

Ecosystem Services and their Contribution to Sustainability

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Overview

- Forest Planning Rule requirements for ecosystem services and sustainability
- Ecosystem Service information needs
- What Ecosystem Services information is being collected in Forest Assessments?
- Next Steps: Tools for Integrating ES and Sustainability

2012 National Forest Planning Rule

Purpose of forest plans: *Guide management so [forests]...have the **capacity to provide people and communities with ecosystem services...** [36 CFR 219.1]*

2012 Rule Requires:

1. Assessment: *Ecosystem services are to be assessed using existing information*
2. Developing Alternative plans: *The plan must include plan components... to **guide the plan area's contribution to social and economic sustainability, taking into account...ecosystem services***

Ecosystem Service Definitions

Definition: Benefits people obtain from ecosystems including (MEA):

Provisioning Services: clean air/water, energy, timber

Regulating Services: carbon storage; flood control

Supporting Services: pollination, nutrient cycling

Cultural Services: educational, spiritual, cultural, recreation

Proposed Forest Service Handbook Direction:

Focus on “**key**” **ecosystem services** that are:

- Important (to people) beyond the plan area
- Likely to be affected by the plan

Definition: Sustainability

“Capability of society to meet the needs of the present generation without compromising the ability of future generations to meet their needs”



Definition: Sustainability

- Economic Needs: **Produce and consume, or otherwise benefit** from goods and services, including contributions to jobs and market/non-market benefits.
- Social Needs: **Support the network of relationships, traditions, cultures, and activities** that connect people to the land and one another, and support vibrant communities.

Paradigm Shift for Economics?

2012 Rule – ‘Meeting today’s needs without compromising future needs’

- Greater flexibility to allocate resources that insure a range of benefit opportunities (Less constraining)
 - Rely on more qualitative information about links between ecosystem services and social and economic conditions

1982 Rule: “plans shall provide for ...sustained yield of goods and services in a manner **that maximizes long term net public benefits**”

- More constraining - Identify optimal resource allocations:
 - Rely on more detailed and quantified information about ecosystem service supplies, costs, and demand

Intermediate vs Final Services

Ecosystem Services	
Supporting services Nutrient cycling Soil formation Primary production	Provisioning services Food (crops, livestock, wild foods, etc.) Fiber (timber, cotton/hemp/silk, wood fuel) Genetic resources Biochemicals, natural medicines, pharmaceuticals Fresh water
	Regulating services Air quality regulation Climate regulation (global, regional, and local) Water regulation Erosion regulation Disease regulation Pest regulation Pollination Natural hazard regulation
	Cultural services Aesthetic values Spiritual and religious values Recreation and ecotourism

Ecosystem Services: Different Definitions/Approaches

T.M. Patterson, D.L. Coelho/Forest Ecology and Management 257 (2009) 1637–1646

Citation	Definition	Principal uses
Daily, 1997	The conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life	Awareness
MEA, 2005	The benefits people obtain from ecosystems	Awareness
Collins and Larry, 2007	Natural assets that support human health and well-being	Awareness
Costanza et al., 1997	Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human (est. of replacement cost) modeling populations derive, directly or indirectly, from ecosystem functions	Awareness, valuation,
US EPA, 2006	Outputs of ecological functions or processes that directly or indirectly contribute to social welfare or have the potential to do so in the future. Some outputs may be bought and sold, but most are not marketed	Valuation (Ecological Benefits Assessment*)
Boyd and Banzhaf, 2007	The ecological components directly consumed or enjoyed	Valuation (green accounting)

Increasing specificity ↓

↑ Increasing inclusivity

What level of Information are Forests Collecting?

- Will ecosystem service information support:
 - Sustainability assessments (inclusive), or
 - Efficiency evaluations (specific)?
- Will sufficient information be collected to:
 - Quantify ES Provision (supply) and ES social/econ needs
 - Differentiate between Intermediate (input) vs Final services?
 - Quantify changes in social and economic conditions associated with ecosystem services?

Early Adopter Forests

- First waves of National Forests and Grasslands revising land management plans under the 2012 Rule
- Representing all areas of the country
- Currently completing assessments or beginning to develop alternative plans
 - Assessments reviewed for 8 Forests Regions
1 (Northern), 3 (SW), 5 (CA), and 8 (East)

Information and Resources Used for Ecosystem Services

- Focus group, public involvement (8 Forests)
 - 4 Forests used collaborative web-based tools
- Scientific and peer-reviewed articles (4 Forests)
- Bio-regional (wiki) assessment (3 Forests)
- Agency and other public data (EPS-HDT, NVUM, etc) (> 3 Forests)
- Other Sources: Science Synthesis; “Participatory Research Project”

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Defining Ecosystem Services

- All used MEA classification as departure point
- Four (4) forests adapted or referenced the ‘specific’ definition of ‘final services’ (Landers et.al. (2012); Boyd and Banzhaf’s (2007), etc):
 - ***components of natural, directly enjoyed, consumed, or used to yield human well-being***
- Most forests selected ‘key ecosystem services’ according to the proposed agency directives:



Selected 'Key' Ecosystem Services

- Between 7 to 22 key services identified per assessment



Comprehensive List of All 'Key' Ecosystem Services

- Aesthetics
- air purification
- at-risk species
- biodiversity
- Carbon sequestration and climate regulation
- Clean air-clean water-health
- cultural heritage and sense of place
- economic development
- Economy-timber-jobs
- Economy-tourism-jobs
- ecosystem resilience
- education, science and health
- energy
- Fish and wildlife
- Flood control
- flora and fauna
- food production
- Forage
- forest products
- Grazing
- habitat for flora and fauna
- human well-being
- Hunting-fishing-family-food-access
- hydropower
- maintenance of biodiversity
- national patrimony
- Natural fibers
- natural hazard regulation
- nutrient cycling
- oxygen production
- pollination
- purification of water and air
- rainfall
- recreation
- Recreation-hiking-camping-viewing nature-access
- research and education
- scenic value
- soil erosion control
- soil formation
- Soil stabilization and landslide protection
- spiritual, inspirational, and aesthetic services
- temperature regulation
- Timber
- Water
- water purification
- water quality
- water regulation
- Water supply
- watersheds
- Wildlife-habitat-diversity-nature-natural resources
- Wood products

Types of Ecosystem Services

Most or all assessments include:

- Services for all 4 MEA groups
- Carbon sequestration
- Some intermediate services (1 to 3) ('inclusive')
 - E.g., Soil stability; ecosystem resilience; pollination

Some assessments (4) include:

- Biodiversity
- “non-services”
 - e.g., jobs, human wellbeing, economic development



ES/Sustainability Factors

Most assessments describe:

- 1. *Geographic scale of key ecosystem services***
- 2. *Conditions and trends of key services***
- 3. *Drivers affecting key ecosystem services***
- 4. *Stability or resiliency of ecosystems* that contribute to ecosystem service provision**
- 5. *Influence of non-NFS lands or other conditions* on key ecosystem services**

But, information can be vague and not quantitative

Social and Economic Sustainability

Most assessments have sections touching on social and economic sustainability:

- “Importance to people in Broader Landscape”
- “Contributions to Social and Economic Sustainability”

Inconsistencies across Assessments regarding:

- Level of detail and amount of quantified data
- Transparent links between ecosystem services, ecosystem conditions, and social/econ conditions
- Drivers, trends, and outside influences on ecosystem service provision and/or needs.

Overall Observations

- Information being collected and assessed is:
 - Supportive (but still with gaps) for evaluations of social and economic sustainability
 - Less supportive of net benefits or efficiency evaluations:
 - Risk of double counting
 - Incomplete or confusing links between ES and social and economic conditions
 - Unclear if changes in ES can be quantified

Template Tables (1)

- Encouraging more complete information collection

←	↔	→	→	
Social and Economic Sustainability Issue	Direct Beneficiaries (People)	"Final" Forest Attributes	Ecosystem Processes and functions	Management Actions
What is the Social or Economic sustainability issue being raised by communities of interest or place?	Who directly interacts with or experience and therefore benefit from forest attributes?	What forest attributes, including infrastructure, or qualities do beneficiaries most directly interact with or gain satisfaction from?	What ecosystem processes or structures are affected by action and impact the "final forest attributes"?	What Forest management actions affect final forest attributes or ecosystem services linked to beneficiaries?
Growth of tourism industries	Catch-&-release anglers	Stream access		Access point development and maintenance
		Population of native fish	Competition with non-native fish	Non-native fish control (controllable?)
		Stream aesthetics	Erosion	Riparian protection/standards

Template Tables (2)

←	↔	→	→	→	→	→
Social and Economic Sustainability Issue	Direct Beneficiaries (People)	"Final" Service		"Final" Forest Attributes	Ecosystem Processes and functions	Management
What is the Social or Economic sustainability issue being raised by communities of interest or place?	<u>Who</u> directly interacts with or experience and therefore benefit from forest attributes?	What service opportunities are provided, in aggregate, by "Final" Forest attributes?	"Key" service?	What forest attributes, including infrastructure, or qualities do beneficiaries most directly interact with or gain satisfaction from?	What ecosystem processes or structures are affected by action and impact the "final forest attributes"?	What actions/attributes/s...
Growth of tourism industries	Catch-&-release anglers	Recreational Fishing		Stream access		development
				Population of native fish	Competition with non-native fish	Non- (
				Stream aesthetics	Erosion	prot

Template Tables (3)

	←	↔	→	→	→	→	
Economic ity Issue	Social, Cultural, or Economic Measure	Direct Beneficiaries (People)	"Final" Service		Final Service Measure	"Final" Forest Attributes	Ecosyste and f
Social or ustainability aised by interest or ?	What social and economic condition is affected by beneficiary activity or outputs?	<u>Who directly</u> interacts with or experience and therefore benefit from forest attributes?	What service opportunities are provided, in aggregate, by "Final" Forest attributes?	"Key" service?	Indicator of services based on the aggregate effect of multiple Forest Attributes	What forest attributes, including infrastructure, or qualities do beneficiaries most directly interact with or gain satisfaction from?	What ecos or structure action and forest
ourism ies	Employment	Catch-&-release anglers	Recreational Fishing		Proportion of stream miles with High Quality fishing with access	Stream access	
						Population of native fish	Compet na
						Stream aesthetics	E

Table 4: Identify Trends and Stressors/Drivers

Questions?

Other Slides

Social & Economic Sustainability

Uncertain factors affecting net benefits :

- Contributions (complements) in broader landscape,
- Stressors/drivers outside the control of the forest,
- Long-term ecosystem integrity, and
- Demand or values for goods and services

1982 Rule	Preferred Alternative
Assumes you have sufficient information to describe an alternative that will maximize net benefits.	Recognizes uncertainty. Shifts focus to providing a range of benefits that contribute to social-economic sustainability, and to using a more adaptive process to obtain and use new information about outside factors and drivers.

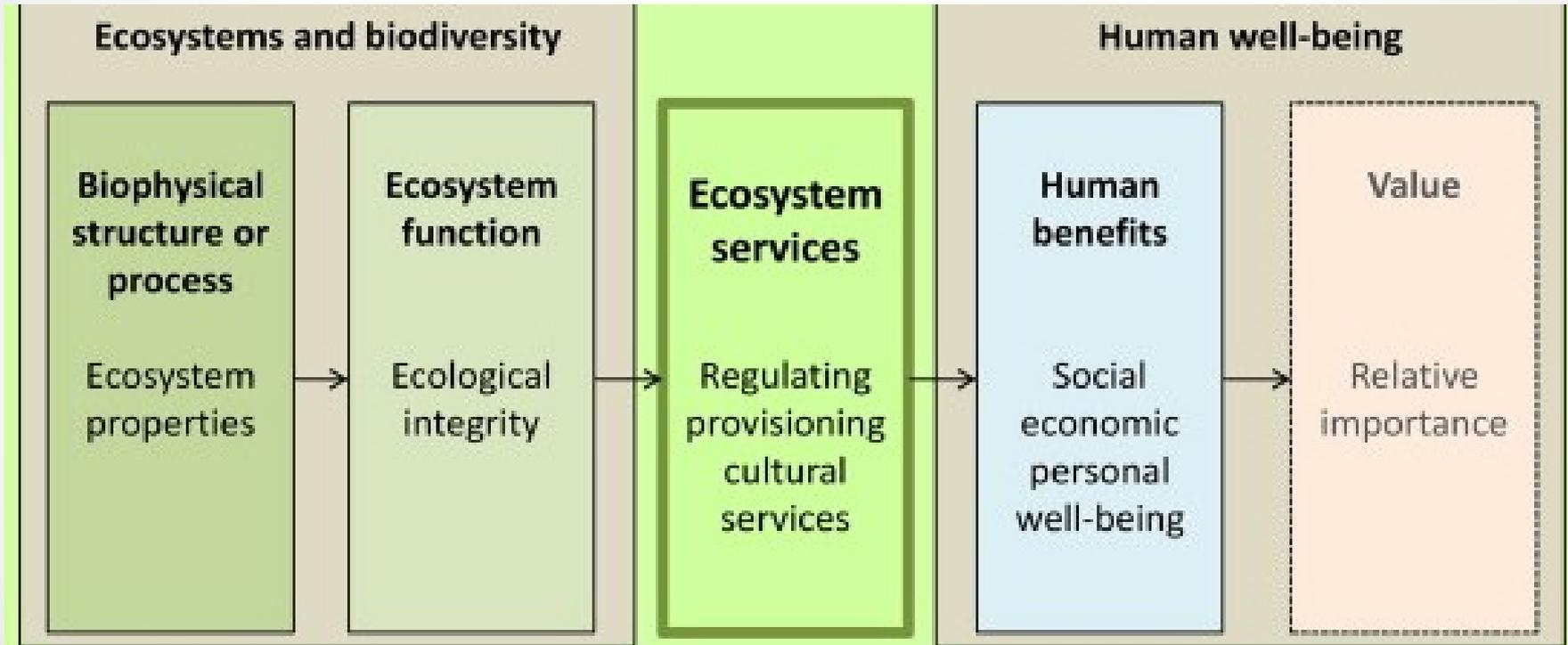
Paradigm Shift for Economics?

1982 Rule	2012 Rule
<p>“plans shall provide for multiple uses and sustained yield of goods and services in a manner that <u>maximizes long term net public benefits</u>”</p>	<p>“plans will guide management of NFS lands so they are ecologically sustainable and <u>contribute to social and economic sustainability</u>...and have the capacity to provide people and communities with ecosystem services and multiple uses that <u>provide a range of social, economic, and ecological benefits</u> for the present and into the future” (219.1(c))</p>

Ecosystem Services Information Needs?

- Forest Contributions to social and economic sustainability
 - Broader, less detailed descriptions of ecosystem services needs (demand) and provision (supply)
- Maximizing net public benefits (efficiency)?
 - More precise and detailed descriptions of ecosystem service supply and demand trends
 - Differentiate between final and intermediate services to avoid double counting?
 - Quantify links between ES and social/economic conditions

Linkage between Ecosystem services and Ecological Condition/ Integrity



From Kandziora et al. (2013), after Haines-Young and Potschin (2010a); Haines-Young and Potschin, (2010b); de Groot et al. (2010b) and Müller and Burkhard (2010)

Role of Ecosystem Services?

- **In Sustainability:** Helping characterize (and quantify) how a Forest contributes to a variety of social and economic conditions,
- Improves our ability to incorporate a broader spectrum of non-market benefits, under uncertainty, into decision-making?

AND/OR

- **In Efficiency:** Improves Forest capability to describe changes in net public benefits from alternative plans?

