An assessment of accomplishments and gaps in Maine Land Conservation

5/2021

Public Access, Habitat, and Natural Resources

A review of land conservation in Maine, guided by the goals of the 1997 Report of the Land Acquisition Priorities Committee.

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PUBLIC ACCESS, HABITAT, AND NATURAL RESOURCES

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This report completed thanks to financial support from:

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INTRODUCTION

In 1996 the Land Acquisition Priorities Advisory Committee (LAPAC) was established to fulfill an Executive Order meant to create a plan and develop a set of priorities for future land acquisition in Maine.

Now some 25 years later, and amidst a new round of conservation funding from the Land for Maine's Future program, and a growing suite of conservation planning efforts such as the State Wildlife Action Plan (2015), Land Conservation Task Force Report (2019), and Maine Climate Action Plan (2020) among others, a reflection on conservation achievements and gaps relative to those LAPAC goals was due.

The purpose of this assessment is to examine the achievements and potential gaps in Maine land conservation and compare these against the goals in the 1997 final report of the LAPAC. The primary reference for most assessments is the Maine State Conserved Lands Layer, served by the Maine Office of GIS. Conserved lands include certain lands managed by federal, state, and municipal agencies, land trusts, and other organizations with specific objectives for lands to be managed for recreational, biological, and other public benefits. Tribal lands and certain private and municipal lands without secondary conservation easements contain important cultural and ecological benefits but are not captured in the state conserved lands layer.

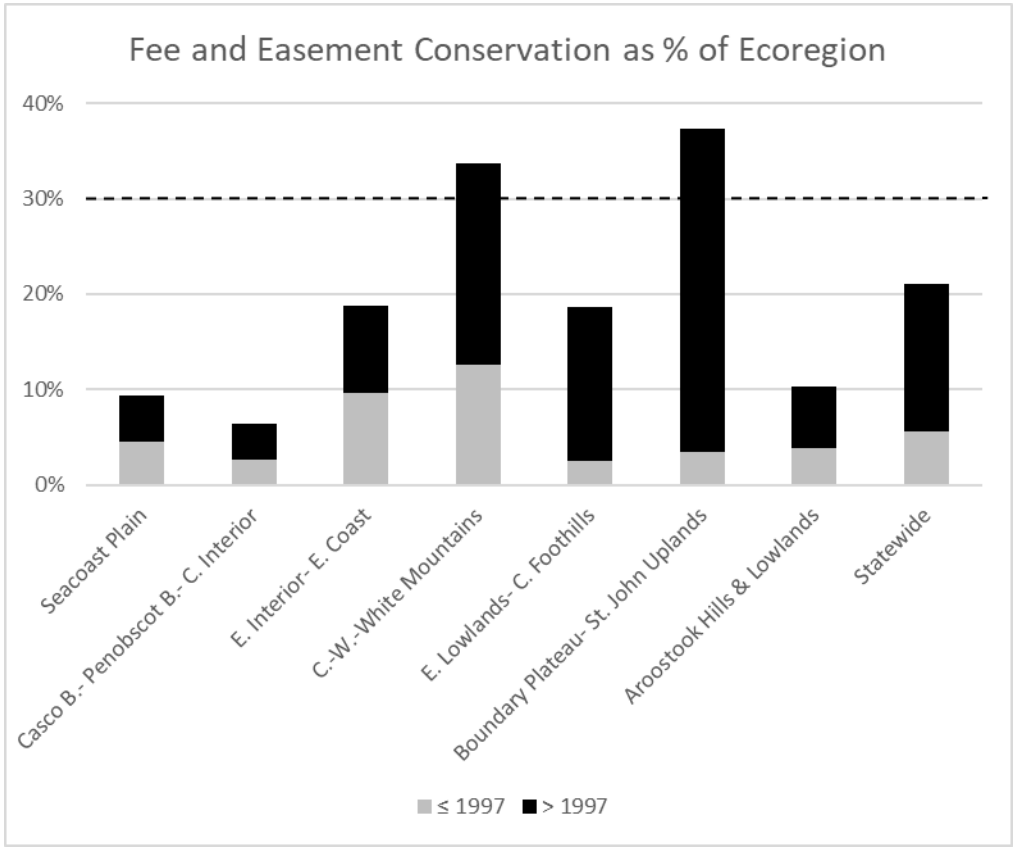

Figure 1. Fee and Easement conservation before and after 1997 through 2020, by Maine ecoregion (ecoregions defined by Gawler and Cutko 2010). The dashed line indicates the 30% x 2030 conservation goal of the Maine Climate Council. Ecoregion locations are displayed in Figure 7.

LAPAC Goals and Acquisition Priorities: The LAPAC identified an overarching goal of doubling land conservation in Maine by 2020. In 1997, nearly 6% of the state was conserved through fee or easement conservation. Since this time, land conservation has nearly quadrupled and now covers over 4,000,000 acres and roughly 21% of the land area of the state (Figure 1). In addition to this general target, the 15 specific land acquisition priorities identified by LAPAC and reported on here fall under the following themes:

- Access to Lands and Waters (*improving access to water, municipal and urban open space, trail systems, regional parks, additions and access to existing public lands, and mountains*)

- Protection of Biodiversity and Habitat Values
  (*southern Maine conservation, ecological reserves, river systems, undeveloped coastline, islands, northern forests, and mountains*)
- Protection of Culturally and Economically Valuable Natural Resources
  (*farmland, mineral collecting sites, drinking water protection, northern forests, and southern Maine*)

Accomplishments and gaps within each of these project areas are described each within their own section of the following report.

Looking forward: In creating this review of conservation achievements, the LAPAC Steering Committee and dozens of reviewers took advantage of new data, thoughtful expertise, and available reports to also identify where there is still important conservation work to be done. These "gaps" are clearly defined in each section of the following report. The results also repeatedly leverage many of the recommendations and specific action items called for by The Land Conservation Task Force (2019) and these are also specifically referenced in relevant sections of the following report.

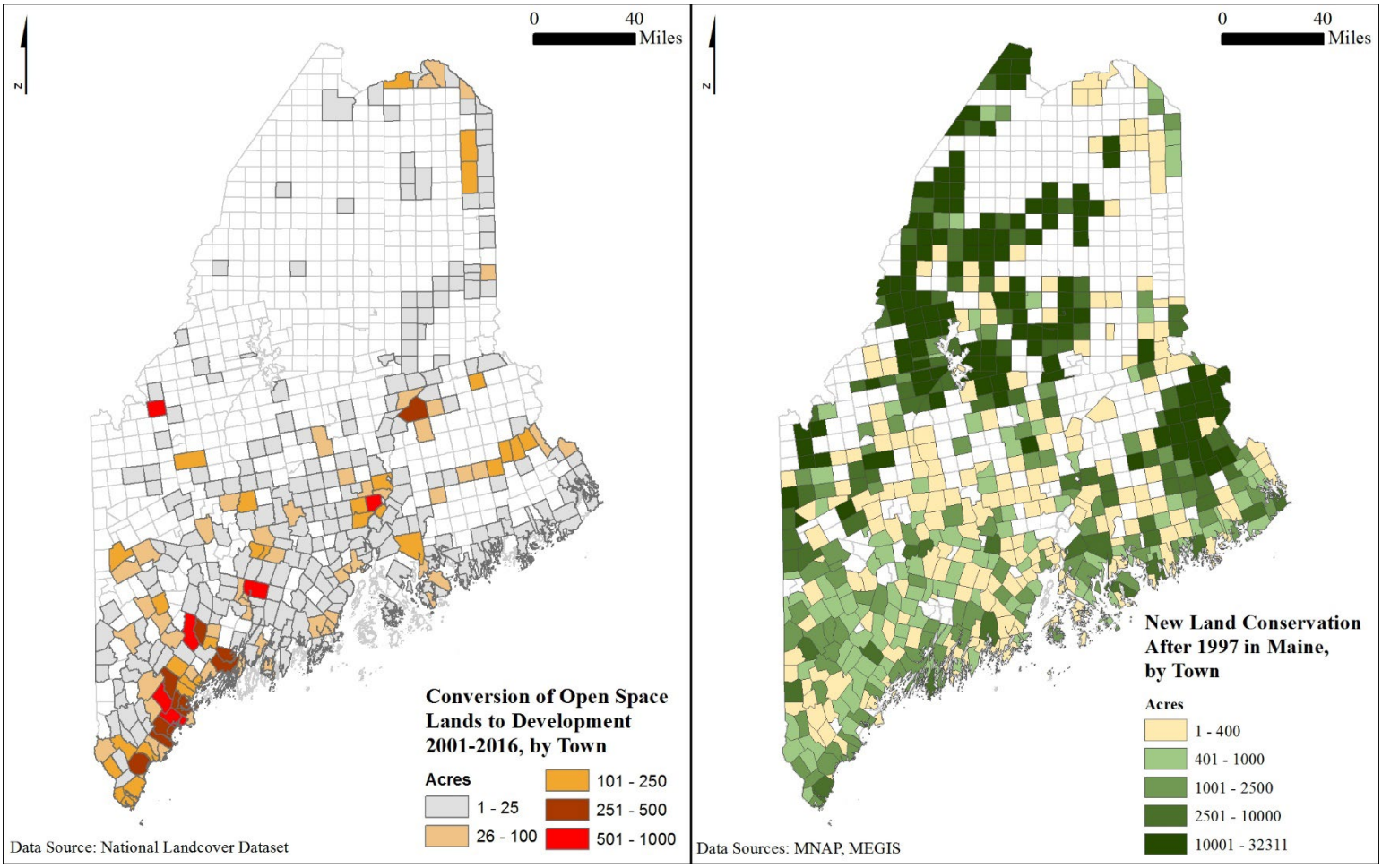

Figure 2. Conversion of open space lands to development (left), and new land conservation after 1997(right) in Maine by town. Open space lands include forest, palustrine and estuarine wetlands, agricultural lands, and other lands not already classified as 'Developed' in the 2001 National Landcover Dataset. Road development associated with logging operations is poorly reflected in the National Landcover Dataset.

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1. ACCESS TO WATER

LAPAC Language (1997): "Access to Water: Maine is blessed with abundant rivers and lakes, as well as a spectacular coastline, that provide outstanding fishing, boating, and shoreline recreation opportunities. However, traditional water access sites are increasingly being closed off by private landowners and opportunities to acquire affordable shorefront properties suitable for public access are dwindling. A recent study by state agencies found that the growth in public fishing and boating access sites will probably not keep pace with demand unless additional funding becomes available. The study includes a ten-year plan for acquisition of priority water access sites, as well as shorelands. Acquisition and development of public access to waters should seek to provide a diversity of high-quality recreational opportunities such as boat ramps, carry-in boat access sites, and walk-in access to remote ponds."

Findings (overall):

- Maine has 579 public boat launch sites (improved hand carry or trailer access), as tracked by BPL's Boating Access program. Of these, 321 boat launch sites provide access to ponds and lakes, 154 launch sites are along rivers and streams, and 104 public (BPL) launch sites are along tidal waters.
- The Maine Coastal Program has inventoried an additional 136 boat launch sites along the coast
- Many informal, unimproved boat access sites exist along roadways throughout Maine.
- LMF has contributed to 46 projects that provide boating access (improved hand carry or trailer access).
    - Coastal boating access: 6 launch sites
    - Pond/lake boating access: 27 launch sites
    - River boating access: 13 launch sites
- Bank access is important for a variety of uses including hunting, fishing, swimming, traditional gathering and others.

Ponds/Lakes

To begin analysis, we need to define what data best represents ponds and lakes where public access is important. For this analysis, freshwater ponds and lakes are defined spatially (in the spirit of Great Ponds statute) as NAMED NHD waterbodies > 10 acres. Unnamed waterbodies and waterbodies < 10 acres in NHD waterbodies data are typically other types of wetlands likely not significant targets for public access. These features are better captured under analysis of wetland conservation.

Findings:

- Maine has 2,309 named freshwater lakes and ponds over 10 acres, totaling 3,909.8 km^2 (966,136 acres), 4.2 % of the state (smaller unnamed open waterbodies are approximately 0.9% of the state)
- The state has 17,617 km (10,946.7 miles) of freshwater pond and lake shoreline (NHD mapping)
- 5,178 km (3,217 miles) or 29.4% of pond and lake shoreline has public bank access from conserved lands. This includes municipal ownership and other public/private conservation lands (Conserved lands layer, ALL gap codes, no restricted access - including conservation easements where public access is either allowed or not known to be restricted).
- 906 of Maine's lakes and ponds (39% of total) have public bank access via conserved lands. (Conserved lands layer, ALL gap codes, no restricted access- including conservation easements). While many conservation accomplishments include or are adjacent to waterbodies, access to those waterbodies hasn't necessarily been developed; these numbers do not imply that access is available via trails or other convenient access points. Enhanced water access on existing conservation lands is therefore a potential future opportunity.
- 323 of Maine's lakes and ponds (14% of total) have public boating access, either by carry in access or by boat ramp. A significant portion of ponds and lakes without boating access are smaller ponds and lakes. In many cases, ramp or drive-in access to these ponds and lakes may not be desired.
- Boating access exists on most large ponds and lakes resulting in access to 66% of Maine's pond/lake surface water area.
- 53 of Maine's lakes and ponds (2.3% of total) have ADA accessible boat launches, representing a higher bar of quality of accessibility. ADA accessible boat launches provide access to 28% of Maine's pond/lake surface water area.
- Swimming access has remained a priority for both freshwater and coastal sites. However, sufficient data to quantify swimming access is not available. The SCORP (State Comprehensive Outdoor Recreation Plan) has listed swimming access sites as a needed resource.
- Certain regions of the state have poorer access to water. For example:
    - The Greater Bangor area has limited ADA accessible water access sites within a 10 mile proximity (a priority of MDIFW is to have ADA accessible boating within 10 miles of Maine population centers)
    - Eastern Aroostook County, areas of central Maine, and southern York County have limited pond/lake access. In part, this is due to lower numbers of ponds and lakes in these areas; this may further heighten the importance of securing public access to the few ponds/lakes in these regions.

  - Certain freshwater pond/lake boat launches may need increased parking capacity, especially in areas with higher population density. Additional analysis and public use data may be needed to identify where additional parking capacity may be needed.
- Maine is fortunate that many private landowners provide bank access over their lands. However, access is not guaranteed at these sites.

Rivers/Streams

To begin analysis, we mapped all 'boatable' streams/rivers, identified using NHD Plus HR stream data with 100 km of contributing upstream flow. This data was checked and augmented with Maine Trail Finder water trails data, the AMC Rivers Guide: Maine, and the Northern Forest Canoe Trail to ensure stream lengths otherwise noted as important for paddling were included. Only public access points could be analyzed due to available data sets.

Findings:

- Maine has nearly 39,400 miles of perennial streams and nearly 5,600 miles of boatable river routes (in some cases this includes length of passage through lakes).
- 95 of 307 (31%) of boatable rivers and streams have some form of public access, including Maine's larger rivers. Nearly 60% of Maine's boatable rivers and streams length is served by improved public boating access.
- 41 of 58 (70%) of Maine rivers and streams with boatable stretches of over 25 miles have improved public access launches somewhere along their length.
- While, by design, several remote waterways in northern Maine do not have public launches, several rivers closer to population centers may not have adequate public access including the Carrabassett River, the Crooked River, Macwahoc Stream, the Little Androscoggin River, Molunkus Stream, and the Ossipee River.

Coastal access

Note: When examining access to tidal waters, several datasets were used. Tidal waters were defined by the Maine Geological Survey's LiDAR based highest annual tide data. Coastal access data was drawn from Maine's Coastal Access Guide and from BPL's boating data. Data was augmented for boating access sites through air photo interpretation to improve information on coastal boat launch parking capacity. Coastal access for boating on ferried islands was not addressed at a statewide scale for some analyses, as these access issues are far more local in nature and including these areas in statewide analysis could lead to misleading results. In addition, municipal mooring data were not included because these numbers can

fluctuate and the moorings have no conservation status, making tracking difficult. Similarly, private access points could not be tallied and are subject to a change in status.

LMF's primary water access goal is public access, however the Program does accommodate commercial use and access when it does not interfere with public use. This policy is documented and recorded in the applicant's project agreement. Generally, access for commercial uses is considered a positive thing for a project, but it is not a requirement.

Findings

- Maine has 5,484 miles of coastline when measured in 2m lengths (data source- LiDAR based MGS highest annual tide line).
- Data from the 2013 Maine Coastal Access Guide, a product of the Maine Coastal Program, indicates that overland public access is available along 365 miles (or 7%) of Maine's coast at 717 sites. A recent analysis by the Maine Coast Heritage Trust indicates that an additional 86 coastal access sites were conserved or developed since 2013, primarily managed by land trusts. Overall, most sites are either municipally owned or state owned.
- Additional undeveloped, rough bank access is available on other conserved lands on the coast. 24% of Maine's coastline is in conservation.
- There is a high level of overland public access to Maine's sand beaches. All large beaches (defined as beaches > 50 acres) in Maine have some level of overland public access. There is public access to approximately 2/3 of all sand beach *area* in Maine. Public access is less available for Maine's cobble and gravel beaches, with < 20% of these coarse sediment beaches having public access. Additionally, public access to many smaller, locally important beaches may be missing.

- There is no statewide tracking of conserved access and established trails to mudflats for shellfish harvesting. Similar to bank access, conserved shoreline does not necessarily guarantee facilitated access such as trails, boat launches, or parking.
- On average, there is a public boating access location every ~2 linear miles (note: not coastline miles), with some of the larger gaps in boating access in Wells, Jonesport/Jonesboro, upper Penobscot Bay, and Lincolnville/Northport.

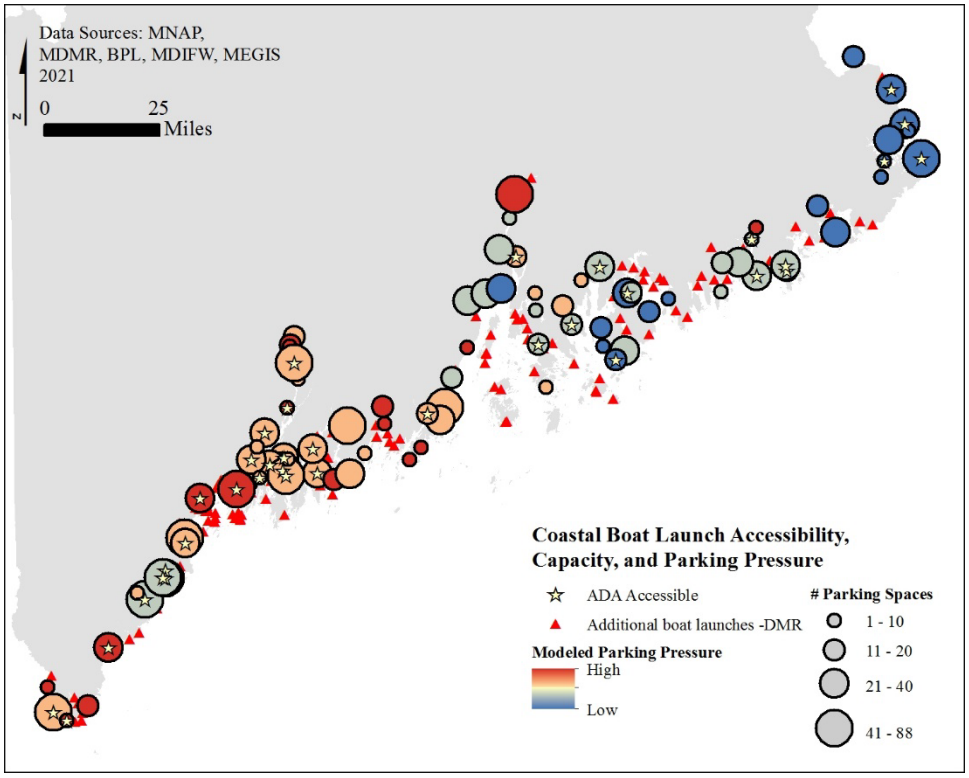


Figure 3. Coastal launch accessibility, capacity, and use pressure. Centroid size symbolizes the number of parking spaces at a given boat launch. Centroid color symbolizes modeled parking pressure from boat registration and parking capacity data. Fully ADA accessible boat launches are flagged with a star. Additional, lower capacity boating access sites identified by the Maine Coastal Program, a division of the Maine Department of Marine Resources, are symbolized with red triangles.

- Parking capacity for boat launches is as critical an issue as the location of boat launches. Despite the highest capacity at public boat launches in areas of Casco Bay and the Southern Coast, boating pressure in these areas is likely still much greater than further east in Maine, due to a larger boating population nearby. Areas of the coast where boat launch parking is low compared to the boating population include Wells, Brunswick, Western Penobscot Bay (Camden-Northport), and on Mount Desert Island.
- Data on the availability of overnight parking is needed but not easily tallied using available data.

Nexus with Maine Land Conservation Task Force recommendations (2019)

- Task Force Recommendation #1: Take proper care of our treasured public and private conservation land and ensure that they meet the needs of Maine people into the future.
- The Task Force study found that Maine State Parks have a significant backlog of basic infrastructure maintenance and improvement needs, estimated at a cost of $50 million. Updates for recreational

access and diversity of opportunities were also highlighted as a need in the report. These identified costs and needs include not only water access points, but also facilities including campgrounds, trails, roads, and other infrastructure.

2. SOUTHERN MAINE CONSERVATION

LAPAC Language (1997): "The southern portion of the state (south of Bangor) is richest in biological diversity. It is also the part of the state where development threats to plant and wildlife resources are the greatest and where existing public land holdings are most limited, particularly larger holdings. There are still opportunities to acquire significant public lands protecting critical natural resources while also providing Maine's largest population centers with greater access to expanded recreation opportunities closer to home."

Findings:

- For the purposes of this assessment focusing on biodiversity elements in southern Maine, "southern Maine" is defined as the Seacoast Plain- Ossipee and Casco Bay- Penobscot Bay- Central Interior ecoregions (see Figure 7 for locations). Defined as such, southern Maine accounts for approximately ¼ of Maine's land area.
- The last two decades have been a period of slow population growth in Maine, with approximately 60,000 new residents in Maine in 2018 compared to 2000 (5% growth in population). During this period Maine's population growth has been concentrated in York and Cumberland Counties, while other counties saw declines in population. Population growth rates were much greater from the period of 1970-2000. In that time, Maine's population increased by 280,000 people (28% growth in population), with the greatest gains in population during the decade of 1970 -1980 (131,000 residents and 13% growth). Patterns of land conversion to development follow population trends, though are amplified by second homes and rental properties.

- Real Estate data from the office of the Maine State Economist indicate that after a low in 2008, housing starts have increased steadily, from 6,668 in 2008 to 18,330 in 2020 (source: Office of the State Economist). Still, 2020 housing starts are well below the high in 2005.

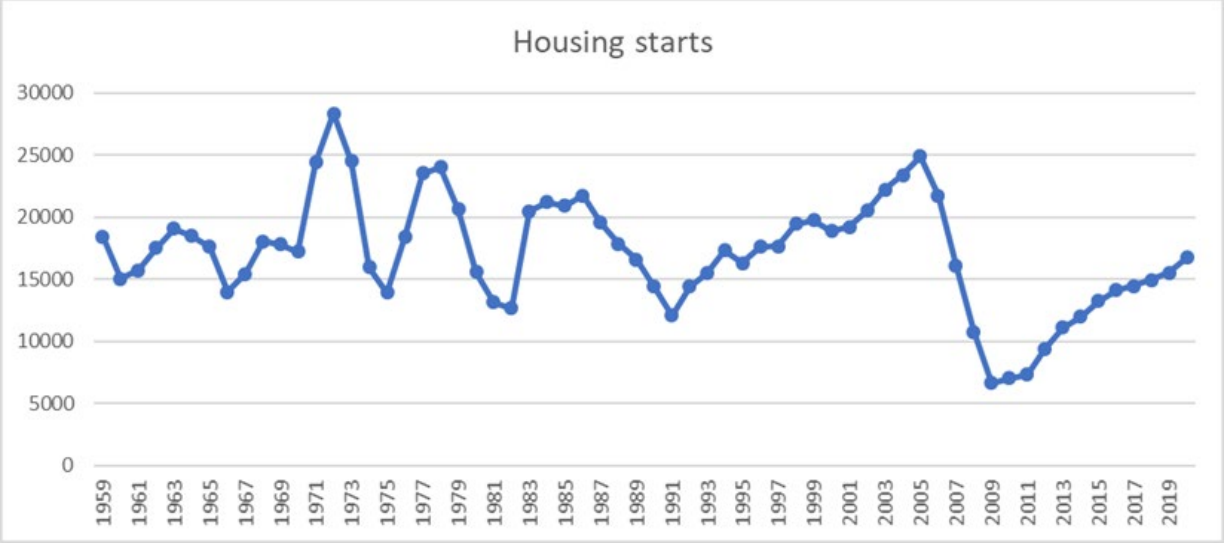


Figure 4. Maine new housing starts over time. Data provided by the office of the Maine State Economist.

- The National Landcover Dataset (NLCD), a spatial resource published by the United States Geological Survey every five years, can be used to calculate current land-use and changes in land-use over time. According to NLCD data, roughly 14,000 acres were converted to development (including lawns and other developed open space) in southern Maine between 2001 and 2016, or 0.3% of the land area in southern Maine.
- Roughly 80% of Maine's population resides in southern Maine. According to NLCD data, land conversion to development in southern Maine accounted for 75% of all new commercial, industrial, and residential development in Maine between 2001-2016. Note: While NLCD represents residential, industrial, and commercial development with reasonable accuracy (~80% Producer's and User's

Accuracy), road development associated with logging operations is poorly represented or absent. This is most significant in northern Maine but could affect results statewide.

- During the period of 2001-2016, land conversion to development in southern Maine has been greatest in or adjacent to urban areas (Source: NLCD, see Figure 2). The towns of Scarborough (925 ac), Augusta (770 ac), Bangor (570 ac), Auburn (550 ac) and Gorham (530 ac) had the greatest amounts of land conversion to development (in descending order) in the area defined here as southern Maine.
- According to NLCD data, southern Maine is 90% undeveloped. However, southern Maine ecoregions are more highly *fragmented* than other regions of the state. There is a wealth of literature on the impacts of fragmentation to biodiversity. More highly fragmented areas are more vulnerable to tree pests and invasive plants, cannot support species with large home ranges, and support significantly fewer habitat niches for different species. One way to evaluate fragmentation is by using data on Undeveloped, Roadless Blocks maintained by the Beginning with Habitat Program in the Maine Department of Fisheries and Wildlife. This dataset factors numerous landcover datasets to identify areas of the state that are buffered from development impacts. Only 64% of southern Maine is in well-buffered undeveloped, roadless blocks of more than 200 acres. Roughly 10% of southern Maine is developed and smaller, more fragmented, or poorly buffered habitat blocks with lower habitat value occupy roughly a quarter of southern Maine. Still, a significant portion (45%) of southern Maine is still in large, undeveloped blocks >1200 acres (Data source: MDIFW Undeveloped Blocks, 2015). See Figure 5.

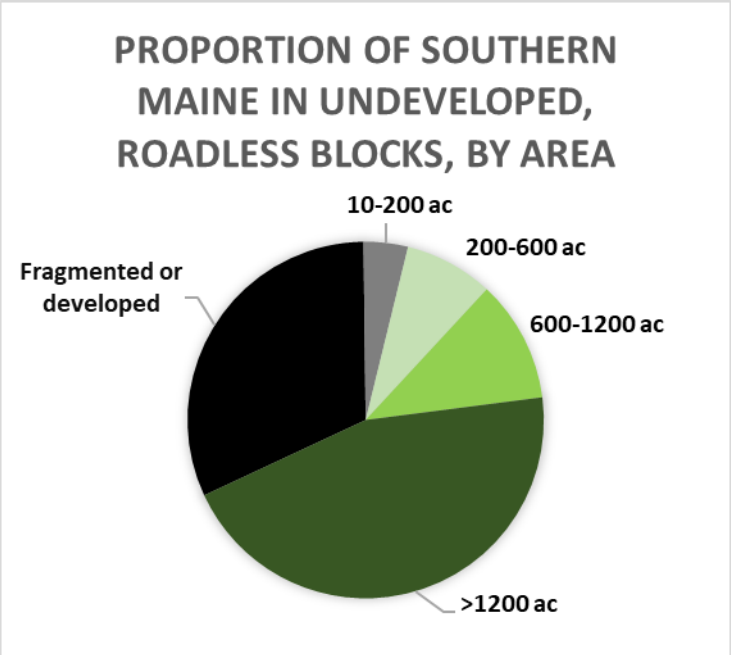


Figure 5. Proportion of Southern Maine in Undeveloped, Roadless Blocks, by Area. The 'Fragmented or Developed' category includes lands fragmented or impacted by human land use, as well as areas naturally fragmented by waterbodies, such as small islands. The Beginning with Habitat Program uses the thresholds of 200-600 ac, 600-1200 ac, and >1200 acres in co-occurrence modelling to assess relative habitat value of different areas of the landscape. Source data: MDIFW Undeveloped Blocks, 2015.

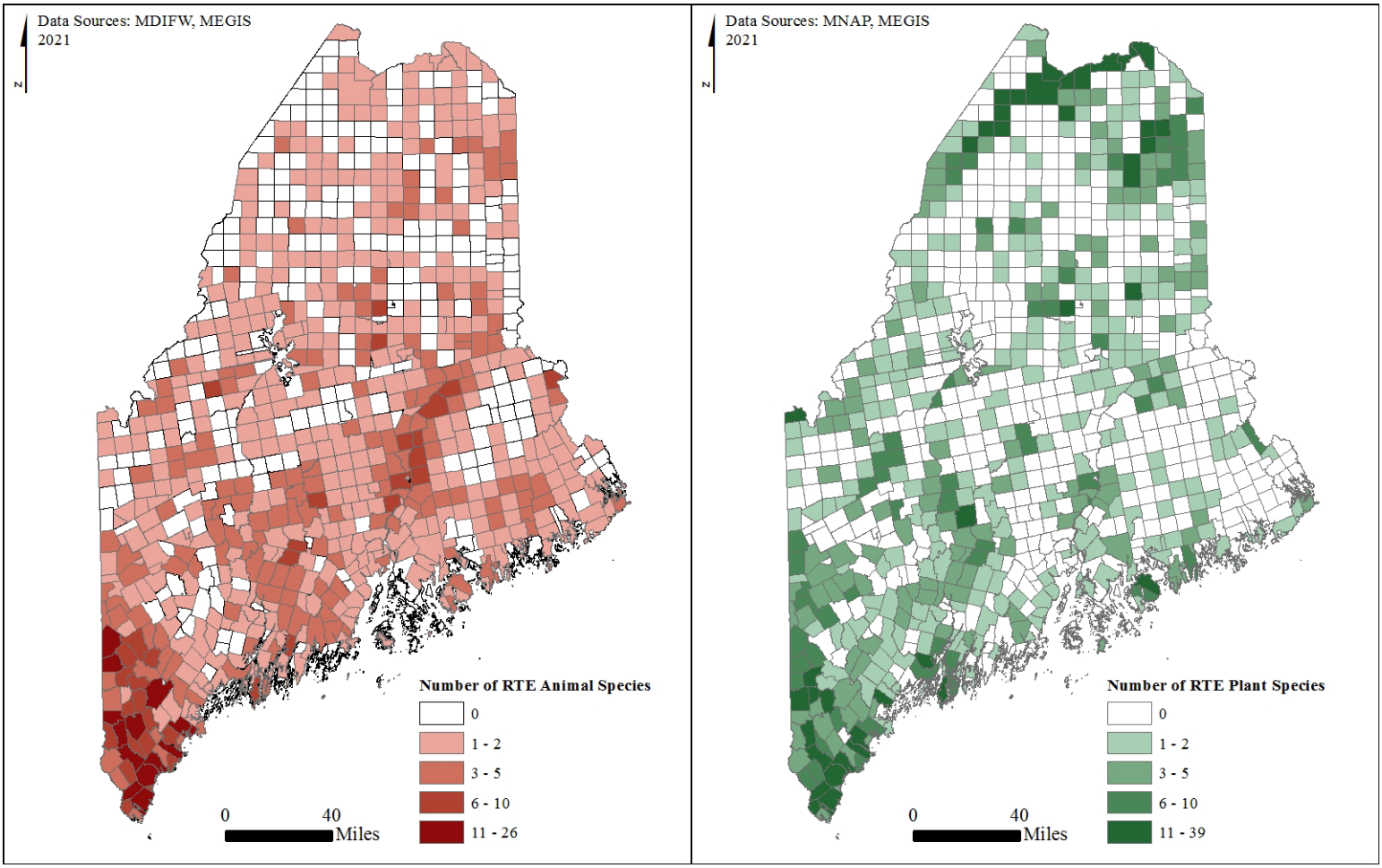


Figure 6. Number of rare, threatened, and endangered plant and animal species in Maine, by town. These maps highlight the concentration of rare species in southern Maine.

- Large undeveloped blocks (>1200 acres) occur in most towns in southern Maine. Undeveloped blocks in, or near, towns with the higher rates of land conversion to development may benefit most from land conservation efforts. Examples of Beginning with Habitat Focus Areas of Statewide Significance in areas with high rates of land conversion to development include[1]:
    - Mount Agamenticus
    - Biddeford/ Kennebunk Vernal Pool Complex
    - Saco Heath
    - Spectacle and Tolman Ponds (Augusta)
    - Caribou Bog Wetland Complex

  There are several additional large, undeveloped, roadless blocks in towns with high rates of development including in:

[1] It should also be noted that many of these Focus Areas also contain significant areas of conservation land.

  - Topsham and Brunswick (northern portions)
  - Lewiston/Auburn (both southern and northern)
  - Windham (eastern side)
  - Biddeford (interior)
  - Wells (interior areas not included in the Mount Agamenticus Focus Area)
- Conserved lands contribute significantly to the character of southern Maine. Since 1997, conservation in southern Maine has more than doubled, from 160,000 acres to over 360,000 acres, yet just over 10% of the land area of Southern Maine is in fee or easement conservation.
- Of all the conserved acres in southern Maine, 70% are held in fee. Management across fee and easement lands is best revealed by the GAP status assigned to each acre. Looking at GAP Status, 38% are GAP 1 or GAP 2 and therefore managed as Ecological Reserves or to be maintained in natural cover (no resource extraction).
- Roughly ¼ of new conserved land area in southern Maine since 1997 has been in projects that have received LMF funding (~52,750 acres). A total of nearly 62,000 acres in southern Maine have been conserved using LMF funding.
- Conservation in southern Maine has focused on biodiversity values. Beginning with Habitat (BwH) Focus Areas are natural areas of statewide ecological significance that contain concentrations of at-risk species and habitats (see Figure 7).
  - 25% of the land area of Focus Areas of Statewide Significance in southern Maine is protected by land conservation (compared to 7% of the ecoregions as a whole).
  - Although Focus Areas only include 11% of the total land area of southern Maine, 37% of conserved lands are within Focus Areas of Statewide Significance.
  - This is most pronounced in the Seacoast Plain- Ossipee Ecoregion, where 50% of conserved lands are within Focus Areas of Statewide Significance.
  - While significant portions of Focus Areas were conserved in 1997, Focus Areas have continued to be prioritized for land protection. 32% of new land conservation in southern Maine since 1997 has been in Focus Areas.

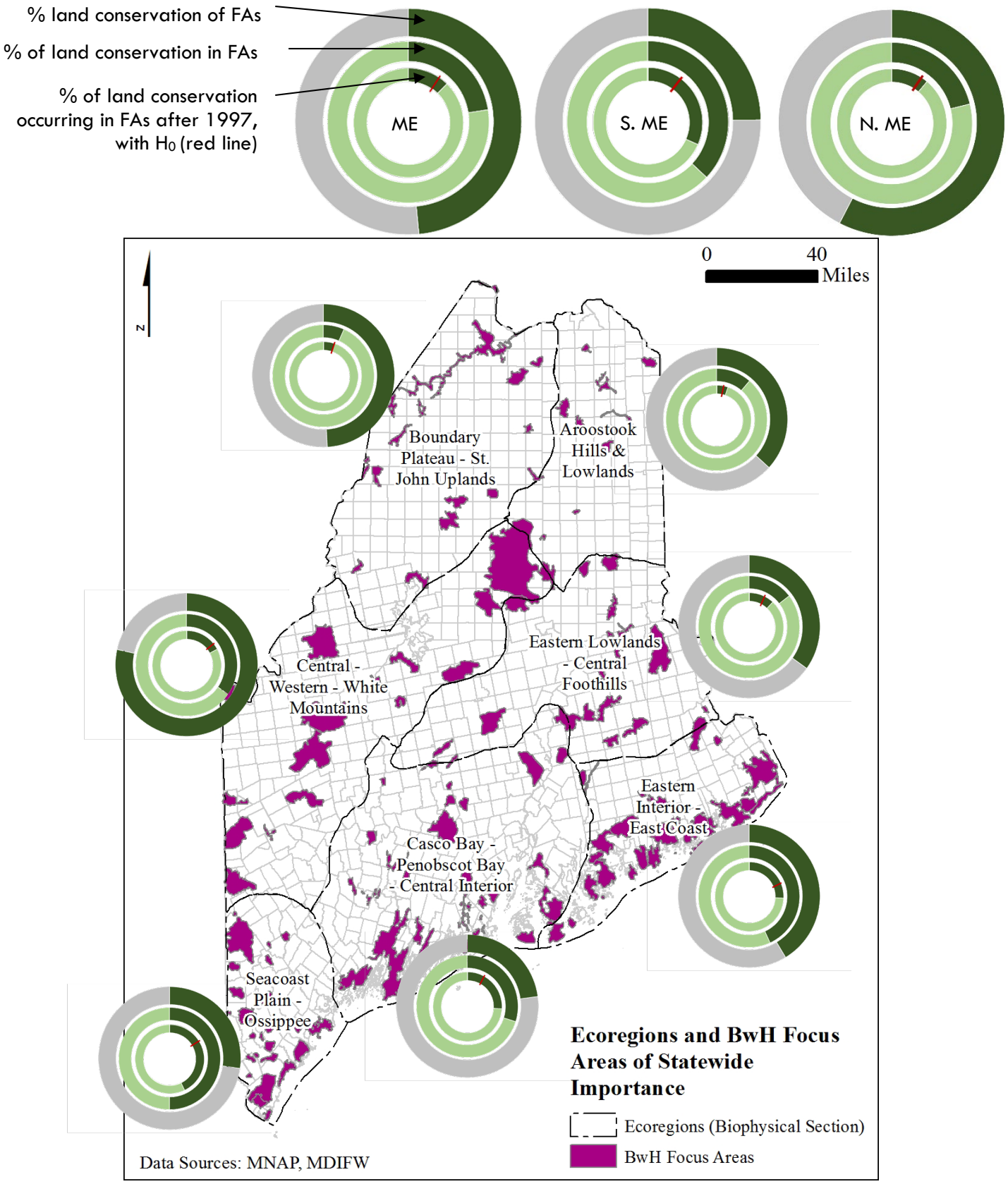


Figure 7. Ecoregions and BwH Focus areas of Statewide importance (FAs), with donut plots describing proportion of FAs conserved (outer), proportion of all conserved lands within that region that are in FAs (middle); and proportion of lands conserved since 1997 that are within focus areas (inner), including a red line indicating the expected proportion if conservation was completely random (H_0)

- Assessments of representation of habitats in conservation land follow methods used by (Schlawin and Cutko 2014) (https://www.maine.gov/dacf/mnap/about/publications/ra.htm) and a new analysis by the Maine Natural Areas Program of exemplary and rare habitats on conservation land (contact the Maine Natural Areas Program for more information).
    - A number of common and rare habitat types are well represented in conserved lands in southern Maine, including:
        - Vernal pools and swamps
        - Peatlands
        - Tidal wetlands
        - Pitch pine – scrub oak barrens and other Pitch pine natural communities
        - Atlantic white cedar swamps
    - High quality examples of all common forest types are poorly represented on conservation lands in southern Maine, especially in ecological reserves.
    - Large blocks of common forest types (regardless of current condition) are also poorly represented in conservation lands in southern Maine, and especially in ecological reserves.
    - No exemplary, high-quality occurrences of Red Oak- Northern Hardwoods- White Pine Forest, a common forest type in southern Maine, are currently known from southern Maine. High quality examples could potentially be restored on lands managed as Ecological Reserves.
    - Northwestern portions of the Casco Bay- Penobscot Bay- Central Interior ecoregion have limited amounts of conservation relative to southern and more coastal portions of the region.
- The Nature Conservancy (Anderson, et al. 2016) has estimated climate resilience across the northeast by integrating metrics describing the landscape's adaptive capacity and landscape condition.
- Using TNC resilience data, the Seacoast- Ossipee and Casco Bay- Penobscot Bay- Central Interior ecoregions have the lowest average estimated resilience to the impacts of climate change of all of Maine's ecoregions. This is mostly because southern Maine is more developed and with poorer habitat connectivity. However, compared to the rest of the broader Northern Applachian Region, which extends from the Adirondacks in New York to the Canadian Maritimes, southern Maine has an average overall estimated resilience to the impacts of climate change.
- Conserved lands in southern Maine have higher estimated resilience to climate change than southern Maine's average for all lands. However, the average acre of conserved lands is not considered highly resilient to the impacts of climate change. Conservation of remaining large blocks of unfragmented forest could maintain resilience of these habitat blocks to impacts of climate change.

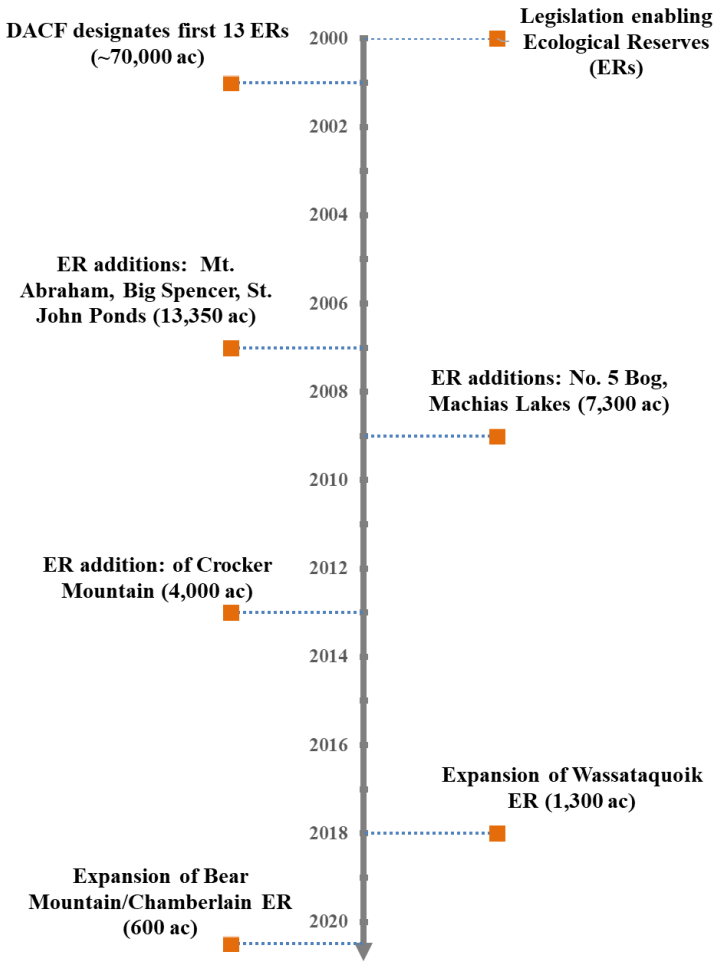
- For information on sea level and coastal connectivity, reference should be made to the Undeveloped Coastline section.
- For information on recreation issues, reference should be made to the Access to Water, Trails, Regional Parks, and Additions and Access to Public Lands sections.

3. ECOLOGICAL RESERVES

LAPAC Language (1997): "Maine is a state of enormous natural variety. A State Planning Office study and follow-up efforts by the Maine Forest Biodiversity Project (a collaborative effort involving State agencies, landowners, scientists, and environmentalists), have documented that Maine's existing conservation ownerships do not protect the full range of Maine's native plants, animals, and natural communities. In order to establish an ecological reserve system that protects all the natural communities and species found in the State, additional lands will need to be acquired to complement existing sites. Special attention should be given to those areas that include rare species, as well as unique or exemplary natural communities. Ecological reserves can serve as benchmarks which will provide important information about changes to our environment. These sites can be used for scientific research, long-term environmental monitoring, education, and in most cases can also provide important outdoor recreation opportunities."

Findings:

- In August 2000 the Maine Legislature passed an Act to Establish Standards and Conditions for Designation of Ecological Reserves on Lands Managed by the Bureau of Parks and Lands (Chapter 592, MSRA Section 13076). Ecological Reserves maintain "one or more natural community types or native ecosystem types in a natural condition and range of variation and contribute to the protection of Maine's biological diversity and are managed:
    - As a benchmark against which biological and environmental change may be measured,



- To protect sufficient habitat for those species whose habitat needs are unlikely to be met on lands managed for other purposes; or
- As a site for ongoing scientific research, long-term environmental monitoring and education."

Definitions for Gap Status are as follows (from the USGS National Gap Analysis Program):

***GAP Status 1**: Permanent protection from conversion of natural land cover and a mandated management plan to maintain a natural state within which disturbance events or are allowed to proceed without interference or are mimicked through management.*

***GAP Status 2**: Permanent protection from conversion of natural land cover and a mandated management plan to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.*

***GAP Status 3**: Permanent protection from conversion of natural land cover for the majority of area. Subject to extractive uses of either broad, low-intensity type (e.g. logging) or localized intense type (e.g.mining).*

***GAP Status 4**: No known public/private institutional mandates/legally recognized easements.*

- Recent studies continue to show that Ecological Reserves and similarly managed lands provide habitat for species requiring mature forest, refugia for species sensitive to disturbance, buffer aquatic habitats to maintain cold water fisheries, and many other important habitat values.
- Following the enabling legislation, Ecological Reserves were established in 13 state public reserve land units, totaling roughly 70,000 acres. In the intervening ~20 years, 6 new units were donated to the Maine public reserve lands system that partly or wholly included Ecological Reserves. These new units total roughly 25,000 acres of Ecological Reserve.

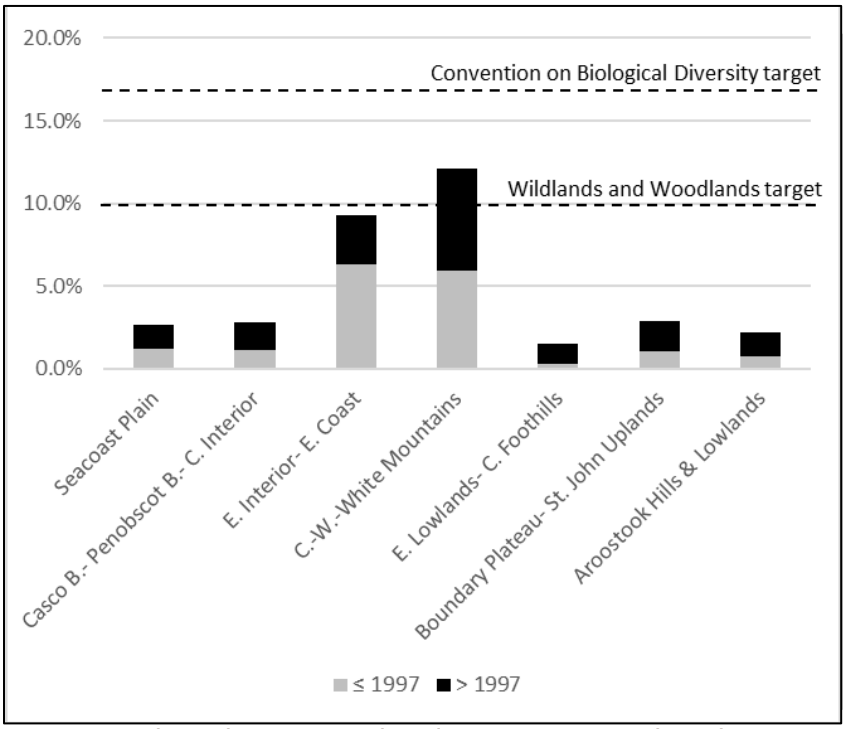


Figure 8. Ecological Reserves and similar conservation with similar management (GAP 1 and GAP 2 status) as percent of ecoregion, acquired before and after 1997, compared with Wildlands and Woodlands and Convention on Biological Diversity conservation targets. GAP 1 and GAP 2 lands include both state Ecological Reserves as well as other private, state, and federal lands that are similarly managed.

- LMF funding contributed to state acquisition of four public reserve lands units that include acreage that was later designated as ecological reserve. These include:
    - Nahmakanta
    - Cutler
    - Tunk Mountain
    - Salmon Brook Lake Bog
- LMF funding also contributed to state acquisition of five public reserve lands units that were donated to the state to be managed as ecological reserves.
    - St. John Ponds
    - Number 5 Bog
    - Crocker Mountain
    - Mt. Abraham
    - Fifth Machias Lake
- While Ecological Reserves provide significant benefits to biodiversity, they also coincide with many of Maine's premier recreation destinations, allowing multi-day remote camping experiences in stunning locations. Ecological Reserve values are enhanced by intact forest landscapes managed for other purposes buffering them.
- Certain lands managed by state agencies other than the Maine Bureau of Parks and Lands, Federal Agencies, as well as private conservation organizations are managed consistently with BPL Ecological Reserves. In these areas timber harvesting and other resource extraction is prohibited. These are coded in Maine's conserved lands GIS layer as either GAP status 1 or GAP status 2. Collectively, these lands will be subsequently referred to as 'reserve management lands'
- Reserve management lands have doubled since 1997 to a total of 950,000 acres or 4.8% of the state.
- No statewide targets for reserve management lands have been set. The Wildlands and Woodlands report of the Harvard Forest has set a target of 10% of New England as 'wildlands', comparable to reserve management. The Convention on Biological Diversity set a global target of 17% conservation for biodiversity by 2020.
- Roughly 100,000 acres of reserve management lands (GAP 1 or 2) were acquired with funding from LMF.

- At 4.8% of Maine's land area, conservation of reserve management lands in Maine is proportionally consistent with other New England states. New Hampshire has the greatest proportion of reserve management lands (USPAD GAP 1 or 2) at 5.7%, and Massachusetts has the lowest at 3.7%. A high percentage of New York State (12.8%) is in reserve management, including the Adirondack State Park (Data source USPAD 2.0).

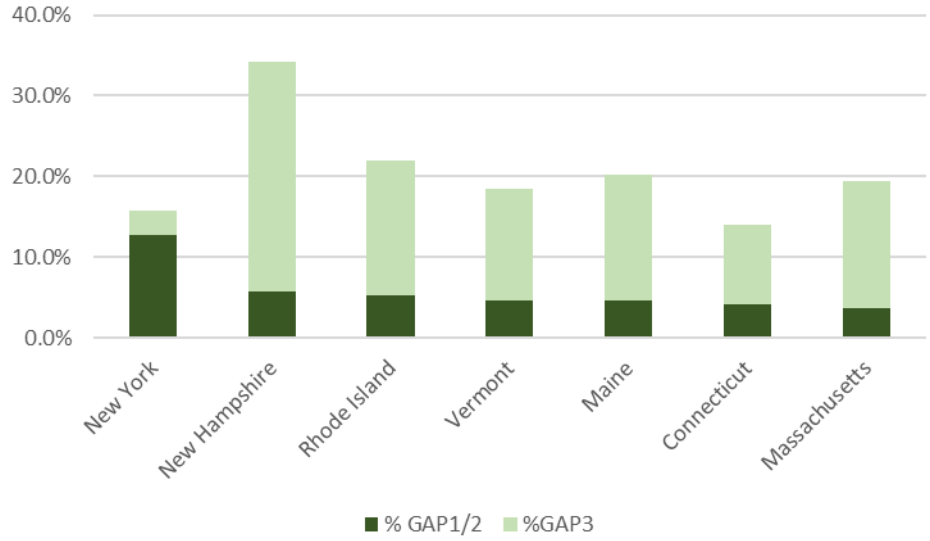


Figure 9. Conservation of northeastern US states by GAP status. GAP 1/2 lands are considered reserve management lands. GAP 3 lands are managed for multiple uses including timber resources. (Source: USPAD 2.0)

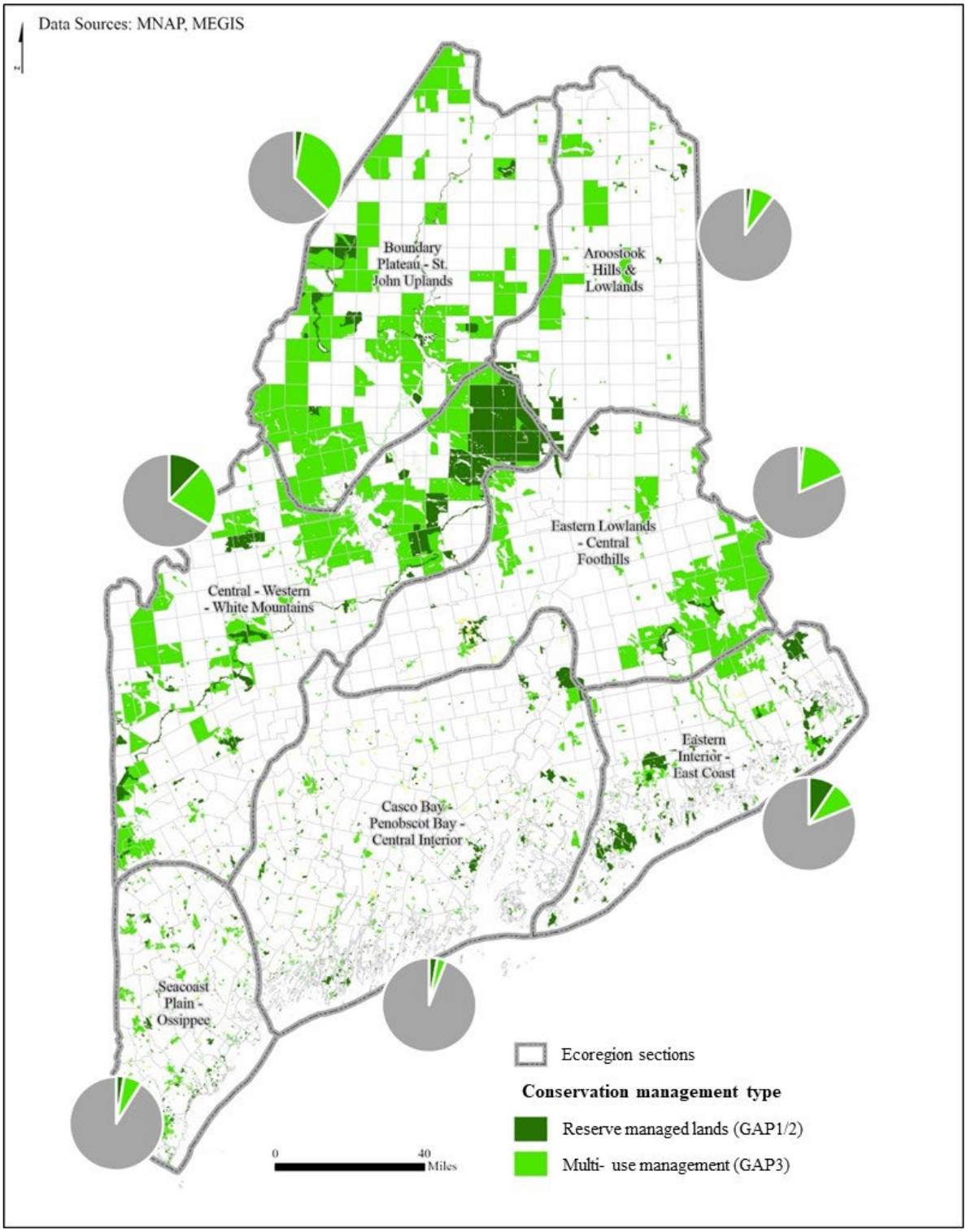


Figure 10. Maine land conservation by management type, and proportion of each ecoregion conserved.

- Emerging results from a new study on Ecological Reserves managed by the Bureau of Parks and Lands and The Nature Conservancy indicates that Ecological Reserves both store and sequester significant amounts of Carbon (Puhlick and Weiskittel 2021):
    - On average, Ecological Reserves store 30% more above ground carbon than Maine's managed forests on a per-acre basis.
    - Ecological Reserves are carbon sinks and are capturing, on average, at least as much carbon as managed forests on a per-acre/per year basis
- Conservation of Ecological Reserves remains a priority.
    - Ecological Reserves are recognized for carbon sequestration potential and contributions to the resilience of Maine forests. Conservation of Ecological Reserves is a key recommendation of the Natural and Working Lands group of the Maine Climate Council.
    - Many forest types are under-represented in reserve type management among Maine's ecoregions.
- The Maine Natural Areas Program has used both habitat occurrence information and landcover data to understand gaps in Maine land conservation.
        - Ecological Systems Landcover data developed by The Nature Conservancy was analyzed to examine representation of habitats within reserve management lands, irrespective of current condition.
        - MNAP natural community data was analyzed to examine representation of *exemplary* forested habitats within reserve management lands.
    - Results vary by ecoregion, but **no ecoregion had adequate representation of all habitat types within reserve management lands**.
        - While reserve management lands capture many high-quality examples of forest types, fewer than 2 high-quality examples of most forest types are conserved within reserve management lands in each ecoregion, a threshold of the Maine Forest Biodiversity project.
        - Representation was best in the Central- Western- White mountains, and the Eastern Interior- East Coast ecoregions, which have higher amounts of reserve management lands.
        - High-elevation habitats are well represented in reserve management lands including:
            - 31% of area above 2700'
            - 25% of mapped cliff/talus habitat
            - ~75% of subalpine fir forest
        - Emergent wetlands are well represented in reserve management lands including:
            - 20% of tidal marshes
            - 20% of coastal peatland systems

        - >10% of interior peatland systems
    - **Lower elevation forest types are under- represented within reserve management lands in several ecoregions, regardless of condition,** including:
        - Northern hardwoods forest in low elevation settings (i.e. outside the Central-Western and White Mountains ecoregion)
        - Northern white cedar swamps in northern Maine
        - Lower elevation forest types including oak- pine forest, oak- northern hardwoods forest, and hemlock forest in the Central, Western and White Mountains,
        - Spruce flats in the eastern lowlands- central foothills ecoregion
        - All common forest types in the Seacoast Plain- Ossipee ecoregion.
- There are several forest types for which high quality examples are *unknown* from ecoregions in which these types occur, **and** for which fair to poor condition examples are also under-represented in reserve management lands. This is significant because there is little opportunity for examples of these forest types to recover from past land-use practices. These include:
    - Oak- northern hardwoods- white pine forest in the Seacoast Plain- Ossipee and Casco Bay- Penobscot Bay- Central Interior ecoregion
    - Spruce flats in the Eastern Lowlands- Central Foothills region.
- **High quality examples of forested natural communities associated with moderately calcareous to calcareous settings are poorly captured within reserve management lands.** This is consistent with (Anderson, et al. 2016)who found that low elevation calcareous and moderately calcareous settings were under-represented in conservation land in Maine. These types include:
    - Northern white cedar swamp
    - Cedar- spruce seepage forest
    - Beech- birch maple forest
    - Maple- basswood- ash forest
    - Hardwood river terrace forest, and
    - Silver maple floodplain forest

- Reserve management of freshwater shoreline is higher than for other terrestrial habitats, especially among rivers and lakes. This is partly driven by large conservation ownerships, such as the Allagash Wilderness Waterway, Machias River conservation lands, and Baxter State Park and other large conservation projects.

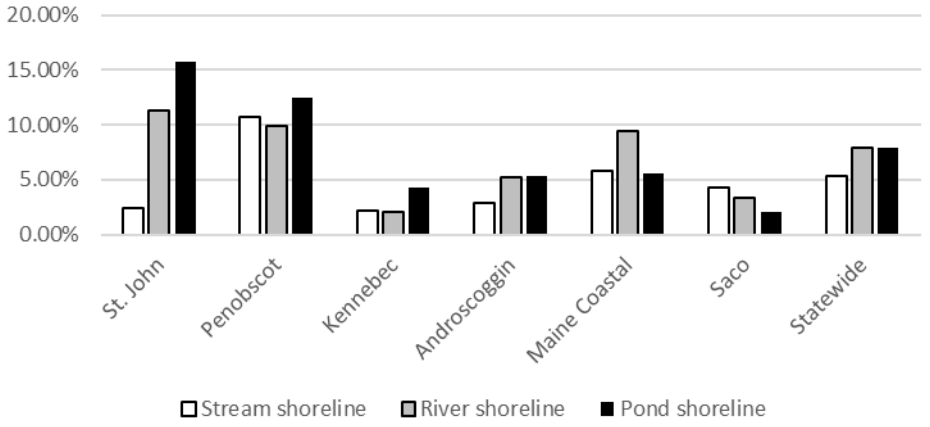


Figure 11. Percent reserve management (GAP 1 and 2) conservation of freshwater shoreline among Maine's HUC 4 watersheds, separated by waterbody type.

- Maine has 633 heritage fish waters. These ponds and lakes contain among the best cold-water pond habitat in the state, and are managed for wild populations of brook trout and arctic char. For the purposes of this assessment, heritage fish waters are considered completely conserved if ≥ 90% of the 250' buffer to their shoreline is in reserve management. Roughly 21% of heritage fish waters are completely conserved in reserve type management.

Key takeaways:

- Over the last 20 years, the area of Ecological Reserves and similarly managed lands (reserve management lands) has doubled to include 4.8% of Maine's land area, including lands managed by federal and state agencies and private organizations.
- Conservation of Ecological Reserves remains a priority and is a key recommendation of the Working Lands and Waters Work Group of the Maine's Climate Action Council.
- While Ecological Reserves and similarly managed lands (reserve management lands) include examples of most habitats in Maine, habitat gaps in Maine's network of reserve management lands still exist all Maine ecoregions. New Ecological Reserves targeting large blocks of forest in southern Maine, and northern hardwoods forest and cedar swamps in northern Maine could help fill gaps in Maine's network of reserve management lands.

4. RIVER SYSTEMS

LAPAC Language (1997): "Maine possesses some of the finest river systems in the Eastern United States, many of which remain largely undeveloped. These rivers are important fisheries, possess critical riparian habitat, and provide unparalleled outdoor recreation opportunities. Future acquisition efforts should protect extended corridors on the state's most valued river systems."

Findings:

For the purposes of this report, land conservation of all freshwater shoreline including streams, rivers, ponds and lakes are addressed in this section of the report. For information on water access and recreation, reference the Water Access section of this report.

Streams and Rivers

Small, Upper- Watershed and Headwater Streams

- A focus has been placed on headwater streams and small creeks in the uppermost portions of Maine's watersheds because of their importance for cold water aquatic habitat. These streams are the most likely places within a watershed to retain cold water fisheries following different projections of climate change. The Nature Conservancy's Aquatic Habitat Classification System was used to identify these streams, defined as 'Size Class 1' in the classification scheme with upstream watersheds of <30 square miles.
- Maine has 8,242 miles of headwater streams. Headwater streams are defined in NHD Plus data as 'network starts'. These are the first segments of perennial streams at the top of flow networks.
- 1,847 miles of headwater streams (or 22.4%) occur in conservation lands, with the highest level of conservation in the Androscoggin, Kennebec and Penobscot River Watersheds, at the HUC 4 scale. The lowest level of Maine headwater stream conservation is in the Saco River Watershed (12.6%), which at the HUC 4 scale includes the drainages of the Saco, Presumpscot/Sebago Lake, Mousam, and Salmon Falls Rivers.
- 109 LMF projects have protected 318 miles of perennial headwater streams.

Streams and River Shoreline

- For the purposes of this assessment, perennial streams are defined as streams depicted in the NHD flowline dataset by a linear path and not also depicted as NHD area features. Rivers are defined as streams and rivers depicted in the NHD flowline dataset as 'artificial path' features and are also depicted as NHD Area features.
- For the purposes of this assessment, stream and river shoreline is defined as follows:

- Stream shoreline is the area buffering perennial streams by 75' on either side, for a maximum width of 150'. The data source for perennial streams is NHD flowline data.
- River shoreline is the area buffering a river by 250' from either bank. The data source for rivers is NHD Area.

- Conservation of stream banks is proportional to conservation statewide. The highest levels of conservation are within the Penobscot River watershed. The headwaters of the Penobscot River Watershed include several large areas of conserved lands, including Baxter State Park.
- Conservation of rivers is also proportional to conservation statewide. The highest levels of conservation are among Maine's Down East rivers (HUC4 Maine Coastal watershed), including the Machias River and tributaries to the St. Croix River. High levels of conservation also occur in the St. John and Penobscot River watersheds. This includes conservation along the Allagash, the St. John, and the East and West Branch Penobscot Rivers.
- The lowest level of stream and riverbank conservation among Maine watersheds is within the Maine portion of the Saco River Watershed (HUC 4). This includes the Saco River and its tributaries, as well as other smaller coastal rivers from Kittery through eastern Casco Bay.
- Large portions of the Saco and Androscoggin watersheds are within New Hampshire including conservation within the White Mountains National Forest. Most of the St. John River watershed is within New Brunswick.
- Of Maine's larger river watersheds, the Kennebec and Penobscot drainages are fully within Maine. Lower levels of conservation buffering portions of the Kennebec River are notable.

Table 1. Percent conservation of stream shoreline, by conservation type and by watershed. Total stream length in miles for Maine portions of these watersheds is provided for context. GAP12 refers to ecological reserves or similarly managed lands. GAP123 includes all conserved lands.

Watershed	% GAP12	% GAP123	Length Miles (ME)
St. John	2.4%	19.5%	6,399
Penobscot	10.7%	26.7%	8,101
Kennebec	2.1%	20.2%	5,867
Androscoggin	2.8%	17.3%	2,393
Maine Coastal	5.8%	22.8%	4,929
Saco	4.3%	13.3%	3,229
Statewide	5.3%	21.2%	30,918

Table 2 Percent conservation of river shoreline, by conservation type and by watershed. Total river length in miles for Maine portions of these watersheds is provided for context. GAP12 refers to ecological reserves or similarly managed lands. GAP123 includes all conserved lands.

Watershed name	% GAP12	% GAP123	River Miles (ME)
St. John	11.3%	23.6%	1,087
Penobscot	9.9%	23.5%	1,632
Kennebec	2.1%	13.2%	998
Androscoggin	5.2%	13.6%	571
Maine Coastal	9.4%	34.0%	986
Saco	3.4%	12.3%	496
Statewide	7.9%	21.6%	5,770

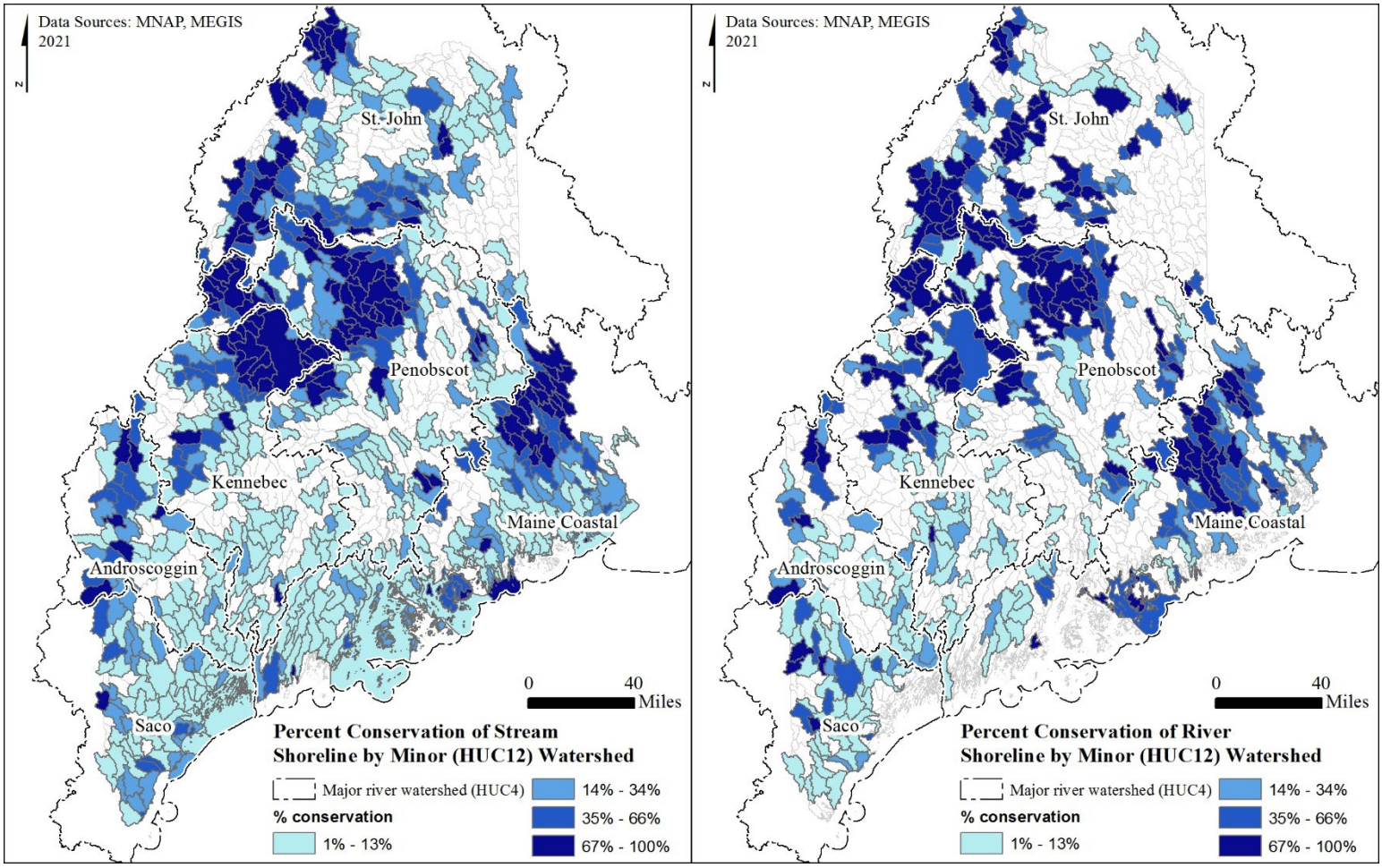


Figure 12. Percent conservation of stream shoreline (left) and river shoreline (right) by minor (HUC12) watershed. GAP status 1, 2 and 3, lands are considered conserved for the purposes of this assessment.

- The Maine Stream Habitat Viewer is a go-to resource to address impacts to stream connectivity and opportunities for restoration. Maine has among the most comprehensive stream surveys for connectivity in the country.

Pond and lake shoreline

- For the purposes of this assessment, pond and lake shoreline is defined as a 250' buffer area to ponds and lakes.
- Conservation of pond and lake shoreline is higher than statewide conservation averages. Nearly 8% of Maine's pond and lake shoreline is within Ecological Reserves or similarly managed lands (GAP12). For comparison, 4.6% of the state is in Ecological Reserves or similarly managed lands. Similarly, nearly 29% of pond and lake shoreline is captured when working forest easements and other multi-use conservation are included. For comparison, ~21% of Maine is in some form of conservation (GAP123)
- Conservation is greatest among ponds and lakes in the Penobscot River watershed, where large ponds and lakes in the watershed's headwaters intersect with large areas of conservation. Nearly 40% of pond and lake shoreline is in conservation. Similar patterns occur within the Kennebec River watershed.
- Conservation is lowest among pond and lake shoreline within the Saco River watershed (10%) and is roughly proportional to all conserved lands within that watershed.
- TNC has produced a pond and lake classification scheme based on temperature, trophic level, and acidity. Conservation can benefit oligotrophic ponds to maintain these habitats. Stratifying by this classification, we examined how many ponds had complete (>90%) shoreline conservation in each of Maine's major watersheds. A complete table of complete pond conservation is included in Appendix II.

Table 3. Percent conservation of pond and lake shoreline, by watershed and conservation type. GAP12 refers to ecological reserves or similarly managed lands. GAP123 includes all conserved lands.

Watershed name	%GAP12	%GAP123
St. John	15.8%	31.1%
Penobscot	12.4%	39.2%
Kennebec	4.2%	29.6%
Androscoggin	5.3%	21.9%
Maine Coastal	5.6%	24.3%
Saco	2.1%	10.1%
Statewide	7.9%	28.7%

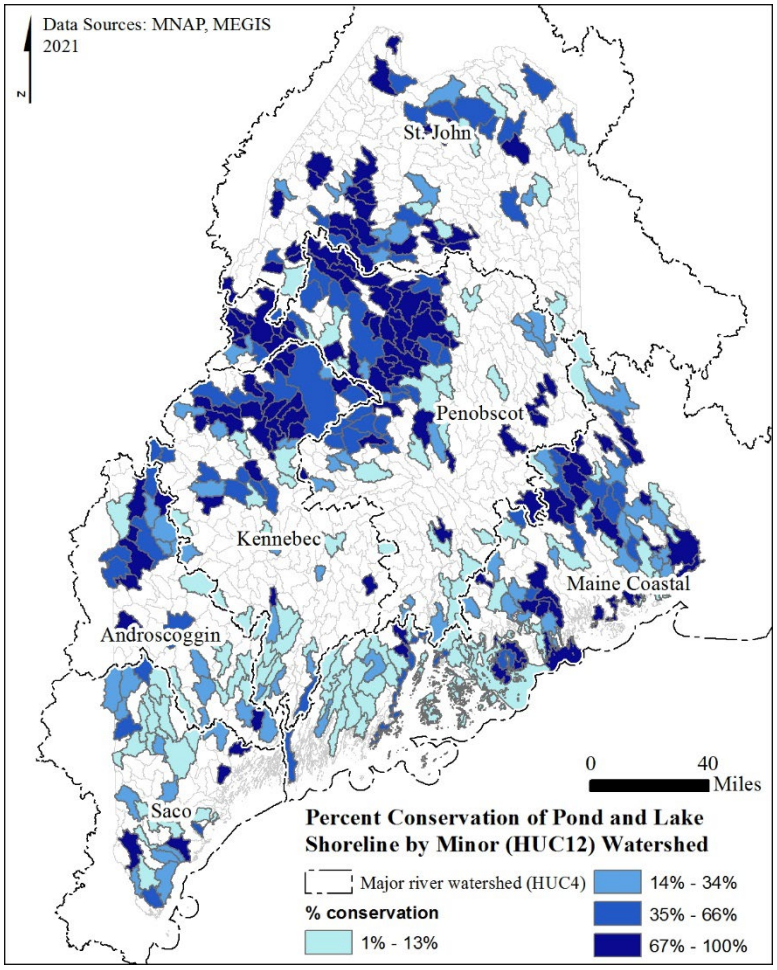


Figure 13. Percent conservation of pond and lake shoreline, by minor (HUC 12) watershed. GAP status 1, 2 and 3, lands are considered conserved for the purposes of this assessment.

- The greatest number with complete conservation are in the Penobscot and Maine Coastal watersheds are completely conserved both in GAP12 lands and GAP123 lands.
- The largest pond or lake with a shoreline that is completely conserved in either GAP12 or GAP123 lands is Chamberlain Lake in the Allagash Wilderness Waterway (~11,000 ac).
- Most ponds with complete conservation are cold water, acidic, oligotrophic ponds.

Table 4. Number and percent of ponds completely conserved (>90% shoreline conservation) in Maine by HUC4 watershed. GAP12 includes ecological reserves or similarly managed lands. GAP123 includes all conserved lands.

Watershed (HUC4)	# GAP12 (%)	# GAP123 (%)
Androscoggin	5 (1.3)	40 (11.0)
Kennebec	7 (0.6)	125 (12.4)
Maine Coastal	90 (7.4)	184 (15.3)
Penobscot	211 (14.2)	368 (24.8)
Saco	3 (0.4)	34 (5.0)
St. John	25 (3.5)	96 (13.7)

- There is minimal conservation of alkaline and circumneutral ponds, which are rare in Maine. Adjacent land to many, of these ponds includes development and agricultural use impacting water quality and conservation values. Alkaline and circumneutral ponds contain many rare plant species and contribute importantly to the state's biodiversity. Conservation of alkaline and circumneutral ponds would buffer these from adjacent land

Cold water

- Conservation has been identified as an important tool for maintaining cold water fisheries, which are vulnerable to shoreline disturbance.

Table 5. Number of heritage fish waters completely conserved by watershed and conservation type (left), and percent shoreline conservation of MDIFW-TNC priority freshwater fisheries (right). GAP12 includes ecological reserves or similarly managed lands. GAP123 includes all conserved lands.

Watershed name	# GAP12	# GAP123	# Total
St. John	16	37	127
Penobscot	92	149	260
Kennebec	2	45	131
Androscoggin	1	14	42
Maine Coastal	1	8	20
Saco	0	3	4
Statewide	112	256	584

Watershed	%GAP12	%GAP123
St. John	2.0%	19.0%
Penobscot	13.4%	45.2%
Kennebec	2.5%	27.1%
Androscoggin	3.5%	22.8%
Maine Coastal	7.3%	24.2%
Saco	2.7%	16.3%
Statewide	5.8%	27.1%

- MDIFW and TNC have developed a new dataset of cold-water stream priorities for conservation. Patterns of conservation in cold water stream shoreline priorities match trends for stream shoreline conservation in general
- Maine has 584 heritage fish waters. These ponds and lakes contain among the best cold-water pond habitat in the state, and are managed for wild populations of brook trout and arctic char. For the purposes of this assessment, heritage fish waters are considered completely conserved if ≥ 90% of the 250' buffer to their shoreline is in conservation. Roughly 44% of heritage fish waters are completely conserved, and 19% of heritage fish waters are completely conserved in Ecological Reserves or similarly managed lands.
- The Penobscot Watershed contains roughly half of Maine's heritage fish waters and 62% of conserved heritage fish waters.
- Additional resources modeling stream temperature and brook trout occupancy are being developed regionally and will be helpful for targeting cold water stream refugia (ecosheds.org).

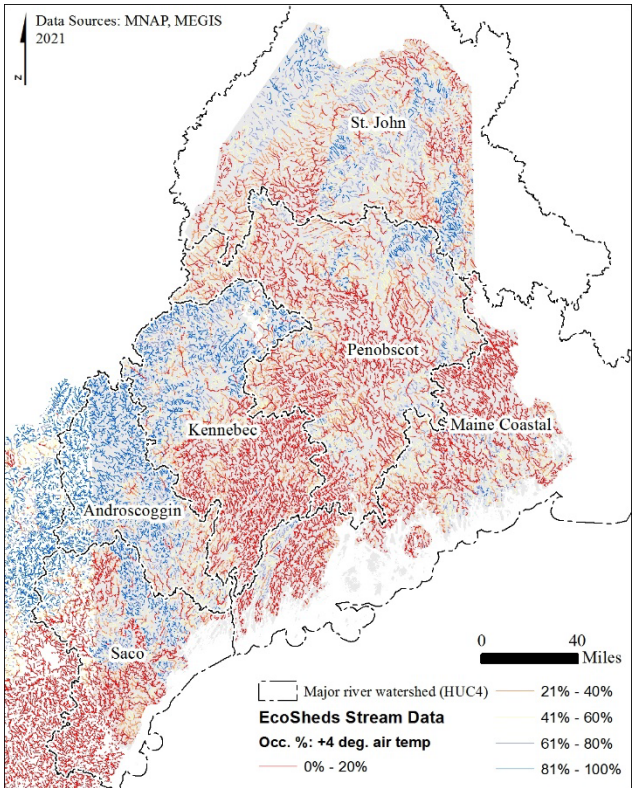


Figure 14. EcoSheds modeled brook trout occupancy stream data, following a 4 degree increase in mean summer air temperature.

Conclusions:

- There is a high degree of conservation of the shoreline for headwater streams and lakes in Maine's largest watersheds. These have a higher capacity to maintain cold water fisheries than other water bodies and may be more resilient to climate change.

- Stream, river, and pond/lake shoreline conservation can continue to benefit water quality and habitat for aquatic organisms.

5. UNDEVELOPED COASTLINE

LAPAC Language (1997): "Maine is famous for its coastline. However, only a small percentage of the coast is in public ownership. In particular, there are significant undeveloped stretches of shore, including coastal wetlands and estuaries, that provide critical habitat to many species of wildlife and offer opportunities for expanded coastal recreation. It is important to take advantage of remaining opportunities before large ownerships become fragmented."

Note: Analyses examining relative conservation of Maine's coastline was assessed in three ways 1) percentage of coastline captured within conserved lands, 2) Conservation status of a 250 foot coastline buffer, and 3) percent conservation land within coastal towns. Information about recreational access along the coastline, including beaches, is contained in the Access to Water section.

Findings:

- 13.4% of land within a 250' buffer of the coast is developed, a threshold used in shoreland zoning. Shoreland zoning regulations have limited development in this buffer zone in recent years. According to NLCD landcover data, between 2001-2016, less than 200 acres of land within 250' of Maine's coastline have converted from natural landcover classes to developed classes (< 0.25% of this area). Much of Maine's new development since 1997 has been an intensification of development within low-density developed areas that are much more difficult to quantify but do significantly alter the character of the Maine coast.
- Portions of Maine's coastal towns are being developed at a high rate compared to the rest of the state. According to NLCD 2001-2016 data, 8,875 acres within coastal towns have been developed over this time period. Development in coastal towns accounts for nearly 50% of all development that occurred in Maine between 2001-2016.
- 24% of Maine's coastline length is in permanent land conservation. Similarly, there is 23% conservation within the first 250' of upland buffering Maine's coast.
- LMF has funded 91 projects that conserve and provide access to nearly 90 miles of Maine coastline.
- Coastal land conservation is proportional among rocky coastline and estuarine wetland habitats.

- Conservation is greatest in southern Maine and Down East. Coastal portions of Midcoast have more limited land protection, especially areas on the west side of Penobscot Bay. Water access data indicates that there are also gaps in coastal access in these areas.
- Conservation of interior portions of coastal Maine towns is lower than along the coastline. 12.2% of coastal towns are conserved.
- Beginning with Habitat (BwH) Focus Areas are natural areas of statewide ecological significance that contain concentrations of at-risk species and habitats. Roughly 28% of the land area of coastal Focus Areas of Statewide Significance are conserved. The highest levels of conservation are within Focus Areas that include islands between Penobscot Bay and Frenchman's Bay. These are areas with considerable federal conservation land.

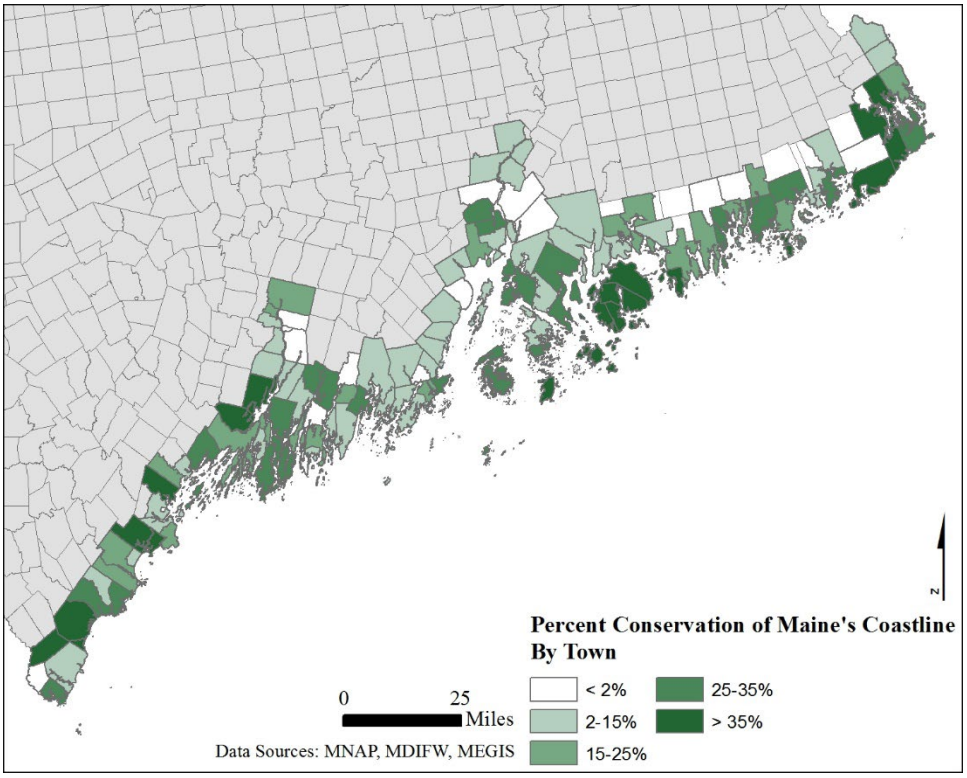


Figure 15. Percent Conservation of Maine's Coastline by Town

- Sea level rise is a major threat to tidal habitats. Recent reports suggest that 89% of the predicted tide levels for Maine in 2019 were exceeded, and October 2019 had the highest historical mean tide for any October (Maine Geological Survey). Catastrophic loss of salt marsh could occur if sea level rise is out of balance with sediment accretion rates, which would enable the marsh surface to "keep up" with rising water. In the absence of increasing marsh elevation, marshes must be able to move inland (migrate) to keep pace with rising seas. Adding to the concern, while coastal marshes have the ability to sequester a disproportionately higher amount of carbon dioxide compared to terrestrial systems (Mcleod, et al. 2011), sea level rise and barriers to tidal exchange threaten both sequestration and storage rates. Catastrophic loss of salt marsh could occur if sea level rise is out of balance with sediment accretion rates. One possible conservation action to contribute to the resiliency of estuarine systems is to maintain marsh migration areas in natural cover. These are areas that are not currently tidal, but which could become tidal following various sea level rise scenarios.

- Given the LAPAC priority on coastal systems and current concerns about habitat connectivity, biodiversity, and ecosystem health and resiliency, the identification of tidal restrictions is valuable data towards finding restoration opportunities that will benefit whole systems. The Maine Coastal Program's Tidal Barrier Atlas project has evaluated 1040 crossings of tidal waterways to include dams, roads, and other potential barriers and classified them as restriction, non-restriction, or "unknown" (Moore, pers. com. 2021). Of these, 90% were restrictions to tidal flow (100% of dams, 90% of roads, 87% of tidal "other" crossings). These tidal barriers are likely to increase in number and severity with sea level rise unless restored.
- Over the next 100 years, it is likely that we will see between 1.2' and 6.1' of sea level rise in Maine. The Maine Climate Council recently recommended that the state consider "committing to manage" for 1.5 ft. of relative sea level rise by 2050, and 3.9 feet of sea level rise by 2100. This recommendation also urges the state to "prepare to manage" for 3.0 ft. of relative sea level rise by 2050 and 8.8 feet by 2100 (relative to 2020 levels). Maine's future tidal marshes are likely to be in existing estuaries, and the future arrangement of tidal marshes is likely to include the space currently occupied by tidal marshes and newly flooded areas (depending on rates of sea level rise and sediment accretion).
- Maine currently has approximately 22,000 acres of tidal marshes, including 17,700 acres of salt and brackish marsh and 4,300 acres of freshwater tidal marsh. With 6.1' of sea level rise, newly tidal areas in estuaries is roughly equivalent (21,000 acres) to the area of current tidal marshes. It is unknown to what extent this newly tidal area could support tidal marshes.
- Approximately 2,500 (12%) acres of this migration space is currently developed.
- Statewide, approximately 26% of this potential marsh migration space (new tidal areas to 6.1' SLR) is conserved. Among estuaries supporting salt marshes, the highest amount of conservation of this marsh migration space is in the region between Penobscot Bay and Frenchman's Bay (40%). East of Frenchman's Bay had the lowest level of conservation (12%) within the marsh migration space. This is because many of the larger marsh migration areas between the Narraguagus River and Jonesport are not captured in conservation lands. Conservation of marsh migration space in southern Maine (23%), Casco Bay (20%), and Midcoast (27%) was intermediate. Among freshwater tidal systems, conservation of marsh migration areas in Merrymeeting Bay and Tributaries was moderately high (30%).
- Gaps in the percent of coastal conservation and conservation of marsh migration space differ because Maine's marsh migration space is concentrated within specific estuaries. Priorities for coastal conservation emphasizing ecological values should focus on maintaining the ecological condition of Maine's current coastline and contributing to resilience of Maine's tidal marshes.

6. NORTHERN FORESTS

LAPAC Language (1997): "The expanse of undeveloped forest, rivers, lakes, mountains and wetlands that comprise the north woods of Maine is truly unique, providing a sense of wildness and remoteness that is becoming increasingly rare in today's world. It is the part of the State where the majority of public ownership currently exists, and yet many of the region's finest natural treasures and recreational lands have been maintained in private ownership. Some of these areas, most notably the shorelines of lakes and ponds, are coming under increasing development pressures. The future of the north woods is the subject of great public interest that will likely increase in the years to come. Several large-scale acquisition proposals put forward by conservation groups have precipitated a debate over the appropriate role for public land acquisition in the northern forest. The State has both the opportunity, and the responsibility, to work cooperatively with forest landowners and other interests to develop workable acquisition models that protect the economic, ecological and recreational values of this region. Conservation easements should play an important role in this effort. In the near term, acquisition efforts in the northern forest should focus on those lands that possess a high concentration of wildlife, recreation, and scenic values and are most threatened with fragmentation and development. Planning efforts coordinated by LMFB should seek to identify these priorities and to develop successful acquisition strategies that could then be utilized in these areas and elsewhere. If large northern forest tracts come on to the market, LMFB should evaluate both the threat and opportunity presented by the land sale, and respond accordingly. The conservation goal for Northern Forest Conservation Lands should be to maintain their natural character, preserve public recreation opportunities, protect important habitat, and manage timber resources in a sustainable manner. To acquire, even conservation easements, over large tracts of northern forest land will likely require federal funding assistance. The Forest Legacy program is well suited to Maine's working forest landscape and allows for state control over acquisition projects. This program, and other appropriate federal funding opportunities, should be actively pursued to achieve the state's northern forest goals."

Findings:

Note: For the purposes of this assessment, "northern Maine" is defined as the northern and eastern five ecoregions of Maine (Central- Western- White Mountains, Eastern Interior- East Coast, Boundary Plateau- St. John Uplands, Aroostook Hills & Lowlands, and the Eastern Lowlands- Central foothills, see Figure 7 for locations).

- Land conversion to development has been low across most of northern Maine over the last 20 years, with some notable exceptions.
    - The last two decades have been a period of slow population growth in Maine, with approximately 60,000 new residents in Maine in 2018 compared to 2000 (5% growth in population). During this period Maine's population growth has been concentrated in York and Cumberland Counties, while other counties saw declines in population. Population growth rates were much greater from the period of 1970-2000. In that time, Maine's population increased by 280,000 people (28% growth in population), with the greatest gains in population during the decade of 1970 -1980 (131,000 residents and 13% growth). Patterns of land conversion to development follow population trends.
    - The National Landcover Dataset (NLCD), a spatial resource published by the United States Geological Survey every five years, can be used to calculate current land-use and changes in land-use over time. According to NLCD data, roughly 4,300 acres were converted to residential, commercial, industrial and urban development in northern Maine ecoregions between 2001 and 2016, or 0.03% of the land area in northern Maine. This does not include the footprint of new logging roads.
    - The greatest source of land conversion to other land use types in FIA (forest inventory and analysis) plots administered by the Maine Forest Service were to right-of-way (improved road, railway, powerline). However, area estimates based on these plots have considerable error.
    - Future land use practices may or may not reflect patterns of the last 20 years, which included renewable energy development, roading, and expanding urban and town centers.
    - Significant changes have been occurring over the last 20 years in industrial forest ownership, influencing the type and intent of management for those lands. This change in ownership affects development potential, forest management practices, and conservation opportunities.
- Land conservation nearly quadrupled in northern Maine since 1997, with many large additions of working forest easements and working forest fee conservation lands. There are 3,850,000 acres in some kind of conservation in northern Maine, which is over 26% of the region. While Maine does not have absolute targets for the percentage of the landscape in conservation, the Harvard Forest in its 'Wildlands and Woodlands' report advocates securing 70% of the landscape under working forest easements or fee conservation, and 10% of the landscape as ecological reserves or similarly managed lands across all of New England. Given that Maine has the greatest extent of unfragmented forest in New England, the report authors expected that Maine would need to have a higher percentage of conservation to meet these targets. See Ecological Reserve section for further breakdown of conservation land by GAP status.

- Significantly more land is conserved in conservation easements in northern Maine than in fee conservation. Terms of easements vary, and conservation goals and allowed uses vary by easement (Table 1).
- Roughly 570,000 acres or 15% of conserved land area in northern Maine has been in projects that have included LMF funding. Most of that area (~516,000 acres) has been conserved since 1997.
- Conserved lands in northern Maine coincide overwhelmingly with biodiversity hotspots within the region. However, recent conservation in northern Maine has focused on landscape scale projects at the township or multiple township level and has not targeted biodiversity hotspots. While recent conservation efforts have included many occurrences of rare and at-risk species and habitats, they also have not favored biodiversity hotspots (Focus Areas).
    - Beginning with Habitat (BwH) Focus Areas are natural areas of statewide ecological significance that contain concentrations of at-risk species and habitats.
    - 58% of the land area within Focus Areas of Statewide Significance in northern Maine is protected by land conservation (compared to 26% of the ecoregions as a whole).
    - Although Focus Areas only include 9.6% of the total land area of northern Maine, 21% of northern Maine conserved lands are within Focus Areas of Statewide Significance. This is largely because many focus areas in northern Maine included conserved lands when they were designated.
    - 11% of new land conservation in northern Maine since 1997 has been in Focus Areas, which is only slightly greater than what would be expected for conservation of Focus Areas in northern Maine if patterns of conservation were randomized.
- Most forested habitats are proportionately represented within working forest conservation lands. However, most low elevation forest habitats are under-represented in ecological reserves or similarly managed lands that are set aside from timber harvesting. There are less than 2 high quality examples of most low elevation forest types within ecological reserves or similarly managed lands, a threshold for redundancy identified by the Maine Forest Biodiversity Project.
- Additions to ecological reserves in northern Maine that could address these gaps would include:
    - Forested habitats of low elevation calcareous or moderately calcareous settings:
        - Northern hardwoods forest
        - Northern white cedar swamp
    - Other low elevation forested habitats including
        - Spruce-fir flats in the Eastern Lowlands- Central Foothills ecoregion
        - Hemlock, oak, and pine forests in the Central, Western and White Mountains.

- Maine's forests and certain conservation lands are emerging as important resources for meeting Maine's carbon sequestration and storage goals. Emerging results from a new study on Ecological Reserves managed by the Bureau of Parks and Lands and The Nature Conservancy indicates that Ecological Reserves both store and sequester significant amounts of Carbon (Puhlick and Weiskittel 2021):
    - On average, Ecological Reserves store 30% more above ground carbon than Maine's managed forests on a per-acre basis.
    - Ecological Reserves are carbon sinks and are capturing, on average, at least as much carbon as managed forests on a per-acre/per year basis.
- Northern forests play a key role in both mitigation and buffering Maine from the impacts of climate change. Northern forests are an important factor in the recommendation of the Maine Climate Council. Northern forests:
    - Will be important for meeting statewide goals for carbon sequestration
    - Have above-average estimated resilience and the ability to adapt to a changing climate (based on models from The Nature Conservancy). These benefit both biodiversity and the timber products industry.
- The basis for TNC's climate resiliency analysis is adequate conservation of 'nature's stage', or combinations of soils, landscape position, latitude, and elevation called "Geophysical Settings" that are the drivers of biodiversity. Conservation of all the parts of 'nature's stage' and the connections between these parts will ensure the best opportunities for species to both persist or to transition to new habitats. The 'Low elevation calcareous' Geophysical Setting has been identified as being under-represented in northern Maine conservation lands and could be a key target for conservation.
- Conservation easement lands play an important role in permanently securing connections between Focus Areas and other significant areas for biodiversity.
- For information on recreation issues, reference should be made to Access to Water, Trails, Regional Parks, and Additions and Access to Public Lands sections.

Nexus with Maine Land Conservation task force recommendations (2019)

Task Force Recommendation 5: Target land conservation efforts to effectively protect critical natural resources and help Maine combat and adapt to a changing climate.

Action Item 5.C: Place priority on utilizing available wildlife, aquatic and ecological assessment data to help increase conservation of land and water resources in areas of high biodiversity, seeking representation of all habitat types in each biophysical region of the state.

Multiple analyses (including LAPAC) found that Low elevation calcareous and moderately calcareous habitats are under-represented in conservation lands, especially ecological reserves or similarly managed lands. An emphasis on conservation of habitats and Geophysical Settings that are poorly represented in existing conservation lands will help protect areas of high biodiversity as well as work towards representation of all habitat types in each biophysical region in the state. In addition to ecological reserves or similarly managed lands, working forest conservation can ensure important habitats are connected in perpetuity.

7. MUNICIPAL AND URBAN OPEN SPACE

LAPAC Language (1997): "As Maine communities continue to grow, local open space lands are increasingly being developed or closed off to public use. To maintain the quality of life in our towns and cities, it will be important to expand efforts to protect local open space resources including greenways, neighborhood parks, town commons, beaches, town forests, wetlands, and wildlife habitat. Productive agricultural lands in proximity to growing residential areas are particularly at risk. Growing concern over development sprawl has prompted state and local governments to search for effective means to encourage growth in appropriate locations while better protecting valued resources. Land acquisition is an important tool in community efforts to address sprawl and preserve the character of a community. Several southern Maine municipalities have recently initiated land acquisition programs. It is likely that many more towns and cities would follow suit if matching funds were available from the State"

Findings:

- The main questions regarding municipal and open space contributions to public access, or habitat and open space protection cannot be addressed using the current inventory of municipal lands data. Conducting a more thorough inventory of municipal and urban open space is an existing, important goal of conserved land data managers.
- Many towns have municipal lands with conservation values. Towns acquire land through different mechanisms, and some have been identified as having potential habitat or recreation-related conservation values but currently do not have a permanent conservation status.
- There are 16 LMF water access projects held and managed by municipalities and 14 Conservation and Recreation projects held by municipalities.
- Priorities identified by SCORP (State Comprehensive Outdoor Recreation Plan) survey respondents included recreation areas close to population centers.
- Additionally, SCORP survey respondents overwhelmingly said they visited a municipal park or open space within the past three years.

8. TRAIL SYSTEMS

LAPAC Language (1997): "A number of trail development efforts in Maine--including the State snowmobile trail network, the Appalachian Trail, and the recently established island trail network--have proven very successful. However, there are additional recreational trail needs and opportunities that require attention including the development of extended loop hiking trails (2-5 days), as well as the creation of extended interconnected multi-use trail systems for uses such as hiking, biking, skiing, and snowmobiling and ATV riding. In particular, acquisition efforts should focus on opportunities to link existing public land holdings by trail corridors and to acquire ready-made trail corridors such as abandoned railroad beds. Additionally, expanded inland and coastal water trail systems are needed to accommodate small boat use."

Motorized, multi-use trails

Findings:

- There are 12,491 miles of snowmobile trails in Maine
- 1,972 miles (16%) of snowmobile trails are on conservation lands. Snowmobile use is not necessarily permanently secured within these lands, and in many cases depends on voluntary agreements with land managers and landowners. 560 miles of snowmobile trails occur on conservation lands conserved using LMF funding.
- The majority of snowmobile trails are in southern and central Maine where they are largely on private land, but in Downeast and Northern Maine, conserved lands contain significant mileage of snowmobile trails including the Sunrise Trail, the Bangor and Aroostook Rail Trail, and others.
- There are 6,614 miles of ATV trails in Maine, many of which overlap with Maine's snowmobile trails.
- Maine's conserved lands contain 1,465 miles of ATV trails, or roughly 22% of mapped ATV trails. However, much of this conservation land does not guarantee motorized use and maintenance of existing public trails. Only 11% of ATV trails (736 miles) occur on conservation lands where ATV use is explicit in easement or fee conservation (Source: Maine ATV Program).
- 477 miles of ATV trails occur on land conserved using LMF funding.
- 409 miles of multi-use trails are on old rail-road beds. The Maine Trails Coalition has developed a rail trail plan for Maine and advocates for the addition of multi-use rail-trails that can be converted back to rail use if needed.
- Conserved lands are important in securing ATV trails in Downeast Maine, including the Sunrise Trail and NEFF easement; in eastern Aroostook County, including the Bangor and Aroostook Rail Trail; and in the greater Moosehead Lake region.

- Nearly 50% of trail access to lower elevation hills and summits (summits with elevation <2700) is provided through ATV or snowmobile trails.
- Landowner generosity plays an outsized role in allowing snowmobile and ATV access to private lands (>80% of the state's motorized trail network). Permanently secured access is minimal and if landowner sentiments change, public access could be reduced; trail easements could be a useful to ensure permanent access.

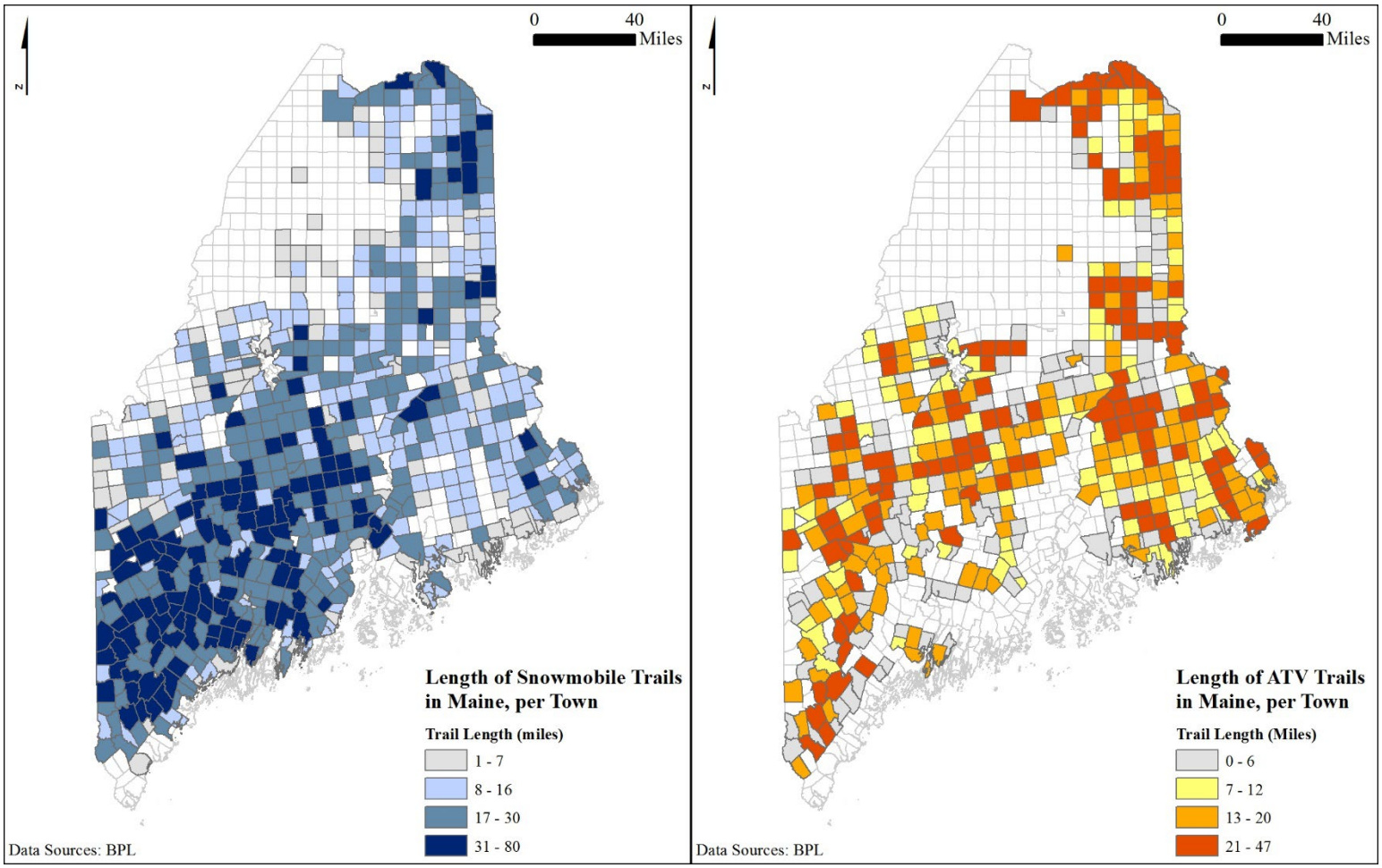


Figure 16. Miles of snowmobile and ATV trails, by town in Maine. Data source: BPL.

Non-motorized trails

Findings:

- There are 3,721 miles of mapped non-motorized trails in Maine (identified from BPL, Baxter State Park, the Appalachian Trail, and Maine Trail Finder data). While currently the best data source available for non-motorized trails, it is understood that the Maine Trail Finder data is not a complete inventory of trails and many smaller, locally important trails, especially those on private lands are missing from this dataset.

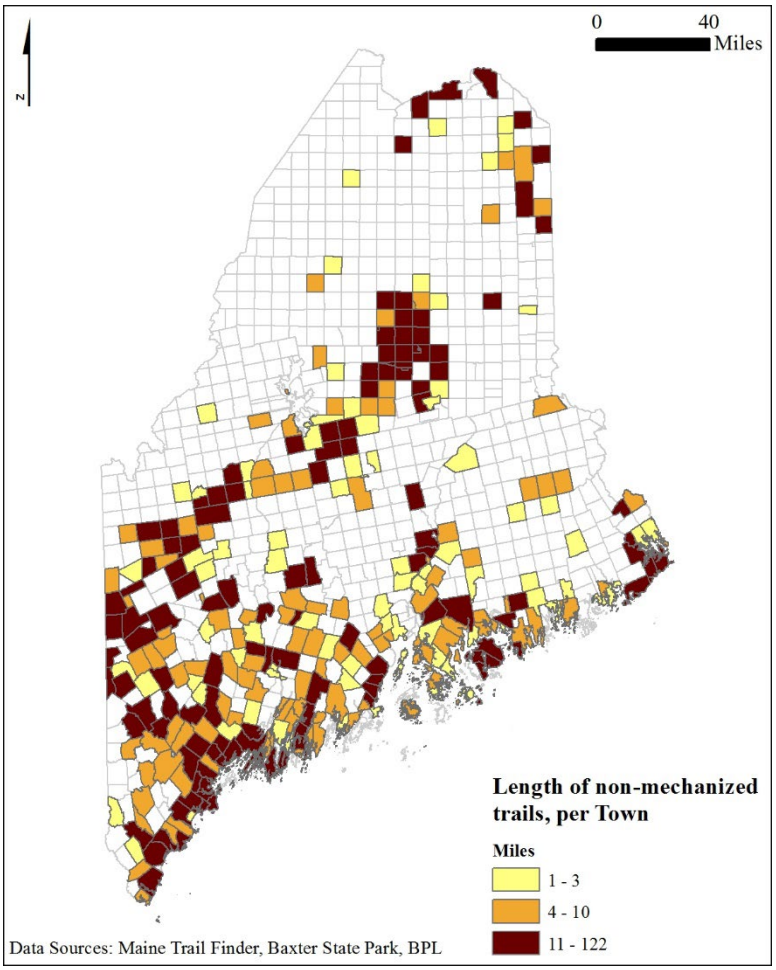


Figure 17. Miles of non-mechanized hiking and walking trails. Specialized single-track trails for mountain biking are not represented. Source data: Maine Trail Finder, BPL, Baxter State Park, Appalachian Trail, MNAP.

- 21 miles of non-motorized trails in Maine occur on old railroad beds. The Maine Trails Coalition has developed a rail trail plan for Maine and advocates for the addition of multi-use rail-trails that can be converted back to rail use if needed.
- There are 2,750 miles of non-motorized trails mapped on conservation lands in Maine, or 74% of the total mapped trails. Approximately 1,800 miles are mapped in fee conservation lands. 653 miles of non-motorized trails are on land conserved using LMF funding. These estimates may overestimate the percentage of trails permanently secured, as there are additional locally important trails that are not captured in our data.
- Lands conserved with LMF funding are guaranteed for public recreation access on foot.
- Examples of trails not in conservation include portions of the International Appalachian Trail; portions if the Georges Highland Path; and trails managed by Maine Huts and Trails and other non-profit or for-profit recreation organizations. Land conservation largely protects existing trail networks from land-use change or public access restrictions, though some local and regional trails are not permanently secured in conservation.

- Regional and local parks provide non-motorized recreation opportunities, but these are largely concentrated in areas with more trail availability.

- A recent analysis from the Trust for Public Lands indicates that 23% of Maine's population must drive more than 10 minutes to access permanently secured areas for non-motorized recreation.
- Certain areas of the state have limited walking and hiking trails including western York county, portions of central Maine, and southern Aroostook County.
- Multi-use trails in portions of the state without dedicated hiking and walking trails also provide non-motorized recreation opportunities. However, most of these areas are on private lands and so public access to these areas is not guaranteed.

Maine Land Conservation Task Force Nexus:

- Recommendation #2 calls for the creation of land conservation opportunities that connect people with the land and water. Specifically, Action Item 2.A cites a need for "community projects" that may meet demonstrated public interest for conserving lands closer to population centers, in both rural and heavily populated areas, as well as efforts that preserve traditional access to the land (Bley and Petruska, 2019).

9. FARMLAND

LAPAC Language (1997): "Over the past 35 years, the amount of farmland in Maine has shrunk by over 50%. In some parts of the state, the number of farms is barely sufficient to support the infrastructure necessary to make farming viable. With at least half of Maine's farmers approaching retirement with the 2017 Census of Agriculture reporting approximately one third of Maine producers are 65 or older. Therefore, a major turnover of farm ownership is anticipated in the coming years and the challenge is how to best facilitate transfer of farmland to a younger generation. Other states facing similar losses of farmland have initiated ambitious programs to acquire development rights to help ensure that land stays in agriculture. Such a program would not address all of the pressures facing Maine farmers, but can provide farmers with an alternative to selling the farm and preserve strategic agricultural and open space lands."

LAPAC Review Findings:

- Farmland acreage has declined dramatically since its peak just before the US Civil War. The US Census of Agriculture reports continued precipitous declines in farmland and numbers of farms through 1970. After this time, the number of farms has fluctuated slightly reaching a high in 2012 with 8,173 and then dropping back to 7,600 farms in 2017 slightly more than Maine had in 1997 with 7,404 farms. However, the acreage of farmed cropland has more gradually declined from ~700,000 acres in 1970 to ~500,000 acres in 2020. In the US Census of Agriculture, cropland includes row crops, closely sown crops, hay and silage crops, vegetable crops, small fruits, and tree fruits and nuts.
- Some agricultural lands have been converted to development, but a majority of abandoned cropland has reverted to forest. Declines in Maine farmland in the US Census of Agriculture are not due in large part to loss of farmland available for agricultural use through land conversion.

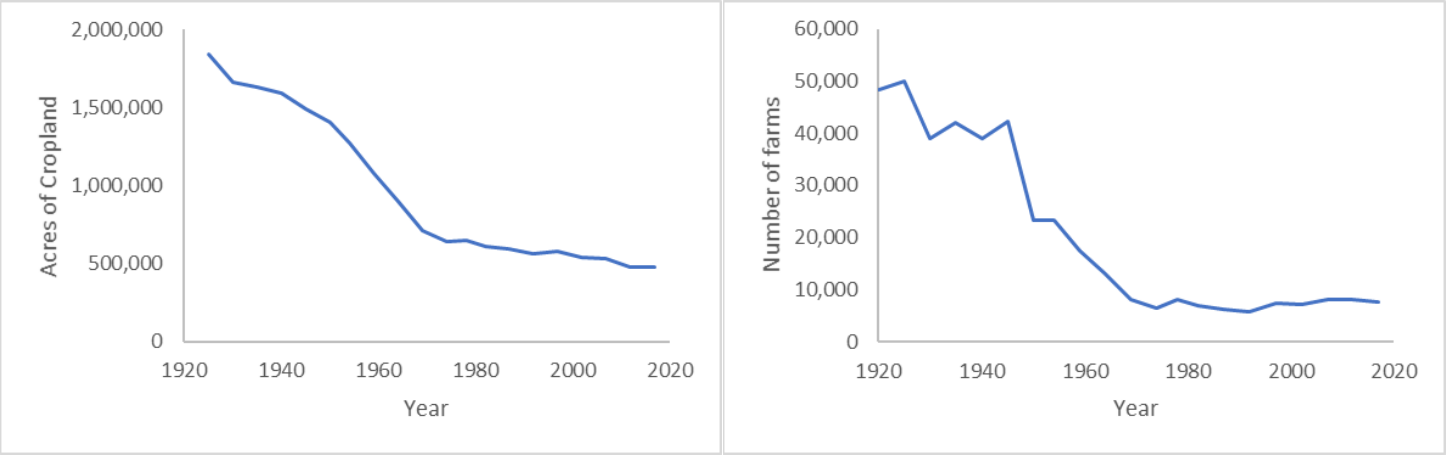


Figure 18. Number of farms and farmed cropland acres in Maine, 1920-2017. Source data: US Census of Agriculture.

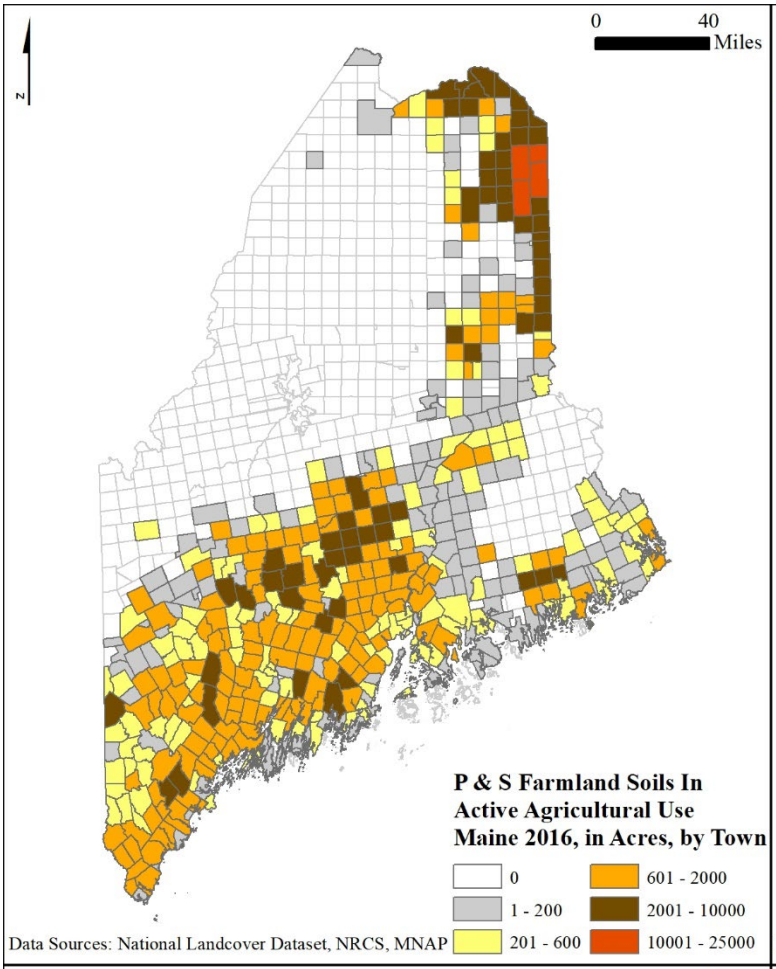
- The National Landcover Dataset (NLCD), a spatial resource published by the United States Geological Survey every five years, has two use classes directly linked to agricultural land use: Hay/Pasture and Cultivated Cropland. See https://www.mrlc.gov/data/legends/national-land-cover-database-2011-nlcd2011-legend for definitions. Combined, these landcover classes geographically represent 'cropland' as defined in the US Census of Agriculture. Map accuracy averages at over 80%. We used NLCD to evaluate 1. The amount of active-use farmland (hay/pasture, cultivated crops) in Maine (Table 7), 2. The amount of Prime Farmland Soils and Farmland Soils of Statewide Importance (from NRCS soils data) in active-use (Table 7, Figure 20), 3. The amount of active-use farmland conserved (Table 7), and conserved using LMF funding (Table 7), and 4. The amount of Prime Farmland Soils and Farmland Soils of Statewide Importance(P&S Farmland Soils) in active-use conserved, and conserved using LMF funding (Table 7).

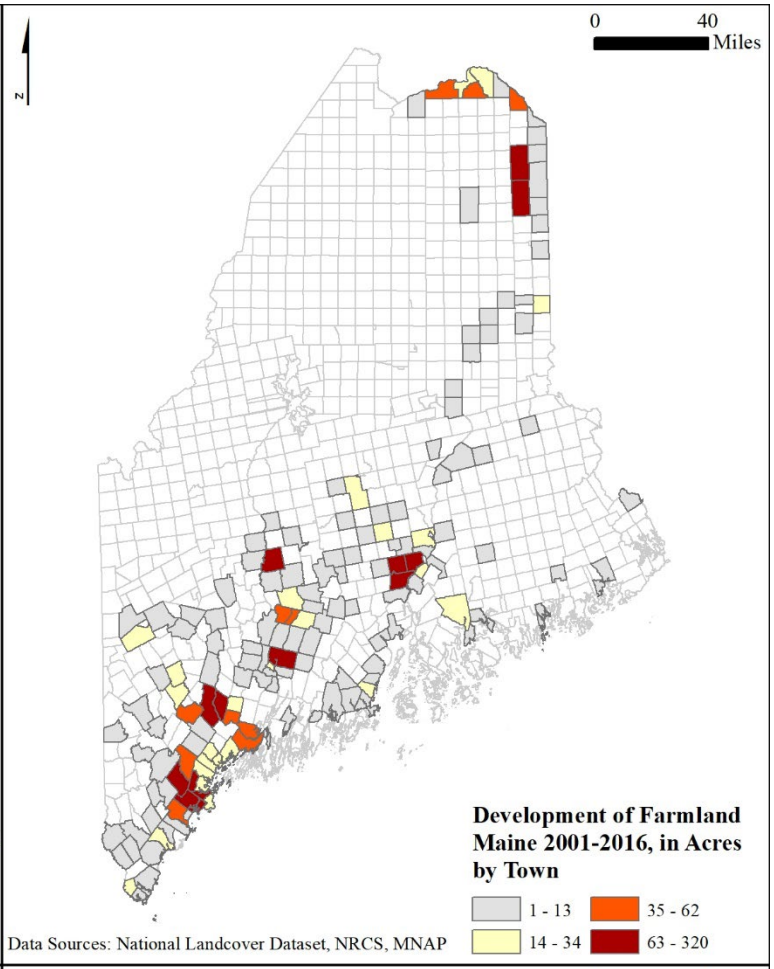
Table 6. Acres of farmland in Maine, and acres (%) of farmland conservation in Maine by landcover type. P&S Farmland Soils includes both Prime Farmland Soils and Farmland Soils of Statewide Importance (Source: NLCD 2016).

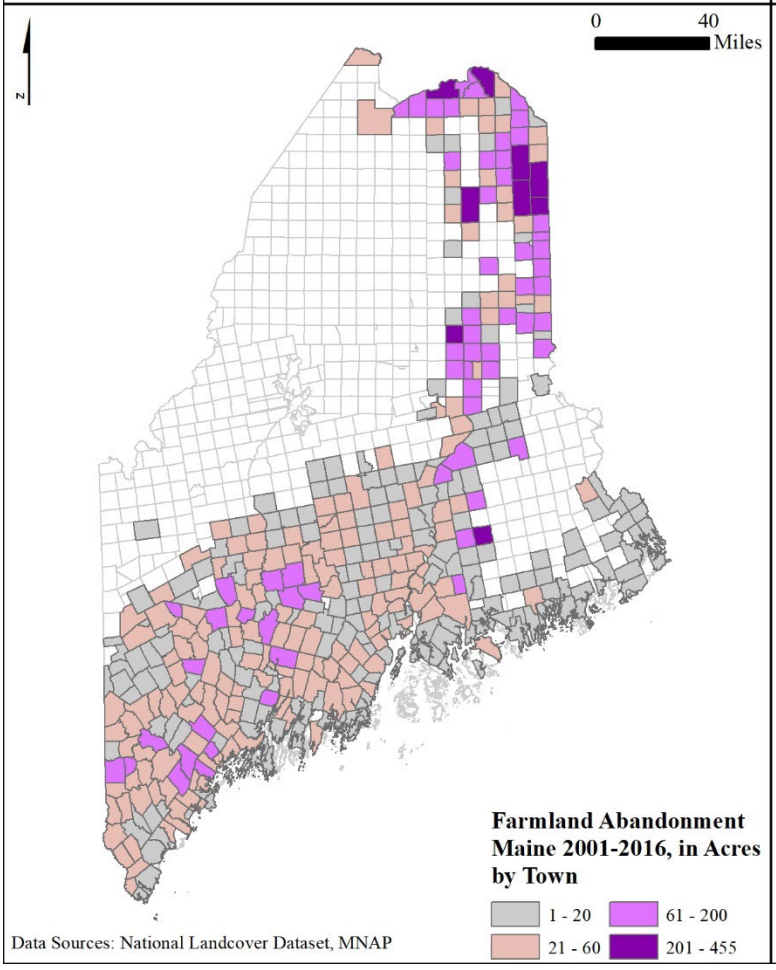
	Hay/Pasture	Cropland	Total
Total Maine	499,360	230,847	730,207
Total Maine P & S Farmland Soils	334,330	207,248	541,578
Conserved	15,811 (3.1%)	3,545 (1.5%)	19,356 (2.6%)
P & S Farmland Soils Conserved	9,615 (2.8%)	2,830 (1.3%)	12,445 (2.2%)
LMF conserved	2,477 (0.4%)	368 (0.1%)	2,845 (0.3%)
P & S Farmland Soils LMF Conserved	1,376 (0.4%)	270 (0.1%)	1,646 (0.3%)

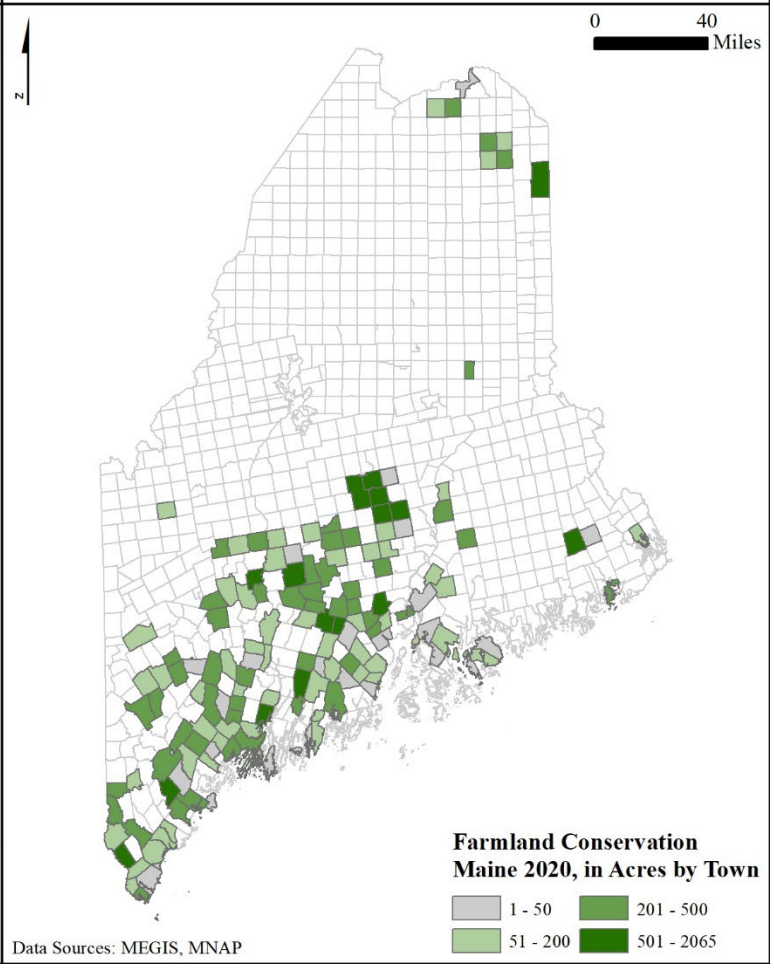
- Additionally, 2001 and 2016 NLCD landcover data were compared to evaluate conversion of agricultural lands to other land-use types. For the period of 2001-2016, NLCD landcover change of farmland land use to development was minimal, with 0.5% of Maine's farmland converted to development for that period (~3,500 acres total). Development that has occurred on farmland has largely occurred adjacent to urban centers. Towns where significant areas of agricultural land were developed between 2001-2016 include Augusta, Lewiston-Auburn, greater Bangor, greater Auburn, and Presque Isle (Figure 20).
- A recent analysis by the American Farmland Trust titled "Farms Under Threat- The State of the States" found that an additional ~14,400 acres of farmland in Maine had been fragmented and converted to Low Density Residential land use between 2001-2016. While these areas may not be suitable for large scale or commodity agriculture, they may still be suitable or even ideal for smaller-scale agricultural production. Additionally, many of the areas newly identified as Low-Density Residential land use had very little actual land use change during this time period.
- Significantly more farmland has become overgrown than has been developed. This was measured by examining how mapped farmland in 2001 transitioned to shrubland or forest landcover classes. Examination of these areas indicates that these areas would require extensive clearing of woody vegetation before they could be used for agricultural purposes again. Roughly 3% of 2001 farmland was abandoned and became overgrown by 2016. Farmland abandonment, by town, is roughly proportional to the amount of farmland in each town. An outlier in this trend includes blueberry barrens in Hancock County where in several towns a very high proportion of farmland has become idle or been abandoned and are reverting to shrubland and/or forest.

Figure 19 (below). Clockwise from top left: 1. Acres of Prime farmland soils and Farmland Soils of Statewide Importance in active agricultural use in Maine, taken from NRCS soils data and farmland landcover classes in the 2016 National Landcover Dataset; 2. Acres of development of farmland between 2001-2016. Farmland landcover classes in the 2001 National Landcover Dataset were compared with landcover classes from the 2016 National Landcover Dataset; 3. Acres of conserved farmland (lands classified as GAP-39 in Maine's Conserved Lands dataset, from March 2020), by town; 4. Acres of farmland lost to abandonment between 2001-2016. Farmland landcover classes in the 2001 National Landcover Dataset were compared with landcover classes from the 2016 National Landcover Dataset. Landcover change to shrub, forest, or open water types were considered abandoned.


0
40
Miles
N
P & S Farmland Soils In Active Agricultural Use Maine 2016, in Acres, by Town
0
1 - 200
201 - 600
601 - 2000
2001 - 10000
10001 - 25000
Data Sources: National Landcover Dataset, NRCS, MNAP


0
40
Miles
N
Development of Farmland Maine 2001-2016, in Acres by Town
1 - 13
14 - 34
35 - 62
63 - 320
Data Sources: National Landcover Dataset, NRCS, MNAP


0
40
Miles
N
Farmland Abandonment Maine 2001-2016, in Acres by Town
1 - 20
21 - 60
61 - 200
201 - 455
Data Sources: National Landcover Dataset, MNAP


0
40
Miles
N
Farmland Conservation Maine 2020, in Acres by Town
1 - 50
51 - 200
201 - 500
501 - 2065
Data Sources: MEGIS, MNAP

- Recent trends in landcover change may not reflect future development likelihood. Maine's high growth industries including utility-scale and community solar, and marijuana-related businesses (which are largely indoor facilities) may develop on agricultural land.
- Maine has 38,020 acres designated for agricultural use under protection of agricultural conservation easements or fee lands (GAP-39). Note: Conserved Lands data was current as of April 2020. The vast majority of this area is 'easement' conservation. More than half of this land is currently in forest, shrub, and wetland cover, but some could be converted to farmland use. The vast majority (36,735 acres or 96%) of agricultural conservation lands were conserved after 1997.
- There is 2.6% conservation of cropland and hay/pasture in Maine, and 2.2% conservation of cropland and hay/pasture on prime farmland soils in Maine (Table 7)
- In Maine, there has been significantly more conservation of hay/pasture than cultivated crops, relative to statewide totals for each land use type. Part of the reason for this is that there is significant acreage of cropland in eastern Aroostook County and blueberry barrens in Hancock and Washington Counties, where less conservation has occurred.
- The Land for Maine's Future program has contributed to 41 farmland projects that have totaled 9,755 acres designated for farmland use.
- Food security and support for the farming economy are a primary focus of farmland conservation practitioners. According to the Agricultural Census data, 90 percent of the market value of agricultural products sold come from 10% of the farms, which have annual sales of $100,000 and up. Thus, 90 percent of our farms produce relatively small economic returns but provide a variety of public benefits (open space, wildlife habitat, water quality protection, carbon sequestration, agritourism, etc.).

10. REGIONAL PARKS

LAPAC Language (1997): "Residents of many of the state's population centers have limited public recreation lands within a reasonable traveling distance to where they live (one-hour drive). In particular, there is a need for parks offering day use recreation opportunities such as hiking and picnicking. The popularity of the State's recent acquisition of Dodge Point in Damariscotta highlights this need."

Day use, regional parks

- Maine's Rural Active Living Assessment data is a dataset on recreational resources available in each town in Maine that was created by the National Institute for Health and greatly improved by the Maine Bureau of Parks and Lands. This dataset is Maine's best resource on the location of parks in Maine, though gaps remain in documentation of recreational resources.
- Local parks provide a critical resource for outdoor recreation, especially in more densely populated areas where outdoor recreation may be more limited.

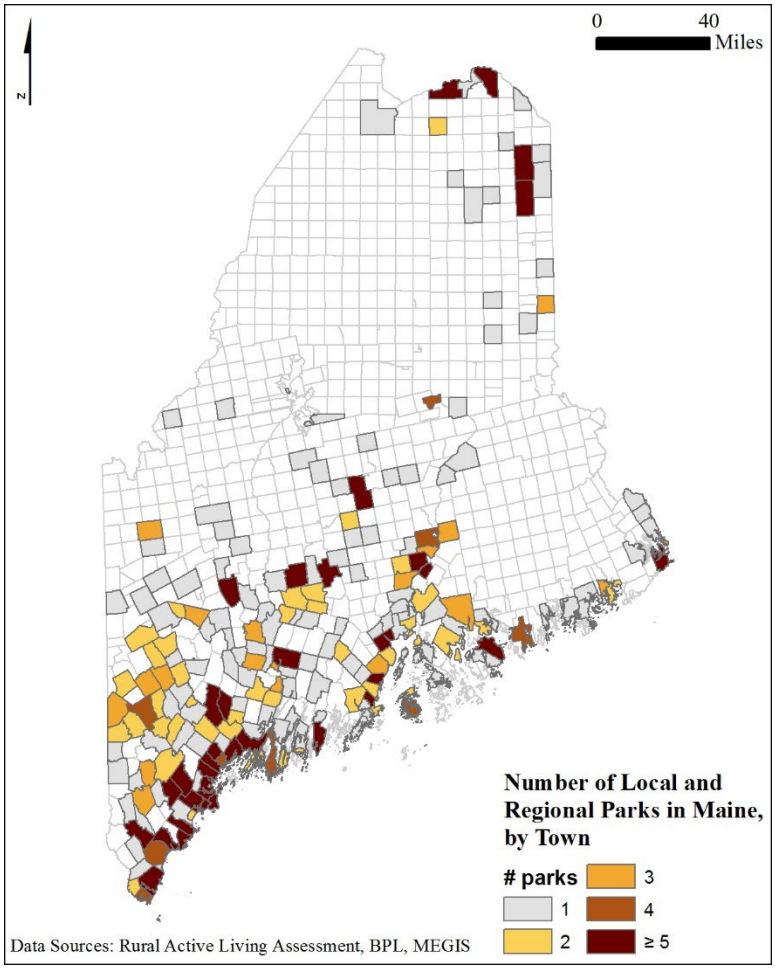


Figure 20. Number of regional and local parks in Maine, per town. Larger State and Federal park lands (e.g. Baxter State Park, Acadia National Park) were excluded from this map. Data sources include data from the Rural Active Living Assessment, the Bureau of Parks and Lands, the Maine Natural Areas Program and MEGIS.

Findings:

- Parks and other recreation areas are available statewide. Recreation within larger cities and towns is met by a mix of urban parks and trail networks, while recreation resources in rural towns is usually met by a mix of multi-use trails and hiking trails.
- With increasing demand for public outdoor recreation, capacity of public recreation sites is challenged in some areas, including parking availability.
- Gaps for public outdoor recreation may occur in Portland exurbs including Saco, Westbrook and Windham.

- An inventory of state park and other recreational infrastructure will be needed to assess its quality and adequacy and to determine what and where upgrades may be needed.

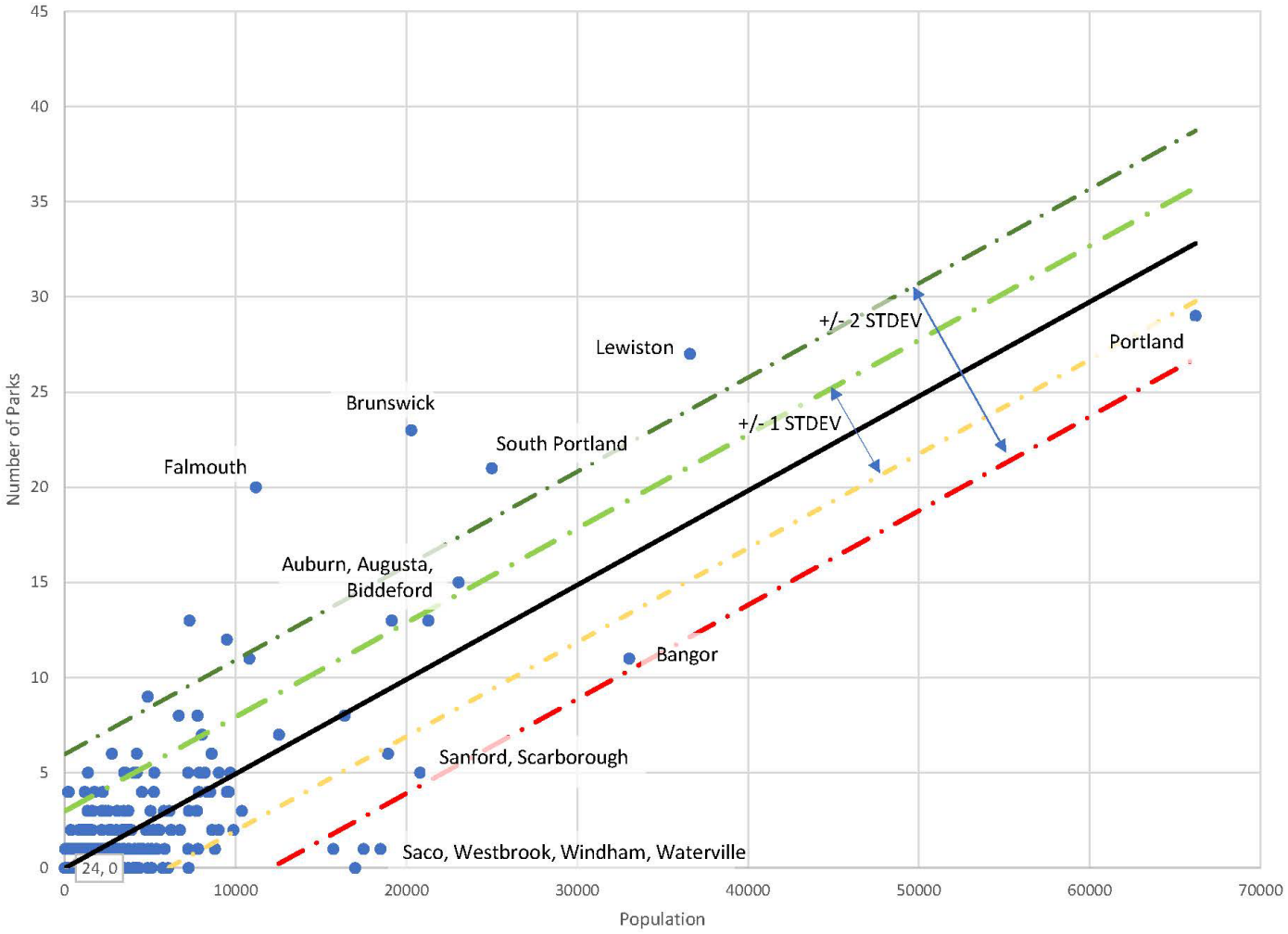


Figure 21. Population charted against number of public parks. Comparing how cities and towns deviate from a linear trendline (black) helps compare public recreation between municipalities. This graph does not consider the size of parks or quality of recreation opportunities available. Source data: 2010 US Census, Maine Rural Active Living Assessment, Maine Bureau of Parks and Lands, Maine Natural Areas program.

Campgrounds

Findings:

- Maine has 195 drive in campgrounds that provide tent and/or RV camping, with a total 22,190 sites. (Data source, Maine Campground Owners Association-2020 data, BPL, Baxter State Park, Acadia National Park).
- York County has far and away the most campground capacity, with a total of nearly 8,000 campsites available, mostly in coastal locations. Cumberland county has roughly 3,900 campsites available, mostly in the Sebago Lake Area, and Hancock County has roughly 2,800 campsites available, mostly on Mount Desert Island. Campgrounds in other counties have lower capacity and are more widely dispersed.

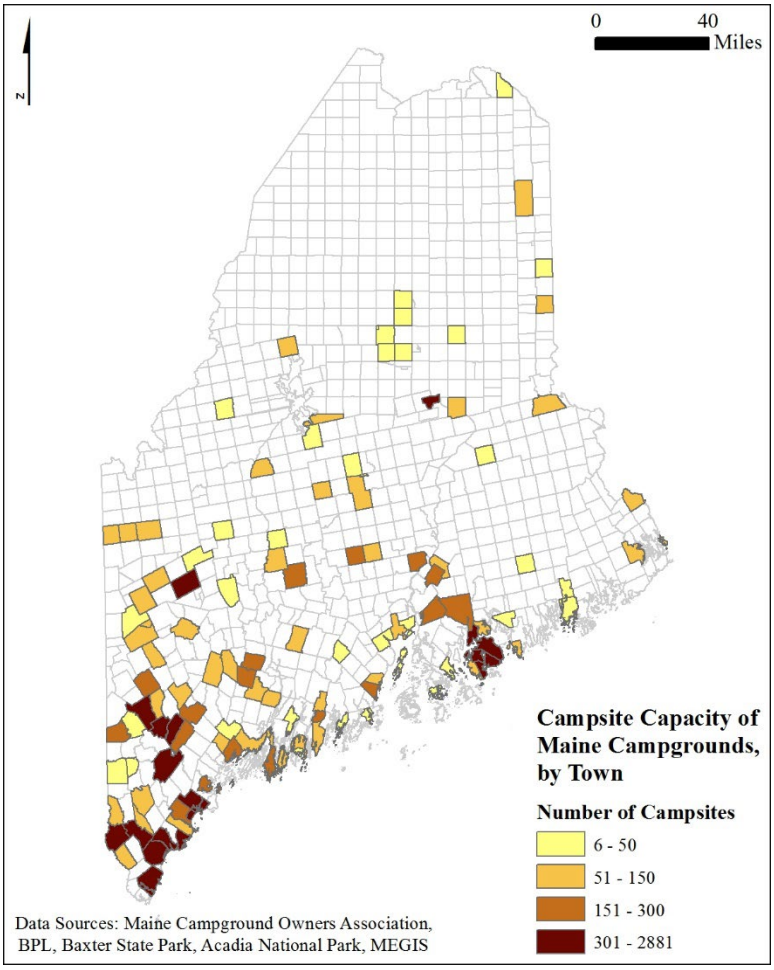


Figure 22. Number of drive-to campsites, per town. North Maine Woods and remote campsites are not included. Data Source: Maine Campground Owner's Association, Maine Bureau of Parks and Lands, Baxter State Park, Acadia National Park.

11. ADDITIONS AND ACCESS TO EXISTING PUBLIC LANDS

LAPAC Language (1997): "Many public lands in Maine would greatly benefit from targeted expansions. Additions to existing ownerships can be a highly cost-effective way of increasing recreation opportunities, securing public access rights and preserving ecological values. In certain instances, additions to existing public ownerships are necessary to protect resources from encroaching development or other threats."

Findings:

- 2,501,900 (or 83%) of the roughly 3,001,000 acres conserved after 1997 are adjacent or connected to conservation lands acquired prior to that time.
- Over 225,000 acres of land has been acquired in fee by the state since 1997, mostly managed by the Maine Bureau of Parks and Lands and the Maine Department of Inland Fisheries and Wildlife.

Table 7. Area, in acres, acquired in fee before and after December 31, 1997 by state agency.

	Acres acquired, by time period		
Managing Agency	<= 1997	>1997	Total
Baxter State Park Authority	205,657	4,723	210,380
Maine Atlantic Salmon Commission	0	4,595	4,595
Maine Bureau of Parks and Lands	530,477	187,209	717,686
Maine Department of Inland Fisheries and Wildlife	81,032	27,965	108,997
Maine Department of Marine Resources	0	49	49
Maine Department of Transportation	24	677	701
Maine Forest Service	468	0	468
Total acres of state conservation lands	817,658	225,217	1,042,875

- A majority of new lands acquired by the state since 1997 were acquired with LMF funding. Nearly 180,000 acres of state land were acquired with LMF funding.
- Maine residents were surveyed for the creation of the Maine SCORP (State Comprehensive Outdoor Recreation Plan). Investments in conservation of new public lands and development of public access and recreation sites were identified as a high priority among those surveyed.

Table 8. Area acquired using LMF funding, in acres, acquired before and after December 31, 1997 by state agency.

	Acres acquired, by time period		
Managing Agency	<= 1997	>1997	Total
Maine Atlantic Salmon Commission		4,595	4,595
Maine Bureau of Parks and Lands	50,033	161,021	211,054
Maine Department of Inland Fisheries and Wildlife	11,457	12,685	24,142
Maine Department of Marine Resources		49	49
Total acres acquired with LMF funding	61,490	178,350	239,840

- Priorities identified by SCORP survey respondents included remote backcountry recreation opportunities, recreation areas close to population centers, and coastal and freshwater water access.

12. ISLANDS

"LAPAC Language (1997): Maine's coastal and inland islands are one of the state's most unique and threatened resources. Islands, particularly coastal islands, have become increasingly sought after for development, threatening bird nesting habitat and other sensitive ecological values. The State, private conservation organizations, and the federal government have successfully protected many 14 valuable islands in recent years. However, additional acquisition efforts are needed to protect those islands identified as having important resource values that remain vulnerable to development and habitat loss."

Findings:

Note: Data and results are drawn from a 2018 analysis undertaken by the Maine Coast Heritage Trust.

- Maine has over 2,400 islands over 1 acre, of which nearly 1,900 are undeveloped. See Table 10. for full breakdown of island development by size.
- Land conversion to development on islands between 2001-2016 has occurred primarily on bridged and ferried islands (calculated from the National Landcover Dataset). The likelihood of land conversion to development on bridged and ferried islands is consistent with the rest of Maine's coastline, while the likelihood of land conversion to development on other islands remains considerably lower.

Table 9. Development status of Maine Islands over 1 acre, by size. Bridged or ferried islands are among the most developed and support vibrant coastal communities. 'Developed Islands' have more than 5 principal structures and are divided into more than 3 parcels. 'Minimally Developed Islands' had 3 or fewer parcels and 1-5 principal structures. Undeveloped islands had no evidence of development from impervious surface or other landcover data (source MCHT Island Assessment, Sept. 25, 2018).

Island Size	*Undeveloped Islands*		*Minimal development*		*Developed Islands*		*Bridged or Ferried*		*Total*
Under 0.1 ac.	171	90%	0	0%	19	10%	0	0%	190
0.1 to 1 ac.	777	91%	4	0%	64	8%	7	1%	852
1 to 10 ac.	663	83%	88	11%	35	4%	13	2%	799
10 to 100 acc	252	62%	121	30%	8	2%	28	7%	409
100 to 1,000 ac.	31	26%	46	39%	12	10%	30	25%	119
Over 1,000 ac.	1	3%	6	18%	0	0%	27	79%	34
OVERALL	1,895	79%	265	11%	138	6%	105	4%	2,403

Source: MCHT Island assessment, September 25, 2018

- One measure of the potential impacts of sea level rise is the percent of current upland that will become intertidal. Looking at a 6-foot sea level rise scenario, roughly 5% of land on Maine islands will become intertidal by the end of this century. However, 360 islands (15%) are likely to experience catastrophic loss of upland (>50%). The most heavily impacted islands tend to be small, low-lying

islands – many of which are ecologically significant as seabird nesting islands and/or seal pupping islands.

Table 10. Maine coastal islands by conservation status. Islands were considered conserved if > 90% of the island was in conservation. This threshold was set to account for conflicting geometry between Maine conserved lands data..

Island Size	*Conserved islands**		*Total*
Under 0.1 ac.	42	22%	190
0.1 to 1 ac.	309	36%	852
1 to 10 ac.	364	46%	799
10 to 100 acc	197	48%	409
100 to 1,000 ac.	45	38%	119
Over 1,000 ac.	5	15%	34
OVERALL	962	40%	2403

*Defined as 90% or more of whole islands owned in fee for conservation purposes and/or protected by easement.

Source: MCHT Islands Assessment, September 25, 2018

- Conservation plays a significant role in maintaining the character of Maine's coastal islands. Over 900 islands (40%) are permanently conserved through fee or easement, and another 77 islands (3%) benefit from partial conservation. Most of the conserved islands are less than 10 acres in size.
- The majority of the 962 conserved islands in Maine are available for recreation during at least part of the year. However, many conserved islands are inaccessible due to their location and lack of suitable landing sites. Additionally, lack of mainland public boat launches reduces access to some islands.
- More than 30 organizations or programs have carried out coastal island conservation in Maine. Maine Coast Heritage Trust (MCHT) has conserved 160 islands, the third largest number of conserved islands behind only the Maine Bureau of Parks and Lands, and Maine Department of Inland Fisheries and Wildlife. By acreage, Acadia National Park conserves the most land area on coastal islands (MCHT is second in terms of acreage).
- University of Maine biologist assessment and further MCHT analysis suggest there are 253 islands with more than 20 acres of interior habitat, significant for nesting neotropical migrants. 51% of these islands are already conserved.
- Based on Beginning with Habitat and Maine IF&W data, 321 islands have high habitat value, 63% of which are already conserved.
- The Land for Maine's Future Program has contributed funding to conservation projects on 26 non-ferried or bridged coastal islands. 16 of these coastal islands are 1 acre or greater in size, and 10 are less than 1 acre. 19 of these conservation projects were completed after 1997.
- The Land for Maine's Future Program has contributed funding to 17 conservation projects on ferried and bridged islands, including three working waterfront projects. All but three of these were completed after 1997.

13. MINERAL COLLECTING SITES

LAPAC Language (1997): "Maine has some of the finest gem and mineral collecting opportunities in the country. Traditionally, the public has had ample access to private lands to collect gemstones and minerals, an activity that continues to increase in popularity. However, in recent years many of the state's best collecting sites have been closed off to the public. Securing access rights to a small number of quality collection sites will guarantee that the public can continue to have the opportunity to hunt for Maine gems and minerals in the future."

Findings:

- Despite being listed as a conservation priority in the 1997 LAPAC report, very few conservation projects have included special mineral collecting sites.

14. MOUNTAINS

LAPAC Language (1997): "While many of the state's highest peaks are currently in the public domain, there are still a number of significant mountains in private hands that are worthy of public acquisition. Acquisition efforts should focus on those mountain areas with outstanding vistas, established recreational uses, or significant ecological values, as well as those that are in close proximity to population centers."

Summits

An assessment was performed on named summits from the USGS GNIS (Geographic Names Information System) database. Maine Conserved Lands Data, Maine Trail Finder Data, BPL Trails data, Appalachian Trail Data and Baxter State Park Trails data were used to assess public access and conservation.

The Conserved Lands Data used for this analysis only includes completed projects through 2020.

Findings:

- For the purposes of this assessment, named summits in the USGS GNIS database were used to describe hill and mountain peaks. The GNIS summits database is the best currently available resource for coarse scale assessment of conservation of mountains and lower elevation summits. Assessment of conservation is stratified by summit elevation.
- According to NLCD landcover data, between 2001 and 2016 the new area developed >2700' was 226 acres. This new development almost doubles the amount of developed acreage >2700' to 483 acres. Development captured in this data was almost entirely the result of wind projects (these figures do not include associated infrastructure footprints below 2700'). Ski area development is poorly captured in NLCD. However, based on hand digitization of outer ski area bounds from aerial photos it has been calculated that 1085 acres

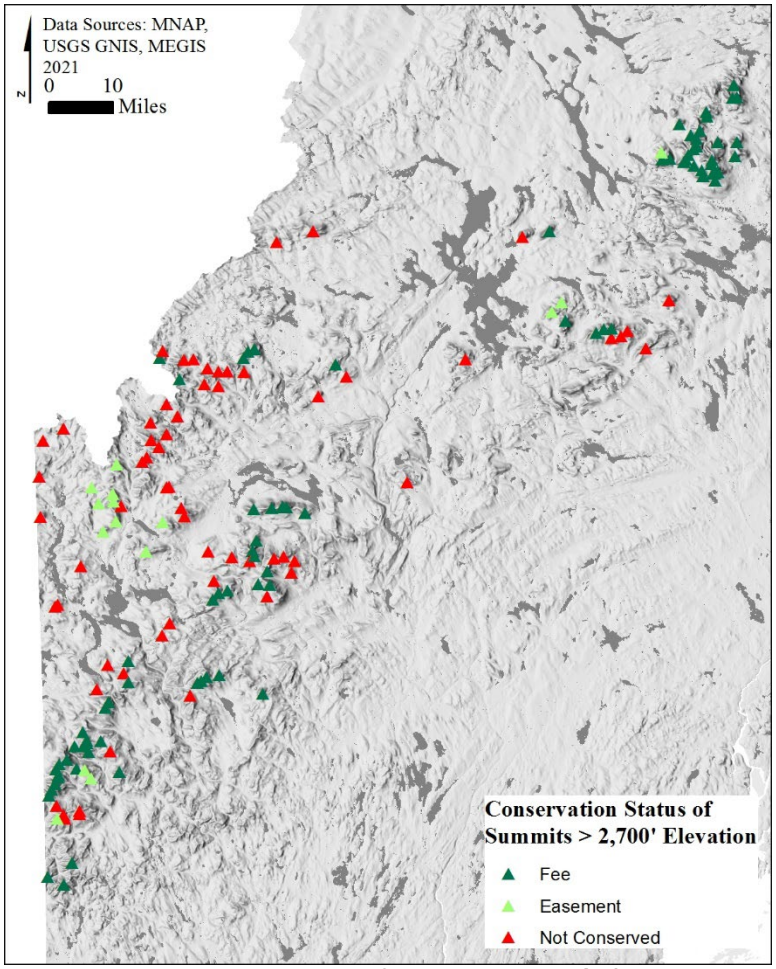


Figure 23. Conservation status of summits > 2700' elevation. Summit data is from the Global Naming Information System and while the best available data for this type of information, there are summits that are poorly represented.

>2700' have been impacted (this includes both ski trails and the forested areas between ski trails) (D. Publicover, pers. com.)

- High elevation summits (>2700') have a high level of protection; more than 60% are conserved. Mid and low elevation summits and hill tops have lesser amounts of conservation
- Similarly, trail access to high elevation summits (>2700') is very good. ~45% of high elevation summits have trail access. Trail access to high elevation summits is primarily via hiking trails, but in some cases includes multi-use trails. Most trails to high elevation summits occur on conservation land.

Table 11. Number of summits, by elevation, within 20, 40, and 60 miles of Maine's population centers.

# ME summits with trails									
	Portland			Lewiston/Auburn			Bangor		
Summit Elevation	20 miles	40 miles	60 miles	20 miles	40 miles	60 miles	20 miles	40 miles	60 miles
< 500 ft	31	61	71	21	66	76	6	25	53
501-1000 ft	2	47	73	38	78	105	9	40	77
1001-1500 ft	0	13	34	5	36	57	3	12	25
1501-2700 ft	0	1	18	1	25	30	0	0	11
2701-5260 ft	0	0	3	0	2	30	0	0	3
Total	33	122	199	65	207	298	18	77	169

- Lower elevation summits (<2700') have less trail access. Motorized trails provide a significant portion of trail access to lower elevation summits. Nearly 50% of trail access to lower elevation summits is provided through ATV or snowmobile trails. Given that >80% of Maine's motorized trails occur on private lands without permanent protection, significant access to low elevation summits could be lost if landowners were to close trail access.
- Of Maine's three largest cities (Bangor, Lewiston/Auburn, Portland), Lewiston/Auburn has the greatest availability of trails to access mountain summits within a two our driving distance. All three cities are within a two-hour driving distance of summit hikes of all elevations.
- The Land for Maine's Future program has funded conservation of 69 Maine summits, evenly spread across elevation ranges.

Table 14. Conservation and amount of trail access to Maine's summits, by elevation range.

Summit elevation	Total ME Summits	# (%) with trails	# (%) conserved	# conserved with LMF funding
< 500 ft	650	137 (21.1)	132 (20.3)	17
501-1000 ft	792	166 (21.0)	109 (13.8)	21
1001-1500 ft	406	88 (21.7)	84 (20.7)	11
1501-2700 ft	434	69 (15.9)	139 (32.0)	10
2701-5260 ft	163	72 (44.2)	99 (60.7)	10
Total	2445	520 (21.3)	563 (23.0)	69

High elevation habitats

A separate assessment was performed for montane habitats, including MNAP natural communities, and elevations >2,700'.

Findings:

- In Maine, there are ~140,000 acres over 2,700' elevation. Of this area 57% of land area > 2,700' is in some form of conservation (76,605 acres total). 41,440 acres (31%) is in state Ecological Reserves or other forms of land conservation that prohibits timber harvesting, including Baxter State Park, Federal Wilderness Areas, and land owned by The Nature Conservancy, the Appalachian Mountain Club and others (GAP1 or GAP2, see Appendix 1), and 35,165 acres (26%) have been conserved through working forest easements or other types of conservation land where timber harvesting is permitted (GAP3).
- Due to the high level of conservation in mountain settings (i.e. Baxter State Park, Mahoosucs Range, Appalachian Trail corridor etc.) several alpine/montane habitats (Gawler and Cutko 2010) only occur on conservation land including:
    - Bilberry- mountain-heath alpine snowbank
    - Cotton-grass – heath alpine bog
    - Diapensia alpine ridge
    - Heath- lichen subalpine slope bog
- Other rare montane natural community types have a high degree of protection, with >80% conservation of most types.
- Many summits have multiple biodiversity values associated with a single summit (e.g. 1 or more natural communities, 1 or more rare plant populations, and at least one rare animal occurrence).
- There are very few alpine or subalpine summits containing rare open upland habitats without trails in Maine.
- Subalpine fir forest, a montane natural community characterized by stunted balsam fir and heart-leaved paper birch, totals over 44,000 acres in Maine. Nearly 75% of this habitat is off limits to timber harvesting (GAP 1 or GAP2) and over 85% of this habitat is in conservation land.
- Lower elevation forest types are under- represented within ecological reserves or similarly managed lands in several ecoregions, regardless of condition. Some of these forest types may occur on lower elevation slopes and low summits (<1500') including:
    - Oak- pine forest, oak- northern hardwoods forest, and hemlock forest in the Central, Western and White Mountains ecoregion.
    - Northern hardwoods forests

    - All matrix forest types in the Seacoast- Ossipee Ecoregion (oak-pine forests, (red oak) northern hardwood forests, hemlock forest, red oak- white oak forest, spruce-fir forest etc.).
- Many areas of Maine's western mountains have valley- peak connectivity of conserved lands. Lower elevation summits and valleys, especially south and west of the Androscoggin River are more poorly captured in conserved lands. These areas are also nearer to population centers and have important recreation values.
- Many lower elevation summits on private land have hiking trails, but mapping is less consistent. Additionally, trail access in these areas is not permanently secured for public use.

Conclusions:

- High elevation habitats are well conserved, and there is abundant recreational access to these areas. Many high elevation summits support multiple biodiversity values in addition to recreational values. Connectivity between high elevation areas will be critical for species to be able to respond to climate change and other stressors.
- Lower elevations hills and mountains, many of which are closer to population centers, have lower levels of conservation and access. Access to many of these areas is by snowmobile and ATV trails and is not ensured through permanent land conservation.

15. DRINKING WATER PROTECTION

Drinking water protection was not an original LAPAC identified priority topic. However, the importance of drinking water protection and the key role that land conservation can play has been identified as a priority of the state and partner organizations.

Findings:

- 66% of the people in Maine receive water from community systems like Portland Water District, Lewiston / Auburn and Bangor Water District. (Maine Drinking Water Program)
- Despite the fact that 94% of the public water systems in Maine use groundwater (springs and wells) as a source of supply, 48% of the water consumed by the public comes from surface water utilities. (Maine Drinking Water Program)
- Only 79 surface water supplies (including lakes and streams) are used as public drinking water supplies. This represents only 3% of the 2,800 great ponds in Maine. (Maine Drinking Water Program)
- Public drinking water in Maine is drawn from a variety of sources, including wells, riverbank filtration wells, and surface water intakes
    - 46 pond and lake watersheds, containing ~400,000 acres of land. These watersheds range from 25 acres to over 125,000 acres.
        - Portland, Bangor and Lewiston/Auburn all draw public drinking water from lakes.
    - There are 41 rivershed source protection areas in Maine, containing 583,761.3 acres of land. These are areas upstream from riverbank wells used as drinking water sources-- often small sections of larger river watersheds. Many of Maine's large rivers have riverbank wells (Penobscot, Androscoggin, Kennebec, Little Androscoggin) and many medium-large towns use riverbank wells as their water source.
    - Across the state, there are over 2,000 wells that are considered public drinking water sources. These are associated with water districts, schools, hotels, restaurants, camps, mobile home parks.
        - There are close to 300 bedrock source water protection areas, areas in proximity to public drinking water sources where the travel time of water through the bedrock is 200-2,500 days.
        - Source water protection areas associated with wells contain ~55,000 acres of land.
    - Sand and gravel aquifers overlapping with population centers (defined as towns with at least 1,000 inhabitants and towns with 5,000 inhabitants and adjoining towns), contain ~530,000 acres. Because of the travel time in these aquifers, they are susceptible to contamination

Wells Protection Areas and Sand and Gravel Aquifers

Landcover patterns:

- Of the ~55,000 acres of land within well source water protection areas, 66% are in natural cover, 23% are developed, and 11% are in agriculture.
- Of the 530,000+ acres of sand and gravel aquifers near population centers, 76% are in natural cover, 14% are developed, and 10% are in agriculture.

Conservation:

- Of the ~55,000 acres of well protection areas, less than 8% are in conservation (4,378 acres). Less than 4% are in *permanent conservation*. Non-permanently protected municipal and water district/company lands make up half of the conserved area (~2,200 acres).
- Of the ~530,000 acres of sand and gravel aquifers, ~7% (39,000 acres) are in permanent conservation and an additional 1.6% (8,500 acres) are in unsecured municipal lands and water district/company lands.

Surface Water: Directsheds and Riversheds

Landcover patterns:

- Overall, public surface drinking water source watersheds are ~ 90% in natural cover. All are at least half in natural cover, 29 have over 90% natural cover and only 6 are less than 80% in natural cover.
    - Watersheds with the lowest natural cover were unnamed pond (Skowhegan), the St. John River in Frenchville, Moose Hill Pond (Livermore Falls), Cobboseecontee Lake, China Lake, and Burntland Pond (Stonington).
    - Floods Pond (Bangor) and Sebago Lake (Portland) watersheds are over 90% in natural cover.
    - Lake Auburn's watershed (Lewiston-Auburn) is 81% in natural cover.
    - Overall, public drinking riversheds are 84% in natural cover, with a range from ~60% to 100%.
        - The riversheds with lowest natural cover are in eastern Aroostook county (Fort Fairfield, Presque Isle, Van Buren, Washburn, Houlton). The Saco River in Saco/Biddeford and the Kennebec in Gardiner/Hallowell are also in the bottom quartile.
        - The 75th percentile includes Rumford/Mexico, Bridgton, KKWWD (Branch Brook), Kezar Falls, Andover, Kingfield, Rangeley, and Sugarloaf.
        - Median= 89.11%; 25th percentile= 78.6%; 75th percentile=96.05%

Conservation:

- Of Maine's ~400,000 direct shed acres, 11.5% (~46,000 acres) are in *permanent* conservation (preserves, conservation easements) and an additional 2% (>8,000 acres) are owned by municipalities or water districts but not permanently conserved.
- Of the > 580,000 acres in riversheds, 5.4% (31,676 acres) are in *permanent* conservation and an additional 0.9% (5,436.5 acres) owned by municipalities or water districts but not permanently conserved.
- Numerous surface watersheds are not protected through land conservation, though regulations and landowner agreements may provide some level of protection in these areas.
- Conservation is important in preserving some surface drinking water watersheds in natural cover.
    - Branch Brook (serving Kennebunk, Kennebunkport and Wells), drinking water sources on Mount Desert Island, Floods Pond (serving Bangor), and watersheds in York and South Berwick (serving Kittery and York). Have more than 30% conservation.
    - Conservation is increasingly an important tool in maintaining natural cover within the Sebago Lake Watershed (serving Portland)

Take-home points

- Maine's urban centers rely on surface water for drinking water.
- Natural vegetation cover in source areas significantly lowers treatments costs. A study found that a 10 percent increase in forest cover leads to a 20 percent decrease in treatment costs, up to around 60 percent forest cover (Ernst, 2002)
- Watersheds of Maines surface drinking water sources are generally in natural cover, but levels vary between watersheds, with lower levels in some Kennebec Valley areas. Compared to Portland and Bangor, Lewiston-Auburn's source watershed has lower natural cover (81%).
- Most of the land area in Maine that contributes to drinking water supply (watersheds, riversheds, well buffers, sand and gravel aquifers) is not under conservation. However, conservation plays and important role in maintaining natural cover in some watersheds including:
    - Branch Brook (serving Kennebunk, Kennebunkport and Wells), drinking water sources on Mount Desert Island, Floods Pond (serving Bangor), and watersheds in York and South Berwick (serving Kittery and York)
- Drinking water sources are vulnerable for Maine's two most populous urban areas- Portland and Lewiston/Auburn.
    - Conservation is low in source watersheds for both Sebago Lake (Portland) and Lake Auburn (Lewiston/Auburn).
        - Sebago Lake: 12% conserved

        - Lake Auburn: 1.5% conserved
    - According to NLCD landcover (2016), land area of Sebago Lake's source watershed is 90.5% natural cover (forest or wetland). Lake Auburn's source watershed is only 81% natural cover.
- A comprehensive inventory of water supply lands in natural cover (owned by water districts and private water companies) is lacking. While not in permanent conservation, these lands play an important role in maintaining forest cover in water supply watersheds.

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APPENDIX 1: CONSERVATION STATUS OF MAINE'S EXEMPLARY NATURAL COMMUNITIES AND ECOSYSTEMS

Overview

When prioritizing ecological conservation actions, it is important to consider to what degree the current network of conservation lands protects the state's wide diversity of natural habitats (i.e., natural communities). In this project, we examine the conservation status and degree of representation of each of the exemplary and rare natural community types tracked by the Maine Natural Areas Program, in each of the state's seven ecoregional sections (following McMahon 1990).

Background

Guidelines and thresholds for identifying sufficient levels of protection for each natural community type may differ by agency or organization. For example, when locations of state ecological reserves were being planned for public reserve land in Maine, a recommendation by the Maine Forest Biodiversity Project was to capture at least one *high quality* example of every natural community type in each ecoregional subsection, or two examples in each ecoregional section (McMahon 1998). However, the Forest Stewardship Council (FSC), as part of their certification process, recommends that a forest type is only adequately conserved in an ecoregion if at least *5 high quality* examples are protected (Forest Stewardship Council 2010).

In 2014, the Maine Natural Areas Program produced the report *A Conservation Vision for Maine Using Ecological Systems* (Schlawin and Cutko 2014) which used The Nature Conservancy's Terrestrial Habitat GIS layer to examine the relative abundance of different habitats, ***regardless of condition***, on the state's conservation lands. Habitats under-represented on GAP 1&2 status lands, i.e., reserve type lands (see definitions at right), and habitats under-represented on all conserved lands - GAP 1,2&3 (including working forest easements and managed private and public conservation lands), were identified.

Definitions for Gap Status are as follows (from the USGS National Gap Analysis Program):

***GAP 1 Status**: Permanent protection from conversion of natural land cover and a mandated management plan to maintain a natural state within which disturbance events or are allowed to proceed without interference or are mimicked through management.*

***GAP 2 Status**: Permanent protection from conversion of natural land cover and a mandated management plan to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.*

***GAP 3 Status**: Permanent protection from conversion of natural land cover for the majority of area. Subject to extractive uses of either broad, low-intensity type (e.g. logging) or localized intense type (e.g., mining).*

***GAP 4 Status**: No known public/private institutional mandates/legally recognized easements.*

Methods

For this project, we used a methodology similar to that used by Schlawin and Cutko (2014) to examine the conservation status by ecological region (biophysical section scale, McMahon 1998), of **high quality** (A or B quality rank, see Appendix IV) natural communities as mapped by the Maine Natural Areas Program (Gawler and Cutko 2010). The acreage and number of high quality natural community occurrences captured in reserve type lands and all other conserved lands were quantified. Natural communities were considered captured (represented)

within conserved lands if either > 90% of the occurrence was on conservation lands or if the acreage on conserved lands met the MNAP 'B' size rank metric for that type. For an overview of the location of the state's seven ecological regions and of the distribution of Gap 1,2&3 conservation lands, see the 'Conservation Lands by Maine Ecoregion' map in Appendix V.

In performing the analysis, we chose to address forested communities separately from non-forested communities because, while forested types can be managed on GAP 3 conservation lands (e.g., managed public lands and sustainable forestry easements), non-forested types are generally less likely to be managed on these lands and can therefore be considered to provide representational value. Consequently, representational analysis for non-forested natural communities was conducted using GAP 1,2&3 conservation lands. For forested types, we conducted the representational analysis for GAP 1&2 lands and also separately for GAP 1,2&3 lands. For some forested communities, such as *Beech – Birch – Maple Forest* in the Aroostook Hills & Lowlands Ecoregion, there are no high quality examples on GAP 1&2 lands (where they would be left unmanaged), but there are some examples on GAP 3 lands where they can be managed and could potentially lose their representational value. The presentation of the results for the GAP 1&2 lands versus GAP 1,2&3 lands for forested types aids in acknowledging these important differences in the potential for the future representation of these types across the regions and should be useful for conservation planning.

Table 1 for forested types (Appendix I) and Table 2 for non-forested types (Appendix II) use three categories to identify *representational status* of high quality (A or B rank) natural communities on conservation lands (Gap 1&2 and Gap 1,2&3) within the respective ecoregions:

1. ***Good representation*** – Five or more A or B quality examples of the natural community type occur on conservation land within the ecoregion. This level is based on indicator 6.4.a in the FSC Forest Management Standard which indicates that a forest type is adequately represented if five or more high quality examples are included on conservation lands per ecoregion.

2. ***Fair representation*** – Two to four A or B quality examples occur on conservation land within the ecoregion. This level is based on the Maine Forest Biodiversity Project, which provided guidance and criteria for the establishment of state ecological reserves, and recommended that at least two high quality examples of each natural community occur within ecological reserves per ecoregion.

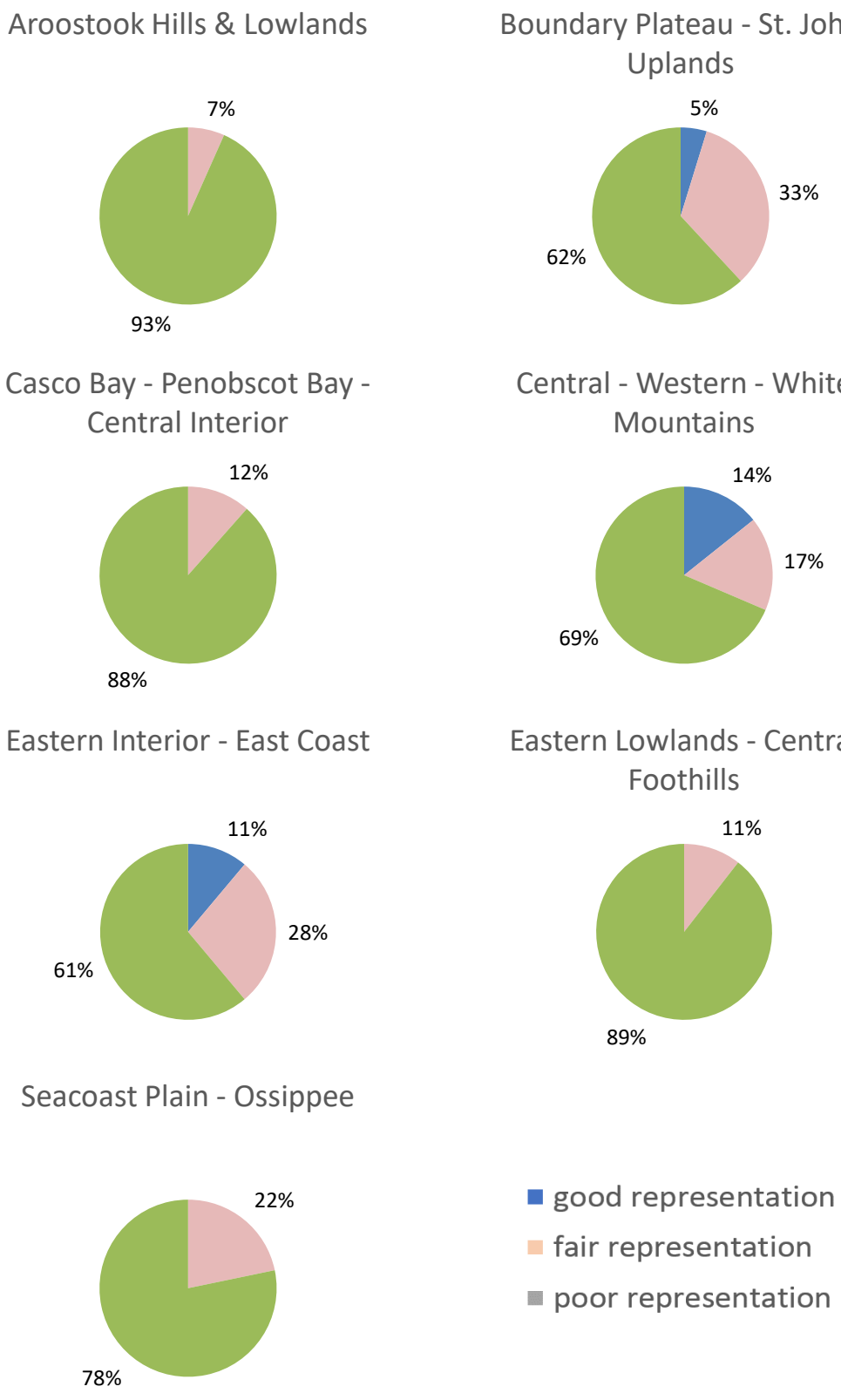
3. ***Poor representation*** – the natural community type is known to occur in a given ecoregion, but less than two A or B quality examples occur on conservation land.

Results (See Tables 1 and 2 in Appendices I and II, respectively)

Only a small percentage of natural communities, forested and non-forested, in any ecoregion have 'Good' representation (See Figure 1 for forested types, page 5, & Figure 2 for non-forested types, Appendix III). There are significantly more natural communities with 'Fair' representation than 'Good', though as a percentage of the total this still represents a small minority of the types within the respective ecoregions. Slightly more non-forested types have 'Good' representation than forested types. Several ecoregions, including the Aroostook Hills & Lowlands, Casco Bay - Penobscot Bay - Central Interior, and the Eastern Lowlands - Central Foothills, have no forest types with 'Good' representation on reserve status lands (GAP 1&2). Despite the generally poor representational status of most community types, there are a few types that are very well represented (Findings 2-a&b below). These results support the assertion, that for practical purposes, nearly all high quality examples of forested natural communities currently mapped should be considered as having high conservation value.

Key Findings:

1. There are relatively few natural community types for which high quality examples are well represented on conservation land in any ecoregion. This is particularly true for forested types on GAP 1&2 lands where they will remain unmanaged (Figure 1, page 5).
2. The conservation status of high quality natural communities generally follows regional patterns of land conservation around the state:
    a) High elevation forest (i.e., *Fir – Heart-leaved Birch Subalpine Forest*) has good representation on reserve lands (GAP 1&2).
    b) Coastal forest types (e.g., *Maritime Spruce Fir Forest* and *Pitch Pine Woodland*) have good representation on reserve lands (GAP 1&2).
    c) Natural community types with 'Good' representation on conservation lands differ among ecoregions.
3. There are some rare natural community types for which it is probable that fewer than five examples exist within a given ecoregion or even statewide. Examples of these include *Atlantic White Cedar Bog* and *Chestnut Oak Woodland*.
4. There are several ecoregions for which no high quality examples of a specific common forest type is known. For example, *Spruce – Fir - Cinnamon Fern Forest* (spruce flats) is known to be present on GAP 1&2 status lands in the Eastern Lowlands – Central Foothills Region, but there are no high quality examples. This is also the case for *Red Oak - Northern Hardwoods - White Pine Forest* in both the Casco Bay – Penobscot Bay- Central Interior and the Seacoast Plain – Ossipee ecoregions.
5. High quality examples of forested natural communities of moderately calcareous, low elevation settings are poorly represented in GAP 1&2 conserved lands in several ecoregions. They include *Northern White Cedar Swamp*, *Cedar - Spruce Seepage Forest*, *Beech- Birch- Maple Forest*, *Maple - Basswood - Ash Forest*, *Hardwood River Terrace Floodplain Forest*, and *Silver Maple Floodplain Forest*. This is consistent with regional findings by Anderson et al. (2016) which found that low elevation, calcareous settings were poorly represented in conserved lands throughout the northeast.
6. For several forest types that are known from specific ecoregions, there are minimal to no occurrences <u>regardless of condition</u> (Schlawin and Cutko 2014) in reserve type (GAP 1&2) lands. It is likely that the only way to achieve represention for these types in the respective ecoregions will be to create new GAP 1&2 status lands that include them. These types include:
    1. *Beech – Birch Maple Forest* in three ecoregions
        - Aroostook Hills & Lowlands
        - Eastern Interior – East Coast
        - Eastern Lowlands – Central Foothills
    2. Floodplain forests in the Casco Bay- Penobscot Bay- Central Interior ecoregion
    3. Several matrix-forming common forest types in Southern and coastal Maine including
        - *Oak – Pine Forest*
        - *Red Oak – Northern Hardwoods- White Pine Forest*
        - *White Pine- Mixed Conifer Forest*



Representation of forested habitats in ecological reserves (GAP 1 and GAP2), by ecoregion.

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Table: Conservation Status of Maine's Exemplary Forested Natural Communities and Ecosystems

Table 1: Conservation Status of Maine's Forested Natural Communities, 2017

Symbol definitions*:
●●●- Good representation, at least 5 A or B rank occurrences on conserved lands per ecoregion;
●● - Fair representation, 2 - 4 A or B rank occurrences on conservation land per ecoregion;
● - No significant representation, though the community type is known from the ecoregion.
Rare community types are noted by State rarity ranks - S1, S2, & S3 - See Appendix III for explanation.

Representation by conservation GAP status

**for further explanation of categories, see report.*

Ecoregion	Macrogroup	Natural Community	GAP 12	GAP 123
Aroostook Hills & Lowlands	Boreal Forested Peatland	Spruce - larch wooded bog	●	●
	Boreal Upland Forest	Low elevation spruce-fir forest	●	●
		Montane spruce-fir forest	●	●
		Spruce - fir - northern hardwoods ecosystem	●	●
	Large River Floodplain	Appalachian - Acadian rivershore ecosystem	●	●
		Balsam poplar floodplain forest (S2)	●	●
		Hardwood river terrace forest (S3)	●●	●●
		Silver maple floodplain forest (S3)	●	●
	Northern Hardwood & Conifer	Beech - birch - maple forest	●	●●
		Hemlock forest	●	●●
		Maple - basswood - ash forest (S3)	●	●●
		Spruce - northern hardwoods forest	●	●
	Northern Swamp	Northern white cedar swamp	●	●
		Northern white cedar woodland fen	●	●●
	Outcrop & Summit Scrub	Red spruce - mixed conifer woodland	●	●

Boundary Plateau - St. John Uplands	Boreal Forested Peatland	Spruce - larch wooded bog	●	●
	Boreal Upland Forest	Aspen - birch woodland/forest complex	●	●
		Black spruce woodland (S3)	●●	●●
		Low elevation spruce-fir forest	●●	●●
		Montane spruce-fir forest	●	●●
		Spruce - fir - cinnamon fern forest	●●●	●●●
		Spruce - fir - northern hardwoods ecosystem	●●	●●●
	Large River Floodplain	Balsam poplar floodplain forest (S2)	●	●
	Northern Hardwood & Conifer	Beech - birch - maple forest	●●	●●●
		Hardwood seepage forest (S3)	●	●
		Hemlock forest	●	●
		Maple - basswood - ash forest (S3)	●	●
		Spruce - northern hardwoods forest	●●	●
		White pine - mixed conifer forest	●	●
	Northern Swamp	Appalachian - Acadian basin swamp ecosystem	●	●
		Cedar - spruce seepage forest	●●	●●●
		Northern white cedar swamp	●	●
		Northern white cedar woodland fen	●	●●
	Outcrop & Summit Scrub	Red pine woodland (S3)	●	●
		Spruce - heath barren (S2)	●●	●
		Spruce talus woodland	●	●

Casco Bay - Penobscot Bay - Central Interior	Boreal Forested Peatland	Spruce - larch wooded bog	●	●
	Boreal Upland Forest	Low elevation spruce-fir forest	●	●
		Maritime spruce - fir forest	●●	●●
	Central Oak-Pine	Birch - oak talus woodland (S3)	●	●
		Oak - pine woodland	●	●●
		Pitch pine dune woodland (S1)	●	●●
		Pitch pine woodland (S3)	●●	●●●
	Coastal Plain Swamp	Atlantic white cedar bog (S1)	●	●
		Atlantic white cedar swamp (S2)	●	●
	Glade, Barren and Savanna	Ironwood - oak - ash woodland (S3)	●●	●●
	Large River Floodplain	Hardwood river terrace forest (S3)	●	●●
		Silver maple floodplain forest (S3)	●	●
	Northern Hardwood & Conifer	Beech - birch - maple forest	●	●
		Hardwood seepage forest (S3)	●	●
		Hemlock forest	●	●
		Maple - basswood - ash forest (S3)	●	●
		Oak - hickory forest (S1)	●	●
		Oak - pine forest	●	●
		Red oak - northern hardwoods - white pine forest	●	●
		White pine - mixed conifer forest	●	●
	Northern Peatland & Fens	Pitch pine bog (S2)	●	●
	Northern Swamp	Appalachian - Acadian basin swamp ecosystem	●	●
		Hemlock - hardwood pocket swamp (S2)	●	●
		Northern white cedar woodland fen	●	●
		Red maple - sensitive fern swamp	●	●
		Red maple wooded fen	●	●

Central - Western - White Mountains	Alpine	Spruce - fir - birch krummholz (S3)	●●	●●
	Boreal Forested Peatland	Spruce - larch wooded bog	●	●
	Boreal Upland Forest	Aspen - birch woodland/forest complex	●	●
		Fir - heart-leaved birch subalpine forest (S3)	●●●	●●●
		Jack pine forest (S1)	●	●
		Low elevation spruce-fir forest	●●	●●●
		Montane spruce-fir forest	●●	●●
		Red pine - white pine forest (S3)	●●	●●●
		Spruce - fir - cinnamon fern forest	●	●
		Spruce - fir - northern hardwoods ecosystem	●●●	●●●
	Central Oak-Pine	Birch - oak talus woodland (S3)	●	●
		Oak - pine woodland	●	●●
	Glade, Barren and Savanna	Ironwood - oak - ash woodland (S3)	●	●
	Large River Floodplain	Appalachian - Acadian rivershore ecosystem	●	●
		Hardwood river terrace forest (S3)	●●●	●●●
		Silver maple floodplain forest (S3)	●	●●
	Northern Hardwood & Conifer	Beech - birch - maple forest	●●●	●●●
		Hemlock forest	●	●
		Maple - basswood - ash forest (S3)	●	●●
		Red oak - northern hardwoods - white pine forest	●	●●
		Semi-rich northern hardwood forest	●	●
		Spruce - northern hardwoods forest	●●●	●●●
		White pine - mixed conifer forest	●	●
		White pine - mixed hardwoods forest ecosystem	●	●
	Northern Swamp	Appalachian - Acadian basin swamp ecosystem	●	●
		Balsam poplar floodplain forest (S2)	●	●

		Black ash swamp	●	●
		Cedar - spruce seepage forest	●	●
		Northern white cedar swamp	●	●
		Northern white cedar woodland fen	●	●
	Outcrop & Summit Scrub	Jack pine woodland (S3)	●	●
		Red pine woodland (S3)	●●	●●
		Red spruce - mixed conifer woodland	●●	●●●
		Spruce talus woodland	●	●●
		White cedar woodland (S2)	●	●

Eastern Interior - East Coast	Boreal Upland Forest	Aspen - birch woodland/forest complex	●	●
		Black spruce woodland (S3)	●	●
		Low elevation spruce-fir forest	●●	●●
		Maritime spruce - fir forest	●●●	●●●
		Red pine - white pine forest (S3)	●●	●●
		Spruce - fir - northern hardwoods ecosystem	●●	●●
	Central Oak-Pine	Birch - oak talus woodland (S3)	●	●
		Oak - pine woodland	●	●
		Pitch pine woodland (S3)	●●●	●●●
	Northern Hardwood & Conifer	Beech - birch - maple forest	●	●
		Hemlock forest	●	●
		Red oak - northern hardwoods - white pine forest	●●	●●
		Spruce - northern hardwoods forest	●	●
	Northern Swamp	Northern white cedar woodland fen	●	●
	Outcrop & Summit Scrub	Jack pine woodland (S3)	●●	●●
		Red pine woodland (S3)	●	●
		Red spruce - mixed conifer woodland	●	●
		White cedar woodland (S2)	●	●

Eastern Lowlands - Central Foothills	Boreal Forested Peatland	Spruce - larch wooded bog	●	●●
	Boreal Upland Forest	Low elevation spruce-fir forest	●	●
		Red pine - white pine forest (S3)	●	●●
		Spruce - fir - cinnamon fern forest	●	●
		Spruce - fir - northern hardwoods ecosystem	●	●●
	Central Oak-Pine	Birch - oak talus woodland (S3)	●	●
	Large River Floodplain	Appalachian - Acadian rivershore ecosystem	●	●
		Hardwood river terrace forest (S3)	●	●●
		Silver maple floodplain forest (S3)	●●	●●
	Northern Hardwood & Conifer	Beech - birch - maple forest	●	●
		Hemlock forest	●●	●●●
		Spruce - northern hardwoods forest	●	●
		White pine - mixed conifer forest	●	●
	Northern Swamp	Appalachian - acadian basin swamp ecosystem	●	●●
		Northern white cedar swamp	●	●●
		Northern white cedar woodland fen	●	●●●
	Outcrop & Summit Scrub	Jack pine woodland (S3)	●	●
		Red pine woodland (S3)	●	●
		Red spruce - mixed conifer woodland	●	●●

Seacoast Plain - Ossipee	Central Oak-Pine	Chestnut oak woodland (S1)	●	●
		Oak - pine woodland	●	●●
		Pitch pine - heath barren (S1)	●	●●
		Pitch pine - scrub oak barren (S2)	●	●●●
		Pitch pine dune woodland (S1)	●	●
		Pitch pine woodland (S3)	●	●
	Coastal Plain Swamp	Atlantic white cedar bog (S1)	●	●
		Atlantic white cedar swamp (S2)	●●	●●●
	Glade, Barren and Savanna	Ironwood - oak - ash woodland (S3)	●●	●●●
	Large River Floodplain	Appalachian - Acadian rivershore ecosystem	●	●
		Silver maple floodplain forest (S3)	●●	●●
	Northern Hardwood & Conifer	Hardwood seepage forest (S3)	●	●
		Hemlock forest	●	●
		Maple - basswood - ash forest (S3)	●	●
		Oak - hickory forest (S1)	●●	●●
		Oak - pine forest	●	●
		Red oak - northern hardwoods - white pine forest	●	●
	Northern Peatland & Fens	Pitch pine bog (S2)	●●	●●
	Northern Swamp	Appalachian - Acadian basin swamp ecosystem	●	●
		Hemlock - hardwood pocket swamp (S2)	●	●●
		Red maple - sensitive fern swamp	●	●●
		Red maple wooded fen	●	●
	Outcrop & Summit Scrub	Red pine woodland	●	●

Table: Conservation Status of Maine's Exemplary Non- Forested Natural Communities and Ecosystems

Table 2: Conservation Status of Maine's Non-Forested Natural Communities, 2017

Symbol definitions*:
●●●- Good representation, at least 5 A or B rank occurrences on conserved lands per ecoregion;
●● - Fair representation, 2 - 4 A or B rank occurrences on conservation land per ecoregion;
● - No significant representation, though the community type is known from the ecoregion.
Rare community types are noted by State rarity ranks - S1, S2, & S3 - See Appendix III for explanation.
(Note: some public domain areas including lakes and ponds, and tidal wetlands may not be fully captured in this analysis due to the mapping standards of Maine's conserved lands GIS layer)

Ecoregion	Macrogroup	Natural Community	GAP 123
Aroostook Hills & Lowlands	Emergent Marsh	Bulrush bed	●
	Lake & River Shore	Bluebell - balsam ragwort shoreline outcrop (S2)	●
		Streamshore ecosystem	●
	Lakes and Ponds	Circumneutral-alkaline water macrophyte suite (S2)	●
	Large River Floodplain	Sand cherry - tufted hairgrass river beach (S2)	●
	Northern Peatland & Fens	Domed bog ecosystem (S3)	●
		Eccentric bog ecosystem (S3)	●
		Leatherleaf boggy fen	●
		Low sedge - buckbean fen lawn (S3)	●●
		Patterned fen ecosystem (S3)	●
		Raised level bog ecosystem	●
		Sedge - leatherleaf fen lawn	●●
		Sheep laurel dwarf shrub bog	●●
		Shrubby cinquefoil - sedge circumneutral fen (S2)	●●
		Unpatterned fen ecosystem	●
	Wet Meadow / Shrub Marsh	Alder shrub thicket	●
		Sweetgale mixed shrub fen	●

Boundary Plateau - St. John Uplands	Cliff and Talus	Labrador tea talus dwarf-shrubland (S2)	●
	Emergent Marsh	Bluejoint meadow	●
	Lake & River Shore	Bluebell - balsam ragwort shoreline outcrop (S2)	●●
		Streamshore ecosystem	●
	Lakes and Ponds	Circumneutral-alkaline water macrophyte suite (S2)	●
	Large River Floodplain	Circumneutral riverside seep (S2)	●●●
		Sand cherry - tufted hairgrass river beach (S2)	●
	Northern Peatland & Fens	Low sedge - buckbean fen lawn (S3)	●●●
		Mixed tall sedge fen	●
		Patterned fen ecosystem (S3)	●●●
		Sedge - leatherleaf fen lawn	●●●
		Shrubby cinquefoil - sedge circumneutral fen (S2)	●●
		Unpatterned fen ecosystem	●●●
	Outcrop & Summit Scrub	Boreal circumneutral open outcrop (S2)	●
	Wet Meadow / Shrub Marsh	Alder shrub thicket	●

Casco Bay - Penobscot Bay - Central Interior	Coastal Grassland & Shrubland	Coastal dune-marsh ecosystem (S3)	●
		Dune grassland (S2)	●●
		Rose - bayberry maritime shrubland	●●
	Emergent Marsh	Bluejoint meadow	●
		Cattail marsh	●
		Tussock sedge meadow	●
	Lake & River Shore	Bluebell - balsam ragwort shoreline outcrop (S2)	●
		Streamshore ecosystem	●●
	Lakes and Ponds	Pickerelweed - macrophyte aquatic bed	●
		Pipewort - water lobelia aquatic bed	●
	Northern Peatland & Fens	Domed bog ecosystem (S3)	●●
		Eccentric bog ecosystem (S3)	●
		Kettlehole bog-pond ecosystem	●
		Leatherleaf boggy fen	●
		Mixed tall sedge fen	●
		Raised level bog ecosystem	●
		Sedge - leatherleaf fen lawn	●
		Sheep laurel dwarf shrub bog	●
		Unpatterned fen ecosystem	●●
	Outcrop & Summit Scrub	Rocky Summit Heath	●
		Three-toothed cinquefoil - blueberry low summit bald (S3)	●●
	Tidal Marsh	Brackish tidal marsh (S3)	●●
		Freshwater tidal marsh (S2)	●
		Mixed graminoid - forb saltmarsh (S3)	●●
		Spartina saltmarsh (S3)	●●
		Tidal marsh estuary ecosystem (S3)	●

	Wet Meadow / Shrub Marsh	Sweetgale mixed shrub fen	●

Central - Western - White Mountains	Alpine	Alpine ecosystem (S2)	●
		Bilberry - mountain-heath alpine snowbank (S1)	●
		Cotton-grass - heath alpine bog (S1)	●●
		Crowberry - bilberry summit bald (S3)	●●●
		Diapensia alpine ridge (S1)	●●
		Dwarf heath - graminoid alpine ridge (S2)	●●
		Heath - lichen subalpine slope bog (S1)	●●
	Cliff and Talus	Acidic cliff - gorge	●●
		Labrador tea talus dwarf-shrubland (S2)	●●
		Mountain alder - bush-honeysuckle subalpine meadow (S1)	●
	Lake & River Shore	Streamshore ecosystem	●
	Lakes and Ponds	Pipewort - water lobelia aquatic bed	●
	Large River Floodplain	Alder floodplain	●
	Northern Peatland & Fens	Domed bog ecosystem (S3)	●
		Eccentric bog ecosystem (S3)	●
		Leatherleaf boggy fen	●●
		Mixed tall sedge fen	●
		Patterned fen ecosystem (S3)	●●
		Sedge - leatherleaf fen lawn	●
		Sheep laurel dwarf shrub bog	●●
		Shrubby cinquefoil - sedge circumneutral fen (S2)	●
		Unpatterned fen ecosystem	●
	Outcrop & Summit Scrub	Blueberry - lichen barren (S2)	●
		Boreal circumneutral open outcrop (S2)	●●
		Rock outcrop ecosystem	●●●
		Rocky Summit Heath	●●●

		Three-toothed cinquefoil - blueberry low summit bald (S3)	●
	Wet Meadow / Shrub Marsh	Alder shrub thicket	●
		Sweetgale mixed shrub fen	●
		Twisted sedge cobble rivershore	●

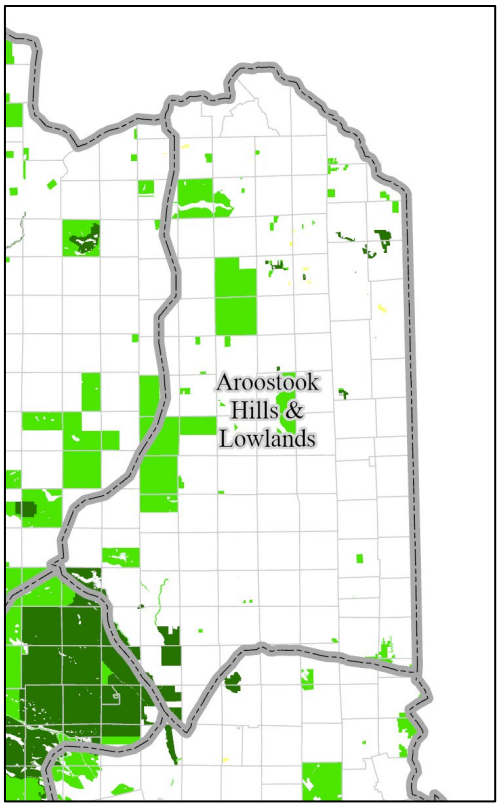
Eastern Interior - East Coast	Coastal Grassland & Shrubland	Dune grassland (S2)	●
	Emergent Marsh	Bluejoint meadow	●●●
		Tussock sedge meadow	●
	Lake & River Shore	Streamshore ecosystem	●
	Lakes and Ponds	Pipewort - water lobelia aquatic bed	●
	Northern Peatland & Fens	Coastal plateau bog ecosystem (S3)	●●●
		Deer-hair sedge bog lawn (S2)	●●
		Domed bog ecosystem (S3)	●
		Heath - crowberry maritime slope bog (S2)	●●
		Huckleberry - crowberry bog (S3)	●●●
		Kettlehole bog-pond ecosystem	●
		Leatherleaf boggy fen	●●
		Raised level bog ecosystem	●●
		Sedge - leatherleaf fen lawn	●
		Sheep laurel dwarf shrub bog	●
		Unpatterned fen ecosystem	●●
	Outcrop & Summit Scrub	Three-toothed cinquefoil - blueberry low summit bald (S3)	●●●
	Rocky Coast	Coastal headland ecosystem (S3)	●
		Crowberry - bayberry headland (S2)	●●
		Seaside goldenrod - goosetongue open headland	●●
	Tidal Marsh	Brackish tidal marsh (S3)	●
		Mixed graminoid - forb saltmarsh (S3)	●
		Spartina saltmarsh (S3)	●
	Wet Meadow / Shrub Marsh	Mixed graminoid - shrub marsh	●

Eastern Lowlands - Central Foothills	Lake & River Shore	Bluebell - balsam ragwort shoreline outcrop (S2)	●
		Lakeshore ecosystem	●
		Lakeshore sand / cobble beach	●
		Streamshore ecosystem	●●
	Lakes and Ponds	Water-lily - macrophyte aquatic bed	●
	Large River Floodplain	Alder floodplain	●
	Northern Peatland & Fens	Bog moss lawn	●
		Deer-hair sedge bog lawn (S2)	●
		Domed bog ecosystem (S3)	●●
		Eccentric bog ecosystem (S3)	●●
		Kettlehole bog-pond ecosystem	●
		Leatherleaf boggy fen	●
		Mixed tall sedge fen	●
		Patterned fen ecosystem	●
		Raised level bog ecosystem	●●
		Sedge - leatherleaf fen lawn	●
		Sheep laurel dwarf shrub bog	●●●
		Shrubby cinquefoil - sedge circumneutral fen (S2)	●●
		Unpatterned fen ecosystem	●●●
	Outcrop & Summit Scrub	Blueberry - lichen barren (S2)	●●
	Wet Meadow / Shrub Marsh	Alder shrub thicket	●
		Sweetgale mixed shrub fen	●

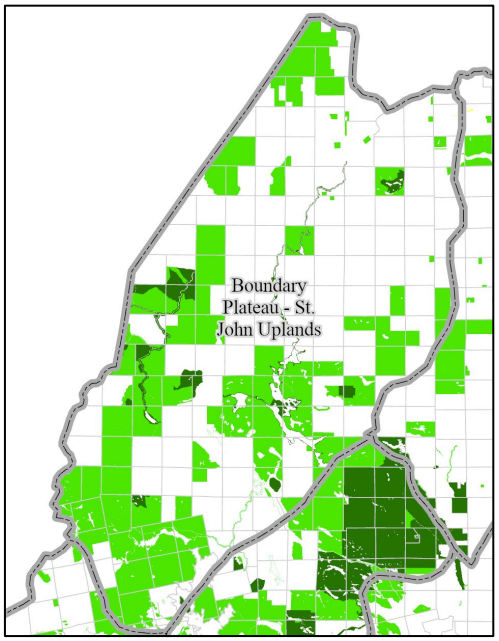
Seacoast Plain – Ossipee	Central Oak-Pine	Little bluestem - blueberry sandplain grassland (S1)	●
	Coastal Grassland & Shrubland	Coastal dune-marsh ecosystem (S3)	●●
		Dune grassland (S2)	●●
	Coastal Plain Pond	Three-way sedge - goldenrod outwash plain pondshore (S1)	●
	Emergent Marsh	Cattail marsh	●
		Tussock sedge meadow	●
	Lake & River Shore	Lakeshore ecosystem	●
		Streamshore ecosystem	●
	Lakes and Ponds	Pipewort - water lobelia aquatic bed	●
	Large River Floodplain	Hudsonia river beach (S1)	●
	Northern Peatland & Fens	Kettlehole bog-pond ecosystem	●
		Leatherleaf boggy fen	●●
		Mixed tall sedge fen	●●
		Raised level bog ecosystem	●
		Sheep laurel dwarf shrub bog	●
	Tidal Marsh	Brackish tidal marsh (S3)	●
		Freshwater tidal marsh (S2)	●
		Mixed graminoid - forb saltmarsh (S3)	●
		Spartina saltmarsh (S3)	●●●
		Tidal marsh estuary ecosystem (S3)	●●
	Wet Meadow / Shrub Marsh	Mixed graminoid - shrub marsh	●●
		Sweetgale mixed shrub fen	●

APPENDIX 2: CONSERVATION STATUS OF COMMON MAINE HABITATS USING TERRESTRIAL ECOLOGICAL SYSTEMS

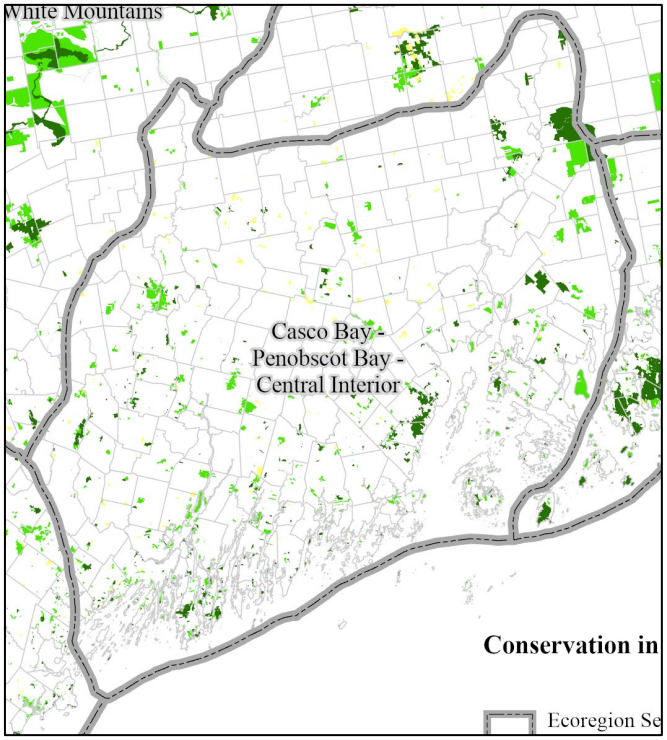
The below figures and tables are the result of a GAP analysis examining conservation status of habitats as mapped by The Nature Conservancy's Terrestrial Ecological Systems data. Habitats were considered under-represented if they were less than 50% as common in conservation as the landscape as a whole, and also if multiple examples of the habitat did not occur in conservation lands. This GAP analysis was performed for all conservation lands (GAP123) and 'reserve' type conservation lands (GAP12) where timber harvesting and other extractive resource use is not allowed. In the below figures, under represented habitats are marked with 'X' or (R). Habitats marked with 'X' indicate that the habitat was proportionally under-represented, while habitats marked with (R) indicate that it only occurred once in conservation lands of that type.



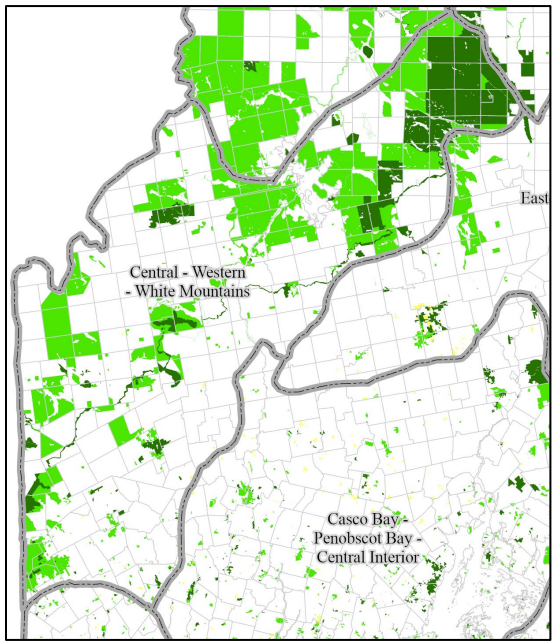
	relative % of total area			Cons. Lands Rep.	
	GAP123	GAP12	All land area	GAP123	GAP12
Aroostook Hills and Lowlands					
Acadian Low Elevation Spruce-Fir-Hardwood Forest	33.65%	24.51%	27.40%		
Acadian Sub-boreal Spruce Flat	7.74%	2.88%	3.90%		
Acidic Cliff, Talus and Rocky Outcrop	0.11%	0.46%	0.10%		
Alkaline Conifer-Hardwood Swamp	1.40%	1.68%	3.70%	X	X
Calcareous Cliff, Talus and Rocky Outcrop	0.15%	0.31%	0.10%		
Laurentian- N. Appalachian-Boreal Peatland	1.31%	1.05%	0.90%		
Laurentian-Acadian Floodplain Forest	0.20%	0.93%	0.10%		
Laurentian-Acadian Freshwater Marsh	0.44%	1.12%	0.30%		
Laurentian-Acadian Northern Hardwood Forest	11.69%	16.90%	12.80%		(R)
Laurentian-Acadian Northern Hardwood Forest, high conifer	5.40%	9.61%	3.00%		
Laurentian-Acadian Red Oak-Northern Hardwood Forest	0.00%	0.00%	0.10%	X	X
Laurentian-Acadian Wet Meadow-Shrub Swamp	1.00%	1.65%	0.80%		
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	2.73%	0.97%	2.20%		X



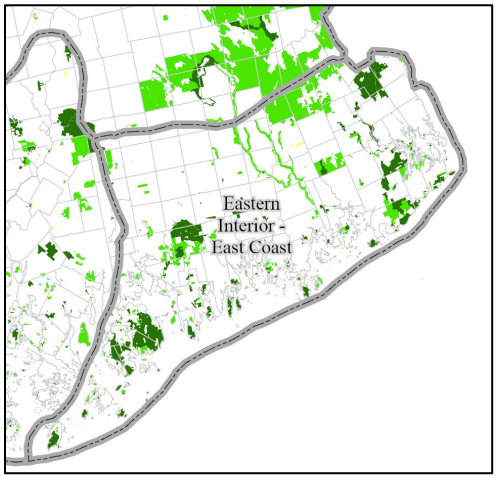
	relative % of total area			Cons. Lands Rep.	
	GAP123	GAP12	All land area	GAP123	GAP12
Boundary Plateau and St. John Uplands					
Acadian Low Elevation Spruce-Fir-Hardwood Forest	31.18%	26.63%	29.70%		
Acadian Sub-boreal Spruce Flat	6.60%	7.19%	5.40%		
Acadian-Appalachian Montane Spr-Fir-Hwd Forest	0	0.00%	0.00%	X	X
Acidic Cliff, Talus and Rocky Outcrop	0.24%	0.73%	0.40%		
Alkaline Conifer-Hardwood Swamp	0.92%	0.48%	1.00%		X
Calcareous Cliff, Talus and Rocky Outcrop	0.08%	0.02%	0.10%		X
Laurentian- N. Appalachian-Boreal Peatland	1.10%	2.27%	0.90%		
Laurentian-Acadian Floodplain Forest	0.03%	0.15%	0.00%		
Laurentian-Acadian Freshwater Marsh	0.37%	1.38%	0.30%		
Laurentian-Acadian Northern Hardwood Forest	22.50%	10.52%	25.60%		X
Laurentian-Acadian Northern Hardwood Forest, high conifer	34.99%	3.18%	6.30%		
Laurentian-Acadian Wet Meadow-Shrub Swamp	0.55%	1.54%	0.50%		
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	2.16%	4.36%	2.00%		



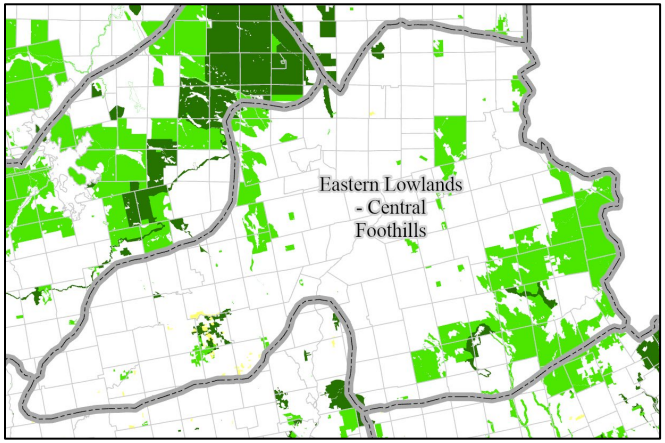
	relative % of total area			Cons. Lands Rep.	
	GAP123	GAP12	All land area	GAP123	GAP12
Casco Bay - Penobscot Bay - Central Interior					
Acadian Low Elevation Spruce-Fir-Hardwood Forest	3.02%	3.64%	4.00%		
Acadian Maritime Bog	0.04%	0.08%	0.00%	(R)	(R)
Acadian Sub-boreal Spruce Flat	0.42%	0.66%	0.60%		
Acadian-North Atlantic Rocky Coast	0.17%	0.14%	0.10%		
Acidic Cliff, Talus and Rocky Outcrop	0.23%	0.38%	0.00%		
Alkaline Conifer-Hardwood Swamp	5.26%	5.81%	4.10%		
Appalachian-Acadian Pine-Hemlock-Hardwood Forest	19.00%	19.08%	30.80%		
Calcareous Cliff, Talus and Rocky Outcrop	0.02%	0.02%	0.00%		
Central Appalachian Dry Oak-Pine Forest	0.01%	0.01%	0.00%		(R)
Laurentian- N. Appalachian-Boreal Peatland	6.01%	9.56%	1.70%		
Laurentian-Acadian Floodplain Forest	0.15%	0.05%	0.20%		X
Laurentian-Acadian Freshwater Marsh	1.75%	1.46%	1.20%		
Laurentian-Acadian Northern Hardwood Forest	1.70%	1.04%	2.50%		X
Laurentian-Acadian Northern Hardwood Forest, high conifer	0.00%	0.00%	0.10%	X	X
Laurentian-Acadian Red Oak-Northern Hardwood Forest	5.95%	6.42%	4.40%		
Laurentian-Acadian Wet Meadow-Shrub Swamp	1.51%	0.97%	1.20%		
North Atlantic Coastal Plain Maritime Forest	0.91%	1.00%	0.50%		
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	0.48%	0.72%	0.60%		
Northern Atlantic Coastal Plain Dune and Swale/Sandy Beach	0.09%	0.17%	0.00%		
Tidal Marsh	1.11%	0.96%	0.30%		



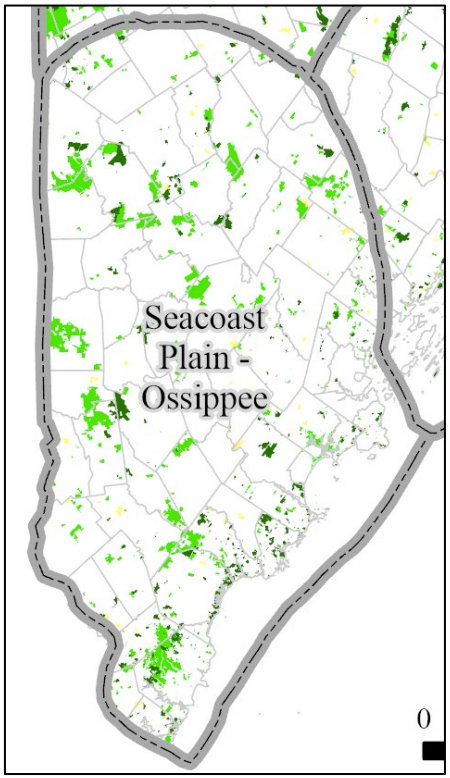
	C. relative % of total area			D. Cons. Lands Rep.	
	Type 1 Cons. Land	Type 2 Cons. Land	All land area	Type 1	Type 2
Central - Western - White Mountains					
Acadian Low Elevation Spruce-Fir-Hardwood Forest	21.8%	22.1%	16.1%		
Acadian Sub-boreal Spruce Flat	2.5%	2.0%	1.8%		
Acadian-Appalachian Alpine Tundra	0.3%	0.5%	0.1%		
Acadian-Appalachian Montane Spr-Fir-Hwd Forest	12.0%	14.5%	9.3%		
Acidic Cliff, Talus and Rocky Outcrop	2.0%	3.5%	1.4%		
Alkaline Conifer-Hardwood Swamp	0.7%	0.2%	0.8%		X
Appalachian-Acadian Pine-Hemlock-Hardwood Forest	0.7%	0.3%	4.8%	X	X
Calcareous Cliff, Talus and Rocky Outcrop	0.3%	0.5%	0.3%		
Central Appalachian Dry Oak-Pine Forest	0.0%	0.0%	0.0%		X
Laurentian- N. Appalachian-Boreal Peatland	0.7%	1.0%	0.4%		
Laurentian-Acadian Floodplain Forest	0.1%	0.1%	0.1%		
Laurentian-Acadian Freshwater Marsh	0.2%	0.2%	0.2%		
Laurentian-Acadian Northern Hardwood Forest	21.6%	19.8%	26.5%		
Laurentian-Acadian Northern Hardwood Forest, high conifer	6.0%	7.7%	4.6%		
Laurentian-Acadian Red Oak-Northern Hardwood Forest	1.3%	0.5%	3.6%	X	X
Laurentian-Acadian Wet Meadow-Shrub Swamp	0.6%	0.6%	0.6%		
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	0.9%	1.1%	0.8%		



	relative % of total area			Cons. Lands Rep.	
	GAP123	GAP12	All land area	GAP123	GAP12
Eastern Interior - East Coast					
Acadian Low Elevation Spruce-Fir-Hardwood Forest	29.4%	31.2%	35.0%		
Acadian Maritime Bog	0.3%	0.6%	0.3%		
Acadian Sub-boreal Spruce Flat	2.5%	2.2%	3.6%		
Acidic Cliff, Talus and Rocky Outcrop	0.1%	2.5%	0.3%	X	
Alkaline Conifer-Hardwood Swamp	3.1%	3.1%	3.2%		
Appalachian-Acadian Pine-Hemlock-Hardwood Forest	3.8%	0.9%	5.9%		X
Calcareous Cliff, Talus and Rocky Outcrop	0.0%	0.0%	0.0%		
Central Appalachian Dry Oak-Pine Forest	0.1%	0.1%	0.0%		
Laurentian- N. Appalachian-Boreal Peatland	2.3%	4.1%	1.7%		
Laurentian-Acadian Floodplain Forest	0.1%	0.0%	0.1%		X
Laurentian-Acadian Freshwater Marsh	1.7%	2.2%	1.2%		
Laurentian-Acadian Northern Hardwood Forest	1.0%	0.9%	2.1%	X	X
Laurentian-Acadian Northern Hardwood Forest, high conifer	0.1%	0.0%	0.1%	(R)	X
Laurentian-Acadian Red Oak-Northern Hardwood Forest	2.8%	2.0%	2.5%		
Laurentian-Acadian Wet Meadow-Shrub Swamp	1.8%	1.3%	1.4%		
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	0.6%	0.8%	1.1%		
Tidal Marsh	0.2%	0.3%	0.2%		



	relative % of total area			Cons. Lands Rep.	
	GAP123	GAP12	All land area	GAP123	GAP12
Eastern Lowlands - Central Foothills					
Acadian Low Elevation Spruce-Fir-Hardwood Forest	9.2%	4.0%	13.2%		X
Acadian Sub-boreal Spruce Flat	1.9%	0.5%	2.1%		X
Acidic Cliff, Talus and Rocky Outcrop	0.1%	0.3%	0.1%		
Alkaline Conifer-Hardwood Swamp	6.5%	7.9%	4.6%		
Appalachian-Acadian Pine-Hemlock-Hardwood Forest	32.7%	22.8%	22.5%		
Calcareous Cliff, Talus and Rocky Outcrop	0.0%	0.0%	0.0%	X	X
Laurentian- N. Appalachian-Boreal Peatland	2.8%	8.6%	2.2%		
Laurentian-Acadian Floodplain Forest	0.2%	0.8%	0.2%		
Laurentian-Acadian Freshwater Marsh	1.1%	2.9%	0.8%		
Laurentian-Acadian Northern Hardwood Forest	7.0%	2.6%	10.9%		X
Laurentian-Acadian Northern Hardwood Forest, high conifer	0.8%	0.7%	1.6%		X
Laurentian-Acadian Red Oak-Northern Hardwood Forest	0.7%	0.0%	0.7%		X
Laurentian-Acadian Wet Meadow-Shrub Swamp	2.2%	2.4%	1.5%		
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	1.4%	3.8%	1.6%		



	relative % of total area			Cons. Lands Rep.	
	Type 1 Cons. Land	Type 2 Cons. Land	All land area	Type 1	Type 2
Seacoast Plain - Ossipee					
Acadian-North Atlantic Rocky Coast	0.1%	0.2%	0.1%		
Acidic Cliff, Talus and Rocky Outcrop	0.2%	0.4%	0.1%		
Alkaline Conifer-Hardwood Swamp	4.0%	5.3%	3.3%		
Appalachian-Acadian Pine-Hemlock-Hardwood Forest	17.4%	12.5%	25.6%		X
Calcareous Cliff, Talus and Rocky Outcrop	0.3%	0.9%	0.1%		
Central Appalachian Alkaline Glade and Woodland	0.0%	0.0%	0.0%		X
Central Appalachian Dry Oak-Pine Forest	0.3%	0.5%	0.2%		
Central Appalachian Floodplain Forest	1.9%	1.5%	0.5%		
Laurentian- N. Appalachian-Boreal Peatland	0.9%	2.3%	0.2%		(R)
Laurentian-Acadian Freshwater Marsh	1.6%	2.1%	0.9%		
Laurentian-Acadian Wet Meadow-Shrub Swamp	1.5%	1.0%	1.2%		
North Atlantic Coastal Plain Basin Peat Swamp	0.1%	0.0%	0.0%	(R)	X
North Atlantic Coastal Plain Hardwood Forest	3.0%	2.7%	1.0%		
North Atlantic Coastal Plain Maritime Forest	0.1%	0.2%	0.1%	(R)	(R)
North-Central Appalachian Pine Barrens	2.0%	1.5%	0.4%		
North-Central Interior Wet Flatwoods	0.0%	0.1%	0.1%	X	
Northeastern Coastal and Interior Pine-Oak Forest	9.8%	4.0%	13.0%		X
Northern Appalachian-Acadian Conifer-Hardwood Acidic Swamp	2.4%	2.1%	1.8%		
Northern Atlantic Coastal Plain Dune and Swale/Sandy Beach	0.1%	0.3%	0.2%		
Tidal Marsh	3.7%	6.9%	0.5%		

APPENDIX 3: POND CONSERVATION

A table of Maine ponds with complete (>90%) shoreline conservation by temperature, trophic level, and acidity.

HUC 4Watershed and Temperature/Trophic/Alkalinity Class	Total Ponds	GAP 12 Conserved	GAP 123 conserved
Androscoggin	**362**	**5**	**40**
11. Cold, Eutrophic, Circumneutral	4		
12. Cold, Eutrophic, Acidic	7	1	1
13. Warm to Cool, Oligo-Mesotrophic, Alkaline	2		
14. Warm to Cool, Oligo-Mesotrophic, Circumneutral	33		
15. Warm to Cool, Oligo-Mesotrophic, Acidic	40		
17. Warm to Cool, Eutrophic, Circumneutral	13		
18. Warm to Cool, Eutrophic, Acidic	44	1	2
2. Very Cold, Oligo-Mesotrophic, Circumneutral	13		
3. Very Cold, Oligo-Mesotrophic, Acidic	30		1
5. Very Cold, Eutrophic, Circumneutral	2		
8. Cold, Oligo-Mesotrophic, Circumneutral	34		2
9. Cold, Oligo-Mesotrophic, Acidic	140	3	34
Kennebec	**1001**	**7**	**125**
1. Very Cold, Oligo-Mesotrophic, Alkaline	1		
10. Cold, Eutrophic, Alkaline	1		
11. Cold, Eutrophic, Circumneutral	17		

12. Cold, Eutrophic, Acidic	28		1
14. Warm to Cool, Oligo-Mesotrophic, Circumneutral	68	1	3
15. Warm to Cool, Oligo-Mesotrophic, Acidic	97		5
16. Warm to Cool, Eutrophic, Alkaline	2		
17. Warm to Cool, Eutrophic, Circumneutral	66		
18. Warm to Cool, Eutrophic, Acidic	18		
2. Very Cold, Oligo-Mesotrophic, Circumneutral	31		
3. Very Cold, Oligo-Mesotrophic, Acidic	47		
5. Very Cold, Eutrophic, Circumneutral	2		
6. Very Cold, Eutrophic, Acidic	10		
8. Cold, Oligo-Mesotrophic, Circumneutral	168	1	29
9. Cold, Oligo-Mesotrophic, Acidic	445	5	87
Maine Coastal	**1205**	**90**	**184**
11. Cold, Eutrophic, Circumneutral	1		
12. Cold, Eutrophic, Acidic	38	1	3
14. Warm to Cool, Oligo-Mesotrophic, Circumneutral	40		
15. Warm to Cool, Oligo-Mesotrophic, Acidic	605	48	90
16. Warm to Cool, Eutrophic, Alkaline	19		
17. Warm to Cool, Eutrophic, Circumneutral	71	2	3
18. Warm to Cool, Eutrophic, Acidic	77	4	4
2. Very Cold, Oligo-Mesotrophic, Circumneutral	2		
3. Very Cold, Oligo-Mesotrophic, Acidic	86	6	10
6. Very Cold, Eutrophic, Acidic	2		
7. Cold, Oligo-Mesotrophic, Alkaline	2		
8. Cold, Oligo-Mesotrophic, Circumneutral	4		
9. Cold, Oligo-Mesotrophic, Acidic	258	29	74
Penobscot	**1485**	**211**	**368**
10. Cold, Eutrophic, Alkaline	2		
11. Cold, Eutrophic, Circumneutral	10		2
12. Cold, Eutrophic, Acidic	22	1	2
13. Warm to Cool, Oligo-Mesotrophic, Alkaline	2		
14. Warm to Cool, Oligo-Mesotrophic, Circumneutral	47		3
15. Warm to Cool, Oligo-Mesotrophic, Acidic	188	1	1

17. Warm to Cool, Eutrophic, Circumneutral	19		
18. Warm to Cool, Eutrophic, Acidic	11		
2. Very Cold, Oligo-Mesotrophic, Circumneutral	5		1
3. Very Cold, Oligo-Mesotrophic, Acidic	61	2	2
6. Very Cold, Eutrophic, Acidic	1		1
7. Cold, Oligo-Mesotrophic, Alkaline	6		
8. Cold, Oligo-Mesotrophic, Circumneutral	178	11	44
9. Cold, Oligo-Mesotrophic, Acidic	933	196	312
Saco	**679**	**3**	**34**
11. Cold, Eutrophic, Circumneutral	8		
12. Cold, Eutrophic, Acidic	70		4
13. Warm to Cool, Oligo-Mesotrophic, Alkaline	1		
14. Warm to Cool, Oligo-Mesotrophic, Circumneutral	20		
15. Warm to Cool, Oligo-Mesotrophic, Acidic	167	2	14
16. Warm to Cool, Eutrophic, Alkaline	6		
17. Warm to Cool, Eutrophic, Circumneutral	64		1
18. Warm to Cool, Eutrophic, Acidic	101	1	3
2. Very Cold, Oligo-Mesotrophic, Circumneutral	2		
3. Very Cold, Oligo-Mesotrophic, Acidic	72		3
6. Very Cold, Eutrophic, Acidic	1		
8. Cold, Oligo-Mesotrophic, Circumneutral	2		
9. Cold, Oligo-Mesotrophic, Acidic	165		9
St. John	**698**	**25**	**96**
1. Very Cold, Oligo-Mesotrophic, Alkaline	3		
10. Cold, Eutrophic, Alkaline	72		
11. Cold, Eutrophic, Circumneutral	32	4	5
12. Cold, Eutrophic, Acidic	3		
14. Warm to Cool, Oligo-Mesotrophic, Circumneutral	10		1
16. Warm to Cool, Eutrophic, Alkaline	1		
17. Warm to Cool, Eutrophic, Circumneutral	4		
2. Very Cold, Oligo-Mesotrophic, Circumneutral	21	1	1
3. Very Cold, Oligo-Mesotrophic, Acidic	2		
5. Very Cold, Eutrophic, Circumneutral	1		

7. Cold, Oligo-Mesotrophic, Alkaline	23		
8. Cold, Oligo-Mesotrophic, Circumneutral	504	19	88
9. Cold, Oligo-Mesotrophic, Acidic	22	1	1
Grand Total	**5430**	**341**	**847**