RFA1_Ecological Flows

Through this RFA, the Appalachian LCC is seeking parties interested in accomplishing the following project in support of the stated Top Science Need – Ecological Flows.

Thematic Area Goal: *Quantitatively describe current and future hydrologic and structural habitat conditions and aquatic population trends, and set conservation goals for both, in order to maintain native habitats and endemic aquatic species in their current locations or support these as they migrate with land use and climate changes in the future.*

Specific Science Support Need: *Assemble the necessary scientific information or conduct the necessary studies required to develop a rigorous understanding of the relationships among ecological flows and hydrology (discharge, seasonal, etc.), habitat (temp, geology, physical space, etc.), and aquatic biota/communities in order to assess how alterations to systems will affect their sustainability.*

Project Description for Science Need

Inventory and review of ecological flow models and monitoring networks with applicability to Appalachian watersheds

Problem Statement: Historic hydrologic data including streamflow as measured by river gages is no longer a reliable indicator of future conditions, as municipal/industrial development (impervious surfaces, water consumption for households, hydro-fracturing and other industry uses) and climate change increasingly alter "normal" flows. While these impacts reduce predictive capabilities regarding instream flow rates, resource managers are challenged to justify protective measures recommended to retain minimum flows necessary to sustain endemic aquatic communities.

Flow models offer a methodology to predict instream flow using a variety of parameters, and are the best tool available to assist resource managers in making scientifically defensible recommendations and setting sound water resource policy. Existing instream flow models can be used to explore flow-ecology relationships to enhance long-term management of aquatic resources across the Appalachian region, however, many of these were developed at spatial or temporal scales that do not match existing benthic and fish data, model only high or low flows, or were developed by groups who wish to keep them proprietary. In phase I of this project will conduct an inventory and critical review of flow models and the underlying, or potential, data sources from instream monitoring networks, and provide recommendations of suitable model(s) for instream flow predictions both dependent and independent of ecological/biological data (the availability of which may be lacking or disjunct for the Appalachians at this time. Phase II would apply an appropriate model or models as identified in phase I, that assesses how existing permitted and non-permitted water uses and future climate conditions will alter critical hydrologic and hydraulic forces that maintain aquatic habitats, and forecast stream discharge for use in predictive habitat models and water supply estimates including municipal, energy and other industrial uses.

Project Narrative: It is essential to have an adequate understanding of the hydrology of a region to effectively manage and sustain aquatic resources. Assessing available information on instream flow and flow-ecology relations is a sensible first step in developing an organized regional program. Additionally, the information needed to explore flow-ecology relationships, particularly long-term monitoring networks and

predictive models, is also needed to assess, predict, and plan for climate change. Managers have relied on their understanding of hydrology based primarily on long-term monitoring, and secondarily on the application of modeling results derived from input data from these long-term networks. Most long-term flow data are collected in the region by the USGS streamgaging network made up of the USGS and its partners National Streamflow Information Program (NSIP**,** http://water.usgs.gov/nsip/). One of the roles of the NSIP is to identify existing gaps in the network and their relative importance to aquatic resource management. Integrated monitoring programs associated with streamgages are designed to monitor aquatic assemblages as well as chemical and physical habitat conditions through time ,and are among the most important networks to identify; examples of these networks include those in Maryland (Roth et al. 2001) and the Clinch-Powell River Basins of Virginia (http://vwrrc.vt.edu/cpcri/monitoring_and_information_management_team.asp).

Project Goal: Existing flow models can be used to explore flow-ecology relationships to enhance long-term management of aquatic resources across the Appalachian region, however, many of these were developed at spatial or temporal scales that do not match existing benthic and fish data, model only high or low flows, or were developed by groups who wish to keep them proprietary. Therefore, in Phase I of this project an inventory of flow models and the underlying, or potential, data sources from instream monitoring networks is needed to: 1) Determine what ecological flow models are in use or are applicable to the Appalachian LCC that would result in predictions of both low and high flows; 2) Recommend suitable model(s) for instream flow predictions both dependent and independent of ecological/biological data (the availability of which may be lacking or disjunct for the Appalachians at this time). The next steps to be conducted as a Phase II of this project are to: 3) Apply a predictive model(s) that assesses how existing permitted and non-permitted water uses and future climate conditions will alter critical hydrologic and hydraulic forces that maintain aquatic habitats; and finally, 4) Forecast stream discharge for use in predictive habitat models and water supply estimates including municipal, energy and other industrial uses.

Deliverable(s):
Phase I:
1) A report that assesses the availability of hydraulic/hydrologic and ecological flow models suitable for the Appalachians that predict discharge thresholds and frequency of both high and low flow events and the vulnerabilities these extremes will create for conservation targets, then recommends one or more models for use in the Appalachians.
2) A georeferenced summary assessment of adequacy of available ecological data to inform ecological flow model(s) for Appalachian streams, including a summary assessment of critical information gaps.

Phase II
3) Application of suitable hydraulic/hydrologic model(s), as recommended under Deliverable #1 above, to anticipate how an altered flow regimes will affect critical conditions; where those conditions are defined as discharge, hydraulic stability, minimum and maximum flows, and timing and duration of critical flows.
4) A forecast of discharge rates, hydraulic stability, minimum and maximum flows, as well as timing and duration of these for Appalachian watersheds.

Pre-existing Activity, Accomplishments, Tools, or Funding related to this Project:

South Atlantic Landscape Conservation Cooperative, SARP Aquatic Resource Management Project - Assessment of Hydrologic Model Availability

http://api.ning.com/files/pdNlG3cyALsHlA3C6k1q*9LASvmq68LrZOTJGoyOrp9HDardDy2ykushDB3uiyW00-6QSgyH64NhcQexvREwWXQJ4jX2sCvg/SALCCHydrologicModelAssessment.pdf

Historic streamflow statistics and regional regression equations for predicting discharge have been calculated in recent publications (Austin and Wiegand, 2010; Austin and Wiegand, 2010b; Law et al., 2009) using standard USGS methods, and can be used in gaged or ungaged basins.

Ongoing work by the Instream Flow Council (http://www.instreamflowcouncil.org/) and the Southern Instream Flow Network (http://southeastaquatics.net/programs/southern-instream-flow-network-sifn)

Multi-state Aquatic Resources Information System (MARIS) is an online resource that contains over one million population estimate, total catch, total weight, and water quality records for nearly 600 fish species, and it includes data from 8 of the 15 States within the AppLCC boundary.

Vendors interested in implementing the project as described above will be required to address a list of questions, as well as provide a Statement of Work and additional materials (as attachments). Please be thorough but brief in your responses.