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Evaluating Ecosystem Services as Management Outcomes in National Forest and Grassland Planning Assessments

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Abstract

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National forest planning and management traditionally have involved addressing a broad spectrum of natural resource issues and ecological conditions to comply with forest management regulations and policies. In 2012, the U.S. Department of Agriculture Forest Service issued a new forest planning rule requiring that national forests and grasslands identify and evaluate information on the ecosystem services provided by plan areas from which people benefit as part of the plan assessment phase of plan revision. Specifically, planning teams are directed now to identify "key" ecosystem services that are both of importance outside the plan area and likely to be affected by plan alternatives. The agency's intent is to integrate ecosystem services into the planning and management process to help ensure forest plans produce more beneficial outcomes for the public while meeting the needs of present and future generations. In this report, we develop and demonstrate a conceptual framework and process that forest planning teams can use or draw upon to address ecosystem services during the assessment phase of planning. We provide several examples regarding how planning teams might identify key goods and services, as well as a worksheet teams might use in their analysis.

Keywords: Ecosystem services, public benefits and costs, National Forest System, forest planning, plan revision, assessment process.

Contents

Introduction

National forest planning and management traditionally have involved addressing and accounting for a broad spectrum of natural resource issues and ecological conditions to comply with forest management regulations and policies. The very mission of the U.S. Department of Agriculture (USDA) Forest Service, "To sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations" (USDA FS 2015b), is broad in scope and calls for fairly comprehensive assessment of what the U.S. public gains from federal management of national forests and grasslands. To achieve its mission, the USDA Forest Service, in 2012, issued a new forest planning rule requiring that national forests and grasslands identify and evaluate information on the ecosystem services people receive from the plan area, as part of the assessment and development phases of forest plan revisions.

However, accounting for, evaluating, and communicating the benefits of forest management to policymakers and the public has long been a challenge, in part, because the forest characteristics and other features from which people benefit often are not well defined, or they are difficult to measure, or both (Kline 2006, Kline and Mazzotta 2012). The integrity of the forest planning and management processes thus depends on forest planning teams and the public developing ways of communicating information about public benefits, so that management options can be identified and evaluated in ways the public both understands and trusts. Recognition of this ongoing challenge is a primary factor in the Forest Service's adoption of the concept of ecosystem services as a way to both describe and evaluate potential forest management outcomes. In fact, the ecosystem services concept also is part of a broader movement, occurring within most, if not all, federal agencies involved in environmental and natural resource management, to conduct agency work and evaluate performance based on ecosystem services outcomes and how they benefit people (e.g., Landers and Nahlik 2013, National Ecosystem Services Partnership 2016). In some cases, increasing collaboration across agencies is leading to the development of approaches that are roughly transferable among multiple agencies when they have similar needs.

Forest planning and management processes depend on forest planning teams and the public developing ways of communicating information about public benefits.

In this report, we develop a conceptual framework and process that forest planning teams can use or draw upon to address ecosystem services during the assessment phase of forest planning, as called for in the 2012 planning rule (USDA FS 2012) and further clarified by directives encoded in the Forest Service Land Management Planning Handbook (USDA FS 2015c). We focus specifically on what we will call "forest goods and services" and provide examples of how forest

goods and services can be identified, the types of information that planning teams might collect about them, and how plan components can be designed to enable national forests and grasslands to continue to provide forest goods and services that the public desires. More broadly, we suggest ways that forest planning teams, with public and stakeholder input, could describe how people benefit from national forests and their management, and how benefits might change in response to forest plan revisions.

Why Include Ecosystem Services in Forest Planning and Management?

During the forest planning process, planning teams are tasked with evaluating the likely effects of planning decisions involving the allocation of forest resources across alternative uses. Some examples might include determining where off-highway vehicle use could occur, where wilderness could be proposed, or where timber cutting could be conducted. Evaluating these effects—including what the public might gain or lose from any given plan alternative—implies (1) consideration of the tradeoffs among the public benefits produced by the forest under alternative plans and (2) the relative worth or value of affected benefits to people. However, evaluating tradeoffs and values is complicated because agency staff and the public often do not have a clear or shared understanding of the full spectrum of public benefits provided by national forests and grasslands. Nor do they often have good information about how particular benefits will be affected by plan alternatives over time, and how the public will perceive any changes in benefits—whether positive or negative. Although some benefits, such as wood products, are fairly easy to quantify and value in monetary terms, other benefits, such as endangered species or cultural experiences, are more difficult to value. The challenges in describing the harder-to-value benefits can create the perception among the public and concerned stakeholders that such benefits are not fully accounted for in national forest planning decisions. Mitigating or alleviating such perceptions—by ensuring that an array of public benefits are considered in forest planning processes—is a principal rationale for the Forest Service's adoption of the "ecosystem services" concept (e.g., Kline et al. 2013: 144–145).

Forest planning involves evaluating and revising desired conditions and objectives across the variety of ecosystems within the plan area. Under the 2012 planning rule, these revisions are expected to reflect information about ecosystem services, as well as uncertainty about stressors, influencing factors, and concerns about resource conditions and trends. Evaluating ecosystem services in forest planning therefore can involve the following:

- Considering a broad set of potentially important or relevant ecosystem services as a step in the identification of a subset of key ecosystem services with which to help weigh management alternatives.
- Considering the effects of various stressors and influencing factors on the provision of, and demand for, ecosystem services.
- Considering production linkages that characterize the relationships between resource conditions that exist within the planning area and the provision of those key ecosystem services of concern to or valued by the public.

The agency's goal is to integrate ecosystem services into the planning process to help produce planning decisions that are more meaningful and transparent for the public and stakeholders. Ideally, the ecosystem services concept enables a fuller consideration of the uses and values of a diverse population of users and other beneficiaries, by creating a common language with which to describe how forest resources and management decisions enable or provide benefits that affect human well-being. The hope is that this will afford planning teams greater opportunities to recognize and communicate potential tradeoffs when presenting and comparing alternative plans. It may also provide a foundation for developing greater understanding and appreciation among public land managers, nonagency stakeholders and stewards, and private landowners from across the broader landscape for how each entity contributes to producing benefits often associated solely with national forests and grasslands.

An often heard question about ecosystem services in Forest Service contexts is, "How does ecosystem services differ from multiple use?" From our perspective, consideration of ecosystem services arguably is a continuation of an evolution in the agency's management philosophy that began with a post-World War II emphasis on sustained timber yield, followed by an emphasis on multiple uses, and then followed by ecosystem management (e.g., Kline et al. 2013). The specific benefits traditionally included among the "multiple uses" considered in the Multiple Use Sustained Yield Act (1960)—including timber, water, range, recreation, and fish and wildlife—all fall within the broad definition of ecosystem services adopted by the Forest Service. Indeed, many economists who have focused on forest management issues, both in the past and present, see little distinction between "ecosystem services" and "multiple uses" (e.g., Kline and Mazzotta 2012: 4-5). Thus, the Forest Service's embrace of the ecosystem services concept can be thought of as an expansion on traditional views of multiple use to acknowledge and include a broader array of benefits provided by ecosystems, combined with a renewed emphasis on communicating to the public the role that management plays in helping to bring about these benefits (e.g., Kline et al. 2013: 142).

2012 Planning Rule Requirements

The 2012 planning rule (USDA FS 2012) directs responsible officials to identify and evaluate existing information about the benefits (or ecosystem services) people obtain from the planning area as part of the plan assessment phase of plan revision.

The 2012 planning rule (USDA FS 2012) directs responsible officials to identify and evaluate existing information about the benefits (or ecosystem services) people obtain from the planning area as part of the plan assessment phase of plan revision. To meet these requirements, the Forest Service Handbook directs planning teams to focus on "key" ecosystem services. Key ecosystem services are those that meet two criteria: (1) they are important to people in the broader landscape or beyond the plan area itself, and (2) they are likely to be affected by the management plan under revision (USDA FS 2015c). The handbook focuses on consideration of key ecosystem services rather than identifying and evaluating all ecosystem services that may be produced by the plan area. Key ecosystem services are inherent to the specific plan area under consideration, whether forestwide or for a smaller area within a forest. What may be a key ecosystem service for one plan area may not necessarily be a key ecosystem service for another plan area.

The 2012 planning rule also directs responsible officials to take ecosystem services into account when developing plan components that contribute to social and economic sustainability (USDA FS 2012). Similarly, the Forest Service Handbook also directs that key ecosystem services be tracked further in the planning process and that plan components must provide for them (USDA FS 2015c). Because of this, the list and description of key ecosystem services initially identified in the assessment phase can be later modified, expanded, or reduced based on information obtained in later phases of the planning process, while still adhering to the definition of key services. Such changes might be necessary when, for example, new information suggests that a given service initially not identified as "key" is later found to be important from a sustainability standpoint. Key ecosystem services may include many of the traditional multiple-use benefits associated with the National Forest System (e.g., timber, water, forage, recreation).

The planning directives note that interdisciplinary (or ID) planning teams should identify and evaluate available information about each of the identified key ecosystem services, including the geographic scale, conditions, and trends of key services (USDA FS 2015c). Information should also be evaluated to help describe the role of critical ecosystem components, lands outside the plan area, stressors, drivers, and socioeconomic conditions in the production of and demand for key ecosystem services. Information of this nature can help to address questions about key ecosystem services that are useful in the development or revision of alternative plan components. Some examples include the following:

- Who is using or benefiting from the national forest, what forest resources are they using or enjoying, and at what geographic scale? How are these uses changing over time? Are there competing or conflicting uses within the national forest?
- How have the forest resource conditions and related ecosystem services been changing over time?
- How are human activities and management decisions on lands outside the plan area affecting the national forest's ability to provide key ecosystem services and benefits?
- How are ecosystem services contributing to local economies and jobs?

The definition of ecosystem services provided in the 2012 planning rule provides a framework for considering the range of benefits that people receive from a forest plan area (text box 1). The 2012 planning rule provides substantial flexibility about how the planning process is to be conducted and how plans are to be written and evaluated to satisfy requirements for addressing ecosystem services. The rule does not require that forest plans identify or provide for every ecosystem service occurring on a national forest or grassland, nor does it outline guidelines for achieving specific levels of ecosystem services. Distinguishing ecosystem services from "multiple uses" also is not required, though planning teams may find that integrating the two may be helpful. For these reasons, planning teams may decide to avoid using the term ecosystem services if it does not resonate with the public, stakeholders, or the planning team itself. For example, planning teams might simply use the terms "forest goods and services," and "forest benefits," rather than ecosystem services. Using alternative terms is allowed as long as they meet the intent of the 2012 planning rule by considering the range of benefits included in the planning rule definition. In this report, for example, we use the term "forest goods and services."

The planning rule does not explicitly require quantification of ecosystem services, but rather expects some characterization of services in forest assessments. Many of the goods and services falling under the "provisioning" and "cultural" categories have traditionally been included for consideration under multiple use, and so some overlap may exist in how planning teams address each of these. Planning teams may find it advantageous to address "regulating" and "supporting services" (text box 1) as simply those ecological conditions and processes that help to sustain the variety of "provisioning" and "cultural" ecosystem services defined in the 2012 planning rule. In these cases, however, planning teams should explain the specific roles of ecological conditions and processes in providing key provisioning and cultural ecosystem services to ensure that the importance and benefits of different forest resource and program specialist areas are adequately recognized and accounted

Text box 1. Operationalizing the Forest Service's 2012 planning rule definition of ecosystem services for use in plan assessment.

Although researchers, policymakers, and practitioners have adopted various definitions of ecosystem services, the U.S. Department of Agriculture Forest Service's 2012 planning rule (36 CFR 219.19) defines ecosystem services as "benefits people obtain from ecosystems." These are further delineated following categories outlined by the Millennium Ecosystem Assessment (2005):

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

Although this classification of ecosystem services can be useful for identifying key services of interest in specific Forest Service planning and management applications, planning teams at their discretion may wish to augment this classification, or develop other terms or classification systems for characterizing various forest benefits relevant to their specific forest or application of interest. For example, planning teams may want to opt for using a more generic "forest goods and services" term in place of "ecosystem services," as we do in this report. It also may be helpful to define ecosystem (or forest) goods and services as the specific forest resources, characteristics, or features that directly benefit people, such things listed among the "provisioning" and "cultural" services categories of the 2012 planning rule definition. Many of the items that fall under the provisioning and cultural categories traditionally also fell under the scope of multiple uses. We consider "supporting" and "regulating" services identified in the 2012 planning rule definition more akin to the ecosystem conditions and processes that help to sustain the delivery of provisioning and cultural ecosystem services.

for in the planning process. Ideally, planning teams should strive to identify and evaluate "final" goods and services, while underscoring "intermediate" goods and services that are critical to sustaining these final goods and services (text box 2).

Lastly, monetary valuation of ecosystem services is not required by the 2012 planning rule. Indeed, some observers have suggested that the Forest Service currently may lack sufficient economics expertise to allow for routine monetary valuation of ecosystem services in forest planning processes, and that for this reason, the agency might best develop reasonable and defensible nonmonetary approaches to evaluating ecosystem services (e.g., Kline et al. 2013). However, nothing precludes planning teams from considering or referencing monetary values as long as they are defensible and consistent with the best available scientific information. Presenting monetary

Text box 2. Final versus intermediate forest goods and services

An important distinction between different forest goods and services is that some are "final," while others are "intermediate." Final goods and services are those directly consumed, experienced, or enjoyed by users or other beneficiaries, while intermediate goods and services are factors that contribute to producing or creating final goods and services. For example, an elk population might be considered a final good or service directly enjoyed by hunters or people who enjoy viewing elk, while forage produced on a forest might be considered (in the absence of a commercial grazing program) an intermediate service that contributes to the production of an elk population. Some goods and services can be both intermediate and final. For example, clean water can be a final service when considered for its role in a community's water supply, but also an intermediate service for its role in maintaining fish populations directly enjoyed by anglers. Ideally, planning teams should strive to identify and evaluate "final" goods and services, as opposed to "intermediate" goods and services. Final goods and services are biophysical features, quantities, or qualities that require little further translation to make clear their relevance or importance to people (Boyd and Krupnick 2009). However, identifying intermediate goods and services, and their role in producing final goods and services, often can be an effective way for determining and characterizing how different management activities or plan alternatives might influence final forest goods and services, and thus affect users and other beneficiaries.

values for ecosystem services can help to characterize the importance of key ecosystem services relative to other more easily valued benefits. When discussing monetary values, planning teams should try to describe the value of the incremental contribution of the national forest or grassland to the production of a given ecosystem service (whether positive or negative), and not simply the total value of the ecosystem service as a whole. For example, if a planning team were to discuss the value of water supplied by a given forest plan area, ideally it should discuss how much the forest or area incrementally contributes to overall supply in the region (e.g., Caldwell et al. 2014) or what the incremental value of water increase or decrease resulting from a plan alternative might be. Although, we do not offer specific guidance on monetary valuation for ecosystem services, several other resources do. Rosenberger et al. (2017), for example, offer data and guidance on monetary values for individual recreation activities. Binder et al. (2017) discuss monetary valuation of other ecosystem services of interest in Forest Service contexts. A good general reference on valuation is Champ et al. (2017).

A Five-Step Process for Evaluating Ecosystem Services in Plan Assessment

The five-step process we outline below is intended to help planning teams comply with the 2012 planning rule by characterizing how people benefit from a given national forest or grassland.

The five-step process we outline below is intended to help planning teams comply with the 2012 planning rule by characterizing how people benefit from a given national forest or grassland, and how those benefits might change as a result of plan revision. Plan revision consists of (1) assessment; (2) plan revision, including the preparation of an environmental impact statement (EIS) as part of the National Environmental Policy Act process; and (3) monitoring. The five-step process we outline addresses specifically the ecosystem services requirements in the assessment phase but can provide preparatory information that can serve as a bridge for considering ecosystem services in the plan revision and monitoring phases as well. We have provided an example worksheet (app. 1) that planning teams could use as an aid to completing the five steps.

Note that this five-step process is a recommendation only. Planning teams and other users are free to modify the approach or adopt a different approach altogether, to best meet the needs of their particular forest or situation when assessing ecosystem services in forest planning. Also note that our five-step process focuses on how planning teams could gather and consider information pertaining to key ecosystem services for a given national forest. Although we do not specifically address public engagement in our process, planning teams may find some sort of public engagement process useful for identifying and evaluating key ecosystem services. We thus encourage planning teams to consider augmenting the five-step process with an appropriate public engagement process so that the identification and evaluation

of key ecosystem services is reasonably representative of public perspectives about the forest of concern. Discussions with forest specialists and other staff also may be useful. Guidance on public engagement is available in the Forest Service Land Management Planning Handbook (USDA FS 2015a), as well as other technical advice maintained by the Forest Service's, National Forest System, Washington office, Ecosystem Management Coordination.

Our five-step process is based on a conceptual framework that defines the relationships among a given national forest or grassland, the goods and services it provides, and specific users or other beneficiaries who enjoy those goods and services as benefits (fig. 1). The term "beneficiaries" refers to anyone who benefits from the national forest or grassland under consideration. National forests and grasslands, along with the broader landscape, comprise ecosystem conditions and processes that provide forest goods and services (e.g., timber, water, forage, recreation opportunities, etc.). When combined with agency infrastructure—such as roads and trails—and other private and public goods and services—such as equipment outfitters and guide services—these forest goods and services produce benefits to users and other beneficiaries (fig. 1). More broadly, these benefits also are associated with factors that contribute to social and economic conditions and sustainability, such as local jobs, quality of life, education, health and safety, local traditions, among others. The basic premise of addressing ecosystem services in forest planning is to develop a narrative describing these relationships for "key" forest goods and services and how they might be affected by plan revision or other management changes (see text box 3, for an example). Each of the five steps is described below with references to objectives, approaches, and examples of leading questions.

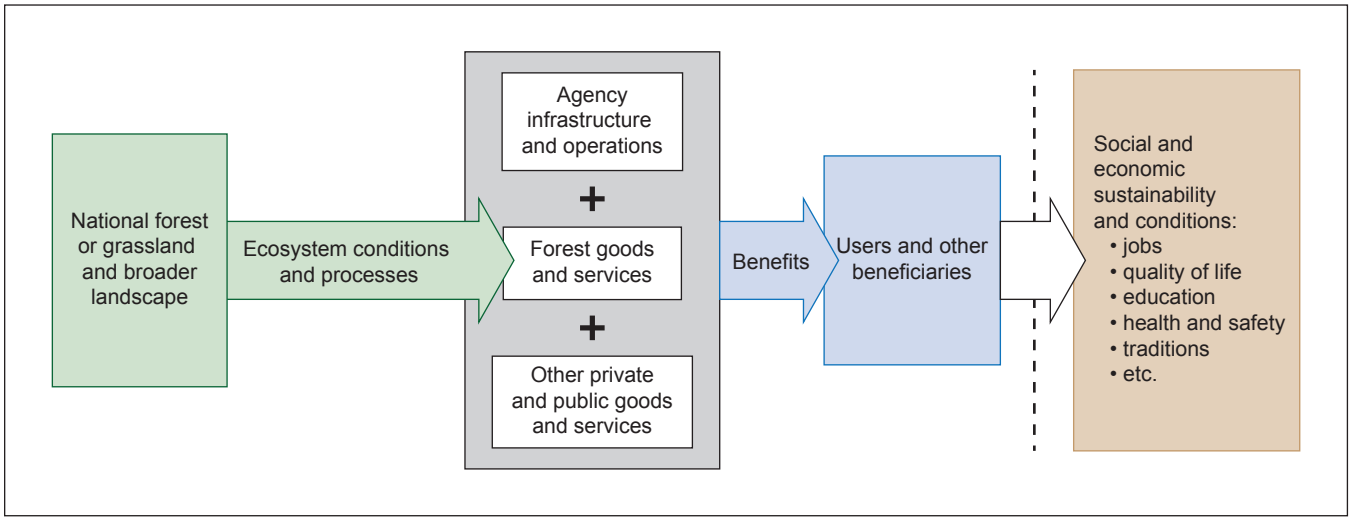
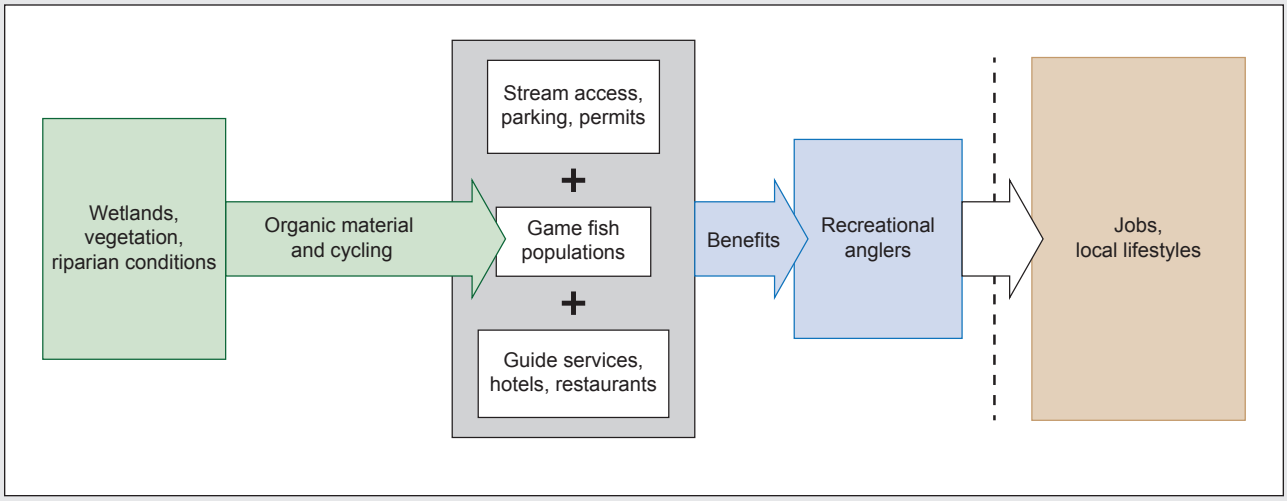


Figure 1—Relationship among national forests and grasslands, forest goods and services, and users and other beneficiaries.

Text box 3. Example application of the conceptual framework for fish populations and recreational anglers

An example application of the conceptual framework for fish populations and recreational anglers might acknowledge the role that wetlands, vegetation, hydrologic function, and riparian conditions and processes play in influencing landscape-level organic material and nutrient cycling to produce game fish populations. The resulting game fish "service" is augmented by stream access; parking and permitting processes provided by the national forest or grassland; as well as perhaps local guide services; and hotel, restaurant, and other businesses that cater to the recreational anglers. Together, these ecosystem and agency contributions provide benefits to recreational anglers. In a broader sense, gamefish populations help to support jobs and local lifestyles. Forest plan components thus have potential to influence these benefits and their broader social and economic impacts, by influencing the ecosystem conditions and processes, and agency infrastructure and operations that make the game fish service possible.



Step 1. Develop a common understanding among planning team members about how people benefit from the national forest or grassland.

Objective—Use figure 1 to facilitate a discussion among planning staff about how different people benefit from the forest goods and services the forest or grassland provides.

Approach—Planning teams should meet together to accomplish this step at the beginning of the plan assessment phase. Planning teams should consider and identify relationships among ecosystem conditions and processes, specific forest goods and services, and specific users and other beneficiaries, that define pathways by

which benefits are produced on or by the forest or grasslands under consideration. Further considering how specific benefits relate to social, cultural, and economic conditions within communities near the plan area, as well as the broader region surrounding the plan area, helps provide a more complete narrative about the broader impacts that the forest or grassland might have on social and economic sustainability. Input from public engagement processes and forest specialists and other staff may be useful.

Leading questions—In accomplishing this step, planning teams may find the following "leading questions" useful for initiating discussion of possible forest goods and services, beneficiaries, and benefits among resource specialists assigned to the planning team:

- Why is your resource area important to people who use or care about the forest or grassland?
- Who cares about or interacts with your particular resource?
- Does your resource area support or sustain other forest goods and services, or does it produce forest goods and services that people directly use or from which people directly benefit? What would happen if your resource area were removed from the ecosystem or severely affected, for example?

Planning teams should not necessarily feel compelled to describe or "fill in" every "box" included in figure 1 for each benefit identified. Rather, we suggest that planning teams focus instead on identifying each forest good or service in combination with a specific user or other beneficiary, as well as how it relates to a particular social, cultural, and economic condition. We suspect that many resource specialists may at least initially find it easier to identify and describe ecosystem conditions and processes. The point of step 1, however, is to encourage resource specialists to use figure 1 to develop one or several narratives about how their particular resource area and program contributes to providing benefits to specific users or other beneficiaries.

Step 2. Identify a preliminary list of forest goods and services and associated beneficiaries.

Objective—Drawing on step 1 outcomes, for each resource area develop a preliminary list of forest goods and services and their users or other beneficiaries. Also, develop a list of the key linkages between ecosystem conditions and processes and the delivery of each forest good or service, as well as a list of corresponding social, cultural, or economic conditions that are most directly affected by each forest good or service and beneficiary.

Approach—Convene an interdisciplinary team meeting to brainstorm a preliminary list of users or other beneficiaries. Ideally, this step would include considering input from the public and stakeholders. We have provided a "starter list" (app. 2) of potential beneficiaries that interdisciplinary teams might use to initiate consideration of their preliminary list. The starter list is adapted from a typology of ecosystem services developed by the U.S. Environmental Protection Agency (Landers and Nahlik 2013) and thus begins to provide some consistency across federal agencies. Meeting organizers might consider providing the starter list to meeting attendees before the interdisciplinary team meeting, so that team members can begin to consider potential users and other beneficiaries they might include in the assessment. Interdisciplinary teams might also refer to prior planning documents, such as EIS or analysis of the management situation documents. This step is intended to identify a list of possible forest goods and services that could be included in the assessment. The process for identifying key goods and services for actual inclusion in the assessment occurs as step 3.

Leading questions:

- Who uses, interacts with, or experiences, and therefore benefits from, the forest or grassland under consideration?
- What individuals, users, groups, organizations, businesses, or communities benefit?
- From which specific forest resources, ecosystem characteristics, or features do they benefit and why?

Although this step focuses on identifying forest goods and services, and beneficiaries, the accompanying worksheets (app. 1) provide opportunities for identifying ecosystem conditions and processes, as well as agency infrastructure and operations that contribute to or complement production of forest goods and services.

Step 3. Refine the list of forest goods and services (and beneficiaries) to include only "key" forest goods and services.

Objective—Using the initial list developed in step 2, select those forest goods and services that the planning team considers as "key" goods and services, on which to focus for the assessment (and ultimately the rest of the planning process).

Approach—Convene the interdisciplinary team to distill the initial list of forest goods and services to a list of key goods and services. The responsible official may elect to engage the public and stakeholders to help identify key forest goods and services. Also, specific team members or resource specialists likely have an interest in, or a desire to focus on particular forest goods and services within the plan area, by virtue of the specific program area in which they work. Prior to the full interdisciplinary

team meeting, it may be useful to have resource specialists work together who share an interest in or focus on particular forest goods and services, to identify a candidate list of possible key goods and services related to their common interest or focus. This candidate list can then be refined further based on evidence found in prior planning documents, and new input from other interdisciplinary team members and the public.

Leading questions—Criteria that interdisciplinary teams should consider when distilling the initial list developed in step 2 to a list of "key" forest goods and services include the two criteria from the 2012 planning rule, which we have expanded on below:

1. Which forest goods and services are important outside the plan area itself, in areas of influence, or the broader landscape?
    - Do members of the public use and enjoy the good or service? Have they expressed a desire to sustain or increase this service?
    - Have members of the public voiced concerns regarding decreased availability of the good or service?
    - Do nearby communities rely on the good or service to support livelihoods, cultural practices, subsistence, or other factors that affect their quality of life?
    - Have published plans, policies, or other documents from government or nongovernmental sources specifically emphasized the importance of the good or service from the plan area?
    - Are there few (or no) alternative ways to obtain the good or service in nearby communities or broader landscape?
2. Which forest goods and services are most likely to be influenced by the management plan?
    - Is it within the legal authority of the planning unit to influence the good or service?
    - Does the Forest Service have the capability to influence the good or service? Is the good or service "at risk" from some type of threat?
    - Could the plan reasonably establish plan components that would lead to policies, projects, or other activities that would influence the good or service?
    - Does management of the plan area reasonably have the capability to influence the good or service?

Ultimately, the interdisciplinary team should develop a list of key forest goods and services that (1) reasonably represents the range of uses and benefits experienced by users and other beneficiaries of the forests or grasslands under consideration and (2) could be affected by the plan or management action under development.

If the list of key goods and services is thought to be too lengthy, interdisciplinary teams might consider grouping some goods and services based on similarities in how they might be influenced or affected by plan decisions. For example, recreational opportunities for backpacking, cross-country skiing, and hiking (e.g., dispersed recreation) may all be similarly affected by particular plan decisions, and hence could possibly be grouped together. Whether a given forest good or service ultimately is identified as key can be recorded on the worksheet provided in appendix 1.

Step 4. Identify available information for characterizing key forest goods and services, beneficiaries, and their broader social, cultural, or economic influence.

Objective—Identify available information, if any, for describing and, if possible, measuring the key forest goods and services identified, including related ecosystem conditions and processes, users or other beneficiaries, and any notable relationships to social, cultural, and economic conditions.

Approach—This step might be accomplished in planning team meetings, by individual resource specialists, or a combination of the two. Consultation with "human dimensions" specialists (e.g., regional social scientists, tribal liaisons, and heritage program managers, among others) is recommended for identifying information about users and other beneficiaries, as well as potential relationships with social, cultural, and economic impacts or conditions. The 2012 planning rule and directives emphasizes relying on readily available information and taking advantage of indicators and measures already being compiled by other resource, program, or multiple-use sections of the ongoing assessment. The goal is to gather readily available information that can be used to develop as complete a narrative as is possible about the importance of each key forest good or service to people and how the good or service might be affected by the subsequent plan revision and its management actions.

Leading questions—for identifying information and indicator needs include:

- What additional information is needed that is not already provided in other resource or program sections of the ongoing assessment that would help to describe:
  - What levels of key forest goods or services is the forest or grassland providing?
  - What levels of key goods and services do users or other beneficiaries rely on, need, or otherwise desire?
  - What ecosystem conditions or processes support the production of these key goods and services?

  - What data and indicators are readily available for quantifying changes in the availability of key forest goods and services, as well as the levels that users and other beneficiaries would like to have made available?

- Can data and indicators, both spatial and nonspatial, help you describe the following:
  - Forest goods and services, and users and other beneficiaries at an appropriate geographic scale?
  - Current conditions, trends, and likely future conditions over time?
  - Key ecosystem conditions or processes, drivers, or stressors affecting the availability of, and user demand for, key goods and services?
- Are indicators sensitive to changes in plan components?
- Are there gaps in available information for characterizing key forest goods and services, and if so, what are they?

Available data and other information for describing users and other beneficiaries, and ecosystem conditions and processes that contribute to providing key forest goods and services can be noted on the worksheet provided in appendix 1.

Step 5. Summarize key forest goods and services in the assessment document.

Objective—Use information from steps 1 through 4 to prepare assessment documents that address key forest goods and services.

Approach—Two possible approaches to completing this step are (1) assign individual resource specialists the task of drafting portions of the assessment for goods and services and beneficiaries relevant to their particular resource areas; or (2) an "ecosystem services point person" can be assigned to coordinate input from each resource specialist and compile an assessment section based on their input.

Planning teams will note that there are considerable overlaps between forest goods and services requirements and other assessment requirements outlined in the 2012 planning rule. For example, the assessment section addressing multiple uses may cover some provisioning services included among the list of key forest goods and services defined in the process just presented. Similarly, the section addressing recreation may cover some of the key cultural services. The task for the planning team is to effectively integrate information about key forest goods and services collected from steps 1 through 4 with the other assessment topic areas to which they relate. This can be done by summarizing or referencing information from other sections of the assessment. The intent is to fully embrace the key forest goods and services concept as the connecting theme of the assessment document, to better integrate resource areas by addressing the ways in which the public benefits from

the national forest or grassland and how benefits rely on a combination of different resource or program areas. The leading questions outlined in this step may be useful for structuring, summarizing, and integrating information about key goods and services provided by the plan area.

Leading questions—for summarizing forest goods and services in the assessment documents:

- How is each key good or service related to a specific resource area or areas?
  - What are the current conditions and trends concerning these resource areas, and how do these affect the delivery of each key good or service?
  - How do conditions and trends on the broader landscape (outside the authority of the Forest Service) affect the delivery of each key good or service?
- How is each key good or service used or valued by users and other beneficiaries?
  - What are the current locations, conditions, and trends concerning uses and users, and how do they affect the current and future delivery of and demand for each key good or service?

Based on the above information, discuss any consistencies or mismatches between current uses (or demands) and the availability of each key good or service. For example, if the resource base for a given forest good or service is declining, that may not support an increasing user population for that good or service, and this concern should be addressed.

The following examples describe hypothetical scenarios illustrating cases where particular forest goods or services might be considered as key forest goods or services and when they might not, as well as potential plan components appropriate for addressing those forest goods or services.

Example Applications

The importance of particular forest goods and services are expected to emerge from the public participation process during the assessment phase of forest plan revision. In some cases, an assessment team may identify tentative key forest goods and services, when particular goods or services are recognized as important, but there is uncertainty about whether the plan revision is likely to have a meaningful effect on it. Ultimately, the determination as to which forest goods and services are key goods and services and which plan components are needed to provide for each key good or service is made in conjunction with the approval of the responsible official. The following examples describe hypothetical scenarios illustrating cases where particular forest goods or services might be considered as key forest goods or services and when they might not, as well as potential plan components appropriate for addressing those forest goods or services.

Example 1: Fish and Recreational Anglers

The circumstances—On a particular national forest, hydrologic and riparian conditions support a relatively stable population of a species of game fish, and an active and popular recreational fishery drawing anglers locally and from afar (fig. 2). Several local businesses cater to the recreational anglers, including local guide services, hotels, and restaurants.

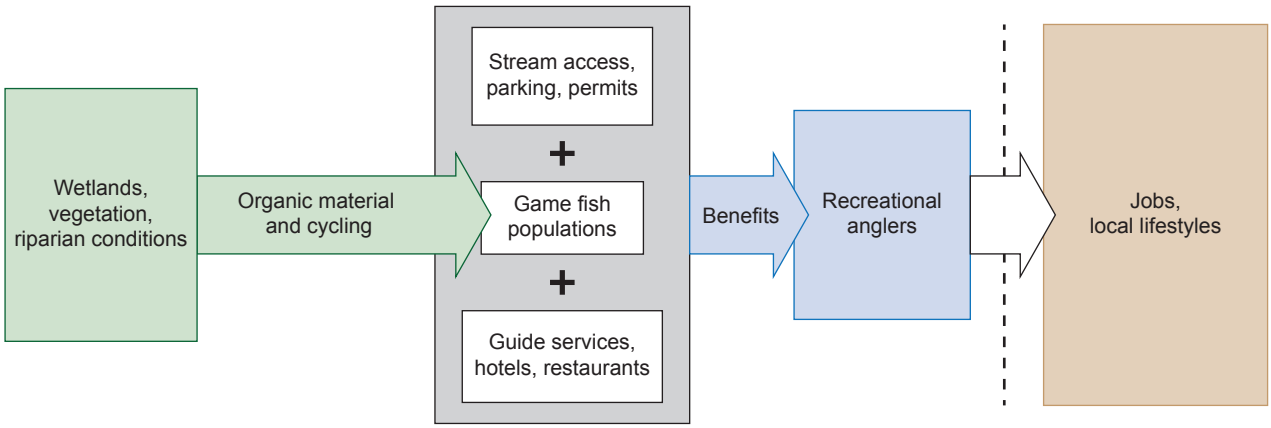
Is the game fish population a key forest good or service on this particular national forest?—Given the popularity of the recreational fishery, the responsible official identifies the game fish population as an important forest good or service provided by riparian conditions on this national forest. Public and stakeholder comments about maintaining opportunities to access the fishery, including concerns about occasional overcrowding and limitations on parking, reinforce this perception. The national forest in recent years has been considering improving access by expanding the number of access points, while also striving to protect the riparian corridor from overuse. Thus, plan components have the potential to influence access to the game fish, and their habitat is of interest outside of the plan area. The responsible official reasonably concludes that the game fish is one of this national forest's key forest goods or services.

What information is identified and evaluated in the assessment?—Information is identified and evaluated pertaining to the locations of game fish populations and their habitat conditions, as well as the access points used by recreational anglers and the levels and quality of use throughout the year.

How is this key forest good or service evaluated during the planning process?—In the initial development of the proposed plan components and alternatives, the responsible official considers how the plan would affect recreational access to the game fish stocks, and the degree of protection or mitigation related to heavy visitation and use of the riparian corridor by anglers.

What plan components provide for this key forest good or service?—In this case, the plan will have components that provide improved access to the game fish populations, and the implementation of measures to protect streambanks from heavy use at the most popular access points. Components will also address how to sustain water quality and flows.

Step 1—Develop a common understanding about how people benefit



Step 2—Identify users or beneficiaries, and forest goods and services

Users and other beneficiaries: Who interacts with or experiences, and therefore benefits from, the forest good or service?	**Forest goods and services:** From what forest resource, feature, or characteristic do they benefit?	**Agency infrastructure and operations:** What does the agency provide or permit that enables these benefits?	**Ecosystem conditions and processes:** How do ecosystem conditions and processes provide for the forest good or service?	**Importance of forest good or service to beneficiary:** Why do the beneficiaries care about the forest good or service?
Recreational anglers	Game fish population	Access, parking, permits	Hydrologic function (water storage and filtration), organic material and nutrient cycling	Recreation, food, business opportunities (for guides and other suppliers)

Step 3—Identify which forest goods and services are key services

Key forest good or service identification: Is it (1) important outside the plan area and (2) likely to be influenced by the management plan?	**Group or sort (optional):** Use this column to group or sort like categories of forest goods or services, or beneficiaries
Yes	

Step 4—What information can be used to describe beneficiaries and forest goods and services?

Information for characterizing users and other beneficiaries: What information can be used to describe the use or demand among beneficiaries for the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.	**Ecosystem conditions and processes:** What information can be used to describe the availability of the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.
Trends in parking or other permits issued; National Visitor Use Monitoring data; visitor feedback	Stream-miles providing different qualities of habitat condition

Figure 2—Completing steps 1 though 4 for a hypothetical game fish population (example 1)

Example 2: Fish, Case 2

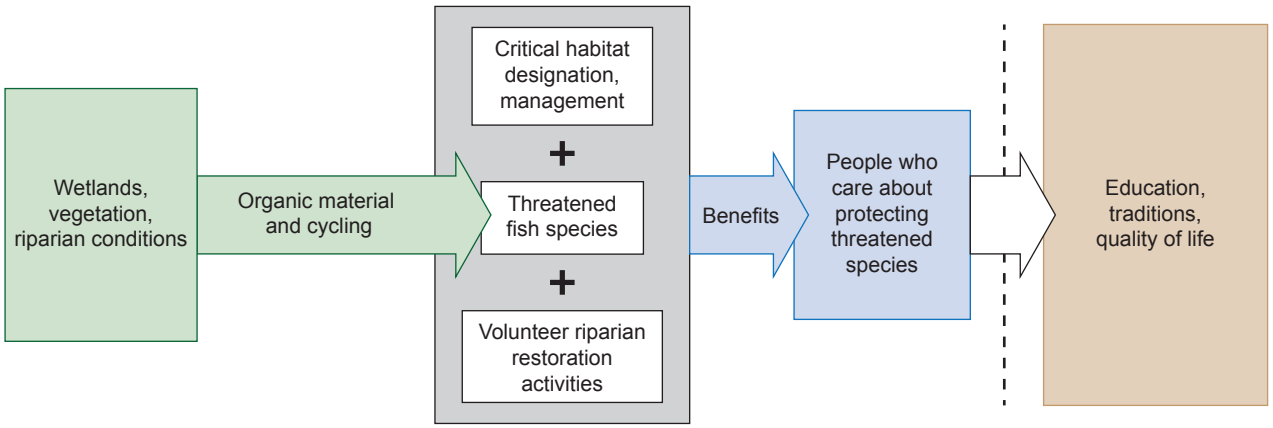
The circumstances—On a different national forest, there are unique spawning areas for an anadromous fish species. This species has been listed as threatened and a portion of the national forest has been identified as critical habitat subject to a number of specific restrictions associated with managing habitat for the species (fig. 3). Although current management of the plan area already is consistent with the threatened species designation, the plan itself has not yet been revised to align with the critical habitat designation.

Is the anadromous fish species a key forest good or service on this particular national forest?—The responsible official is convinced that the anadromous fish population is an important ecosystem service provided by habitat on this particular forest. Public comments and concerns about the species have further reinforced this perception. However, beyond adjusting and complying with provisions associated with the critical habitat designation, the responsible official is not convinced that anticipated changes in the plan are likely to affect the fish or its spawning habitat, even as the fish species is considered to be of significant importance to the public and stakeholders. The responsible official feels that the critical habitat designation already provides necessary support for the fish and that further detailed examination during plan revision will detract from completing the revision in a timely manner. However, given the importance of the resource to the public and stakeholders, the responsible official decides to defer a determination as to whether the anadromous fish stock is a key ecosystem service until the planning team has begun drafting plan alternatives and evaluating environmental impacts.

What information is identified and evaluated in the assessment?—Existing information provided by the forest biologist is identified and evaluates the locations of the anadromous fish species, its habitat, and the specific conditions required to sustain the species, as well as habitat conditions, trends, and any threats or other factors influencing its population (e.g., invasive species).

How is this key forest good or service evaluated during the planning process?—In the initial development of the proposed plan components and alternatives, the responsible official examines how the plan would affect the anadromous fish population and its habitat beyond meeting the basic requirements associated with critical habitat designation. The EIS would describe differences in the outcomes for the species among the alternatives. Depending on the outcome, the responsible official may conclude one of two ways:

Step 1—Develop a common understanding about how people benefit



Step 2—Identify users or beneficiaries, and forest goods and services

Users and other beneficiaries: Who interacts with or experiences, and therefore benefits from, the forest good or service?	**Forest goods and services:** From what forest resource, feature, or characteristic do they benefit?	**Agency infrastructure and operations:** What does the agency provide or permit that enables these benefits?	**Ecosystem conditions and processes:** How do ecosystem conditions and processes provide for the forest good or service?	**Importance of forest good or service to beneficiary:** Why do the beneficiaries care about the forest good or service?
People who care about protecting threatened species, American Indian tribes	Threatened fish population	Compliance with riparian management restrictions and water quality guidelines mandated by listing	Organic material and nutrient cycling; water storage and filtration, fish passage; may be adversely affected by invasive species.	Compliance with federal regulations regarding listing

Step 3—Identify which forest goods and services are key services

Key forest good or service identification: Is it (1) important outside the plan area and (2) likely to be influenced by the management plan?	**Group or sort (optional):** Use this column to group or sort like categories of forest goods or services, or beneficiaries
Outcome to be determined by environmental impact statement	

Step 4—What information can be used to describe beneficiaries and forest goods and services?

Information for characterizing users and other beneficiaries: What information can be used to describe the use or demand among beneficiaries for the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.	**Ecosystem conditions and processes:** What information can be used to describe the availability of the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.
Number and nature of public comments addressing the threatened species, consultation with tribes	Locations of species, continuous stream-miles providing different qualities of habitat, both threatened and invasive fish population estimates

Figure 3—Completing steps 1 through 4 for a hypothetical threatened fish population (example 2).

1. The anadromous fish species is a key ecosystem service if there are different outcomes for the species that result from the type and organization of plan components in the different alternatives.
2. The current critical habitat designation provides all that the plan area can reasonably do to protect the fish species, and additional plan components for this anadromous fish are not likely to be effective or necessary. In the latter case, the anadromous fish species would not be identified as a key ecosystem service in the context of plan revision on this particular forest.

What plan components provide for this key forest good or service?—In either outcome, the plan will have components that provide for the anadromous fish species, at the very least by referring to requirements associated with the critical habitat designation. These components likely would include desired conditions and standards and guidelines intended to aid in recovery and maintenance of the fish.

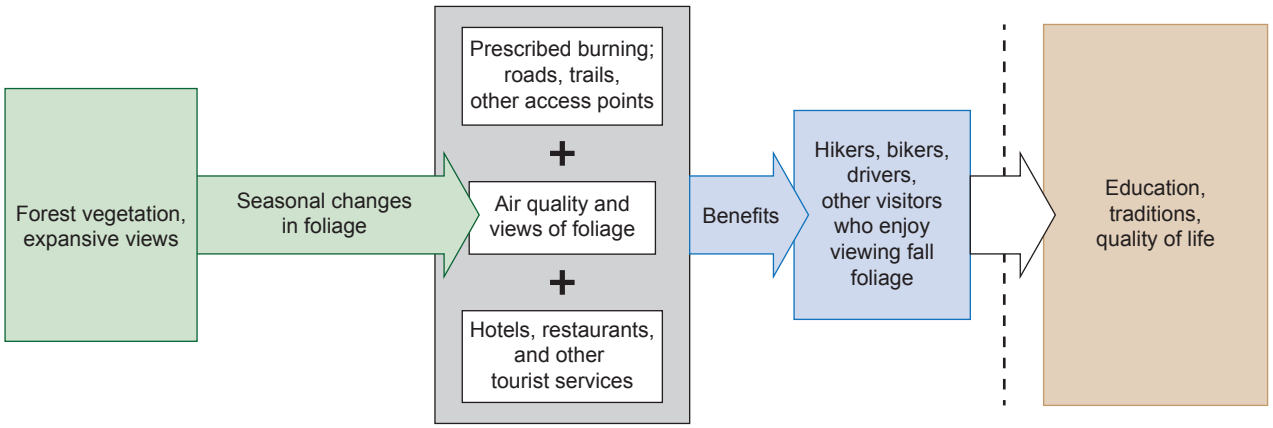
Example 3: Air Quality and Scenic Views

The circumstances—Another national forest receives significant numbers of visitors during the summer and fall seasons, attracted to its scenic views and fall foliage, and this use is a major factor influencing management (fig. 4a). The national forest also is working to restore the ecological integrity of the forest through greater use of prescribed fire, which can result in occasional reductions in air quality within the forest that diminishes the views of fall foliage from roads, trails, and other access points that forest visitors can enjoy on some days.

Is air quality a key forest good or service for this particular national forest?—In this particular situation, visits to the national forest not only benefit visitors but also benefit several private businesses outside of the plan area who cater to these same visitors (fig. 4). Additionally, the public has voiced concern about maintaining air quality during peak visitor periods, particularly in the fall. Given these factors, the responsible official might reasonably conclude that air quality is a key ecosystem service that is relevant for consideration in plan revision. Plan components—specifically those influencing management that includes prescribed burning—have the potential to significantly affect air quality, and air quality is of significant interest outside the plan area.

However, alternatively, the responsible official might instead identify fall foliage as the relevant forest good or service. In this case, the planning team would acknowledge the dependency of fall foliage viewing on air quality and access to scenic views. Moreover, planning staff would also acknowledge the influence of vegetation management (e.g., prescribed burning) and its effect on air quality, which in

Step 1—Develop a common understanding about how people benefit



Step 2—Identify users or beneficiaries, and forest goods and services

Users and other beneficiaries: Who interacts with or experiences, and therefore benefits from, the forest good or service?	**Forest goods and services:** From what forest resource, feature, or characteristic do they benefit?	**Agency infrastructure and operations:** What does the agency provide or permit that enables these benefits?	**Ecosystem conditions and processes:** How do ecosystem conditions and processes provide for the forest good or service?	**Importance of forest good or service to beneficiary:** Why do the beneficiaries care about the forest good or service?
Hikers, bikers, and other visitors who enjoy the scenic views	Fall foliage; air quality	Forest roads, trails, and other access points, parking, traffic enforcement; prescribed burning	Forest vegetation health, seasonal changes in tree foliage; air quality	Enjoyment of physical activity or family outing featuring scenic views

Step 3—Identify which forest goods and services are key services

Key forest good or service identification: Is it (1) important outside the plan area and (2) likely to be influenced by the management plan?	**Group or sort (optional):** Use this column to group or sort like categories of forest goods or services, or beneficiaries
Yes	

Step 4—What information can be used to describe beneficiaries and forest goods and services?

Information for characterizing users and other beneficiaries: What information can be used to describe the use or demand among beneficiaries for the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.	**Ecosystem conditions and processes:** What information can be used to describe the availability of the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.
Number of visitors during fall foliage season, versus the rest of the year, National Visitor Use Monitoring data	Data describing air quality throughout the year, particularly on days of prescribed burning; extent and persistence of relevant tree species producing fall foliage

Figure 4a—Completing steps 1 through 4 for an air quality example and its impact on scenic views (example 3).

turn influences fall foliage viewing. In this way, air quality arguably can be viewed as an intermediate service necessary for providing the final service of scenic views of fall foliage, while the various access points are provided by agency infrastructure and operations. Following this perspective, plan components, including prescribed burning, have the potential to significantly reduce air quality and thus diminish scenic views of fall foliage, and these reductions are of interest outside the plan area.

What information is identified and evaluated in the assessment?—Information pertaining to air quality and its impact on scenic views of fall foliage that could be evaluated during plan revision might include data pertaining to air quality levels throughout the year and their relationship to use of prescribed fire. Additionally, the planning team might consider the cost-effectiveness of prescribed fire versus mechanical treatments in achieving desired vegetative conditions, relative to visitation patterns and access points throughout the year, to determine whether prescribed fire activities could be conducted during periods of lower visitation or at specific locations.

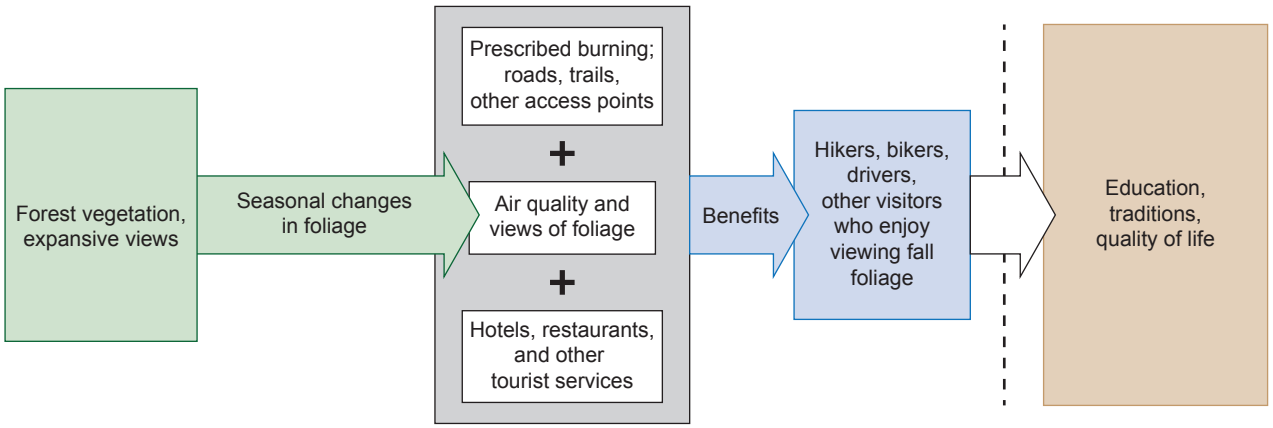
How is this key forest good or service evaluated during the planning process?—In the initial development of proposed plan components and alternatives, the responsible official seeks to find a solution that will maintain air quality without significantly diminishing scenic views of fall foliage, while allowing for appropriate vegetation treatments. One alternative heavily emphasizes use of prescribed fire to achieve desired vegetation conditions, another emphasizes mechanical treatments, while a third and preferred alternative emphasizes a mix of treatments without use of prescribed fire between June and November. The EIS describes the changes in air quality and visibility that would occur under these alternatives.

What plan components provide for this key forest good or service?—The desired condition explicitly describes that the forest landscape is visibly attractive and one that draws visitors to the area to enjoy the scenic vistas, especially during late summer and fall foliage seasons. A forestwide guideline excludes the use of prescribed fire between June and November from specific locations.

Example 4: Air Quality, Case 2

The circumstances—A different national forest is located in a region where air quality is widely known to suffer the effects of air pollution from sources external to the forest. This national forest has only a very small prescribed fire program connected with its limited silvicultural activities, and so does not substantially influence air quality within the broader plan area (fig. 4b). Additionally, public participation processes connected with the assessment have resulted in few comments or suggestions regarding air quality.

Step 1—Develop a common understanding about how people benefit



Step 2—Identify users or beneficiaries, and forest goods and services

Users and other beneficiaries: Who interacts with or experiences, and therefore benefits from, the forest good or service?	**Forest goods and services:** From what forest resource, feature, or characteristic do they benefit?	**Agency infrastructure and operations:** What does the agency provide or permit that enables these benefits?	**Ecosystem conditions and processes:** How do ecosystem conditions and processes provide for the forest good or service?	**Importance of forest good or service to beneficiary:** Why do the beneficiaries care about the forest good or service?
Forest visitors	Air quality within the forest and the region	Forest management has limited impact	Forest itself has little impact relative to activities in broader region	Health, enjoyment of scenic views within the forest and of the region

Step 3—Identify which forest goods and services are key services

Key forest good or service identification: Is it (1) important outside the plan area and (2) likely to be influenced by the management plan?	**Group or sort (optional):** Use this column to group or sort like categories of forest goods or services, or beneficiaries
No	

Step 4—What information can be used to describe beneficiaries and forest goods and services?

Information for characterizing users and other beneficiaries: What information can be used to describe the use or demand among beneficiaries for the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.	**Ecosystem conditions and processes:** What information can be used to describe the availability of the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.
Number of visitors during fall foliage season, versus the rest of the year, National Visitor Use Monitoring data	Data describing air quality throughout the year, particularly on days of prescribed burning; extent and persistence of relevant tree species producing fall foliage

Figure 4b—Completing steps 1 through 4 for an air quality example and its impact on scenic views (example 4).

Is air quality a key forest good or service for this particular national forest?—In this case, the responsible official on this forest decides not to include air quality among its key forest goods and services. Although air quality is of importance to the broader plan area, the impact that this particular national forest can have on improving or reducing that air quality is limited, given the small role that prescribed fire plays in the overall management of the forest.

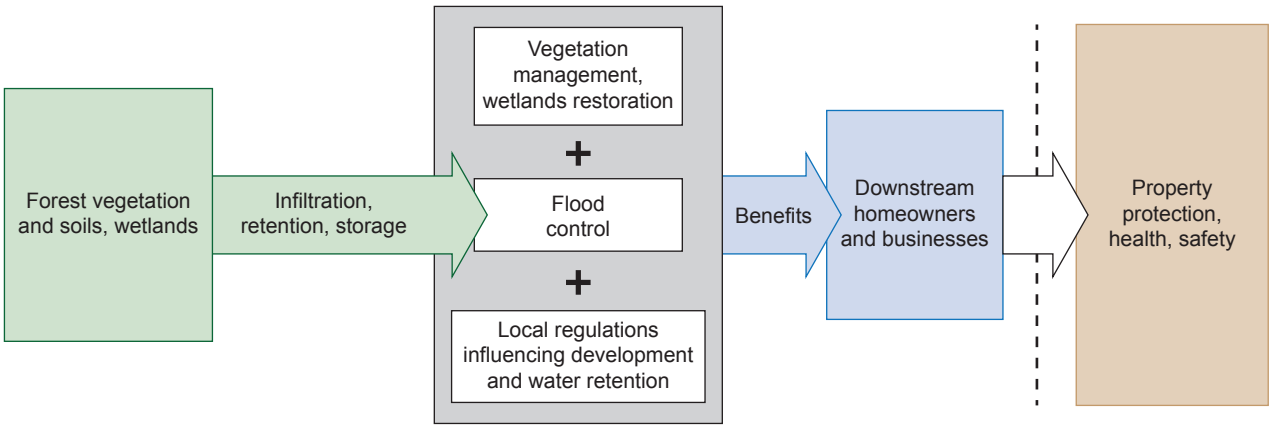
Implication—When a given forest good or service is determined to not be a key service, there is no need for the planning team to provide plan components for that service in the plan. There would, however, still need to be an evaluation of air quality in the EIS, which would essentially indicate that there is no meaningful change to air quality anticipated as a result of the management alternatives being considered for plan revision. The planning team may also need to document, either in the planning record or the assessment chapter itself, that air quality was considered during the assessment phase but determined to be a non-key good or service.

Example 5: Flood Control

The circumstances—When substantial rainfall events occur on one national forest, there can be severe flooding downstream of the plan area that affects several towns and a small city. Climate change projections suggest more intense storms are likely to exacerbate this problem in the future, leading to greater flooding. There have also been suggestions from the public that this national forest could reduce the magnitude and impacts of these flood events by restoring wetlands that would act as reservoirs that would slow potential runoff (fig. 5).

Is flood control a key forest good or service on this particular national forest?—The responsible official concludes that flooding is an important issue downstream and outside of the plan area, though the impact of flood events, when they occur, appears to be fairly localized. Flood control thus meets the first key ecosystem service criterion—that it be important to people in the broader landscape or beyond the plan area itself. However, the responsible official is unsure about the capability of the plan revision to do much to mitigate the flooding risk, and thus is uncertain about whether flood control meets the second key ecosystem service criterion—that it likely will be affected by the management plan under revision. Therefore, as part of the assessment, the responsible official requests an evaluation of existing information related to wetland or floodplain restoration within this national forest. The responsible official concludes that flood control may be a key ecosystem service, if management alternatives can be designed that are likely to substantially reduce flood risk. The outcome of the effects analysis will ultimately determine whether flood control is identified as a key forest good or service on this particular national forest.

Step 1—Develop a common understanding about how people benefit



Step 2—Identify users or beneficiaries, and forest goods and services

Users and other beneficiaries: Who interacts with or experiences, and therefore benefits from, the forest good or service?	**Forest goods and services:** From what forest resource, feature, or characteristic do they benefit?	**Agency infrastructure and operations:** What does the agency provide or permit that enables these benefits?	**Ecosystem conditions and processes:** How do ecosystem conditions and processes provide for the forest good or service?	**Importance of forest good or service to beneficiary:** Why do the beneficiaries care about the forest good or service?
Downstream homeowners and businesses	Flood control	Forest management, particularly in riparian zones	Vegetation, wetlands, flood plains, infiltration, water uptake and storage	Protection of property, health, and safety

Step 3—Identify which forest goods and services are key services

Key forest good or service identification: Is it (1) important outside the plan area and (2) likely to be influenced by the management plan?	**Group or sort (optional):** Use this column to group or sort like categories of forest goods or services, or beneficiaries
To be determined	

Step 4—What information can be used to describe beneficiaries and forest goods and services?

Information for characterizing users and other beneficiaries: What information can be used to describe the use or demand among beneficiaries for the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.	**Ecosystem conditions and processes:** What information can be used to describe the availability of the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.
Number of downstream property owners affected, flood-zone development trends, data on past flood events, impacts on lands valued by users (habitats for game species, recreation areas, etc.)	Data concerning infiltration and storage capacity of national forest lands; relative contributions of forestlands to streamflow

Figure 5—Completing steps 1 through 4 for a flood control example (example 5).

What information is identified and evaluated in the assessment?—Existing information is evaluated in the assessment that pertains to the severity and patterns of past flood events, and precipitation rates and trends in light of available information pertaining to projected climate change. Opportunities for wetland and floodplain restoration also are examined and evaluated to determine whether there is substantial potential for such efforts to mitigate flooding risk.

How is this key forest good or service evaluated during the planning process?—During the initial development of plan alternatives, the EIS examines the issue of flood control. This includes the likely nature of future flood events and specifically how one alternative that emphasizes wetland restoration is likely to influence streamflow and flooding in the future. One of two outcomes is possible:

1. The analysis reveals that a reasonable program of wetland restoration can be accomplished within the fiscal capability of the forest, and likely would substantially reduce future downstream flood impacts. With this outcome, the responsible official concludes that flood control is a key ecosystem service.
2. The analysis reveals that only a very significant commitment of funds toward wetland restoration, well beyond the current fiscal capability of the planning unit, would lead to any appreciable reduction in the magnitude of flood events. With this outcome, the responsible official concludes that management by the forest would be unable to appreciably reduce flooding and so the responsible official concludes that flood control is not a key ecosystem service.

In the case of outcome 1, flood control would be given further consideration in the plan revision process.

What plan components provide for this key forest good or service?—In the case of outcome 1, in which flood control is identified as a key ecosystem service, the desired condition explicitly describes the desired role of the plan area's wetlands in providing for downstream flood control. Objectives seek to identify an acreage goal for restored or new wetlands, consistent with the unit's fiscal capability.

Using Information About Key Forest Goods and Services in the Next Planning Phases

The 2012 planning rule mandates that forest plans guide management of National Forest System lands so they are ecologically sustainable and contribute to social and economic sustainability. Forest goods and services are important considerations when evaluating a plan area's contribution to social and economic sustainability. Following the assessment phase, planning teams should anticipate addressing how plan components provide for key forest goods and services through a variety of resource and program areas. Relevant resource and program areas should be addressed in an integrated fashion to ensure they work together in providing forest goods and services. Planning

Following the assessment phase, planning teams should anticipate addressing how plan components provide for key forest goods and services through a variety of resource and program areas.

teams should also anticipate demonstrating how alternative plan components, in aggregate, provide for alternative ecological conditions, and how those conditions produce different levels of key forest goods and services. Although the manner in which forest goods and services affect social and economic conditions may be uncertain, planning teams should attempt to demonstrate how alternative levels of forest goods and services influence social and economic conditions and opportunities over time, without committing to providing specific social or economic conditions. Planning teams have flexibility in how they might demonstrate the contributions of forest goods and services, and potential impacts, to social and economic conditions during plan revision.

Many plan components may not appear to explicitly target forest goods and services. In fact, some plan components may occur in various resource-specific sections of the plan not commonly associated with forest goods and services or economic and social conditions. Examples might include fire management and infrastructure. However, the role of such plan components may become more apparent after key forest goods and services are identified in the assessment and where planning teams can demonstrate linkages between resource areas, management, and benefits to people. The identification of key forest goods and services, and their users and other beneficiaries, during the assessment phase of planning can aid in this process. Ideally, making such connections will enable planning teams to demonstrate the integrated resource management and ecosystem services goals envisioned in the 2012 planning rule. Plan components do not need to be designed explicitly to address each specific key forest goods and services, so long as there is a clear linkage between each of the key forest goods and services and plan components.

The Forest Service Handbook (USDA FS 2015c) provides several considerations (or leading questions) to aid planning teams in developing plan components that provide levels of forest goods and services that contribute to social and economic sustainability:

- What forest goods and services contributions are needed or desired from the plan area to support social, cultural, and economic conditions?
- Will the plan area, under management identified in the plan, be able to sustain these contributions?
- How will plan components influence the contributions of the plan area to social and economic sustainability?
- How will the plan affect social, economic, and cultural conditions in the plan area(s) of influence and the broader landscape? Will the plan adversely affect or benefit minority or low-income populations?
- Will the plan be able to sustain the plan area's contributions to social, cultural, and economic conditions under the reasonably foreseeable risks and uncertainties affecting the plan area, the area of influence, and the broader landscape?

- Are the plan components related to contributions to social and economic sustainability well integrated with the plan components that provide for ecological sustainability, including those that provide for ecosystem integrity and species diversity?

These questions frame the relevant dimensions of social, cultural, and economic considerations that not only facilitate development of plan components, but also the effects analysis. Adequately evaluating these considerations may call for the involvement of the public and stakeholders, and planning teams are encouraged to obtain such input, to the extent that is feasible, throughout the plan revision process.

Conclusions and Additional Resources

Although we have proposed a specific process that forest planning teams might use to describe public benefits, we stress that there is no single recommended procedure for addressing forest goods and services during assessment, plan revision, or monitoring phases of national forest planning. Planning teams and responsible public officials continue to have the flexibility to adopt planning procedures, methods, and public engagement strategies they feel best suit the needs of their particular national forest or grassland. In addition to this report, planning teams and others interested in addressing ecosystem services might find additional resources on potential approaches and methods of analysis in the following resources:

- Technical guidance (e.g., technical advice bulletins) available from the National Forest System, Washington office, Ecosystem Management Coordination website.
- Kline, J.D.; Mazzotta, M.J. 2012. Evaluating tradeoffs among ecosystem services in the management of public lands. Gen. Tech. Rep. PNW-GTR-865. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48 p.
- National Ecosystem Services Partnership. 2016. Federal Resource Management and Ecosystem Services Guidebook. 2nd ed. Durham, NC: National Ecosystem Services Partnership, Duke University.

Planning teams and responsible public officials continue to have the flexibility to adopt planning procedures, methods, and public engagement strategies they feel best suit the needs of their particular national forest or grassland.

Our hope is that this report, along with these and other resources, may help planning teams develop their own preferred strategy for effectively addressing public benefits to meet 2012 forest planning rules regarding characterizing ecosystem services.

Acknowledgments

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Appendix 1: Worksheet for Evaluating Forest Goods and Services

Step 2—Users and beneficiaries, and forest goods and services

Users and other beneficiaries:	Forest goods and services:	Agency infrastructure and operations:	Ecosystem conditions and processes:	Importance of forest good or service to beneficiary:
Who interacts with or experiences, and therefore benefits from, the forest good or service?	From what forest resource, feature, or characteristic do they benefit?	What does the agency provide or permit that enables these benefits?	How do ecosystem conditions and processes provide for the forest good or service?	Why do the beneficiaries care about the forest good or service?

Step 3—Which forest goods and services are key services?	
Key forest good or service identification:	**Group or sort (optional):**
Is it (1) important outside the plan area, and (2) likely to be influenced by the management plan?	Use this column to group or sort like categories of forest goods or services, or beneficiaries

Step 4—What information can be used to describe beneficiaries and forest goods and services?	
Information for characterizing users and other beneficiaries:	**Ecosystem conditions and processes:**
What information can be used to describe the use or demand among beneficiaries for the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.	What information can be used to describe the availability of the forest good or service? Provide data source for each possible indicator or "unknown" for no indicators.

Appendix 2: Forest Goods and Services Starter List

The foregoing starter list of potential users and other beneficiaries (and associated forest goods and services) of national forests and grasslands is based on work by the Environmental Protection Agency (Landers and Nahlik 2013). The work was intended to aid in developing a common set of concepts and terms for characterizing individual forest goods and services, identifying metrics and indicators that can be used to characterize environmental change, and identifying linkages between forest goods and services and human well-being. Most notably, the work outlines a classification system for characterizing ecosystem services using the concept of "final ecosystem goods and services" to define specifically those ecosystem services that are directly enjoyed by people. The intent is to aid in distinguishing final goods and services, such as provisioning and cultural services, from more "intermediate" services, such as regulating and supporting services, as outlined in the Millennium Ecosystem Assessment (2005). We have adapted the Landers and Nahlik (2013) list of final ecosystem goods and services for use by forest planning teams and others working to identify potential beneficiaries and forest goods and services in forest planning and management applications. The list is not intended as an exhaustive list of all potential users and other beneficiaries, but rather is intended to aid in stimulating thinking about possible users and other beneficiaries.

Table A2.1—Starter list of example users and other beneficiaries, forest goods and services, and potential measures, for use in developing initial lists of forest goods and services

Users and other beneficiaries	Forest good or service	Infrastructure, operations and other agency services	Ecosystem conditions and processes	Importance of forest good or service to user or other beneficiary	Beneficiary indicators and measures	Forest good or service indicators and measures
Commercial businesses and consumers						
Agricultural irrigators	Water		Waterflow	Functioning forests ensure waterflow in sufficient quantity and predictable timing for growing and maintaining crops	Number, size, and type of agricultural producers (trend)	Streamflow trends on NFS lands, percentage of flow from NFS lands, retention by wetlands, water quality, subsidence risk areas
Electric or energy providers and consumers	Forest landscapes, lands, and features	Permits	Wildfire	Opportunity to install power generation structures or transmission lines	Number of facilities or businesses and jobs, consumers and population trends (demand), distribution infrastructure or grid capacity, substitute corridors	Suitable areas for rights-of-way, powerlines
Utility and communication providers and consumers	Forest lands		Wildfire	Opportunity to install transmitting or transporting facilities	Number of facilities or businesses, and jobs; local consumers and population trends; expansion plans; substitute corridors	Suitable areas for rights-of-way
Agricultural growers, orchards, and consumers	Bees, bats, and birds		Pollination	Forestland provides habitat for species that provide pollination service to plants, including fruit trees adjacent to the forest		
Fur and hide trappers and consumers	Fauna, fox		Habitat structure and connectivity	Species that provide fur or hides for commercial use or sale	Number of enterprises or businesses, licenses	Population or habitat trends for target species
Timber and fiber, and ornamental producers and consumers	Timber, fiber, natural materials, nontimber forest products		Soil formation, regulation of insects and disease, biological diversity	Noncultivated timber for commercial use or sale	Cut and sold reports and trends; number, type, and capacity of regional loggers and processors (e.g., mills); stumpage values; sales; special collection and harvest permits; firewood cutters; set aside targets and sales	Suitable areas or volume (age and diameter), sale quotas, roads, treatment schedules or budgets
Food extractors and consumers	Flora, fauna, and fungi					
Outfitters and customers	Flora, fauna, and game		Habitat structure		Number of outfitter and guide permits, outfitter capacity and use	Fish and game populations and habitat
Minerals and energy producers and consumers	Locatable, leasable, and salable mineral reserves	Roads, rights-of-way, surface occupancy permits		Minerals that can be extracted to generate revenue	Volume and activity trends, revenues and prices, job contributions, royalties, revenues, and payments	Suitable areas, accessible reserves (volume), company production data, BLM exploration and drilling application documents, FS surface occupancy and leasing consent documentation
Other energy producers and consumers (hydro, geothermal, biomass, solar, wind)	Waterflow, forest land, flora				Number of facilities lands, number of proposed projects, alternative energy incentives	Suitable areas

Table A2.1—Starter list of example users and other beneficiaries, forest goods and services, and potential measures, for use in developing initial lists of forest goods and services (continued)

Users and other beneficiaries	Forest good or service	Infrastructure, operations and other agency services	Ecosystem conditions and processes	Importance of forest good or service to user or other beneficiary	Beneficiary indicators and measures	Forest good or service indicators and measures
Other resource-dependent businesses and customers (e.g., marinas, resorts)	Forest landscapes, forest lands, forest features				Number of recreation or tourism-related businesses, recreational use and spending surveys and job contributions, FS revenue	
Pharmaceutical and medical suppliers and consumers	Flora, fungi	Permits, access	Biological diversity		Number of special use and harvest permits, FS revenue, industry trends	Relevant habitat and vegetation acreage and trends
Livestock operators and consumers	Forage	Permit administration, inspection, and range improvements implementation	Wildfire, regulation of invasive species	Noncultivated vegetation for livestock consumption	Permit and animal unit month trends; substitute forage (seasonal) available; number, type, size of operators, and trends	Allotments and acreage, allotment management plans, range conditions and trends, water access
Government, municipal, residential						
Residents and property owners	Clean air	Prescribed burns	Wildfire, fuel conditions	Functioning and intact forest provides sufficient air filtration service, recreationists benefit from clean air for health and enjoyment	Population trends, health and demographic trends	Seasonal air quality provision, air filtration
Residents and property owners	Waterflow, waterflow and flood regulation		Infiltration, storage	Natural or regulated waterflows decrease the risks of floods and property damage	Populations and property trends in flood-prone areas, past damages, avoided damages, private water diversions, landslides or subsidence, development	Streamflow probabilities and trends on NFS lands (max), percentage of flow from FS land, wetland acres, water quality, subsidence risk areas
Residents and property owners	Views, scenery, aesthetics			Scenery and natural views increase satisfaction and property values of residents	Number of residents and seasonal home owners, and trends	Scenery, scenic quality, viewsheds
Residents and property owners	Fire regulation in wildland-urban interface	Fuel treatments	Wildfire, regulation of insects and disease, and natural succession	Functioning healthy forest provides natural fire conditions and lower risk of high-intensity fires	Property and populations within wildland-urban interface	Fuel and vegetation conditions in wildland-urban interface
Municipal drinking water plant operators	Clean water, waterflow	Rights-of-way, utility corridors	Water filtration and purification services, watershed conditions	Water suitable for processing by a municipal drinking water plant (ultimately providing benefits to end commercial and residential users)	Consumption and population (demand) trends, treatment costs (avoided), development trends, drinking water index	Water quality and quantity reliability and trends on NFS lands, percentage of flow from NFS lands, overall watershed condition
Recreation						
Nonconsumptive recreationalist	Forest landscape, forest features, flora, fauna, at-risk species		Regulation of invasive species, biological diversity	Opportunity to recreate in a forest setting while viewing the landscape and species within it benefits many visitors	Number of visits, spending, and satisfaction (by activity, including wilderness); special use permits; demographics; local and traditional knowledge about importance; primary locations and sites; values for visits	Number of campgrounds, miles trails; rights-of-way; scenery; site conditions; wildlife populations and trends; wilderness areas

Table A2.1—Starter list of example users and other beneficiaries, forest goods and services, and potential measures, for use in developing initial lists of forest goods and services (continued)

Users and other beneficiaries	Forest good or service	Infrastructure, operations and other agency services	Ecosystem conditions and processes	Importance of forest good or service to user or other beneficiary	Beneficiary indicators and measures	Forest good or service indicators and measures
Gardeners	Bees, bats, birds		Pollination, soil formation	Forestland provides habitat for these species, which in turn provides pollination service to plants, including fruit trees adjacent to the forest		
Recreational gatherers and pickers	Flora, fungi, berries, mushrooms	Access, parking, trailheads	Nutrient cycling, seed dispersal	Gathering of plants and materials for consumption or other uses benefits some recreational visitors	Number of visits, spending, and satisfaction; special use permits; local and traditional knowledge about importance	Habitat and site conditions and trends
Recreational anglers	Fish, game fish	Access, parking	Habitat structure, organic and biological cycling, clean water	Soil retention and the capacity to prevent and mitigate soil erosion; stabilization of hazardous soils	Number of visits, spending, and satisfaction; license trends; value of visit; available at substitute sites	Fish population or habitat trends
Recreational hunters	Game species	Access, parking, trailheads	Habitat structure, habitat connectivity	Species that can be hunted	Number of visits, spending, and satisfaction; permits trends; value of visit; available substitute areas	Game population or habitat trends
Recreational visitors	Clean air, views, scenery, aesthetics	Access, parking, trailheads	Natural succession	Aesthetics improves satisfaction of recreational visits	Number of visits, spending, and satisfaction; demographics; FS revenue; value of visits; available substitute sites; visit locations and activity types; off-road vehicle licenses	Rights-of-way, scenery, site conditions
Learning						
Researchers	Forest landscapes, forest lands, archeological sites, fauna		Energy transfer, predator and prey dynamics, biological diversity	Forest and grasslands provide opportunities to further scientific understanding	Academic citations; research grants citations, including proposals and requests	Research natural areas, agreements
Educators and students	Forest landscapes, forest lands, archeology and historic sites, fauna	Interpretive facilities, outreach programs	Energy transfer, predator and prey dynamics, biological diversity	Forest and grasslands provide opportunities to further scientific understanding, communication, and education	Number of field trips or classes, attendance at FS activities, school curricula, education plans and strategies	
Subsistence						
Subsistence user - food	Flora, fauna, fish		Biological diversity	Edible organisms (i.e., birds, mammals, reptiles, etc.) that are hunted for personal use (i.e., not for sale)	Local and traditional knowledge about importance of species	
Subsistence user - drinking	Clean water		Erosion regulation	Water suitable for drinking, wetlands within the plan area provide water filtration service	Number of private water diversions and wells, demographic and development trends; drinking water index	Water quality and quantity, overall watershed condition
Subsistence user - materials	Timber, fiber, fur		Habitat structure		Local and traditional knowledge about importance of timber fiber and fur	

Table A2.1—Starter list of example users and other beneficiaries, forest goods and services, and potential measures, for use in developing initial lists of forest goods and services (continued)

Users and other beneficiaries	Forest good or service	Infrastructure, operations and other agency services	Ecosystem conditions and processes	Importance of forest good or service to user or other beneficiary	Beneficiary indicators and measures	Forest good or service indicators and measures
Cultural, inspirational						
Artists	Forest landscapes, flora, fauna		Biological diversity	Forest resources provide source material and inspiration for artists	Number and type of artists, visits or permits, publications and galleries	Scenery, scenic quality, wildlife and plant populations
Cultural, spiritual, ceremonial, sense-of-place participants and groups	Forestlands, cultural sites, fauna			Some lands and features are of special cultural or spiritual value to particular groups	Demographic trends for American Indian tribes, Alaska Native corporations, and other populations; number of visits (including distance traveled); local and traditional knowledge	Number of protected or preserved sites, national historic registered sites, rights-of-way
Traditional knowledge groups and seekers	Forest landscapes, forestlands, archeological sites, fauna				Number and type of groups; populations; partnerships; number of events and festivals	Condition and level of protection of sites and resources
Historical participants and groups	Historical sites, archeological sites	Site identification and protection		Some sites are of historical or archeological interest to some people	Number of visitors, events or festivals; use of outreach and education facilities	Condition and level of protection of sites and resources
Non-use options						
People who care (existence of resource)	At-risk species, forest features		Biological diversity		Non-use values	
People who care (options for future use or future generations)	At-risk species, forest features		Biological diversity		Non-use values	
Broader global populations						
Global populations	Sequestered carbon		Climate regulation and carbon sequestration	Long-term storage of greenhouse gases in ecosystems	Regional or national net sequestration or emission objectives or goals, sequestration trends on non-FS lands, wood products processing trends	Forest carbon inventories and trends, carbon emissions from operations, climate change scorecards, Forest Inventory and Analysis data
Foreign subsistence, commercial, and recreational groups	Migratory species		Habitat structure, habitat connectivity	Forest species that migrate to other areas or countries provide benefits to other populations	International populations and demographics	Seasonal migratory wildlife populations and habitat

Note: NFS = National Forest System, BLM = Bureau of Land Management, FS = Forest Service.

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