A Heuristic for Landscape Management

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Abstract—*The development of landscape ecology has stressed out the importance of spatial and sequential relationships as explanations to forest stand dynamics, and for other natural ambiences. This presentation offers a specific design that introduces spatial considerations into forest planning with the idea of regulating fragmentation and connectivity in commercial forest stands when these stands are subject to silvicultural regimes for conversion to a condition similar to pristine. El Llanito, a group of forest tracts privately owned in Atenguillo, Jalisco, Mexico, is under a forest plan that will serve as an example of landscape management. In this plan, the harvest schedule from SICODESI, a traditional Mexican forest management method, is used as the initial feasible solution in a heuristic that introduces successive changes in prescription, and timing of treatment, to improve the solution features, considering fragmentation and connectivity specs, and the proportional balance of successional stand structures. Results in the example case show a clear trend towards a more balanced distribution of successional stages, and a harvest level comparable to historic levels. There is a slight decline in fragmentation and connectivity goals, much of which can be explained by the sizable amount of area damaged by pests and fire in the previous cycle. This outcome is a welcomed improvement over the features displayed by the SICODESI solution, which could have been chosen if landscape management were not available.*

Introduction

Landscape ecology has brought attention to spatial relationships that explain many of the most important ecological processes. Keeping track of disturbance patterns is one recurrent theme in spatial studies within landscape ecology. Introducing these advances into forest management planning is the purpose of this paper.

The particular case of Mexican forestry favors one particular design of landscape management. After almost a century of harvesting in commercial timberland stand structure has changed in a way that characteristic elements of late successional stages have been drastically reduced, while the simpler and younger stand structures typical of early succession predominate. Fragmentation and connectivity have steadily worsened. Stand structure demands specific silvicultural regimes, known as biopaths, to gradually replenish elements that define mature and old stages and functions. Meanwhile, adjacency and time sequence in treatments need to keep tabs on fragmentation and connectivity. Designing a form of forest planning that will fulfill both aims is requires the use of a specific heuristic such as the one presented here.

Case Study

El Llanito is a forest comprising a set of five contiguous forested tracks controlled by a single timber company, Sánchez Monroy Cia. S. de R.L. de C.V., and managed by a single consulting firm, Servicios Forestales Profesionales Mascota S.C. The 3357 ha of El Llanito contains 2017 ha of commercial timber land covered with mixed conifers. These biological and socioeconomic conditions are representative of many other forest in the southwest of Jalisco.

In 2002, a new forest plan was needed to guide the fourth entry in the forest. The steady hand of a

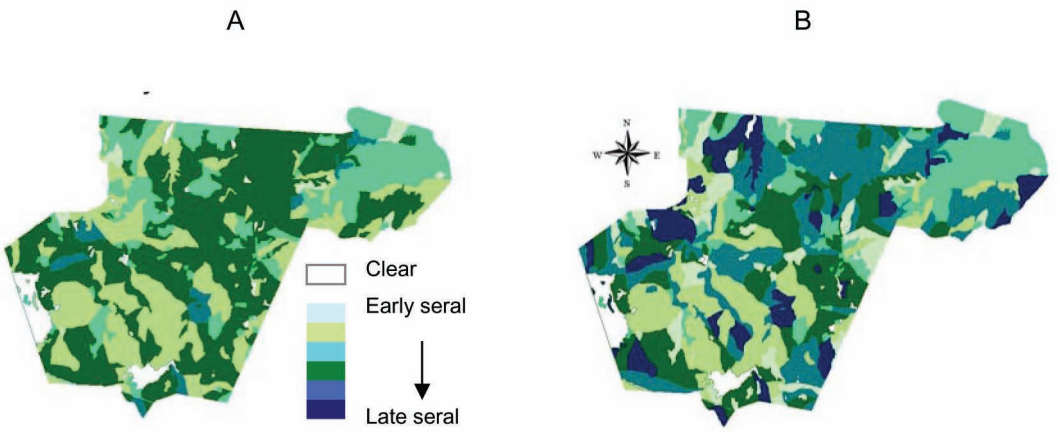

Figure 1. Current stand conditions (A), and landscape management expected stand structures (B). El Llanito, Jalisco, México 2002-2011 forest plan.

professional forester has conducted a careful and continuous, long term operation in El Llanito. The residual forest structure still contains considerable stocking and opportunities for silviculture, hence offering a benevolent setting where new ideas such as landscape forest management, can be tested with ease.

Silvicultural Regimes

Background

The initial entries in El Llanito followed selective criteria that fostered liquidation of old-growth elements, but retained most of the former structural diversity and canopy stories. Difficulties with diminishing regeneration was one factor in a policy change in 1992 towards even-aged silviculture. For a decade these efforts advanced in developing high yield, young, single story stands, and solved the regeneration concerns of the past through applying seedtree cuts to the most mature stands.

In the previous cutting cycle catastrophic events impacted a third of the forest area, reducing 9 percent standing volume in the commercial portion of the forest. Neither selection nor even-aged regimes were prepared to handle recurring considerable pests and fire damages, because both assume no catastrophic events. They only deduce a small penalty to adjust standing volume estimates. However, the whole region is prone to serious fire and pest incidents that reach El Llanito, even though it is located at the top of the mountain range known as Sierra Occidental.

Timber Regimes

Under the new landscape management, each stand is visited by a professional silviculturist and prescribed. Mature one story stands generally are assigned for final harvest. Natural regeneration is obtained from seedtrees. Sites with slope or erosion potential receive a lighter cut similar to protection cut. Areas with multiple canopy stories, and low productivity stands are regenerated using selection cut. All other stands are prescribed thinning, except if stocking is so low that it would be uneconomic to log.

Special Regimes

Crests and riparian zones are prescribed special biopaths that pretend to reconstruct natural conditions. Presence of very large trees with long crowns, plenty of large woody debris in advanced decay, minimal organic matter and small fuels, dense understory with visibility under 50 m are desirable attributes that are retained when present, and fostered when absent.

Best Management Practices

Road network was carefully surveyed to define stretches of road that could be closed and vegetated, specially shortcuts and roads near riparian conditions. Some of the access roads had small portions in need of realignment, but most were prescribed a set of improvements in line with FAO's low impact logging specifications (Dykstra and Heinrich 1996).

Forest Planning and Regulation

Net revenue optimization was the initial approximation to a harvest schedule for the planning cycle 2002-2011. This criterion is in line with the private nature of forest ownership, and interests of the logging firm. Maintaining an even flow of harvest similar in amount to the previous cycle was a second level screening criterion. Last, feasible combinations of stand, treatment and annual cutting area allocation were required to follow a rule that every annual cutting area should at least maintain fragmentation and connectivity stats.

Results

Figure 1 depicts graphically differences between unconditional revenue maximization, and the final round of choices in harvest schedule. A total of 300 stands (93.5 %) received regimes different from the unconditional recommendation prescribed by the silviculturist. Most changes were from options where those that allowed the revised prescription to be coherent with the current stand condition. This meant to induce an accelerated change to latter seral structures in 119 stands, and move to early successional stages the other 181 stands.

References

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