

Round 11 SNPLMA Lake Tahoe Program Science Themes and Sub-themes

LTFAC Preliminary Recommendation 2-23-10

All research should leverage previous and existing efforts to the extent possible, including the synthesis and analysis of existing data to further understand environmental processes, conditions and trends. These analyses should aim to extract possibly unknown, yet critical information from existing data sets. Models should leverage previous and existing efforts to the extent possible, including the use and application of existing data and models or model elements. Proposals should identify which research needs in the Tahoe Science Plan that their proposal helps to address; furthermore, as part of their conclusions, projects should identify appropriate steps to advance scientific understanding, environmental policies, and management activities in the Basin. Stakeholders in the Lake Tahoe Basin should be engaged early and throughout the research. The Pacific Southwest Research Station, as the sponsor of this science program, will work with the recipients of funds and management agencies to help ensure that projects meet these objectives.

**2/23/10 LTFAC
Preliminary
Recommendation
\$34M & \$34M+**

**2/23/10 LTFAC
Preliminary
Recommendation
\$30 Million**

Forest Health

\$850,000

\$700,000

Title	Type of Research	Management/Policy Need	Description
Integrating the effects of forest management into the Lake Tahoe TMDL	Conventional Investigations and/or Synthesis & Review	Parallel efforts to date have collected field data and developed models for (1) effects of forest and fire management on nutrient loads in surface runoff and soil leachate in the Tahoe Basin uplands, and (2) watershed loading of sediments and nutrients to Lake Tahoe based on land use type. One model (NuCycling submodel for LANDIS-II), supported by field observations and experiments, predicts nitrogen and phosphorus leachate concentrations given forest and fuel management scenarios, but does not predict impacts to Lake Tahoe water clarity. The other model (Lake Tahoe Watershed Model - LSPC) provides input to the Lake Tahoe clarity model, but does not explicitly account for alternative forest and fuel management scenarios. Agency managers require a decision support tool for evaluating the effects of alternative forest management scenarios on nutrient and sediment loading at the watershed and basin-wide scales. TMDL Managers need to be able to link model based outputs of forest management actions to the TMDL Management System, including a comprehensive monitoring approach to validate the linkage and resulting estimates.	Proposed research should lead to increased understanding and quantification of how forest management practices (e.g., mechanical treatment, hand treatment, burning, or a combination of these activities) influence nutrient and sediment loading to Lake Tahoe and its tributaries. Research should address the question, "How do alternative forest management practices compare with regard to their short/long-term and cumulative effects on pollutant loading to tributaries and groundwater, and ultimately lake water quality?" Research proposals should address one or more of the following approaches, although proposals that integrate across these approaches are encouraged: (1) analyze, review and synthesize existing field data and incorporate results into the current models used at Lake Tahoe to simulate watershed processes (model parameterization). Where uncertainty exists, develop improved localized field data sets for incorporation into models; (2) develop modeling approaches to integrate and quantify nutrient and sediment outputs from models of vegetation dynamics in response to forest management practices; (3) develop decision support tools for evaluation of alternative upland forest management scenarios with regard to short/long-term and cumulative effects on Lake Tahoe water quality; and (4) develop a comprehensive monitoring approach to validate and calibrate model estimates.
Impact of climate change on ecological communities and the evaluation of adaptation strategies	Conventional Investigations and/or Synthesis & Review	Significant changes in climate, recreational use, and air pollution are expected to affect the Sierra Nevada in coming decades. Management agencies want to understand how ecological communities within the Lake Tahoe basin, including forest communities, alpine communities, subalpine wetlands and other sensitive communities, will respond to these changing conditions over the next few decades. Current science emphasizes that adaptation strategies should be site-specific. Adaptation strategies could include thinning of forests to increase tolerance to drought and resistance to wildfire or insects, planting species or genotypes that may be more resilient to changing climate, genetic conservation of species, preservation of refugial habitats (including wetlands and riparian areas), assisted migration of species to suitable habitat, and development of wildlife corridors to facilitate migration. Such actions could be taken in anticipation of future changes or opportunistically following disturbances such as wildfires.	Proposed research projects should conduct new research and/or synthesize previous research to: (1) establish the potential range of key climate conditions relevant to ecological processes and biological communities in the Tahoe basin; (2) identify which ecological processes and biological communities in the Tahoe Basin are most vulnerable to the effects of climate change; (3) evaluate the effects of Basin-specific adaptation strategies and treatments to conserve particular ecological processes and biological communities; and/or (4) guide the temporal and spatial design of forest treatments to avoid unacceptable ecological impacts while promoting long-term desired conditions (particularly in the Jeffrey pine, mixed-conifer, and lodgepole forest community types).

Watershed, Water Quality, and Habitat Restoration				\$1,050,000	\$800,000
Title	Type of Research	Management/Policy Need	Description		
Understanding the impacts of aquatic invasive species	Conventional Investigations and/or Synthesis & Review	The prevention of new introductions and the control of established invasive species is a high priority for Tahoe basin land management and regulatory agencies. Agencies have a need for ongoing quantitative information to manage established species and minimize their impacts. Information related to prevention is required to assess risks from individual species and to track environmental conditions that may facilitate new invasions. Information related to control of invasive species is needed to assess the effectiveness and potential environmental effects of various control strategies. Long-term status and trend monitoring of priority invasive species in near shore habitats and streams in the Tahoe basin and their environmental effects is needed for strategic planning efforts and assessment of impacts to environmental thresholds.	Synthesis and review and/or conventional research should be conducted in collaboration with agency representatives and other research teams to ensure products will meet agency information and evaluation needs. Proposals are requested to: (1) Synthesize existing data and develop new strategies to prepare a regional and sub-regional monitoring plan for priority aquatic invasive species (AIS). The monitoring plan should assess the long-term status and trends of established AIS, aid the early detection of new invasions, and provide insight into the effectiveness of control and prevention strategies in Lake Tahoe's near shore environment, tributary streams, and other lakes of the region. (2) Determine the effectiveness of various control strategies for priority species, such as treatment of satellite populations vs. source populations, re-colonization rates, and the effects of control measures on near shore water quality and aesthetic indicators (biological, chemical, and physical). (3) Develop a predictive model to assess the risk of introduction of priority invasive species based on life history, habitat requirements, current and predicted environmental conditions of the region, and vectors, such as motorized boats, non-motorized watercraft (e.g., kayaks, canoes, or paddle boards), aquatic accessories (e.g., beach toys or power boat toys), and boating appurtenances (e.g., anchors, lines, or fenders).		
Quantifying the benefits of urban stormwater management	Conventional Investigations and/or Synthesis & Review	Research associated with the Lake Tahoe total maximum daily load (TMDL) indicates that stormwater from urban land uses is the largest contributor and presents the greatest opportunity to reduce fine sediment particle (< 16 µm) and total phosphorous loads to streams and Lake Tahoe. However, pollutant loading and reduction estimates are based upon limited information, particularly with respect to fine sediment particle size class distribution. Improved characterization of urban stormwater is needed for the purposes of load reduction modeling, BMP design and TMDL crediting. A better understanding of the factors and processes related to the generation, mobilization, transport and fate of pollutants is needed. Furthermore, a better understanding of innovative treatment and control/recovery mechanisms to reduce fine sediment particles is needed to inform feasibility and cost-effectiveness evaluations and refine implementation plans and strategies. Roadways are a land use of primary concern, as these have the greatest pollutant yield potential. There is a need to evaluate roadway operations and maintenance practices and optimize them to ensure cost effective fine sediment particle load reductions.	Research proposals should address one or more of the following. (1) Source characterization: What are the factors controlling particle size distribution and turbidity of urban stormwater? How do these factors vary geographically, seasonally, and over the hydrograph? How does impervious area connectivity and hydrologic routing affect pollutant concentrations and loadings? What is the correlation between suspended sediment size classes and phosphorous (total and dissolved) concentrations? (2) Improving existing tools: How can existing tools and methods to estimate, track and report urban stormwater load reductions be improved? (3) Pollutant control/treatment: What is the effectiveness of controls to reduce pollutant concentrations and loadings? What are the key BMP design features that influence load reductions and what are the associated ranges? What are the optimal O&M practices in terms of cost and effectiveness and under various pollutant loading scenarios? How should BMPs be designed to maximize pollutant removal? How does BMP effectiveness vary over time? Research on innovative control strategies (e.g., pump and infiltrate) is especially encouraged. Research should examine the full range of particle size classes (total, < 63µm, < 16µm), and express suspended sediment measurements in terms of both mass and particle numbers.		
Quantifying the effects of actions to reduce sediment loads using SEZs	Conventional Investigations and/or Synthesis & Review	Management and regulatory agencies need tools and methodologies to quantify the direct effects of stream environment zone (SEZ) restoration projects in achieving pollutant load reductions targets for the Lake Tahoe TMDL. Quantifications of benefits and impacts are important in demonstrating the fulfillment of basin-wide planning and environmental improvement efforts such as the Lake Tahoe TMDL and the Environmental Improvement Program. Specifically, estimates of the direct effects of SEZ restoration projects to achieve TMDL reduction goals are needed. Development of a protocol similar to the Lake Clarity Crediting Program is also needed for tracking and reporting purposes.	Research proposals should aim to develop methods that quantify the direct effects (both benefits and impacts) of SEZ restoration projects to reduce pollutant loads relative to the Lake Tahoe TMDL targets. Research projects should build upon existing datasets, methodologies, and models to the extent feasible and appropriate. Research proposals should address the following: (1) Development of tools and methodologies to quantify the direct effects of SEZ restoration projects in achieving pollutant load reductions targets for the Lake Tahoe TMDL. (2) Identify the capacity of SEZ and stream restoration activities to treat polluted urban stormwater runoff. (3) Identify the origin (i.e., anthropogenic or natural) and quantify the volume of stormwater that directly and indirectly drains into streams. (4) Identify the sources and anthropogenic origin of fine sediment and nutrients that are carried in the stream load and deposited on the floodplain. Research may focus on a particular site, but efforts are encouraged to develop and test methodologies for application at appropriately broad spatial and temporal scales.		
Air Quality				\$850,000	\$700,000
Title	Type of Research	Management/Policy Need	Description		
Secondary pollutant formation and the impacts of TMDL-related primary and secondary atmospheric pollutants	Conventional Investigations and/or Synthesis & Review	Secondary pollutants are not directly emitted from sources but are instead formed by chemical reactions in the atmosphere. Examples include ammonium sulfate and ammonium nitrate, which are major contributors to visibility degradation in the Tahoe basin and ozone concentrations, which now exceed air quality standards. Due to the secondary nature of these pollutants, the development of effective control strategies requires detailed knowledge of the chemical and physical processes leading to their formation. A related need is to model the transport and deposition of atmospheric pollutants into Lake Tahoe considered important in the Lake Tahoe Total Maximum Daily Load: particles, nitrogen, and phosphorus.	Proposals under this subtheme should yield results that inform issues related to the processes leading to gaseous and particulate secondary pollutants in the Lake Tahoe basin, lead to the development of an air quality model, estimate primary pollutant carrying capacities, or increase our understanding of TMDL pollutant transport and deposition. Potential modeling and measurement studies must relate to: (1) the development and validation of an air quality model to: (i) predict secondary pollutant formation, and as feasible, (ii) estimate the transport and deposition of TMDL-related primary and secondary pollutants to the lake; (2) conducting focused studies to quantify the precursor sources and pathways leading to the formation of these secondary species; (3) the development of "carrying capacity" estimates for the primary and secondary pollutant precursors (i.e., hydrocarbons, nitrous oxides, ammonia, etc.), which can be used by agencies to develop acceptable level of emissions (i.e., carrying capacities) to help ensure the Tahoe Basin meets the most stringent pollution standards. Research to develop carrying capacities also should include an assessment of how much of each pollutant needs to be removed in order to attain and maintain standards. Research proposals for the development of TMDL pollutant transport and deposition estimates also should include the development of protocols to estimate, track, and report on the effectiveness of atmospheric pollutant load reduction actions.		
Assessing the impacts of fire on air quality	Conventional Investigations and/or Synthesis & Review	Emissions from burning impact human health, ambient air quality, atmospheric visibility, and lake water quality. Information available to managers for predicting and mitigating these impacts is inadequate to quantify tradeoffs among various alternatives. The Tahoe Fire Commission found that there was "a lack of comprehensive air quality and meteorological information within the Lake Tahoe Basin to analyze air quality conditions to optimize burn windows for prescribed fire activities," and also that "low emission fuel reduction techniques are part of the necessary tools needed to minimize health-based air quality issues and visibility impacts when reducing the fuel load." Therefore, information is needed to increase our understanding of the effects of alternative fuel treatments, wildfires, and residential wood burning on air quality and pollutant deposition; and the development of best management practices to reduce these impacts.	Research should address one or more of the following issues: (1) evaluating local and regional impacts on air quality and/or particle deposition of various alternatives in the basin for reducing forest fuels (e.g., underburning, broadcast burning, pile burning, thinning, mastication, removing biomass for burning in the basin, and removing biomass out-of-basin), considering short-term impacts and long-term effects given the likelihood of wildfires; (2) evaluating the impacts of residential wood burning to air quality and pollutant deposition; and (3) evaluating the ability of alternative BMPs or control measures to mitigate the air quality impacts of various practices.		

Integrating Science				\$1,000,000	\$965,000
Title	Type of Research	Management/Policy Need	Description		
Tahoe science consortium	Synthesis & Review	Further support is needed to allow the Consortium to continue providing environmental managers and decision makers with comprehensive and well-synthesized scientific findings drawn from research, monitoring, and modeling. Continued support for the TSC also is needed to provide for science community involvement in agency programs such as the SNPLMA Lake Tahoe Program and the Environmental Improvement Program.	Funding will support continued operations of the Tahoe Science Consortium, whose activities include: (1) science planning and information synthesis, (2) technical peer review, (3) technical consultation, and (4) science information communication. The Tahoe Science Consortium will coordinate workshops and efforts to synthesize scientific information to support decision-making in the Lake Tahoe basin. In addition, the TSC will continue to build a reserve to fund rapid response efforts (e.g., focused research or short-term monitoring) deemed necessary to obtain critical information about the effects of catastrophes (e.g., wildfires, sewage spills, or earthquakes), or provide critical baseline information to understand the effects of restoration and remediation efforts undertaken in response to a catastrophe. Unexpended rapid response funds would not be redirected to other TSC activities, but would be held in reserve until needed.		
Understanding current and future resource conditions through analysis of remote sensing data	Analysis & model development	The Round 10 Lake Tahoe SNPLMA capital program included funding to acquire high-resolution LiDAR data and multispectral imagery for the Tahoe basin. Analyses of these datasets and images are needed to develop information that agencies can use in the future planning of capital projects, to characterize current natural resource conditions, and to provide a baseline for comparison of future conditions resulting from the ongoing implementation of forest management and habitat restoration projects. Proposed research that fuses/integrates high-resolution LiDAR and multispectral imagery to further our understanding of landuse patterns, and current and future natural resource conditions and management options is encouraged.	Research proposals are requested to (1) provide a spatially explicit determination of current forest structural classes across topographic features; (2) model a range of forest structure restoration strategies that include a range of tree density reductions and creation of openings based on (a) a range of opening sizes, (b) frequency distributions of opening sizes on the landscape, (c) rate of application of openings, e.g., number of openings by size per year, and (d) differences between intensity versus extent of openings. Climate change factors and model parameters could be included in forecasting possible forest density and structural restoration. (3) Analyze datasets to document the location and extent of hard and soft impervious cover; (4) develop derivative products to identify catastrophic fire risk, extent and distribution of defensible space in the urban intermix and Wildland Urban Interface, or hydrologic networks for application to TMDL project planning, floodplain management, or characterization of stream geomorphology; and (5) develop spatial models and maps of habitat suitability for special status plant and wildlife species or communities of concern.		
Identifying environmental indicators and development of approaches for monitoring and evaluation	Conventional Investigations and/or Synthesis & Review	Land management and regulatory agencies need to evaluate whether their actions are effective at meeting environmental goals. Credible evaluations require meaningful indicators, appropriate standards, and monitoring plans to evaluate the status and trends of environmental indicators relative to established standards, as well as tools and protocols for consistent and comprehensive data analysis and reporting.	Synthesis and review and/or conventional research proposals should address all of the following: (1) Synthesize and review previous and ongoing research efforts need to identify scientifically-supported environmental indicators for a specific topic area of agency interest. (2) Prepare a monitoring and evaluation plan that can be implemented to measure the identified indicators and report on long-term status and trends of environmental threshold area considering basin-wide needs, regulatory/programmatic requirements, statistical reliability, and agency financial constraints. (3) As appropriate, conduct pilot testing of field, analysis, data management and reporting protocols and procedures included in new or existing monitoring plans to support refinements that maximize the utility of these protocols and procedures to agencies. And (4) complete analyses to assess how the proposed new indicators compare to existing relevant indicators. Projects proposed under this subtheme should to the extent possible extract valuable information from existing datasets and provide data in accessible and useful formats to other researchers and managers seeking to evaluate changes in environmental thresholds. Researchers should plan to work collaboratively with agency representatives and other research teams to ensure the products will meet agency information and evaluation needs. Any environmental threshold area could be the focus of research proposed under this subtheme.		
Development of robust assessment methods for evaluating fine sediment concentrations and loads ¹	Directed Action	The control of fine sediment particles is a high priority for achieving the Lake Tahoe TMDL clarity challenge. Reliable, low-cost methods are needed for evaluating fine sediment concentrations on a regional basis and for improving estimates of fine particle loading from various sources.	The measurement and assessment of fine particle concentrations and loads is required for effective water quality management in the Tahoe Basin. Low-cost methods for quantifying fine sediment concentrations must be developed that are reliable, repeatable, and applicable on a regional basis for monitoring the benefits from implementation of water quality improvement projects. Additional analyses should evaluate the extent to which data produced by proposed methods are dependant upon site conditions or other characteristics. Direct consultation with the Regional Stormwater Monitoring Program development staff is required to ensure that methods are complete and standardized. This research also should examine the relations between fine sediment particle numbers and other important water quality characteristics, such as turbidity, total suspended solids, and phosphorus loading. Research should build on past monitoring data, methods and studies conducted in the Tahoe basin.		
Total Science Funding²				\$3,750,000	\$3,165,000
¹ Science work under this subtheme would be pursued as a 'directed action' under the Tahoe Science Consortium work plan. This would mean the projects would not be determined as part of the normal Round 10 RFP, but would instead be implemented based on scopes of work developed at the direction of the TSC in collaboration with appropriate agency representatives. One or more proposals may be solicited by the TSC based on each scope of work and all proposals would undergo independent peer review for an evaluation of technical merit. Appropriate agencies would need to dedicate technical staff time to work in collaboration with the selected scientists to complete the projects. The intent of this approach is to maximize agency-researcher interactions needed to achieve the products desired by agency representatives in an efficient and timely manner.					
² The full amount available for science has been allocated among four theme areas, with a target level of funding identified for each theme area. Actual funding levels may vary from targeted levels based on the merit of the proposals received and the specific dollar amount of the selected proposals; however, it is intended that all theme areas receive funding close to their targeted funding levels in order to accomplish the objectives identified as priorities by the TSC and relevant agencies. Regardless of the allocation among theme areas, the total funding will not exceed the amount approved by the Secretary of Interior. The cost to the Pacific Southwest Research Station of administering the funding will be calculated as a percent of the total and will be deducted from the final funding for each theme area. Administrative costs will be minimized to the extent possible.					