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

Human Community actions (local land use control, infrastructure, local fuels reduction)

Management Agencies’ actions (fire use, fire suppression, fuel reduction)

Identify feedbacks through system: spatial, temporal

Landscape and ecosystem services: Values and outcomes sought by society

Ecosystem

- Fire – behavior, etc
- Ecosystem structure, function

Identify knowledge gaps, policy needs, at all arrows.

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
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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