Using the Landscape Treatment Designer to Prioritize Stands for Treatment
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The Landscape Treatment Designer (LTD) is a spatial prioritization and optimization program designed for use in developing and comparing landscape fuel treatment scenarios. It was developed by Alan Ager and others (2012) to streamline the use of fire behavior modeling in fuel treatment planning, but is flexible enough to contribute to many spatial planning problems. The LTD program is included in the ArcFuels system (Ager and others 2006), a library of ArcGIS macros that facilitates communication among the array of models and other programs commonly used in fuel treatment planning at the landscape scale: vegetation growth and yield simulators, fire behavior models, ArcGIS, and desktop software.

The LTD allows the user to incorporate multiple management objectives and treatment thresholds and constraints in treatment planning. Any classifiable stand feature, such as habitat value, proximity to human communities, and wildfire hazard, may be combined in prioritizing stands for treatment. The process of selecting stands for treatment can be made subject to treatment thresholds, such as minimum stand density index or maximum slope steepness; and constraints, such as financial or acreage limitations. The LTD program quickly generates treatment alternatives, permitting ready comparison of the tradeoffs associated with management decisions.

The following is a description of how we employed the LTD program in the Task 5 study of landscape treatments. Please refer to the LTD manual (Ager and others 2012) and website (http://www.fs.fed.us/wwetac/ltd/) for further information.

In the Task 5 analysis, we evaluated how restrictions on treatment placement and treatment methods influence wildfire risk across the landscape and within the habitat of a sensitive species, the California spotted owl. We compared landscape treatment scenarios in which sensitive habitat for owls was either excluded from or available for treatment. Additionally we compared including versus excluding private land for treatments. Landscape-scale wildfire modeling was used prior to simulating fuel treatments, to identify those stands associated with high fire hazard, as well as after treatment to evaluate and compare fuel treatment scenarios with respect to wildfire hazard.

We attempted to incorporate realistic management priorities and limitations in this modeling exercise. Our fuel treatment prioritization combined pre-treatment stand structure and wildfire hazard in order to identify those stands most conducive to forest thinning and most in need of treatment. Prior to LTD runs, each stand was assigned numeric rating scores characterizing the stand’s vegetation structure and wildfire hazard (Table 1). Stand structure ratings (0, 1, 2) were based on cover class category; for example, cover classes not amenable to forest thinning, such as clearcut stands, received a structure rating of 0. Fire hazard ratings were derived from landscape fire behavior modeling in RandIg (a command-line version of FlamMap (Finney 2006)). By simulating many wildfires on the landscape, we obtained a probabilistic estimate of flame length, known as conditional flame length (CFL), for each stand. A full description of wildfire modeling methods is provided in the Task 5 report. Fire hazard ratings were assigned according to stand CFL; stands with high predicted fire intensity received the highest rating (Table 2). For all LTD runs, we directed the model to maximize a total score equal to the sum of the stand structure and fire hazard ratings.

Table 1. Conditional flame lengths and assigned wildfire hazard ratings for LTD runs

Conditional Flame Length (m)	Fire Hazard Rating
0 – <3.5	0
3.5 – <5.1	2
≥5.1	3

Table 2. Vegetation structure classes and class ratings for LTD runs

Structure Class	Structure Class Description	Structure Class Rating
1	Hardwood forest	1
2	Clearcut or shrub/small tree	0
3	Pole forest	0
4	Medium-diameter conifer/mixed-conifer forest with low to medium canopy closure	2
5	Medium-diameter conifer/mixed-conifer forest with high canopy closure	2
6	Mature conifer/mixed-conifer forest with low to medium canopy closure	1
7	Mature conifer/mixed-conifer forest with high canopy closure	1
8	Water	0

Additional restrictions were placed on the selection process according to the treatment scenarios, which varied in the land designations eligible for treatment. The LTD interface shown in Figure 1 is populated for Treatment Scenario 1. Scenario 1 excluded spotted owl protected activity centers from treatment consideration (*Treatment Thresholds/PAC<1*), and private land (*Options/Check Availability/Availability Field: Public*). For comparison, Treatment Scenario 2 included private lands in potential treatment stands, while Scenario 3 allowed treatment on all land designations, including within spotted owl habitat. All treatment scenarios also excluded slopes ≥50% (*Treatment*

Thresholds/ SLOPE_PCT<50) To isolate the effect of holding some land area off base with respect to treatment, total area treated were held constant across treatment scenarios.

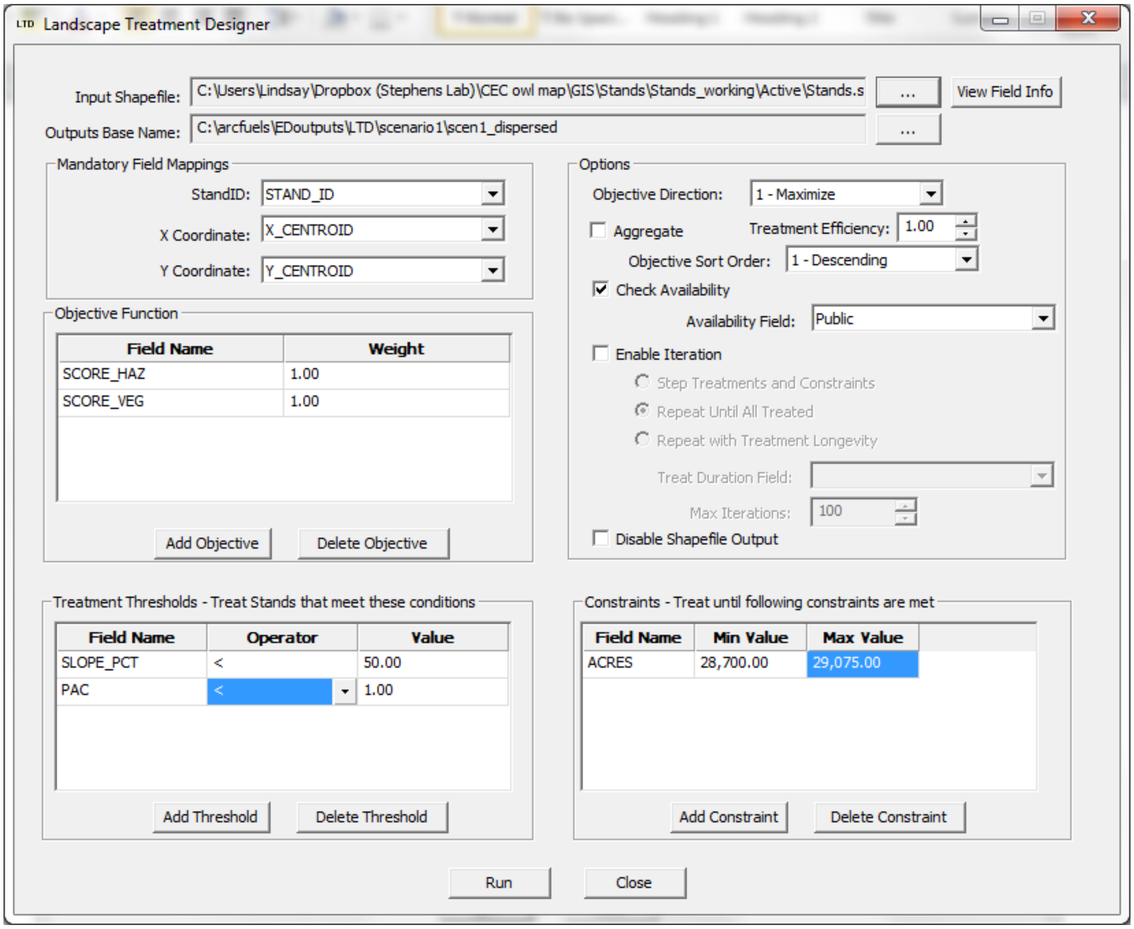

Figure 1. Landscape Treatment Designer interface populated for Treatment Scenario 1, which excluded spotted owl protected activity centers (PAC's) and private land from treatment. All treatment scenarios also excluded steep slopes and preferentially selected stands with high wildfire hazard and stand structure scores until total treatment area totaled approximately 20% of the study area.

The LTD can identify spatially contiguous treatment areas by iteratively selecting stands to be incorporated in a treatment area, and can prioritize treatment areas on the landscape. We instead allowed the model to distribute selected stands over the landscape, using other management priorities to optimize the placement of treatments. However, recognizing that small, spatially isolated treatment areas would be impractical from a management standpoint, we applied a manually iterative process for selecting stands for treatment. Following each LTD run, we excluded all stands selected for treatment that were not contiguous with a ≥30 acre treatment area, and calculated the treatment area remaining. Treatment acreage constraints supplied to the LTD were then adjusted and the process repeated until total treatment area approximately summed to the target area of 27,380 acres (20% of the landscape). For example, in Figure 1, the treatment acreage of 28,700 and 29,075 acres supplied in the Constraints section was determined from previous LTD runs. When the small, isolated stands ultimately selected for treatment are removed, the total treatment acreage remaining approximates 27,380 acres.

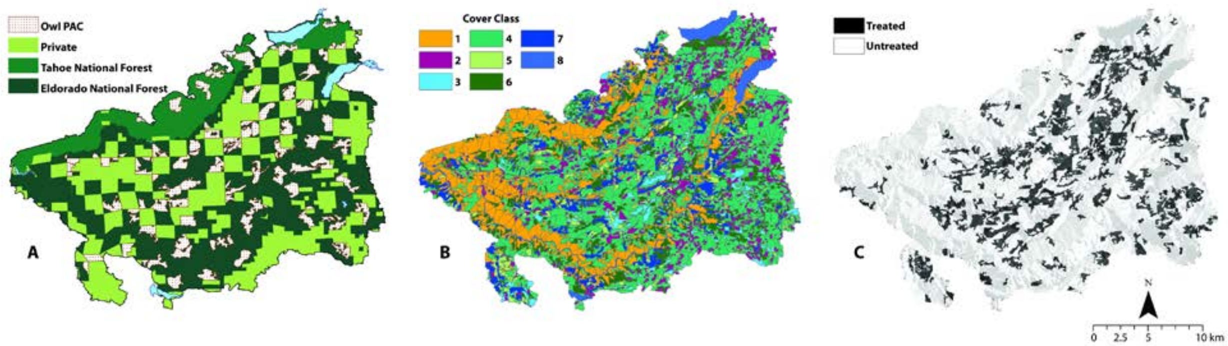

Figure 2. Landscape features used in treatment prioritization (**A**, **B**) and final stands selected for treatment (**C**). **A**: private and public lands and spotted owl habitat; **B**: stand cover classes (see Table 2 for class descriptions).

Treatments in stands selected by the LTD (Figure 2C) were simulated with FVS-FFE. The effects of treatment scenarios on fire behavior across the landscape, and within sensitive species habitat, were then compared based on fire behavior and effects modeling.

References

Ager, A., Bahro, B., Barber, K., 2006. Automating the fireshed assessment process with ArcGIS. Andrews, PL, Butler, BW (Comps), Fuels Management--How to Measure Success: Conference Proceedings, Portland, OR, March 28-30, 2006. USDA Forest Service, Rocky Mountain Research Station, Proceedings RMRS-P-41, Fort Collins, CO, 163-167.

Ager, A.A., Vaillant, N.M., Owens, D.E., Brittain, S., Hamann, J., 2012. Overview and example application of the Landscape Treatment Designer. Portland, OR, General Technical Report PNW-GTR-859, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 11.