Northeast Climate Science Center FY2012 Stakeholder-Identified Research Projects

[*http://necsc.umass.edu/projects*](http://necsc.umass.edu/projects)

1. **Mapping the terrestrial habitats of Atlantic Canada**

*Mark G. Anderson, Charles Ferree (The Nature Conservancy, TNC); Kevin McGarigal (UMass); R. A. Lautenschlager (Canada Conservation Data Centre); & Margot Morrison (Nature Conservancy Canada, NCC)*

Many federal, state, and non-government organization (NGO) partners desire a standardized, uniform habitat classification map for the region encompassing the footprint of the Northeast Climate Science Center (NECSC), including parts of the North Atlantic, Upper Midwest, Great Lakes, and Eastern Tallgrass Prairie landscapes in the U.S. and adjacent areas of Canada. This map will play an important role in regional assessments, including identification and quantification of habitats thought to be more susceptible to climate change (e.g., peatlands, mesic low-elevation habitats, alpine and subalpine habitats). The Ecological Systems Classification, developed by NatureServe and partners, and the U.S. National Vegetation Classification (USNVC) have served as a basis for mapping targets and organizing the map legends for three maps that cover all or large parts of the NECSC region; the USGS Southeast GAP Land Cover project, NatureServe the Nature Conservancy’s Terrestrial Habitats of the Northeast and Mid-Atlantic Region, and the National Map provided by NatureServe, which itself is a combination of the US Forest Service’s LANDFIRE national Existing Vegetation Type (EVT) map, the Southeast GAP map, and additional improvements that have been added and are still occurring. Project investigators will work with key national, regional, and local partners to (1) review existing map products in terms of classification and map legend, input data, and methods used, (2) compare existing maps in a quantitative (tabular) and spatially specific (GIS database) fashion in order to highlight areas of agreement and disagreement among maps, (3) summarize current product pros and cons and future needs based on a regional partner meeting designed to review products from the first two steps, (4) as possible, based on outcomes from previous steps, provide a comprehensive map legend linked to the USNVC, and a merged and improved map with a focus on the Appalachian LCC, (5) provide recommendations of alternatives (including cost) for future regional map improvements, and (6) identify habitat types (ecological systems) that may be sensitive to climate change in the region based on application of a revised version of habitat climate change vulnerability index (HCCVI).This revision will draw from components of the HCCVI that allow for a rapid assessment and systematic documentation of selected habitats for vulnerability to climate change.

Primary Stakeholders: U.S. Fish and Wildlife Service (USFWS), Canada Fish and Wildlife, State Fish and Wildlife Agency biologists, State Natural Heritage Programs, Provincial Agency biologists, Canada Data Centre, TNC, NCC

1. **Critically Evaluating Existing Methods and Supporting a Standardization of Terrestrial and Wetland Habitat Classification and Mapping that Includes Characterization of Climate Sensitive Systems**

*David Diamond (Missouri Resource Assessment Partnership, University of Missouri); Don Faber-Langendoen, Lee Elliott, Judy Teague, Lesley Sneddon, Shannon Menard, & Milo Pyne (NatureServe)*

This project coordinates with partners to provide a systematic comparison of existing habitat classification and mapping products within the footprint of the Northeast Climate Science Center (NECSC), a merged and improved map product as far as possible, an evaluation of habitats vulnerable to climate change within the region, and recommendations for needed improvement in habitat mapping products for the future. Tasks will be organized within the four-phase outline recommended in the addendum to the proposal solicitation. Partners will be asked to evaluate the resulting systematic comparisons of current maps and proposed improvements to ensure that user needs are addressed.

Primary Stakeholders: U.S. Forest Service (USFS), TNC, Canadian Forest Service, State Heritage Program Staff, Canadian Provinces

1. **Environmental Effects of Agricultural Practices (EEAP), Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperative (LCC) and Upper Midwest and Great Lakes LCC – Literature search**

*Kasey Hutchinson, Carl Carlson & Charlie Perry (U.S. Geological Survey, USGS)*

The purpose of this project was to conduct an extensive search for both published and ongoing research that, in general, deals with climate change and agriculture in a water quality context for the Eastern Tallgrass Prairie and Big Rivers Landscape Conservation Cooperative (LCC) and Upper Midwest and Great Lakes LCC. A bulleted topic list was provided to help narrow the search, though selection of publications/projects has been more on the liberal side so as not to omit any potentially-relevant ones. The search was two-fold; one portion of the search dealt with an on-line literature search for published peer-reviewed articles for the time period of 2000 (sometimes slightly earlier depending on the relative degree of the publication’s relevance to the topic) to present. The other portion of the search dealt with contacting USGS Water Science Centers and state institutions requesting information on current research projects dealing with this topic that have not yet been published or are currently in publication, and response to these requests has been varied. In addition to time period and relevancy to bulleted topics, another criteria is geographic location; only projects and publications taking place within one of the LCC’s were acquired. The two LCC’s cover partial states in cases but searches were conducted for the state as a whole if any portion fell within one of the two regions. In addition, relevant publications were obtained for southern Ontario. An outline for search methodology, including sources and keywords, was to keep the search process consistent and well-documented. In addition, manual filtering of results was required to ensure that they were both contextually and geographically relevant. While the effort is not likely entirely exhaustive, the methodology entailed a progression of searches using multiple search engines and resources that upon completion did not return any results that had not already been acquired. The software tool EndNote was selected for compiling the database as this assisted in streamlining the process of publication retrieval during the literature search. It also standardized the way in which publications were recorded, and provided a means to organize, reduce redundancy, and search the ongoing database. The states falling within the two LCC’s were divided among Kasey, Carl, and Charlie, with the resulting products aggregated to produce one final EndNote library. The library has been categorized by geographic location but can be categorized using various criteria and keyword searches within EndNote. The data can be exported and converted to any number of formats. Through cooperation with the Center for Integrated Data Analytics (CIDA), this data can be incorporated into the EEAP Agricultural Research Map, an online tool that can be used to search the data interactively.

Primary Stakeholders: Federal, state, and local agencies

1. **Characterization of Spatial and Temporal Variability in Fishes in Response to Climate Change**

*Brian Irwin (University of Georgia); Tyler Wagner (The Pennsylvania State University); & James Bence (Michigan State University)*

Predicting population responses to climate change requires an understanding of how population dynamics vary over space and time. For instance, a measured indicator may vary among repeated samples from a single site, from site to site within a lake, from lake to lake, and over time. Although variability has historically been viewed as an impediment to understanding population responses to ecological changes, the structure of variation can also be an important part of the response. In this project, we will build upon recently completed analyses of fish population data in the Great Lakes basin to help predict how spatial and temporal variation in fish populations may respond to climate change and other important drivers. We will evaluate whether a shifting variance structure can be indicative of population-level responses to climate change. We expect that the structure of variation (i.e., variance components themselves), not just the total variance, will be responsive to severe large-scale perturbation, and that this change in variance structure will have implications for how we conduct ecological monitoring. This research will help elucidate the extent to which quantifiable responses in spatial and temporal variability occur in fish population data. The data available for such analyses of fish and other populations are usually non-negative integer counts of the number of organisms, often dominated by many low values with few observations of relatively high abundance. These characteristics are not well approximated by the Gaussian distribution. Thus, we will explore additional distributional assumptions (e.g., negative binomial, Poisson) within a mixed-model framework to model count data and quantitatively estimate spatial and temporal variation.

Primary Stakeholders: WI Department of Natural Resources (DNR), MI DNR, Ontario Ministry of Natural Resources, New York Department of Environmental Conservation (DEC), and other state and federal agencies

1. **Developing Fish Trophic Interaction Indicators of Climate Change for the Great Lakes**

*Richard Kraus, Patrick M. Kocovsky, Brian Weidel, Mark Rogers (USGS); Carey Knight & Ann Marie Gorman (OH Division of Wildlife)*

Over the past century, large variations in Great Lake’s fishery resources have occurred with many resulting in undesirable consequences for the resources stakeholders. These changes are often associated with dramatic shifts in food web structure that have consequences to the sustainability of fishery resources and the regional economies that depend on the resources. Long-term increases in temperature, freshwater inputs, and eutrophication are predicted to result in a northward expansion of cool and warm water fish populations and a reduction in habitat for cold water species, and these changes will have profound effects on the food web structure of aquatic ecosystems. Lake Erie represents a natural laboratory where this situation occurs on a seasonal basis through the displacement of fish due to temperature changes, stratification and hypoxia. Previous research on Lake Erie has demonstrated that changes in the distribution of organisms due to vertical stratification of temperature and oxygen can have profound effects on predator-prey interactions. Here, we build on this information and use a comparative seasonal-spatial sampling approach to develop indicators of food web change in Great Lakes fisheries as they are forced by environmental conditions. We will use standard and biochemical techniques to examine seasonal food web structure and analytical metrics than can serve as synoptic measures of these climate forces on food web structure that are relevant to fishery resource monitoring and management.

Primary Stakeholders: Upper Great Lakes LCC, OH DNR, NY DEC, MI DNR, PA Fish and Boat Commission, Ontario Ministry of Natural Resources

1. **Bringing people, data, and models together – addressing impacts of climate change on stream temperature**

*Austin Polebitski, Yi-Chen Yang, Rick Palmer, Casey Brown (UMass); Benjamin Letcher (USGS); Keith Nislow (USFS)*

Few previous studies have focused on how climate change may impact headwater systems, despite the importance of these areas for aquatic refugia. The lack of these studies has resulted in the majority of climate impact assessments focusing on conservation of ecological systems at broad levels, and has not focused on turning results into useful and actionable information for managers on the ground. A critical and timely research question is: “What data and modeling frameworks are needed to provide scientists reliable, climate-informed, water temperature estimates for freshwater ecosystems that can assist watershed management decision making?” This research will answer this through two primary activities: 1) gathering and compiling existing stream temperature data within the DOI-Northeast region and subsequent deployment of data loggers to areas where additional data are needed, and 2) an intercomparison of state-of-the-art statistical and deterministic stream temperature models to evaluate their ability to replicate point stream temperature measurements and model scalability to non-gaged sites with the Northeast region. The expected results for this project are: 1) a web-accessible database containing stream temperature data from across the Northeast domain, 2) identification of critical areas in need of long term monitoring efforts, and 3) deployment of temperature loggers to enhance existing long term monitoring network and 4) a comprehensive model intercomparison, focusing on model accuracy, flexibility, and parsimony. The team will compare the ability of weekly/monthly stream temperature models to estimate stream temperatures across the domain, and examine the ability of hourly/daily models to predict in a select number of case study basins. A comparison between monthly and daily models will provide an assessment as to whether temporal resolution impacts stream temperature estimates.

Primary Stakeholders: state departments of environmental protection (e.g., Connecticut DEP) state fish and wildlife service (e.g., MA FWS), TNC, FWS, Trout Unlimited

1. **A stream temperature inventory mapper and data portal for evaluating climate change effects on New England, Mid Atlantic and Great Lakes states streams**

*Jana Stewart, Dave Armstrong, James E. McKenna, Nick Estes, Nate Booth, Marcus C. Waldron (USGS); Dana Infante, Yin-Phan Tsang (MSU); & Kevin Wehrly (MI Institute of Fisheries Research)*

This project seeks to move towards development of a coordinated, multi-agency regional stream temperature framework and database for New England (ME, VT, NH, CT, RI, MA) and the Great Lakes States (MN, WI, IL, MI, IN, OH, PA, NY) by first compiling metadata about existing stream temperature monitoring locations and networks; developing a web-based decision support mapper to display, integrate, and share that information; building a community of contacts with interest in this effort; and developing data portal capabilities that integrate stream temperature data from several data sources.

Primary Stakeholders: Numerous, including USFWS, USFS, state and regional water science centers (e.g., MD-DE-DC WSC), state departments of environmental protection and natural resources (e.g., WI DNR), TNC, Chicago Wilderness Congress, etc.

1. **A research and decision support framework to evaluate sea-level rise impacts in the northeastern U.S.**

*E. Robert Thieler, Nathaniel Plant, Dean Gesch (USGS); & Radley Horton (Columbia University)*

We propose to conduct a reconnaissance study to distinguish coastal areas of the northeastern U.S. that will experience an inundation-dominated response to sea-level rise from those that will respond dynamically due to physical and bio-physical sedimentation and erosion processes. We will use this information to develop a scientific research and decision support program that addresses the cross-cutting and unique problems in these areas.

Primary Stakeholders: North Atlantic LCC, FEMA, Army Corps of Engineers, NOAA

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| **NE CSC FY13 Priorities** | **Title of proposal** | **Lead PI** | **Co-PI's, and other collaborators** | **Budget Request FY13** | **Budget Request FY14** | **Budget Request FY15** | **Total Budget Request** |
| Stream & Rivers | A regional modeling approach to identify aquatic ecosystems vulnerable to changes in water temperature and nutrient loading under current and future climate conditions | Robertson, USGS WI WSC | Vavrus/UW-Madison; Dievel/WDNR | $ - | $ 92,607 | $106,781 | $ 199,388 |
| Stream & Rivers | Investigating temporal variability and effects of climate change on flow, temperature, and macroinvertebrates in small, minimally-disturbed streams | Roy,  USGS MA CRU | Armstrong/USGS MA WSC; Brierwagon/USEPA; Parker/MA DER; DeStefano/USGS MA CRU; Bellucci/CT DEP; Duffy/NY DEC; Fiske/VT DEC; Neils/NH DES; Nuzzo/MA DEP; Tsomides/ME DEP; Wixsom/USFS | $ 95,254 | $ 7,858 |  | $ 103,112 |
| Stream & Rivers | NorEaST – Stream Temperature Web Portal Demonstration and Application | Stewart,  USGS WI WSC | Polebitski/UMass; Armstrong/USGS MA WSC; Infante/Mich State; Palmer/UMass; Mckenna/USGS GLSC; Boothe/USGS WI WSC; Latzke/USGS WI WSC; Tsang/Mich State; Demaria/UMass | $ 77,739 | $ 60,207 | $ - | $ 137,946 |
| Stream & Rivers | Evaluating the Response of Genetic Indicators of Resilience: Forecasts of Climate Change Effects on Headwater Habitat Patches | Whiteley,  UMass | Letcher/USGS CAFRC; Nislow/USFS; Hudy/USGS EMA; Coombs/MA DEC; Perry/Eastern Brook Trout Joint Venture; Colton/USFS | $ 63,168 | $105,984 | $ - | $ 169,152 |
| Stream & Rivers | A decision support mapper for conserving stream fish habitats of the NE CSC region | Paukert,  USGS MO CRU | Infante/Mich State; Stewart/USGS WI WSC; Whittier/U Missouri; Wagner/USGS PA CRU | $ 158,726 | $ 41,155 | $ - | $ 199,881 |
| Great Lakes | Climate Change Impacts on Lake Michigan Fishes | Bennington,  UW-Madison | Ketichell/UW-Madison; Kitchell/UW-Madison; Seilheimer/WI Sea Grant; Read/USGS WI WSC; Donofrio/WI DNR | $ - | $ 56,944 | $ 45,548 | $ 102,492 |
| Great Lakes | A deliberative-analytic process for near-term HABs forecasts in Lake Erie | Evans,  USGS GLSC | Bidwell/GLISA; Scavia/U Mich; Fahnenstiel/U Mich | $ 196,267 | $ - | $ - | $ 196,267 |
| Wetlands | Science to Inform Management of Floodplain Conservation Lands under Non-Stationary Conditions | Jacobson,  USGS CERC | Paukerat/USGS MO CRU; Lubinsk/USGS UMESC, Galat/Nature Conservancy; Webb/USGS MO CRU; Goyne/U Missouri | $ 187,163 | $ - | $ - | $ 187,163 |
| Wetlands | Climate-driven Hydrologic Change and the Future of Northeast U.S. Coastal Plan Ponds—Freshwater Biodiversity Hotspots | Neil,  MBL | Walter/USGS MA WSC; Brown/UMass; Simmons/MA Nat Heritage; Cambareri/Cape Cod Comm; Bowden/MA Nature Conservancy | $ 183,383 | $ - | $ - | $ 183,383 |
| Prairies | Fitting the climate lens to grassland bird conservation: Assessing climate change vulnerability using demographically-informed species distribution models | Zuckerberg,  UW-Madison | Ribbick/USGS WI CRU; Griffin/UMass; Saken/USGS Fort; Hull/WI DNR; King/USFS; Koch/USFWS; Knutson; USFWS; Lorenz/UW-Madison; Paulios/WI DNR; Radeloff/UW-Madison; Renfrew/VT Center of Ecostudies; Rugg/USFS; Sample/WI DNR; Trosen/USFWS | $ 22,257 | $ 89,907 | $ 64,195 | $ 176,359 |
| Forests & Headwaters | Modeling Effects of Climate Change on Spruce-Fir Forest Ecosystems and Associated Priority Bird Populations | D'Amato, U Minn | King/USFS; Palik/USFS; Brissettw/USFS; Weiskitell/U Maine; Faspohler/Mich Tech; Destefano/USGS MA CRU; Rimmer/VT Center for Ecostudies | $ 80,414 | $ 68,414 | $ - | $ 148,828 |
| Forests & Headwaters | Changes in forested landscapes of the northeastern U.S. under alternate climate scenarios | Thompson, U Missouri | He/U Missouri; Gustafson/USFS; Iverson/USFS; Swanston/USFS; Maladenoff/UW-Madison; Weiskeittel/U Maine | $ 95,660 | $ 70,248 | $ - | $ 165,908 |
| Cultural Resources | Impacts of Climate Change on Houlton Band of Maliseet Indians Medicinal Flora in the Meduxnekeag River Watershed, Maine | Dudley, USGS ME WSC | Culbertson/USGS; Venno/HBMI Tribe; Edberg/HBMI Tribe | $ 48,508 | $ 94,472 | $ 48,509 | $ 191,489 |
| Decision Frameworks | Frameworks for Decisions for the Northeast Climate Science Center | Brown, UMass | Yang/UMass; Thieler/USGS CAFRC; Letcher/USGS CAFRC; Werric/USACE | $ 99,282 | $ 99,574 | $ - | $ 198,856 |
| Decision Frameworks | Making decisions in complex landscapes: headwater stream management across multiple agencies | Grant, USGS PWRC | Nislow, USFS; Washington, USFWS; Woofrd, NPS; Runge/USGS PWRC; Letcher, USGS CAFRC; Bennett/USFWS; Foley, NPS | $ 99,728 | $ 99,728 | $ - | $ 199,456 |
| Total | | | | $1,407,549 | $887,098 | $265,033 | $2,559,680 |

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| **NE CSC Science Agenda**  **(draft: 11.20.2012) :**  **Climate Science Themes** | **NE CSC Funded Projects and Annual Science Priority Needs** | | | |
| **Science**  **Priority** | **FY2012**  **Funded**  **Projects** | **FY2013**  **(Invited)**  **Proposals** | **FY2014**  **Proposals**  **Sought** |
| Theme 1. Climate Assessments and Projections | [NE CSC does not seek proposals at this time; cross-CSC & interagency initiatives are under development] | | | |
| Theme 2. Climate Impacts on Freshwater Resources and Ecosystems | Stream and Rivers | 2 | (6) | Build on existing projects and identify high priority needs |
| Great Lakes | 1 | (2) |
| Wetlands | 0 | (2) |
| Theme 3. Coastal and Near Shore Response to Climate Variability and Change | Sea-Level Rise | 1 | [NE CSC does not seek proposals at this time; cross-CSC & interagency initiatives are under development] | |
| Theme 4. Climate Impacts on Land-use and Land-cover Change | Land Use/Cover | 2 | (1) | Build on existing projects and identify high priority needs |
| Theme 5. Ecosystem Vulnerability and Species Response to Climate Variability and Change | Prairies | 0 | (1) | Build on existing projects and identify high priority needs |
| Forests and Headwaters | 1 | (2) |
| Theme 6. Impacts of Climate Variability and Change on Cultural Resources | Cultural  Resources | 1 | (1) | Focus on TEK and other high priority needs |
| Theme 7. Decision Frameworks for Evaluating Risk and Managing Natural Resources Under Climate Change | Decision Frameworks | 1 | (2) | All supported work will include this component |

* **NE CSC Funding Opportunity for FY-2014 to be released in early May**
* **Priorities: smaller, more targeted call with focus on underrepresented priorities**
  + **Great Lakes and Wetlands**
  + **Prairies & Forested Ecosystems**
  + **Cultural Resources & TEK**
* **Funding: at most, only 400-500K available for FY14 projects**