CHARACTERISTIC SPECIES

Acadia National Park

Empetrum nigrum, Sibbaldiopsis tridentata

Globally

VEGETATION DESCRIPTION

Acadia National Park

Mat-forming vegetation on exposed headlands. Most of the cover is shrubs 30 cm or less in height (*Empetrum nigrum* and *Myrica pensylvanica* dominant), punctuated by islands of taller shrubs (some *Myrica*) or stunted trees (most commonly *Picea mariana*). The dwarf shrub layer often forms an almost continuous carpet: *Rubus hispidus, Vaccinium macrocarpon, V. angustifolia, Juniperus communis,* and *Photinia melanocarpa* are common associates of the Empetrum - Myrica dominants. Herbs are patchy among the shrub mats. *Sibbaldiopsis tridentata, Carex nigra,* and *Prenanthes trifoliolata* are typical; *Oclomena nemoralis, Triadenum fraseri, Iris versicolor,* and certain woodland species such as *Trientalis borealis* and *Maianthemum canadense* are found in some locations. The bryoid layer is minor, but typically features Cladina lichens.

Globally

The dominant shrub is *Empetrum nigrum* which forms a thick mat. *Myrica pensylvanica* is codominant or a frequent associate, with other shrubs including *Vaccinium macrocarpon, Vaccinium vitis-idaea, Arctostaphylos uva-ursi, Rubus hispidus, Juniperus communis,* and *Aronia melanocarpa*. Herbaceous species may include *Campanula rotundifolia, Juncus greenei, Agrostis*

hyemalis, Trisetum spicatum, Danthonia compressa, Deschampsia flexuosa, Plantago maritima, Ligusticum scothicum, Solidago simplex var. *randii, Sibbaldiopsis tridentata, Carex nigra*, and *Prenanthes trifoliolata*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006510

COMMENTS

Acadia National Park

Herb composition varies but the shrub dominants are fairly constant. Islands of full-grown trees may occur within expanses of this type.

Northern Maritime Rocky Headland *(Solidago sempervirens - (Rhodiola rosea) - Juniperus horizontalis* Sparse Vegetation), also on exposed headlands, shares many species with this type but is sparse vegetation, not dwarf-shrub mats as this is. Other vegetation types featuring *Empetrum nigrum* are either peatland vegetation types, or alpine.

Globally

Kalmia angustifolia - Chamaedaphne calyculata - (Picea mariana) / Cladina spp. Dwarf-shrubland

COMMON NAME	Sheep Laurel - Leatherleaf - (Black Spruce) / Reindeer Lichen species Dwarf-shrubland
SYNONYM	Northern Dwarf-shrub Bog
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A)
PHYSIOGNOMIC GROUP	Needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (IV.A.1.N)
FORMATION	Saturated needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.g)
ALLIANCE	CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 1

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Massachusetts, Maine, New Hampshire, New York, Vermont, and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Dwarf shrub bogs occur in low elevation basins that have formed over glacial till. The vegetation often creates a hummock and hollow microtopography within the bog. The substrate is peat; the one pH reading available is 5.0. They are widely distributed where the topographic conditions are right.

Globally

This ombrotrophic dwarf-shrub bog of northern New England and Canada occurs on the well-drained portions of raised bogs.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Short Shrub	*Vaccinium corymbosum, Picea mariana*
Dwarf Shrub	*Kalmia angustifolia, Rhododendron canadense, Chamaedaphne calyculata, Vaccinium corymbosum, Gaylussacia baccata, Rhododendron groenlandicum, Vaccinium oxycoccos*
Herbaceous	*Picea mariana, Carex trisperma, Eriophorum angustifolium, Eriophorum vaginautm, Cornus canadensis, Maianthemum trifolium*
Non-vascular	*Sphagnum* spp.

Globally

Stratum	Species
Dwarf Shrub	*Kalmia angustifolia, Chamaedaphne calyculata, Picea mariana*
Herbaceous	*Eriophorum vaginatum* var. *spissum, Eriophorum alpinum, Carex trisperma, Sarracenia purpurea, Cornus canadensis, Trientalis borealis, Calopogon tuberosus, Solidago uliginosa, Drosera rotundifolia*
Non-vascular	*Sphagnum fuscum*

CHARACTERISTIC SPECIES

Acadia National Park

Dominance of *Kalmia angustifolia* or *Rhododendron canadense*; *Eriophorum vaginatum*; *Cornus canadensis* not common in any other wetland type

Globally

VEGETATION DESCRIPTION

Acadia National Park

(based on 2 samples plus observations) This is the dominant vegetation of raised bogs, and of portions of peatlands that include areas transitional to raised bogs. Heath shrubs are the main constituent, and include *Kalmia angustifolia, Rhododendron canadense, Chamaedaphne calyculata, Vaccinium oxycoccos,* and *Rhododendron groenlandicum* (the latter three typically less abundant than the first two). *Picea mariana* and *Larix laricina* commonly occur as islands of stunted trees above or among the shrubs, and can also be common in the lower layers. Herbs are patchy. Cottongrasses (*Eriophorum vaginatum* var. *spissum* and *E. angustifolium*) and *Carex trisperma* are the most typical; other common species include *Drosera rotundifolia, Sarracenia*

purpurea, Solidago uliginosa, and *Maianthemum trifolium*. The vascular vegetation is underlain by thick *Sphagnum* that typically develops a hummock and hollow topography. *Sphagnum fuscum* and *S. capillifolium* dominate the more oligotrophic hummocks with *Cladonia* and *Cladina* lichens, while *Sphagnum magellanicum* and *S. girgensohnii* typify the somewhat more minerotrophic hollows.

Globally
This association is the most common northern bog type, dominated by *Kalmia angustifolia* and *Chamaedaphne calyculata* with scattered, stunted *Picea mariana*. Other scattered trees may include *Larix laricina* and *Pinus strobus*. Associated dwarf shrubs include *Ledum groenlandicum, Rhododendron canadense, Kalmia polifolia, Rubus chamaemorus, Vaccinium angustifolium* and *Vaccinium oxycoccos*. Herbaceous species include *Eriophorum vaginatum* var. *spissum, Eriophorum alpinum, Carex trisperma, Sarracenia purpurea, Cornus canadensis, Trientalis borealis, Calopogon tuberosus, Solidago uliginosa*, and *Drosera rotundifolia*. The bryophyte layer is well-developed, usually dominated by *Sphagnum fuscum*, with other associated species including *Sphagnum capillifolium, Sphagnum magellanicum*. Lichens are common associates as well, including *Cladonia crispata, Cladonia cristatella, Cladonia verticillata, Cladonia uncialis* and others. Fires occur occasionally in the central portions of raised bogs and can cause lichen cover to increase.

OTHER NOTEWORTHY SPECIES *Rubus chamaemorus* and *Arethusa bulbosa* occur here.

CONSERVATION RANK G5.

DATABASE CODE CEGL006225

COMMENTS
Acadia National Park
There is a range of variation in the relative dominance of the various heaths.

Maritime Crowberry Bog (*Empetrum nigrum - Gaylussacia dumosa - Rubus chamaemorus / Sphagnum* spp. Dwarf-shrubland) is most similar, and occurs under similar environmental conditions, but is much more geographically restricted than this type. Dwarf Shrub Bogs can also grade into Leatherleaf Acidic Fens *(Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland): while the types are distinguished by the relative amounts of *Kalmia angustifolia* or *Rhododendron canadense* vs. *Chamaedaphne calyculata*, in the field there is a continuous gradient.

Globally

Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum Dwarf-shrubland

COMMON NAME	Leatherleaf / Tussock Cottongrass / Red Peatmoss Dwarf-shrubland
SYNONYM	Leatherleaf Acidic Fen
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A)
PHYSIOGNOMIC GROUP	Needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (IV.A.1.N)
FORMATION	Saturated needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.g)
ALLIANCE	CHAMAEDAPHNE CALYCULATA SATURATED DWARF-SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These occur in low elevation basins (under 100 m), often over marine deposits. The substrate is peat, varying in depth from about 25 cm to more than a meter. The substrate is constantly saturated, and often not very firm. pH ranges from 4.8 to 5.4. Usually thse are found in association with one or more other peatland vegetation types.

Globally

This poor acidic fen community of northern New England and adjacent maritime provinces is characterized by a peat mat that is moderately consolidated and in contact with weakly minerotophic water.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Short Shrub	*Picea mariana*
Dwarf Shrub	*Chamaedaphne calyculata, Gaylussacia baccata, Gay dum, Myrica gale, Kalmia angustifolia, Rhododendron groenlandicum, Vaccinium oxycoccos, Vaccinium macrocarpon, Ilex verticillata, Ilex glabra*
Herbaceous	*Symplocarpus foetidus, Eriophorum angustifolium, Carex magellanica, Drosera intermedia, Eriohporum virginicum, Rhynchospora alba, Maianthemum trifolium, Picea mariana, Pogonia ophioglossoides, Carex trisperma, Drosera rotundiolia, Sarracenia purpurea, Woodwardia virginica, Eriophorum tenellum, Glyceria obtusa, Calamagrostis canadensis*
Non-vascular	*Sphagnum magellanicum, Sphagnum palustre, Sphagnum papillosum, Sphagnum girgensohnii, Sphagnum pylaesii, Sphagnum flavicomans, Sphagnum fuscum, Sphagnum majus*

Globally

Stratum	Species
Dwarf Shrub	*Chamaedaphne calyculata, Kalmia angustifolia, Myrica gale, Kalmia polifolia, Gaylussacia baccata*
Herbaceous	*Eriophorum virginicum, Eriophorum angustifolium, Eriophorum tenellum, Eriophorum vaginatum* var. *spissum, Carex lasiocarpa, Carex trisperma, Rhynchospora alba, Pogonia ophioglossoides, Maianthemum trifolium*
Non-vascular	

CHARACTERISTIC SPECIES

Acadia National Park

Dwarf shrub cover almost equalling to exceeding herb cover, in a fen setting (i.e. *Kalmia angustifolia* if present is not dominant); OR (for odd sites) fen shrubs present but not dominant and *Carex exilis* absent

Globally

VEGETATION DESCRIPTION

Acadia National Park

Shrub and mixed herb fen vegetation dominated by one or more (usually heath) shrubs, mostly but not always under 1 m in height: *Chamaedaphne calyculata, Gaylussacia baccata, G. dumosa,* or *Myrica gale* (in one Isle au Haut fen *Ilex glabra* dominates). The shrub composition is variable among sites. Other frequent, but low cover, shrubs include *Kalmia angustifolia, Rhododendron groenlandicum, Vaccinium oxycoccos, Vaccinium macrocarpon,* and *Ilex verticillata*. Herb layer coverage is generally less than that of the shrub layer; herb dominants include *Oclomena nemoralis, Symplocarpus foetidus,* and *Eriophorum angustifolium*. The number of herb species (9 - 24 per plot) almost always exceeds that of trees, shrubs, or bryoids. Frequent but not dominant herbs include *Carex magellanica, Drosera intermedia, D. rotundifolia, Eriophorum virginicum, Rhynchospora alba, Maianthemum trifolium, Pogonia ophioglossoides, Carex trisperma,* and *Sarracenia purpurea*. *Woodwardia virginica, Eriophorum tenellum, Glyceria obtusa,* and *Calamagrostis canadensis* are infrequent but may have relatively high cover where they occur. The essentially continuous bryophyte layer (lichens are nearly absent) is dominated by relatively nutriphilic *Sphagnum* species (*S. magellanicum, S. palustre, S. papillosum*); occasionally, *S. pylaesii, S. flavicomans, S. fuscum,* or *S. majus* may be co-dominant. This type is highly variable, both in the shrub:herb proportions and in the shrub and herb constituents. While *Chamaedaphne calyculata* typically dominates (in concept), *Myrica gale, Gaylussacia baccata* or (at one site) *Ilex glabra* can substitute for *Chamaedaphne calyculata* at some sites. *Oclomena nemoralis* is a constant in the herb layer (where it can range from dominant to less than 1% cover) except at the one site dominated by *Woodwardia virginica*.

The basal area ranged from 1 m^2/ha. Canopy heights were 3 m.

Globally

The vegetation is situated on the lower slopes of raised bogs, or along drainage tracks from ombrotrophic bogs, and is often flooded by spring meltwater. The dwarf-shrub layer is characterized by *Chamaedaphne calyculata* with other shrub associates including *Kalmia angustifolia, Myrica gale, Kalmia polifolia, Gaylussacia baccata, Gaylussacia dumosa, Rhododendron canadense, Vaccinium oxycoccos,* and *Ledum groenlandicum*. Herbaceous associates include *Eriophorum virginicum, Eriophorum angustifolium, Eriophorum tenellum, Eriophorum vaginatum* var. *spissum, Carex lasiocarpa, Carex trisperma, Rhynchospora alba, Pogonia ophioglossoides,* and *Maianthemum trifolium*. Other less frequent species that indicate nutrient input include *Symplocarpus foetidus, Calamagrostis canadensis,* and *Glyceria obtusa*. The bryophyte layer is characterized by *Sphagnum flavicomans, Sphagnum magellanicum, Sphagnum palustre, Sphagnum papillosum* and others.

OTHER NOTEWORTHY SPECIES *Ilex glabra* at one site

CONSERVATION RANK G?.

DATABASE CODE CEGL006513

COMMENTS

Acadia National Park

Often difficult to separate from Few-seeded Sedge - Leatherleaf Fen *(Carex (oligosperma, exilis) - Chamaedaphne calyculata* Shrub Herbaceous Vegetation) on the ground. Although the concept works statewide, in Acadia this is a difficult type to define and to classify samples into because of the weird fens on Isle au Haut.

Leatherleaf Acidic Fens (*Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland), in concept, are more shrub-dominated and lack *Carex exilis* and *Carex oligosperma*. In Few-seeded Sedge - Leatherleaf Fens, the cover of herbaceous species is more than twice that of dwarf shrub species, and many have a strong component of *Carex exilis*. These fens can also grade to Sweetgale Shrub Fens (*Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland), where *Myrica* is the dominant shrub. Sweetgale Shrub Fens are usually very strongly *Myrica*-dominated, have less *Sphagnum* cover, and often have standing water for much of the season. *Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrublands, where *Kalmia angustifolia* is well represented, can be thought of as transitional to dwarf shrub bogs, to which this type is also related.

Globally

Empetrum nigrum - Gaylussacia dumosa - Rubus chamaemorus / Sphagnum spp. Dwarf-shrubland

COMMON NAME	Black Crowberry - Dwarf Huckleberry - Cloudberry / Peatmoss species Dwarf-shrubland
SYNONYM	Maritime Crowberry Bog
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A)
PHYSIOGNOMIC GROUP	Needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (IV.A.1.N)
FORMATION	Saturated needle-leaved or microphyllous evergreen dwarf-shrubland (IV.A.1.N.g)
ALLIANCE	EMPETRUM NIGRUM SATURATED DWARF-SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This is a relatively uncommon association in the Park, restricted to coastal environments.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

This type, like the closely related dwarf shrub bog, is found in oligotrophic bog environments.

Globally

This bog community of the coastal region of northern New England and adjacent maritime provinces of Canada occurs in plateau bogs and has an ombrotrophic nutrient regime. Peat accumulation isolates this community from groundwater influence.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Gaylussacia dumosa, Empetrum nigrum, Juniperus communis, Kalmia angustifolia, Vaccinium oxycoccos, Chamaedaphne calyculata, Rhododendron groenlandicum, Kalmia polifolia*
Herbaceous	*Picea mariana, Symplocarpus foetidus, Sarracenia purpurea, Drosera rotundiolia, Trichophorum cespitosum, Eriophorum vaginatum, Carex trisperma*
Non-vascular	*Sphagnum fuscum, Sphagnum capilifolium, Sphagnum magellanicum*

Globally

Stratum	Species
Dwarf Shrub	*Chamaedaphne calyculata, Rhododendron canadense, Vaccinium angustifolium, Kalmia angustifolia, Kalmia polifolia, Ledum groenlandicum, Empetrum nigrum, Gaylussacia dumosa*
Herbaceous	*Eriophorum vaginatum* var. *spissum, Drosera rotundifolia, Sarracenia purpurea, Trientalis borealis, Calopogon tuberosus*
Non-vascular	*Sphagnum fuscum, Sphagnum rubellum, Sphagnum magellanicum*

CHARACTERISTIC SPECIES

Acadia National Park

Gaylussacia dumosa with *Empetrum nigrum* and *Juniperus communis*. *Tricophorum cespitosum*, if present, is less abundant than the shrubs.

Globally

VEGETATION DESCRIPTION

Acadia National Park

(description based on two samples). Peatland vegetation dominated by dwarf shrubs, with some combination of *Gaylussacia dumosa, Empetrum nigrum* and *Juniperus communis* dominant. Scattered, stunted *Picea mariana* may be present. The shrub layer tends to be lower than that of typical dwarf shrub bogs. Herbs are sparse and vary among sites. Common constituents of the herb layer include *Picea mariana, Symplocarpus foetidus, Sarracenia purpurea,* and *Drosera rotundifolia*. Some sites may have relatively high cover of *Eriphorum vaginatum* var. *spissum*, *Tricophorum cespitosum*, or *Carex trisperma*. The well developed *Sphagnum* layer usually is dominated by *Sphagnum fuscum* and *S. capillifolium* var. *tenellum*, some sites have relatively high cover of *Sphagnum magellanicum* or *Cladonia rangiferina*.

Globally
Dwarf-shrubs are dominant, including *Chamaedaphne calyculata, Rhododendron canadense, Vaccinium angustifolium, Kalmia angustifolia, Kalmia polifolia, Ledum groenlandicum,* and *Vaccinium oxycoccos.* Associated herbs include *Eriophorum vaginatum* var. *spissum, Drosera rotundifolia, Sarracenia purpurea, Trientalis borealis, Calopogon tuberosus,* and *Solidago uliginosa*. The bryophyte layer is well developed and is characterized by *Sphagnum fuscum, Sphagnum rubellum, Sphagnum magellanicum,* and lichens of the genus *Cladina*. The dwarf-shrubs *Empetrum nigrum, Gaylussacia dumosa,* and *Rubus chamaemorus*, the sedge *Scirpus cespitosus,* and the moss *Sphagnum imbricatum* characterize this association from others in the alliance.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G5.

DATABASE CODE CEGL006248

COMMENTS
Acadia National Park
A coastal variant of dwarf shrub bogs. The two are distinguished by the greater importance of *Gaylussacia dumosa* and *Empetrum nigrum* in this type. Maritime Crowberry Bogs are often adjacent to, and may grade into, the Maritime Peatland Sedge Lawn (*Trichophorum caespitosum - Gaylussacia dumosa / Sphagnum (fuscum, rubellum, magellanicum)* Herbaceous Vegetation) dominated by *Tricophroum cespitosum*. The two are distinguished by the relative amounts of graminoids vs. shrubs, but actually assigning a particular sample to one or the other can be difficult in intermediate cases.

Globally

Vaccinium angustifolium - Sorbus americana / Sibbaldiopsis tridentata Dwarf-shrubland

COMMON NAME	Northern Lowbush Blueberry - American Mountain-ash / Mountain-cinquefoil Dwarf-shrubland
SYNONYM	Blueberry Granite Barrens
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Deciduous dwarf-shrubland (IV.B)
PHYSIOGNOMIC GROUP	Cold-deciduous dwarf-shrubland (IV.B.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (IV.B.2.N)
FORMATION	Caespitose cold-deciduous dwarf-shrubland (IV.B.2.N.a)
ALLIANCE	VACCINIUM (ANGUSTIFOLIUM, MYRTILLOIDES, PALLIDUM) DWARF-SHRUBLAND ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs primarily on summits of Mount Desert Island and high rocky headlands of Isle au Haut.

Globally

This association is found in Connecticut, Massachusetts, Maine, New Hampshire, New York, Ontario, Pennsylvania, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Summits and high upper slopes, all but one sample above 200 m and most above 350 m. Slopes are gentle, 5-15%. All occur on granitic bedrock, with "soils" consisting of weathered sand or gravel a few cm deep. Peat forms in some pockets and provides a substrate for much of the vegetation. Elevation and exposure, rather than fire, is the determining factor for this vegetation, and it occurs in areas both inside and outside of the 1947 fire area.

Globally

This association of northern or high-elevation acidic rock outcrops or summits occurs on rocky ridges, outcrops and summits. Soils are shallow, well-drained, dry, acidic, coarse sands. Significant exposed bedrock is typical, with minimal soil development restricted to crevices or shelter areas. Elevations of known examples range from almost sea level on the Maine coast to about 2700 feet. Ground cover is mainly exposed bedrock.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Short Shrub	*Nemopanthus mucronata, Viburnum nudum, Ilex verticillata, Acer rubrum, Picea rubens*
Dwarf Shrub	*Vaccinium angustifolia, Kalmia angustifolia, Gaylussacia baccata, Photinia melanocarpa, Alnus viridis, Vaccinium vitis-idaea, Sorbus americana, Nemopanthus mucronata, Rhododendron canadense*
Herbaceous	*Sibbaldiopsis tridentata, Deschampsia flexuosa, Cornus canadensis, Solidago randii, Danthonia spicata, Maianthemum canadense, Hypericum gentianoides, Minuatia glabra, Trichophorum cespitosum*
Non-vascular	*Polytrichum piliferum, Grimmia* spp., *Cladina sylvatica, Sphagnum girgensohnii, Cladina* spp.

Globally

Stratum	Species
Dwarf Shrub	*Vaccinium angustifolium, Vaccinium myrtilloides, Comptonia peregrina, Gaylussacia baccata, Arctostaphylos uva-ursi, Kalmia angustifolia*
Herbaceous	*Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Carex lucorum, Oryzopsis pungens, Sibbaldiopsis tridentata, Maianthemum canadense, Gaultheria procumbens, Trientalis borealis, Pteridium aquilinum*
Non-vascular	*Polytrichum commune, Polytrichum juniperinum, Dicranum polysetum, Cladonia* lichens

CHARACTERISTIC SPECIES

Acadia National Park

Globally

VEGETATION DESCRIPTION

Acadia National Park

A summit vegetation complex consisting of patches of bare rock (*Rhizocarpon* or other crustose lichens), patches of dwarf heath shrub vegetation with widely scattered *Picea rubens* or *Abies balsamea* (rarely *Quercus rubra*) trees (mapped as BB), and patches of dense taller non-heath shrubs with scattered stunted conifers over a heath shrub understory (mapped as MSS). The blueberry (BB) subtype consists of patches of *Vaccinium angustifolium* or *Gaylussacia baccata*, with lesser amounts of *Kalmia angustifolia* and *Photinia melanocarpa*, and sometimes *Vaccinium vitis-idaea*. The primary herbs, which can form the dominant vegetation in patches among the shrubs, are *Sibbaldiopsis tridentata* and *Deschampsia flexuosa*. *Minuartia glabra* is locally common on bare rock patches at the edges of shrub areas. Frequent herbs include *Cornus canadensis, Solidago randii*, *Danthonia spicata, Maianthemum canadense,* and *Hypericum gentianoides. Trichophorum cespitosum* can dominate locally in shallow rock basins where moisture accumulates. On some summits, this patchy dwarf shrub - bare rock vegetation is punctuated by areas of mixed summit shrubland (MSS), where *Nemopanthus mucronata*, *Viburnum nudum*, and/or *Ilex verticillata* form a 1 - 2 m tall shrub layer with scattered *Abies balsamea, Acer rubrum, Betula papyrifera*, or *B. populifolia*. The heath shrub and herb layers under these shrubs are similar in composition to that in the blueberry subtype. Composition of the bryoid layer is variable as in the blueberry subtype, except that the mixed summit shrubland subtype generally has *Sphagnum girgensohnii*, absent from the more exposed areas.

The basal area ranged from 1 - 10 m^2/ha. Canopy heights were none - 8 m

Globally

Physiognomy of this community is quite variable, ranging from woodland to shrubland to sparsely vegetated rock. A tree canopy is absent or poorly developed and may include *Picea rubens, Abies balsamea, Quercus rubra, Pinus strobus, Betula papyrifera, Betula papyrifera* var. *cordifolia*, or various other species. Scattered tall shrubs may include *Sorbus americana, Viburnum nudum* var. *cassinoides, Nemopanthus mucronatus, Aronia melanocarpa*, or *Amelanchier* spp. Dwarf heath shrubs are prominent, including *Vaccinium angustifolium, Vaccinium myrtilloides, Comptonia peregrina, Gaylussacia baccata, Arctostaphylos uva-ursi*, and *Kalmia angustifolia*. The sparse herb layer includes graminoids, such as *Deschampsia flexuosa, Danthonia spicata, Carex pensylvanica, Carex lucorum*, and *Oryzopsis pungens*, and the forbs *Sibbaldiopsis tridentata, Solidago simplex* var. *randii, Maianthemum canadense, Gaultheria procumbens, Trientalis borealis, Pteridium aquilinum.* Abundant mosses and lichens form a bryophyte layer characterized by *Polytrichum commune, Polytrichum juniperinum, Dicranum polysetum*, and *Cladonia* lichens.

OTHER NOTEWORTHY SPECIES *Vaccinium boreale* occurs locally at some sites.

CONSERVATION RANK G?

DATABASE CODE CEGL005094

COMMENTS

Acadia National Park

The expression of the this type varies from summit to summit (at least in mappable units). Distribution of vegetated vs unvegetated patches is variable within sites. Among sites, the dominant species are quite consistent although associates vary.

This type grades downslope into the birch scrub subtype of the aspen - birch woodland complex {*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland}. As tree cover increases, it can also grade into pitch pine woodlands or other conifer woodland types.

Globally

Ammophila breviligulata - Lathyrus japonicus Herbaceous Vegetation

COMMON NAME	American Beachgrass - Beach Pea Herbaceous Vegetation
SYNONYM	Northern Beachgrass Dune
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c)
ALLIANCE	AMMOPHILA BREVILIGULATA HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This has very limited extent in Acadia. It is only found in the Sand Beach area.

Globally

This association occurs in Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, and Rhode Island.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Sand dunes.

Globally

This dune grassland community of maritime beaches occurs on the North Atlantic coast from New Jersey north to central Maine. The substrate is wind-deposited sand of foredunes with no soil development.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Ammpohila breviligulata, Lathryus japonicus*

Globally

Stratum	Species
Herbaceous	*Ammpohila breviligulata*

CHARACTERISTIC SPECIES

Acadia National Park

Ammophila breviligulata

Globally

VEGETATION DESCRIPTION

Acadia National Park

Dunegrass vegetation dominated by *Ammpohila breviligulata* forming patchy cover in the 25-60% range. The one Acadia sample had only one additional species, *Lathryus japonicus*.

Globally

Vegetation cover is often sparse and bare sand is usually evident. The dominant species is *Ammophila breviligulata*. Characteristic associates include *Lathyrus japonicus, Solidago sempervirens, Chamaecyse polygonifolia* and *Cakile edentula*. Other associates may include *Carex silicea, Artemisia stellariana, Lechea maritima, Polygonella articulata, Xanthium strumarium, Sueda maritima, Cyperus filiculmis,* and *Cyperus grayii*. Other grasses that may be present include *Panicum amarum* in the southern portion of the range, and *Leymus mollis* at the northern end of the range.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4?.

DATABASE CODE CEGL006274

COMMENTS

Acadia National Park

This vegetation type is at its northeastern range limit, or perhaps better thought of as disjunct, in Acadia, and so not surprisingly is quite depauperate here. The associated species so typically found with *Ammophila breviligulata* further southwest (*Artemisia*

spp., *Hudsonia* spp, etc.) do not occur here.

Very susceptible to foot traffic

Globally

(Pinus strobus, Quercus rubra) / Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation

COMMON NAME	(Eastern White Pine, Northern Red Oak) / Poverty Oatgrass Acid Bedrock Wooded Herbaceous Vegetation
SYNONYM	White Pine - Oak Acid Bedrock Glade
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Short sod temperate or subpolar grassland (V.A.5.N.e)
ALLIANCE	DANTHONIA SPICATA HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs primarily in the 1947 fire area of Mount Desert Island.

Globally

This association occurs in Massachusetts, Maine, Michigan, New Hampshire, New York, Wisconsin, and possibly Ontario.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Low to mid-elevation woodlands (up to about 250 m), with aspects spanning the compass. Most are on moderate, middle to upper slopes (slope 12 - 30%), occasionally on mid-elevation crests (around 100 m), a few on lower slopes (4-8%). The substrate is generally exposed bedrock, occasionally till. Soils, which are typically thin, are moderately well drained to excessively drained, with a pH of 5.0 - 5.2. All sites sampled had evidence of recent fire (most in the 1947 fire area).

Globally

In the Great Lakes area, these glades occupy upper portions above the granitic bedrock shorelines; elsewhere in the Great Lakes and New England they are found on rocky openings.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Tree Canopy	*Quercus rubra, Pinus strobus, Pinus resinosa, Populus grandidentata, Acer rubrum, Picea rubens*
Tree Subcanopy	*Picea rubens, Acer rubrum, Pinus strobus, Quercus rubra, Betula populifolia*
Dwarf Shrub	*Vaccinium angustifolia, Gaylussacia baccata, Kalmia angustifolia, Comptonia peregrina, Vaccinium myrtilloides, Amelanchier* spp.
Herbaceous	*Pteridium aquilinum, Festuca ovina, Quercus rubra, Gaultheria procumbens, Danthonia spicata, Picea rubens, Trientalis borealis, Maianthemum canadense*
Non-vascular	*Polytrichum commune, Polytrichum juniperinum, Cladina sylvatica, Leucobryum glaucum, Dicranum polysetum, Pleurozium schreberi*

Globally

Stratum	Species
Tree Canopy	*Pinus strobus, Quercus rubra*
Short Shrub	*Diervilla lonicera, Juniperus communis*
Dwarf Shrub	*Arctostaphylos uva-ursi*
Herbaceous	*Campanula rotundifolia, Danthonia spicata, Deschampsia cespitosa, Epilobium angustifolium, Poa compressa, Sibbaldiopsis tridentata*

CHARACTERISTIC SPECIES

Acadia National Park

Picea rubens (as a minor component) generally differentiates this type from ROW1. The lower canopy cover and more extensive dwarf shrub layer differentiate from Oak - Pine Forests.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Partial to very open (60% - 20%) canopy woodlands dominated by a mixture of *Quercus rubra* and *Pinus strobus* (occasionally, *Pinus resinosa* may be the pine species). The most common associated trees are *Acer rubrum* and *Picea rubens* as minor components; less consistent associates include *Populus grandidentata* and *Abies balsamea*. The lower tree stratum is variable. The shrub layer is mostly tree regeneration, varying in species from site to site. The dwarf shrub layer is consistently important (generally 20 - 50% cover), dominated by *Vaccinium angustifolium*, *Gaylussacia baccata*, and *Kalmia angustifolia*; occasional species include *Vaccinium myrtilloides*, *Amelanchier* spp., and/or *Comptonia peregrina*. In the herb layer, the dominant and constant species is *Pteridium aquilinum*. Frequent, but lower cover, herbs include *Quercus rubra* seedlings, *Festuca ovina, Danthonia spicata, Oryzopsis asperifolia, Apocynum androsaemifolium*, and the ubiquitous *Gaultheria procumbens, Trientalis borealis*, and *Maianthemum canadense*. Bryoids are patchy and typically include *Polytrichum commune, Polytrichum juniperinum* and/or *P. piliferum*, and *Cladina* lichens.

The basal area ranged from 10 - 17 m^2/ha. Canopy heights were 6 - 14 m (avg. 11 m).

Globally

Shrubs and scattered trees dominate the woody canopy layers. Trees include *Betula papyrifera, Pinus banksiana, Pinus resinosa, Pinus strobus*, and *Quercus rubra*. The shrub layer contains *Diervilla lonicera, Juniperus communis*, and, less frequently, *Physocarpus opulifolius*. The dwarf-shrub *Arctostaphylos uva-ursi* is also present. The herbaceous layer contains *Agrostis hyemalis, Campanula rotundifolia, Danthonia spicata, Deschampsia cespitosa, Epilobium angustifolium, Poa compressa, Sibbaldiopsis tridentata (= Potentilla tridentata)*, and *Vaccinium angustifolium*. Moss and lichen cover may be substantial. In New England a similar composition is found, but *Deschampsia flexuosa* replaces *Deschampsia cespitosa*, and the common shrubs are *Arctostaphylos uva-ursi, Comptonia peregrina, Gaultheria procumbens, Gaylussacia baccata, Juniperus communis, Kalmia angustifolia*, and *Vaccinium angustifolium*. *Picea rubens* is occasionally present. Common herbaceous species include *Maianthemum canadense, Melampyrum lineare, Oryzopsis asperifolia, Pteridium aquilinum*, and *Trientalis borealis*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G3G4.

DATABASE CODE CEGL005101

COMMENTS

Acadia National Park

Strata dominants are consistent but associated species can be very different from site to site.

Some (about half) of the Red Oak Woodlands (*Quercus rubra - (Quercus prinus) / Vaccinium spp. / Deschampsia flexuosa* Woodland) are compositionally very similar to this type but lack the oak-pine mixture in the canopy. Oak - Pine Woodlands also grade to Oak Pine Forests (*Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest), and transitional sites can be difficult to classify. Sites with a sizeable proportion of *Betula papyrifera* or *Populus tremuloides* can be transitional to the Early Successional Woodland/Forest (*Populus (tremuloides, grandidentata) - Betula (populifolia, papyrifera)* Woodland).

Globally

Trichophorum caespitosum - Gaylussacia dumosa / Sphagnum (fuscum, rubellum, magellanicum) Herbaceous Vegetation

COMMON NAME	Deerhair Bulrush - Dwarf Huckleberry / (Brown Peatmoss, Red Peatmoss, Magellan's Peatmoss) Herbaceous Vegetation
SYNONYM	Maritime Peatland Sedge Lawn
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Short alpine or subalpine dry bunch grassland (V.A.5.N.h)
ALLIANCE	TRICHOPHORUM CAESPITOSUM HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association's only know location is at Big Heath.

Globally

This association occurs in Maine, New Hampshire, New York, Vermont, and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Coastal plateau bogs reach their southwestern range limit here, and so this community is restricted to one location within the Park, Big Heath. This peatland does not show the best development of the coastal plateau bog morphology, but does include several of the elements characteristic of those bogs, such as this vegetation type. Big Heath is immediately adjacent to the coast, and experiences the cool temperatures and frequent fogs that are dominant where coastal plateau peatlands develop.

Globally

This ombrotrophic coastal bog community occurs on the raised, drier portions of the peatland.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Gaylussacia dumosa*
Herbaceous	*Carex exilis, Trichophorum cespitosum*
Non-vascular	*Sphagnum cuspidatum, Sphagnum capiliffolium, Sphagnum fuscum*

Globally

Stratum	Species
Dwarf Shrub	*Gaylussacia dumosa*, *Chamaedaphne calyculata*
Herbaceous	*Scirpus cespitosus*
Non-vascular	*Sphagnum rubellum, Sphagnum fuscum, Sphagnum magellanicum, Sphagnum flavicomans, Cladonia rangiferina, Cladonia mitis, Cladonia arbuscula, Cladonia terra-novae, Cladonia uncialis, Cladonia crispata*

CHARACTERISTIC SPECIES

Acadia National Park

Sedge lawn is the structural dominant, with *Trichophorum cespitosum* a major species. *Gaylussacia dumosa* and *Empetrum nigrum* occur, but are reduced in importance.

Globally

VEGETATION DESCRIPTION

Acadia National Park

(based on one sample and the extent of the type in the Park) A graminoid-dominated peatland community typical of coastal plateau bogs. *Trichophorum cespitosum* and *Carex exilis* are the characteristic and dominant herbs. They occur mixed in with dwarf shrubs (which are less extensive than the graminoids), primarily *Gaylussacia dumosa*, but with smaller amounts of *Empetrum nigrum, Chamaedaphne calyculata, Myrica gale, Andromeda polifolia, Kalmia polifolia, Vaccinium oxycoccos*, etc. Other graminoids include *Eriophorum angustifolium, E. virginicum, E. vaginatum* var. *spissum* and *Eleocharis acicularis*. Forbs are sparse, and include several typical bog species such as *Drosera rotundifolia, Sarracenia purpurea, Solidago uliginosa*, and *Oclomena nemoralis*, as well as the more uncommon *Arethusa bulbosa*. The bryoid layer is dominated by *Sphagnum* (*S.*

cuspidatum, S. capiliffolium, and *S. fuscum*, and a small amount of *S. papillosum*), but also includes the liverwort *Cladopodiella fluitans* and the lichen *Cladina sylvatica*. The distribution of dwarf shrubs vs. herbs can be patchy. Secondary pools with *Nymphaea odorata* and *Nuphar lutea* have developed at Big Heath.

Globally
The sedge-dominated peatland "lawns" are characterized by abundant *Scirpus cespitosus*. Scattered low shrubs are admixed, and include *Gaylussacia dumosa* and *Chamaedaphne calyculata*, as well as occasional *Kalmia angustifolia, Kalmia polifolia, Vaccinium oxycoccos, Andromeda glaucophylla, Ledum groenlandicum, Rubus chamaemorus*, and *Empetrum nigrum*. Other associates include *Eriophorum vaginatum* var. *spissum, Arethusa bulbosa, Calopogon tuberosus, Drosera rotundifolia*, and *Solidago uliginosa*. The bryophyte layer is very well developed and is dominated by *Sphagnum rubellum (= Sphagnum capillifolium* var. *tenellum), Sphagnum fuscum,* as well as *Sphagnum magellanicum* and *Sphagnum flavicomans*. Lichens also characterize this association, and include *Cladonia rangiferina, Cladonia mitis, Cladonia arbuscula, Cladonia terra-novae, Cladonia uncialis* and *Cladonia crispata*.

OTHER NOTEWORTHY SPECIES *Arethusa bulbosa*

CONSERVATION RANK G?.

DATABASE CODE CEGL006260

COMMENTS
Acadia National Park
Only one occurrence within the Park; that includes areas of moss lawn and "mud bottoms" (*Cladopodiella fluitans* dominant) that are not extensive enough here to consider as separate types.

This plateau bog "lawn" vegetation is closely related to the huckleberry shrub bog type. The two share the same dominant species, but in this type graminoids are dominant and in the huckleberry type the dwarf shrubs are dominant. They do sometimes occur adjacent, with a continuous gradation from one to the other.

Globally

Carex stricta - Carex vesicaria Seasonally Flooded Herbaceous Vegetation

COMMON NAME	Tussock Sedge - Inflated Sedge Seasonally Flooded Herbaceous Vegetation
SYNONYM	Eastern Tussock Sedge Meadow
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k)
ALLIANCE	CAREX STRICTA SEASONALLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Connecticut, Delaware, Massachusetts, Maryland, Maine, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont, and West Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These marshes form in shallow basins. The substrate is thin peat over seasonally flooded marine or glacier deposits. Some sites may have standing water all year. The pH (in the one sample collected) was 5.6.

Globally

This tussock sedge meadow occurs in seasonally flooded basins or on stream or lake margins. The substrate is peat or muck of variable depth overlying mineral soil. Microtopography is characterized by tussocks, particularly when the hydroperiod is extended.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Myrica gale, Chamaedaphne calyculata, Ilex verticillata, Spiraea alba*
Herbaceous	*Carex stricta, Osmunda regalis, Calamagrostis canadensis, Triadenum fraseri*
Non-vascular	*Sphagnum papillosum, Sphagnum magellanicum*

Globally

Stratum	Species
Herbaceous	*Carex stricta, Carex comosa, Carex scoparia, Carex stipata, Carex vulpinoidea, Glyceria canadensis, Calamagrostis canadensis, Asclepias incarnata, Thelypteris palustris*
Non-vascular	*Sphagnum magellanicum, Sphagnum girgensohnii, Sphagnum palustre*

CHARACTERISTIC SPECIES

Acadia National Park

Carex stricta

Globally

VEGETATION DESCRIPTION

Acadia National Park

Tussocks of *Carex stricta* are the dominant feature of this vegetation type. They may be interspersed with shrubs, usually *Myrica gale, Chamaedaphne calyculata, Ilex verticillata, or Spiraea alba*; however, shrub cover is less than herbaceous cover. *Osmunda regalis, Oclomena nemoralis, Calamagrostis canadensis,* and *Triadenum fraseri* are common associates. The bryoid layer is often patchy, and may feature one or several *Sphagnum* species (including *S. papillosum, S. magellanicum, S. girgensohnii*, or *S. palustre*); lichens are absent.

Canopy heights were 3 m.

Globally

Species composition is variable but usually includes *Carex stricta, Carex comosa, Carex scoparia, Carex stipata, Carex vulpinoidea, Glyceria canadensis, Calamagrostis canadensis, Asclepias incarnata, Thelypteris palustris*, with other associates including *Eupatorium maculatum, Campanula aparinoides, Osmunda regalis, Angelica atropurpurea, Eupatorium perfoliatum,*

Lycopus americanus,Galium obtusum and others. A shrub layer is absent, but scattered shrubs may be present and vary with geography. In the northern part of the range, *Myrica gale, Ilex verticillata* and *Spiraea alba* are often present. A bryophyte layer comprised of species of *Sphagnum* may be present, including *Sphagnum magellanicum, Sphagnum girgensohnii, Sphagnum palustre,* and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006412

COMMENTS

Acadia National Park

This can grade into the Sweetgale Mixed Shrub Fen (*Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland), which are by definition shrubbier but share many of the species. In the Sweetgale Mixed Shrub Fen (*Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland), *Carex stricta* may be present but often does not occur as well-developed tussocks.

Globally

Calamagrostis canadensis - Scirpus spp. *- Dulichium arundinaceum* Herbaceous Vegetation

COMMON NAME	Bluejoint - Bulrush species - Threeway Sedge Herbaceous Vegetation
SYNONYM	Seasonally Flooded Mixed Graminoid Meadow
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k)
ALLIANCE	CALAMAGROSTIS CANADENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

In shallow basins at low elevations, often over alluvial or lacustrine deposits. Substrate is muck (generally 30 - 50 cm deep), which may be saturated throughout the growing season and always with standing water for part of the season. Sites sampled ranged in pH from 5.0 to 5.6.

Globally

This seasonally flooded wetland meadow occurs on flats, floodplains of small streams, beaver meadows, and lakeshores. Substrate is muck or well-decomposed peat overlying mineral soil.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Spiraea tomentosa, Spiraea alba, Gaylussacia baccata, Vaccinium corymbosum*
Herbaceous	*Calamagrostis canadensis, Scirpus cyperinus, Onoclea sensibilis, Lysimachia terrestris, Triadenum fraseri, Aster umbellatum, Acer rubrum, Dulichium arundinaceum, Carex lacustris, Carex stricta, Glyceria canadensis*
Non-vascular	*Sphagnum palustre, Sphagnum magellanicum, Sphagnum capillifolium*

Globally

Stratum	Species
Herbaceous	*Calamagrostis canadensis, Scirpus cyperinus, Dulichium arundinaceum*

CHARACTERISTIC SPECIES

Acadia National Park

Dominance of *Calamagrostis canadensis* and/or *Scirpus cyperinus*

Globally

VEGETATION DESCRIPTION

Acadia National Park

A variable type, with *Calamagrostis canadensis* and/or *Scirpus cyperinus* dominant. Shrubs may be scattered in with, or above, the herbaceous vegetation. Shrub species vary strongly from site to site: *Ilex verticillata, Spiraea alba, S. tomentosa, Alnus incana, Gaylussacia baccata*, and *Vaccinium corymbosum*. At some sites, *Dulichium arundinaceum, Carex lacustris, C. stricta*, or *Glyceria canadensis* may be co-dominant with the *Calamagrostis canadensis* and/or *Scirpus cyperinus.* Frequent but less abundant herbs include *Onoclea sensibilis, Lysimachia terrestris, Triadenum fraseri, Doellingeria umbellata,* and small *Acer rubrum*. Calhoun et al. (1994) note additional common species including *Carex utriculata, Juncus canadensis, Iris versicolor, Triadenum virginicum*, and *Persicaria sagittata*. Bryophyte coverage is variable from sote to site, from none to almost continuous; *Sphagnum* spp. are the primary constituents (including *S. papillosum, S. magellanicum, S. palustre*, and *S. capillifolium*). Herb species richness far exceeds that of shrubs or bryoids.

Globally
Species composition is variable but often includes *Calamagrostis canadensis, Scirpus cyperinus, Dulichium arundinaceum* as well as *Carex stricta, Carex utriculata, Carex lacustris, Phalaris arundinacea, Glyceria grandis, Glyceria canadensis, Onoclea sensibilis, Lysimachia terrestris, Juncus canadensis, Iris versicolor,Triadenum fraseri, Agrostis gigantea, Agrostis alba, Poa palustris,* and others. A shrub layer is not present, but scattered shrubs may include *Viburnum dentatum, Ilex verticillata, Gaylussacia baccata, Alnus incana,* or *Spiraea alba.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006519

COMMENTS
Acadia National Park
Species diversity is moderately high. Although *Calamagrostis canadensis* and/or *Scirpus cyperinus* are reliable as dominants, the associated species vary widely.

The other "graminoid meadow" types are distinctive. Eastern Tussock Sedge Meadow (*Carex stricta - Carex vesicaria* Seasonally Flooded Herbaceous Vegetation) is *Carex stricta* sedge meadow, and while *C. stricta* may be present in this type, it is less abundant than *Calamagrostis canadensis*. Bayonet Rush Herbaceous Vegetation (Juncus militaris Herbaceous Vegetation) are drawdown ponds where *Juncus militaris* is a dominant feature. Again, while that species may occur in this type, it will not nearly be a dominant feature.

Globally

Eriocaulon aquaticum - Lobelia dortmanna Herbaceous Vegetation

COMMON NAME	Seven-angle Pipewort - Dortmann's Cardinal-flower Herbaceous Vegetation
SYNONYM	
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l)
ALLIANCE	ELEOCHARIS SPP. - ERIOCAULON AQUATICUM SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association has been observed along the south side of Jordan Pond, but may occur elsewhere.

Globally

This association occurs in Massachusetts, New York, Rhode Island, Maine, and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Usually on sand or fine granitic gravel substrates, quiet oligotrophic waters, shallow (depths 0.2 - 1.1 m). The lakebottom substrate almost always has a predominant mineral soil component, rather than muck.

Globally

This low aquatic vegetation of the semipermanently flooded zone of oligotrophic is found in sandy-bottomed ponds and lakes. The substrate is sand or gravelly sand with or without an organic layer of peaty muck at the surface.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Eriocaulon aquaticum, Lorbelia dortmanna*

Globally

Stratum	Species
Herbaceous	*Eriocaulon aquaticum, Lobelia dortmanna*

CHARACTERISTIC SPECIES

Acadia National Park

Globally

VEGETATION DESCRIPTION

Acadia National Park

(not sampled) Submerged vegetation of shallow pondshores dominated by *Eriocaulon aquaticum* and/or *Lobelia dortmanna*.

Globally

The characteristic species are *Eriocaulon aquaticum, Lobelia dortmanna,* with other associates including *Eleocharis acicularis, Nymphoides cordata, Myriophyllum tenellum, Gratiola aurea,* and *Scirpus pungens.*

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006346

COMMENTS

Acadia National Park

Photography did not allow detailed mapping of aquatic vegetation types, and aquatic vegetation was not sampled.

Globally

Juncus militaris Herbaceous Vegetation

COMMON NAME	Bayonet Rush Herbaceous Vegetation
SYNONYM	
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l)
ALLIANCE	JUNCUS MILITARIS SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Massachusetts, New York, Rhode Island, Maine, and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

This type occupies small basins which are flooded early in the season but generally dry later on. The substrate is sedgy peat, and circumneutral (two samples at pH 5.4 and 7.0). The setting, and many of the species, resemble outwash plain pondshore vegetation, but these Acadia examples are not associated with outwash plain ponds.

Globally

This vegetation of oligotrophic lake and pondshores of New England and adjacent Canadian maritime provinces occurs on sandy or gravelly substrates with variable amounts of organic accumulation. Standing water is nearly always present, although the substrate may be exposed in years of extreme drought.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Juncus militaris, Proserpinaca pectinata, Potamogeton* spp., *Triadenum fraseri, Dulichium arundinaceum*
Non-vascular	*Sphagnum* spp.

Globally

Stratum	Species
Herbaceous	*Juncus militaris*

CHARACTERISTIC SPECIES

Acadia National Park

Juncus militaris in abundance

Globally

VEGETATION DESCRIPTION

Acadia National Park

A species-poor but distinctive graminoid vegetation dominated by *Juncus militaris*. This rush can form a continuous expanse, punctuated by only a few other species. *Proserpinaca pectinata* can be locally common, as can (to a lesser extent) *Potamogeton* spp., *Triadenum fraseri*, and *Dulichium arundinaceum*.

Globally

The dominant species is *Juncus militaris*. Associates are generally few and of low cover but may include *Eriocaulon aquaticum, Gratiola aurea, Juncus pelocarpus, Nymphoides cordata, Eleocharis robbinsii, Pontederia cordata, Sagittaria teres, Eleocharis acicularis, Lysimachia terrestris, Triadenum virginicum, Triadenum fraseri, Proserpinaca pectinata,* or *Dulichium arundinaceum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006345

COMMENTS

Acadia National Park

Other graminoid meadow types are dominated by *Carex stricta*, *Calamagrostis canadensis*, and/or *Scirpus cyperinus*.

Globally

Typha (angustifolia, latifolia) - (Schoenoplectus spp.*)* Eastern Herbaceous Vegetation

COMMON NAME	(Narrowleaf Cattail, Broadleaf Cattail) - (Bulrush species) Eastern Herbaceous Vegetation
SYNONYM	Eastern Cattail Marsh
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l)
ALLIANCE	TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Connecticut, Delaware, Massachusetts, Maryland, Maine, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Virginia, Vermont, and West Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Globally

These communities occur along lake margins and in shallow basins, and river backwaters. Lacustrine cattail marshes typically have a muck-bottom zone bordering the shoreline, where cattails are rooted in the bottom substrate, and a floating mat zone, where the roots grow suspended in a buoyant peaty mat.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Typha latifolia*

Globally

Stratum	Species
Herbaceous	*Typha latifolia, Typha angustifolia*

CHARACTERISTIC SPECIES

Acadia National Park

Typha latifolia, or, less commonly, *T. angustifolia*

Globally

VEGETATION DESCRIPTION

Acadia National Park

(Not sampled during vegetation sampling) Emergent marshes dominated by *Typha latifolia*.

Globally

Graminoid marshes dominated by *Typha angustifolia* and/or *Typha latifolia*, either alone or in combination with other tall emergent marsh species. Associated species vary widely; sedges such as *Carex aquatilis, Carex lurida, Carex rostrata, Carex lanuginosa*, and bulrushes such as *Scirpus americanus* and *Scirpus acutus* occur. Broad-leaved herbs include *Thelypteris palustris, Asclepias incarnata, Impatiens capensis, Sagittaria latifolia, Scutellaria lateriflora, Sparganium eurycarpum*, and *Verbena hastata*. Floating aquatics, such as *Lemna minor*, may predominate in deeper zones. *Typha angustifolia* can grow in deeper water compared to *Typha latifolia*, although both species reach maximum growth at a water depth of 50 cm. *Typha* spp. often occurs in pure stands and can colonize areas recently exposed by either natural or human causes.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5.

DATABASE CODE CEGL006153

COMMENTS

Acadia National Park

Aquatic vegetation was not sampled.

Globally

Schoenoplectus (tabernaemontani, acutus) Eastern Herbaceous Vegetation

COMMON NAME	(Softstem Bulrush, Hardstem Bulrush) Eastern Herbaceous Vegetation
SYNONYM	Bulrush Deepwater Marsh
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Semipermanently flooded temperate or subpolar grassland (V.A.5.N.l)
ALLIANCE	SCHOENOPLECTUS ACUTUS - (SCHOENOPLECTUS TABERNAEMONTANI) SEMIPERMANENTLY FLOODED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is likely to be in Acadia National Park but was not sampled. Only global information is available.

Globally

This variable deepwater marsh community occurs in the northeastern United States and adjacent Canadian provinces. It has been identified in Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Delaware, Maryland, New York, New Jersey, Pennsylvania, Rhode Island, Virginia, and West Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Globally

These deepwater bulrush marshes occur across the northeastern United States and adjacent Canadian provinces. They are found in a variety of wetland settings, most commonly in quiet-water areas along the shores of ponds, lakes, rivers, and larger streams, but also in flooded basins and ditches. The vegetation occurs in deep water (usually 0.4-1 m deep) that is present in all but the driest of conditions. Seasonal spring flooding and heavy rainstorms provide nutrient input. The substrate is usually deep muck overlying mineral soil; where wave action is more prevalent, the mineral soil may be exposed.

MOST ABUNDANT SPECIES

Stratum	Species

Acadia National Park

Globally

Herbaceous	*Schoenoplectus acutus, Schoenoplectus tabernaemontani, Schoenoplectus americanus*

CHARACTERISTIC SPECIES

Acadia National Park

Globally

VEGETATION DESCRIPTION

Acadia National Park

Globally

The vegetation is dominated by bulrushes and robust graminoids, with scattered emergent forbs. Trees and shrubs are absent. Dominant species are usually *Schoenoplectus acutus* (= Scirpus acutus), *Schoenoplectus tabernaemontani* (= Scirpus tabernaemontani), and/or *Schoenoplectus americanus* (= Scirpus americanus). Associated herbs include *Carex aquatilis, Carex pellita* (= Carex lanuginosa), *Carex utriculata, Thelypteris palustris, Typha latifolia, Asclepias incarnata, Impatiens capensis, Pontederia cordata, Sagittaria latifolia, Schoenoplectus fluviatilis* (= Scirpus fluviatilis), *Scutellaria lateriflora, Verbena hastata,* and others. Floating-leaved and submerged plants (such as *Potamogeton* spp., *Sparganium* spp., *Elodea canadensis, Ceratophyllum* spp.) may be scattered among the emergent plants.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?

DATABASE CODE CEGL006275

COMMENTS
Acadia National Park

Globally

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Carex (lasiocarpa, utriculata, canescens) Herbaceous Vegetation

COMMON NAME	(Wiregrass Sedge, Beaked Sedge, Silvery Sedge) Herbaceous Vegetation
SYNONYM	Slender Sedge Fen
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Saturated temperate or subpolar grassland (V.A.5.N.m)
ALLIANCE	CAREX LASIOCARPA SATURATED HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Connecticut, Massachusetts, New Hampshire, New York, Pennsylvania, Vermont, and Maine.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

This vegetation occurs in minerotrophic portions of peatlands, usually those with open water, and it often occurs adjacent to the open water.

Globally

This poor fen vegetation type occurs in acidic waters receiving weakly minerotrophic input from surface water inflow or seepage from surrounding uplands.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Myrica gale, Chamaedaphne calyculata, Vaccinium oxycoccos, Anromeda polifolia, Vaccinium macrocarpon*
Herbaceous	*Carex lasiocarpa, Carex utriculata, Calamagrostis canadensis, Carex exilis, Drosera rotundiolia, D. intermedia, Carex stricta, Pogonia ophioglossoides, Triadenum fraseri*
Non-vascular	*Sphagnum palustre, Sphagnum papillosum, Sphagnum magellanicum*

Globally

Stratum	Species
Herbaceous	*Carex lasiocarpa, Carex utriculata*
Non-vascular	*Sphagnum fallax, Sphagnum papillosum, Sphagnum lescurii*

CHARACTERISTIC SPECIES

Acadia National Park

Carex lasiocarpa

Globally

VEGETATION DESCRIPTION

Acadia National Park

Graminoid fen vegetation dominated by tall sedges, especially *Carex lasiocarpa* and/or *C. utriculata*. *Oclomena nemoralis* is a common, and locally dominant, forb. Also frequent, although at less cover, are *Calamagrostis canadensis, Carex exilis, Drosera rotundifolia* and *D. intermedia, Carex stricta, Pogonia ophioglossoides,* and *Triadenum fraseri*. There is usually a partial cover of low shrubs mixed in with the sedges: typically *Myrica gale* and *Chamaedaphne calyculata*, sometimes with *Vaccinium oxycoccos, V. macrocarpon*, and/or *Andromeda polifolia*. *Sphagnum* cover varies from patchy to almost continuous, with *Sphagnum palustre* and *S. papillosum* most abundant and *S. magellanicum* and *S. flavicomans* locally important. Other bryophytes are minor, and lichens are absent. Herb species richness far exceeds that of bryoids, shrubs, or trees.

Globally

Sedges are dominant and most often include *Carex lasiocarpa* or *Carex utriculata* in association with *Carex oligosperma, Carex exilis, Rhynchospora alba, Calamagrostis canadensis, Cladium mariscoides, Eriophorum vaginatum, Eriophorum virginicum*, as well as other herbaceous species such as *Lysimachia terrestris, Triadenum virginicum, Peltandra virginica*, and *Pogonia ophioglossoides*. Shrubs are present but not dominant and typically include *Chamaedaphne calyculata* and *Vaccinium*

macrocarpon. Other frequent shrub associates depend on geography and may include *Myrica gale, Clethra alnifolia, Vaccinium corymbosum, Ilex verticillata, Spiraea alba,* or *Rhododendron viscosum*. The bryophyte layer is dominated by species of *Sphagnum*, including *Sphagnum fallax, Sphagnum papillosum, Sphagnum lescurii*, and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4G5

DATABASE CODE CEGL006302

COMMENTS

Acadia National Park

Quite distinct from other types, although can grade into both the Sweetgale Shrub Fen (*Myrica gale - Spiraea alba - Chamaedaphne calyculata* Shrubland) and the Leatherleaf Acidic Fen (*Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland). Although the types share many species, the abundance of *C. lasiocarpa* is diagnostic for this type.

Fairly common, though most occurrences small.

Globally

Typha angustifolia - Hibiscus moscheutos Herbaceous Vegetation

COMMON NAME	Narrowleaf Cattail - Eastern Rose-mallow Herbaceous Vegetation
SYNONYM	Brackish Tidal Marsh, Cattail Variant
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Tidal temperate or subpolar grassland (V.A.5.N.n)
ALLIANCE	TYPHA (ANGUSTIFOLIA, DOMINGENSIS) TIDAL HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association is uncommon within the Park.

Globally

This association occurs in Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Rhode Island, Virginia, and possibly North and South Carolina.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Fresh to brackish tidal areas along streams, with one or more drainage channels. The soils may have an organic layer over the mineral soil, but if so it is fairly shallow (much less than 40 cm), compared to the deeper organic layers in freshwater peatlands and saltmarshes.

Globally

This community is a brackish tidal marsh of the northern to central Atlantic coast, occurring along the margin of tidal rivers and at the upper margins of some high salt marshes where water salinity ranges from 0.5-18.0 ppt. Brackish marshes are most extensive on large tidal rivers, but smaller marshes of this alliance also occur at the upper limits of larger tidal creeks.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Spartina pectinata, Bolboschoenus maritimus, Schoenoplectus tabernaemontanii, Calamagrostis canadensis, Typha angustifolia, Typha latifolia*

Globally

Stratum	Species
Herbaceous	*Typha angustifolia, Spartina cynosuroides, Phragmites australis, Scirpus americanus, Pontederia cordata, Lilaeopsis chinensis, Hibiscus moscheutos*

CHARACTERISTIC SPECIES

Acadia National Park

Globally

VEGETATION DESCRIPTION

Acadia National Park

(drawn from Calhoun et al. 1994 and other observations) This graminoid-dominated vegetation generally shows gradations in composition as one moves perpendicularly away from the stream channels. Closest to the channels, tall rushes and other graminoids dominate, including *Spartina pectinata, Bolboschoenus maritimus, Schoenoplectus tabernaemontanii,* and *Calamagrostis canadensis*. Lower-growing graminoids are often mixed in, such as *Spartina patens, Juncus gerardii, J. balticus, Agrostis stolonifera*, and *Carex paleacea*. Common forbs include *Doellingeria umbellata, Lysimachia terrestris,* and *Triglochin maritima*. Landward these graminoid swards grade into shrub fens with *Myrica gale*. At the upstream tidal edge, *Typha angustifolia* and/or *T. latifolia* may be common.

Globally

The vegetation is a mixture of salt marsh and freshwater tidal marsh species, often with no single species dominant over an extensive area. The vegetation is dense and characterized by tall graminoids such as *Typha angustifolia,* with associates including *Spartina cynosuroides, Phragmites australis,* or *Scirpus americanus, Pontederia cordata, Lilaeopsis chinensis, Hibiscus moscheutos (= Hibiscus palustris),* and *Pluchea odorata*. Other characteristic species include *Spartina patens,*

Distichlis spicata, Scirpus pungens, Lycopus americanus, Eleocharis palustris, Hydrocotyle umbellata, Eupatorium capillifolium, Ptilimnium capillaceum, Bidens spp., and *Spartina alterniflora*. Occurrences at the northern edge of the range are also characterized by *Carex paleacea* and *Triglochin maritima*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL004201

COMMENTS
Acadia National Park
Not extensive, but variable nonetheless uncommon

Globally

Spartina patens - Distichlis spicata - (Juncus gerardii) Herbaceous Vegetation

COMMON NAME	Saltmeadow Cordgrass - Saltgrass - (Black-grass) Herbaceous Vegetation
SYNONYM	Spartina High Salt Marsh
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.5.N)
FORMATION	Tidal temperate or subpolar grassland (V.A.5.N.n)
ALLIANCE	SPARTINA PATENS - (DISTICHLIS SPICATA) TIDAL HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 2

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs within the Park's one extensive saltmarsh complex and as small pockets in scattered locations on Mount Desert Island.

Globally

This association occurs in Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Rhode Island, and Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Relatively protected shores at and just below the high tide line. Calhoun et al. (1994) describe three settings: tidal stream marshes, fringe marshes, and embayments and coves.

Globally

This high salt marsh vegetation occurs along the north Atlantic coast from Delaware (discontinuously south to Virginia) north to the Canadian maritime provinces. It occupies the zone extending from mean high tide landwards to the limit of spring tides and is subjected to irregular tidal flooding. The substrate is peat overlying mineral soil.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Carex paleacea, Juncus gerardii, Distichlis spicata*

Globally

Stratum	Species
Herbaceous	*Spartina patens, Distichlis spicata, Juncus gerardii*

CHARACTERISTIC SPECIES

Acadia National Park

Carex paleacea or *Juncus gerardi*

Globally

VEGETATION DESCRIPTION

Acadia National Park

Pocket saltmarshes with highly variable vegetation (across only two samples). One sample (and possibly a subtype) is dominated by *Carex paleacea* and *Juncus balticus*, with *Solidago uliginosa* and *Festuca rubra*. The other sample (and possible subtype) is the more standard upper marsh vegetation dominated by *Juncus gerardi*, *Distichlis spicata*, and *Limonium carolinanum*, with smaller amounts of *Glaux maritima, Spartina alterniflora*, and *Plantago maritima*. Additional description condensed from Calhoun et al. 1994: Regularly flooded low marsh zones have a mixture of *Juncus gerardii, J. balticus, Festuca rubra*, and *Agrostis gigantea*, with only small areas or strips of *Spartina alterniflora*. The irregularly high marsh is a mosaic of associations reflecting subtle environmental differences as well as stochastic events. Patches of *Juncus gerardii* or *J. balticus* are common, with mixed associations including those rushes as well as *Spartina patens, Agropyron repens, Agrostis alba*, and *Triglochin maritima*. Occasional species typical of these marshes include *Plantago maritima, Glaux maritima, Limonium carolinianum, Suaeda* spp., *Hierochloe odorata*, and *Carex hormathodes*. Pannes include different species that can tolerate extremes in moisture, temperature, and salinity.

Globally
The most characteristic and dominant species of this marsh community are *Spartina patens, Distichlis spicata* and *Juncus gerardii*. Other associates include *Limonium carolinianum, Panicum virgatum, Aster tenuifolius, Solidago sempervirens*, and a short form of *Spartina alterniflora*. At the northern end of the range, other associates include *Carex paleacea, Glaux maritima, Juncus balticus, Triglochin maritima*, and *Sueda maritima*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5.

DATABASE CODE CEGL006006

COMMENTS
Acadia National Park
Acadia composition differs from NVCS concept, but no better fit could be found. Also, the complete lack of overlap between the two Acadia samples leads one to question how best to classify. The NVCS saltmarsh types work better for areas lower (SW) on the coast, where extensive marshes form, rather than for our limited bands of saltmarsh vegetation.

Globally

Carex (oligosperma, exilis) - Chamaedaphne calyculata Shrub Herbaceous Vegetation

COMMON NAME	(Few-seed Sedge, Meager Sedge) - Leatherleaf Shrub Herbaceous Vegetation
SYNONYM	Few-seeded Sedge - Leatherleaf Fen
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland with a sparse shrub layer (V.A.7)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.A.7.N)
FORMATION	Saturated temperate or subpolar grassland with a sparse broad-leaved evergreen shrub layer (V.A.7.N.o)
ALLIANCE	CHAMAEDAPHNE CALYCULATA / CAREX LASIOCARPA SATURATED SHRUB HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine, New Hampshire, New York, and Vermont.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

These occur in low elevation basins (under 100 m), often over marine deposits. The substrate is peat, varying in depth from about 25 cm to more than a meter. The substrate is constantly saturated, and often not very firm. The pH ranges from 4.8 to 5.4. Usually these are found in association with one or more other peatland vegetation types.

Globally

This weakly minerotophic peatland of northern New England occurs on wet flats and peat-accumulating depressions, generally over acidic bedrock.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Short Shrub	*Nemopanthus mucronata*
Dwarf Shrub	*Chamaedaphne calyculata, Myrica gale, Vaccinium oxycoccos, Rubus hispidus, Andromeda polifolia, Gaylussacia baccata, Vaccinium macrocarpon*
Herbaceous	*Carex exilis, Dro intermedia, Rhynchospora alba, Drosera rotundiolia, Maianthemum trifolium, Pogonia ophioglossoides, Utricularia cornuta, Eriophorum angustifolium, Muhlenbergia uniflora*
Non-vascular	*Sphagnum magellanicum, Sphagnum papillosum, Sphagnum capillifolium, Sphagnum pylaesii*

Globally

Stratum	Species
Dwarf Shrub	*Chamaedaphne calyculata*
Herbaceous	*Carex oligosperma, Carex exilis, Carex cordorrhiza, Eriophorum* spp., *Rhynchospora alba, Scirpus cespitosus, Scheuchzeria palustris*

CHARACTERISTIC SPECIES

Acadia National Park

Carex exilis; Rhynchospora alba more abundant than in other types; herb cover more than twice dwarf shrub cover and tall sedges (*C. stricta* or *C. lasiocarpa* and similar species) not dominant.

Globally

VEGETATION DESCRIPTION

Acadia National Park

A graminoid (or, less commonly, forb) dominated fen with a moderate component of heath shrubs. Above these dominant layers there may be a scattering, or patches, of *Nemopanthus mucronata* and/or *Thuja occidentalis*. The typical dwarf shrubs are *Chamaedaphne calyculata* and *Myrica gale*; less frequent but occasionally dominant are *Andromeda polifolia*, *Gaylussacia baccata*, or *Vaccinium macrocarpon*. *Rubus hispidus* and *Vaccinium oxycoccos* are frequent but at low cover. The extensive herb layer is dominated either by *Carex exilis* (2 samples), *Oclomena nemoralis*, or *Eriophorum angustifolium*. *Drosera intermedia* and *Rhynchospora alba* are frequent and occasionally dominant. *Muhlenbergia uniflora* is not frequent but maybe characteristic wher it occurs. Other species frequently occuring in the herb layer, but at low cover, are *Drosera rotundifolia,*

Maianthemum trifolium, Pogonia ophioglossoides, Utricularia cornuta, and *Acer rubrum*. The extensive bryophyte layer is typically dominated by *Sphagnum magellanicum* or *S. papillosum,* with *S. capillifolium* and *S. pylaesii* locally common. Herb species richness usually far exceeds that of trees, shrubs, or bryoids.

The basal area ranged from 0 - 6 m^2/ha. Canopy heights were 0 - 5 m.

Globally
Graminoid species characterize this association, and include *Carex oligosperma, Carex exilis, Carex cordorrhiza, Eriophorum* spp., *Rhynchospora alba, Scirpus cespitosus* and *Scheuchzeria palustris*. Other herbaceous associates include *Solidago nemoralis, Drosera intermedia, Pogonia ophioglossoides,* and others. Scattered low shrubs may be present, most characteristically *Chamaedaphne calyculata*. Other associates may include *Ledum groenlandicum, Nemopanthus mucronata, Myrica gale, Andromeda polifolia, Gaylussacia baccata, Vaccinium macrocarpon,* and *Betula pumila*.

OTHER NOTEWORTHY SPECIES *Arethusa bulbosa* occurs in this type.

CONSERVATION RANK G?.

DATABASE CODE CEGL006524

COMMENTS
Acadia National Park
Distinctions between this and Leatherleaf Acidic Fens (*Chamaedaphne calyculata / Eriophorum virginicum / Sphagnum rubellum* Dwarf-shrubland) are good in concept but can be difficult to implement in the field. Leatherleaf Acidic Fens, in concept, are more shrub-dominated and lack *Carex exilis* and *Carex oligosperma*. In this type, the cover of herbaceous species is more than twice that of dwarf shrub species, and many have a strong component of *Carex exilis*. Few-seeded Sedge - Leatherleaf Fens {*Carex (oligosperma, exilis) - Chamaedaphne calyculata* Shrub Herbaceous Vegetation} can also be similar to mixed tall sedge fens, where *C. lasiocarpa* is a characteristic component.

Moderately variable, especially in the identity of the dominant herbaceous species. While *Carex exilis* is classic, some sites are dominated by *Aster nemoralis* or *Eriophorum angustifolium*.

Globally

Vallisneria americana - Potamogeton perfoliatus Herbaceous Vegetation

COMMON NAME	American Eelgrass - Clasping-leaf Pondweed Herbaceous Vegetation
SYNONYM	Open Water Marsh with Mixed Submergents/Emergents
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Hydromorphic rooted vegetation (V.C)
PHYSIOGNOMIC GROUP	Temperate or subpolar hydromorphic rooted vegetation (V.C.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.C.2.N)
FORMATION	Permanently flooded temperate or subpolar hydromorphic rooted vegetation (V.C.2.N.a)
ALLIANCE	VALLISNERIA AMERICANA PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association's range is unknown, but is believed to be relatively uncommon throughout the Park.

Globally

This association occurs in Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

In quiet waters, at depths mostly > 0.5 m, up to 2.5 m deep. Substrate typically a mixture of silty-organic muck.

Globally

This aquatic vegetation of sheltered bays of the northeastern United States occurs on lakes and streams where it isnot highly disturbed by wave action.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	

Globally

Stratum	Species
Herbaceous	*Vallisneria americana, Potomogeton perfoliatus, Potamogeton epihydrus, Utricularia* spp., *Eriocaulon aquaticum*

CHARACTERISTIC SPECIES

Acadia National Park

Nymphaea odorata and/or *Nuphar lutea*

Globally

VEGETATION DESCRIPTION

Acadia National Park

Floating aquatic vegetation with *Nymphaea odorata, Nuphar lutea*, and/or *Brasenia schreberi* as the most abundant species. Submerged aquatics are also common, and can include *Utricularia macrorhiza*, other bladderworts, and pipewort. Shoreward there may be a zone of emergent plants including *Pontederia cordata* and *Sagittaria latifolia.*

Globally

The vegetation is dominated by submergent or emergent plants with only minor floating-leaved components. Characteristic species may include *Vallisneria americana, Potomogeton perfoliatus, Potamogeton epihydrus, Utricularia* spp., and *Eriocaulon aquaticum*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G5.

DATABASE CODE CEGL006196

COMMENTS

Acadia National Park

Photography did not allow detailed mapping of aquatic vegetation types, and aquatic vegetation was not sampled.

Open Water Marsh with Mixed Submergents/Emergents (*Vallisneria americana - Potamogeton perfoliatus Herbaceous Vegetation*) occurs in similar settings but is dominated by pondweeds rather than by water-lilies; however, intermediates occur.

Globally

Nuphar lutea ssp. advena - Nymphaea odorata Herbaceous Vegetation

COMMON NAME	Broadleaf Pondlily - White Waterlily Herbaceous Vegetation
SYNONYM	Water Lily Aquatic Wetland
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Hydromorphic rooted vegetation (V.C)
PHYSIOGNOMIC GROUP	Temperate or subpolar hydromorphic rooted vegetation (V.C.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (V.C.2.N)
FORMATION	Permanently flooded temperate or subpolar hydromorphic rooted vegetation (V.C.2.N.a)
ALLIANCE	NYMPHAEA ODORATA - NUPHAR SPP. PERMANENTLY FLOODED TEMPERATE HERBACEOUS ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This widespread association is found in throughout the central and eastern United States and southern Canada in Alabama, Arkansas, Connecticutt, Delaware, Georgia, Iowa, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, Mississippi, North Carolina, New Hampshire, New Jersey, New York, Ohio, Oklahoma, Ontario, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Vermont, Wisconsin, and West Virginia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

In quiet waters, at depths mostly > 0.5 m, up to 2.5 m deep. Substrate typically a mixture of silty-organic muck.

Globally

This rooted aquatic or open marsh community occupies shallow water depressions, oxbow ponds, backwater sloughs of river floodplains, slow moving streams, ponds, and small lakes.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Potamogeton epihydrus*, *Nuphar lutea* ssp. *advena*, *Nymphaea odorata*

Globally

Stratum	Species
Herbaceous	*Nuphar lutea* ssp. *advena*, *Nymphaea odorata*

CHARACTERISTIC SPECIES

Acadia National Park

Floating-leaved pondweed species such as *Potamogeton epihydrus* or others

Globally

VEGETATION DESCRIPTION

Acadia National Park

Aquatic macrophyte vegetation dominated by floating-leaved pondweed species such as *Potamogeton epihydrus* or others. Submerged aquatics are also common, and can include bladderworts and pipewort.

Globally

This community is dominated by rooted, floating-leaved aquatic species, with both submergent and emergent aquatics also present. *Nuphar lutea* ssp. *advena* and *Nymphaea odorata* are dominants. Other species present include *Brasenia schreberi*, various *Potamogeton* spp., *Polygonum amphibium*, and *Polygonum amphibium* var. *emersum* (= *Polygonum coccineum*). Submerged aquatic species that are more common in the southern part of the range include *Cabomba caroliniana, Ceratophyllum demersum*, and *Heteranthera dubia*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G4G5

DATABASE CODE CEGL002386

COMMENTS

Acadia National Park

Water Lily Aquatic Wetlands (*Nuphar lutea ssp. advena - Nymphaea odorata* Herbaceous Vegetation) occurs in similar settings but is dominated by water-lilies, however, intermediates occur.

Globally

Polypodium (virginianum, appalachianum) / Lichen spp. Nonvascular Vegetation

COMMON NAME	(Rock Polypody, Appalachian Rockcap Fern) / Lichen species Nonvascular Vegetation
SYNONYM	Northern Lichen Talus Barrens
PHYSIOGNOMIC CLASS	Nonvascular Vegetation (VI)
PHYSIOGNOMIC SUBCLASS	Lichen vegetation (VI.B)
PHYSIOGNOMIC GROUP	Temperate or subpolar lichen vegetation (VI.B.1)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (VI.B.1.N)
FORMATION	Lichen vegetation with a sparse tree layer (VI.B.1.N.c)
ALLIANCE	LICHEN SPP. NONVASCULAR ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in New Hampshire, Maine, Vermont, New York, and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Talus slopes with sparse vegetation.

Globally

This sparsely vegetated open talus slope of the northern Appalachian Mountains and boreal region is characterized by large boulder talus dominated by lichen cover.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Non-vascular	Information not available.

Globally

Stratum	Species
Non-vascular	*Cladonia* spp., *Ptilidium ciliare, Hylocomium splendens*

CHARACTERISTIC SPECIES

Acadia National Park

Toxicodendron rydbergii and crustose lichens

Globally

VEGETATION DESCRIPTION

Acadia National Park

(not sampled; some AA points)

Globally

Vascular plant species are of low cover, and consist of a heterogeneous mix of scattered individuals of *Picea rubens, Betula papyrifera* var. *cordifolia, Betula papyrifera* var. *papyrifera, Betula alleghaniensis, Acer spicatum, Polypodium virginianum, Deschampsia flexuosa*, and *Parthenocissus quinquefolia*. Nonvascular plant species charcterize this community and include lichen species of the genus *Cladonia* as well as mosses *Ptilidium ciliare, Hylocomium splendens*, and others.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006534

COMMENTS

Acadia National Park

Can grade into Red Spruce Talus Slope Woodland (*Picea rubens / Ribes glandulosum* Woodland) as tree cover increases. Common; can be large or small.

Globally

Solidago sempervirens - (Rhodiola rosea) - Juniperus horizontalis Sparse Vegetation

COMMON NAME	Seaside Goldenrod - (Roseroot Stonecrop) - Creeping Juniper Sparse Vegetation
SYNONYM	Northern Maritime Rocky Headlands
PHYSIOGNOMIC CLASS	Sparse Vegetation (VII)
PHYSIOGNOMIC SUBCLASS	Consolidated rock sparse vegetation (VII.A)
PHYSIOGNOMIC GROUP	Sparsely vegetated pavement (VII.A.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (VII.A.2.N)
FORMATION	Pavement with sparse vascular vegetation (VII.A.2.N.a)
ALLIANCE	OPEN PAVEMENT SPARSE VEGETATION ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs on throughout the Park along the immediate coast.

Globally

This association occurs in Maine and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Sparsely vegetated exposed bedrock along the immediate shore. Salt spray, fog, and wind are obvious influences.

Globally

This maritime headland community occurs on the northern Atlantic coast from central Maine to the maritime provinces. The vegetation is of sparse and variable cover, and is maintained in the open condition by wind, salt spray, ice, and storm waves.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Dwarf Shrub	*Juniperus horizontalis*
Herbaceous	*Solidago sempervirens, Campanula rotundifolia*
Non-vascular	*Rhizocarpon geographicum*

Globally

Stratum	Species
Dwarf Shrub	*Juniperus horizontalis*
Herbaceous	*Triglochin maritimum, Lathyrus japonicus, Solidago sempervirens*

CHARACTERISTIC SPECIES

Acadia National Park

Solidago sempervirens, Rhodalia rosea, Iris setosa

Globally

VEGETATION DESCRIPTION

Acadia National Park

Sparse vegetation in patches, in rock crevices or somewhat sheltered hollows. *Solidago sempervirens*, *Plantago maritima*, and *Triglochin maritima* are typical; the boreal maritime element is represented by *Rhodalia rosea, Iris setosa, Sagina nodosa, Euphrasia randii*, etc. Near the border with the upland forest *Lathyrus japonicus, Angelica atropurpurea*, *Ligusticum scothicum*, and *Achillaea millefolium* may occur, with *Festuca rubra* forming locally dense patches. *Juniperus horizontalis* is a characteristic low shrub.

Globally

The most characteristic species are *Juniperus horizontalis, Triglochin maritimum, Lathyrus japonicus,* and *Solidago sempervirens* which are accompanied by plants of boreal affinity including *Sedum rosea, Iris setosa, Sagina nodosa, Euphrasia randii* as well as other species of open maritime habitats: *Mertensia maritima, Angelica atropurpurea,* and *Ligusticum scothicum*. Other non-native species include *Achillea millefolium* and *Festuca rubra*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006529

COMMENTS

Acadia National Park

Patchy but with some quite consistent species. The boreal elements in the shore vegetation here disappear as one moves southwest from Acadia NP along the coast. Fairly common though not necessarily extensive.

Globally

Cakile edentula ssp. edentula - Mertensia maritima Sparse Vegetation

COMMON NAME	Sea-rocket - Oysterleaf Sparse Vegetation
SYNONYM	
PHYSIOGNOMIC CLASS	Sparse Vegetation (VII)
PHYSIOGNOMIC SUBCLASS	Unconsolidated material sparse vegetation (VII.C)
PHYSIOGNOMIC GROUP	Sparsely vegetated sand flats (VII.C.2)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural (VII.C.2.N)
FORMATION	Sand flats (VII.C.2.N.a)
ALLIANCE	CAKILE EDENTULA SPARSE VEGETATION ALLIANCE

CLASSIFICATION CONFIDENCE LEVEL 3

USFWS WETLAND SYSTEM Terrestrial

RANGE

Acadia National Park

This association occurs throughout the Park.

Globally

This association occurs in Maine and Nova Scotia.

ENVIRONMENTAL DESCRIPTION

Acadia National Park

Above the usual high-tide line on sand or gravel coastal beaches. Occasionally flooded at very high tides.

Globally

This sparsely vegetated community of shingle and, to a lesser extent, sandy maritime beaches occurs from central Maine to the maritime provinces. The middle beach is the first vegetated zone adjacent to the water, lying above mean high tide but exposed to storm waves and is often covered by ice in winter. Water-rounded cobbles overlying sand and gravel is the most common substrate of this dynamic habitat.

MOST ABUNDANT SPECIES

Acadia National Park

Stratum	Species
Herbaceous	*Mertensia maritima*

Globally

Stratum	Species
Herbaceous	*Cakile edentula*, *Mertensia maritima*

CHARACTERISTIC SPECIES

Acadia National Park

Location just above the high-tide line, with presence of beach-pea and sea-kale; forbs more abundant than grasses.

Globally

VEGETATION DESCRIPTION

Acadia National Park

Sparsely vegetated upper beaches, where plants adapted to withstand the effects of salt spray and drying winds are typical. These include annuals such as sea-beach sandwort, sea-kale, beach pea, and others. On downeast gravel/cobble beaches, *Mertensia maritima* (oysterleaf) may be characteristic. This linear community is usually bordered landward by either sand dunes or by shrubby-edged upland forest vegetation.

Globally

The two most characteristic species of this association are *Cakile edentula* and *Mertensia maritima*, but vegetation is sparse and variable. Associates may incude *Lathyrus japonicus, Honckenya peploides, Calystegia spithamaea* ssp. *purshiana, Oenothera biennis, Toxicodendron radicans, Geranium robertianum* and *Achillea millefolium.* Lithophytic lichens may include *Rhizocarpon geographicum, Lecidea tenebrosa*, and *Gyrophora hyperborea*.

OTHER NOTEWORTHY SPECIES

CONSERVATION RANK G?.

DATABASE CODE CEGL006106

COMMENTS

Acadia National Park
Substrate more often gravel/cobble than sand.

Globally