

## Prescribed Herbivory for Fire Fuels Management

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The website address of the California department of forestry is ironically named *fire.ca.gov*. This is an appropriate, although problematic description of the sphere in which fire fuel management takes place. There is a lot of confusion about how much money is spent on fire fighting as opposed to fire prevention; however long-term averages for direct costs of fire fighting are somewhere around \$100 million annually. There are now so many people involved in fire fighting in California that some are postulating the existence of a ‘fire fighting industry.’ In contrast, fire prevention is receiving much less attention and there is potential for conflict between fire prevention and fire fighting as considerable economic interests are involved. In general, it is appropriate to state that public support for wildfire prevention does not seem to be commensurate with the rapidly increasing damage potential for human life and property due to accelerated urbanization of CA wildlands.

Traditional tools for fire fuel management are becoming more limited. Prescribed burns have become increasingly difficult to implement due to air-quality issues, increasingly narrower time windows, risk management, and cost. The environmental impact of herbicides has come under increased scrutiny in recent years. In Europe, the discouraged use of herbicides has facilitated public support of use of livestock for landscape restoration and management. The third traditional method of fire fuel reduction is mechanical clearing. Mechanical clearing is prohibitively costly and often requires the integration of prescribed fire (and to a lesser degree, herbicides) for effective biomass removal. Recent accelerated urbanization of wildlands has drastically increased the need to safely remove so-called 1 and 10 hour fuels, plant biomass that facilitates the generation of catastrophic, fast-moving crown fires. Prescribed burns cannot be used in these areas, and mechanical clearing is not economically feasible for fragmented landholdings.

Fuel reduction via prescribed herbivory has become an acceptable tool in fire-safe plans, which is a rather drastic change from less than 6 years ago, when the use of livestock was not officially considered an appropriate tool for fuel reduction. Interest in this approach is increasing and several commercial operators are offering fuel reduction services. However, they operate without quality control and certification oversight. Management problems (for example, alleged abuse of animals; inappropriate vegetation treatment) have occurred and may put in jeopardy the public acceptance of prescribed herbivory as a sustainable fuel reduction tool.

At present time, only anecdotal evidence is available for the estimation of biomass removal by goats and sheep in fuel reduction schemes. Prediction of intake is very difficult because of lack of knowledge about nutritional and anti-nutritional properties of CA brush. Some pertinent research was conducted at UC Davis in the 1980’s. Unfortunately, the methods used were

inadequate and most results erroneous. However, since these data were published in major journals, important misconceptions persist. Accordingly, the most urgent need to address was the analysis of nutritional and anti-nutritional properties of fuel reduction target plans so that operators can better plan their management costs. Considerable seasonal variation of these attributes had to be expected. Given the number of species involved, a combination of in vivo and in vitro experiments appeared to be the most cost-effective way to acquire this information.

In several years of field and laboratory research we developed detailed tables for nutritional properties of the most important fire matrix species in California. We have further determined the tannin chemistry of these species, thereby addressing the most important plant secondary compound present in the CA fire matrix species. Several new assays were developed in the process and we have now a much better understanding of the animal performance impact of fire fuel management by prescribed herbivory.

It is important to realize that the overall drastic reduction of grazing in California, in particular in the more marginal lands, has accelerated brush encroachment. This has compounded with fire suppression to create vegetation densities in many locations too difficult to tackle by prescribed herbivory and too dangerous for prescribed fire. Thus, it is not difficult to predict that the probability of catastrophic super wildfires will further increase. Considering the ever expanding human settlement of lands not really appropriate for housing development, future damages in human life, property and ecosystem integrity will likely vastly exceed previously known figures. However, despite the economic and ecological significance of the problem, no specific funding sources for research on prescribed herbivory in vegetation management are available. One of the reasons is the lack of commodity interests, and the fact that those impacted by the consequences of lack of appropriate fire prevention have no unified voice. UCCE has supported prescribed herbivory for fire fuel management in several ways, most notably by the California Browsing Academy. More concerted work is needed. The next research priorities to be addressed are quantitative impact assessment of prescribed herbivory, comparative cost studies relating herbivory to other methods (including the consideration of ecological costs), and modeling short and long-term effects of various methods on various attributes of interest (fire risk, soil stability, biodiversity, conservation of endangered species).

Our practical conclusions of the research indicate that economically sustainable use of prescribed herbivory is feasible in:

- Maintenance grazing of fuel breaks with mixed goat-sheep flocks without charging a fee for the service, provided there are appropriate market opportunities for meat goats and lambs
- High impact browsing where prescribed burns are not possible as high cost service due to supplementation needs
- Specialized impact browsing on timber plantations at a medium to high cost to allow timber companies foregoing herbicide use in meeting environmental standards for specific markets
- Follow-up grazing on burned areas for a maximum of two to three years at low cost.