



Landscape Management of a Native Invader



Promoting rangeland productivity and sage grouse conservation through coordinated juniper treatment

Allison Dedrick, Shahla Farzan, Matthew Hamilton, Erik Porse, Gabriel Sampson, and Derek Young
REACH IGERT, University of California, Davis

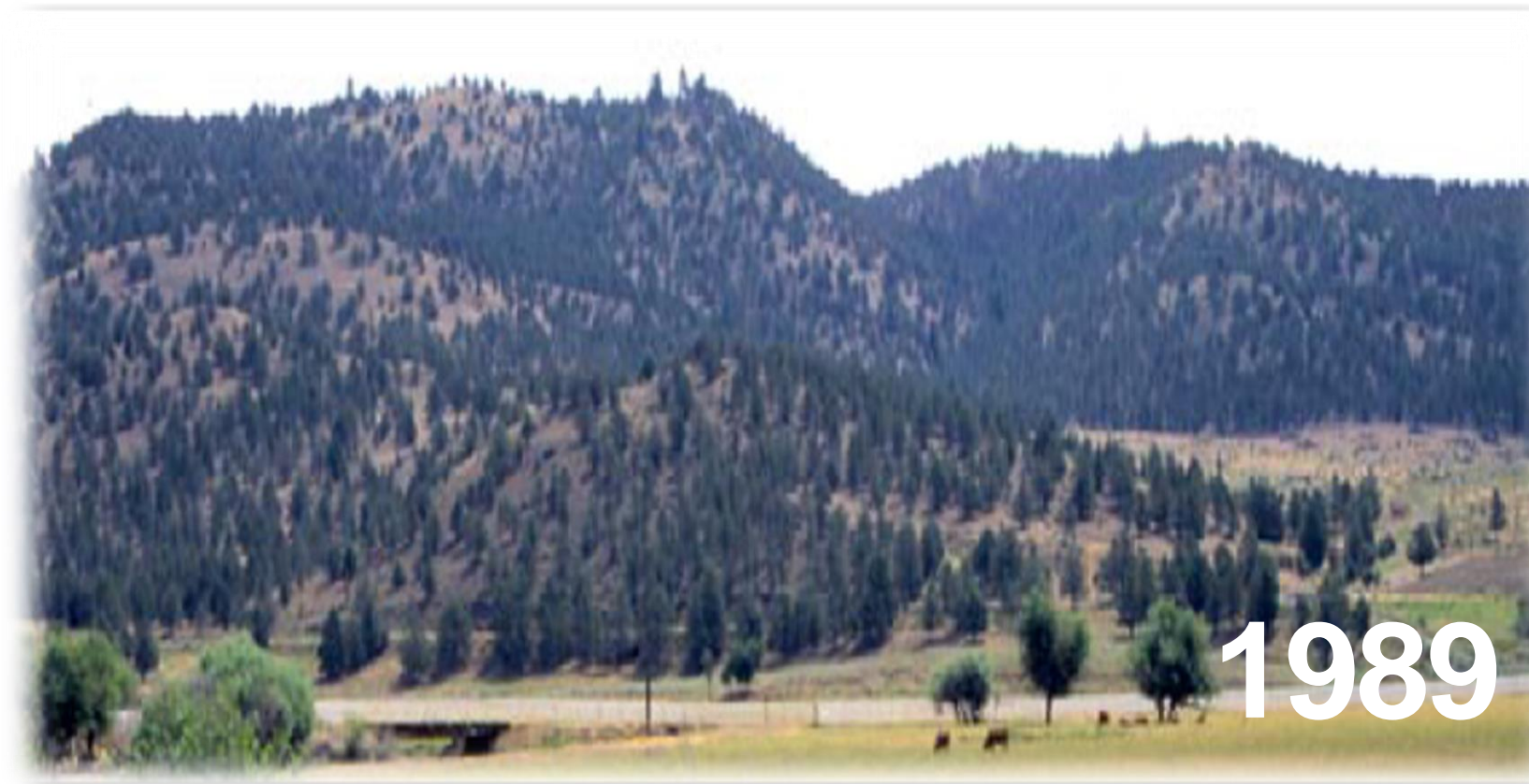
Western Juniper: A Native Invader



Western juniper (*Juniperus occidentalis*) is a long-lived conifer species native to the western U.S. Due to environmental and management changes during the last 130 years, western juniper has rapidly expanded into large areas of sagebrush steppe habitat. It has displaced important plant and animal species, including the greater sage grouse, a candidate for listing under the US Endangered Species Act. Because juniper competes with herbaceous plants, including forage for cattle grazing, its expansion also threatens regional economies.



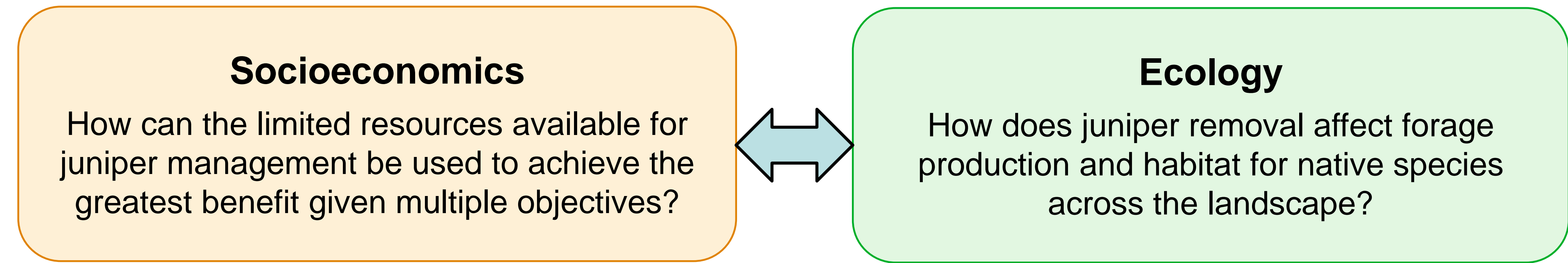
1890s



1989

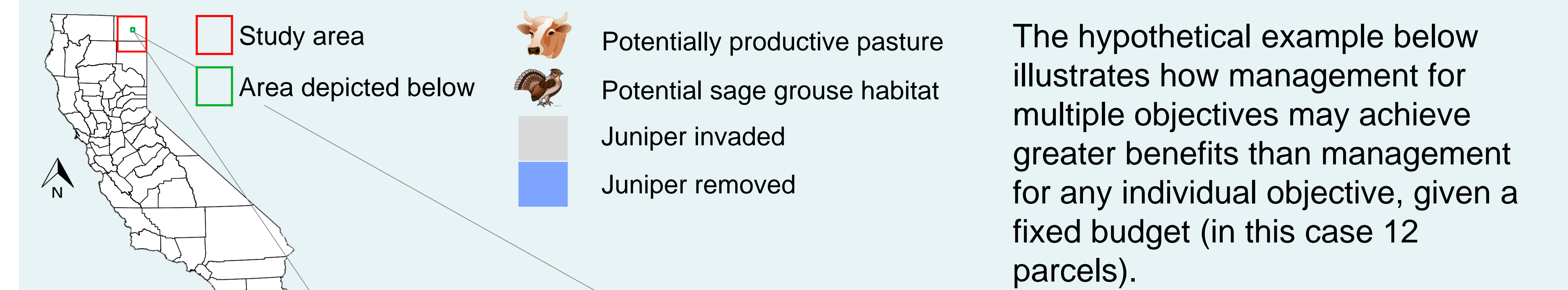
Our Socio-Ecological Approach: Landscape Optimization Modeling of Juniper Management

Through an interdisciplinary exploration of the tradeoffs and synergies among the distinct interests of habitat conservation and cattle ranching, we are working to identify opportunities to increase the overall benefit of juniper management given limited funding.

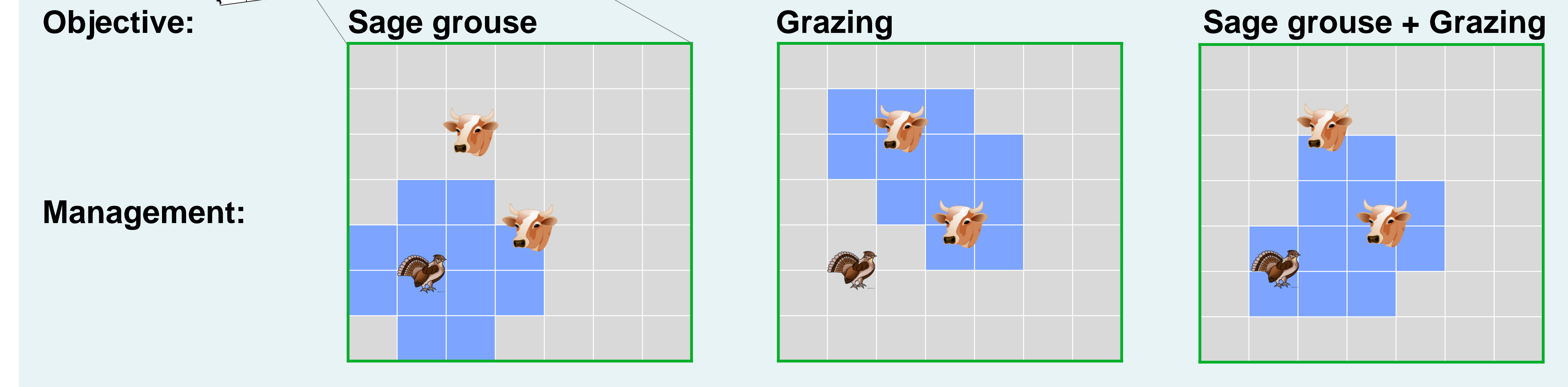


Approach

We are using **mixed-integer linear programming** and **genetic algorithm-based optimization** routines, combined with **GIS-based spatial analysis**, to determine the optimal landscape management approach for a range of management objectives on a real-world landscape in northeastern California.



The hypothetical example below illustrates how management for multiple objectives may achieve greater benefits than management for any individual objective, given a fixed budget (in this case 12 parcels).



Responding to Juniper Expansion: A Unique Partnership

Juniper expansion offers an opportunity to develop a new paradigm of environmental management that simultaneously addresses both human and environmental needs. Most regional stakeholders, including groups with very different objectives, agree that invading junipers should be removed. Because sage grouse and cattle can coexist, conservation and local economies can be enhanced simultaneously.



Many **conservationists** support juniper removal because of its benefit to native species, including the greater sage grouse.



Most **ranchers** wish to remove encroaching junipers in order to restore the health and productivity of their rangelands.

The Challenge of Coordinated Management

In the Modoc Plateau region of northeastern California, government agencies, ranchers, and non-profit organizations collaborate to remove juniper on both public and private lands. However, because the invaded area is so large, coordination among the many planned and ongoing projects is imperfect. **Is there a way to increase the benefits of juniper management by refining the site selection process?**



Felled junipers on the Modoc National Forest

Data Sources	Outcomes
<ul style="list-style-type: none"> Biophysical data (e.g., juniper cover, forage potential) for individual parcels Effects of juniper removal based on scientific literature Semi-structured interviews with key agency personnel, private landowners, and other decisionmakers 	<ul style="list-style-type: none"> Analysis of opportunities to improve efficiency of juniper management by exploiting synergies among distinct objectives Short non-technical reports summarizing results, sent to stakeholders A workshop in Modoc County that brings together stakeholders from government agencies, NGOs, private landowners, and other decisionmakers

Photo credits: Juniper invasion: Miller et al (2005); Sage grouse: Gail Patricelli; Cattle: US Forest Service; Juniper tree and felled junipers: A. Dedrick
Reference: Miller, R. F. 2005. Biology, ecology, and management of western juniper (*Juniperus occidentalis*). Technical Bulletin 152. Oregon State University.
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