Global Earth Observation - Benefit Estimation: Now, Next and Emerging

GEOBENE

Assessing the economic, social and enviromental benefits of the GEO domains

Improvement in Optimal Forest Management through Earth Observations -A Global Integrated Analysis Considering Fire Risk –

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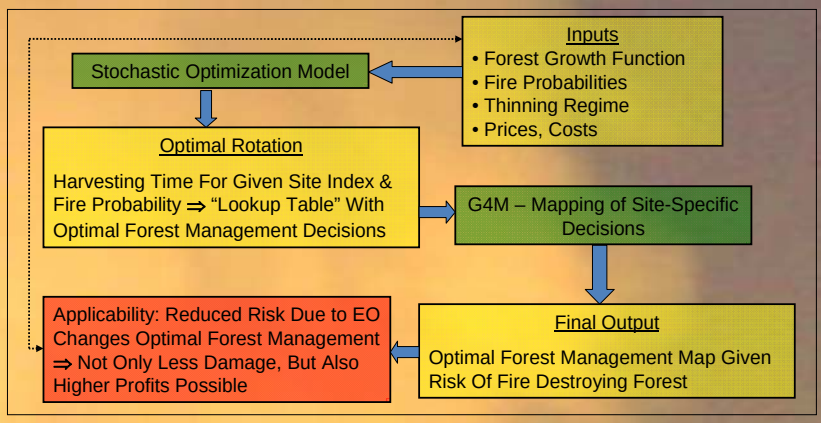
Objective

The objective of this study is to create a framework, where uncertainty (in the form of fire risk) can be taken into account and the value of better or more frequent Earth Observation (EO) can be estimated at the global scale. The result is an integrated modelling framework, where stochastic optimization is used to generate optimal forest management decisions at the local scale for a range of parameterizations that are then used as behavioural rules in the spatially explicit Global Forest Model (G4M). The impact of EO can thus be derived as the difference in management results (i.e. between parameters representing states with and without EO).

Approach

Stochastic optimization is a standard tool used to determine optimal strategies in the face of uncertainty. Inputs for the model (the forest growth function depending on the site index, the probability of fire in different regions (see example below), price and cost parameters) were taken from forest growth models developed at IIASA. The output of the model is a "lookup table" with the optimal rotation and stocking degree, as well as the size of clear corridors, that lead to a decreased fire risk for all combinations of mentioned parameters. This serves as input for the G4M model to determine the optimal forest management for different regions.



Modeling Framework

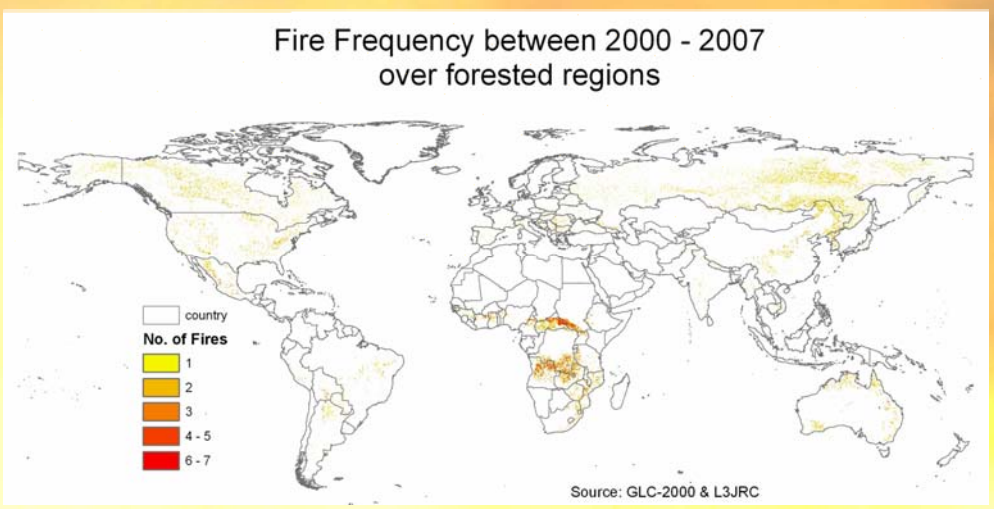
Fire risk can be decreased by better EO resulting in changes to optimal forest management decisions.

Legend

Results

Models

GEO Benefit

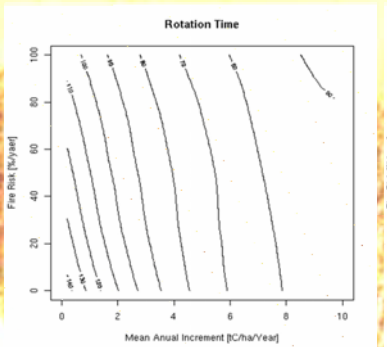


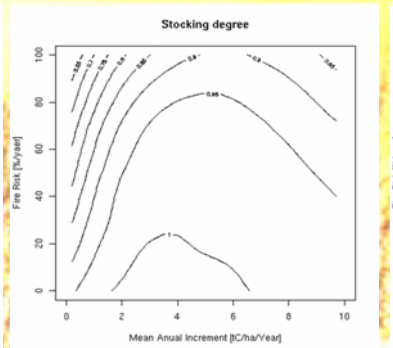
Fire Frequency

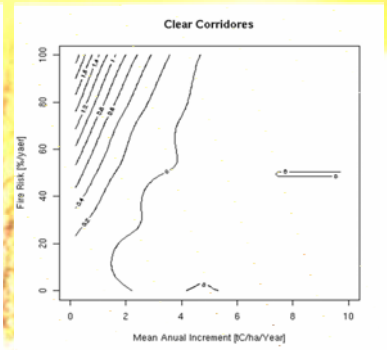
Global burnt area detected via EO using SPOT VGT S1, is recorded between years 2000 - 2007, by the L3JRC consortium. The dataset was pre-processed to remove cloud shadow and other unwanted data and then post-processed to remove some over detections, with the help of the GLC-2000 land cover product. It is assumed that a global fire year starts on the 1st April of every year and that a surface cannot be burned more than once in the same fire season. The cell value refers to the number of years the cell was identified as burnt area (total cell 1km2) between 2000-2007. Noticeable, are the areas in Africa which burn annually. In other parts of the world, the fire return interval is much lower. Improvements and lengthening of this dataset will greatly improve the quality of estimations based on fire history.

Earth observation (work in progress)

This modeling framework now enables us to use fire frequency maps like the one on the left together with the derived optimal forest management decisions and a site-index map in order to examine the impact of Earth observations.







Results of the stochastic optimization - mapped for a discount rate of 1%, the same output for discounting at 2% and 3% is available upon request.

G4M Decisions

G4M provides combinations of:
• mean annual increment form 0.25-10 tC/ha/year,
• age from 0-400 years,
• yield table stocking degree from 0.1-1 and stocking for unmanaged forests
the values
⇒ volume in the forest, diameter, volume removed during thinning

Optimal management for different magnitudes of forest fire risk, assuming wood price and harvesting costs depending on tree size and amount of removed wood volume (and if used during thinning or final cut), planting costs, infrastructure costs, different discount rates
⇒ optimal rotation time, stocking degree, size of separating corridors

Background: FreeFoto.com

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Design: Nadine Reuter