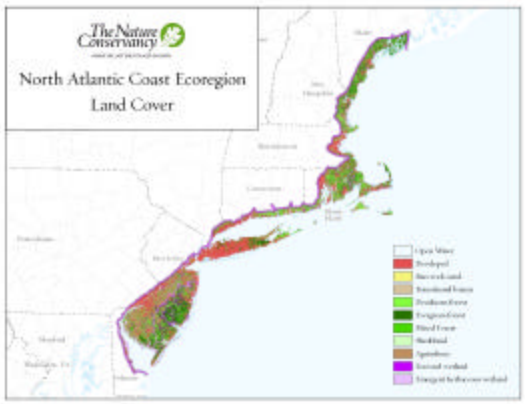
The North Atlantic Coast Ecoregional Assessment, Conservation Status Report & Resource CD

2006

Ecosystems

Species

Streams



Land Conservation

The Nature Conservancy:
North Atlantic Coast Team
M. G. Anderson, K. Lombard, J. Lundgren, B. Allen, S. Antenen, D. Bechtel, A. Bowden, M. Carabetta, C. Ferree, M. Jordan, S. Khanna, D. Morse, A. Olivero, N. Sferra, M. Upmeyer

Conservation Status of the North Atlantic Coast

• KEY FINDINGS

Three percent of the North Atlantic Coast ecoregion is secured primarily for nature conservation. Another fourteen percent is secured from conversion to development while allowing for multiple uses including resource extraction.

Forty percent of the ecoregion has been lost to conversion. The ratio of habitat lost to habitat secured is 16 to 1 with over 26% of the ecoregion converted to development and 14% to agriculture. By a standard measure the region ranks as "Critically Endangered." Ratios of loss to securement are highest in Delaware, New Jersey and New York where they range up to 40 to 1.

The distribution of the few secured lands is appropriately skewed towards the coastal zone and towards ecosystems and species found in coarse sandy soils such as beaches and dunes. However, important settings like fine-sediment floodplains and productive, moderately calcareous soils are almost completely absent from the secured lands. Unusual, high relief features, like cliffs and summits have better representation than more common features.

With 120 rare endemic species, the North Atlantic Coast ecoregion is a center of endemism in the Northeast, second only to the Central Appalachians. Although many larger species have been extirpated from the region, 117 species (plants, vertebrates and invertebrates) were identified as specific conservation priorities because their populations are too small, or are declining too fast, to rely on general ecosystem protection alone as a conservation strategy. Of these, 95% have fewer than ten populations on secured land.

Contiguous and ecologically complete forest ecosystems that once dominated the region are now largely young, simplified and heavily fragmented by roads and development. Thirteen priority areas were identified that still retain relatively intact interior forest systems over 10,000 acres in size. Only one of these has a core area, secured for nature, on a scale that could maintain these ecosystems in their full complexity and dynamics.

Forest cover has been increasing since the extensive deforestation of the 19th century. Relatively large areas with over 80 percent natural cover can be found in several key sections of the ecoregion. We identified 131 areas over 1000 acres each, that remain unfragmented and if secured against conversion would help retain landscape function in key areas.

Small-scale **upland** ecosystems harbor extensive biodiversity. Over 354 examples of beaches, barrens, heathlands, woodlands and distinct forest types were targeted for conservation. Of these, only coastal dunes and inland sand barrens have over 20 percent of their best, and most critical examples secured on nature reserves. Critical occurrences of bedrock shores, sandstone barrens, acidic slopes and lake-plain forests have fewer than 20% on land secured primarily for nature conservation.

Critical **wetland** ecosystems have considerably less explicit protection than their upland counterparts. Acidic wetlands, such as peatlands, enjoy the highest level of securement with about 25% secured on nature reserves. Floodplain, riverside and tidal wetlands all have fewer than 10% of their best examples on secured land.

Conservation in this ecoregion is a collective effort. Conservation of rare species and ecosystems is the result of actions by dozens of different public agencies and private organizations. Private ownerships account for 35% of the land secured primarily for nature. Almost 5% of the total is attributable to The Nature Conservancy.

Threats to this region are on the rise. Coastal and floodplain ecosystems are vulnerable to intense pressure in the next half-century. Further, there are emerging threats that cannot be prevented by land protection alone. These threats include the impacts from atmospheric deposition, climate change, and invasive species, especially forest tree pathogens. Addressing these will require new conservation strategies.

• KEY FINDINGS (continued)

AQUATIC

The portfolio selection process identified 6,554 miles of high quality tidal creeks, medium-sized streams and large river systems. Of the critical streams, 8% of the buffer land flanking them is secured for nature conservation, while another 14% is secured on multiple use land. While many of the tidal creeks are free flowing to the ocean, most of the larger streams in the portfolio are fragmented by numerous dams.

Eleven fish species and four aquatic mollusks were identified as needing direct conservation action in this region. The vast majority, 70%, of the best populations occur in areas without any permanent protection or securement.

NAC CORE TEAM: November 2005

• ACKNOWLEGEMENTS

NAC Core Team

Allen, Bob	New Jersey Chapter
Anderson, Mark	Eastern Conservation Science
Antenen, Susan	Long Island Chapter
Bechtel, Doug	New Hampshire Chapter
Bowden, Alison	Massachusetts Chapter
Carabetta, Mark	Connecticut Chapter
Ferree, Charles	Eastern Conservation Science
Jordan, Marilyn	Long Island Chapter
Khanna, Shyama	Eastern Conservation Science
Lombard, Karen	Massachusetts Chapter
Lundgren, Julie	Rhode Island Chapter
Manus, Andy	Delaware Chapter
Morse, Dan	Eastern Conservation Science
Olivero, Arlene	Eastern Conservation Science
Sferra, Nancy	Maine Chapter
Upmeyer, Mariana	New Jersey Chapter

Regional Secured-Lands Team

August Froehlich (OH), Thomas Minney (WV), Allison Jones (WV), Christopher Bruce (VA), Stephanie Orndorff (PA), Michelle Canick (MD), Kristen Pollard (DE), David Gelona (NJ), Bradford Stratton (NY), Craig Cheeseman (NY), Barnaby Friedman (NY), Sarah Wakefield (VT), Pete Ingraham (NH), Daniel Coker (ME), Katie L. Andrews (MA), Kevin A. Ruddock (RI), Kenneth H. Geisler (CT), Arlene Olivero (ECS), Dan Morse (ECS), Erin Smyth (ERO)

State Natural Heritage Programs, and NatureServe Thanks to the following for sharing their expertise, staff time and data: Molly Docherty, Lionel Chute, David VanLuven, Henry Woolsey, Rick Enser, Nancy Murray, Jean Fike, Tony Davis, Bob Cartica, Greg Schneider, Karen Bennett, Glenn Therres.

Front page image of Atlantic Sturgeon courtesy of Rob and Ann Simpson. Other photos courtesy of J. Lundgren.

• TECHNICAL TEAMS

HERPTILES
Team Leader: Mark Carabetta (Connecticut)
Reviewers: Dawn McKay and Karen Zyko (CT NDDB); Karen Lombard and Alison Bowden (MA TNC); Lloyd Gamble and Paul R. Sievert (UMASS); Bob Allen, Mike Dunphy and Mariana Upmeyer (NJ TNC); Dave Golden (NJ Fish & Wildlife); Nancy Sferra (ME TNC) and Phillip deMaynadier (ME Inland Fisheries & Wildlife); Doug Bechtel (NH TNC); John Kanter, Mike Marchand and Jim Oehler (NH Fish & Game); Pam Hunt (NH Audubon); Julie Lundgren (RI TNC); Marilyn Jordan (NY TNC); Paul Novak (NY Heritage); Susi VonOettingen (USFWS); and the CT DEP Scientific Advisory Committee

MAMMALS
Team Leaders: Bob Allen and Mariana Upmeyer (New Jersey)
Reviewer: John Litvaitis (UNH)

BIRDS
Team Leaders: Bob Allen (New Jersey), Nancy Sferra (Maine)
Reviewers: Nancy Sferra (ME TNC), Lindsay Tudor, Brad Allen, and Tom Hodgman (ME Inland Fisheries and Wildlife), Peter Vickery (Center for Ecol. Res.), Doug Bechtel (NH TNC), Karen Lombard (MA TNC), Tom Maloney (MA TNC), Julie Lundgren (RI TNC), Mark Carabetta (CT TNC), Dawn McKay (CT NDDB), Paul Buckley (URI), Marilyn Jordan (NY TNC), Joe Jannsen (NY TNC), Tara Seoane (NY Natural Heritage), Paul Novak (NY Natural Heritage), Mike Scheibel (NY TNC), and Mike Bisignano (NJ TNC).

TERRESTRIAL INVERTEBRATES
Team leader: Karen Lombard (Massachusetts)
Reviewers: Dale Schweitzer (NatureServe), Paul Novak (NY Natural Heritage), Tim Simmons (MA Heritage), Mike Nelson (MA Heritage), Philip DeMaynadier (ME Inland Fisheries & Wildlife), Marilyn Jordan (NY TNC), Nancy Sferra (ME TNC), Jeff Lougee (NH TNC) and Mark Carabetta (CT TNC).

AQUATIC SPECIES
Team Leader: Alison Bowden (Massachusetts)
Reviewers (TNC): Nancy Sferra, Kathy Jensen (ME TNC); Mark Carabetta (CT TNC); Doug Bechtel (NH TNC), Julie Lundgren (RI TNC); Arlene Olivero (ECS TNC); Colin Apse (Eastern Freshwater Program TNC); Marilyn Jordan (NY TNC-Long Island); Mark Bryer (Chesapeake Bay TNC); George Schuler, Rebecca Shirer (NY TNC – Eastern NY); Jay Odell (NH TNC); Charles DeCurtis (PA TNC)

Reviewers (Other): Karsten Hartel (Harvard MCZ); Kevin Curry (Bridgewater State College); Phil DeMaynadier (ME Division of Inland Fisheries); Boyd Kynard (Conte Anadromous Fish Laboratory); Brad Chase (MA Division of Marine Fisheries); Fred SaintOurs (entomologist); Jennifer Loose (MA Heritage); Ginger Brown (RI Natural History Survey); Dawn McKay (CT Heritage); Robert Buchsbaum (MA Audubon); Jay Cordeiro (NatureServe); David McLain (UMASS); Ken Sprankle (US FWS); Chris Raithel (RI DEM)

PLANTS
Team Leader: Doug Bechtel (New Hampshire)
Reviewers: Bill Nichols and Dan Sperduto (NH Heritage); Arthur Haines and Bill Brumback (New England Wildflower Society); Karen Lombard (MA TNC); Bob Allen and Andrea Stevens (NJ TNC) and Mike Van Clef (NJ TNC formerly); Nancy Sferra (ME TNC) and Don Cameron (ME Nature Areas); Marilyn Jordan, Bruce Horwith, Joe Jannsen (NY TNC) and Steve Young (NY Heritage); Ellen Roca (DE TNC) and Bill MacAvoy (DE Heritage); Mark Carabetta (CT TNC); Julie Lundgren (RI TNC).

UPLAND & WETLAND ECOSYSTEMS
Team Leaders: Julie Lundgren (Rhode Island), Mark Anderson (ECS), Charles Ferree (ECS)
Reviewers: Dan Sperduto (NH Heritage); Pat Swain (MA Heritage); Andy Windish (NJ Heritage) Andy Cutko (ME Heritage) Ken Metzler (CT Heritage), Greg Edinger (NY Heritage); NAC core team.

FRESHWATER STREAM SYSTEMS
Team Leader: Arlene Olivero (ECS)
Reviewers (TNC): Mark Carabetta (CT TNC); Andrew Manus (DE TNC); Alison Bowden (MA TNC): Nancy Sferra (ME TNC); Doug Bechtel (NH TNC); Jay Odell (NH TNC); Marianna Upmeyer (NJ TNC); Marilyn Jordan (NY TNC – Long Island); Becky Shirer (NY TNC – Eastern NY); Julie Lundgren (RI TNC).

• KEY TERMS

Defining "Secured," "Protected" and "Managed"
The ecoregion encompasses parts of nine states each with their own distinctive land use and ownership patterns, as well as institutional contexts. The conservation status data was compiled to identify all land areas that were intended (by policy and practice) to contribute toward biodiversity conservation. We conducted a multi-jurisdictional review using a standard framework to compare land status across administrative and political boundaries.

As scientists and conservationists we agreed on conventions for talking about, mapping, and analyzing **Land Status**. The terms **Protected** and **Managed** were problematic as they have a variety of uses and implications in various places. We reached consensus on the term **Secured** to refer to all *land permanently secured against conversion of natural cover to development.*

Our rules for assigning a value to a tract of land were consistent with the National Gap Analysis Program (GAP - Crist 2000) in that:

- Management regime rather than institutional authority, mandate or ownership type was the primary determinant in assigning status.
- Management intent (e.g., maintaining forest cover) was used to define status, rather than the legal designation (e.g., protected area).
- Management effectiveness was not measured, i.e., whether the management objectives or prescription had achieved the desired outcome

Secured Land (S): This broad designation encompassed all the potential conservation land with ownership or restrictions that prevent it from being converted to development (including mining). The term "secured" *does not* necessarily imply explicit biodiversity conservation, although such land and protections exist within the secured lands. Most secured land is managed for multiple uses especially recreation, conservation and/or resource extraction. The management practices are mixed with respect to conservation value. Secured lands consist largely of public land subject to policy restrictions, but also include private land subject to conservation easements or owned by conservation organizations. Certified land or volunteer conservation land was not included as most can be withdrawn from their respective programs at any time.

Although we use the term "permanent" it is understood that the term is a hopeful one as it is theoretically possible to undo the protection of virtually any land.

Finer Distinctions: The secured lands were subdivided by conservation intent, reflecting different degrees of biodiversity focus. We adopted the definitions for classifying land stewardship status used by the GAP program (Crist 2000).

GAP 1 or 2: Secured Primarily for Nature (P): *GAP Status 1*: is land having permanent protection from conversion of natural land cover and a *mandated management plan in operation to maintain a natural state* (< 5% anthropogenic use), within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference, or are mimicked through management. *Status 2:* is similar but aims for a *primarily natural state* and allows for land which may receive uses or management practices that degrade the quality of existing natural communities (< 5% low intensity anthropogenic disturbance), including suppression of natural disturbance. *Examples include nature reserves, research natural areas, "forever wild" easements (GAP 1), wildlife refuges, some US national parks (GAP 2).*

GAP 3: Secured for Multiple Uses (M): Status 3 is land having permanent protection from conversion of natural land cover for the majority of the area (> 50%), but *subject to extractive uses* (> 5%) of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). In the U.S. it confers protection to federally listed endangered and threatened species throughout the area. *Examples include State forests and private lands subject to what are colloquially known as working forest easements (legally binding, permanent deed restrictions), that allow forestry and other renewable resource extraction*.

The following shorthand is used in this document
Secured Lands (S) = GAP 1, 2 & 3
Secured Primarily for Nature (P) = GAP 1, 2
Secured for Multiple Uses (M) = GAP 3
Different degrees of securement are appropriate for various conservation targets. By improving management practices and regulatory policies we can enhance the biodiversity value of GAP 3 land. Land in status 1 or 2 may be necessary to conserve a species population or restore the structure and full diversity of an ecosystem.
Secured land data was current to JANUARY 2006.

- **TABLE OF CONTENTS**

Plan and Resource CD
Text, Maps and Appendices
(In separate documents on CD)

Citation:

Please cite as: Anderson, M. G., Lombard, K., Lundgren, J., Allen, B., Antenen, S., Bechtel, D., Bowden, A., Carabetta, M., Ferree, C., Jordan, M., Khanna, S., Morse, D., Olivero, A., Sferra, N., Upmeyer, A. 2006. The North Atlantic Coast: Ecoregional Assessment, Conservation Status Report and Resource CD. The Nature Conservancy, Eastern Conservation Science, Boston, MA

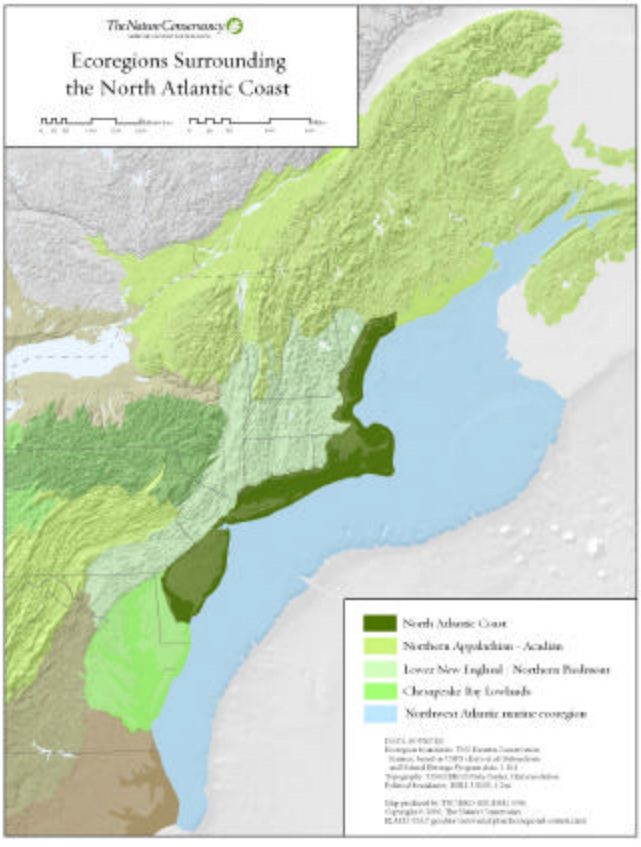
Conservation Status of the North Atlantic Coast

• INTRODUCTION

This report aims to measure and summarize the status of Nature and Conservation in the North Atlantic Coast ecological region. Using sophisticated quantitative and spatial analysis techniques, the report summarizes three decades of ecological inventory data, geological, hydrological, and landcover mapping, advanced predictive modeling techniques, and expert knowledge from the abundant store of academic, public and privately based conservation scientists in the region.

The goal of this **ecoregional assessment** was to identify the critical places to protect in order to conserve all the biodiversity of the ecoregion. Additionally, this report utilizes the Conservancy's recently compiled (Jan 2006) s**ecured lands data base** representing over 150,000 tracts of land in the northeastern US and maritime Canada that have conservation value.

Focal Ecoregion:



The extent of the ecoregion is shown above. The 13 million acre area forms a narrow coastal strip covering parts of nine states. It has a straight line distance of 475 miles but encompasses almost 5,000 miles of irregular shoreline habitat. Rocky shores, sandy beaches and tidal marshes are all characteristic. Once mostly wooded it is now primarily residential.

Measuring Nature :
How do you measure nature? Life, diversity and natural processes exist as a continuum across scales and time that we do not fully comprehend. Any attempt to count and measure "Nature" is fraught with obstacles and swamped with detail. Fortunately, many ecological features may be productively compared and contrasted if the estimated measurements are done consistently. Thus the goal in this assessment was a consistent and transparent rendering of trends and the identification of robust patterns.

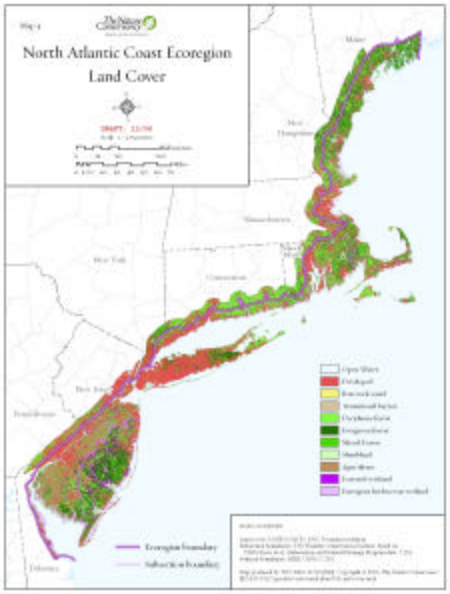
Although we strove for maximum accuracy, readers should understand that each number is an estimate with some error associated with it. For brevity we report most numbers without their standard deviations, variances and error bars.

It is our hope this document serves as an initial benchmark against which conservation efforts may *be measured, focused and improved.

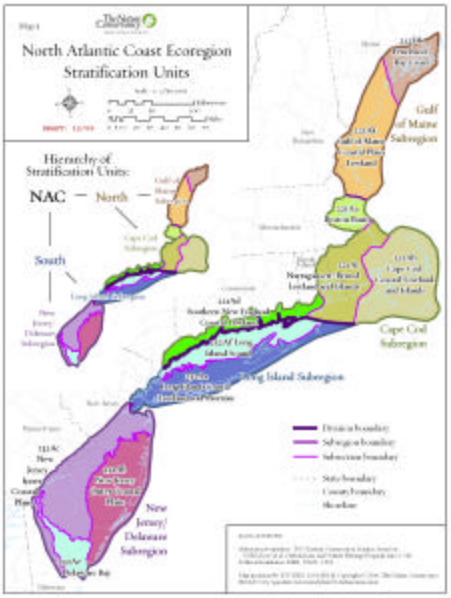
Detailed information on other ecoregional assessments may be found at (website).

Conservation Status of the North Atlantic Coast

- **THE ECOREGION**



- **THE SUBSECTIONS**



NORTH ATLANTIC COAST (NAC)

The ecoregion consists of a glaciated irregular plain composed of sandy till and modified by coastal processes in NJ, DE, NY, RI, CT, MA, NH, ME and a tiny piece of PA. Kames, kettle holes, drumlins and reworked terminal moraines are typical features. Entirely below 600 ft., the region boasts extensive marine and estuarine habitats including salt marshes, beach dune and barrier island systems, fresh and brackish tidal marshes. Inland forest types include coastal pine-oak forests, and oak-beech-holly forest.

Vital Statistics

- **Size: 7,365,363 acres**
- **GAP 1, 2 = 3%, GAP 3 = 11%**
- **Unsecured = 87%**
- **Converted to Protected ratio: 16 to 1**
- **Natural Cover: 60%**
- **# Endemic species: 120**
- **Portfolio Target Occurrences: 1,900**
- **Portfolio Stream-miles: 6554 miles**

The extent of the region covered by this report includes parts of nine states. The statistics below summarize some of the key features of state with *acres given to the nearest million.*

SUBSECTIONS: NORTH to SOUTH

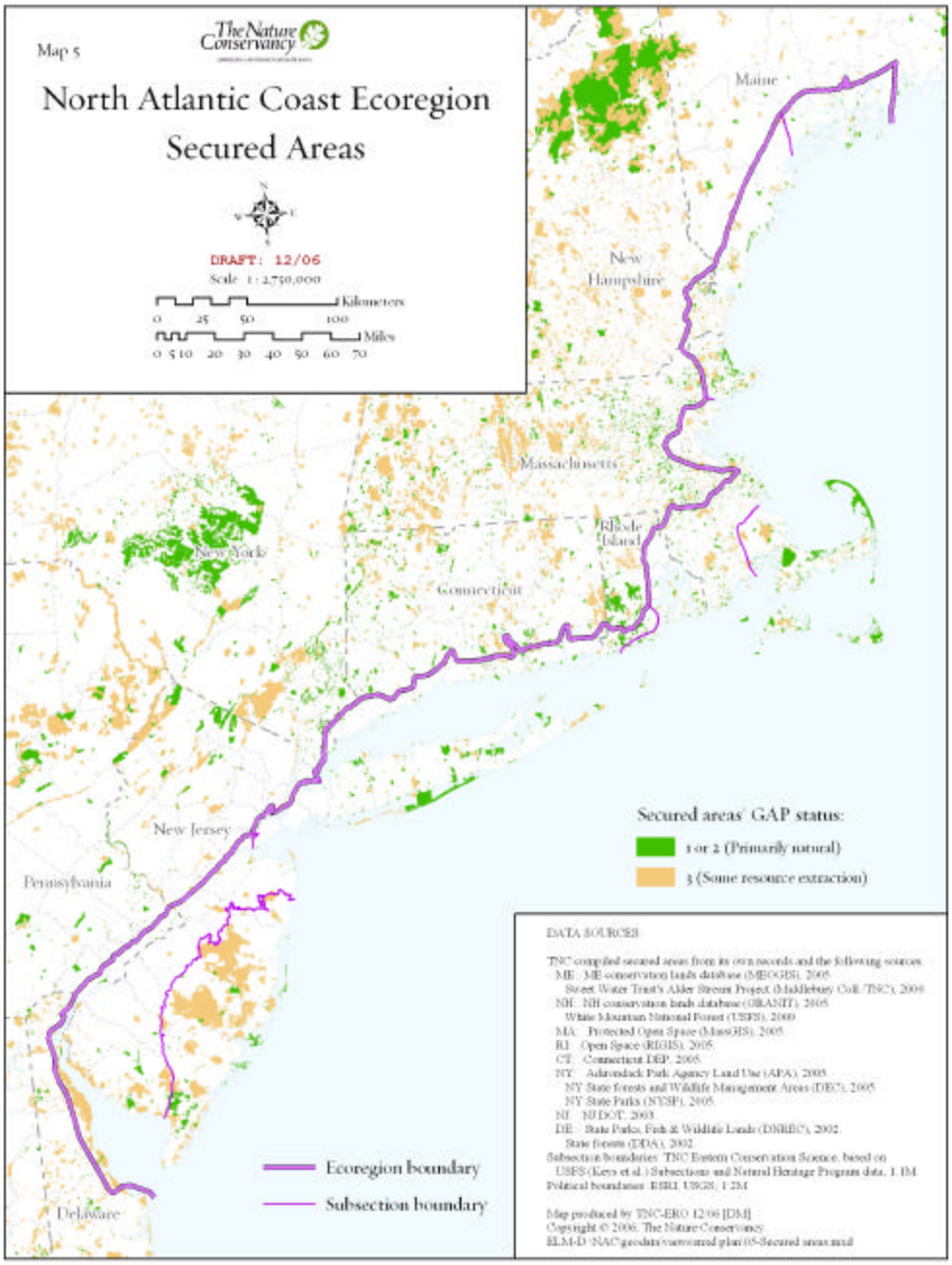
(The numbers given below are for the units shown in color above, including areas of water not assessed in this report)

SUBSECTION NAME	Acres
Penobscot Bay Coast	625,913
Gulf of Maine Coastal Lowland	1,500,533
Boston Basin	348,222
Narragansett-Bristol Lowland and Islands	1,317,265
Cape Cod Coastal Lowland and Islands	1,947,888
Southern New England Coastal Lowland	581,847
Long Island Sound	1,021,223
Long Island Coastal Lowland and Moraine	1,499,187
New Jersey Pine Barren Outer Coastal Plain	1,592,708
New Jersey Inner Coastal Plain	1,824,949
Delaware Bay	451,742
TOTAL (rounded)	**12,712,000**

State Statistics (NAC portion only)

State	Acres	GAP 1-2	GAP 3	Un-Secured	Nat.	Agri.	Dev.
CT:	463,864	3%,	4%,	93%,	57%	9%	35%.
DE:	163,821	0%	37%,	63,	60%	34%	7%.
ME:	777,000	1%	3%	95%,	80%	10%	10%.
MA:	1,509,255	8%,	7%,	85%,	68%	7%	25%.
NH:	173,211	2%,	9%,	89%,	72%	11%	17%.
NJ:	2,879,003	0%,	17%,	83%,	62%	21%	8%.
NY:	952,372	4%,	5%,	92%,	33%	10%	58%.
PA:	145,295	0%,	5%,	95%,	23%	7%	69%
RI:	301,542	2%,	8%,	90%,	57%	13%	31%
NAC:	7,365,363	3%,	11%,	87%,	60%	14%	26%

SECTION 1: CONSERVATION LANDS



Map of Secured Lands

The spatial database of secured land was created using existing state, provincial and federal data layers compiled and calibrated by the Nature Conservancy's Eastern Region Secured Lands team into a single coverage. Base information was augmented with parcel data from the Nature Conservancy and other land trusts, collected, categorized and digitized through Jan 2006. The data is updated annually via a coordinated network of states/provinces.

The process involves both Nature Conservancy field offices and numerous public agencies. Funding was provided by Sweetwater Trust and other foundations.

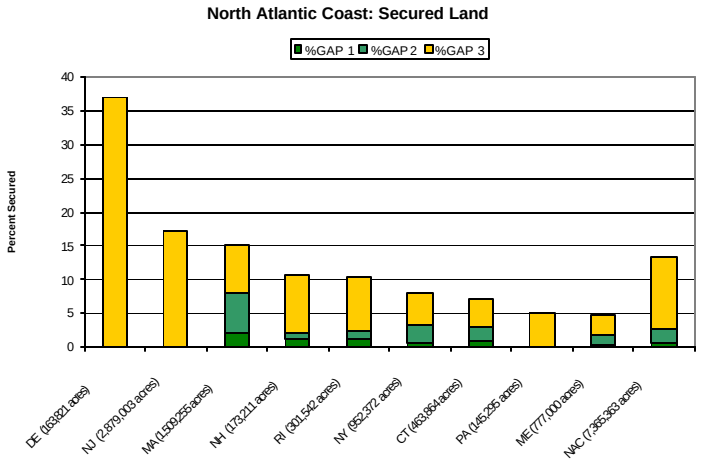
Secured land data were current to Jan 2006.

- **New information will be compiled and revised annually.**

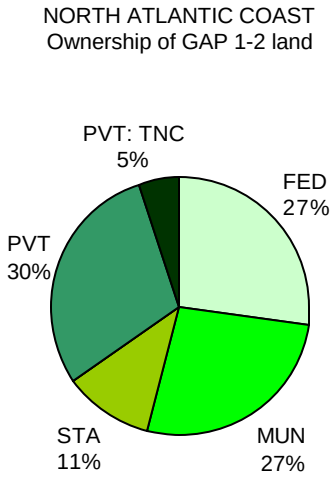
Conservation Status of the North Atlantic Coast

- **PERMANENTLY SECURED LANDS**

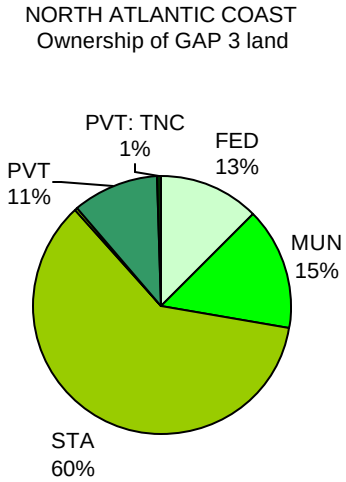
Permanently Secured Land by State



NAC: Ownership of Land Secured Primarily for Nature (GAP 1-2) 188,869 acres.



Ownership of Multiple Use Land (GAP 3) 236,275 acres.



What is This Measure and Why is it Important? This indicator looks at land ownership and identifies those tracts of land that have permanent legal protection against conversion to development. We classified the land into three levels: GAP 1 lands are secured exclusively for nature with a management plan to ensure this purpose and to allow for natural processes to occur freely (nature reserves, research natural areas). GAP 2 lands are secured primarily for nature but allow for alterations of natural processes and artific ial manipulations (wildlife refuges, some US national parks). GAP 3 lands are secured for multiple uses including resource extraction such as logging (e.g. state forests). The land is governed by policy restrictions such as maintaining stream buffer areas. GAP 3 lands will remain in primarily natural cover and are likely to play a key supporting role in maintaining biodiversity. (See discussion under KEY TERMS).

What Do the Data Show? The upper chart illustrates that 14% of the ecoregion, equaling 1 million acres, is secured from conversion to development (GAP1-3) but only 3% is primarily secured for nature (GAP 1, 2). The bar chart shows that total amounts range from a high in Delaware of 37% secured land with no land secured primarily for nature to a low in Maine of 4% secured land with 1% secured primarily for nature.

The pie charts show how the secured lands are distributed among public and private ownerships. The upper chart shows that public lands account for 65% of the land secured for nature (GAP 1, 2) distributed among federal, municipal and state owned lands. Private land accounts for 65,597 acres, or 35%, of the land area secured primarily for nature. The Nature Conservancy land accounts for 5% of that – 9,191 acres.

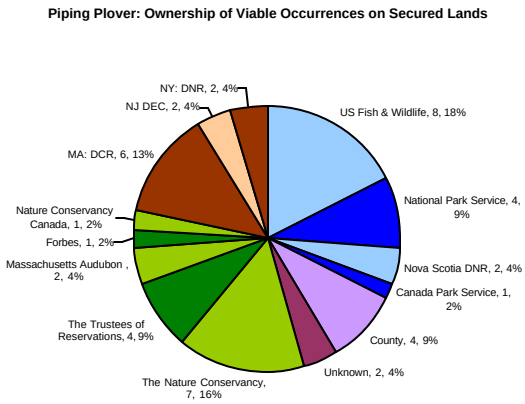
Land secured for multiple uses (GAP 3) is 88% publically owned with most of that being state land. Private land constitutes 12% or 27,000 acres.

Data Sources: TNC: Lands permanently secured from conversion to development (Dec 2005)

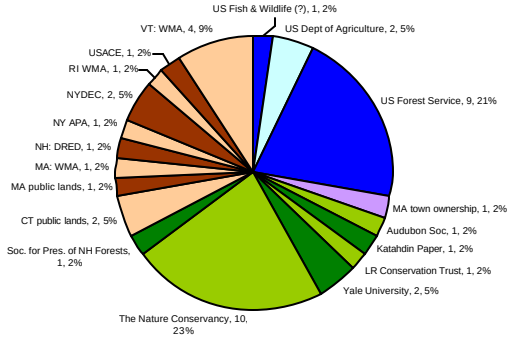
Conservation Status of the North Atlantic Coast

- **COLLECTIVE CONSERVATION**

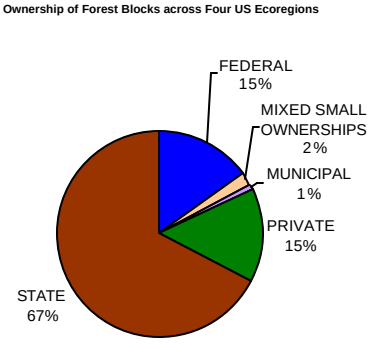
Species Example: Piping Plover



Ecosystem Example : Acidic Fens



Matrix Forest Example:



Data source: TNC's ecoregional assessments

What does this Measure and Why is it Important?
The conservation of critical ecosystems and species is a joint public–private effort. This measure examines, accounts for, and recognizes, the vast network of players involved in achieving a cumulative conservation effect. Sorting out acquisitions, fee ownership, management leads and easement holders can be complex. The charts and tables on this page have been simplified to provide the clearest picture of how responsibilities are distributed across organizations and individuals.

What Do the Data Show? Patterns differ from target to target but general trends are reflected in the pie charts shown for Piping plover and Acidic fens. These illustrate that the conservation of an individual species (the plover), or a small-scale ecosystem (the fen), is dispersed across many ownerships (14 for the plover and 19 for the fens) and ownership categories (shown by color groups). Additionally each owner may manage many occurrences or breeding sites, 64 total in the case of the plover.

The two targets shown here are both relevant to the North Atlantic Coast Ecoregion but the data shown are not only from the NAC region but also from adjacent ecoregions where these targets also occur. This emphasizes the fact that the conservation of a single target species may extend beyond a single ecoregion.

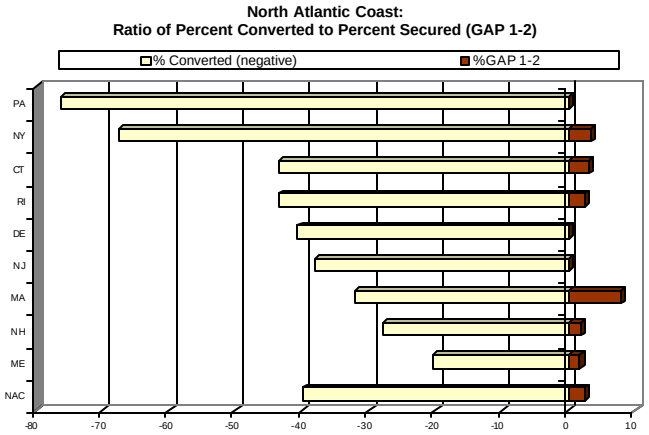
The conservation of large contiguous matrix-forest blocks is dominated by state lands (70%) with federal and private contributing about 15 % each. Within any single forest block however conservation ownerships are highly variable ranging from sole organizations to over 20 different organizations and individuals.
.
The ownership patterns highlight the significant results achieved by collective and collaborative conservation efforts. Particularly notable is the large role played by private conservation land (shown in green on the pie charts – Plover 33%, Fen 36%, Forest 15%).

How is the measure calculated? Information on tract boundaries, fee ownership, easement holders, organization types, acreages, and level of protection are maintained in a spatial data base of permanently secured lands. This information was overlaid with other spatial data sets such as the locations of critical features to identify the correspondence between ownerships and targets.

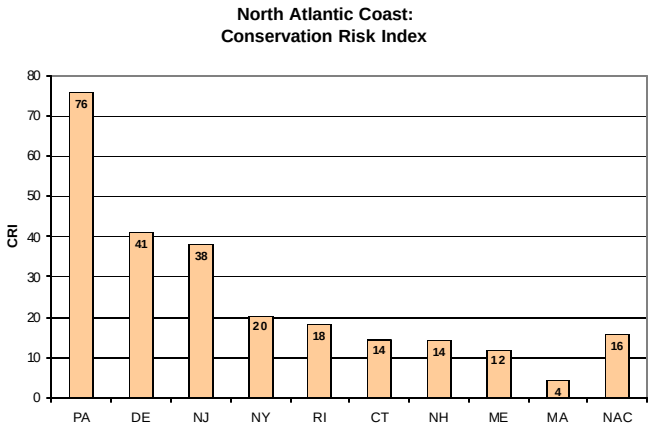
Conservation Status of the North Atlantic Coast

- **CONSERVATION RISK INDEX**

Ratio of Conversion to Protection by State



The Conservation Risk Index (CRI) by State



Data Sources: NLCD landcover (US Environmental Protection Agency), Permanently Secured Lands (The Nature Conservancy – Eastern US region)

The North Atlantic Coast is ranked as a Crisis Ecoregion. Crisis and Opportunity Ecoregions have been identified at a coarse level for all the biomes and ecoregions on Earth. This categorization is an important part of the prioritization process used by the Nature Conservancy to reach its 2015 goal

What is this Measure and Why is it Important?
The Conservation Risk Index (CRI) measures the disparity between habitat loss and protection. It is calculated as:
CRI = % lost to conversion / % secured for nature
Assuming that the ecoregion was once entirely covered by natural systems, this indicator examines the proportion of the ecoregion that has been lost to conversion and compares it to the proportion that has been secured primarily for biodiversity (GAP 1, 2). A high CRI indicates that the area converted is much greater than area secured. Ecoregions with 20% or more conversion and a CRI of over 2 (twice as much conversion as securement) are considered "Vulnerable" while those with conversion >40% and CRI > 10 are considered "Endangered" and those with conversion >50% and CRI > 24 are considered "Critically Endangered" (Hoekstra et al 2005). In these analyses, lands managed for forest extraction are treated as "unconverted" but are not considered secured primarily for nature.

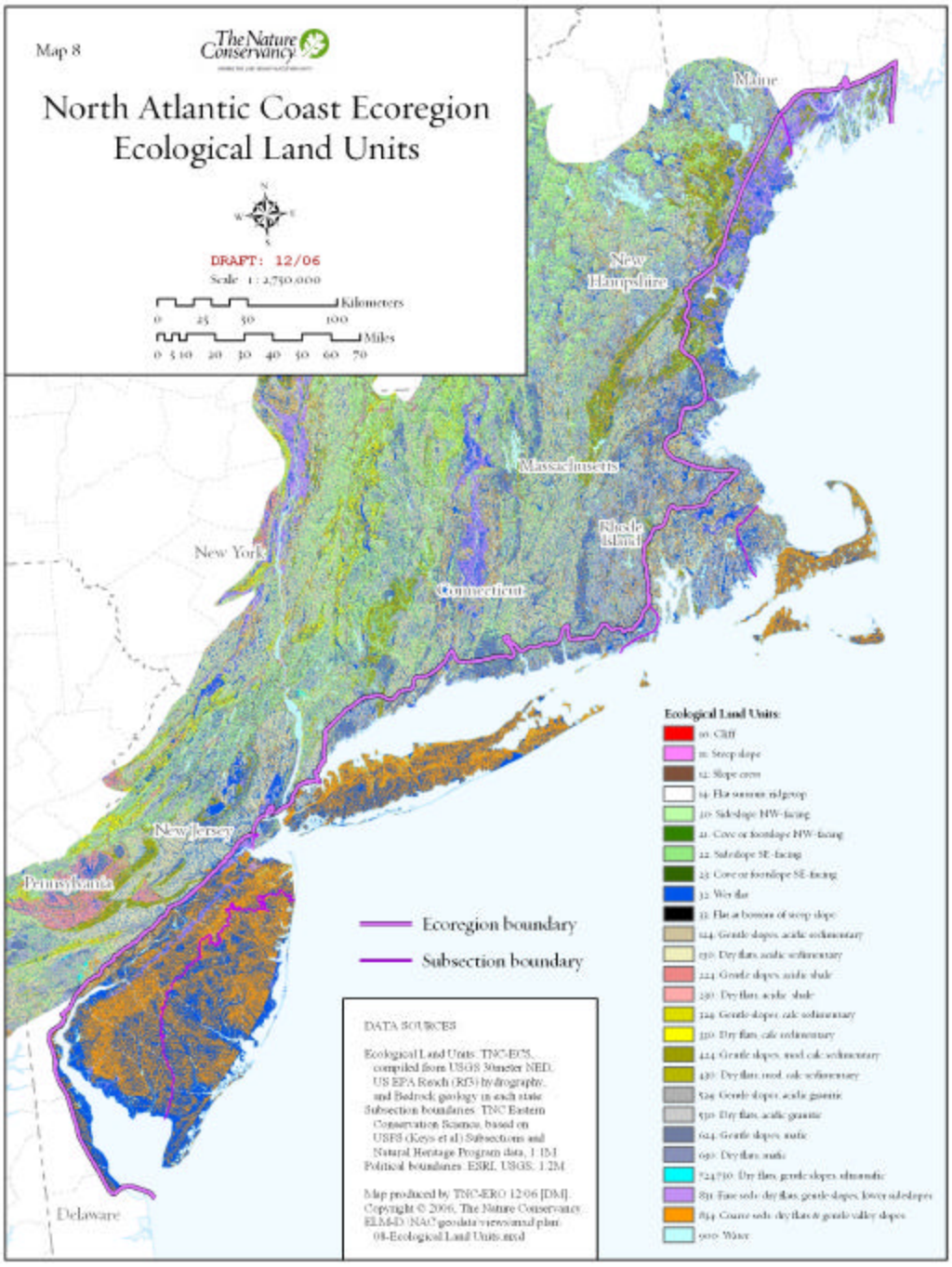
What Do the Data Show? Forty percent of the ecoregion has been lost to habitat conversion. Efforts to secure land for nature conservation are currently at a ratio of 1 acre secured per 16 acres lost. (CRI = Critically Endangered). The two charts illustrate that when applied to the states, the NAC portion of all states are ranked vulnerable, endangered or critically endangered:

- Critically endangered: PA,NY,CT,RI, DE
- Endangered: NJ, MA,NH, ME

In the Northeast and Mid-Atlantic regions, the North Atlantic Coast ecoregion has the highest conservation risk of any ecoregion and containing the most unique set of ecosystems. It ranks second highest in the Northeast for the amount of endemic species (behind the Central Appalachians).

The following pages detail which ecosystems and species are most in need of conservation action and where the most critical examples are. The document also points to where opportunities exist for conserving large-scale functional landscapes and which environments are missed by the current collection of secured lands.

SECTION 2:
PHYSICAL FACTORS

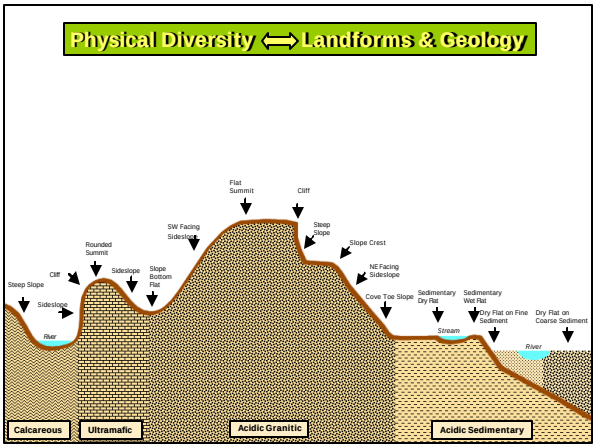


This section examines the distribution of secured land in relation to the distribution of physical factors that determine biodiversity patterns.

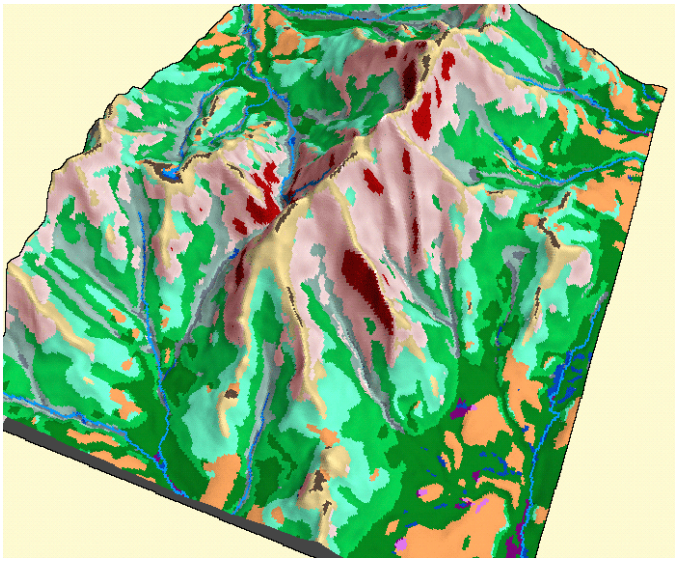
Data summaries were limited to the area of the North Atlantic Coast (NAC) ecoregions shown on the above map. This area is focused on the coastal region and omits substantial sections of each included State. Please keep this in mind when reviewing state summaries.

Conservation Status of the North Atlantic Coast

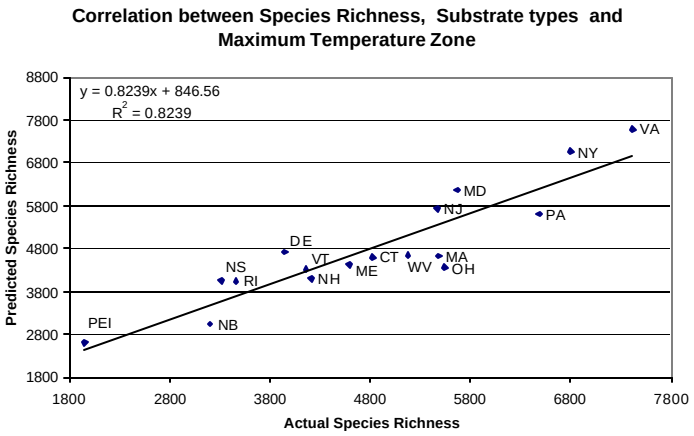
- **PHYSICAL FACTORS AND SPECIES RICHNESS**



Zoom-in of Ecological Land Unit map shown on previous page and in the map appendix



Relationship between Species Richness and Physical Factors



Why are Physical Factors important?
This section examines a number of physical environments that underlie and explain biodiversity patterns. Examining how the secured areas are distributed across physical environments allows us to address the questions: 1) Does the current protection network consistently miss certain features? and 2) Are we over- emphasizing particular types of environments at the expense of others? To answer questions such as these we used a data layer known as the Ecological Land Units (ELUs). The ELU data layer is composed of topographic landforms, bedrock and surficial geology, and elevation zones. For example a high elevation granite cliff is a single ELU. The units were carefully created to reflect physical factors that are correlated with biodiversity patterns. The ecoregion's remarkable floodplain forests, for example, tend to occur on fine surficial deposits, adjacent to rivers at low elevations –a setting easily measured by an ELU analysis.

Species Richness and Physical Factors .
The number of species present within a given area is referred to as its **species richness**. Species richness is often used as an indicator of biodiversity, biodiversity being a general term referring to the diversity of genes, species, ecosystems and processes in a given area. Richness is widely used, relatively easy to measure and inherently interesting; however, there is not strong evidence that species richness is a reliable indicator of all biodiversity. Alternative, and arguably much better, measures of biodiversity include the physical factors, ecosystems and vulnerable species.

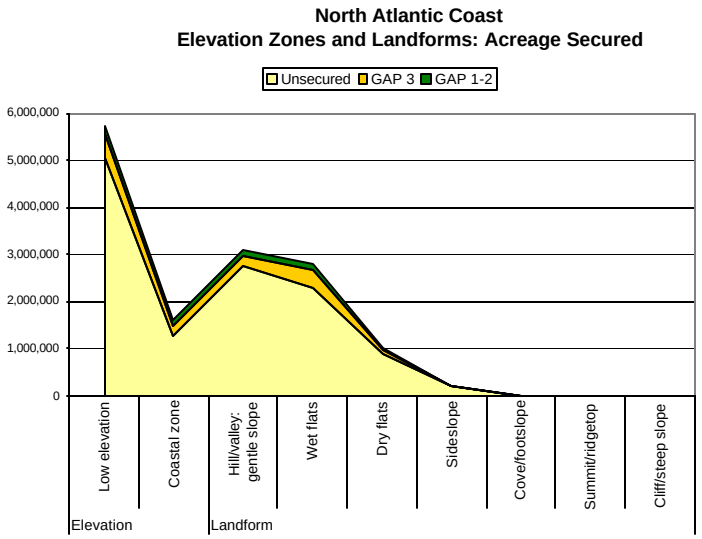
What Do the Data Show? The lower chart illustrates the relationship between the species richness of a NE state or province and three physical factors: 1) the number of substrate types; 2) the amount of fine grained sediment and 3) the maximum temperature zone. The trend line on the chart shows the predicted richness for each state derived solely from these three variables. Based on these factors, the **North Atlantic Coast is estimated to have a species richness of 5477* species**.

*Richness in this case refers to all vertebrates, vascular plants and macro invertebrates like beetles or mussels. (The number of fungi, moss and all microscopic species is not known for any ecoregion).

Conserving the factors that underlie biodiversity is a powerful conservation strategy. In the face of future uncertainties the physical template of the land is the arena in which species and processes interact, and on which evolution exerts its influence.

PHYSICAL FACTORS
ELEVATION ZONES & LANDFORMS

Secured lands by Elevation and Landforms



Why are Elevation Zones Important?
This measure examines how the secured lands are distributed across elevation zones. The actual elevation cutoffs used to calculate this measure vary slightly by ecoregion but they are reported here by two basic zones:

- Coastal: 0-20 ft.
- Low: 20 to 800 ft.

Coastal: This elevation zone contains most shoreline targets including tidal marshes, dunes, rocky shores, river-mouths and deltas. Numerous endemic species breed within this zone which is unlike any other portion of the region (M: 13%, P: 7%).

Low: This elevation zone contains most of the valleys, floodplains, low rolling hills, large marshes and bogs, and settled lands. It is naturally associated with more erodable substrates such as limestone or unconsolidated sediment. Pine-oak, oak-heath or oak-hickory forests predominate (M: 9%, P: 3%).

Why are the Landforms Important?
This measure examines how secured lands are distributed across topographic settings. Certain landforms such as wetland basins, upland summits, talus slopes and steep cliffs provide significant habitat for specific biodiversity even though the feature may cover a relatively small portion of the land.

- **Hills & valleys, Gentle slopes**

The most common setting in the region gently rolling hills and valleys are dominated by matrix forest and are also the center of human settlements, logging, agricultural activity and urban sprawl (M: 7%, P: 3%).

- **Wet flats**

One of the most critical settings in the region: marshes, mudflats, seeps, swamps and bogs support breeding populations of many wetland dependent species. Taxonomic groups like rails, bitterns, night herons, frogs, and dragonflies – plus a myriad of sedges, rushes, bladderworts, orchids, water-lilies, and pondweeds, have special adaptations for these semi-aquatic systems. In addition, coastal wetlands are packed with unique diversity (M: 14%, P: 5%).

- **Dry flats**

Dry flats are the third most common setting in the region and are mostly dominated by matrix forest. Non-forest ecosystems of interest are extreme rocky pavements or glades with shallow soils, sparse trees and scattered heaths (M: 8%, P: 3%).

- **Side-slopes**

Steep, but not extreme, slopes predominate in the hilly sections of the region as well as in canyons associated with well-developed river basins. A surprising number of trees and breeding species appear to prefer sloping landscapes (M: 6%, P: 5%).

- **Coves, Ravines and Toe slopes**

Wooded ravines, and enriched toe slopes provide some of the most fertile settings in the region. As local repositories of soil minerals, this setting supports nutrient-loving plants such as trillium, basswood, and white ash: the components of "cove" forests (M: 6%, P: 5%).

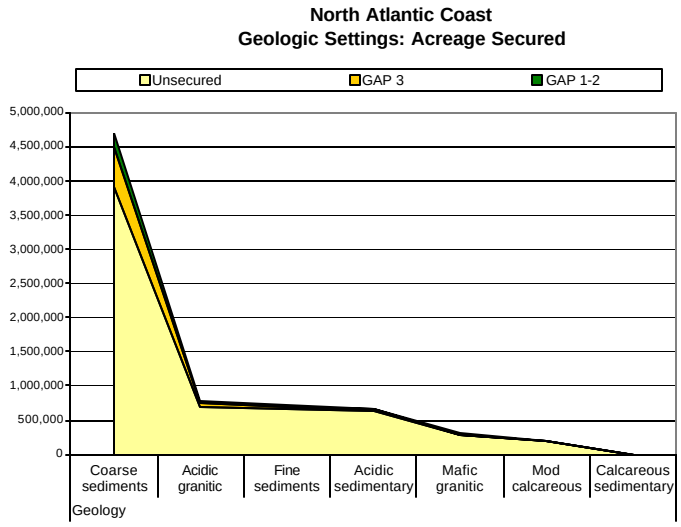
- **Summit/Ridgetop, Cliffs & Steep slopes**

Hilltops, cliffs, river bluffs and talus slopes are rare in this ecoregion. Vertical faces are choice settings for peregrine falcons and ferns like the tenacious cliff brake. Accumulated talus creates key habitat for snakes and small mammals (Summits M: 7%, P: 7%, Steep slopes M: 24%, P: 4%).

Conservation Status of the North Atlantic Coast

• PHYSICAL FACTORS BEDROCK & SURFICIAL DEPOSITS

Secured lands by Bedrock Types



Feature Elevation	GAP 1-2	%	GAP 3	%	Unsecured	%	Total
Low elevation	182.526	3	502.516	9	5.061.865	88	5.746.907
Coastal zone	108,526	7	216,195	13	1,288,186	80	1,612,907
Landform							
Hill/valley: gentle slope	111,267	4	213,821	7	2,775,730	90	3,100,818
Wet flats	129.474	5	391.706	14	2.277.906	81	2.799.086
Dry flats	30,971	3	85,676	8	910,730	89	1,027,378
Sideslope	12,274	5	12,610	6	201,502	89	226,386
Cove/footslope	290	5	328	6	4,891	89	5,509
Summit/ridgetop	338	7	348	7	3,961	85	4,646
Cliff/steep slope	44	24	7	4	133	72	184
Geology							
Coarse sediments	205,558	4	575,214	12	3,914,803	83	4,695,574
Acidic granitic	37,789	5	61,035	8	688,874	87	787,698
Fine sediments	14.713	2	42.053	6	653.355	92	710.121
Acidic sedimentary	17,667	3	17,658	3	636,977	95	672,302
Mafic granitic	11,380	4	16,147	5	268,027	91	295,554
Mod calcareous	3,848	2	6,587	3	186,446	95	196,881
Calcareous sedimentary	98	6	17	1	1,569	93	1,684
Open water	6,394	3	14,216	7	175,198	89	195,808
Total	291,052	4	718,711	10	6,350,051	86	7,359,814

Bedrock and Surficial Geology

What is this Factor and Why is it Important?
This measure examines how secured lands are distributed across geological settings. Bedrock types, surficial deposits and soils are some of the primary drivers of biodiversity. The eight basic substrate types used to calculate this measure relate closely to soil drainage and productivity; hence they are tightly correlated with plant and invertebrate diversity

- **Surficial coarse grained sediments**

Deep unconsolidated sand and gravel deposits along rives, shorelines, beaches, and in glacial moraines. Fire prone ecosystems and species adapted to dry, well drained and shifting sediments are found here (M: 12%, P: 4%).

- **Acidic granites**

This group includes a range of resistant, quartz-rich volcanic rocks that weather to thin coarse acidic soils. Typical rock types include granite, granidiorite, felsite and their metamorphic equivalents such as gneiss. Granitic rock underlies most of the rocky New England coast (M: 8%, P: 5%).

- **Surficial fine-grained sediment**

These are deep unconsolidated silt and clay deposits on ancient lake beds and flat plains. Floodplains of large slow-moving rivers and tidal wetlands are typical (M: 6%, P: 2%).

- **Acidic sedimentary**

Conglomerates, sandstones, siltstones, mudstones and their metamorphic equivalents like schist. Low to moderately resistant rocks associated with lowlands and areas of subdued topography. Rocks in this group weather to coarse or fine grained, moderately productive, acidic soils (M: 3%, P: 3%).

- **Intermediate to mafic granites**

Mafic granites are similar to acidic granites but with higher proportions of magnesium and iron (*ma*gnesium + *f*erri*c* = *mafic*). Soils derived from them are more productive and finer grained than granite. We included extrusive lavas (e.g. basalt) to intrusive anorthosites in this category. Rare plants can be abundant (M: 5%, P: 4%).

- **Moderately calcareous sedimentary rocks**

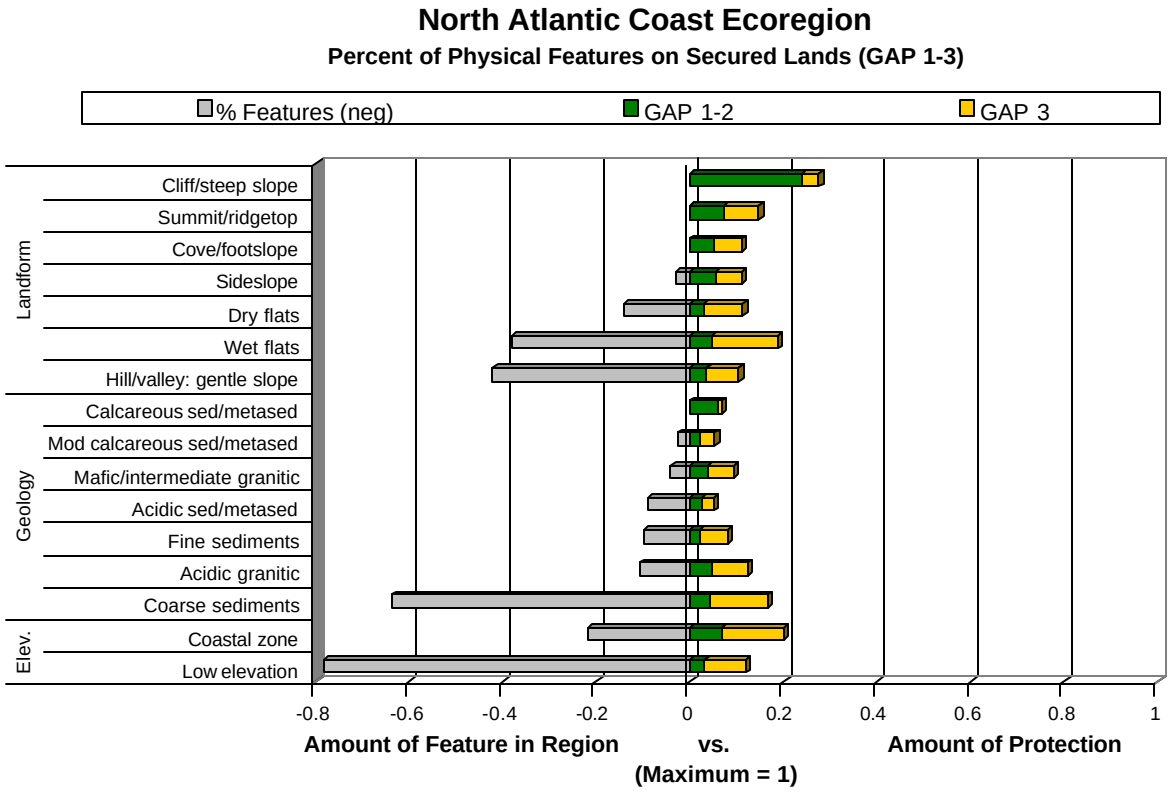
This group includes neutral to basic, moderately soft sedimentary rock containing some calcium. It is a variable mix of calcareous shale and sandstones. Generally susceptible to chemical weathering, these "soft" sediments often underlie agricultural areas (M: 3%, P: 2%).

- **Calcareous limestone & dolomite**

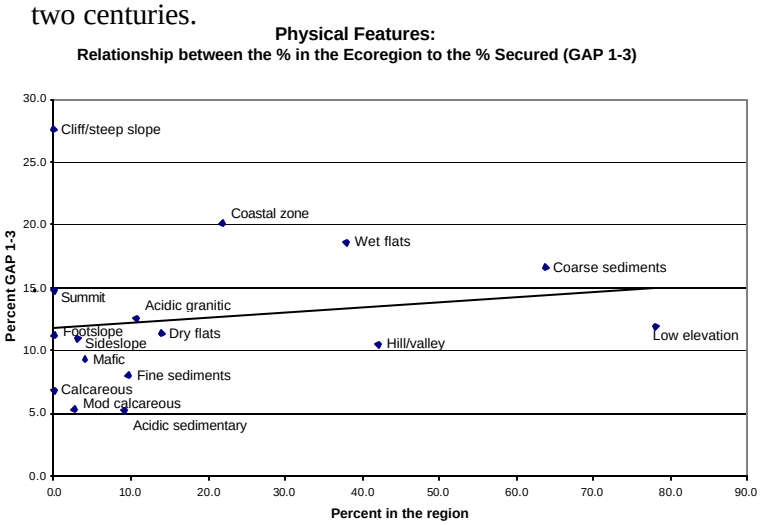
This group includes limestone, dolomites, dolostone and metamorphic equivalents (marble) derived from the accumulation of calcium shells in shallow seas. Easily erodable and often in valley bottoms, these rocks weather to form productive soils with neutral/alkaline pH values. Calcareous settings are abundant in plant rarities, unusual ecosystems, caves and richer forests with trillium, basswood, and white ash (M: 1%, P: 6%).

Conservation Status of the North Atlantic Coast

- **PERCENT SECURED ECOREGIONAL SUMMARY**



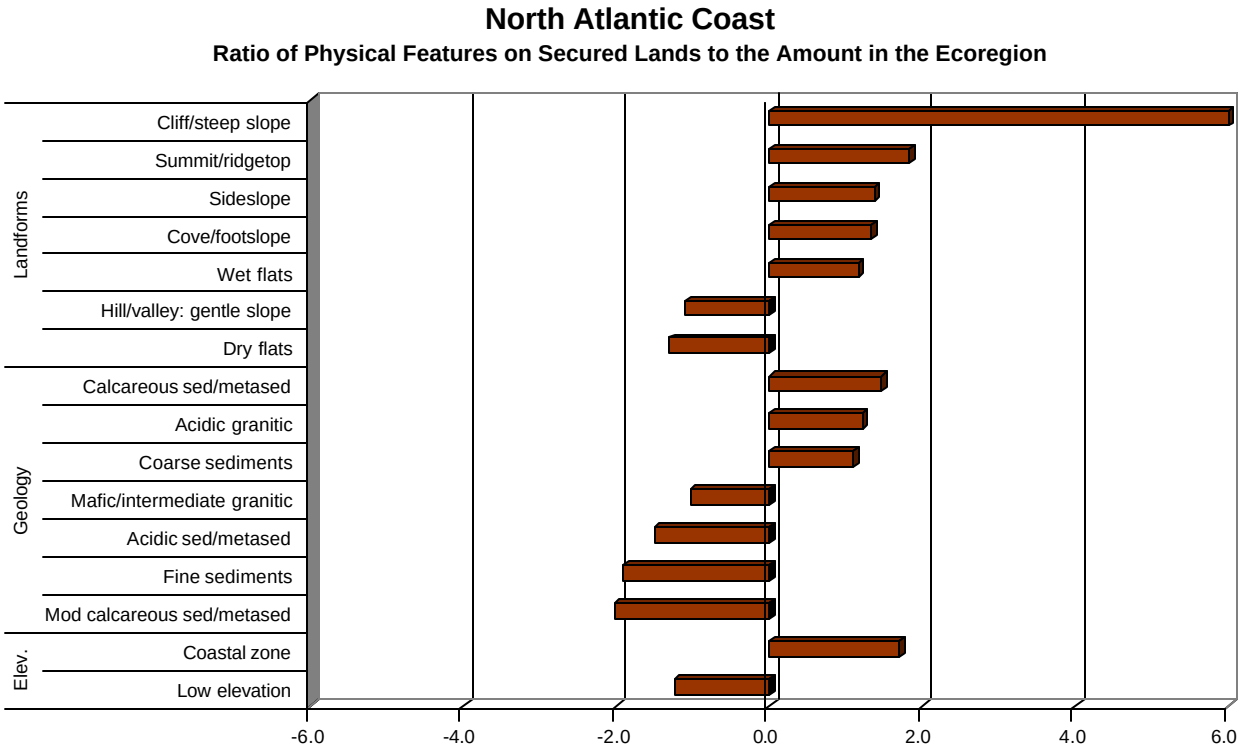
What is this Measure and Why is it Important?
This indicator examines the amount of each ecological feature on land permanently secured from conversion to development. To evaluate this we combined the ecological land unit (ELU) data layer with the secured lands data. The ecological land units (ELUs) reflect physical environments that underlie and explain biodiversity patterns. They may be used to determine the cumulative effect of conservation efforts over the last two centuries.



What do the data show?
Conservation efforts have been appropriately focused on coastal zone features and coarse sandy environments (such as beaches and dunes). Uncommon but important settings that are underrepresented in the current secured lands include fine sediment floodplains and clayplains, forests and ecosystems associated with low elevation hill and valley landscapes. Additionally ecosystems on acidic sedimentary and moderately calcareous bedrock are urgently in need of protection. All are less than 10% secured on GAP 1-3 land and less than 10% of the ecoregion, most have very small percentages secured primarily for nature (GAP1, 2). Cliffs, which are very uncommon in the region, have the highest levels of protection.

Conservation Status of the North Atlantic Coast

- **REPRESENTATIVENESS: ECOREGIONAL SUMMARY**



How do you read this chart? This chart is designed to highlight ecological bias in the current secured lands network. Ecological features that are more common in the secured lands than in the landscape are shown to the right side of the zero line, with the amount of the bias indicated by the length of the bar. Those factors found in secured lands at exactly the same proportion as they occur in the region are shown on the chart at the vertical "zero line" indicating a 1 to 1 ratio*. Those with higher abundances in the region but poor representation in the secured lands are shown left of the line.

Assuming limited conservation dollars and the necessity of tradeoffs, future protection efforts would have to focus on these underrepresented environments to achieve a balanced and representative conservation portfolio supporting all biodiversity.

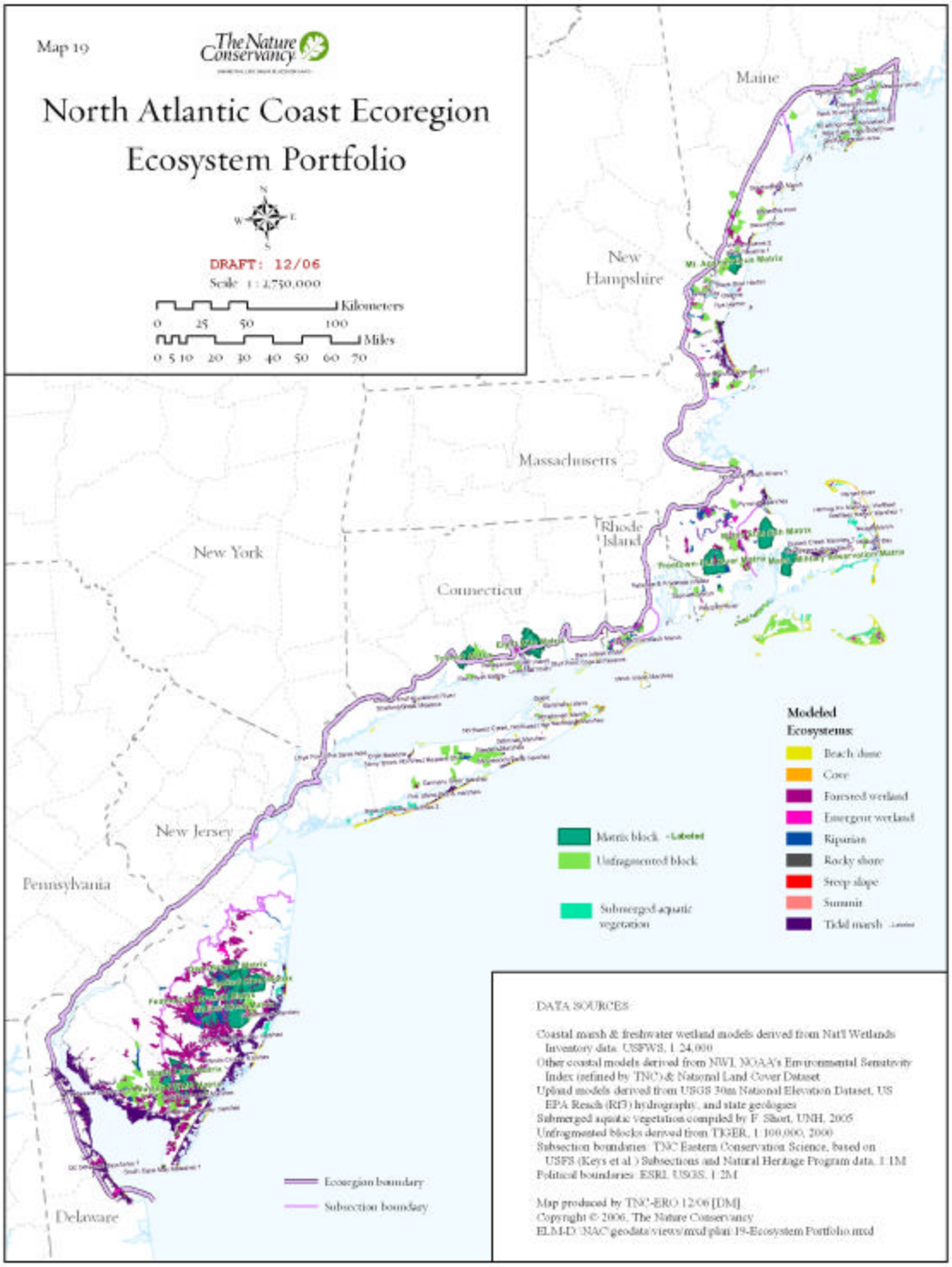
What Do the Data Show? Cliffs, summits, sideslopes footslopes and wet flats are all 2 to 7 times* more common in the secured lands than they are in the ecoregion, indicating a bias in current land protection towards high relief features. Forests and other ecosystems occurring in fine sediment soils (floodplains, clayplains and valley bottoms) as well as mafic bedrock, acidic sedimentary and moderately calcareous settings all make up a larger proportion of the ecoregion than they do of the secured lands.

Wetlands are secured at a slightly higher proportion than they occur in the landscape. This pattern is partially due to most wetlands being small and evenly distributed throughout the ecoregion at all elevations and across all bedrock types. Many of the critical wetlands are large and occur at low elevations on coarse and fine sediments. Specific occurrences of these wetland types are mostly unsecured, although that is not apparent in this chart unless you combine the factors of elevation, substrate and landform together. See the pages on the wetland portfolio for information on the protection of the critical wetlands in the ecoregion.

Data sources: TNC: Ecological land units, TNC Lands permanently secured from conversion.

**** To ascertain the ratio add 1 to the number shown on the x axis of the chart. For example the 2 line equals a (2+1)/1 ratio or 3/1***

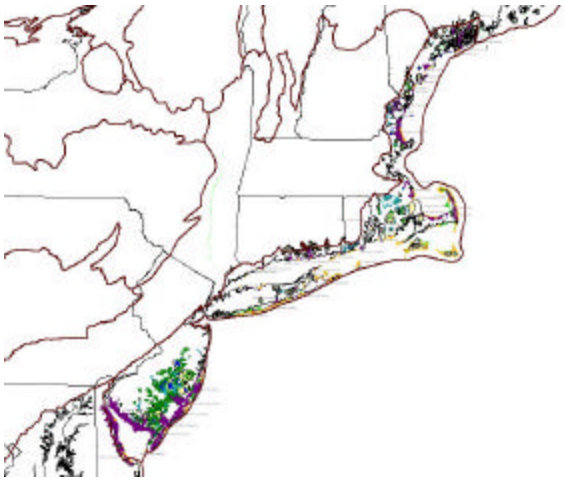
SECTION 3:
CRITICAL PLACES



Not all places are equal in conservation value. Specifically, not all occurrences of species and examples of ecosystems contribute equally to the maintenance of biodiversity across the region. This map, known as the "portfolio" shows the critical places for conservation as identified by The Nature Conservancy and its collaborators through the process of ecoregional assessments.

The map was developed as a guide to conservation activity. In this document we use it as a *yardstick* to determine how closely aligned the current conservation lands are with the critical places. And as a *benchmark*, to assess how much further effort it will take to conserve these areas. And as a *measure*, to see how the efforts of many public and private organizations are contributing to the bigger picture of conservation success.

- **PORTFOLIO OF CRITICAL OCCURRENCES**



The Portfolio Map shows the location of the best examples of:

- **Terrestrial Intact Forest Areas and Coastal Un-fragmented Blocks**
  Large (1,000 – 50,000 acre) areas of contiguous forests with few roads and mostly intact interior forest ecosystem features.

- **Terrestrial Patch-scale Ecosystems***
  Coastal dunes and beaches
  Rocky shores
  Summits, hills, cliffs, steep slopes, & ravines
  Barrens and flats

- **Wetland Ecosystems**
  Forested swamps
  Bogs and fens
  Fresh water marshes
  Tidal salt and brackish marshes
  Seeps and swales
  Floodplains
  Coastal plain ponds

- **Aquatic Stream Networks**
  Large rivers
  Medium sized streams
  Small headwater, feeder and coastal streams

- **Vulnerable Species**
  Rare mammals, birds, reptiles, amphibians, fish, invertebrates, plants and global endemics.
  Wide-ranging vertebrates
  Breeding, wintering and stopover concentrations

What is the Portfolio and Why is it Important?

The conservation portfolio was developed to identify those places that are the most critical to conserve. It reflects the understanding that some places play a more important role than others in maintaining biodiversity across the landscape. Particularly crucial are source habitats for interior forest species, complete and functional examples of common ecosystems, viable populations and breeding sites of rare species, and flowing stream systems connected from headwater to mouth.

These "occurrences" have been evaluated based on their size, condition and landscape context, and have had their importance confirmed by over 6,000 ground inventory points provided by State Natural Heritage Programs. Additionally they reflect the knowledge and opinions of over 50 ecologists, biologists, forest managers and wildlife specialists from academic, state and federal institutions.

The portfolio of critical occurrences has taken almost a decade of collaborative effort to develop and is revised and maintained annually based on new information and conservation progress.

How are these Data Used?

These are not the only places to do conservation, of course, but the portfolio provides a scientific gauge to assess whether finite conservation dollars and efforts are being directed at the most influential and critical places.

Ecological bias in the current secured lands that was uncovered in the physical factor section underlie the portfolio as well, although in this section we are looking at specific places and at higher levels of protection (generally GAP 1, 2). The specificity is important. In some cases there may be apparently little protection but it is in exactly in the right places, in other cases the converse may be true.

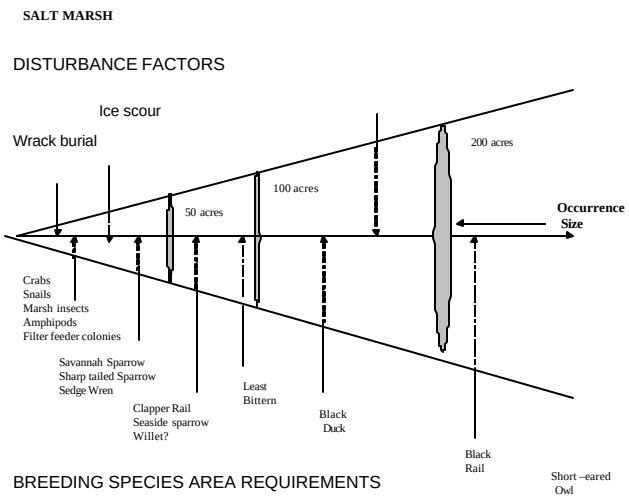
For further information on the portfolio contact your state Nature Conservancy office or the Eastern Regional Conservation Science Team which is responsible for the development and maintenance of the information.

* Includes specialized forest types

- **SCREENING CRITERIA**

Size and Condition

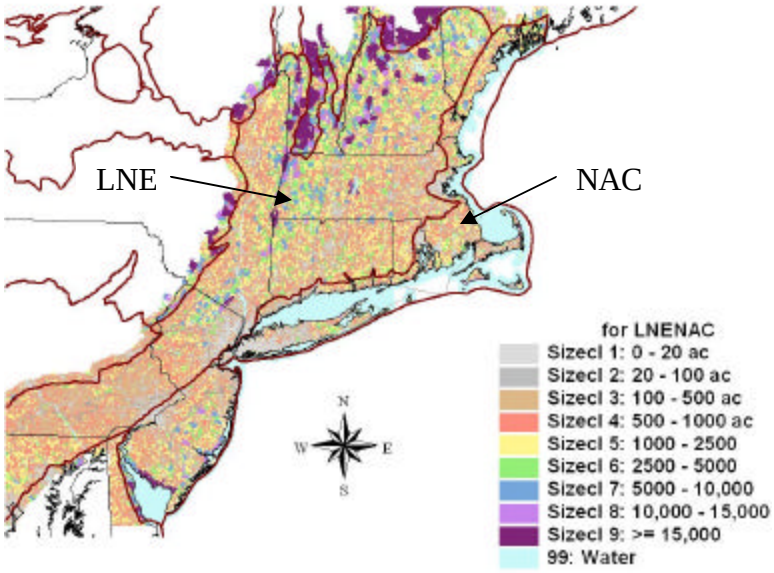
Example: Chart of disturbances and species area requirements for northeastern saltmarsh



Threats Surface Map components

Example 1: Land-cover Map (see page 8 or full version in appendix)

Example 2: Roads and Road-bounded Blocks. Shown here with the Lower New England Ecoregion (LNE)



What are the Criteria and Why is it Important?

The contribution of a particular ecosystem example or a species breeding location to maintaining regional biodiversity is due, in a large part to its **size** and **condition**. Ideally, an ecosystem should be complete with respect to its component species, should serve as source habitat for characteristic species and play a pivotal role in exporting individuals to the larger landscape. High quality examples contain habitat in which the component species thrive, because the habitat provides adequate resources, minimizes mortality and facilitates reproduction. Critical population sites or breeding areas consistently produce surplus individuals that emigrate to the larger landscape. High quality habitat may also serve as refugia or strongholds of rare or uncommon species that have already disappeared from the surrounding landscape.

The landscape context in which the occurrence is found is also crucial in determining whether the feature will persist into the next century and what sort of threat pressures are likely to constrain its influence or impair its function. Landscape context is commonly evaluated by creating a spatially explicit "**threat surface**" map, developed by compiling maps of human derived constraints such as development, agriculture, quarries, mining leases, roads, road-bounded blocks, dams, toxic release points, ownerships, housing density, etc. This allows any point on the landscape to be objectively ranked as to degree of threat and to quantify the threat pressure using a numeric index.

We established and applied **screening criteria** to every ecosystem example and species occurrence to determine if it was a **critical** occurrence and therefore qualified for the portfolio. Those that met the criteria were referred to as **qualifying;** those that did not meet the criteria were classified as **supporting** occurrences. Supporting occurrences are important but not crucial to the conservation of biodiversity in the ecoregion. The criteria used to separate the critical occurrences from the supporting ones were:

- **Size and Condition** of the occurrence.
- **Threat and Landscape context** surrounding the occurrence.

Application of the screening criteria eliminated thousands of potential occurrences from the portfolio narrowing the set of final places down to those that were absolutely critical to maintaining biodiversity in the ecoregion. These are used as a benchmark to determine if land protection is focused on the crucial places.

Conservation Status of the North Atlantic Coast

• UPLAND ECOSYSTEMS: BASIC PATCH-SCALE TYPES

Beach and Dunes

Rocky Shores

Summits, cliffs, bowls, & ravines

Flats, Barrens and Pavements

Beach and Dunes: Open sandy dunes and beaches provide breeding habitat for plovers, terns and many other species. Several species are in decline as this habitat is rapidly becoming fragmented, isolated and degraded. Characteristic plant species of North Atlantic coast beaches and dunes include: beach grass, sea rocket, sea-beach sandwort, seaside spurge, dusty miller, sea oats, seaside goldenrod, beach heather and bayberry.
Statistics: 1,700 occurrences amounting to over 100,000 acres. 60% are less than 10 acres in extent. 32% are between 10 and 100 acres in size, 8% are over 100 acres and just 1% (19 occurrences) are over 1000 acres in extent.

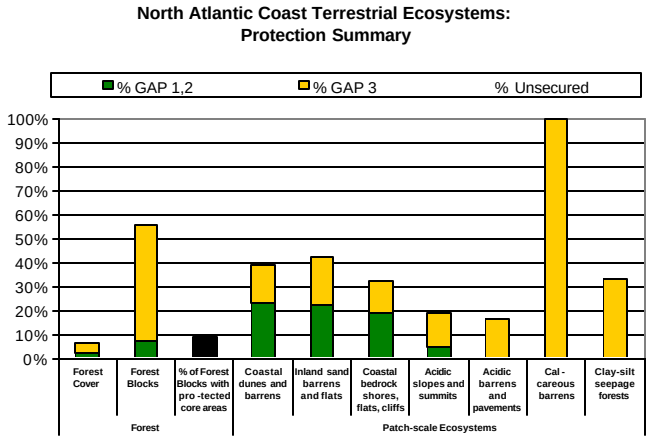
Rocky shores: Coastal islands, pounding shores, rocky beaches contribute character to the rugged landscapes of the northern coastal region. Bedrock provides substrate for algae such as rockweeds, and invertebrates such as blue mussel, rock barnacle, sea star, and sea urchin. Island occurrences of rocky headlands provide nesting areas for terns and cormorants.
Statistics: In NAC the size of rocky shore occurrences range from 1 to 186 acres, with nearly 70% of occurrences being less than 5 acres and the average being 6.5 acres. Only 31 rocky shore occurrences out of a total of 1434 (2%) were over 50 acres.

Summits, Cliffs, Bluffs and Ravines: From coastal bluffs to gentle hills to wooded ravines. These settings harbor a wealth of biodiversity not found in the flatter expanses of the region.
Statistics: Each of these features has its own restricted distribution pattern; they are very uncommon in the region. See individual chapters in the NAC plan.

Flats, Barrens and Pavements. Dry flats are a common setting in the region and are mostly dominated by matrix forest. The non-forest ecosystems of interest are extreme rocky pavements or glades with shallow soils, sparse trees and scattered heaths and grasses. Some are edaphically maintained but many are fire prone. These are difficult to locate using models, thus our assessment relied heavily on ground inventory data.
Statistics: This group contains a variety of distinct ecosystems and communities. See summaries on the following page as well as individual chapters in the main ecoregional assessment.

Conservation Status of the North Atlantic Coast

- **UPLAND PORTFOLIO***



Upland Portfolio: This page reports on ecosystem examples that met a 3-part screening criteria and were considered crucial to the protection of biodiversity in the region. In sum there were 354 critical occurrences identified in 7 ecosystem types described below. 19% secured on GAP 1 or 2 land (**P**), 15% secured on GAP 3 land (**M**).

Forests: 13 forest blocks identified - see page 30.

Coastal dunes and barren: Terrestrial ecosystems on coarse or fine sands directly on the coast at elevations below 20 ft. and influenced by maritime processes. Ecosystems in this group include maritime dunes and shrublands, coastal oak-holly woodlands, pitch pine woodlands, maritime spruce-fir forests, and coastal post oak forest. P: 24%, M: 11%

Sandy barrens and flat: Terrestrial ecosystems on coarse sands above 20 ft. elevation and not directly in the maritime zone. Ecosystems in this group have well drained, droughty acidic soils and are often fire-prone or slow to recover from disturbances. They share characteristics with acidic flats and coastal communities. The most common are pitch pine –scrub oak barrens associated with fires or agricultural abandonment. The group also includes dry oak forests, inland sand barrens and successional shrublands. P: 19%, M: 21%

Coastal bedrock shores, flats and cliff: Terrestrial ecosystems on rocky shores, coastal cliffs and open headlands. P: 17%, M: 12%

Acidic slopes & summits: Sloping terrestrial ecosystems on acidic shale, conglomerates, sandstones, siltstones, or granites. Includes land with over 6% slope or narrow summits associated with sloping features. A large, diverse group that includes mountains, rocky summits, cliffs, talus slopes, steep hillsides, landslide scars, unstable shale slopes, bowls, ravines, dry river bluffs and craggy outcrops. P: 35%, M: 41%

Acidic barrens and pavements. Level terrestrial ecosystems on acidic shale, conglomerates, sandstones, siltstones, or granites and defined by flats with less than 6% slope. A common setting, dominated by forest. The non-forest ecosystems are extreme rocky glades and pavements with shallow soils, sparse trees and scattered heaths and grasses - often fire prone. P: 25%, M: 27%

Calcareous barrens. Terrestrial ecosystems on limestone, dolomites, dolostone, or moderately calcareous shale and sandstones and defined by flats with less than 6% slope. Ecosystems in this group have exposed bedrock and shallow soils, exemplified by the limestone glades and woodlands. Most are sparsely wooded with scattered herbs and rarities. P: 5%, M: 16%

Clay-silt seepage forest: Terrestrial ecosystems on fine grained silts and clays deposited on ancient lake beds at elevations above 20 ft. Ecosystems in this group have poorly drained, silty soils sometimes rich in nutrients. A number of moist forest types occur here often with "mesic", "seepage", or "clayplain", in their state names. Some distinctive grassland types including moist calcareous grasslands and related communities occasionally occur in this setting. P: 25%, M: 16%

* Dominant, matrix forest types were evaluated separately. See page 30

- **WETLAND ECOSYSTEMS: BASIC TYPES**

Tidal Marshes

Tidal Marshes: The 5,000 miles of coastal shoreline in this region hosts over 300,000 acres of salt and brackish marshes, tidal flats, rocky shores, and eel grass beds with a remarkable amount of concentrated biodiversity. Tidal wetlands are important to many of our rarest birds such as the salt marsh sparrow, clapper rails, piping plover and roseate terns. Rare or declining species include seaside dock, saltmarsh sedge, seashore saltgrass, creeping alkali grass and small spikerush.
Statistics: The region abounds with over 300,000 acres of salt marshes, brackish marshes, and tidal flats. Individually, the discrete tidal marshes average only 32 acres in size. The huge marsh complexes flanking Delaware Bay account for 70 percent of the tidal marsh area in the ecoregion. We identified 71 key tidal marsh complexes that are described on the following pages.

Riparian wetlands

Riparian wetlands: Submerged riversides and floodplains provide critical feeding and spawning areas for many species. During dryer seasons, receding water reveals a myriad of fresh silt deposits, scoured riverbanks, sand bars, alluvial meadows and oxbow lakes amid lush floodplain forests. Rich in biodiversity, intact riparian systems provide habitat for flood tolerant trees like silver maple, green ash, American elm and box elder and ideal conditions for many native ferns, nettles, vines and herbs. Reptiles such as the spotted turtle, eastern box turtle, wood turtle, northern red-bellied cooter, Blanding's turtle and bog turtle, and amphibians like the tiger salamander, blue spotted salamander and eastern spadefoot are all characteristic. Northern parula and prothonotary warbler as well as cuckoos and orioles are typical birds.

Freshwater wetlands:
Coastal plain ponds, bogs, cattail marsh.

(photo credit: Ron Garnett-AirScapes)

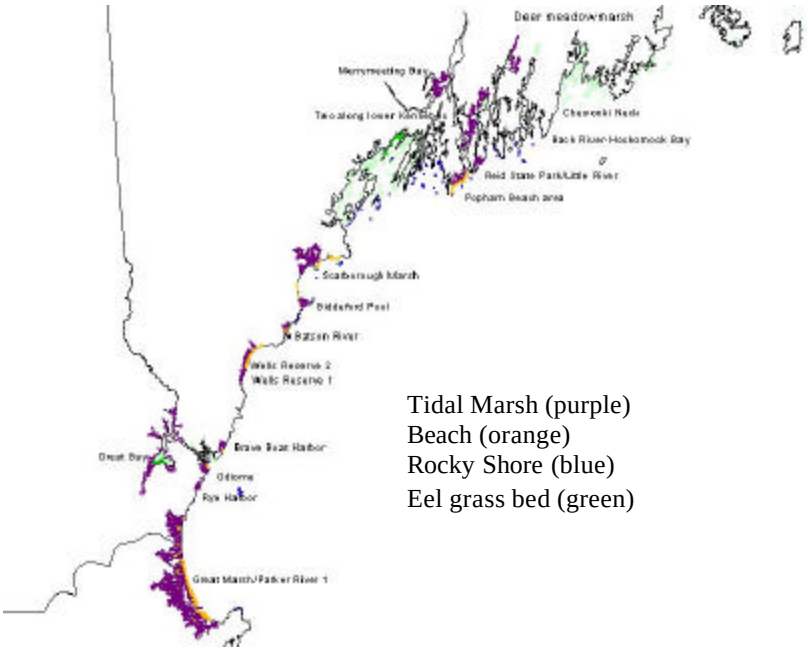
Freshwater wetlands: The region hosts over half a million acres of marshes, mudflats, swamps and seeps. Breeding populations of rails, bitterns, night herons, marsh wrens, frogs, salamanders and insects - plus a myriad of sedges, rushes, bladderworts, orchids, water-lilies, and pondweeds depend on these ecosystems.
Statistics: The *freshwater wetlands* make up roughly 800,000 acres; about 11 percent of the ecoregion. *Forested wetlands* comprise the bulk of this acreage, with approximately 618,800 acres or 80% of the total, compared to *non-forested wetlands* such as bogs and fens, shrub swamps, marshes and wet meadows that make up 20% of the wetlands (167,800 acres).

Data source: TNC's ecoregional assessments

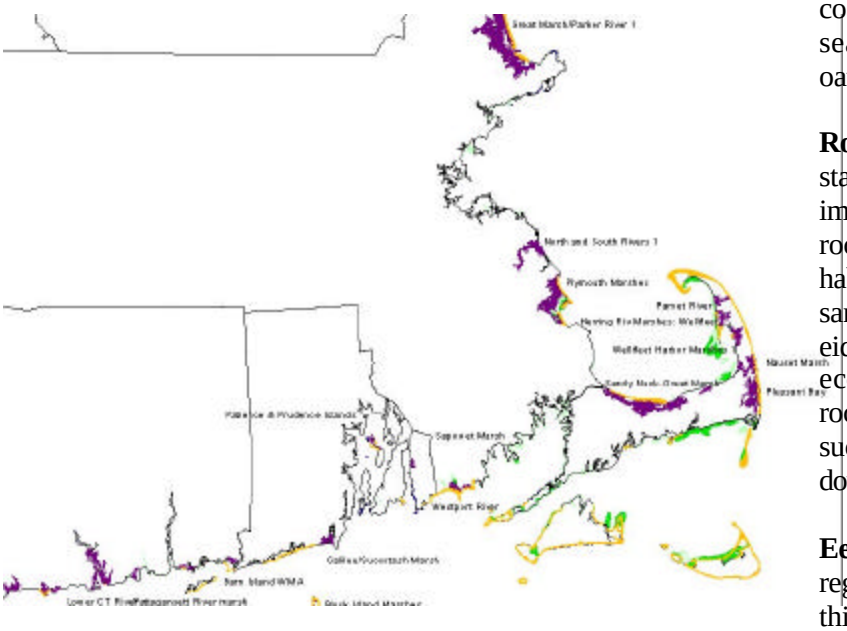
Conservation Status of the North Atlantic Coast

- **TIDAL MARSH PORTFOLIO North**

Tidal Marshes: Deer Meadow to Parker River



Tidal Marshes: Parker River to Barn Island



What are the Tidal Marsh Complexes and Why are they Important?

Tidal marshes, sandy beaches, rocky shores and eel grass beds are some of the most characteristic ecosystems of the North Atlantic Coast. The critical habitat they provide to numerous rare species, shore birds, and offshore fisheries is well known but the conservation needs of the thousands of specialized plants and invertebrates (crabs, shellfish, amphipods and other macro/micro invertebrates) that inhabit these environments are not well studied.

Salt and **brackish tidal marshes** provide critical breeding and migratory stopover areas to many of the region's rarest birds such as the salt marsh sparrow, roseate tern, arctic tern, willet, king rail and black rail. The common vegetation, exemplified by the dominant spartina grasses, can resist desiccation and maintain salt balance in this extreme setting. Rare or declining plants species include saltmarsh geradia, long's bittercress, seabeach sedge, saltmarsh false foxglove, dwarf glasswort and many others.

Sandy beach habitat is fragmenting and degrading throughout the region. Breeding species restricted to this extremely specific habitat, like plovers and terns, rely on exposed scrapes and isolation to prevent predation by mammals and other birds. Many are in decline although several species have wide ranges along the Atlantic coast. Characteristic plant species of North Atlantic coast beaches and dunes include: beach grass, sea rocket, sea-beach sandwort, seaside spurge, dusty miller, sea oats, seaside goldenrod, beach heather and bayberry.

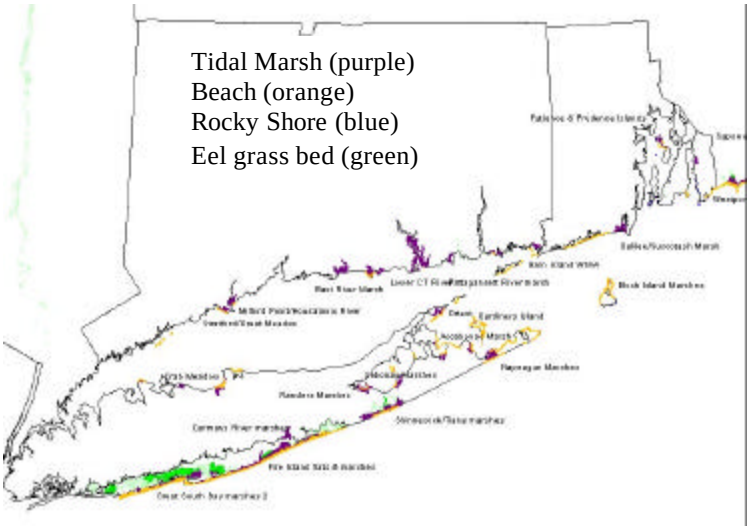
Rocky headlands support organisms that attach to stable bedrock and boulders and that can withstand wave impact and periodic desiccation. These include rockweeds, mussel, rock barnacle and sea urchin. This habitat is critical winter foraging area for purple sandpiper and harlequin duck and is also frequented by eiders, fish, harbor seals (in the northern part of the ecoregion) and other species. Island occurrences of rocky headlands provide nesting areas for waterbirds such as roseate tern, arctic tern, common tern and double-crested cormorant.

Eel grass beds provide important fish nurseries in this region. These were not systematically assessed during this study, but the larger occurrences, in close proximity to the marshes, are shown on the facing maps.

Conservation Status of the North Atlantic Coast

- **TIDAL MARSH PORTFOLIO South**

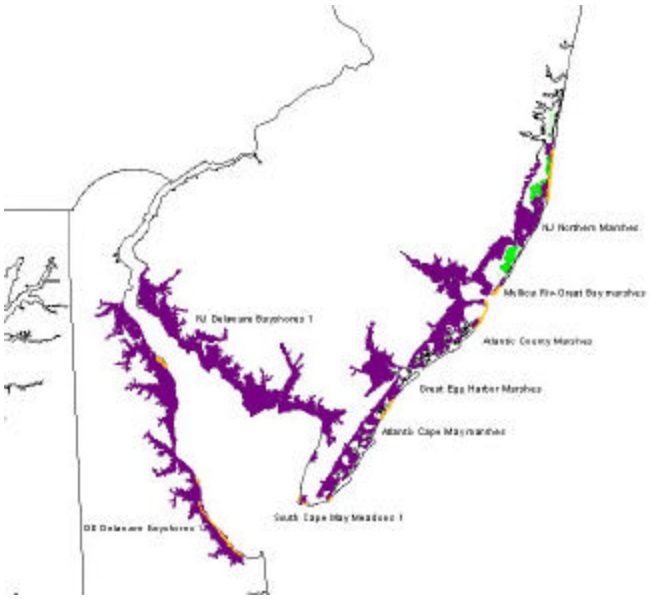
Tidal Marshes: Barn island to Great S. Bay



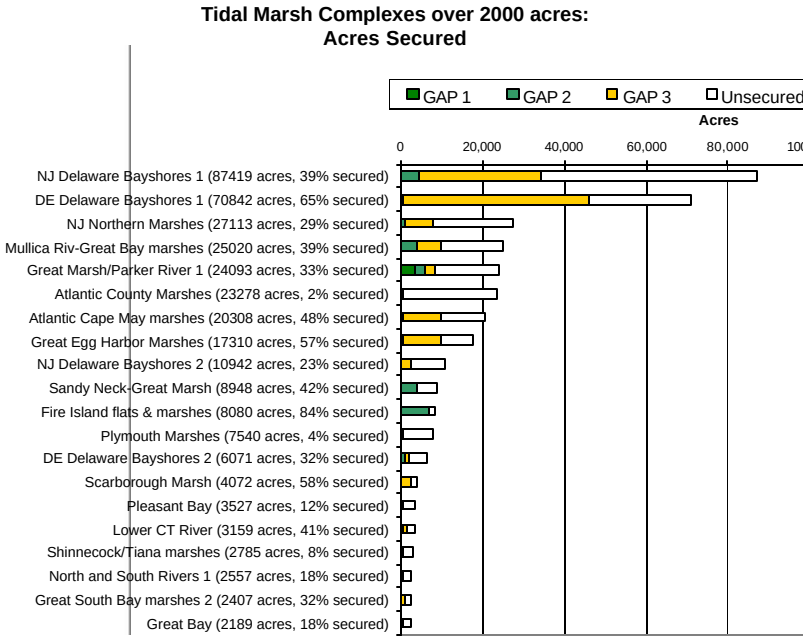
What Do the Data Show? The portfolio identified 71 critical marsh complexes (facing maps and previous page) where protection is crucial to maintaining biodiversity. In sum this represents the majority of the tidal marshes in the region and virtually all of the larger ones. Currently these key complexes are 40% secured (GAP 1-3) including 10 % that is secured primarily for nature (GAP 1-2). Small, fragmented or degraded examples were rejected from the portfolio.

Of the 20 complexes over 2000 acres, securement levels range from 4% to 65% (below) reflecting several decades of conservation work. Because housing pressure is so high in these areas, land protection as well as coastal policies are important in maintaining this habitat in adequate supply and quality.

Tidal Marshes: NJ north to Delaware Bay



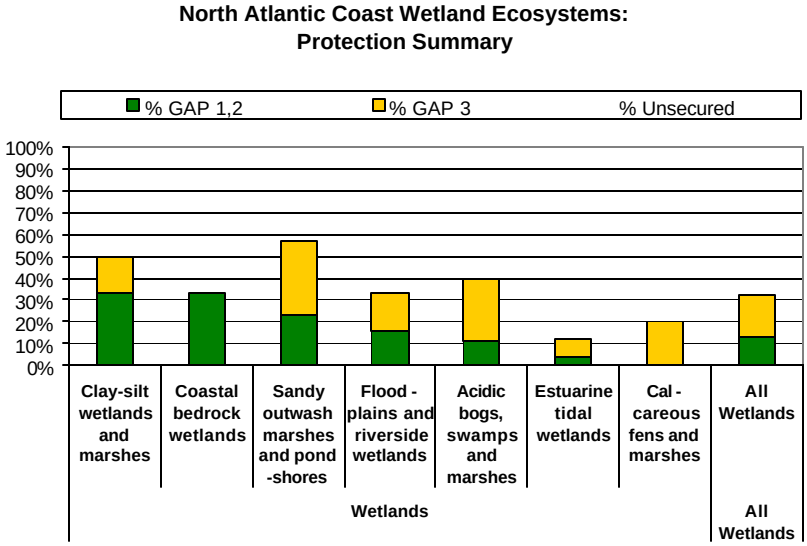
Complexes of 2000 Acres: Securement



Data source: TNC's ecoregional assessments

Conservation Status of the North Atlantic Coast

- **WETLAND PORTFOLIO**



Wetland Portfolio: This page reports on those ecosystem examples that met a 3-part screening criteria and were considered crucial to the protection of biodiversity in the region. In sum there were 861critical occurrences identified in seven wetland types described below. 13% are secured on land with a GAP status 1 or 2 (**P**), 19% are secured on GAP 3 land (**M**).

Acidic bogs, swamps and marshes: Palustrine ecosystems on acidic shale, conglomerates, sandstones or siltstones, or granites. A large diverse group that includes a variety of tree-dominated forested swamps, shrub-dominated bogs and shrub swamps, or sedge-dominated acidic fens and flushes. Most have pH values below 5 and accumulate sphagnum or sedge peat to form a spongy substrate. P: 30%, M: 29%

Calcareous fens and marshes. Palustrine ecosystems on limestone, dolomite or moderately calcareous sedimentary rocks. Rare plants are associated with the high PH waters especially where oxygenated from mild flows along gentle slopes. State named types include rich fens, sloping fens, shrub fens, red maple - larch treed fens, calcareous seeps and spring fens. These have had extensive inventory and study over the last decade. P: 24%, M: 19%

Sandy outwash pondshores and marshes: Palustrine ecosystems on coarse sands above 20 ft. elevation and not directly in the maritime zone. Wetlands in this group tend to have fluctuating hydrology resulting from being set in well-drained sands deposited over an impervious soil horizon. Emblematic of this group are the coastal plain pondshores with their unique floras. Equally common were vernal pools, saturated pitch pine wetlands, buttonbush shrub swamps and coastal plain poor fens. P: 21%, M 31%

Clay-silt wetlands and marshes. Palustrine ecosystems on fine grained silts and clays deposited on ancient lake beds at elevations above 20 ft. A large proportion of emergent marshes and green ash swamps occur in these sediments often in conjunction with the moist seepage forests of slightly drier areas. P: 21%, M: 23%

Estuarine tidal wetlands: Wetlands wholly or partially inundated by tidal saline waters. In sheltered bays tidal marshes may be extensive or they may occur as fringing wetlands along intricate shorelines. Typical communities include high and low salt marsh, brackish marsh, tidal flats and salt ponds. P: 6%, M: 6%

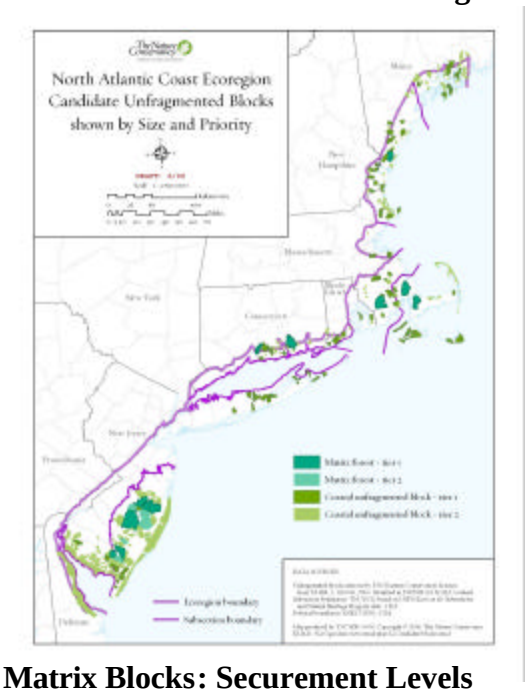
Coastal bedrock wetlands. Wetlands in the maritime zone on relatively thin soils over bedrock. Types include maritime slope bogs and sea level fens. P: 16%, M: 17%.

Floodplains and riverside communities. Wetlands associated with rivers and dependent on river flooding processes. Floodplain forests, riverside scour meadows, riverside seeps and outcrops, sand and gravel bar communities. (Terrace forests were classified as terrestrial and alluvial swamps and marshes were classified as palustrine wetlands in one of the previous groups). P: 18%, M: 29%

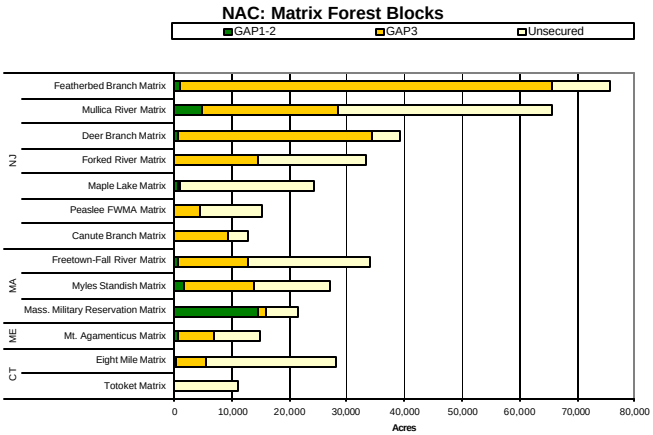
Conservation Status of the North Atlantic Coast

- **FOREST ECOSYSTEMS**

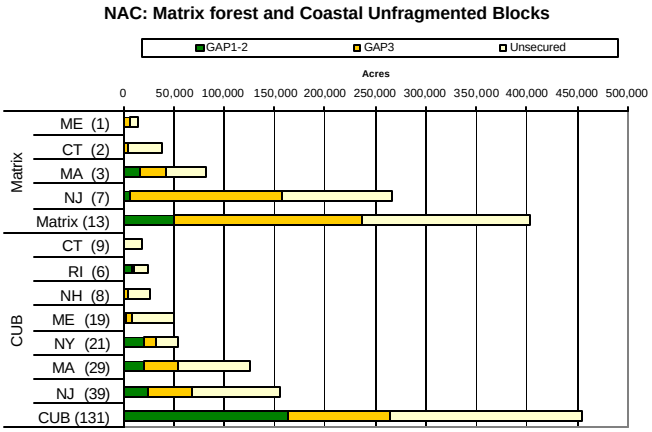
Matrix Forest and Coastal Unfragmented Blocks



Matrix Blocks: Securement Levels



CUBS and Matrix: Total Securement Levels



What is this Measure and Why is it Important?
Forests are the dominant ecosystem of northeastern North America, which is the center of distribution for many trees such as Pitch pine and Scrub oak. The ecoregional assessment identified 13 critical forest blocks, representing the largest (10,000 acres or more), most intact, remaining examples of forest interior regions that collectively contain all forest types of the ecoregion. When possible alternative blocks were identified to allow for flexibility in the conservation process but these are not included here.

The assessment also identified 131 coastal un-fragmented blocks (CUBs). These are areas that are too small to restore a fully functioning forest ecosystem but in aggregate will help to retain landscape functionality.

This indicator examines two aspects of forest conservation: 1) in the Matrix blocks the focus is on the protection of large forest reserves where conservation is focused on the restoration of forest ecosystems and on providing source breeding area for interior species; 2) in the CUBs it is the conservation of forest cover in areas of portfolio targets where we hope to retain landscape function through preventing conversion and promoting best management practices.

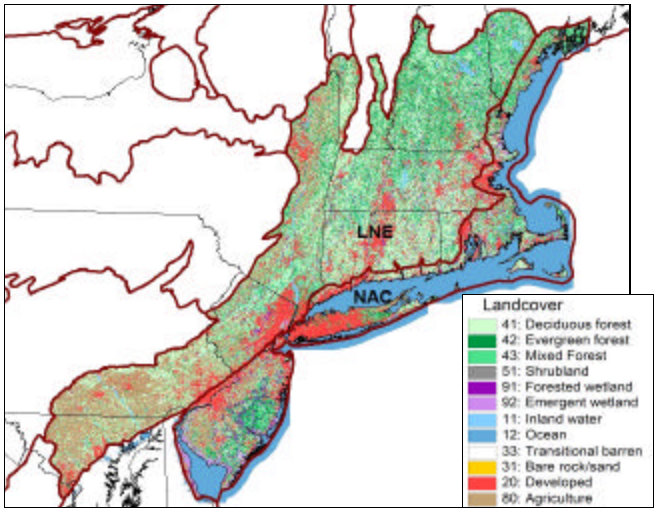
What Do the Data Show? The establishment of core reserves within the best remaining examples of every forest type is only beginning. Currently only 1 out of the 13 critical forest areas have core areas of sufficient size secured primarily for nature (over 10,000 acres).

The lower chart reveals that many of the coastal unfragmented blocks are secured against conversion to development particularly in New York, Massachusetts and New Jersey. Securing land from conversion is often a first step towards establishing a secured core as well as an essential ingredient in buffering and connecting key forest areas across the region.

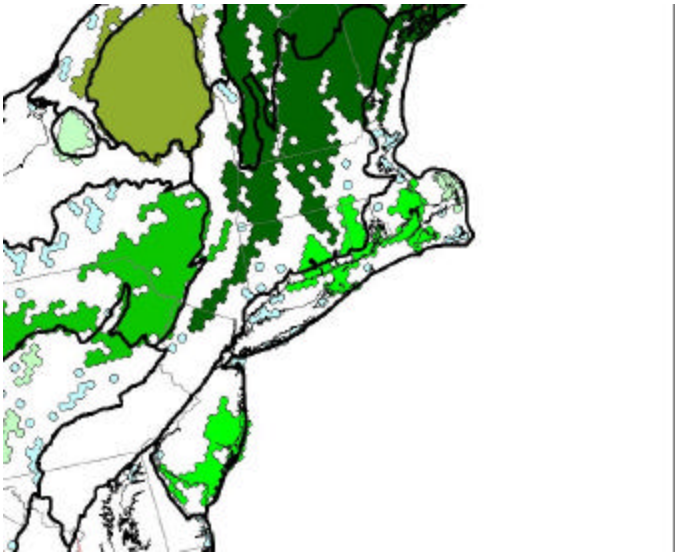
Conservation Status of the North Atlantic Coast

- **LANDSCAPE INTACTNESS**

NAC Landcover Map: Shown here with the Lower New England Ecoregion (LNE)



Blocks of Contiguous Natural Cover over 80%



What is this Measure and Why is it Important?
This measure was used to find areas of contiguous natural cover. The regions identified are likely to have intact landscape processes and high levels of connectivity. For those features that occur in these areas, the likelihood of them persisting over time is greater than the same features occurring in highly fragmented areas.

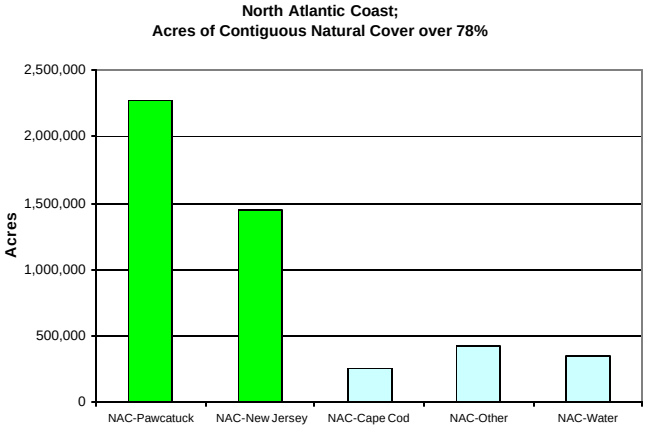
How is this Measure Calculated?
To build this indicator the entire Northeastern US region was divided into a regular grid consisting of 25,000 acre interlocking cells (hexagons). The amount of natural land cover was calculated for each cell and those with 80% or higher natural land cover were selected. Adjacent selected cells were aggregated into larger units.

What Do the Data Show? The results shown on the middle map identified 83 blocks of contiguous cover with eight of them being over a half a million acres. The two largest blocks were each over 25 million acres each. These are potentially key areas where conservation could be taken to the landscape scale i.e. working with people and industry to prevent fragmentation and maintain critical connections. Presumably smaller scale protection within these intact landscapes could continue to focus on specific features and places.

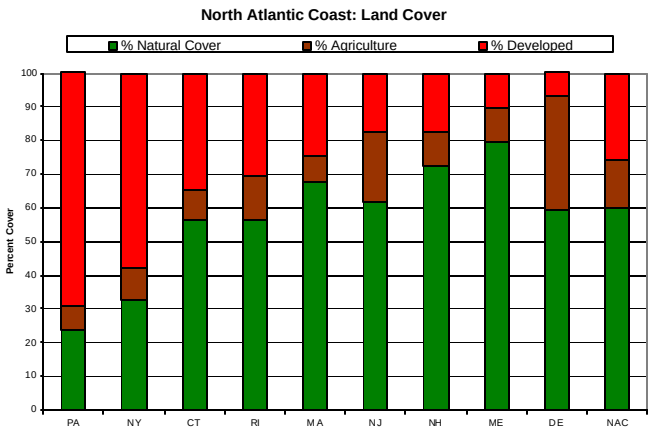
In the North Atlantic Coast ecoregion several areas emerge as intact coastal regions, These include three very large blocks: the New Jersey Pine Barrens, the Connecticut-Rhode Island Borderlands and Cape Cod.

The charts at the bottom of the page compare the difference between this more selective metric and the raw land-cover data.

Distribution of Contiguous Natural Cover Blocks



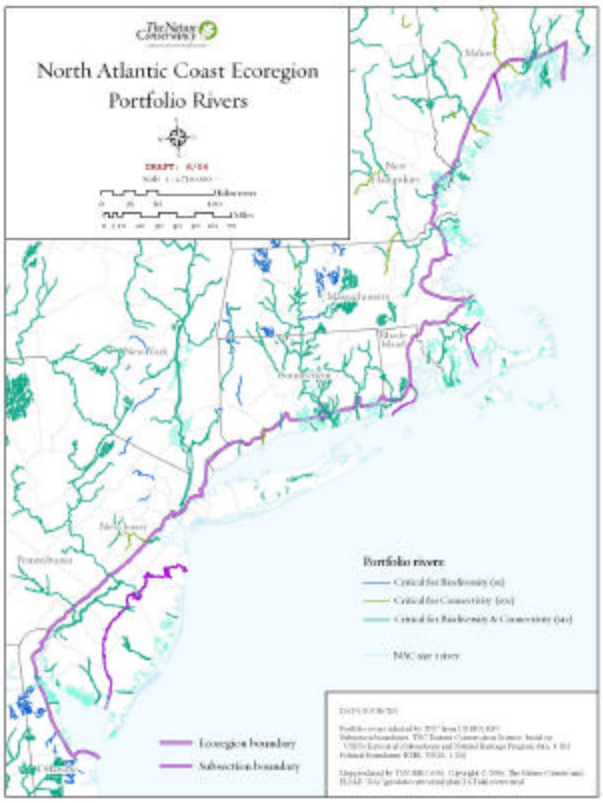
Distribution of Land Cover (for Comparison)



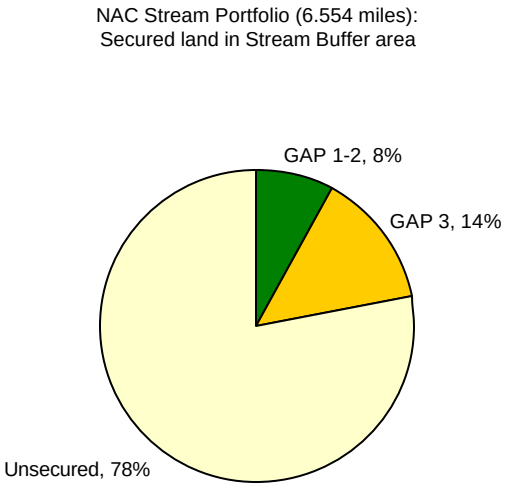
Conservation Status of the North Atlantic Coast

- **FRESHWATER ECOSYSTEMS**

Stream Portfolio for the North Atlantic Coast



Riparian Zone Land Secured From Conversion



What is the Stream Portfolio ?
The objective of The Nature Conservancy's freshwater aquatic system assessment was to identify the most intact and functional river networks and lake/pond ecosystems in such a way as to represent the full variety of freshwater diversity present within the ecoregions. Streams were evaluated within four general size classes: headwater and feeder streams (**Size 1**: 0-30 sq. mile watersheds), moderate-sized streams (**Size 2**: 30-200 sq. mile watersheds), large stream (**Size 3**: 200 – 1000 sq mile watersheds), and large deep rivers **Size 4**: 1000+ sq. mile watersheds). Portfolio "Priority 1" rivers were selected as the most viable and critical rivers. "Priority 2" rivers were identified as alternates to the portfolio. "Connectivity only" reaches were identified to complete critical connectivity networks in the region.

What Do the Data Show?
The portfolio selection process resulted in 6,554 miles of high quality, mostly connected, tidal creeks to large river systems. Only 8% of the portfolio river buffers are secured for nature, while another 14% are secured for multiple uses (GAP 3). While many of the tidal creeks are free flowing to the ocean, most of the larger streams in the portfolio are fragmented by numerous dams.

Tidal creeks were given special attention in the assessment as they are utilized as nursery areas, refuges and important food sources for a variety of crabs, fish and other coastal/marine animals. Characteristic plants in the tidal section include widgeon-grass and several cyanobacteria. The most abundant fishes of tidal creeks are the Common Mummichog, Striped Killifish, the Sheepshead Minnow and the Atlantic Silverside.

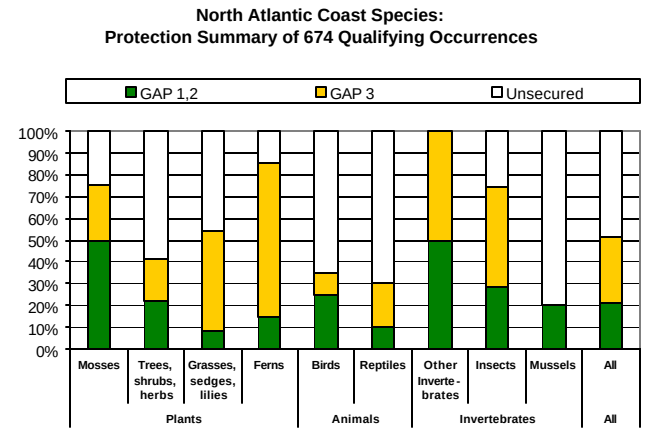
Several fishes that are resident in tidal creeks at low tide also use the low salt marsh during inundation periods. Fishes that have this distribution pattern include Atlantic Silverside, Mummichog, Sheepshead Minnow, Fourspine Stickleback, Threespine Stickleback, and American Eel. Young-of-the-year Winter Flounder may also be found in tidal creeks. Higher salinity creeks often contain productive shellfish beds.

Data Sources: EPA NLCD Land Cover 2000. EPA National Inventory of Dams 1999. TNC: Lands permanently secured from conversion to development (Dec 2005).

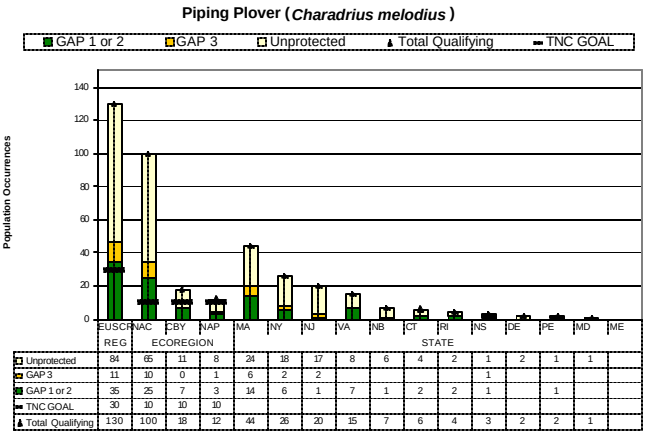
Conservation Status of the North Atlantic Coast

- **VULNERABLE SPECIES: SECUREMENT LEVELS**

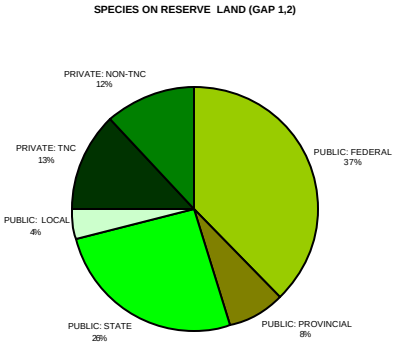
Species Groups



Individual Species Example: Piping Plover



All species: distribution of GAP 1, 2 land



Data Sources: TNC ecoregional plans, Natureserve: Natural Heritage occurrence data; used with permission.

What is this Measure and Why is it Important?
For many rare species, direct protection of their habitat and breeding areas is a critical step towards ensuring their long term persistence. This indicator examines 106 rare, endemic or wide-ranging species* and asks the question – How many of the 674 qualifying occurrences are currently found on land secured primarily for nature? How many are on unsecured land? **(not including fish)*

What Do the Data Show? Considerable progress has been made in species conservation over the last several decades. The top chart shows that over 50% of the 674 qualifying occurrences for vulnerable species are on secured lands with almost half of those, 22%, occurring on land secured primarily for nature (GAP 1, 2).

Conservation trends differ across taxonomic groups. For **vertebrates** (mammals, birds, reptiles and amphibians) 34% of the 110 qualifying occurrences are now on secured lands, including 24% on GAP 1,2 land. Over 166 populations of rare **invertebrate** species have been located and 73% are now on secured lands with 23% on GAP 1, 2 land. Rare **plants** are moderately secured, with 47% of the 398 qualifying populations on secured lands, including 17% on land secured for nature (GAP 1, 2).

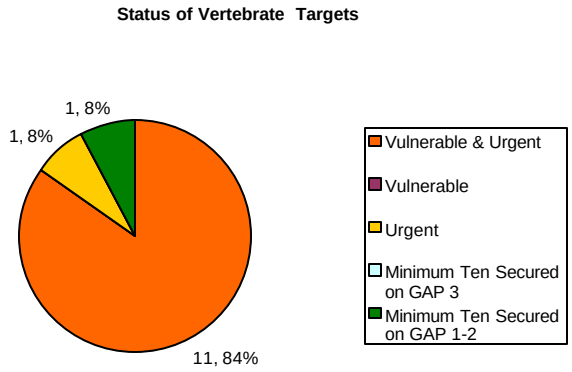
For species the concept of an **occurrence** has been one of the most potent and useful developments in conservation over the last 20 years**.** NatureServe defines an occurrence as *"area of land and/or water where a species or natural community is, or was, present and has practical conservation value."* Occurrences are often mapped locations of persistent breeding sites, however not all mapped locations are appropriate places to do conservation work. Even after applying criteria to identify the most important occurrences there is no guarantee that the areas will remain viable if other factors change, hence the need for monitoring.

The middle chart emphasizes that conserving viable **populations** involves conserving many disjunct occurrences to form a constellation of conservation sites that crosses states and ecoregions. The pie chart shows how occurrences are distributed across ownerships providing some idea of the network of protection involved in conserving species in this ecoregion. Private land accounts for 25% of the land involved in protection of vulnerable species although they account for only 10% of the land secured for nature (GAP 1, 2).

Conservation Status of the North Atlantic Coast

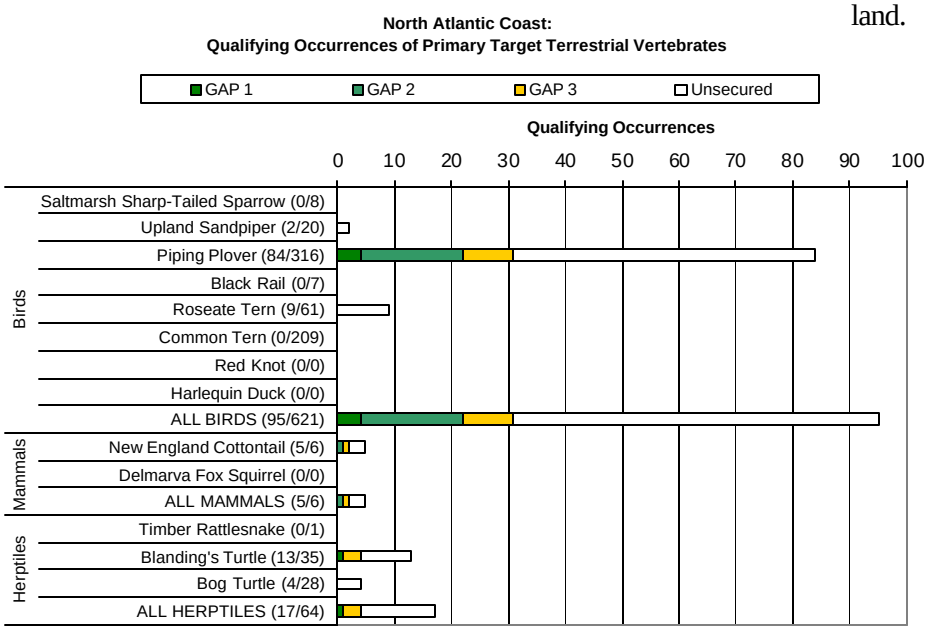
- **VERTEBRATES**

Eastern Fauna: 1304 species
Primary Targets = 13 species (not incl. fish)
Qualifying Occurrences = 117
Total Occurrences Assessed = 691



What is this Measure and Why is it Important?
In the ecoregional planning process, 13 species, or 1% of the northeastern vertebrate fauna, was identified as needing direct conservation action. For each of these **primary targets**, known population sites were identified and evaluated, and a conservation plan was developed. This status measure looks specifically at high quality occurrences and groups them into protection categories

- **Vulnerable: not urgent (0)** = fewer than 10 known qualifying occurrences, all are on GAP1-3 land.
- **Vulnerable and Urgent (11)** = fewer than 10 known qualifying occurrences and not all on GAP 1-3 land.
- **Urgent (1)** = more than 10 known qualifying occurrences but fewer than 10 on GAP 1, 2 land.
- **Minimum Ten Secured (0)** = over 10 qualifying occurrences on GAP 3 land but fewer than 10 on GAP 1, 2 land.
- **Minimum Ten Secured on Nature reserves (1)** = over 10 qualifying occurrences on GAP 1, 2 land.



What Do the Data Show? For only one species, the Piping Plover were more than ten viable occurrences located and secured on GAP 1-3 land. For most rare species less than 10 qualifying occurrences were located and few or none are currently on GAP land. There are big deficiencies in the data for timber rattlesnake.

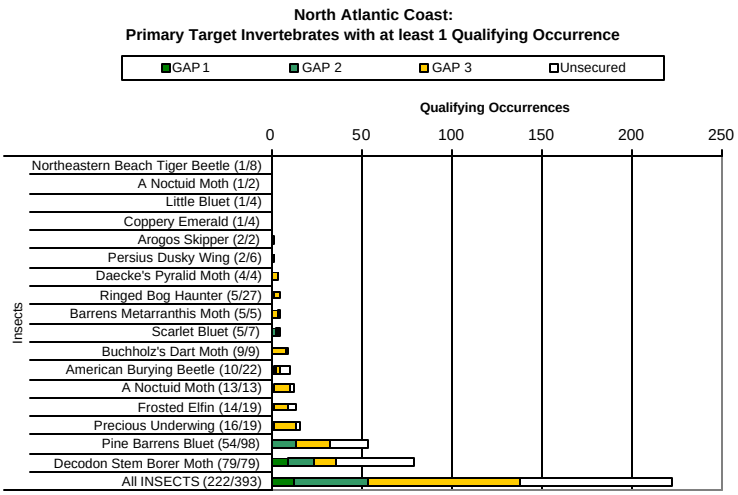
Results for every species are on the CD.

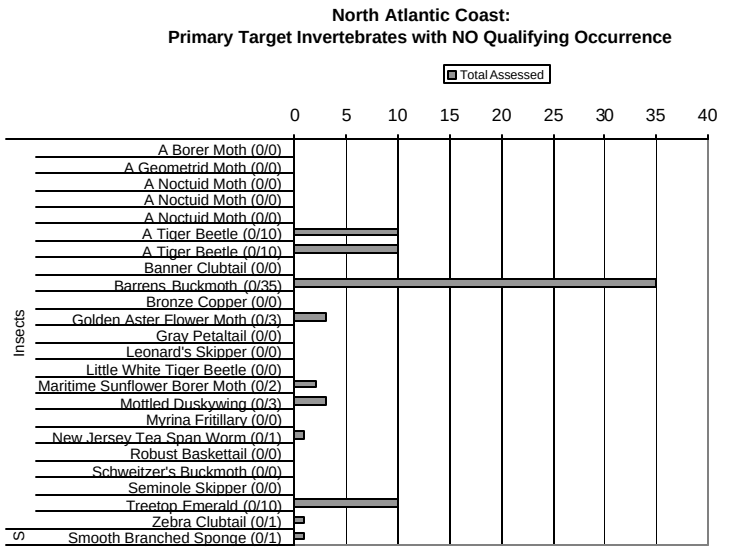
Data Sources: TNC ecoregional plans, Natureserve: Natural Heritage occurrence data; used with permission.

Conservation Status of the North Atlantic Coast

- **INVERTEBRATES**

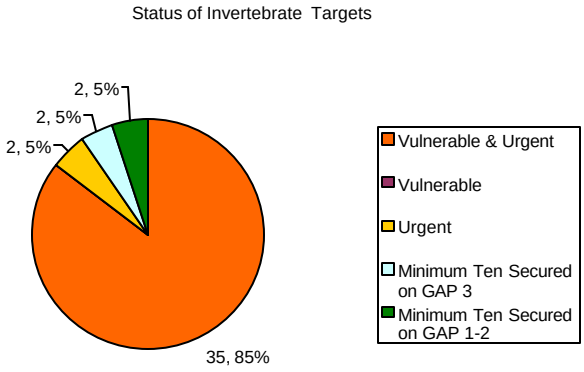
Eastern Fauna: 4003 species
NAC Primary Targets = 41 species
NAC Qualifying Occurrences = 222





Data Sources: TNC ecoregional plans, Natureserve: Natural Heritage occurrence data; used with permission.

What is this Measure and Why is it Important?
In the ecoregional planning process, 176 species, or 4% of the northeastern invertebrate fauna, were identified as needing direct conservation action. For each of these **primary targets**, known population sites were identified and evaluated, and a conservation plan was developed. This status measure looks specifically at high quality occurrences and groups them into protection categories



- **Vulnerable: not urgent (18%)** = fewer than 10 known qualifying occurrences, all are on GAP1-3 land.
- **Vulnerable and Urgent (60%)** = fewer than 10 known qualifying occurrences and some are not on GAP 1-3 land.
- **Urgent (15%)** = more than 10 known qualifying occurrences but fewer than 10 on GAP 1, 2 land.
- **Minimum Ten Secured (4%)** = more than 10 qualifying occurrences on GAP 3 lands but fewer than 10 qualifying occurrences on GAP 1, 2 land.
- **Minimum Ten Secured on Nature reserves (3%)** = over 10 qualifying occurrences on GAP 1, 2 land.

What Do the Data Show?

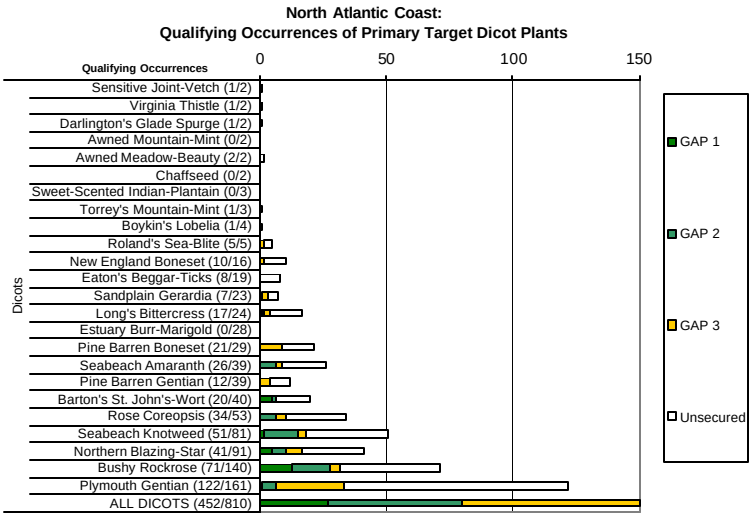
Species by species results are on the CD.

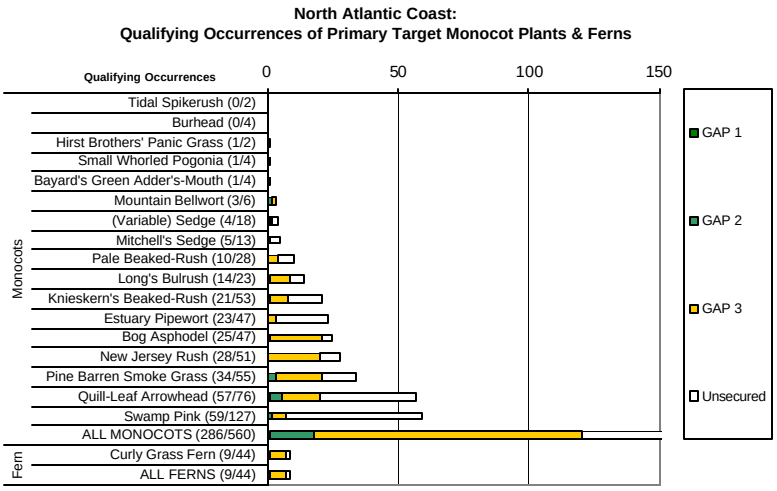
Conservation Status of the North Atlantic Coast

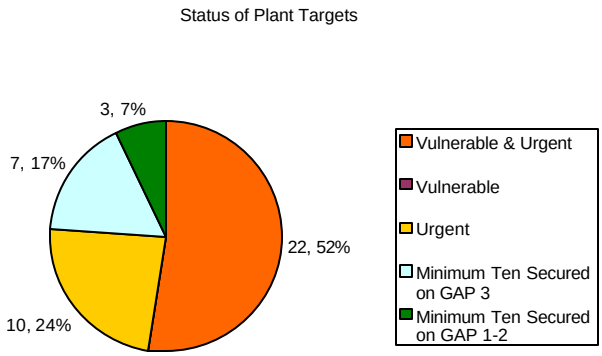
- **PLANTS**

Eastern Flora: 8223 species
Primary targets = 52 species,
Qualifying Occurrences = 2388

What is this Measure and Why is it Important?
In the ecoregional planning process, 52 species were identified as needing direct conservation action. For each of these **primary targets**, known population sites were identified and evaluated, and a conservation plan was developed. This status measure looks specifically at high quality occurrences and groups them into protection categories







- **Vulnerable: not urgent (20%)** = fewer than 10 known qualifying occurrences, all are on GAP1-3 land.
- **Vulnerable and Urgent (55%)** = fewer than 10 known qualifying occurrences and some are not on GAP 1-3 land.
- **Urgent (14%)** = more than 10 known qualifying occurrences but fewer than 10 on GAP 1, 2 land.
- **Ten Secured (7%)** = more than 10 qualifying occurrences on GAP 3 land but fewer than 10 on GAP 1, 2 land.
- **Ten Secured on Nature reserves (4%)** = over 10 qualifying occurrences on GAP 1, 2 land.

What Do the Data Show?

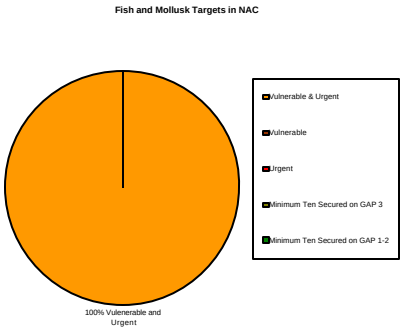
- Species by species results are on the CD.

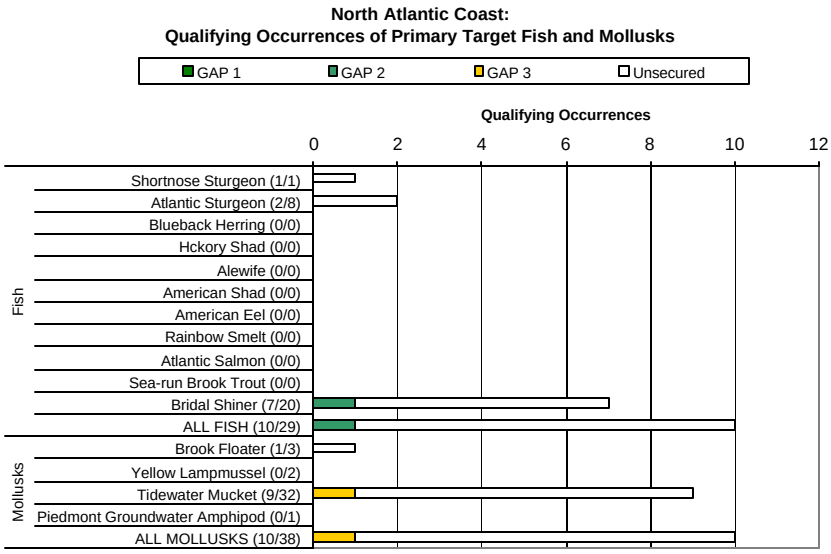
Data Sources: TNC ecoregional plans, Natureserve: Natural Heritage occurrence data; used with permission.

Conservation Status of the North Atlantic Coast

- **FISH & MUSSELS**

Eastern Fauna: 400 fish, 269 mollusks
Primary Targets = 11 fish and 4 Mollusks
Qualifying Occurrences = 20
Total Occurrences Assessed = 67





What is this Measure and Why is it Important?
In the ecoregional planning process, 11 fish and 4 mollusk species were identified as needing direct conservation action. For each of these **primary targets**, known population sites were identified and evaluated, and a conservation plan was developed. This status measure looks specifically at high quality occurrences and groups them into protection categories

- **Vulnerable: not urgent (0)** = fewer than 10 known qualifying occurrences, all are on GAP1-3 land.
- **Vulnerable and Urgent (11)** = fewer than 10 known qualifying occurrences and not all on GAP 1-3 land.
- **Urgent (1)** = more than 10 known qualifying occurrences but fewer than 10 on GAP 1, 2 land.
- **Minimum Ten Secured (0)** = over 10 qualifying occurrences on GAP 3 land but fewer than 10 on GAP 1, 2 land.
- **Minimum Ten Secured on Nature reserves (1)** = over 10 qualifying occurrences on GAP 1, 2 land.

What Do the Data Show? For all species less than 10 viable occurrences were located and very few were currently on secured land. Currently we are compiling data on breeding habitat and ocean-freshwater connections to get a clearer picture of freshwater species conservation.

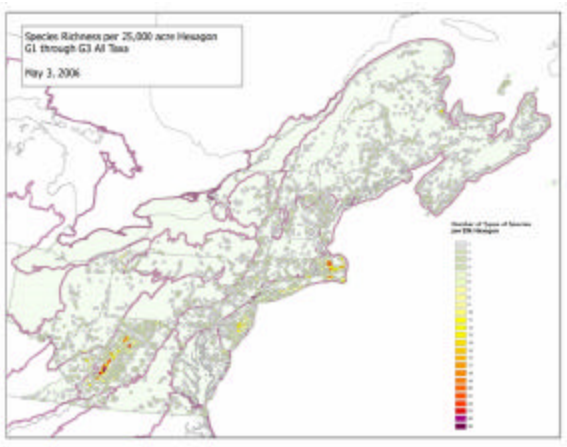
Results for every species are on the CD.

Data Sources: TNC ecoregional plans, NatureServe: Natural Heritage occurrence data; used with permission.

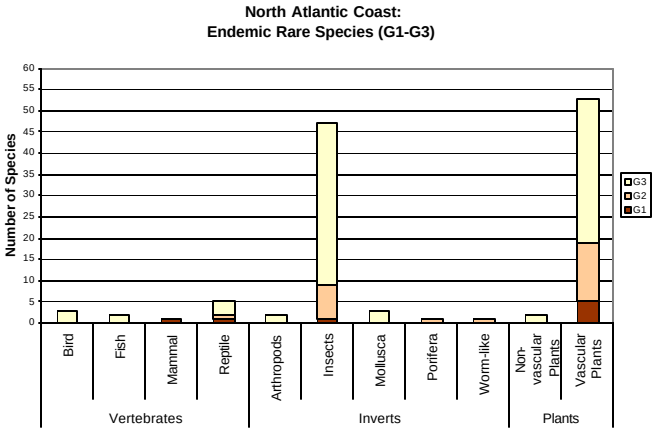
Conservation Status of the North Atlantic Coast

- **CENTERS OF ENDEMISM**

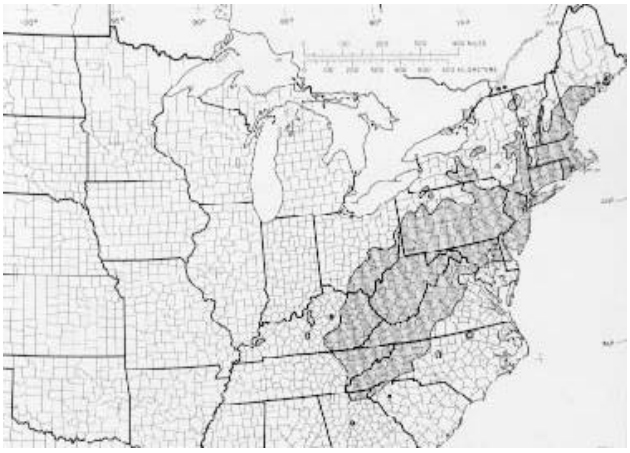
All Regional Endemic G1 – G3 Species



Endemic G1-G3 Species in the North Atlantic Coast Ecoregion



Pitch pine distribution map, an example of a common regional endemic, characteristic of NAC but not include in this analysis.



What is an Endemic and Why is it Important?
Endemic species are those for which the entire known population is restricted to, or centered around, a particular geographic region - in this case the North Atlantic Coast. It follows that the ecoregion is solely responsible for the conservation of that species. In this region most of the globally rare G1 and G2 species are endemic as are most of the slightly more common G3 species – all of which are endemic to the region.

A few caveats are useful in interpreting endemic patterns. First, this analysis and most "Hot Spot" analyses, are based largely on vertebrates, higher plants and well studied macro invertebrates. Estimates suggest that the former two (vertebrates and higher plants) account for about 10% of the species within an ecosystem. Adding the macro invertebrates is helpful although the data is less consistent. Fundamentally, however, most of the species that perform the functional aspects and account for the diversity of nature are the billions of micro-invertebrates, algae and fungi that are not well inventoried, nor counted.

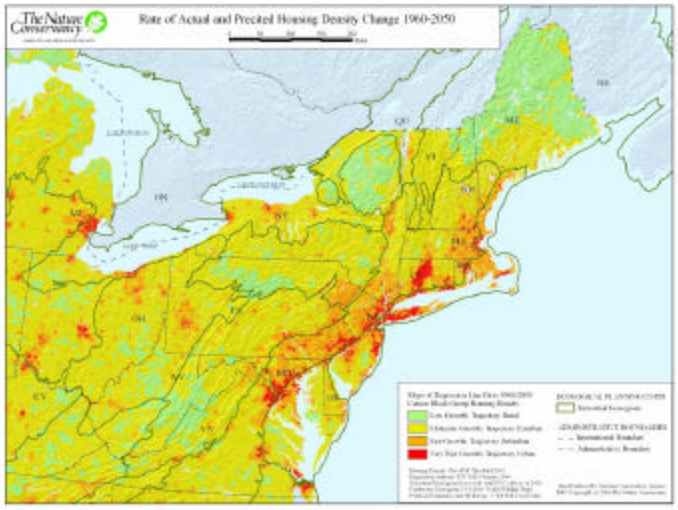
Second, many types of regional endemics such as pitch pine have the core of their distribution centered in this ecoregion, or a small group of ecoregions but are not locally uncommon. These species for which there is a "high conservation responsibility," but which are fairly common in the ecoregion were not included in this analysis. Many scientists have come to believe that the conservation of all species can probably only be accomplished through the protection of functioning ecosystems – hence the shift in conservation biology from a species-by-species focus to an ecosystem focus.

What Do the Data Show?
The upper map shows that the North Atlantic Coast is second only to the Central Appalachian in the number of rare endemic species. The bar chart illustrates that of the 120 recognized endemics found in this ecoregion, most are plants or invertebrates. The plants consist mostly of coastal plain, salt marsh or beach endemics. Insects include rare dragonflies and tiger beetles among others.

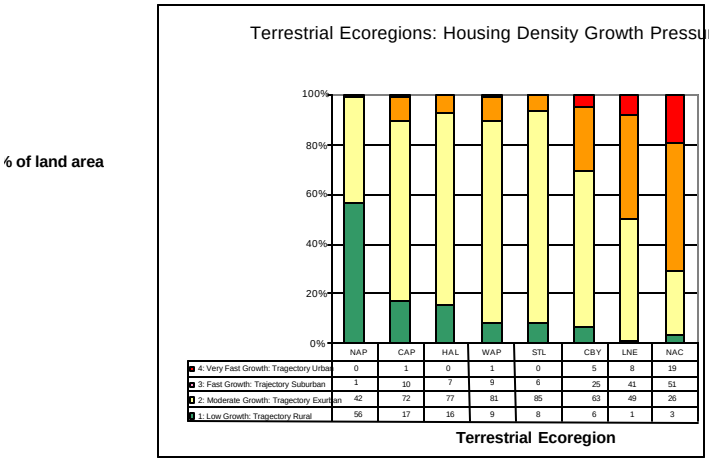
Data Source: TNC ecoregional assessments, Natureserve, Natural Heritage community element occurrences. Flora of North America

SECTION 4: FUTURE THREATS

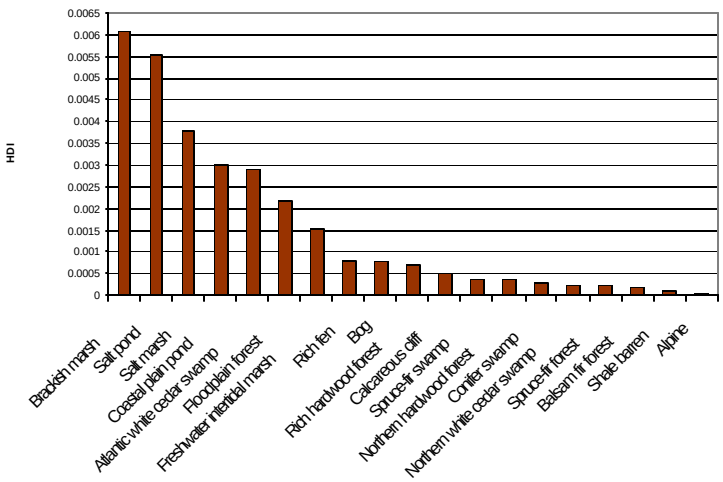
- **HOUSING DENSITY PRESSURE**



Map of Housing Density Rates (explained in text) and rates summarized by ecoregion



Ecosystems and Communities in relation to Housing Density Pressure :



What is this Measure and Why is it Important?
The Housing Density Pressure (HDP) index estimates rate and intensity of housing pressure based on trends in the census data from 1940 projected through 2050. On the map red indicates areas where the rate of change is fast with housing density predicted to reach urban levels in the next 45 years, green indicates areas where the rate of change are slow. The latter areas will remain at low density rural levels through 2050. The index is calculated by fitting a regression line to five decades of census data and using the slope as an estimate of the rate of change.

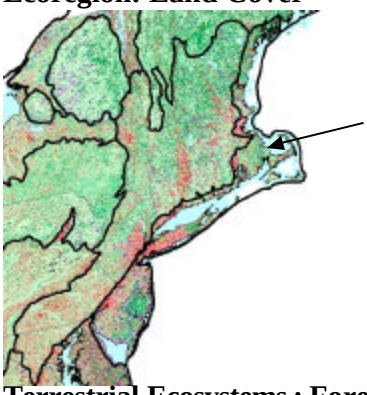
What Do the Data Show?
The upper chart summarizes housing density pressure across eight eastern ecoregions. In this analysis the North Atlantic Coast along with neighboring Lower New England and Chesapeake Bay stand out as regions with extremely high rates of housing density pressure. The NAC ecoregion is under the greatest threat of all the eastern ecoregions with 20% of its area predicted to have urban level housing densities by 2050.

The lower chart summarizes the data by ecosystem. This emphasizes that the **coastal systems ,** so characteristic of the NAC ecoregion, are subject to the highest housing density pressure within the next half century. The best salt marshes, beaches, coastal plain ponds and tidal wetlands are all found in counties that are rapidly moving towards urban densities. **Floodplain systems** , already heavily impaired by agricultural fragmentation and water regulations, are also at high risk from housing density pressure. **Calcareous soil ecosystems** such as rich fens and rich hardwood forests are subject to moderate rates of housing density pressure.

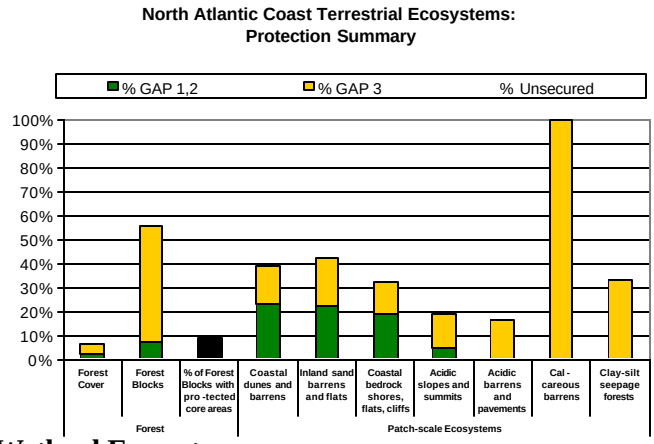
Data Source: Theobold 2003, TNC Eastern Conservation Science TNC ecoregional assessments, Natureserve, Natural Heritage community element occurrences

SECTION 5: ECOREGION SUMMARY

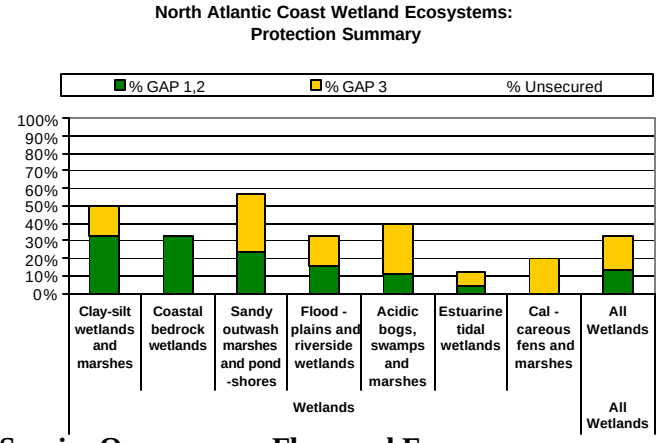
Ecoregion: Land Cover



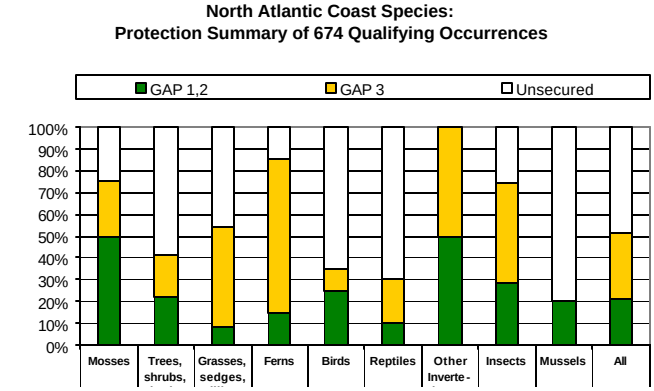
Terrestrial Ecosystems : Forest & Non-Forest



Wetland Ecosystems



Species Occurrences: Flora and Fauna



NORTH ATLANTIC COAST

Glaciated irregular plain composed of sandy till and modified by coastal processes in NJ, DE, NY, RI, CT, MA, NH, and ME. Kames, kettle holes, drumlins and reworked terminal moraines are typical features. Entirely below 600 ft., the region boasts extensive marine and estuarine habitats including salt marshes, beach dune and barrier island systems, fresh and brackish tidal marshes. Inland forest types include coastal pine-oak forests, and oak-beech-holly forest.

- **Size: 12,711,982 acres**
- **GAP 1, 2 = 3%, GAP 3 = 6%**
- **Unsecured = 92%**
- **Converted to Protected ratio: 9.6**
- **Natural Cover: 60%**
- **# Endemic species: 120**
- **Portfolio Target Occurrences: 1,900**
- **Portfolio Stream-miles: 6554 miles**

Portfolio Protection Status: Qualifying Occurrences

Terrestrial

- **Forest Blocks: 11 / 9% w Cores**
- **Non-Forest occurrences: 354 / 19% GAP 1,2**
- **Wetland occurrences: 861/ 13% GAP 1,2**
- **Species occurrences: 674 / 21% GAP 1,2**

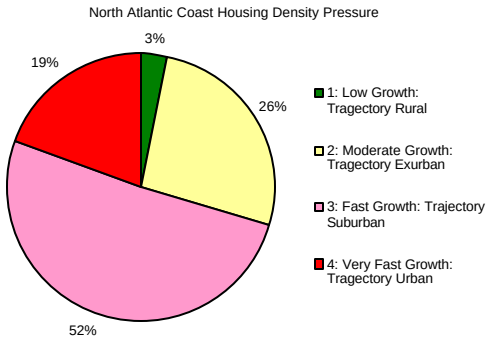
Average = 16% =/- 6%
Sum = 17%

Terrestrial Protection Average = 16%

Aquatic

- **Stream miles: 6136 / 11%**

Housing Density Pressure



SECTION 6: APPENDICES

SPECIES NAMES:

Common Name	Standard Name
Alewife	Alosa pseucoharengus
American Burying Beetle	Nicrophorus americanus
American Eel	Anguilla rostradta
American Shad	Alosa sapidissima
Arogos Skipper	Atrytone arogos arogos
Atlantic Salmon	Salmo salar
Atlantic Sturgeon	Acipenser oxyrinchus
Awned Meadow-Beauty	Rhexia aristosa
Awned Mountain-Mint	Pycnanthemum setosum
Banner Clubtail	Gomphus apomyius
Barrens Buckmoth	Hemileuca maia
Barrens Metarranthis Moth	Metarranthis apiciaria
Barton's St. John's-Wort	Hypericum adpressum
Bayard's Green Adder's-Mouth	Malaxis bayardii
Black Rail	Laterallus jamaicensis
Blanding's Turtle	Emydoidea blandingii
Blueback Herring	Alosa aestivalis
Bog Asphodel	Narthecium americanum
Bog Turtle	Glyptemys muhlenbergii
Boykin's Lobelia	Lobelia boykinii
Bridal Shiner	Notropis bifrenatus
Bronze Copper	Lycaena hyllus
Brook Floater	Alasmidonta varicosa
Buchholz's Dart Moth	Agrotis buchholzi
Burhead	Echinodorus tenellus
Bushy Rockrose	Helianthemum dumosum
Chaffseed	Schwalbea americana
Common Tern	Sterna hirundo
Coppery Emerald	Somatochlora georgiana
Curly Grass Fern	Schizaea pusilla
Daecke's Pyralid Moth	Crambus daeckellus
Darlington's Glade Spurge	Euphorbia purpurea
Decodon Stem Borer Moth	Papaipema sulphurata
Delmarva Fox Squirrel	Sciurus niger cinereus
Eaton's Beggar-Ticks	Bidens eatonii
Estuary Burr-Marigold	Bidens bidentoides
Estuary Pipewort	Eriocaulon parkeri
Frosted Elfin	Callophrys irus
Geometrid Moth	Cyclophora sp 1
Golden Aster Flower Moth	Schinia tuberculum
Gray Petaltail	Tachopteryx thoreyi
Harlequin Duck	Histrionicus histrionicus
Hckory Shad	Alosa mediocris
Hirst Brothers' Panic Grass	Panicum hirstii
IM Total	Spongilla aspinosa
Knieskern's Beaked-Rush	Rhynchospora knieskernii
Leonard's Skipper	Hesperia leonardis
Little Bluet	Enallagma minusculum
Little White Tiger Beetle	Cicindela lepida
Long's Bittercress	Cardamine longii
Long's Bulrush	Scirpus longii
Maritime Sunflower Borer Moth	Papaipema maritima
Mitchell's Sedge	Carex mitchelliana
Mottled Duskywing	Erynnis martialis
Mountain Bellwort	Uvularia puberula var. nitida
Myrina Fritillary	Boloria selene myrina
New England Boneset	Eupatorium leucolepis v novae-an
New England Cottontail	Sylvilagus transitionalis
New Jersey Rush	Juncus caesariensis
New Jersey Tea Span Worm	Apodrepanulatrix liberaria
Noctuid Moth	Meropleon cosmion
Noctuid Moth	Meropleon titan
Noctuid Moth	Ptichodis bistrigata
Noctuid Moth	Richia sp. 2
Noctuid Moth	Spartiniphaga carterae
Northeastern Beach Tiger Beetle	Cicindela dorsalis dorsalis
Northern Blazing-Star	Liatris scariosa var. novae-angliae
Pale Beaked-Rush	Rhynchospora pallida
Papaipema	Papaipema buffaloensis
Persius Dusky Wing	Erynnis persius persius
Piedmont Groundwater Amphipod	Stygobromus tenuis tenuis
Pine Barren Boneset	Eupatorium resinosum
Pine Barren Gentian	Gentiana autumnalis
Pine Barren Smoke Grass	Muhlenbergia torreyana
Pine Barrens Bluet	Enallagma recurvatum
Piping Plover	Charadrius melodus
Plymouth Gentian	Sabatia kennedyana
Precious Underwing	Catocala pretiosa pretiosa
Quill-Leaf Arrowhead	Sagittaria teres
Rainbow Smelt	Osmerus mordax
Red Knot	Calidris canutus
Ringed Bog Haunter	Williamsonia lintneri
Robust Baskettail	Epitheca spinosa
Roland's Sea-Blite	Suaeda rolandii
Rose Coreopsis	Coreopsis rosea
Roseate Tern	Sterna dougallii
Saltmarsh Sharp-Tailed Sparrow	Ammodramus caudacutus
Sandplain Gerardia	Agalinis acuta
Scarlet Bluet	Enallagma pictum
Schweitzer's Buckmoth	Hemiluca nevadernsis
Seabeach Amaranth	Amaranthus pumilus
Seabeach Knotweed	Polygonum glaucum
Sea-run Brook Trout	Salvelinus fontinalis
Seminole Skipper	Hesperia attalus slossonae
Sensitive Joint-Vetch	Aeschynomene virginica
Shortnose Sturgeon	Acipenser brevirostrum
Small Whorled Pogonia	Isotria medeoloides
Swamp Pink	Helonias bullata
Sweet-Scented Indian-Plantain	Hasteola suaveolens
Tidal Spikerush	Eleocharis aestuum
Tidewater Mucket	Leptodea ochracea
Tiger Beetle	Cicindela patruela consentanea
Tiger Beetle	Cicindela patruela patruela
Timber Rattlesnake	Crotalus horridus
Torrey's Mountain-Mint	Pycnanthemum torrei
Treetop Emerald	Somatochlora provocans
Upland Sandpiper	Bartramia longicauda
Variable Sedge	Carex polymorpha
Virginia Thistle	Cirsium virginianum
Yellow Lampmussel	Lampsilis cariosa
Zebra Clubtail	Stylurus scudderi

TIDAL MARSH COMPLEXES:

NAME (listed alphabetically)	% GAP 1	% GAP 2	% GAP3	% Un-secured	Total
#1 along lower Kennebec 1 (166 acres, 57% secured)	24	0	33	43	166
#2 along lower Kennebec 2 (162 acres, 9% secured)	0	9	0	91	162
#3 along lower Kennebec 3 (75 acres, 44% secured)	0	0	44	56	75
#4 along lower Kennebec 4 (81 acres, 0% secured)	0	0	0	100	81
Accabonac Marsh (358 acres, 36% secured)	0	36	0	64	358
Allens Pond (300 acres, 45% secured)	24	15	7	55	300
Atlantic Cape May marshes (20308 acres, 48% secured)	0	3	45	52	20,308
Atlantic coast marshes (230) (1190 acres, 0% secured)	0	0	0	100	1,190
Atlantic coast marshes (231) (496 acres, 0% secured)	0	0	0	100	496
Atlantic County Marshes (23278 acres, 2% secured)	0	2	0	98	23,278
Back River-Hockomock Bay (1428 acres, 25% secured)	5	1	20	75	1,428
Barn Island WMA (400 acres, 78% secured)	0	0	78	22	400
Bass Creek: Mashomack (50 acres, 100% secured)	0	100	0	0	50
Batson River (503 acres, 49% secured)	0	49	0	51	503
Biddeford Pool (715 acres, 9% secured)	0	8	1	91	715
Block Island Marshes (219 acres, 2% secured)	0	1	0	98	219
Bluff Point Coastal Reserve (298 acres, 23% secured)	0	23	0	77	298
Boat & Herring River Marsh 1 (518 acres, 35% secured)	2	33	0	65	518
Boat & Herring River Marsh 2 (387 acres, 52% secured)	0	50	2	48	387
Brave Boat Harbor (463 acres, 68% secured)	0	68	0	32	463
Carmans River marshes (872 acres, 96% secured)	0	96	0	4	872
Chewonki Neck (812 acres, 9% secured)	0	8	1	91	812
Cohasset-Scituate (1060 acres, 29% secured)	0	28	2	71	1,060
Crab Meadow (281 acres, 0% secured)	0	0	0	100	281
Curtis Cove to Fortunes Rocks (272 acres, 44% secured)	0	41	3	56	272
DE Delaware Bayshores 1 (70842 acres, 65% secured)	0	1	65	35	70,842
DE Delaware Bayshores 2 (6071 acres, 32% secured)	0	12	20	68	6,071
Deer Meadow north (348 acres, 0% secured)	0	0	0	100	348
Deer Meadow south (726 acres, 0% secured)	0	0	0	100	726
East River Marsh (915 acres, 28% secured)	0	15	14	72	915
Fire Island flats & marshes (8080 acres, 84% secured)	0	82	1	16	8,080
Fisher Eddy: Lower Kennebec (127 acres, 22% secured)	22	0	0	78	127
Flanders Marshes (1024 acres, 58% secured)	0	58	0	42	1,024
Flax Pond/Crane Neck (136 acres, 87% secured)	0	87	0	13	136
Fogland (92 acres, 55% secured)	40	0	16	45	92
Galilee/Succotash Marsh (825 acres, 27% secured)	0	26	1	73	825
Gardiners Island (145 acres, 0% secured)	0	0	0	100	145
Great Bay (2189 acres, 18% secured)	1	2	16	82	2,189
Great Egg Harbor Marshes (17310 acres, 57% secured)	0	1	56	43	17,310
Great Marsh/Parker River 1 (24093 acres, 33% secured)	15	9	9	67	24,093
Great Marsh/Parker River 2 (578 acres, 10% secured)	0	7	4	90	578
Great South Bay marshes 1 (959 acres, 0% secured)	0	0	0	100	959
Great South Bay marshes 2 (2407 acres, 32% secured)	0	0	32	68	2,407
Great South Bay marshes 3 (1400 acres, 15% secured)	0	14	1	85	1,400
Hammock River Marsh (325 acres, 32% secured)	0	6	26	68	325
Hammonasett Marsh (837 acres, 50% secured)	44	6	0	50	837
Herring R. Marshes W. Harwich (487 acres, 8% secured)	0	8	0	92	487
Herring Riv Marshes: Wellfleet (1228 acres, 68% secured)	0	68	0	32	1,228
Hundred Acre Cove (349 acres, 34% secured)	14	6	13	66	349
Lloyd Point/The Sand Hole (121 acres, 85% secured)	0	0	85	15	121
Lower CT River (3159 acres, 41% secured)	7	3	31	59	3,159
Mamacoke Island (6 acres, 84% secured)	0	84	0	16	6
Marsh just S of Del Mem Bridge (77 acres, 0% secured)	0	0	0	100	77
Marshes near Morris Island (944 acres, 4% secured)	0	4	0	96	944
Mashomack Creek (70 acres, 100% secured)	0	100	0	0	70
McKinney Refuge (430 acres, 16% secured)	14	3	0	84	430
Merrymeeting Bay (1996 acres, 0% secured)	0	0	0	100	1,996
Milford Point/Housatonic River (726 acres, 72% secured)	0	0	71	28	726
Miss Annie's Creek: Mashomack (32 acres, 94% secured)	0	94	0	6	32
Mullica Riv-Great Bay marshes (25020 acres, 39% secured)	0	16	22	61	25,020
Napeague Marshes (1480 acres, 27% secured)	0	1	25	73	1,480
Narrow River (288 acres, 32% secured)	7	25	0	68	288
Nauset Marsh (1258 acres, 54% secured)	0	53	0	46	1,258
Nissequoque River (601 acres, 3% secured)	0	1	2	97	601
NJ Delaware Bayshores 1 (87419 acres, 39% secured)	0	5	34	61	87,419
NJ Delaware Bayshores 2 (10942 acres, 23% secured)	0	1	22	77	10,942
NJ Northern Marshes (27113 acres, 29% secured)	0	3	26	71	27,113
No name (Conanicut Island) (125 acres, 74% secured)	28	11	35	26	125
North and South Rivers 1 (2557 acres, 18% secured)	3	13	1	82	2,557
North and South Rivers 2 (800 acres, 29% secured)	0	29	0	71	800
Northwest Creek, Northwest Har (417 acres, 72% secured)	0	72	0	28	417
Odiorne (603 acres, 42% secured)	0	0	42	58	603

SECTION 7: ABOUT THE RESOURCE CD

The two-CD set that accompanies this Summary contains the NAC final draft report, tabular and spatial data, maps and ancillary documents.

The North Atlantic Coast Resource CD was published by Eastern Conservation Science, The Nature Conservancy, in December 2006 as ERO-CD-ECO-v1.

This product was designed for a Microsoft Windows XP or Windows 2000 system.

How Files are Organized on the CDs

NAC_CD1 The files are organized into four folders:

`docs`: contains the assessment report files ("plan"), appendices, and extra resources. The Appendices folder may contain tables (see "tabular" below). Most aquatic appendices are in **`tabular`**.

`maps`: contains maps of the ecoregion in both pdf and jpg formats.

`spatial`: contains the first part of the vector and raster spatial data, and the metadata files and folders.

`tabular`: contains folders for the freshwater aquatics, species conservation targets and unfragmented blocks (including matrix forest and coastal unfragmented block reports), each of which holds ancillary data, generally in tabular form.

NAC_CD2 contains the second part of the spatial data.

Contact Us

To provide feedback on this product or with any other questions or problems, contact us:

The Nature Conservancy, Eastern Conservation Science
Eastern U.S. Conservation Region
11 Avenue de Lafayette, 5th Floor, Boston, MA 02111
Email: ecs-ecoplans@tnc.org