**Project Category**: Cross-Ecosystems (Forest Ecosystems and Freshwater)

**Project Title:** *A Conservation Priorities Tool for the North Pacific LCC*

**Project Leader or Principal Investigator responsible for completion of project:**

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**Project Summary**: Ecotrust proposes to develop an open source, spatially explicit, conservation and restoration priorities tool that will assist the North Pacific LCC and other natural resource managers, individuals, and community organizations in accessing disparate data sources for understanding and visualizing the potential effects of climate change on freshwater and forest ecosystems throughout the North Pacific LCC geographic area. This tool will leverage significant resources spent to develop the codebase for MarineMap (www.marinemap.org) and will build on a conservation priorities tool currently under development for the US Fish and Wildlife Service that helps users identify regional freshwater conservation and restoration priority areas in the Pacific Northwest (Oregon, Washington and Idaho) given the potential impacts of climate change and aquatic invasive species. We propose to expand this tool to include additional terrestrial species of interest and increase the geographic scope to include the entire North Pacific LCC geographic area.

**Project Proposal:**

*Background and Need -* Uncertainties exist about the extent and intensity of climate change impacts in our region. Scientists are working to understand climate change and its effects on the landscape even as managers and policymakers must respond to those effects as they occur and in their short- and long-term planning (Overpeck et al. 2011). Currently, regional landscape-level climate change data is scattered, little of it is easily viewable, and much of it resides in the academic and research domain (e.g., Oregon State University’s PRISM Climate Group (2010); University of Alaska’s Alaska Center for Climate Assessment and Policy (2011) ; University of Washington’s Climate Impacts Group (2011). Furthermore, there is limited access to regional, standardized, easy-to-use visualization and management tools designed to apply state-of-the-art knowledge to real projects on the ground. Our Decision Support Tool will fill that gap by providing free, online access to the most current and credible climate change, watershed condition, freshwater, and forest system data.

Climate change strategies and research commonly identify the need for collaborative, regional action across political and jurisdictional boundaries (Defenders of Wildlife and ODFW 2008; Heller and Zavaleta 2009; Littell et al. 2009; Furniss et al. 2010; USFWS 2010). The sharing of data and analysis is a fundamental component of this collaborative process. The complexity of climate change data and its strong foundation in the academic realm limit its easy accessibility. A recent report in Science (Overpeck et al. 2011) recognizes the need for readily available climate data that are useful and understandable by broad, interdisciplinary audiences. The authors recommend a “new paradigm” of open, user-friendly access to climate data as scientific and public users of that data increase along with its volume and complexity. Furthermore, the Oregon Global Warming Commission (Defenders of Wildlife and ODFW 2008) recognizes that fish and wildlife managers will require better access to existing information on climate change and its impacts in order to respond to the increasing uncertainties of management in the face of climate change. They identify regional-scale assessments of species and ecosystem vulnerability as a major need in order to support prioritization and management decisions.

The U.S. Fish and Wildlife Service (2010) adopts adaptation and engagement strategies in its Strategic Plan for Responding to Accelerating Climate Change. Adaptation goals and objectives include acquiring and applying the best climate change science to planning and conservation design, as well as fostering partner collaboration and coordination. To support its engagement strategy, USFWS proposes developing “useful and accessible information resources” to engage and share climate change information, education and training with Service employees internally as well as, local, state, national, and international partners, both public and private. The development of this tool will support those goals.

Federal, State and local land managers and land management agencies are increasingly interested in identifying priority habitat and ecosystems at multiple scales, and the ability to assess these priorities with respect to vulnerabilities such as threats imposed by the potential effects of climate change. However, their efforts to do so are hampered by a lack of appropriate tools and access to the latest and best region wide data sets, in particular, data sets pertaining to climate change. Managing for multiple objectives requires new data, as well as the ability to compile, sort, and quantitatively analyze them, particularly with respect to tradeoffs and synergies among a diverse set of objectives.

Natural resource planners currently have very limited access to the myriad current data sets generated by universities, government agencies, non-profits and other NPLCC stakeholders. Without easy access and the ability to interpret these data, stakeholders interested in addressing restoration and conservation issues are at a disadvantage. We will address this problem by developing a web based Decision Support Tool (DST) that allows users to access and visualize the most current sets of natural resource and climate change data in one common, spatially explicit framework.

Utilizing the codebase developed as part of the MarineMap (www.MarineMap.org) framework, we have begun to implement a DST for terrestrial ecosystems through a collaboration with the US Fish and Wildlife Service (USFWS) Region 1. We are working with the USFWS to develop an open source, conservation prioritization tool for restoration actions that takes into account the potential impacts of climate change and aquatic invasive species on watershed condition and focal species. This tool will be freely available on the web to conservation and restoration planners. By building on this effort, we take advantage of a codebase that is well established and tested, with a proven track record of success in major planning efforts.

Tighter government budgets dictate that resource managers become more efficient and directed in using funds for management actions. This tool will assist managers in prioritizing conservation and restoration work. Using the tool, managers will be able to visualize spatially explicit data from disparate sources at different geographic scales across the NPLCC region. In addition to data visualization, users will be able to run analyses that prioritize specific areas based on users’ specified objectives. Users will be able to visualize map based and graphical results in real time and can then make changes “on the fly” by rerunning various scenarios. The online, open source nature of the tool allows stakeholders to use the tool in their offices or in large group settings without the need for expensive software licenses. Sessions can be saved and shared with different user groups, facilitating dynamic, multi-stakeholder decision making.

We will create an open-source Decision Support Tool, freely available online, where climate and natural resource conservation data can be readily visualized, explored, and shared. This dynamic tool will give users the ability to instantly identify climate change vulnerability and visualize the results of a range of assumptions by running analyses based on users’ selection of input parameters. This Decision Support Tool will advance resource conservation by fostering the collaboration and communication of scientists, policy-makers, natural resource planners and managers, and landowners.

*Methods*:Our approach entails five sequential tasks including: 1) stakeholder engagement and user needs assessment; 2) review of existing data and analytical approaches; 3) compilation and standardization of data; 4) tool development and; 5) documentation and release. Each task is briefly discussed below.

The stakeholder engagement process (task 1) is an essential step in identifying user needs and preferences and will ultimately inform all subsequent tasks. This task includes meeting with NPLCC stakeholders to demonstrate existing tools (USFWS aquatic priorities tool and MarineMap) and share project goals and objectives as well as receive input on project direction and priorities. We will incorporate NPLCC stakeholder feedback into development of analytical approaches, data sources, and final product.

Data and methods review (task 2) includes a census of all existing climate change and natural resource conservation data and sources and a review of existing regional climate change vulnerability approaches. We will follow the same three-pronged approach used in our current work with USFWS for identifying pertinent data sets, including identifying and mapping priority species, watershed condition, and potential climate effects. In this way, we can focus on long-term conservation goals while also identifying areas vulnerable to the most pressing regional threats. We have already collected over 100 data sets related to these components and will draw on the expertise of Ecotrust’s Alaska program staff and Ecotrust Canada staff to help us identify and compile data necessary to extend the geographic scope of the tool to cover the entire North Pacific LCC geographic area. While this task includes an extensive review of existing data, a few potential data sources are identified below.

Existing and potential data on widespread, migratory fish include: ODFW; WADFW: Anadromous Fish Distribution 2010; ADF&G; CaDFG ; StreamNet; CRITFC; NOAA; and Ecotrust’s State of the Salmon program. Geospatial data on locally endemic species and for terrestrial species can be more difficult to obtain. For the conterminous United States, NatureServe publishes distribution data by watershed (NatureServe 2004). For British Columbia, Natural Resources Canada (2009) maintains geospatial data specific to land cover. For Alaska, AKDNR (2011) and the Alaska Natural Heritage Program (2011) maintain data specific to land cover, terrestrial species and threatened and endangered species. Finally, the California Department of Fish and Game (2011) maintains the California Natural Diversity Database.

Downscaled climate projections are available, but are scattered and limited to varying geographic areas. Some states make this data available (Oregon Geospatial Data Clearinghouse: Average Monthly or annual precipitation, minimum and maximum temperature, 1971-2000). Regionally, the Climate Impact Group (n.d.) provides a wealth of information and spatial data for the Columbia River Basin. While difficult to find on their website, we have obtained data on predicted air temperature, precipitation, and snow-water equivalent (SWE). In Alaska, both the University of Alaska (2011) and the Alaska Center for Climate Assessment and Policy (2011) maintain extensive Alaska satellite and GIS and downscaled climate prediction models. Finally, the University of Victoria maintains regional climate change data for British Columbia and parts of the Yukon as part of the Pacific Climate Impacts Consortium (2011).

Datasets that will be useful in measuring watershed condition include land use and land cover, roads, and environmental quality, among others. Some states make this data available; Oregon’s Geospatial Data Clearinghouse distributes an ecological systems dataset (Kagan 2010) as well as roads and railroads. Washington State makes land use, water quality assessment (WSDOE 2011), and transportation data (WSDOT 2010) available. National datasets for the United States that may be useful include the Wildland Urban Interface (CONUS only) and the Protected Areas Dataset 1.1 (CBI 2010). The National Land Cover Database (MRLC 2011) has recently been updated for 2006, and includes land cover, land cover change, and imperviousness data. Additionally, Natural Resources Canada (2009) maintains geospatial data specific to land cover. NetMap (Earth Systems Institute 2011) is a powerful watershed analysis platform that will support and inform the analysis of watershed condition, within its current geographic scope in the U.S portion of the NPLCC geographic area.

Once all data are identified we will compile both spatial and non-spatial data within the geo-spatial framework and pre-process compiled GIS data in preparation for inclusion in tool (task 3). Both the staff of Ecotrust’s Alaska program, including co-PI Allison Bidlack, and Ecotrust Canada will play a major role in data compilation and standardization.

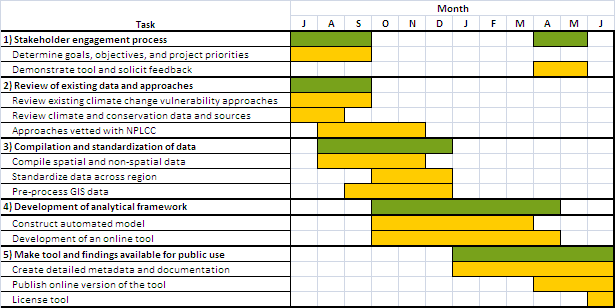
Development of an automated, online, open-source analytical tool (task 4) includes both 1) construction of an automated model that allows for manipulation of key parameters and rapid (real-time) assessment of data given approaches specified through task 2; and 2) customized development of an existing online, spatially explicit, open source tool that facilitates stakeholder interaction (including alpha, beta and final releases). As mentioned above, this task consists of customization of the MarineMap codebase and adaptation of the USFWS aquatic diversity tool. Construction of the automated model includes: server-side modeling including conversion of sample data to input formats; calibration; and integration of results including asynchronous model execution, data translation, and reporting outputs. Customized development of the tool includes: creation of a new instance of MarineMap codebase; client-side project specific UI adjustments; deployment on a production server; implementation (with new data layers, new input widgets, analysis module and KML output) and; cross-browser testing for functionality and data accuracy testing.

Finally, the tool and any findings will be made available for public use (task 5). This task will include creation of a short tutorial video that demonstrates use of tool, creation of detailed metadata and documentation of individual data layers, the decision making process, and the modeling approach; publication of a public, online version of the tool that allows for visualization of inputs and priorities resulting from the process; and licensing the tool under an open source license agreement (GPL) and making the source code available.

*Geographic Extent*:The geographic extent of this work will include the entire geographic area of the North Pacific LCC.

*Timeline of Schedules, Products and Outcomes*:Stakeholder meetings will take place in the first three months of the project and will result in a detailed user needs assessment and engagement process. Based on this input, a detailed software specification will be developed and data compilation and tool development will commence. The software design includes an alpha, beta, and final release with significant time for testing and validation. Major milestones include:

* September 30: Comprehensive list of all potential data sources to be vetted with NPLCC partners
* October 15: Software specification document
* January 31: Alpha release
* March 31: Beta release
* April 30: Final release
* June 30: Final documentation and licensing of the tool



**Budget:** See attached.

**Disclaimer regarding Data Sharing:** Any data generated by Ecotrust will be made freely available through the Decision Support Tool. Data collected from other sources will be cited and permission gained from the originator for free distribution.