



United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 Westgate Center Drive
Hadley, Massachusetts 01035



In Reply Refer To:
FWS/SA

Ms. Carol Sprague, Director
University of Massachusetts Amherst
Office of Grant and Contract Administration
Research Administration – 70 Butterfield Terrace
Amherst, MA 01003
DUNS: 153926712

Subject: North Atlantic Cooperative Ecosystem Studies Unit, F14AC00282. Notice of Cooperative Agreement Award _____

Dear Ms. Sprague:

Your organization's application for Federal financial assistance titled *Forecasting changes in aquatic systems and resilience of aquatic populations in the North Atlantic LCC: decision-support tools for conservation* submitted to the U.S. Fish and Wildlife Service (Service)'s CFDA Program 15.669 is approved. This award is made based on Service approval of your organization's proposal signed on August 28, 2014, hereby incorporated by reference into this award. Funds under this award are to be used to address critical needs of the North Atlantic Landscape Conservation Cooperative (LCC) and resource managers as they consider assessment and remediation of watersheds to sustain aquatic resources in the face of threats such as development and climate change. The work will consist of linked modeling components including, stream flow and temperature models and fish occupancy models. Decision support tools stemming from the modeling efforts will allow managers to assess whether streams are negatively impacted by human activities and, if so, how alternate management activities will contribute to remediation.

Service staff will: (A) Assist in bringing together partners of the North Atlantic LCC and Eastern Brook Trout Joint Venture, including federal, state, and NGO organizations, to coordinate stream and brook trout database and modeling efforts. (B) Collaborate on the development of useful decision support tools. (C) Facilitate application of the models and decision support tools by natural resource and conservation managers through the North Atlantic LCC partnership.

University of Massachusetts Amherst will: (A). Expand existing tools to additional portions of the LCC region. Specifically, this will involve extending the stream temperature and stream flow models to the full geographic area of the North Atlantic LCC, plus the headwaters of the Atlantic-draining watersheds

and, in coordination with the Eastern Brook Trout Joint Venture and other researchers studying brook trout, expand the brook trout occupancy models to the same region as the stream temperature and flow models. (B) Integrate models with management and policy, which will include a pilot effort with the Connecticut DEEP and Massachusetts DEP, designed to be integrated into decision-making processes across the region such as for revisions to state water quality criteria for stream temperature.

The project period of this award begins on the signature date on this letter through October 31, 2015.

This award is funded as follows:

	<u>Service</u>	<u>Recipient</u>
This obligation:	\$110,000	\$0.00
Award Total:	\$110,000	\$0.00

Indirect Costs:

Indirect costs under this Award are approved at the agreed upon rate of 17.5% as specified in the North Atlantic Coast Cooperative Ecosystems Studies Unit Cooperative Agreement between the U.S. Fish and Wildlife Service and University of Massachusetts Amherst (among others) F14AC00282.

System for Award Management (SAM) Registration:

Under the terms and conditions of this award, your organization must maintain an active SAM registration at <https://www.sam.gov/portal/public/SAM/> until the final financial report is submitted or final payment is received, whichever is later. If your organization's SAM registration expires during the required period, the Service will suspend payment under this and all other Service awards to your organization until you update your organization's SAM registration.

Terms of Acceptance:

Acceptance of a financial assistance award (i.e., grant or cooperative agreement) from the Service carries with it the responsibility to be aware of and comply with the terms and conditions applicable to the award. Acceptance is defined as the start of work, drawing down funds, or accepting the award via electronic means. Awards are based on the application submitted to and approved by the Service. Awards are subject to the terms and conditions incorporated into the notice of award either by direct citation or by reference to the following: Federal regulations; program legislation or regulation; and special award terms and conditions. The Federal regulations applicable to Service awards are listed by recipient type in the **Service Financial Assistance Award Terms and Conditions** posted on the Internet at <http://www.fws.gov/grants/>. If you do not have access to the Internet and require a full text copy of the award terms and conditions, contact the Service Project Officer.

Special Conditions and Provisions:

The Department of the Interior (and North Atlantic LCC) is committed to distributing information needed by managers and scientists to make informed decisions and of interest to a wide variety of partners. Raw data, derived data products, and other supporting information created or gathered in the course of Department of the Interior sponsored projects will be made available to the Department at the conclusion of the project (prior to final payment) and during the project as requested, and data are

expected to be made publicly available except where protected by state or federal laws. Principal investigators must preserve and transfer data according to commonly accepted standards, including standards for metadata. All data and derived data products shall be submitted to the Department no later than 90 days after the conclusion of the project. Conclusion of the project is defined as the date the project contract or agreement ends.

Payments:

For domestic recipient enrolled in ASAP:

Your organization has completed enrollment in U.S. Treasury's Automated Standard Application for Payment (ASAP) system. When requesting payment in ASAP, your Payment Requestor will be required to enter an Account ID. The number assigned to this award is the partial Account ID in ASAP. When entering the Account ID in ASAP, the Payment Requestor should enter the award number identified in the subject line on letter followed by a percent sign (%). Refer to the ASAP.gov Help menu for detailed instructions on requesting payments in ASAP.

Reporting Requirements:

Financial and Performance Reporting Requirements:

Semi-annual interim financial and performance reports and final financial and performance reports are required under this award. The report periods and due dates under this award are:

Report:	Report Period:	Report Due Date:
Interim financial & performance	Date Agreement Signed – March 31, 2015	April 30, 2015
Interim financial & performance	April 1, 2015 – October 31, 2015	November 30, 2015

Recipients must use the Standard Form (SF) 425, *Federal Financial Report* form for all financial reporting. This form is available at http://www.whitehouse.gov/omb/grants_forms/.

Performance reports must contain: 1) a comparison of actual accomplishments with the goals and objectives of the award as detailed in the approved scope of work; 2) a description of reasons why established goals were not met, if appropriate; and 3) any other pertinent information relevant to the project results. Please include the Service award number provided in the subject line of this letter on all reports.

Financial and performance reporting due dates may be extended by the Service upon receipt of a written request addressed to the Service Project Officer identifying the type of report to be extended, the requested revised due date, and a justification for the extension. The Service Project Officer may approve an additional extension if justified by a catastrophe that significantly impairs the recipient's operations. Requests for reporting due date extensions must be received by the Service Project Officer no later than one day before the original reporting due date.

Significant Developments Reports:

Events may occur between the scheduled performance reporting dates that have significant impact upon the supported activity. In such cases, notify the Service Project Officer in writing as soon as the following types of conditions become known:

- Problems, delays, or adverse conditions that will materially impair the ability to meet the objective of the Federal award. This disclosure must include a statement of any corrective action(s) taken or contemplated, and any assistance needed to resolve the situation.
- Favorable developments that enable meeting time schedules and objectives sooner or at less cost than anticipated or producing more or different beneficial results than originally planned.

Other Deliverables:

A. Updated map viewer that reflect outputs of stream flow and temperature models run for the entire study region based on environmental data collected for that region. B. Revised decision support tools (prepared in an earlier phase of the project) based on recommendations from users and managers. C. An evaluation of the potential for development of a data-database-model-viewer system to explicitly link all components of the modeling effort. D. User workshops for the stream flow and temperature and aquatic occupancy modeling work.

Project Plan and Budget Amendments:

Recipients are permitted to re-budget within the approved direct cost budget to meet unanticipated requirements and may make limited program changes to the approved project. However, certain types of post-award changes in budgets and projects shall require the *prior written approval* of the Service Project Officer. State, local, or Indian tribal governments must refer to 43 CFR 12.70 for additional information on the types of changes that require prior written approval. Commercial organizations, institutions of higher education, hospitals and other non-profit organizations must refer to 43 CFR 12.925 for additional information on the types of changes that require prior written approval.

Project Period Extensions:

If additional time is needed to complete the approved project, you must send written notice to the Service Project Officer. This notice must be received by the Service Project Officer at least 45 calendar days before the authorized project period end date, and must include supporting reasons and revised end date. The Project Officer will formally advise you if your extension request is approved/not approved. Extensions for time cannot be authorized for the purpose of spending an unused balance of funds that remains after the approved project activities have been completed.

Project Contacts:

The Service Project Officer for this award is:	The Recipient Project Officer for this award is:
Andrew Milliken, North Atlantic LCC Coordinator, U.S. Fish and Wildlife Service, 300 Westgate Center Drive, Hadley, MA 01035, 413- 253-8269, andrew_milliken@fws.gov	Benjamin Letcher, Ph.D., Adjunct Professor, Department of Environmental Conservation, University of Massachusetts Amherst Amherst, MA 01003, 413-863-3803 (phone), 413- 863-9810 (fax), bletcher@eco.umass.edu

Please contact Andrew Milliken with any questions. Please include the Service award number provided in the subject line of this letter in all written communications.

Sincerely,

Kenneth Elowe
Assistant Regional Director – Science Applications

B. Project Summary

Title: Forecasting changes in aquatic systems and resilience of aquatic populations in the North Atlantic LCC: decision-support tools for conservation.

Project Overview: Work from this project will address critical needs of the North Atlantic LCC and resource managers as they consider assessment and remediation of watersheds to sustain aquatic resources in the face of threats such as development and climate change. The work consists of linked modeling components including, stream flow and temperature models and fish occupancy models. Decision support tools stemming from the modeling efforts will allow managers to assess whether streams are negatively impacted by human activities and, if so, how alternate management activities will contribute to remediation. The geographic location of the project is the US North Atlantic LCC region and tributaries feeding into watersheds within the US North Atlantic LCC region.

Project Tasks:

Objective #1, expanding existing and develop new decision support tools for conservation decision making, includes several tasks. Task 1 is to collect environmental data for the entire region; Task 2 is to run flow and temperature models for the rest of the region; Task 3 is updating the map viewer. Investigators will meet with the Eastern Brook Trout Joint Venture and other researchers to establish the common database and modeling approach (Task 4-6). Once established, the model will be run (Task 7) and the map viewer will be updated (Task 8). Objective 2, facilitating adoption of these tools by resource managers and policy makers, involves several additional tasks. Investigators will meet with managers (Task 1) and adapt the existing decision support tool (Tasks 2, 3) to accommodate recommendations from managers. During the process of working with the states, the investigators will also evaluate the potential for the development of a data-database-model-viewer system to explicitly link all components of the modeling effort (Task 4). This system would allow 'real-time' updating of model results following new data uploads from the states. The investigators will also run workshops for interested users of the stream flow and temperature and occupancy modeling work (Task 5).

Expected Outcomes: Managers and researchers across throughout the Atlantic-draining watersheds of the Northeast region will have access to consistent information on stream flow and temperature and decision support tools. Natural resource managers will have information easily available and will be able to make informed management decisions about catchments within their jurisdiction, through flexible and transparent models that predict current and future conditions.

C. Project Narrative

1. Statement of Need:

Natural resource managers need to make decisions about all catchments within their jurisdiction, but there is rarely sufficient information about enough of these catchments. Flexible and transparent models that predict current and future conditions for sampled and unsampled catchments can be very useful to help prioritize catchments and to identify potential remediation actions. In this project, investigators will work with managers to fine-tune models for streams to their specific information needs.

The mission of the North Atlantic Landscape Conservation Cooperative (LCC) is to provide a partnership where the conservation community can guide more effective conservation actions in the face of resource threats amplified by a rapidly changing climate. To accomplish this mission, critical needs exist to 1) expand existing and develop new decision support tools for conservation decision making and 2) facilitate adoption of these tools by resource managers and policy makers. Extending previously supported work for forecasting changes in aquatic systems and aquatic populations can play an important role in addressing both of these needs. This project would build on existing work funded by the North Atlantic LCC and others to develop useful models for streams. Previous accomplishments include:

- Daily stream temperature and annual stream flow models for headwater streams for much of the New England and New York region.
- Projections of relative sensitivity of stream temperature to changes in air temperature.
- Brook trout occupancy models, based on current and projected future climate, for New England and New York, at the local catchment scale.
- Prototype decision-support tool to allow users to use the model results in conservation and restoration planning.

This project will expand the spatial scale of these models and will more fully integrate modeling results with management. Some of the results are currently available in the primary scientific literature (for example, Kanno et al. 2012, 2013, Sigourney et al. 2012, Whiteley et al. 2012, Steinschneider et al. 2012).

2. Project Goals and Objectives:

The goal of this project is to improve natural resources management by providing effective, flexible, portable, and transparent modeling results and decision support tools to managers.

The objectives include:

- 1) *Expand existing tools to additional portions of LCC region*
 - a) Extend the stream temperature and stream flow models to the full geographic area of the North Atlantic LCC, plus the headwaters of the Atlantic-draining watersheds (e.g., Chesapeake, Delaware, Hudson).
 - b) In coordination with the Eastern Brook Trout Joint Venture and other researchers studying brook trout, expand the brook trout occupancy models to the same region as the stream temperature and flow models.

2) *Integrate models with management and policy*

Build upon recent meetings with state agencies to apply the North Atlantic LCC-supported models within the state decision-making processes, such as revisions to state water quality criteria for stream temperature. The Connecticut DEEP and Massachusetts DEP have agreed to participate in this pilot, which will be designed for adoption by interested managers across the region. Specific tasks will include: a) further adapting stream and fish models; b) customizing maps and graphics for decision support; c) modifying the existing map viewer for prioritization of watersheds; and d) exploring the potential for real-time updates of model results based on state-provided data.

3. **Project Activities, Methods and Timetable:**

Objective #1 includes several tasks (see timeline below). Task 1 is to collect environmental data for the entire region. As these data come from web server sources (NLCD, NHDPlus, SSURGO and Daymet), this task simply requires running scripts for the new regions. Running the flow and temperature models with the updated data (Task 2) also does not require model development, but just the task of rerunning models for the new regions. Updating the map viewer (Task 3) is also straightforward. Tasks 4-7 involve developing consensus on a regional brook trout occupancy model and the development of a unified trout database. Investigators will meet with the Eastern Brook Trout Joint Venture and other researchers to establish the common database and modeling approach (Task 4-6). Once established, the model will be run (Task 7) and the map viewer will be updated (Task 8).

To integrate modeling results with management and policy development, investigators will meet with managers (Task 1) and adapt the existing decision support tool (Tasks 2, 3) to accommodate recommendations from managers. For this phase of the project, they will work directly with the MA Department of Environmental Protection and the CT Department of Energy and Environmental Protection. Preliminary meetings have established coordination and mutual interest in continuing joint development of models and linking models with natural resources decisions. During the process of working with the states, the investigators will also evaluate the potential for the development of a data-database-model-viewer system to explicitly link all components of the modeling effort (Task 4). This system would allow 'real-time' updating of model results following new data uploads from the states. The investigators will also run workshops for interested users of the stream flow and temperature and occupancy modeling work (Task 5).

Timeline					
Objective	Task	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
Expand existing models	1. Collect environmental data				
	2. Run flow and temp models				
	3. Update map viewer				
	4. Meet with regional fish modelers				
	5. Establish common fish database				
	6. Establish common occupancy model				
	7. Run occupancy model				
	8. Update map viewer				
Integrate models with policy	1. Meet with managers				
	2. Customize maps and other output				
	3. Modify existing map viewer				
	4. Explore real-time updating of modeling system				
	5. Workshops for users				

4. Stakeholder Coordination/Involvement:

Coordination in this project will occur at two levels, 1) with other researchers involved in stream flow and temperature and brook trout occupancy modeling and 2) with managers and policy makers who will use modeling results to improve decision-making. Investigators will continue discussions with other researchers who are willing to discuss model integration, where possible. Funding from the USGS will provide support for a meeting to establish common databases and modeling efforts. The investigators have also met with CT and MA state personnel, and these agency staff will be heavily involved in guiding the model development, model visualization and model application. There is good potential for model results to be incorporated directly into policy for both states. The project described here will serve as a pilot and, if successful, could be expanded to other states or organizations. The North Atlantic LCC partnership of federal and state agencies, tribes, and nongovernmental organizations will be closely involved in the project. The Eastern Brook Trout Joint Venture will also be involved.

5. Project Monitoring and Evaluation:

The U.S. Fish and Wildlife Service and North Atlantic LCC will contribute to monitoring and evaluation through oversight meetings and partnership involvement. Because the investigators will be working directly with the states on this project, there will be considerable oversight for all tasks by these agencies. Model results will be delivered as maps on a web map viewer. The map viewer will be the primary tool for integrating model results into decision making. Quarterly reports will be reviewed by the Project Officer and a final report will be peer-reviewed by independent reviewers chosen by the Fish and Wildlife Service and North Atlantic LCC.

6. Description of Entities Undertaking the Project: The University of Massachusetts, Amherst is a State University within the Commonwealth of Massachusetts. This project will be led by Dr. Ben Letcher, ben@umass.edu, 413 863-3803, an adjunct professor in the Department of Environmental Conservation at the University of Massachusetts and the leader of the Ecology Section at the USGS Conte Anadromous Fish Research Center.

7. Sustainability: This project is part of a larger effort to provide resource managers with useful scientific information. The larger project has been funded by the USGS, the Northeast Climate Science Center, the MA DOT and the USGS National Climate Science Center. Investigators anticipate that they will continue to receive funding to move the larger project forward.

8. Literature Cited:

- Kanno, Y., J. C. Vokoun, K. E. Holsinger, and B. H. Letcher. 2012. Estimating size-specific brook trout abundance in continuously sampled headwater streams using Bayesian mixed models with zero inflation and overdispersion. *Ecology of Freshwater Fish*:1–16.
- Kanno, Y., J. C. Vokoun, and B. Letcher. 2013. Paired stream-air temperature measurements reveal fine-scale thermal heterogeneity within headwater brook trout streams networkse. *River Research and Applications* 10.1002/rr.

- Sigourney, D. B., S. B. Munch, and B. H. Letcher. 2012. Combining a Bayesian nonparametric method with a hierarchical framework to estimate individual and temporal variation in growth. *Ecological Modelling* 247:125–134.
- Steinschneider, S., A. Polebitski, C. Brown, and B. H. Letcher. 2012. Toward a statistical framework to quantify the uncertainties of hydrologic response under climate change. *Water Resources Research* 48:W11525.
- Whiteley, A. R., J. a. Coombs, M. Hudy, Z. Robinson, K. H. Nislow, and B. H. Letcher. 2012. Sampling strategies for estimating brook trout effective population size. *Conservation Genetics*.

9. **Map of Project Area:** see below. The project area includes the U.S. portion of the North Atlantic LCC, plus the full extent of Atlantic-draining watersheds that intersect with the North Atlantic LCC.

