**Initial 2013 Science Needs – Ecological Planning and Conservation Design Components**

As a starting point for considering North Atlantic LCC science needs for 2013, the following table summarizes potential science needs that have emerged as high priorities and that either are not being addressed by current projects or that are likely to require continued work after existing projects are completed. The table includes high priorities of the 2012 Technical Committee review as well as the 2011 science need prioritization process, Northeast Conservation Framework Workshop results and Conservation Science Strategic Plan. This initial set will be considered as the Technical Committee develops its 2013 recommendations for the LCC Steering Committee.

Note that this table is focused on two components of the Conservation Science Strategic Plan: Ecological Planning and Conservation Design. A complementary effort is underway to develop a North Atlantic LCC “Science Delivery” team that will focus on delivery of conservation science and that will use a parallel process to identify annual science translation, conservation adoption and delivery needs. In addition there are tasks under the monitoring component that are not yet addressed. Information management needs are considered separately.

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| **System** | **Component** | **Science Need** |
| Aquatic | Ecological Planning | Describing and quantifying ecological flows for streams and rivers |
| Ecological Planning & Conservation Design | Continuing work on integrated forecasts of stream temperature and flow including climate projections |
| Monitoring | Standardization of aquatic sampling |
| Coastal and Marine | Ecological Planning | Foundational coastal datasets – elevation, hardened structures, wetlands, etc. |
| Ecological Planning and Conservation Design | Continuing work on impacts of sea level rise on coastal wetlands and adaptation measures |
| Ecological Planning and Conservation Design | Assessing risk for estuarine and marine invasive species |
| Terrestrial and Wetland | Ecological Planning | Characterizing regional forest structure and condition, potentially to include assessment/database of habitat management |
| Ecological Planning | Rate of change (and uncertainties) of distribution of invasive and foundational native plant species in response to climate change |
| Conservation Design | Characterizing vernal pool wetlands and use by amphibians; developing conservation strategies including best management practices |
| Cross-cutting | Ecological Planning | Identification of regional conservation targets (including population objectives) |
| Ecological Planning | Downscaled climate projections including extreme events and other sub-annual parameters |
| Ecological Planning | Assessment of effect of climate change on exposure and sensitivity of species and habitats to environmental contaminants |
| Conservation Design | Integration of economic and other social science considerations into decision support tools |

Initial 2013 North Atlantic LCC Science Needs

Aquatic Resources and Ecosystems

The North Atlantic LCC encompasses a network of thousands of miles of streams and rivers that support a diverse array of species and ecological services. Major rivers include the Kennebec, Androscoggin, Merrimack, Connecticut, Hudson, Delaware, Susquehanna, Potomac, and James. These rivers and their associated watersheds and estuaries support many anadromous (migratory) fish including Atlantic salmon and American shad as well as a variety of other fish and wildlife species, such as eastern brook trout and endangered mussels. Historically serving as important sites of commerce and routes of transportation, rivers have been damaged by erosion, pollution, channelization, damming and other effects. Climate change, which is predicted to result in warmer temperatures and altered patterns of precipitation, will impose further stresses on the species and resources that depend upon freshwater ecosystems.

1. **Stream temperatures and flows**

The volume and temperature of water flowing within streams are fundamental determinants of the kinds and abundance of fish and wildlife species that inhabit these aquatic ecosystems. In the future, changing climate and human activities (such as construction or removal of dams, expansion of urban development and transportation networks, and withdrawal of water for industrial and residential use) will interact to alter stream temperatures and flows and therefore associated fish and wildlife. Understanding current and future stream temperatures and flows, and how they can be modified by conservation and management activities, is critical to sustaining ecosystems and populations of fish and wildlife in the North Atlantic LCC region. Work related to this topic can be considered a critical building block for the next science need, environmental flows.

1. **Environmental flows**

“Environmental flows” refer to the quantity, quality, and timing of water flows necessary to sustain freshwater and estuarine ecosystems and the associated resources that people depend on. Environmental flows are being incorporated into decision making in the Northeast in areas such as the Susquehanna basin, Massachusetts, and Virginia. Numerous uncertainties exist related to environmental flows, however, such as impacts of future changes in climate and development and in how these alterations will affect aquatic resources.

1. **Standardization of aquatic sampling**

Substantial opportunities exist to coordinate and standardize methods and designs for sampling aquatic resources across the North Atlantic region. Such coordination would improve the ability to analyze and synthesize information at regional scales, thereby benefiting states, regional partnerships, and other organizations. Candidate monitoring protocols to address include water quality, temperature, and hydrological flow. Work on this science need would improve available information necessary to address the other two aquatic science needs.

Coastal and Marine Resources and Ecosystems

The North Atlantic LCC area encompasses a wide diversity of coastal and island ecosystems and habitat types. These ecosystems support an equally diverse set of fish and wildlife resources, including a number of federally listed endangered species. The U.S. portion of the LCC alone contains roughly 8,000 miles of coastline, including major estuaries such as Chesapeake Bay. The combination of rising sea levels and a growing human population that represents about 15% of the U.S. population will continue to impose substantial stress on coastal species and ecosystem services. As Hurricane Sandy tragically demonstrated, both people and ecosystems face substantial risks from periodic large storms, and unless adaptation responses are undertaken risks can be anticipated to increase as relative sea levels continue to rise.

1. **Foundational coastal datasets**

Effective planning and conservation at regional scales requires the availability of consistent, comprehensive datasets that characterize human and natural landscapes. Such comprehensive datasets do not yet exist for the entire North Atlantic. In the coastal area, natural habitats include both intertidal habitats (marshes, beaches, flats, rocky coastline) and subtidal features (such as submerged aquatic beds). Infrastructure that is important to delineate includes human-built structures that interact with coastal habitats such as seawalls, groins, jetties, and other hardened shorelines as well as tidal restrictions. High resolution elevation data are also important for characterizing the coastal environment.

1. **Sea-level rise**

Sea-level rise may result in the loss of coastal ecosystems due to erosion and inundation. However, changes vary across space and time and are difficult to predict because landforms such as beaches, barriers, and marshes can respond to sea level rise in complicated, dynamic ways. For example, salt marshes may be able to migrate inland in response to sea-level rise – but only if they are in proximity to upland natural landscapes into which they can move. Understanding the impacts of, and potential adaptation measures to, sea-level rise is important if coastal fish, wildlife, and other resources are to be sustained.

1. **Estuarine and marine invasive species**

Climate changes and human activities may exacerbate the spread and establishment of non-indigenous, invasive species in the estuarine and marine environments. To prevent potential large ecological and economic impacts from such species, a substantial need exists to inventory invasive species, characterize their risk, and compile response plans.

Terrestrial and Wetland Resources and Ecosystems

About two-thirds of the North Atlantic LCC’s 125 million acres is forested, most of it privately owned. Forests support more wildlife species than any other terrestrial habitat but they have been substantially fragmented by residential and commercial development and other human activities. Additionally, major forest pests and diseases such as chestnut blight, emerald ash borer, hemlock wooly adelgid, and beech bark disease have changed, and continue to change, the composition and structure of the region’s forests. Climate change is also anticipated to cause loss and shifts of forest plants and wildlife, with high elevation forests being especially vulnerable to impacts. Freshwater wetlands comprise a relatively small amount of the landscape but they support a disproportionate number of species, some of which are endangered, and they perform important ecological services. Wetland losses and degradation have been severe and climate change is anticipated to be another major stressor to wetland ecosystems.

1. **Characterize regional forest structure and condition**

Although the general distribution of different forest types is reasonably well-known, it is much more difficult to characterize the structure and condition of these forest types across large landscapes. Because the occurrence of wildlife species is closely linked to forest structure, such information is critical for assessing the capacity of landscapes to support species and in designing management strategies. For example, many high-priority wildlife species require early successional forests generated by disturbances. These habitats are temporary and patchy, making them difficult to assess and predict. Improved methods for characterizing current and future forest structure and condition would be valuable in designing landscapes to support wildlife species over the long-term.

1. **Assess shifts in distribution of native and invasive plants**

Plant species have a major influence on where wildlife species occur on the landscape, and therefore as their ranges shift in response to climate change substantial effects on wildlife are anticipated. However, particularly in the case of long-lived tree species, substantial lag times between climate change and plant response can be anticipated. The rate and nature of shifts in distribution of individual plant species, and associated changes to natural communities, are highly uncertain. Nonnative plant species are also expanding and shifting ranges due to human activities and will respond to climate change. Improved understanding of future distribution and abundance of native and invasive plants would substantially contribute to wildlife conservation and management efforts.

1. **Vernal pool wetlands: occurrence and best management practices**

Forest vernal pools constitute critical habitat for many amphibian species as well as other wildlife. However, they are not reliably mapped at regional scales, have typically received little protection, and are susceptible to degradation and destruction. Better characterizing the location of abundance of vernal pools, their use by amphibians, and how to best manage them would aid in regional wildlife conservation.

Cross-cutting Issues

1. **Regional conservation targets**

Shared agreement among the LCC partnership about conservation goals and targets for LCC work would enhance the collective effectiveness of the partnership and establish benchmarks against which success can be measured. In fact, the national LCC network has identified the establishment of conservation goals and objectives as being a basic function of individual LCCs on which they will be evaluated.

1. **Climate projections**

An ongoing need for understanding the future capacity of landscapes to support fish and wildlife is characterization of how climate may change in the future, including associated uncertainties and range of possible changes. In addition to changes in long-term average conditions (e.g., average temperature), understanding changes in extreme events (e.g., storms, high rainfall events, droughts) is important because such events can have drastic effects on fish and wildlife and other natural resources. Guidance on the advantages and disadvantages of various predictions and models for different applications is also important to ensure appropriate use of climate projections.

1. **Economic and social science considerations**

To date, LCC science projects have focused primarily on the needs of fish, wildlife, and other ecological resources. LCC projects are beginning to move into the realm of decision support tools, however, which must involve additional considerations. Decisions about how to manage and protect ecological resources are inherently multi-dimensional choices involving cost, feasibility, and trade-offs among natural and other resources. To give a simple example, it will be much more difficult to protect a land unit that is highly valued by society for other uses than a less desirable unit, which should be considered in conservation priority-setting. A better understanding of the economic and human dimensions “landscape” is needed as a foundation for management of ecological resources.

1. **Climate change interactions with environmental contaminants**

Contaminants (broadly defined to include chemicals, excessive nutrients, and algal toxins) continue to pose risks to terrestrial, aquatic, and marine ecosystems and have the potential to be exacerbated by climate change. A better understanding of the interactions between contaminants and climate change would assist managers in reducing risks and sustaining fish and wildlife populations.