Valuation and Crediting Approaches for Transportation and Metropolitan Planning Agencies

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Measurement and crediting tools for ecosystem services are important to the processes of transportation planning and project implementation because these tools can aid in mitigating environmental impacts by reducing transaction costs, improving environmental outcomes, and shortening the time needed to implement projects. Because of this importance, such tools have been identified as a key step in the Eco-Logical framework to integrate transportation and conservation planning, characterized by a SHRP 2 capacity program study as the Integrated Ecological Framework. Currently, throughout much of the United States, there are no straightforward methods for the creation of transportation-centric crediting programs. However, successful programs in California, North Carolina, Oregon, and Washington have developed approaches cooperatively with regulatory agencies, state and nongovernmental conservation programs, those actively involved in mitigation banking, and agencies or organizations that fund restoration activities. An overview of crediting systems and valuation methods and their use at various scales in transportation planning are presented in this paper. Current projects and programs are evaluated to identify the opportunities and the obstacles that transportation organizations may encounter when attempting to implement a crediting program.

Step 5. Establish and prioritize ecological actions.
Step 6. Develop a crediting strategy.
Step 7. Develop programmatic consultation, biological opinion, or permits.
Step 8. Implement agreements and adaptive management and deliver conservation and transportation projects.
Step 9. Perform ongoing updates to the REF and REIDF.

Step 6, the development of a crediting strategy, which would allow agencies to use rapidly emerging crediting information and tools, has been particularly difficult for departments of transportation (DOTs) and metropolitan planning organizations (MPOs) to implement. The development of a crediting strategy for transportation requires knowledge of the valuation process, ecosystem functions, and ways to measure and credit the benefits and impacts of development and mitigation actions. This paper examines the obstacles and opportunities encountered by transportation agencies in the creation of a meaningful crediting strategy.

VALUATION AND CREDITS

What Is Valuation?

“Valuation” is a formal process for measuring the value of attributes or processes, in which value may have fiscal or nonfiscal expressions. Many decisions related to transportation infrastructure are based on the consideration of social preferences and values (e.g., congestion relief), regional economics, and project costs. Valuation is useful to apply to transportation decision making for multiple needs and can be used to draw equivalencies between dissimilar objects (e.g., driving time, wetland function, and air quality) in a decision space. Equivalent values for these dissimilar objects may either be given on a unitless scale of nonfiscal value or preference or on a fiscal scale, in which the cost is articulated for each object. California has developed an approach for valuing ecosystem attributes in relation to transportation planning and system change (2). Valuation helps inform decisions related to regional planning networks (spatially connected elements) and temporally connected sequences of projects that are efficient in terms of the goals they are intended to achieve (e.g., the provision of large total benefits). Valuation can potentially enable comparisons between project and route alternatives to maximize total benefits. In addition, valuation information facilitates the development of cost estimates and mitigation alternatives, including avoidance, minimization, and compensation. Finally, valuation may inform corridor and regional plan development analyses that set a framework for project-level decision making.
In the proposed process flow in California, transportation system impacts are first identified (2). These impacts are determined by comparing the with project and the without project impacts on environmental conditions in a region or on a corridor. The impacts are quantified, and equivalent values can then be used to translate the impacts into mitigation strategies. As described above, these values could be measured on a preference or fiscal scale or on some other scale suitable for decision making. Impact quantification requires data on potential risks, the geographical and temporal extents of the impacts, and impact severity. Impact quantification also requires the illustration of a relationship between an impact and a quantifiable ecological outcome at an appropriate scale. This relationship must be clear, as not all links between built system impacts, mitigation actions, and ecological processes are straightforward (3). For example, a reduction in pollutant discharge to streams can be measured and permitted, but people and fish do not have measurable preferences for tons of pollutant; people and fish have preferences for resulting water quality. Therefore, it is also important to express the physical parameter in a form that makes the equivalent ecological values obvious.

When impacts are measurable, the next step is to find equivalent values for the impacts. Different methods are available to value ecosystem attributes. Litman provides an extensive literature review on the equivalent fiscal costs of environmental impacts—including air pollution, greenhouse gas emissions, noise, land use, water pollution, and waste disposal—from the transportation sector (4). However, not all impacts can be evaluated through economic valuation methods or given fiscal cost equivalents. A review by Delucchi and McCubbin shows that only congestion delays, accidents, air pollution, climate change, and noise impacts have good cost estimates in road transportation (5).

Three methods for the valuation of ecosystem attributes are (a) revealed and stated preference methods, (b) contingent analysis, and (c) benefit transfers. The two main types of valuation for environmental attributes are the revealed and stated preference methods. Revealed preference approaches depend on a connection between the environmental attribute of interest (e.g., noise) and a market good (e.g., housing). The method uses data revealed by behavior related to actual decisions (e.g., changes in housing prices). The major problem with this method is that it is based on existing conditions; therefore, the potential to evaluate alternatives is limited.

In contrast, stated preference techniques are based on hypothetical situations and surveys that determine people’s willingness to pay for a situation. Stated preference methods can be used for environmental systems, such as wetlands, in which there are both use and nonuse values. The contingent valuation method is a type of stated preference method and is usually used to estimate the value of an environmental change. The method uses a survey that begins with a statement that describes the change in environmental attributes. The survey then asks individuals how much they are willing to pay for the change. For example, people could be asked how much they are willing to pay to restore the wetlands that surround a highway that needs widening.

Benefit transfer allows users to transfer estimates of nonmarket values from existing studies to new locations or to different but related services. An example of this approach is when highway construction results in the destruction or modification of wildlife habitat that has social or economic value, such as a deer or elk winter range. The compensatory mitigation payments that accompany this project would be based on the equivalent cost of each animal multiplied by the number of animals lost. This method is often used because it saves time and resources. Usually, benefit transfer is best suited for tasks in which the need for accuracy is low. Benefit transfer is generally considered a second-best valuation method because benefit transfers involve the reuse of existing data and do not provide error bounds for the value in the new application. For example, it has been found that with benefit transfer methods, the cost per hectare of wetlands that provide a single ecosystem service could vary by two orders of magnitude (6).

When the valuation approach is used in transportation, the last step is to incorporate the values of the affected environmental attributes and a qualitative analysis of those nonmeasurable impacts into the overall transportation plan, project, or corridor analysis. Because there are potential evaluation-scale (project, corridor, or regional) effects on the process, it may be desirable to develop different flows of valuation outputs into a decision process for each scale. Natural (e.g., watershed or ecosystem) and jurisdictional (e.g., district or county) scales can both be used to frame the flow of the valuation process and determine appropriate scales of analysis. The background and information needed for either of these approaches should be contained in the first five steps of the IEF.

What Are Credits?

To plan for infrastructure development in complex social–ecological systems, many think it is necessary to create devices, such as ecosystem credits, that draw equivalencies between nonlike values. Credits use units of measure that are (a) native to part of the system (e.g., land area), (b) derived from financial calculations (e.g., money), or (c) normalized on a preference scale of some kind, usually from least to most preferable. An example of a credit is a hectare of habitat or the dollar equivalent of that habitat. Credits are often proposed when planning and mitigating infrastructure development as a way to accomplish ecologically meaningful mitigation.

The use of a crediting approach to mitigation requires methods and protocols to quantify the units of environmental benefits (the credits) or impacts (the debits), as well as a crediting framework in which regulatory agencies and stakeholders agree to a common set of standards and operating procedures that govern how credits and debits can be used to meet mitigation requirements. Through this process, planners can align mitigation objectives and have greater efficiency and proficiency in the identification of mitigation and restoration opportunities that address multiple ecosystem services. Accurately measured project impacts and mitigation site benefits can be more readily converted into credits. Standards and procedures, agreed to a priori, can both expedite regulatory approval and allow for improved mitigation outcomes.

Ecosystem Services: Possible Crediting System

The ability to measure and value the services provided by the environment holds great promise for society’s ability to ensure that these services are maintained over time. Ecosystem services are commonly defined as the benefits that people obtain from ecosystems and are often characterized into types of service, including provisioning, regulating, supporting, and cultural. Ecosystem service values, costs, and benefits may be an efficient way to consider impacts and improvements to the environment and, as such, can represent a new way for transportation and regulatory agencies to address unavoidable losses and the associated mitigation. However, not all ecosystem processes and attributes can be reflected by an obvious ecosystem service because, although certain aspects of an ecosystem may be recognized and valued, there may be functions and patterns in nature that provide
no obvious or discernible benefit to people but that still have inherent value. An example would be nonpest insects that do not directly benefit people through pollination or other services but that provide an important food source to birds, amphibians, or other animals.

Measurement and crediting tools for ecosystem services can assist the transportation planning and implementation process by improving the mitigation of environmental impacts through reduced transaction costs, improved environmental outcomes, and a potentially shortened time frame for project implementation. Such tools also hold the promise of providing critical information to transportation agencies for the development of environmental performance measures.

Ecosystem service credits are essentially units of environmental benefit. In theory, credits are created through the conservation or high-quality restoration of naturally functioning ecosystems. The credits can quantify items that range from the provision of clean water for community drinking supplies, to the pollination of agricultural crops, to the sequestering of carbon to help mitigate climate change. Of the quantifiable items, carbon, water quantity and availability for drinking and irrigation, endangered species, and water quality are the closest to having established crediting systems or methodologies that DOTS and MPOs can use. Tools for water quality crediting, particularly for nitrogen, phosphorus, and temperature, are well into development. However, erosion and stormwater crediting systems still need extensive work and have been identified as a priority for transportation research.

Market opportunities include existing conservation and mitigation banking systems or payment for ecosystem service programs. Payment for ecosystem service programs are negotiated contracts with landowners to maintain a certain level of environmental performance that preserves or enhances ecosystem services. These programs provide various benefits to DOTS; the benefits include reduced uncertainty associated with a project and its environmental analysis, the transfer of liability to another party responsible for providing and maintaining the service, and adherence to mission alignment because agencies that build roads may have difficulty maintaining ecosystem function. Although payment for ecosystem service systems have great potential power for ecosystem preservation, some criticisms have been made of them (7); these criticisms include the risk that economic arguments about services valued by humans will overwhelm and outweigh noneconomic justifications for conservation and the concern that there is no clear way to track the performance of the system.

**Crediting Systems and Mitigation**

A crediting system should address site design and selection and include a robust analysis of the data on the watershed or landscape in which the compensatory mitigation project is being proposed. Much of the background work to create the system is developed in the earlier steps of the IEF, but when it comes to mitigation, either through a mitigation or conservation bank, an in-lieu fee program, or another compensatory mitigation mechanism, planners should try to characterize a watershed or ecosystem’s functions. There is often some confusion between functions and ecosystem service values, and in general the differences do not impact transportation planners very much. However, when dealing with wetlands and streams, the regulatory community requires that the functions and values both be maintained or replaced (8). Therefore, in the siting and designing of compensatory mitigation projects, it is necessary to ensure that the site will improve the overall condition of a hydrological or ecological unit and provide, at least, the important functions to be credited.

Many states have or are in the process of developing mitigation programs and programmatic agreements to address wetland impacts; a few states have been developing similar programs for endangered species. It is also possible to create crediting tools for transportation by working with regulators to develop methods to measure, map, and value services such as stormwater improvement or water quality (e.g., total maximum daily load or Section 303(d) of the Clean Water Act) nutrient abatement. Trading can lead to programmatic agreements and preapproved mitigation areas with established credits for multiple types of credit. Standard methodologies are needed to enable transportation agencies and MPOs to measure the ecosystem services and functions being lost from project impacts or gained from rehabilitation. Crediting systems, as implemented by transportation agencies for a single service, often focus on regulatory requirements that are based on the areas impacted, so fiscal valuations may not be required.

**Credits and Monetization**

The use of monetary value provides a common scale for the valuation of impacts. Fiscal-equivalent values for some impacts (e.g., emissions) are already used by some DOTS for cost-benefit analysis or, more precisely, life-cycle benefit-cost analysis. In California, such analysis is performed with the California Life-Cycle Benefit-Cost Analysis Model to monetize impacts such as accidents or vehicles emissions (9). Other impacts, such as noise or water pollution, could be monetized as well. Monetary valuation methodology can create problems when ecosystem attributes, such as biodiversity, which can be very difficult to price (10), are addressed. Many wetland functions result in goods and services that are not traded in markets and therefore remain unpriced. It is necessary to value these goods or services through a nonmarket valuation technique. Wetlands and transportation are good examples of the process of nonmarket valuation, because wetlands losses are regulated, and addressing wetland impacts often involves several state and federal agencies and projects related to transportation system planning, expansion, and maintenance.

The first step in putting a fiscal equivalent on wetland credits is to understand what characteristics of the wetland can be valued. The functions, uses, and values of wetlands must first be summarized. Wetland functions represent different ecological processes (e.g., photosynthesis), characteristics (e.g., water depth), and structure (e.g., fauna and flora). Wetlands provide services (e.g., flood control) and goods (e.g., edible fish). At this stage the connection is made between ecology and economy; many wetland uses can be monetized because links can be made between wetland uses and human activity. Yet the monetizing of wetland uses is not direct, is often inaccurate, and depends on what type of use is considered. In addition, decision making regarding wetlands does not have to rely on monetization to include the value of the wetlands.

**IMPLICATIONS FOR TRANSPORTATION PRACTICE**

The estimated value of transportation project impacts on environmental attributes can be used to guide the allocation of resources to lessen the total environmental costs of projects and as part of a benefit-cost analysis of optimal investment in transportation modes and infrastructure (5). The valuation of environmental attributes and the corresponding credits may be used at several points during the transportation planning process: the regional planning process, the system planning process, the corridor planning process, the project development stage, and the programming stage. The development of
actual credits at these different planning stages is likely to require tools or methods appropriate for the spatial–temporal scale of the analysis and the level of detail needed. Valuation and credits for regional planning may require a lower-resolution analysis of the impacts and the calculation of equivalent values to provide a general but coarse overview. Valuation for corridor or project planning may require a higher-resolution analysis of the impacts and the corresponding credit values to enable a choice to be made between project alternatives. It is possible that regional valuation will provide cost savings for the valuation process because of economies of scale. Once equivalent values are found within a region, they may be more legitimately applied to places within the region through the benefits transfer approach. The calculation of the total environmental value or cost of transportation may be more feasible at the corridor or project scale because more detailed information is likely to be available at those scales.

**Environmental Valuation in the Regional Transportation Planning Process**

Regions are appropriate scales for the analysis of certain impacts from transportation systems (e.g., ecological region biodiversity and air quality). MPO regions develop and adopt long-range transportation plans that aggregate the desires of member municipalities and counties for transportation system development. Through MPOs, valuation methods provide institutional frameworks for analysis, decision making, and programming (17). Regions are also suitable scales of analysis for almost all surface transportation-related impacts and benefits and are excellent scales for the planning of transportation systems as networks of interconnected modes and infrastructures. At regional scales, valuation and crediting could establish (a) the links between impacts and the corresponding ecological outcomes, (b) the credit value system that enables comparisons between dissimilar objects and the estimation of total costs of credits, and (c) agreements about the rules used for valuation and credits in eventual project delivery.

**Environmental Valuation in the Corridor–System Planning Process**

Transportation agencies conduct system planning and establish long-term corridor plans. The corridor scale implicitly includes the project scale and is a subunit of the regional and district scales. Planning on this scale provides an important means for reducing the harm from transportation impacts and an opportunity to remediate current harm and mitigate future harm. The corridor scale also provides an opportunity to organize multidisciplinary planning that looks at the whole range of changes in the transportation system, along with long-term operations and maintenance and the environment and human communities. At this scale, valuation and crediting could tier from the regional system and consist of (a) comparing values between projects proposed along a single corridor, (b) comparing values between corridors in a regional network, (c) seeking agreement on corridor-specific value or credit trade-offs between involved parties, and (d) programming long-term actions along and among corridors on the basis of credit values and corresponding costs.

**Environmental Valuation at the Project Development Stage**

The project development stage requires the comparison of project alternatives in environmental analysis and permitting, the estimation of benefits and values, and the estimation of costs. The valuation of environmental attributes could be used at this stage to evaluate the potential environmental impacts associated with each project alternative from a change-in-value point of view and better estimate the mitigation credits (and the corresponding costs) required to offset environmental impacts. If considerations of environmental attributes had been anticipated by valuations in previous planning phases, this process would be streamlined and the projected estimates could be refined. At this scale, valuation and crediting could use the information and agreements arrived at on higher-order scales to (a) describe exactly the value change associated with each project alternative, (b) describe the corresponding credit loss and gain from impacts and mitigation actions, and (c) gain agreement between all the parties involved that a particular action, bank, or mitigation package results in the greatest net value.

**Environmental Valuation at the Programming Stage**

At the programming stage, state decision-making entities require transportation agencies to evaluate their regional transportation plan or their interregional transportation improvement program. Some states use formal models that incorporate project benefits [such as travel time savings, vehicle operating cost savings, safety benefits (e.g., cost savings from avoiding accidents), and emissions reductions] and costs (such as direct project costs, mitigation costs, and transit agency cost savings). For example, the California Department of Transportation uses the California Life-Cycle Benefit–Cost Analysis Model to evaluate the return on investment during the project life cycle. Currently, the California Life-Cycle Benefit–Cost Analysis Model and similar DOT models do not estimate values for most environmental impacts, and such estimation is not required under the principal environmental and transportation laws, including the National Environmental Policy Act and the Endangered Species Act (ESA), that govern the required assessments. New directions in federal transportation law are intended to enhance the consideration of environmental issues and impacts within the transportation planning process. The incorporation of the values of environmental impacts early within transportation planning and analysis can better account for the benefits and costs that society may incur. Through this incorporation, project programming decisions would be partly based on maximizing the environmental benefits and accounting for the environmental values that are lost and gained by various alternatives; this process would be an important advance in sustainable transportation planning. The conversation would be usefully informed by a demonstration of how the environmental values were considered within different orders of decision making (e.g., at the corridor scale) and what process was used to arrive at an agreement on the benefits and credits associated with different construction and mitigation packages.

**EXAMPLES OF CREDITING STRATEGIES**

**California State Highway 37 Stewardship Study (SHRP 2 Project C-21)**

In its pilot test of the tools from the IEF, the University of California, Davis, Road Ecology Center developed a novel crediting strategy that employed nonmonetary and monetary valuation approaches. To be functional, the accounting or credit system would need to provide a way to indicate relative or absolute effects or impacts and
North Carolina has implemented the Ecosystem Enhancement Program (EEP), entirely funded by the North Carolina DOT. The program, which is part of the North Carolina Department of Environment and Natural Resources (DENR), works with watershed groups throughout the state to establish restoration and mitigation priorities and create the equivalent of a statewide programmatic for Clean Water Act issues. This process is possible because the North Carolina DENR also administers the state’s water quality program. Although ESA issues are not an important part of the EEP, the North Carolina Natural Heritage Program, which manages the ESA location information for the state, is also part of the North Carolina DENR and provides information to the EEP office to ensure that state ESA priorities are addressed in the restoration priorities. In 2001, the North Carolina DOT reported that 55% of its transportation developments were delayed by wetland mitigation requirements. After streamlined transportation planning and mitigation through the EEP had been ramped up, from 2003 to 2010 there were no delays in transportation improvement projects associated with the EEP (12). According to the North Carolina DENR program accomplishment report from 2010, the EEP met more than 97% of all mitigation requirements assumed since 1996, and more than 80% of all the EEP’s current stream mitigation credits and 95% of its wetland credits were in a post-construction phase of maturity. A recent detailed study of the EEP determined that the program allowed mitigation to occur at significant distances and in different locations from the impacts. This situation could create concerns related to losses in ecological and landscape function, and the study recommended that these concerns should be addressed in both mitigation policy and crediting program implementation (13).

Oregon’s Willamette Partnership

Among the most current and potentially useful work related to an overall crediting system for transportation is a set of overlapping projects undertaken by the Willamette Partnership. The work was initially focused on Oregon’s Willamette Basin but has expanded to measure the potential performance of credits, usually in the context of mitigation. Credits in this study were proposed as scores on a unitless scale from zero to 100, and scores were given to alternatives for five themes: transportation, environment, cost, community, and reversibility. Each theme was accompanied by indicators of impacts within each theme; this process allowed the development of stewardship-oriented scenarios, as well as the evaluation of the actual impacts that accompanied each scenario. The normalization of impacts to a zero to 100 credit scale was an end in itself and served as an intermediate step for subsequent conversion to scalar equivalents for those system attributes for which scalar equivalents were known. Because these equivalents were usually approximately at best, the unitless credit scale permitted valuation without the inexactness of monetizing the benefits and disbenefits (including costs) of various project choices. For the environmental theme for this corridor, the nearby tidal and freshwater wetlands provided constraints and opportunities for stewardship planning. Because of the unique potential for wetland restoration on the Highway 37 corridor, there were few possibilities for mitigation banking strategies or payments for ecosystem services.

The valuation and crediting approach developed in this study was based on the quantification of impacts within the area of the highway in question. The approach was also based on expert and public evaluations of how well a given project alternative met particular transportation and nontransportation needs. This approach was a nonmonetized contingent valuation, and one result from this approach is shown in Figure 1. In this case, five scenarios for the highway were considered in terms of their relative benefits and disbenefits, and a unitless scale from zero to 100 was used. A low credit score indicates a potentially mitigable inadequacy in that area for that scenario. The expanded footprint scenario (a rough doubling of the right-of-way onto wetlands) provided desirable transportation benefits but required additional action to improve or mitigate the environmental disbenefits. In comparison, the Napa–Sonoma Causeway scenario (which included the expansion of the right-of-way, but on a causeway across the wetlands) provided similar transportation benefits but required few, if any, environmental credits and little mitigation.

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FIGURE 1  Stakeholder approximation of credits received by alternative highway scenarios in each area of value.
cover much of the Pacific Northwest and, in water quality trading, the entire United States. The project focuses on expanding the protection and restoration of ecosystem services by utilizing planning products and decision support tools that model the economic value of natural processes under different development and conservation scenarios. To date, the Willamette Partnership has developed one of the most advanced and comprehensive structures to integrate the economic values of ecosystem services into multiple regulatory programs that require compensatory mitigation.

The Willamette Partnership is a nonprofit organization, under Section 501(c)(3) of the Internal Revenue Code, that is focused on developing markets based on detailed accounting procedures for multiple types of ecosystem service credit. The Willamette Partnership has worked to create science-based ecosystem service quantification methods in partnership with regulatory agencies and agencies that need ecosystem credits. The process, called Counting on the Environment, is a multistakeholder agreement to use a shared accounting system for the quantification of impacts and benefits to ecosystems in a market-based or mitigation banking system. The quantification methods and associated crediting protocols are designed to measure the functions and values associated with improvements and impacts to separate ecosystem services. Tools for measuring improvements and damage to wetland habitat, upland prairie habitat, sagebrush and sage grouse habitat, salmon habitat, nitrogen and phosphorus loadings, thermal pollution offsets, and stream condition have been developed. Several site-based calculation methods have already been approved by state and federal regulators, including those for salmon, prairie, wetlands (tied to the Oregon Rapid Wetland Assessment Protocol), and water temperature.

The partnership’s general crediting protocol, which provides the rules for the ecosystem service accounting system, references priority areas for ecological improvements to salmonid habitat, prairie habitat, wetland habitat, and water temperature impairments. The partnership identifies (a) priority rivers and streams for improved salmon habitat on the basis of National Marine Fisheries Service data, (b) priorities for investment in prairie habitat and thermal pollution mitigation on the basis of the Willamette Basin synthesis map, and (c) priorities for wetland mitigation on the basis of the wetland priorities identified in the synthesis map in areas surrounded by high-function wetlands, as determined by the Oregon Rapid Wetland Assessment Protocol, or in wetland complexes with the highest restoration or mitigation scores in the newly developed state wetlands coverage (14).

The Willamette Partnership is currently working with the Oregon DOT and the Oregon Department of Fish and Wildlife to develop quantification tools and protocols to pilot a mitigation banking approach to meet fish passage requirements for Oregon DOT projects. Results from the pilot will be available for review in June 2014 and should allow the Oregon DOT to create a crediting system for any maintenance or construction work that impacts a culvert, of which there are more than 100,000 in Oregon.

Washington State’s Thurston County

Relevant to transportation agencies that are creating a general crediting framework is a project recently developed by the Willamette Partnership with Thurston County, Washington, and its MPO (the Thurston Regional Planning Council and MPO). The project is built on the prairie calculator, a site-specific valuation methodology designed for native prairies and their species in Oregon’s Willamette Valley. The purpose is to develop a crediting system with an interim permitting strategy and a habitat conservation plan to address the conservation of three species: the Taylor’s checkerspot butterfly (Euphydryas editha taylori), federally proposed to be listed as endangered, and the streaked horned lark (Eremophila alpestris strigata) and the Mazama pocket gopher ( Thomomys mazama), federally proposed to be listed as threatened. The methodology includes tools to quantify the potential prairie impacts and the associated benefits from the proposed mitigation. The methodology’s protocols and templates help make development and conservation decisions predictable and transparent. The methodology is being built from the Species and Habitat Assets and Risk Prioritization framework developed by Environ and perfected for use in the Puget Sound. The Species and Habitat Assets and Risk Prioritization framework is a geospatial model that characterizes habitat suitability on the basis of factors such as vegetation, structural- and management-based impacts, and species presence. The Willamette Partnership’s accounting protocols are added to track, verify, and report on the credits and debits that result from actions on South Puget Sound prairie ecosystems. This project demonstrates both the practicality of modifying a set of protocols developed elsewhere to develop a crediting system and the need for additional resources to address local political and ecological issues.

REGULATORY CONSTRAINTS AND INSTITUTIONAL BARRIERS TO IMPLEMENTING CREDITING SYSTEMS

Local Government Issues with State, Regional, and National Crediting Systems

Large-scale crediting strategies or conservation frameworks sometimes identify mitigation banks and restoration priorities that occur outside local jurisdictions—that is, local governments sometimes see these efforts as reducing their opportunities to conserve open space, wetlands, and the amenities associated with these lands. As a result, local opposition, especially in communities in which local jurisdictions have significant regulatory authority, can become a barrier to the implementation of crediting. Not many studies have examined this issue, but recent work in Oregon, in the city of Gresham and in the water management district for the Tualatin watershed, demonstrated that a major obstacle to scaling down prioritization from the statewide level to local levels is the lack of equivalent data sets. Many of the characteristics needed to identify mitigation priorities that may be available at the local level, such as species distributions linked to stream reaches, are not available for entire watersheds. Several means to solve the data issue have been recommended, including coordinating regional data collection efforts with local efforts and creating incentives to get local jurisdictions to provide updates on attributes such as wetland boundaries to state agencies and groups that are developing regional priorities.

Aside from barriers related to the scale and availability of information, there can be real issues when the areas best suited for restoration and mitigation are located within a watershed but outside the jurisdiction in which the mitigated losses are occurring. An ecosystem services framework may be well suited to address these issues because increased property values attributable to adjacent open space or recreational opportunities could eventually be included in the analysis that identifies priority mitigation sites. However, regulatory agencies are likely to focus initially on the ecological replacement and restoration needs.
Regulatory Constraints

Most of the regulatory constraints related to developing or implementing a crediting protocol result from traditional regulatory barriers. Examples include insisting that mitigation occurs at or immediately adjacent to the project location or general distrust that transportation planners might be searching for alternatives to best restore or protect the resource. Most, if not all, regulatory agencies are interested in moving to functional approaches that allow for more effective and efficient mitigation projects. However, many regulators are so overwhelmed with current permit processing tasks that they find it impossible to make the time to understand and implement a new approach, even if it would be faster and more efficient. The sharing of projects already implemented elsewhere in the agency could overcome this barrier.

Funding and Organizational Barriers

One of the biggest institutional challenges to creating a regional ecosystem framework and developing a valuation and crediting system for ecosystem services is convening the transportation and resource agencies and deciding who will lead, maintain, update, store, track, and fund such an effort (15). This challenge results from agencies working in isolation from one another and occurs at both the state and federal levels. In some instances, a regional or watershed conservation strategy with goals and objectives could be owned by the Army Corps of Engineers, the Bureau of Land Management, the Environmental Protection Agency, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the U.S. Geological Survey, the National Oceanic and Atmospheric Administration, and other agencies. A positive example of this agency ownership occurred with the Maryland Watershed Resource Registry, which was developed jointly by the Environmental Protection Agency and the Army Corps of Engineers, with assistance from the U.S. Fish and Wildlife Service, through a number of large-scale multispecies programmatic agreements (16); the registry has now been adopted by most Maryland state agencies. However, current federal agency cooperation mostly involves communicating what each agency is doing; such cooperation rarely (except in such cases as the Landscape Conservation Cooperatives) involves two agencies in the same department working together. In addition, mechanisms for integrating watershed- or local-scale priorities, methods, or plans into statewide or regional priorities, methods, or plans rarely exist, and almost never in state or federal government agencies.

CONCLUSION

It is unlikely that any DOT or MPO will be able to find a simple tool for the easy establishment of a crediting framework, in spite of the large number of organizations and companies that will suggest that they have or can easily build such a tool. The measurement of environmental improvements that result from restoration or mitigation or of the degradation that results from construction, maintenance, or adjacent growth is never going to be simple. Over time, advances will be made to simplify the measurement of ecosystem services, and more advanced methods to model how restoration may impact stream hydrology and flooding will be developed. However, determining how to understand these environmental changes is less critical to establishing the crediting framework than is the maintenance of the partnership between the transportation and development community and the regulatory community.

States as politically different as North Carolina and Oregon have been able to establish statewide or regional crediting approaches and programs for environmental mitigation, which before the systems were in place had created significant barriers to capacity improvement and maintenance permitting. To succeed in building a crediting system with broad support, MPOs and DOTs must avoid caring only about permit streamlining and focus on working with the conservation and regulatory community to establish goals and methods that measure ecosystem impacts and values and that protect, restore, and rehabilitate important areas. The use of environmental values in planning can demonstrate to the regulatory community that avoidance and minimization are a critical part of all the operations of an MPO or a DOT and allow the crediting framework to focus on environmental improvement.

The simplest way for MPOs and DOTs to succeed is to take one of the existing systems that have been shown to work and modify that system to work locally. This modification could mean getting state or regional agreement on what ecosystem values to consider in transportation planning and what credit values can be used to facilitate communication and agreement about mitigation. It is essential to address local geographical, ecological, and biological issues, as well as political and institutional relationships. If this process is conducted in concert with the nine-step IEF, MPOs and DOTs will have a regional ecosystem framework to build on and some meaningful conservation priorities that can motivate the conservation and regulatory community to embrace a crediting system that provides additional resources for rehabilitation and conservation.

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