RESOURCE NOTE

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Laser Technology for Fire Rehabilitation Project Monitoring

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Specialists from the Winnemucca (Nevada) Field Office are using innovative laser technology to monitor fire rehabilitation treatment performance on burned areas that have been reseeded. This technology can speed up the monitoring of rangelands for fire rehabilitation projects, fuels management projects, or rangeland transects that have been installed for standard rangeland monitoring.

Since spring 2004, the Emergency Stabilization and Rehabilitation (ESR) program monitoring team in Winnemucca has been working with the field office's fuels management staff on the use of new, laser-equipped sampling equipment. The equipment is designed to improve monitoring coverage and provide useful data for the ESR fuels and range program.

After the large fire rehabilitation projects were implemented as a result of the fires of 1999 and 2000, the ESR monitoring team needed ways to improve their monitoring coverage of those large projects. With existing technology, the task was daunting at best, as some of the projects encompassed tens of thousands of acres. In evaluating the projects, the team needed to get an indication of the success of the project treatments, changes in the vegetation composition in the plant community, and a better understanding of invasion of the site by cheatgrass (*Bromus tectorum* L.) or other weeds.

Customarily, Mike Zielinski, a soil scientist, and I, a monitoring specialist, would monitor a plot of land by pounding two stakes in the ground at set intervals, such as every 200 feet or 100 meters, and tightly stretch a steel measuring tape between the stakes to create a transect. I would walk the length of the transect line, stopping at intervals of 20 feet or 20 meters to place a 1-meter hoop on the ground to measure the density of the vegetation inside the hoop. I also measured basal or ground cover along the taped transect. Basal or ground cover are important measures of success for rehabilitation (or mined land reclamation) projects. In determining the success of these projects, they are often read for a period of at least 2 or 3 years after the treatment implementation. This traditional method of monitoring vegetation with the tape and hoop has worked well on small monitoring plots in burned areas, but not as well in the large fire rehabilitation projects that were implemented as a result of the fires in 1999 and 2000.

Figure. A Laser Point Bar projects points of lignt on the ground to generate data that can be used for measuring ground cover.

The field office staff researched various options for improving monitoring efficiency on large treatment areas and learned about the laser technology being used by Steven Viert, a consultant with Cedar Creek Associates, Inc. (CCA, Inc.), Fort Collins, Colorado. The contractor has been using a laser-enhanced tool (Laser Point Bar) to measure vegetation cover at mining restoration sites. The equipment and design are proprietary to CCA, Inc.

In spring 2004, Winnemucca staff took the laser projection bar out to established ESR monitoring sites to test it on sites that had previously been monitored by conventional methodologies. By using sites having already established study plots, the staff was able to calibrate the laser projection bar against the results of cover measurements taken with the traditional methods.

Staff found that in re-reading the data from established plots with the new equipment, the flow of data from the existing plots was fast and seamless.

To instill random selection into study site selection, the Winnemucca Field Office specialists use geographic information systems (GIS) software to stratify each treatment area by vegetation type, soil type, or any other critical ground coverage. They then generate random points from which to anchor their laser-enhanced tool monitoring studies.

To ensure proper resampling at any given study site, the soil scientist or ESR monitoring specialists use global positioning system (GPS) technology to locate their random points in the ESR treatments. They then place their transects on lines radiating from the anchor points, which follow randomly chosen compass directions. Transect samples include 10 subsamples, taken at each meter, over a 10-meter area. The end result is 100 subsamples per transect or sample, with each subsample covering an area of ground surface containing 10 projected points of light from the tool.

Specialists then space each transect line every 30 meters on the smaller treated areas and every 100 meters on the large treated areas, with each transect being laid along the monitoring line. The Laser Point Bar projects 10 evenly spaced 0.5-millimeter points of light on the ground. As the point of light hits plants, bare ground, or litter, the data are recorded on a monitoring sheet. The laser-generated data are used to determine vegetation cover and frequency, and can be used to indicate a percentage of ground cover for the selected landscape.

I have estimated that this tool might allow field specialists to gather roughly 10 times the number of samples per transect as traditional methods, thereby decreasing the field time for gathering the data or, with equal time, increasing the number of transects representing a treatment area. The added precision of the 0.5-millimeter light point "hits" projected by the tool also reduces the possibility of operator error that sometimes results from existing manual monitoring methods and techniques and increases the speed by which decisions are made about what the point is contacting.

I also found the tool would enable monitoring more transects per site and give greater coverage of the ESR treatment areas, resulting in greater efficiencies and higher overall confidence in the data, which represent how a given area responds to any given treatment. In mining reclamation work, Viert found that "Ground cover is the preferred variable for determining revegetation success because, using this technology, a significant amount of cover data can be readily obtained in a statistically adequate, acceptable, and cost-effective manner. When using bias-free techniques, such as the point–intercept method, it is one of the most repeatable variables among independent observers."

I conclude that the use of the more efficient technology allows a larger scale of coverage that would allow a view of fire rehabilitation treatments, and especially posttreatment results, on a landscape scale.

The technology and the point–intercept method are also being used by Utah ESR specialists on the Rattle fire rehabilitation project.

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