Economics of Fire Science

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Economic Science

- Economics is not simply cost-benefit analysis of commercial values such as timber or property.
- Economics evaluates incentives for individuals' and managers' choices affecting risks or outcomes; market and non-market values affecting quality of life and *tradeoffs* among goods and services of value (tourism, water/air quality, wildlife).
- Economics provides a broad framework from which to evaluate alternatives for the public good.

Fire: Physical, Natural, Social

- U.S. Fire crises derive from historic policy, and community and individual choices that have raised fire risk and consequences.
- Historic fire suppression choices failed to recognize:
  - the ecological role of fire,
  - the incentives that suppression creates for individuals and communities to develop rural areas,
  - and the opportunities and benefits that ecosystems provide, or could have provided, under alternative management regimes.

Social and Economic Science

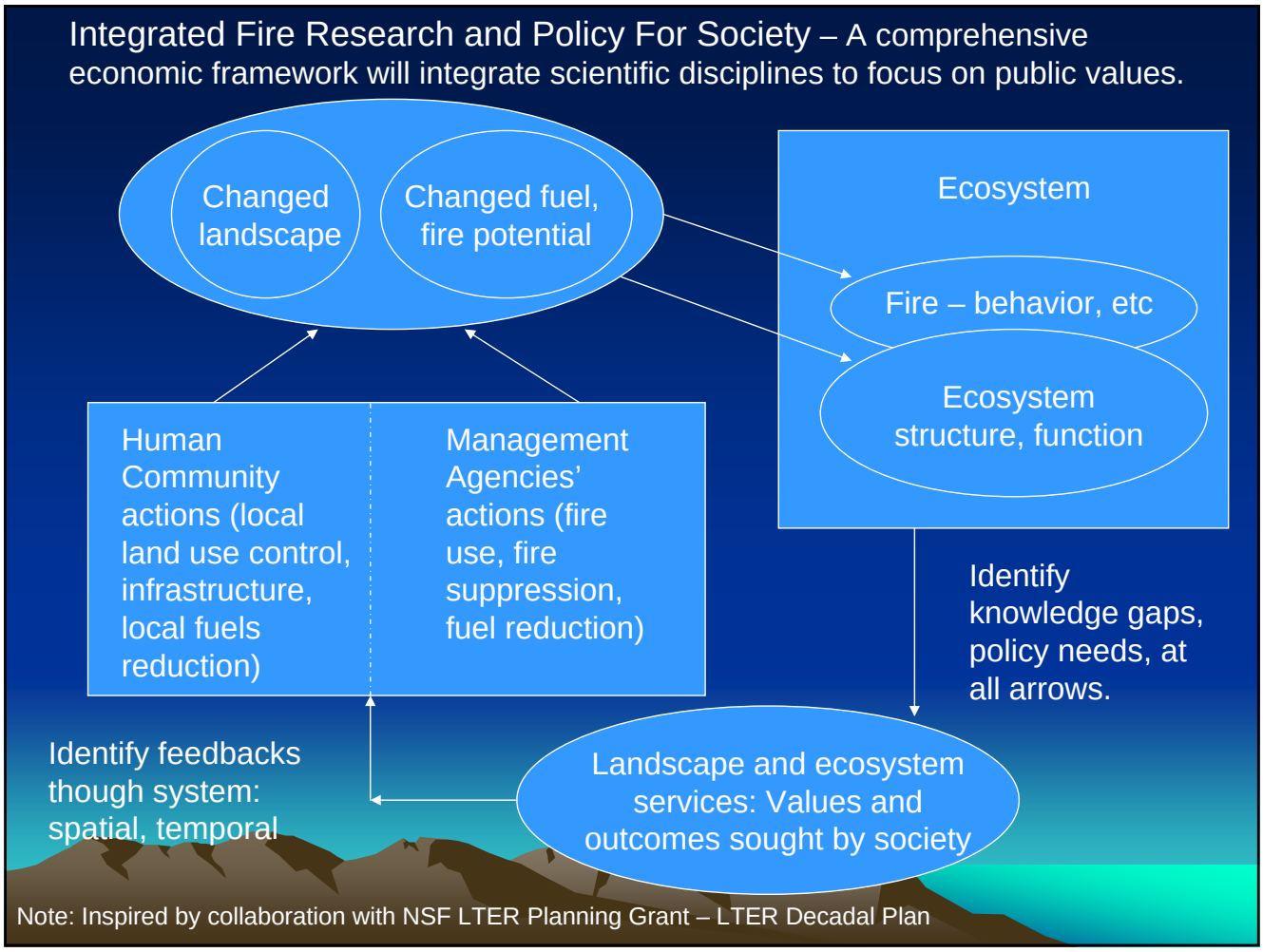
- Effective solutions will involve understanding:
  - public values sought from fire-prone ecosystems;
  - ecological and physical science basis to create, restore, sustain resources of public value;
  - incentives for individual (landowner, homeowner), business, and community actions relative to fire risk and consequences.

Public values

- Commercial value of timber and other natural resources
- Recreation sites: tourism and rural living
- Watersheds for water supply and quality
- Air quality (timing and intensity)
- Fire will happen:
  The issues are when (natural, accidental or planned), how intense, and what will publicly-valued options be after fires.

Integrated Perspective

- Choose policy, management and research priorities, before and after fire, within a framework that creates and integrates ecological, physical and social science knowledge.
- Economic frameworks address how fire-adapted and fire-sensitive ecosystems produce valuable services, in space and time.
- Human choices within fire policy and management regimes create unanticipated or unintended consequences


Integrated Fire Research and Policy For Society – A comprehensive economic framework will integrate scientific disciplines to focus on public values.
Changed landscape
Changed fuel, fire potential
Ecosystem
Fire – behavior, etc
Ecosystem structure, function
Human Community actions (local land use control, infrastructure, local fuels reduction)
Management Agencies' actions (fire use, fire suppression, fuel reduction)
Identify knowledge gaps, policy needs, at all arrows.
Identify feedbacks though system: spatial, temporal
Landscape and ecosystem services: Values and outcomes sought by society
Note: Inspired by collaboration with NSF LTER Planning Grant – LTER Decadal Plan

Pre-Fire Fuel Treatment

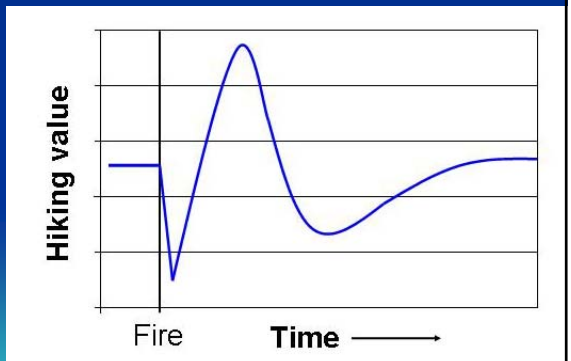
- Risks are distributed across vast landscapes, with substantial uncertainty limiting forecasts of ignition sites.
- Human causes can be linked to accessibility and economic well-being.
- Spatial, geographic linkages influence effectiveness of pre-fire treatment to reduce fuel accumulations.
- New knowledge and decision support models can increase benefits from (returns to) costly fuels reduction.
  - Cost effectiveness increases when guidelines stimulate actions relative to resource and community values that are enhanced.
  - For example, performance measures linked to “acres treated” create incentives to treat accessible acres rather than acres in locations that protect high-value watersheds, at-risk developments or sites of natural resource-based tourism.

Cost Benefit – Fuel Management

- Catastrophic fires can generate large losses of property and ecosystem values.
  - But dispersed risk (low ignition-risk in any particular location) implies expected value of fuel management is low at many locations.
  - Certainty of costs, uncertainty of benefits implies a need for decision support tools.
- Fire will occur.
  - What actions sustain *desirable* resource conditions at what cost?

Temporal Ecosystem Benefits

- Ecological transition means benefits of pre-fire fuel treatment or post-fire recovery or restoration will vary over time.
- Hiking value post fire
  - Initial decline in value
  - Scenic/wildlife recovery with habitat variation
  - Fire sustains attractive ecosystem after time



Example benefit flow following wildfire

Cost Benefit – Post Fire

- Salvage logging may recover some commercial timber value, but may also reduce other ecosystem services of public value.
  - Commercial and business links through tourism, recreation, wildlife, landscape amenity are sought by homeowners and communities.
  - Non-market values through endangered species, wildlife, water quality (public health) affect quality of rural living and associated development.
- Economic sense means post-fire actions should produce set of highest value benefits after costs.

Knowledge Gaps

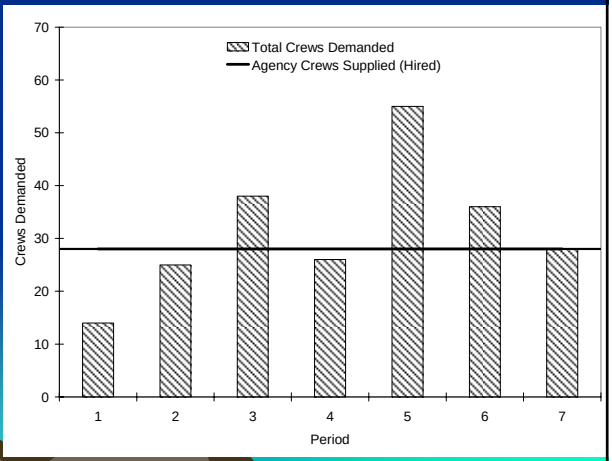
- We face *extensive knowledge gaps*
  - What are ecosystem service values sought by communities? Which communities?
  - How are they produced? Where?
  - How are ecosystem values affected by pre-fire and post-fire management actions?
  - How do management and policy choices alter incentives for individual actions that exacerbate risks and consequences?
- Government regulations constrain social science research and knowledge development.

Education

- There are “two faces of fire” – beneficial and detrimental.
- Science-based, public education can alter the perceptions, and realities, of costs and benefits, and facilitate agencies’ ability to use fire as a tool to produce values for society.
- Education reduces human denial about the reality of living with fire.

Wise use of $$Billions?

- Proactive investment in integrated research for ecological and social science could return dramatic benefits.
- Example:
  Spending on research to balance climate uncertainty and decisions to maintain suppression crews through the fire-season can *reduce* personnel cost by $3 to $22 per $1 spent on the research.
  (Prestemon and Donovan in press)



Economics Sciences - Investigating Solutions

- Science must address critical economic questions:
  - Humans critical to fire risk and implications
  - Understanding humans' value, choice and behavior must be a high priority for effective solutions

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