A SHRP 2 Capacity Project Brief

Planning Transportation Projects for Better Environmental Outcomes

A new institutional framework and tools makes it easier

MAY 2013

Ecosystem approaches to environmental conservation are becoming more widely accepted and increasingly practiced by federal, state, and local resource agencies. From a highway perspective, the Federal Highway Administration document *Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects* (2006) provides a conceptual groundwork for integrated conservation plans and mitigation activities that transcend individual agency jurisdictional boundaries and encourages an outcome-based ecosystem approach to conservation. However, *Eco-Logical* stops short of providing the institutional framework and tools to implement the principles. SHRP 2 reports *An Ecological Approach to Integrating Conservation and Highway Planning: Volumes 1 and 2* are intended to provide the structure and tools needed to implement the ecological approach.

Transportation and natural resource agencies recognize the ecological and economic benefits of integrating landscape-scale environmental considerations into highway planning, but the barriers to achieving the goal are high. Ecosystem-based approaches to highway planning need to be easier and more practical if they are going to be widely implemented. SHRP 2 has developed a structure called the Integrated Ecological Framework ("the Framework" or IEF) that builds on the principles of *Eco-Logical*, providing a step-by-step approach to reaching consensus on environmental goals, identifying and protecting conservation areas, and thereby speeding the delivery of transportation projects. The research also identifies tools for carrying out the analytical steps in the Framework using a cumulative effects assessment and alternatives (CEAA) process.

The Framework can help transportation agencies and resource agencies work together during long-range, corridor, and project planning to identify transportation program needs, their potential environmental impacts, and conservation/advanced mitigation opportunities. The purpose of the Framework is to build or refresh inter-agency relationships and discuss upcoming environmental issues well in advance of the National Environmental Policy Act (NEPA) process. Within the Framework, a CEAA process provides guidance for the analytical steps to help transportation and natural resource practitioners bring the right expertise, data, methods, and tools to the table. By engaging during the long-range or corridor planning process, there is more flexibility in roadway alignment and design and, therefore, more opportunity to avoid and minimize impacts.

The essence of the Framework is to agree in advance on conservation priority areas and avoid them as much as possible, and for unavoidable impacts, to begin agreement on mitigation sites that enhance and enlarge contiguous conservation areas. The benefits of using the Framework include better environmental outcomes through reduced impacts, identification of high-quality mitigation and enhancement opportunities, and the potential for accelerated completion of the NEPA and 404 permitting process (which regulates the discharge of dredged or fill material into waters of the United States, including wetlands) through proactive inclusion of resource considerations early in the transportation planning process.

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Table 1. Steps of the Integrated Ecological Framework (IEF)

Both the cumulative effects assessment alternatives (CEAA) process and the Regional Ecosystem Framework (REF) are part of the IEF. The CEAA process applies to the analytical steps. The REF is a spatial and nonspatial database of resources and scenarios with planning objectives and conservation criteria; this is the core of the IEF.

STEP	PURPOSE
Step 1: Build and Strengthen Collaborative Partnerships and Vision	**Build support among a group of stakeholders** to achieve a statewide or regional planning process that integrates conservation and transportation planning.
Step 2: Characterize Resource Status. Integrate Conservation, Natural Resource, Watershed, and Species Recovery and State Wildlife Action Plans	Develop an overall conservation strategy that integrates conservation priorities, data, and plans, with input from and adoption by all conservation and natural resource stakeholders identified in Step 1 that addresses all species, all habitats, and all relevant environmental issues.
Step 3: Create Regional Ecosystem Framework (Conservation Strategy + Transportation Plan)	Integrate the conservation and restoration strategy (data and plans) prepared in Step 2 with transportation and land use data and plans to create the Regional Ecosystem Framework **(REF).**
Step 4: Assess Land Use and Transportation Effects on Resource Conservation Objectives Identified in the REF	Identify preferred alternatives that meet both transportation and conservation goals by analyzing transportation and/or other land use scenarios in relation to resource conservation objectives and priorities utilizing the REF and models of priority resources. (This is the step in which the **Cumulative Effects Assessment and Alternatives [CEAA]** process, described below, is applied.)
Step 5: Establish and Prioritize Ecological Actions	**Establish mitigation and conservation priorities** and rank action opportunities using assessment results from Steps 3 and 4.
Step 6: Develop Crediting Strategy	Develop a consistent strategy and metrics to measure ecological impacts, restoration benefits, and long-term performance—with the goal of having the analyses in the same language throughout the life of the project.
Step 7: Develop Programmatic Consultation, Biological Opinion, or Permit	Develop memoranda of understanding, agreements, programmatic 404 permits, or Endangered Species Act Section 7 consultations for transportation projects in a way that documents the goals and priorities identified in Step 6 and the parameters for achieving these goals.
Step 8: Implement Agreements and Adaptive Management. Deliver Conservation and Transportation Projects	Design transportation projects in accordance with ecological objectives and goals identified in previous steps—incorporating programmatic agreements, performance measures, and ecological metric tools to improve the project.
Step 9: Update Regional Integrated Plan/Ecosystem Framework	Update the effects assessment to determine if resource goal achievement is still on track. If goal achievement gaps are found, reassess priorities for mitigation, conservation, and restoration in light of new disturbances that may impact the practicality/utility of proceeding with previous priorities. Identify new priorities if warranted.

The Framework

State departments of transportation, metropolitan planning organizations, and resource agencies can use the steps of the Framework (Table 1) to work together during long-range, corridor, and project planning. Doing so will help identify strategic transportation program needs, their potential environmental impacts, and conservation opportunities. Using the Framework enables programmatic tools to increase regulatory predictability during project development while furthering regional conservation goals. It is a comprehensive, dynamic process designed to promote the integration of regulatory and nonregulatory authorities, as well as better environmental outcomes.

Cumulative Effects Assessment and Alternatives Process—*Familiar Methods in a Cohesive Approach*

The foundation for the analytical steps in the Framework is a step-by-step CEAA process that identifies emerging methods to achieve regulatory assurances and environmental accounting. The methods include geospatial tools for updating wetlands maps, inductive species modeling that predicts where sensitive species are most likely to be located based on habitat and observation, and development of credits based on the value of ecosystem services. Ecosystem services include items of value to society like clean water, outdoor recreation, agriculture, fisheries, and species diversity. With these tools, transportation planners can more easily value and avoid sensitive resources early in the planning process and be more confident of setting projects where impacts will be minimized.

Rather than a radical new approach, the CEAA process brings together a variety of well-tested methods, data, and tools into a cohesive ecological assessment approach. Specifically, the CEAA process guides a scientifically rigorous ecological assessment that includes the following: (1) evaluating direct and cumulative effects on resources from any potential planning alternative or project; (2) assisting in the identification or creation of alternatives; and (3) identifying the best mitigation and enhancement opportunities.

The CEAA is intended to be highly scalable to the time, resources, data, and expertise available; and it can be used at the regional, corridor, or project level. Undertaking a CEAA requires transportation and resource agencies and other stakeholders to work collaboratively to agree on targets and goals for an area of interest. This ensures that relevant expertise, data, tools, and methods are considered in the development of a regional ecosystem framework (REF). As noted in Table 1, the REF is basically a set of overlays that map both transportation and conservation priorities. The REF can then be used to assess and guide transportation decision making at all stages of transportation planning and development; it also allows impacts to be assessed and quantified early in the transportation planning and project delivery process.

Within this process, practitioners can begin at any transportation decision point and use the CEAA to help identify and incorporate the necessary questions, data, and analysis needed to support better environmental and transportation decision making. The online version includes references that provide in-depth reading of the concepts and case studies that illustrate real-life applications, as well as useful technical tools and data sources to support its use and implementation.

The major outputs of the CEAA include the following:

- A unified map of transportation, land use, conservation, and restoration priorities;
- Maps of each potential transportation scenario that show an assessment of direct and cumulative effects at a landscape level with supporting data;
- Identification of affected resources and the quantification of the cumulative effects for each transportation scenario being considered; and
- Identification and evaluation of potential mitigation and enhancement areas within a region.

Regulatory Assurances and Ecological Accounting Strategies

Within the overall Framework, two actions are critical. First, transportation planners and project managers must address regulatory requirements, ideally as early in the transportation planning and development process as possible. Second, environmental accounting strategies can be used to reach agreement with regulatory agencies on project impacts and mitigation requirements.

Regulatory Assurances

This SHRP 2 research focused on regulations under the Endangered Species Act (ESA) and the Clean Water Act (CWA). To address regulation under the ESA, species distribution models using inductive modeling methods can create reliable maps that can be used by transportation planners early in the planning process, before significant investments have been made in road design. The maps are also useful in identifying mitigation opportunities and assisting in recovery planning. This information is equally important for improving transportation and conservation outcomes related to wetlands, streams, rivers, and other resources regulated under the CWA.

In many areas of the United States, however, data needed to avoid and minimize impacts to wetlands and to assess mitigation options are currently lacking. Transportation planners need access to digital wetland maps covering the entire country to find the best options. The National Wetlands Inventory (NWI), which is the baseline database for the United States, only covers about 80% of the country digitally, and much of the NWI is based on scanned imagery that is almost 30 years old (Figure 1).

This research project examined case studies that created digital data where such information was lacking in Oregon, and to improve it in Michigan and Virginia. Methods (including collaboration between state agencies; a mix of funding from federal, state, and nonprofit sources; imagery analysis, and modeling) were used in these states to dramatically increase digital wetlands coverage. These strategies have the potential to create wetlands data for the entire country in a few years.

Ecological Accounting Strategies

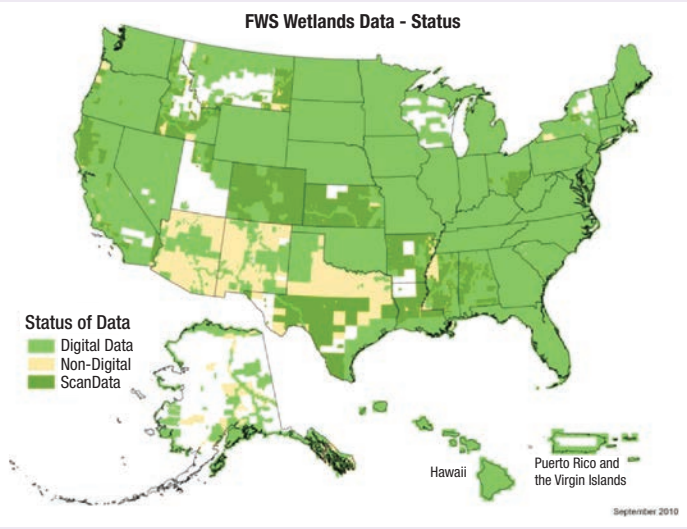
The Framework and CEAA process provide the ability to link and correlate ecological measurements at a landscape scale with measurements of similar resource is sues at a site level. In practice, linking the measurement scales provides the following outcomes:

- A better ability to maintain continuity between early transportation planning and project specific planning,
- Improved regional goal setting and a better ability to track the effect of specific projects on the progress toward those goals,
- A framework for understanding and presenting cumulative effects analyses, and
- An improved understanding of the opportunity and need for using programmatic approaches in project planning, as well as an improved ability to develop them.

Incorporation into TCAPP

Transportation for Communities—Advancing Projects through Partnerships (TCAPP) is a web portal that delivers the content of a number of SHRP 2 projects. TCAPP includes an interactive database developed in this ecological work to

Figure 1. 2010 Status of digital wetlands data for the United States in the NWI



provide access to the CEAA technical guidance and supporting strategies for regulatory assurances and environmental crediting. The database is integrated into the Applications section of the TCAPP (www.transportationforcommunities.com).

Pilot Projects

The IEF process and supporting strategies were tested in three pilot projects in Oregon, Michigan, and Colorado. The objective was to see if the new approach would result in different decisions and outcomes, and how time and cost savings compared to the traditional transportation planning and project-delivery system. The pilots also tested the usability of the new processes. Results showed that the new methodology produced results similar to traditional approaches in the evaluation and mitigation of direct impacts, and the new approach provided better results than the traditional approach for cumulative impact analysis and selection of mitigation options.

Some key findings and conclusions from testing the process include the following:

- **Better Outcomes**: The most significant changes were in the areas of mitigation site selection, evaluation of multiple corridors, and development of transportation plans. The pilot test results led to the selection of mitigation sites with more ecological benefits, and they provided more accurate and comprehensive scenario assessments that identified corridors with the least number of direct and cumulative impacts.
- **Benefits of Modest Investments in Data:** Usefulness of the CEAA for planning and project development is dependent on the accuracy and resolution of available data. A relatively modest investment in process changes and data development up front can help practitioners identify potential impacts and mitigation opportunities earlier in the transportation process—which can vastly improve planning, corridor evaluation, and consideration of mitigation opportunities.
- **Increased Credibility:** Decisions have more credibility because the CEAA process ensures the use of a standardized, scientifically based, peer-reviewed process that applies the best available suite of methods, data, and tools.
- **Savings in Time and Resources:** The CEAA approach can save time and resources by reducing impacts and mitigation requirements, as well as supporting more targeted field studies for assessment of alternatives.
- **Standard Data Management Practices:** Better data management and data-sharing practices contribute to better application and accessibility of data collected during transportation alternative assessments; this can enhance future decision making not only by transportation agencies, but by natural resource agencies as well.

Reports

An Ecological Approach to Integrating Conservation and Highway Planning, Volume 2, (SHRP 2 Report S2-C06-RW-2) includes descriptions of the project approach, the ecological process in transportation planning, the Framework, the pilot projects, the development of the web tool, and a symposium. The appendices include a description of the wetlands workflow and data development, a description of predictive modeling for at-risk species, reports on the pilot projects, an example function of natural flow regulation, the ecosystem-based tools database, and ecosystem service accounting tools. The report is available at http://www.trb.org/Main/Blurbs/166938.aspx.

Two additional reports are expected in 2013: *An Ecological Approach to Integrating Conservation and Highway Planning, Volume 1*, (SHRP 2 Report S2-C06-RW-1) and the *Guide to the Integrated Ecological Framework. Volume 1* summarizes SHRP 2 Project C06A (Integration of Conservation, Highway Planning, and Environmental Permitting Using an Outcome-Based Ecosystem Approach), which developed an integrated ecological framework for ecological decision making and conservation planning to address ecological concerns during highway capacity enhancement projects. The *Guide* offers an expanded view of the IEF, which is presented in *Volume 2*.

SHRP 2 Contact

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