Simulating the Visual Impacts of Fire Management Strategies

Wildfires that occur along the urban-rural interface can represent a significant safety and economic risk to communities in the Western United States. Land managers often address this risk by reducing fuel loadings in woodlands and forest areas that border Western communities. However, because fuel reduction often involves the removal or thinning of large areas of woodlands or forest, the potential visual impacts can be viewed negatively by the public. By photo- realistically representing the proposed management actions for thinning and cutting, land managers can explicitly communicate management plans to the public and engage in productive dialog with the stakeholder community.

PROBLEM/OPPORTUNITY

The frequency, intensity, extent, and cost of wildfires in the western United States has increased dramatically in recent years. Overgrowth of forests coupled with increased development at the urban-wildland boundary present a danger not only to ecosystems but also to human possessions, property, and life. Land managers are challenged to develop strategies that reduce the risk of catastrophic fire while maintaining the perceived values of wildlands in the public eye. One management strategy, aimed at reducing the likelihood of fires as well as the spread and intensity of any fires that do occur, is to reduce the fuel load through preemptive clearing or thinning of brush and trees.

Fuel reduction strategies may be as drastic as cutting stands of trees or as subtle as removing just the undergrowth from a stand. The potential visual impacts of these different strategies are often of major concern to the public. Private landowners may have negative reactions to proposed forest or woodland management plans that they perceive will change a landscape from a "natural" state to one which is or appears to be an "unnatural" state.

The Bureau of Land Management (BLM) has determined that fuel reduction is necessary on over 29,000 acres of public land located in two areas near Ely, Nevada. Thinning will involve the removal of thousands of pinyon and juniper trees. In an effort to reduce visual and ecological impacts, BLM devised an innovative fuel reduction strategy that mimics naturally occurring spatial patterns in pinyon-juniper woodlands.

Communicating the visual impacts of these management decisions to the public and other stakeholders presents a challenge to land managers. Because the assessment of visual impacts combines subjective aesthetics with issues of view angles, viewer location, topography, and vegetation, it is difficult to present the visual impacts of a proposed action. However, effectively communicating impacts prior to instituting a management strategy is essential to insure public acceptance of the project. If potential impacts can be successfully communicated in advance, managers can alter management strategies in response to public feedback, thereby reducing public opposition.

The BLM asked EVS to create realistic visual simulations of BLM's fuel reduction strategy for use in public meetings. Specifically, managers needed photo-realistic simulation from key landscape viewpoints to show the public the potential visual effects of the strategy. The original simulations depicted one management strategy. In response to public feedback, three alternative strategies were also developed.

APPROACH

EVS combined 3-dimensional computer models of the landscape with photographs of 9 key viewpoints to create photo-realistic visual representations of the proposed fuel reduction projects. The computer models assured spatial accuracy of the simulations while the edited photographs lent credence to the former. In addition, the computer models, once built, could be quickly altered to represent alternate management strategies facilitated communication between stakeholders and permitted feedback to be incorporated into the final management plan.

Initially, the landscape was modeled in a 3-dimensional geographic information system (GIS). Trees, shrubs, and understory plants were modeled at the individual-, species-, and stand-level to simulate natural ecosystems. The project area was divided into a number of smaller management areas which would undergo different

thinning regimes. These areas, represented by management polygons, were overlaid onto the modeled landscape and tree densities adjusted accordingly.

Photographs were taken at key viewpoints. The location of the camera was recorded using a global positioning system (GPS) receiver. The photos were digitized and matched with the same viewpoint in the modeled landscape. The modeled, thinned stands were then used to edit the photos to create a photo-realistic simulation of each viewpoint after thinning. In addition, numerous ground-level and aerial views were modeled in the GIS that showed the state of the landscape before and after the management strategy had been instituted.

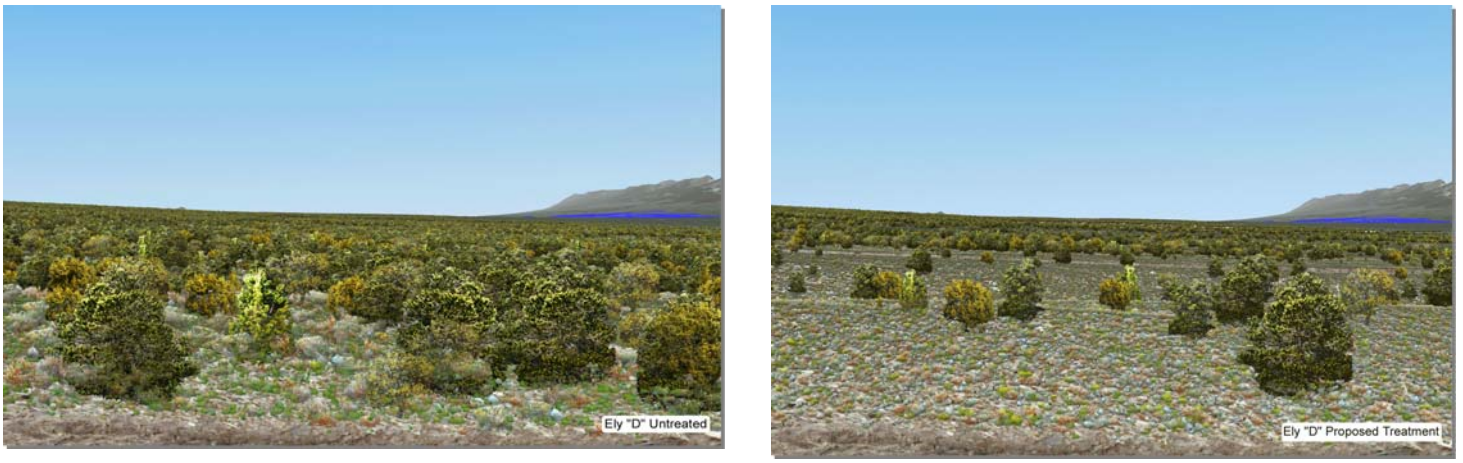
RESULTS

Simulations of the initial management strategy were shown at a number of public meetings. Public feedback was incorporated into the management strategy through a series of iterative modeling exercises that looked at three alternative strategies. The end result was a revised management strategy that was acceptable to the public yet met management objectives.

EVS's approach to this problem, combining computer simulations with photo-realistic simulations, proved to be extremely valuable. The computer simulations could be done relatively quickly, allowing for iterative feedback from EVS, BLM, and the public. Initial project changes regarding thinning strategies (e.g. densities, uncut areas, and the spatial pattern of trees to be left uncut) could be assessed because EVS was able to provide numerous computer simulations of alternative scenarios, thereby allowing management to evaluate proposed outcomes. Once project plans were developed, work on the digitally edited photo-realistic simulations proceeded and all of the visualizations were shown at public meetings. Feedback from initial public meetings resulted in an alteration in the management plan to reduce thinning in target areas. The approach taken by EVS allowed for rapid incorporation of alternative cutting plans into the new simulations. This allowed both land managers and the public to examine potential impacts from alternative strategies in a timely manner, facilitating decision making and aiding the achievement of consensus.

FUTURE

The approaches and tools used to address this fire management problem are applicable to many environmental and natural resource issues where the impacts of alternative spatial changes can be visualized.



Computer simulation showing landscape prior to thinning (top) and after thinning (bottom). Blue areas represent private land.