

Modeling the productivity of forest fire suppression operations using production functions. A methodological approach

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Abstract

Society, forest landscapes and fires constitute a triangle of interaction with important requirements and consequences. These interdependencies offer a field for the application and development of research with a clear focus on social sciences, in which the fire prevention, risk analysis and socio-economic conditions are shaped as basic pillars.

Environmental dryness, climate and the consequences of fire exclusion, aggravated by urban growth in forest areas, with absence of preventive norms and under a scenario of high forest fires risk creates an environment susceptible to large forest fires that can affect the well-being of citizens. In this sense, the authorities and government are committing large budgetary investments for the prevention and suppression of wildfires.

The knowledge advances of the dynamics of fire behavior have allowed to dimension the expansive capacity of fire and, as a function of it, to identify a priori the potential impacts. In this sense, the integration of this knowledge together with social and economic aspects, have allowed us to advance in the studies of costs and benefits, spatial-temporal determination of risks in probabilistic terms and others such as the evaluation of the fire severity, the operational strategy, the reduction of uncertainty and the help in the decision making process.

The present work explores the development of a methodology to incorporate fire suppression experience, detailed historical data on forest fire management from Mediterranean ecosystems, and empirical models to analyze efficiency and production. The resulting models of wildfire suppression production provides a basis for generating a conceptual framework to study suppression operations.

The development of decision support tools based on econometric models of fire suppression production functions requires the selection of variables that define and determine the problem. The present work includes the main methodological considerations for the definition and development of an econometric model based on the study of efficiency and productivity through the development of production functions that can predict the operational suppression yields in different scenarios of forest fires (meters per hour of fire spreading containment and suppression). The resulting model may represent an opportunity to aid in the development of suppression operations plans, helping the fire managers determine the production rates of the resources dispatched to fire suppression.

Keywords: Suppressions operations, production function, econometric models, fire weather danger, production rates, suppression costs, ground resources, aerial resources, suppression difficulty index

The views expressed in this paper are the authors' and do not necessarily reflect those of the U.S. Department of Agriculture or the USDA Forest Service. Results are preliminary and subject to revision.

1. Introduction

The main lines of research developed from the middle of the first quarter of the twentieth century to the present, have allowed us to conceptualize the problem of the occurrence of forest fires, not only in physical, ecological, landscape management or operations suppression terms, but also the knowledge acquired due to the science associated with the study of forest fires, they define a new

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