**Condition Change: UC ANR contributed to improved management and use of land**

**Issue**

Public and private land in California is managed for a wide variety of uses. Challenges include loss of productive working landscapes, human and wildlife conflicts, protecting water quality, living in fire prone areas, and better understanding ecosystem services. Research and extension are needed to help land managers and owners balance the social, economic, and ecological benefits.

**Methods**

UC ANR activities focus on management strategies with regard to livestock, wildlife and land maintenance.

UC Agriculture Experiment Station scientists at the UC Davis location are using remote sensing to better monitor ecosystems for improved forest and agricultural management, especially during drought conditions. Specific projects include: investigating the drivers for burn severity in the coastal mountain ecoregions, and developing an unmanned aerial vehicle to monitor forage production for California’s rangeland (Yufang Jin).

UCCE scientists conduct research and monitoring, which they extend to help landowners and managers improve range management to protect their resources and stay in business. One workshop held in collaboration with the USDA Agricultural Research Service, shared information on new varieties of grasses and shrubs for reseeding purposes, with the goal of helping land owners improve their rangelands. Another workshop was held highlighting the impacts of pests, such as ground squirrels and management practices (Royce Larsen).

Several University of California Cooperative Extension (UCCE) projects have examined practices to reduce weeds on rangelands. One 6-year project has worked to assess various techniques for *Baccharis pilularis* (Coyote brush) control to determine which techniques are most effective and economically feasible. Baccharis encroachment reduces forage production through direct competition and also physically limits cattle access to forage. Numerous control strategies have been implemented and assessed, including mechanical removal, chemical application, and prescribed fire to control this aggressive resprouting species (Jeffery Stackhouse). Several scientists are investigating different herbicide control options for short-pod mustard (Richard Smith and Devii Rao). Scientists also investigated the efficacy of five herbicides across seven treatments to control shortpod mustard on a rangeland, and developed non-chemical weed control options for rangeland weeds, with a focus on targeted grazing (Devii Rao, Theresa Becchetti, Rebecca Ozeran, Josh Davy, and Jeremy James). A workshop on erosion prevention and range management was provided for lessees of Monterey County Water Resources Department grazing allotments around Lake Nacimiento (Royce Larsen and Devii Rao).

Other UCCE research was extended to decision-makers to improve understanding of park, range and forest management challenges and identify solutions. In Orange County (OC) Parks, scientists lead a monitoring program to address the presence of invasive shot-hole borer beetles and have surveyed 45 different areas of interest, including turf parks and wilderness areas. OC Parks management uses the results to make management decisions regarding tree treatments and removals, based on the level of infestation and overall tree health. A similar monitoring program for the Orange County Fire Authority discovered an infestation of the gold-spotted oak borer in the County, and the scientists coordinated efforts with the three agencies who share jurisdiction of the area of the breakout (Beatriz Nobua-Behrmann).

A UCCE collaborative project with UC Berkeley and the California Department of Fish and Wildlife (CDFW) quantified the impacts of elk to private landowners in Humboldt, Del Norte, and Mendocino Counties. The CDFW is currently revising their elk management plan and they have limited data to support their decisions (Jeffrey Stackhouse). A livestock protection tools workshop series reached nearly 200 land owners and managers as well as policy makers and government and non-government organizational leaders. These workshops taught hands-on techniques to non-lethal predator control, led to a better understanding of livestock compensation programs, and educated policy makers on the difficulty of livestock protection on vast rural landscapes (Dan Macon and Laura Snell). An annual rangeland production study entering its 24th year, determine the forage production at eight ranches throughout the Central Sierra region, and gives ranchers a better understanding of available feed (Scott Oneto).

UCCE scientists are collaborating with grazing allotment permittees, and the US Forest Service, to conduct a landscape-level (138 allotments in 16 national forests) investigation of mountain meadow responses to conservation grazing management strategies, as well as examining site-specific ecosystem service responses to grazing pressure across seven national forests (Leslie Roche).

As a result of UC ANR research, outreach, and education, participants learned and adopted practices that lead to improved land management. Outcomes with specific measured indicators follow.

**Outcomes**

**Participants learned about and intend to use strategies and techniques for sustainable land management.**

* Rangeland weed management projects have increased ranchers’ knowledge of weed management options, leading to improved range management, increased forage availability, and possibly even increased income if they are able to increase the number of animals they can graze. 56% of 41 participants surveyed indicated they would implement what they learned within six months. (Devii Rao)
* Ninety-five percent of the 37 participants in the range workshops on reseeding gained knowledge. Ninety-eight percent of the 52 participants in the Ground Squirrel Control workshop indicated they gained useful knowledge, and 85% said they would use the information they gained. (Royce Larsen)
* Surveys from the erosion prevention workshop showed that 100% of attendees gained useful knowledge. One participant explained how they would use what they learned: "Immediately in an effort to reduce cattle concentration and equally distribute the herd." (Royce Larsen and Devii Rao)

**Participants adopted strategies and techniques for sustainable land management.**

* Ranchers involved in the research trial are using the information to assess options for *Baccharis* control via herbicide, mechanical removal, and the use of prescribed fire. One landowner, said: “You have begun to make major changes in saving prairies in Humboldt from being overtaken by coyote brush". By switching away from traditional mechanical treatment with heavy equipment toward the use of herbicides and prescribed fire, ranchers have saved between $350-$1150/acre. (Jeffery Stackhouse)

**Science-based information was applied to land management policy and decision making.**

* Expertise shared about the shot hole borer led the City of Claremont to change their shot hole borer beetles management practices and adopt an integrated pest management strategy that emphasizes tree monitoring, rapid response, and treating only infested trees. (Beatriz Nobua-Behrmann)
* With expertise and leadership from the scientists, three county agencies put together a management plan for the area infested with the gold-spotted oak borer that will be carried out by the Orange County Fire Authority. (Beatriz Nobua-Behrmann)
* The elk monitoring project provided the California Department of Fish and Wildlife a baseline for elk population and the ability to estimate impacts in northern California counties. (Jeffery Stackhouse)
* As a result of the livestock protection tools workshop, the Modoc County Farm Service Agency with support from UCCE was able to better define their livestock indemnity program for predator kills and start educating the public about using the program. (Laura Snell)
* The data from the annual forage production project is being used by ranchers, agencies and other stakeholders to quantify forage production. The values are used to document forage loss from various causes including years of drought. (Scott Oneto)
* Grazing management monitoring in National Forests is informing the National Forest Plan Revision process, and other key public lands policy actions. For example: Sierra, Sequoia and Inyo National Forests have incorporated the work into draft or final Environmental Impact Statements and Stanislaus National Forest, references the research based findings as part of a litigation summary judgement. (Leslie Roche)

**Change in condition: Reduced pest incidence.**

* Many of the Orange County Parks where treatments and/or removals of diseased trees happened showed a reduction in number of trees infested with the shot hole borer beetles by 10-30%. (Beatriz Nobua-Behrmann)

The aforementioned measured outcomes demonstrate improved knowledge and adoption of land management practices. UC ANR has contributed to improvements in land use policies and land management practices that can help maximize the benefits that managed lands provide. For example, providing science-based information for communities to more effectively manage and protect the health of trees is valuable to a community. The USDA reported in 2015 that California’s street trees remove 567,748 tons of carbon dioxide emissions annually, and capture chemicals that can travel to streams, lakes and oceans, reducing water pollution. In this way, UC ANR contributes to the public value of protecting California’s natural resources.