Integrated Indicators for Socioecological Resilience

Social Ecological

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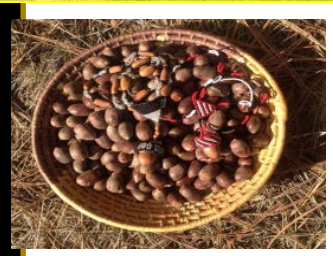
Integrated Indicators Presentation Outline

Brief Overview of Issues and Recent Research

Case studies

- Wet meadows (AZ)
- Black oaks (CA)
- Ecocultural resources (NWFP)

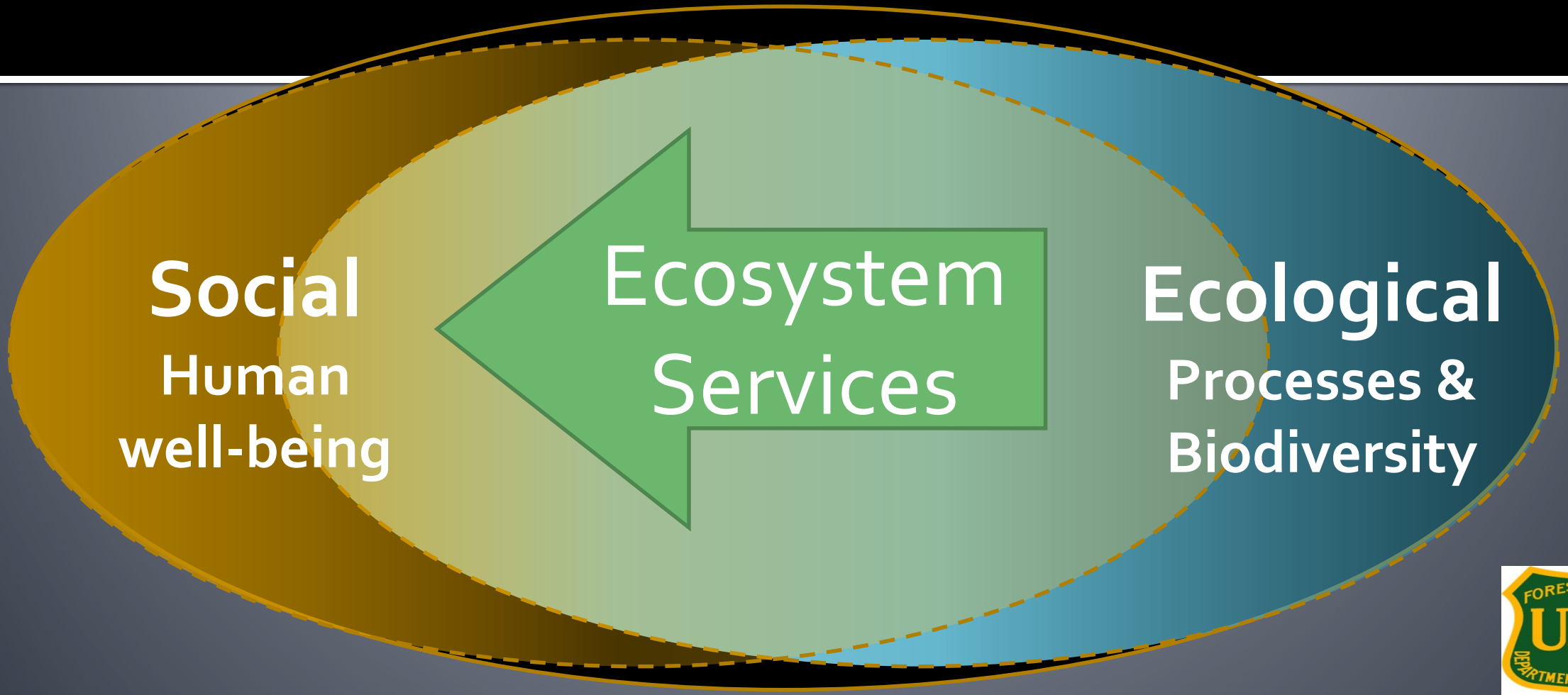


Examples from Draft Sierra National Forest Plan

Take Home Ideas

Brief review of issues and recent research

1) Integrated socioecological systems and ecosystem services



Examples of Indicators Considered in Climate Change Vulnerability Assessment in Thailand

Social

- Income/ poverty
- Land tenture/rights

(Border of Kaeng Kachran National Park)

Ecological

- Forest clearing
- Impacts of wildfires on understory

But **ecosystem services** from natural systems, including forest uses by indigenous people, were not strongly emphasized

A Way Forward using Ecosystem Services

Schröter et al. (2014, Cons. Letters)

"The ES concept offers a 'platform' for bringing people and their different views and interests together" and "can build bridges between science and practice, enabling for integrated, transdisciplinary approaches to solve 'wicked problems.'"

A Way Forward using Ecosystem Services

Schröter et al. (2014, Cons. Letters)

Recommendations:

- More strongly acknowledge **existence/intrinsic values**
- M**ove beyond the Western origin** of the ES concept
- Include nonmarket instruments
- Develop **both biophysical and sociocultural value** indicators to explain humans-nature relationships

2) Monitoring Design and Indicator Selection

1) **Measure "the right things"**

"Most ecological monitoring programs end up "doing the thing right" (precise, local measurement) rather than "doing the right thing" (esp. innovative large-scale monitoring using remote sensing and non-professional labor or citizen scientists"

(Walters 1997, "Adaptive management in riparian and coastal ecosystems")

2) Ensure relevance to local communities and encourage public participation

(Gasteyer & Flora 2010, "Measuring ppm With Tennis Shoes: Science and Locally Meaningful Indicators of Environmental Quality")

3) Avoid gaming, perverse incentives, and other measurement "diseases"

- "hitting the target but missing the point"
- "indicator shopping"
- "short-term outputs" rather than "long-term outcomes"

(Van Reeth 2014, "Ecosystems service indicators in Flanders: Are we measuring what we want to manage")

Important Factors for Strong Indicators

Based on holistic ecosystem services
Practically and reliably measured, including by local community members
Scaleable to large areas (esp. with remote sensing and networks)
Ecologically relevant
Socially relevant
Sensitive to threshold effects

Case #1: Riparian wetland restoration on White Mountain Apache Reservation

Indicators	Channel incision/aggradation and cover of native obligate grass-like vegetation along channel margins
Practically and reliably measured?	Cross-sections and vegetation plots/transects by staff and by local tribal members
Scaleable to large areas	Yes (aggregated reporting of wetland condition)
Ecological relevance	Measures of erosion and wetland function
Social relevance to local community	Sense of place and cultural identity; gathering sites for plants and spring water; hunting sites
Threshold	Incision forming nickpoints

Case #1: Vegetative Indicators of Riparian Wetland Condition

- Dominance of native **obligate wetland grass-like plants**
- Diversity often *higher* at degraded sites
- Most **grasses, forbs, and woody shrubs not desired** along margins of small streams
- Certain taxa (cattails and reeds) have special cultural significance

Case #1: Riparian wetland restoration on White Mountain Apache Reservation (1997-2010)

Sierra NF Plan: Monitoring Meadows

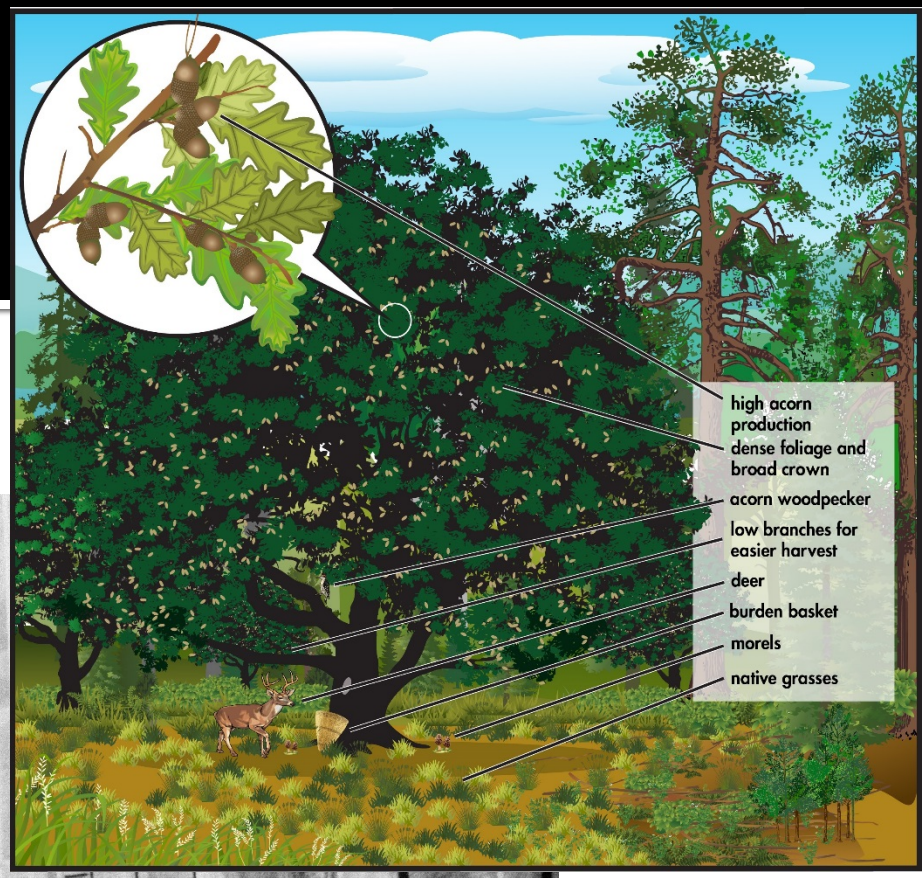
Desired Condition

RCA-MEAD-DC-05 Meadows are in mid- to late-seral condition, with substantive ground cover and a rich and **diverse species composition, especially of grasses and forbs**. Meadows have high plant functional diversity with **late successional** functional types represented. Perennial streams in meadows contain a **diversity of age classes of hardwood shrubs along the stream bank**, where the potential exists.

Alternative Indicators? Wetland vegetation and incision

Case #2: California black oak

Indicators	Amount of high quality acorns and density of large or very large black oaks
Practically and reliably measured?	Tree measurements and potentially acorn counts by local community members
Scaleable to large areas	Yes (FIA data)
Ecological relevance	Large trees important as cavities for old growth associated species (spotted owls, fisher). Acorns support many species.
Social relevance	Access to productive trees important for maintaining gathering traditions
Threshold	Mortality of large trees requires decades to recover



Sierra NF Plan: Monitoring Black Oaks

Desired Condition	Monitoring Question	Associated Indicators
TERR-BLCK-DC-01 Oak trees in varied ages are present, with wide spacing providing full sunlight around **large old oak trees, enhancing their ability to produce abundant acorn crops.** TERR-BLCK-DC-02 **Black oak snags greater than 20 inches in diameter, and live oak trees with dead limbs, hollow boles and cavities provide shelter, resting and nesting habitat for wildlife**. TERR-BLCK-DC-03 **Acorns** and other important plants in this vegetation type are **plentiful and available** for tribal uses. There are a diversity of sizes, ages, and locations of black oaks…. TERR-DMC-DC-03 **Trees > 30 and 40 inches** in diameter are **common, especially** pine and **black oak.**	Are black oak populations stable or increasing?	Oak spatial extent; canopy cover; basal area; density; regeneration; and tree health (e.g., mortality rates, insects, etc.).
Fisher (SPEC-PF-DC-04):Black oaks are well-distributed…throughout the fisher's range. **The majority of trees are in good condition and the number of large oaks is increasing.**		

Large

Case #3: Northwest Forest Plan Area

Photo and Regalia
by Frank Lake

"Cultural barometers of ecological integrity" (Lake et al. The Karuk tribe, planetary stewardship, and world renewal 2010):

- Acorn abundance is linked to wildland fire's "service," and enhanced through the role of humans as stewards and fire managers.
- Woodpeckers are indicators of terrestrial productivity and spiritual wealth
- Spring chinook salmon are indicators of aquatic health and watershed connectivity

Case #3 Example: Cedar logs in PNW

Indicators	Amount of high quality cedar logs for canoes, totem poles, etc.
Practically and reliably measured?	Tree measurements, potentially by community members
Scaleable to large areas	Yes (FIA data)
Ecological relevance	Large trees significant for wildlife species
Social relevance	Key resource for maintaining social traditions and intertribal relations
Threshold	Trees take centuries to mature and fall

Four canoes carved from one log by Frank and Ben Harlow, photo by Dale Northup

Conclusions: Choice of Indicators

1. Choose indicators that are relevant to and readily monitored by local communities yet scalable to larger regions
2. Emphasize "natural capital" that takes long periods to develop (soils, wildlife, trees, and other "legacies") and is vulnerable to abrupt and persistent losses

Conclusion: To promote *social-ecological* resilience → Use *integrated socioecological* indicators

- Tribal communities offer many examples because they traditionally reflect well-integrated socioecological systems
- For ecological restoration of meadows and forests, adjustments to existing indicators may be relatively simple
- Where there may be more conflict, consider ways to pair ecological and social indicators to internalize tradeoffs (see Lee Tarnay's presentation on smoke impacts tomorrow)