Context Document: USFS Fire and Timber Management ESCM

http://bit.ly/NI-ESCM

Ecosystem Service Conceptual Models (ESCMs) summarize the effects of an intervention on ecological and social systems. Each model links changes in biophysical systems caused by an intervention to measurable socioeconomic, human well-being, and ecological outcomes. This is a general ESCM that assumes the intervention is successful and includes all potentially significant outcomes for the intervention. For individual projects, not all outcomes will be relevant and will depend on location and environmental conditions.

The direction of an outcome (whether the intervention will have a positive or negative influence) often depends on the specific situation. There may be multiple links (arrows) leading into an outcome that have opposite effects. Thus, language like "increased" or "decreased" is not included in this model. These models are often used to consider management with or without an intervention or to compare different interventions.

This document provides information about the intervention—**Fire and Timber Management on U.S. Forest Service (USFS) Land**—and details about some of the relationships in the ESCM. It also includes a list of the references used to develop the ESCM and names of experts with whom we spoke to refine the model.

The Predictive Model Library for this ESCM includes summaries of quantitative models available to predict the relationships shown in the ESCM and short discussions of relationships for which predictive models are not currently available. These models could be linked together to develop a scenario modeling tool with ecosystem service outcomes.

USFS Fire and Timber Management Interventions

Four interventions are included in the ESCM:

- **Harvest** of timber for commercial sale refers to the removal of whole trees from a stand for the purpose of milling, and includes clear-cut, shelterwood-cut, and selective harvesting approaches.
- **Thinning** refers to the removal of a certain percentage of trees, particularly from a young stand (10–15 years), to improve stands' commercial value or to manage fuel loads. This includes both precommercial and commercial thinning.
- **Chemical treatment** refers to the application of herbicides and other chemical treatments to prevent the growth of undesirable species of plants from growing in a stand.
- **Prescribed burn** refers to the planned, controlled ignition of typically low-intensity fires to manage fuel loads or shift tree species composition for harvest or habitat

External Factors

Many external environmental and social factors influence the type of intervention that can be done in a certain location and how successful the intervention is. Public opinion can influence the use of prescribed burn (often negatively) and timber harvest (can be negative or positive depending on the community composition and interest groups). Treatment is often not possible on steep slopes due to limited access. Weather conditions and existing fuel status (composition, moisture content) influence the extent and intensity of prescribed burns, which determines how well it achieves management goals.

Model Notes and Clarifications

Landscape aesthetics: Landscape aesthetics are a difficult-to-measure quality that determines how aesthetically pleasing people find the landscape, and therefore how suitable they think it is for various recreational uses. Many characteristics of the landscape can influence aesthetics; a few major ones (canopy structure, plant species composition, tree size, and direct effects of fire on aesthetics via burn scars) are included in the model.

White nodes: White boxes represent system components that are only relevant in specific contexts. For example, pine straw biomass can be a commercially valuable product in certain types of pine forest; ticks and tickborne disease are particularly important in the northeastern U.S., and mushrooms are harvested recreationally and commercially in certain locations.

Prescribed burns and mushrooms: There is some evidence that certain species of morel mushrooms fruit prolifically after a fire, leading to increased harvest. However, many studies that found high morel density following fires may overestimate the effect due to unsystematic sampling. A field study in Yellowstone National Park developed a conceptual model of post-fire morel productivity that includes fire, soil, and plant community characteristics as well as pre-fire morel presence or absence (Larson et al. 2016).

Prescribed burns and ticks: Prescribed burning may be an effective management strategy for reducing tick populations, however, studies have shown inconsistent effects of burning on tick populations. For example, Gleim et al. (2014) found that burns reduced tick populations in Florida and Georgia; Gilliam et al. (2018) concluded that other habitat characteristics have a much stronger effect on ticks than burns in Illinois; and MacDonald et al. (2018) found that exposure to ticks increased immediately after a fire in California, but reduced in subsequent years due to population declines in ticks and their hosts.

Risk of escaped fire: Prescribed burns that "escape" their planned boundaries are rare due to conservative planning, but can occur, as catalogued in a USFS report on escaped prescribed burns (Dether 2005).

Carbon flux: The carbon flux node represents changes in carbon emissions or sequestration. This can occur through short-term events, such as carbon emissions from prescribed burns or wildfires, or over a longer time period, like changes in carbon sequestration rates after a management action reduces the total number of trees in the forest or shifts tree species composition. Both types of changes are included in the ESCM, represented by the links leading to the carbon flux node.

Other relevant ESCMs: This ESCM represents management actions that are focused on timber harvest and reducing fire risk. If you are using the ESCM in a context where a significant fire event is likely to occur, especially in the timeframe you are considering for management, it may be helpful to look at the additional ESCM indicated in a green oval.

Experts Consulted

Matthew Thompson, Research Forester, USFS

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Chris Miller, Economist, USFS

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Jimmy Kagan, Oregon State Institute for Natural Resources

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