

# **Ecosystem Services and Land Management Plan Revision: Preliminary Observations of Three Ecosystem Services Evaluation Framework Workgroup Members**

Chris Miller, Kawa Ng, and Nikola Smith



FEDERAL AGENCY EXPLORATIONS AND APPLICATIONS: CASE 9  
U.S. Forest Service

**Ecosystem Services and Land Management Plan Revision:  
Preliminary Observations of Three Ecosystem Services  
Evaluation Framework Workgroup Members**

Chris Miller, U.S. Forest Service  
Kawa Ng, U.S. Forest Service  
Nikola Smith, U.S. Forest Service

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## About This Document

This case is part of the Federal Resource Management and Ecosystem Services (FRMES) Guidebook created by the [National Ecosystem Services Partnership](#) (NESP). NESP, housed at the [Nicholas Institute for Environmental Policy Solutions](#), seeks to enhance collaboration within the ecosystem services community and to strengthen coordination of policy implementation and research at the national level. The FRMES Guidebook represents a collaborative effort by federal agencies and outside experts to develop a credible and feasible approach to incorporating ecosystem services into the decision-making processes of federal agencies.

Cases are written and approved by the author(s)' agency, but they have not been peer reviewed. They describe the decision-making context within which that agency is considering or testing an ecosystem services management framework, and they present approaches or innovations that the agency is using to incorporate ecosystem services into its planning and decision-making processes. Cases informed development of the FRMES Guidebook and could be of value to others embarking on ecosystem services planning and management efforts.

To read other federal agency explorations and applications of an ecosystem services management framework, visit [www.nespguidebook.com](http://www.nespguidebook.com).

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# **Ecosystem Services and Land Management Plan Revision: Preliminary Observations of Three Ecosystem Services Evaluation Framework Workgroup Members**

To comply with the requirements of the 2012 National Forest Land Management Planning Rule, the National Forest System is revising land management plans for national forests, grasslands, and prairies.<sup>1</sup> This case example presents preliminary observations regarding application of ecosystem services concepts to this effort.<sup>2</sup>

## **Decision Context and Agency Capacity**

### ***Regulatory Background and Policy Direction***

Planning for the management and use of the National Forest System (NFS) must conform to the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) as amended by the National Forest Management Act of 1976 (NFMA), implementing regulations in 36 CFR Part 219, the National Environmental Policy Act (NEPA) associated regulations in 40 CFR 1500-1508 and 36 CFR 220, and Multiple-Use Sustained-Yield Act of 1960 (MUSYA).<sup>3</sup> Each NFS unit (i.e., national forest or grassland) has a land management plan developed in compliance with the 1982 planning rule, which was revised on April 9, 2012 (*77 Fed. Reg.* 21162).<sup>4</sup>

The 2012 planning rule was developed after more than two and a half years of public input, including more than 300,000 public comments. Its framework sets forth process and content requirements to guide the development, amendment, and revision of land management plans to maintain and restore NFS land and resource ecosystems while providing for ecosystem services and multiple uses. Specifically, it states:

§ 219.1 Purpose and applicability... (c) Plans will guide management of NFS lands so that they... have the capacity to provide people and communities with ecosystem services and multiple uses that provide a range of social, economic, and ecological benefits for the present and into the future...

§ 219.6 Assessment... (b) In the assessment for plan development or revision, the responsible official shall identify and evaluate existing information relevant to the plan area for: ... (7) Benefits people obtain from the NFS planning area (ecosystem services)...

§ 219.8 Sustainability... (b) Social and economic sustainability. The plan must include plan components... to guide the plan area's contribution to social and economic sustainability, taking into account: ... (4) Ecosystem services...

§ 219.10 Multiple use... (a) Integrated resource management for multiple use. The plan must include plan components... for integrated resource management to provide for ecosystem services... When developing plan components for integrated resource management, to the extent relevant to the plan area and the public participation process and the requirements of §§ 219.7, 219.8, 219.9, and 219.11, the responsible official shall consider: (1) ecosystem services...

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<sup>1</sup> [http://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb5362536.pdf](http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5362536.pdf).

<sup>2</sup> The authors have had limited opportunity to review early-stage plan revisions under the 2012 planning rule. Therefore, this paper represents a preliminary understanding of the U.S. Forest Service's experience with addressing ecosystem services.

<sup>3</sup> RPA:

[http://www.fs.fed.us/emc/nfma/includes/range74.pdf#search='Forest%20and%20Rangeland%20Renewable%20Resources%20Planning%20Act%20of%201974'](http://www.fs.fed.us/emc/nfma/includes/range74.pdf#search='Forest%20and%20Rangeland%20Renewable%20Resources%20Planning%20Act%20of%201974); NFMA: <http://www.fs.fed.us/emc/nfma/includes/NFMA1976.pdf>;  
MUSYA: <http://www.fs.fed.us/emc/nfma/includes/musya60.pdf>.

<sup>4</sup> <http://www.fs.fed.us/emc/nfma/includes/nfmareg.html>.

The 2012 planning rule defines ecosystem services as benefits people obtain from ecosystems, including

- Provisioning services, such as clean air and fresh water, energy, fuel, forage, fiber, and minerals;
- Regulating services, such as long-term carbon storage, climate regulation, water filtration, soil stabilization, flood control, and disease regulation;
- Supporting services, such as pollination, seed dispersal, soil formation, and nutrient cycling; and
- Cultural services, such as educational, aesthetic, spiritual and cultural heritage values, recreational experiences, and tourism opportunities.

The 2012 planning rule seeks to ensure that ecosystem services are not overlooked by requiring forest plans to include components, such as standards and guidelines, designed “to provide for ecosystem services and multiple uses” (36 CFR 219.10(a)). Ecosystem services are benefits that the national forests and grasslands have always provided while being managed for multiple use. The Multiple-Use Sustained-Yield Act calls for national forests and grasslands to be managed for “outdoor recreation, range, timber, watershed, and wildlife and fish purposes” (16 USC 528). The planning rule requires that plans provide for ecosystem services as part of integrated resource management.

The ecosystem services provided for in the 2012 planning rule are clearly related to multiple-use management. For example, the ecosystem services of water filtration, purification, and storage and flood control are all generated by and support effective management for watershed purposes. The 2012 planning rule provides an integrated resource management approach whereby interdependent elements of sustainability are considered as a whole, instead of as separate resources or uses. The mix of plan components in each land management plan will reflect local conditions in the broader landscape, the best available scientific information, and public input.

### ***Early Adopter Observations***

Eight national forests and grasslands have been selected to be the first to revise their land management plans using the 2012 planning rule. These early adopters include the Nez Perce and Clearwater National forests in Idaho, the Chugach National Forest in Alaska, the Cibola National Forest in New Mexico, the El Yunque National Forest in Puerto Rico and California’s Inyo, Sequoia, and Sierra national forests. Some are in the process of conducting assessments (developing core teams, obtaining input from planning team staff, and preparing for public engagement). Others are finalizing assessments and beginning to develop alternative plan components that guide contributions to ecosystem services, and some are considering strategies for analyzing potential changes in ecosystem services and conducting trade-off analyses. The key players in these efforts have been Forest Service staff at individual units, regional offices, and enterprise units (where resource and discipline-specific capabilities can be contracted out).

Approaches to ecosystem service assessments are not prescribed by the 2012 planning rule, and therefore they vary. In one case, the regional office assembled an ecosystem services assessment team from teams of national forest planning specialists. In another case, a Forest Service unit is working with an academic program, state agencies, and research organizations.

Forest Service research staff (1) develop strategies and general technical reports that provide advice for addressing ecosystem services in land management planning, (2) participate in agency ecosystem



service workgroups, and (3) manage a forum for agency practitioners to communicate and coordinate work related to ecosystem services. In Region 5 (California National Forests), for example, Forest Service research station staff have been involved in developing strategies for an ecosystem services assessment and are assisting with implementation. Third-party contractors are helping with community participation/engagement processes and evaluating and quantifying ecosystem services with GIS-based tools.

## **Analysis and Implications**

### ***Regulatory Background and Policy Direction***

The types of ecosystem services to be considered in a specific land management plan will depend on the individual Forest Service units, will be identified during the assessment phase, and may be tracked throughout the planning process. Services incorporated in the plan may be but are not required to be included in the monitoring program.

Forest Service directives (i.e., Forest Service Handbook) for implementing the 2012 planning rule were proposed and published for public comment in 2013 and are expected to be finalized in 2014.

According to the proposed directives, the ecosystem services that are to be identified and evaluated are those that “are most important to people in the broader landscape and those that would be most affected by the land management plan” (i.e., “key” ecosystem services). The proposed directives identify six types of information that should be but are not required to be considered in ecosystem services assessments:

- Key ecosystem services contributions by the plan area;
- The geographic scale at which the plan area contributes to ecosystem services (e.g., watersheds, counties, regional markets, or eco-regions);
- The condition and trend of these key ecosystem services;
- Drivers likely to affect future demand for and availability of key ecosystem services;
- The stability or resiliency of the ecosystems or key characteristics of ecosystems that currently maintain the plan area’s key ecosystem services; and
- The influence of non-NFS lands or other conditions beyond the authority of the Forest Service that influence the plan area’s capacity to provide ecosystem services.

Identification of key ecosystem services should be collaborative and influenced by the best available scientific information.

Because many ecosystem goods and services exist outside of traditional market economies, researchers and others often use non-market values to quantify them. The 2012 planning rule does not require the Forest Service to determine non-market values or to quantify non-market benefits, but it does require plan components to guide contributions to economic sustainability. Consideration of market and non-market benefits may be carried out qualitatively or quantitatively, which may encompass monetary or non-monetary metrics. Additionally, in a number of sections (e.g., assessment at § 219.6(b), social and economic sustainability at § 219.8(b), and multiple use at § 219.10(a)), the planning rule requires consideration of ecosystem services and multiple uses, including provisioning, regulating, and cultural services, all of which involve numerous non-market goods and services. These requirements, in combination with public participation throughout the planning process (§ 219.4), are expected to improve the Forest Service’s ability to acknowledge the relative values of market and non-market goods and services.

As part of the process to comply with the National Environmental Policy Act (NEPA), environmental documents supporting planning decisions are expected to discuss comparative benefits and tradeoffs

associated with key ecosystem services. The Forest Service is aware of many methods and tools to do so (e.g., InVEST, ARIES, Solves, habitat benefit transfer, and spatial benefits analysis). These methods and tools vary in complexity and data/time requirements. To help Forest Service planners evaluating ecosystem services, the agency is developing its own guidance, including drafts of an ecosystem services evaluation framework (ESEF) (see Appendix A).

### ***Early Adopter (and ESEF) Observations***

#### *Identification of Ecosystem Services*

Early adopters are drafting initial lists of ecosystem services for their respective units. These lists reflect the influence of the Millennium Ecosystem Assessment (MEA) classification system.<sup>5</sup> The services thus far identified include

#### Provisioning services

- Timber
- Grazing (livestock forage)/range
- Water quantity (and quality)
- Clean air
- Animals and plants as food
- Energy (biomass, geothermal, hydropower, and wind/solar)
- Wood as renewable energy and fuel source

#### Cultural services

- Recreation (including hunting, fishing, developed recreation, and wildlife viewing)
- Aesthetics
- Cultural heritage and sense of place
- Education, science, and health
- Research (support or source of scientific knowledge)
- Tribal knowledge

#### Regulating services

- Water quality
- Water regulation (quantity and timing)
- Water filtration
- Flood control
- Carbon sequestration (and climate regulation)
- Fire resilience

#### Supporting services

- Biodiversity
- Sustaining biodiversity, intact ecosystems, and connectivity for global ecological processes
- Nutrient cycling

Managers of early-adopter forests have interpreted application of the classification of ecosystem services within the MEA in various ways, as indicated by the inclusion of water quantity in both provisioning and regulating services. Some early adopters include supporting services as candidates for

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<sup>5</sup> <http://www.millenniumassessment.org/en/index.html>.

key ecosystem services; others, including Region 5, do not. The Region 5 bioregional assessment focuses on final ecosystem services, defined as "...components of nature, directly enjoyed, consumed, or used to yield human well-being," and states that "except for biodiversity, supporting services are not identified as key services but rather become the important underlying processes that help to provide the key services." The Region 5 bioregional assessment also emphasizes the dependence of final ecosystem services on ecological integrity and sustainability (which includes the provision of biodiversity) and notes that the 2012 planning rule requires that national forests be ecologically sustainable.<sup>6</sup> Another early adopter draft assessment also notes that ecosystem services serve as a bridge between ecosystems and human systems.

### *Selection Criteria*

The number of ecosystem services addressed during plan revision could become overwhelming as engagement with the public expands. To prevent this situation from occurring, the Forest Service has emphasized selection of key ecosystem services.<sup>7</sup> For that task, national forest staffs may adopt variations of selection criteria according to

- Interpretations of and relative weights placed on the services most important to people and most affected by the land management plan,
- Prioritization of final rather than intermediate services, and
- Definition of a service or benefit.

### *Information Needs*

To productively discuss selection of ecosystem services, both the FS units and the public need information that allows them to

- Differentiate between supply and demand for services;
- Identify risks and stressors;
- Characterize preferences, needs, or values; and
- Link services to plan components.

Questions can be raised about what level of baseline information is needed to provide a foundation for initiating productive dialogue for identifying key ecosystem services. Too much complexity may hinder initial stages of public and staff engagement; too little information may lead to expansive sets of ecosystem services that creates process burden without helping to focus plan revision on important issues. Some FS units may opt to provide lists of services to jump-start discussion, but doing so could bias the selection process. Alternatively, some units (for plan revision and project development) have asked their staff or the public to describe how they benefit from the national forest or what they value in

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<sup>6</sup> "A stated purpose of the 2012 forest planning rule is that "Plans will guide management of NFS lands so that they are ecologically sustainable and contribute to social and economic sustainability" (36 CFR 219.1(c)). The integration of ecological sustainability with social and economic sustainability is fundamental to the capacity of an ecosystem to provide services to human communities. According to the 2012 planning rule, ecological sustainability "refers to the capability of ecosystems to maintain ecological integrity." (36 CFR 219.19). Ecological integrity is further defined in the rule as "The quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence" (36 CFR 219.19).

<sup>7</sup> Proposed Forest Service Handbook 1901.12 (13.2): "The intent is not to identify all possible ecosystem services provided by the plan area but to identify those ecosystem services that are most important to people in the broader landscape and those that would be most affected by the land management plan. The key ecosystem services identified in the assessment are expected to be tracked further in the planning process."

it. They then relied on agency staff to differentiate between resources, functions, and services and subsequently identified a list of key services.

#### *Assessment Scale*

National forests may contribute to an ecosystem service, the production of which relies on inputs from areas beyond the national forest boundary. The scale of demand for (or population of beneficiaries) may differ from the scale of ecosystem service production. Scale options include bioregions, individual forest plan areas, and sub-plan areas.

#### *Collaborative Capacity*

Within the Forest Service, capacity for collaborative engagement during assessment of ecosystem services varies from national forest to national forest. Strategies (in order of increasing level of rigor) may include the following:

- Initial reliance on staff, followed by public input and comment
- Solicitation of public input through public meetings and comment opportunities; and
- Building of participatory capacity by assessing public knowledge of ecosystem services within communities surrounding the national forest, exploring (researching) options for fostering dialogue/improving understanding, and identifying and leveraging existing programs (e.g., land owner incentive conservation programs) for information about ecosystem service awareness and knowledge.

Some early adopters have held workshops to facilitate identification and selection of ecosystem services. Lessons from those workshops are presented in Appendix B.

#### *Analytical Methods and Tools*

Many methods and tools have been developed or are in development to assess ecosystem services and, more specifically, to value these services using quantitative and monetary measures. These tools, including InVEST, ARIES, Solves, and Habitat Benefit Transfer, range in complexity and data requirements. All these tools and methods must satisfy best available scientific information requirements. Data availability and quality constraints may prove to be a limiting factor in the application of some tools. The U.S. Geological Service and Bureau of Land Management report *Ecosystem Services Valuation to Support Decision-making on Public Lands—A Case Study of the San Pedro River Watershed, Arizona* compares some of spatial landscape-level tools, but early adopters have not reached the phase of planning that would involve these types of tools.<sup>8</sup>

The draft Ecosystem Services Evaluation Framework (ESEF) report and supporting material summarize the functions as well as the advantages and disadvantages of applying some ecosystem service methods and tools in national forest management. The ESEF report is intended to be an advisory (non-authoritative) document that provides a generic set of steps and considerations (criteria) for developing strategies and selecting tools to assess ecosystem services during collaboration and decision making. ESEF steps do not reflect the ecosystem service requirements of the 2012 planning rule; however, the ecosystem services evaluation framework can serve as a resource for addressing ecosystem services in planning. Appendix A describes the framework and efforts to apply portions of it in plan revision.

Some early adopters received assistance with assessment and evaluation of ecosystem services, including identification and selection of key ecosystem services, at workshops. The workshops provided a venue for testing different approaches for facilitating discussions about ecosystem services

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<sup>8</sup> <http://pubs.usgs.gov/sir/2012/5251/sir2012-5251.pdf>.

as they relate to planning. Appendix B summarizes lessons from these workshops, with a focus on the El Yunque National Forest.

*Ecosystem Service Tradeoffs*

None of the early adopters have reached the stage of tradeoff analysis, but they expressed interest in such analysis when examples were presented in workshops. Staffing and information constraints are likely to be a challenge for conducting tradeoff analysis.

## Appendix A: Draft Ecosystem Services Evaluation Framework

The Ecosystem Services Evaluation Framework (ESEF) report is an advisory (non-authoritative) document for evaluating ecosystem services and incorporating them into decision making. Intended users include Forest Service planners and project developers who are responsible for (1) collaborating with the public and advancing a common understanding of the potential values and tradeoffs associated with changes in ecosystem services resulting from management decisions and (2) analyzing and summarizing benefits (or net benefits) and tradeoffs among management alternatives as well as contributing to the standardization and defensibility of ecosystem service evaluations.

The ESEF report outlines three broad, iterative steps (that reflect guidance from other agencies) as well as subtasks for framing and describing the set of important and relevant benefits that people receive from national forest and national grassland resources:

1. Characterize important and relevant ecosystem services and Forest Service contributions to those services
  - a. Describe objectives and scope of decision or action
  - b. Adopt or develop underlying ecosystem services classification structure (e.g., Millennium Ecosystem Assessment classification system)
  - c. Identify important ecosystem services that are relevant to the decision
  - d. Describe how changes in NFS lands affect ecosystem services (incremental effects)
2. Characterize qualitative and quantitative values and dollar indicators for ecosystem services
  - a. Identify the types of values associated with important ecosystem services
  - b. Select methods and tools for characterizing values
  - c. Characterize values for important ecosystem services
3. Apply results (e.g., tradeoff analysis) to decision making or modify prior steps

Neither dollar values nor cost-benefit analysis are emphasized in steps 2 and 3.

Each step and subtask is accompanied by a set of analytical considerations or criteria to identify appropriate tools or to develop analytical strategies/expectations. In addition, each step provides case studies and examples of practices/tools. Templates are included to help users implement the steps.

The ESEF report was developed by a workgroup made up of staff from different deputy areas: Research and Development, State and Private Forestry, and National Forest System. This workgroup shared information about ecosystem service methodologies, including metrics for tracking ecosystem services or ecological conditions for incentive programs.

ESEF steps, subtasks, and considerations were developed to provide a generic framework to address ecosystem services for a variety of decision-making contexts. They do not correspond to the ecosystem services requirements of the 2012 planning rule, nor do they reflect expectations for how to address ecosystem services.

Early adopters of the USFS 2012 Planning Rule have used the ESEF report to different degrees. Some early adopters extracted specific information (e.g., considerations, recommendations, example practices, and case study references) to assist them in developing their own strategy for assessing ecosystem services—that is, to help them (1) describe the link between supporting services and other types of ecosystem services, (2) differentiate intermediate ecosystem services linked to ecosystem conditions and trends from final services that apply more directly to human systems, and (3) list factors affecting the value of ecosystem services.

Other early adopters found the ESEF report complex and lengthy, leading to the authors to develop templates in the form of Excel tables, which were also viewed as too complex or constraining. The ESEF workgroup then developed one template table to facilitate identification of a preliminary list of key ecosystem services. In one attempt to introduce and use the simplified table through conference calls with a planning team, some team members expressed discomfort with the questions posed in the table. In another case, template table questions for initiating dialogue regarding ecosystem services were further distilled into two questions posed to the public (through an interactive Web site): “I benefit from the forest because....” and “have the benefits you receive from the forest been changing over time?”

In yet another case, the ESEF workgroup used the report to craft a set of questions to facilitate face-to-face discussions with selected early adopters. These discussions focused on identification and preliminary assessment of key ecosystem services through questions such as “what services are important to people in the broader landscape?” and “what services would be affected by the forest plan?” The ESEF workgroup also used lists of considerations in the ESEF to frame discussion for identifying indicators and methods for characterizing and changes in the supply and demand of ecosystem services.

## Appendix B: Early Adopter Workshops

The ESEF workgroup held workshops in the summer of 2013 with three early adopters of the USFS 2012 Planning Rule. One workshop included participants from agencies and organizations outside of the Forest Service; two workshops involved participants from the Forest Service alone. The workshops focused on ecosystem services assessment and evaluation to help meet the needs and intent of the rule. They included presentations/instruction, large group discussions, and breakout sessions to identify and select key ecosystem services, to identify indicators and methods for evaluating changes in services, and to evaluate tradeoffs among ecosystem services outcomes. A description of the El Yunque National Forest workshop follows, along with a summary of feedback from participants and the workshop cadre (ESEF workgroup members who include staff from the Washington D.C. and regional offices).

### ***El Yunque National Forest Workshop***

El Yunque National Forest, formerly known as the Caribbean National Forest, is located in northeastern Puerto Rico on the slopes of the Sierra de Luquillo mountains.<sup>9</sup> It encompasses 28,000 acres, making it the largest block of public land in the Commonwealth. El Yunque is the only tropical rainforest in the National Forest System. It supports unique vegetation and habitats and offers tremendous recreation value, clean water, and cultural benefits.

Like many urban forests, El Yunque is affected by development pressure. Concern about related impacts on ecosystem services led the forest to partner with Tania López-Marrero at the USFS Southern Research Station to identify the perspectives of stakeholders on the benefits the forest provides. The project had four primary objectives:

- Assess stakeholders' knowledge of El Yunque's ecosystem services and the factors influencing their availability
- Document the geographic distribution of land cover around El Yunque, particularly the distribution and expansion of urban land cover affecting the national forest and its ecosystem services
- Develop geographic data and a resulting map that can assist in land-use planning efforts that support El Yunque and its ecosystem services, including identification of priority areas
- Explore the potential role of local landowner-incentive conservation programs, including conservation easements, land donations, and land purchases.

The study area included eight municipalities that have a portion of El Yunque within their boundaries. Stakeholders included scientists and forest managers who work in El Yunque, municipal planners and community groups, residents, and nearby landowners. Workshop participants engaged in exercises to list, rank, score, and map services they valued. These services included (in approximate order of importance):

- Water
- Water purification
- Air purification
- Natural hazard moderation
- Carbon sequestration
- Fauna, flora and their habitats
- Recreation
- Maintenance of biodiversity

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<sup>9</sup> <http://www.fs.usda.gov/elyunque>.



- Research and education
- Forest products
- Economic development
- Scenic value
- Human well-being
- National patrimony

Workshop participants were asked to identify change drivers affecting El Yunque’s ecosystem services. Land cover change was the most negative change driver; protected area designation was the most positive.

El Yunque staff benefitted greatly from this research as they began to prepare for Forest Plan Revision in 2012. In June 2013, staff participated in a workshop designed by the USFS Ecosystem Services Evaluation Framework (ESEF) team, which was led by the Ecosystem Management Coordination Office and included staff from the national Forest Management Office as well as the Northern and Pacific Northwest regions. The El Yunque National Forest Planning Team leader played a critical coordination role and provided feedback on workshop strategy and implementation. Planning team members included a forester, wildlife biologist, and recreation specialist. Other workshop participants included representatives of non-governmental organizations, Puerto Rican government agencies, and the research community.

The workshop focused primarily on identification and assessment of key ecosystem services and on work needed for subsequent planning stages in which planning teams develop plan alternatives and describe their effects. Workshop participants reviewed the 2012 planning rule’s ecosystem services content and directives as well as existing information about ecosystem services provided by El Yunque NF and surrounding natural areas.

Services of particular importance included water, recreation, biodiversity, and scenic values. National patrimony was also stressed as a unique service that contributes to cultural identity, history, and sense of place. The significance of national patrimony for constituents and workshop attendees demonstrates the influence of cultural and social values on identification of ecosystem services provided by a landscape. Participants also discussed the importance of highlighting how supporting and regulating services are critical underpinnings of the forest system and cautioned against focusing on final goods and services alone.

Attendees reported enjoying the collaborative process of identifying services. They also acknowledged that such a process could potentially lead to an extensive list of services and discussed the importance of balancing public preferences with a sound understanding of the ecology of the forest and its capacity to sustainably provide specific services that people value.

Following the ecosystem services identification phase, participants selected “key” ecosystem services and discussed the conditions of and the trends and risks for each service. They also discussed data sources that could be used to assess the services. Presentations emphasized that effective ecosystem service indicators are those that measure changes in ecosystem services supply and benefits and that address

- *Incremental changes*, including those resulting from plan components
- *Forest conditions* related to resources and ecological conditions, infrastructure, and use
- *Broad landscape conditions*, including populations benefitting from services, large landscape-scale processes, and complementary contributions by other lands

Workshop facilitators asked that conditions, trends, and risks be considered separately for supply and demand, but it became apparent that doing so was a challenge, because factors affecting supply can be related to demand and vice versa. Increasing demand for drinking water due to population pressure, for example, poses a risk to supply. A more effective approach would be to pose questions such as “how does the condition or trend of water resources affect recreation opportunities and vice versa?” Participants agreed that it is also important to be spatially explicit about conditions, trends, and risks. Spatial specificity can also help minimize tradeoffs by focusing actions in locations that maximize beneficial outcomes and minimize negative ones.

The ESEF workgroup reviewed selected analytical tools and methods for assessing and evaluating tradeoffs among ecosystem services. This portion of the workshop was particularly engaging, because it addressed practical application of ecosystem services concepts. In forest planning, non-monetary measures of ecosystem services value might be most feasible or appropriate. These measures can include other quantitative assessments such as use or satisfaction (e.g., number of visitors accessing trails), qualitative descriptions of importance, or participatory ranking.

The workshop demonstrated that expansion of content related to assessment tools and methods, including development of follow-up training, would be beneficial. Workshop participants expressed interest in webinars and resources that support implementation of concepts introduced in the workshop. Training might include demonstrations of the use of USFS analytical tools and data sources to address ecosystem services and tradeoffs in environmental impact statements.

The workshop provided an effective forum for developing and testing material for demonstrating how ecosystem services frameworks highlight connections between the ecology of the landscape and public benefits, and how they draw attention to stressors on the system (e.g., population growth and climate change) that affect management decision-making. This workshop also demonstrated that simultaneous consideration of processes, functions, benefits, and trends can support better-informed planning activities.

### ***Overall Lessons from All Three Workshops***

The ESEF workgroup facilitated workshops for two national forests in addition to the El Yunque event described above. These workshops demonstrated two overarching needs: to provide a general overview of the ecosystem services concept and to clarify several terms and concepts.

#### ***Providing a General Overview of Ecosystem Service Concept***

An overview or outline of the entire process is needed to clarify how the different stages of ecosystem service assessment and analysis build on one another. Workshop leaders need to explain why ecosystem services are incorporated into the 2012 National Forest Land Management Planning Rule and to stress ecosystem services' contributions to social and economic sustainability.

#### ***Clarifying Terms and Concepts***

Workshop leaders should clarify several terms and concepts. First, they need to clarify supporting and regulating services in the context of intermediate and final ecosystem services and to highlight connections between interim and final services in the context of management activity. They should allow open discussion at the services identification stage and then rely on workshop participants to differentiate between intermediate and final services.

Second, workshop leaders should clarify differences between ecosystem conditions/stocks contributing to ecosystem services and the benefits derived from those conditions/stocks. In that regard, they should consider diagramming the links between ecological conditions and ecosystem services. Differentiating

between supply and benefits (e.g., meeting public needs) of ecosystem services is critical to tradeoff analysis.

Third, workshop leaders should differentiate between how ecosystem services are addressed in assessments as compared with evaluations (e.g., environmental impact statements). Discussion of both tasks in a single workshop may not be practical.

***Cover photo: U.S. Forest Service***

***About the Authors***

**Chris Miller** is an economist with the U.S. Forest Service. He focuses on policy analysis and economic support for forest planning, projects, and rule making.

**Kawa Ng** is an economist for the U.S. Forest Service's Washington Office – Ecosystem Management Coordination Staff, Planning & Analysis Group. In addition to various ecosystem services-related planning and valuation efforts, Ng conducts economic impact analysis and supports other analyses within the National Forest System.

**Nikola Smith** is an ecologist and ecosystem services specialist with the Pacific Northwest Region of the U.S. Forest Service. She assists national forest managers with applications of ecosystem services concepts to land management and is involved with development of markets and payment incentive programs for private forest conservation and restoration. She serves on national U.S. Forest Service teams that are working to advance ecosystem services programming within the agency.

### **About the National Ecosystem Services Partnership**

The National Ecosystem Services Partnership (NESP) engages both public and private individuals and organizations to enhance collaboration within the ecosystem services community and to strengthen coordination of policy and market implementation and research at the national level. The partnership is an initiative of Duke University's Nicholas Institute for Environmental Policy Solutions and was developed with support from the U.S. Environmental Protection Agency and with donations of expertise and time from many public and private institutions. The partnership is led by Lydia Olander, director of the Ecosystem Services Program at the Nicholas Institute, and draws on the expertise of federal agency staff, academics, NGO leaders, and ecosystem services management practitioners.

### **About the Nicholas Institute for Environmental Policy Solutions**

Established in 2005, the Nicholas Institute for Environmental Policy Solutions at Duke University improves environmental policymaking worldwide through objective, fact-based research in the areas of climate change, the economics of limiting carbon pollution, emerging environmental markets, oceans governance and coastal management, and freshwater management. The Nicholas Institute is part of Duke University and its wider community of world-class scholars. This unique resource allows the Nicholas Institute's team of economists, scientists, lawyers, and policy experts not only to deliver timely, credible analyses to a wide variety of decision makers, but also to convene decision makers to reach a shared understanding of this century's most pressing environmental problems.

For more information about the  
*Federal Resources Management and Ecosystem Services Guidebook*,  
visit [www.nespguidebook.com](http://www.nespguidebook.com).

For more information, please contact:

Lydia Olander  
E-mail: [Lydia.olander@duke.edu](mailto:Lydia.olander@duke.edu)  
Phone: 919-613-9713  
Web: <http://bit.ly/1zCpSnt>

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