



# Seventy-Five Years of Vegetation Treatments on Public Rangelands in the Great Basin of North America

By David S. Pilliod, Justin L. Welty, and Gordon R. Toevs

## On the Ground

- Land treatments occurring over millions of hectares of public rangelands in the Great Basin over the last 75 years represent one of the largest vegetation manipulation and restoration efforts in the world.
- The ability to use legacy data from land treatments in adaptive management and ecological research has improved with the creation of the Land Treatment Digital Library (LTDL), a spatially explicit database of land treatments conducted by the U.S. Bureau of Land Management.
- The LTDL contains information on over 9,000 confirmed land treatments in the Great Basin, composed of seedings (58%), vegetation control treatments (24%), and other types of vegetation or soil manipulations (18%).
- The potential application of land treatment legacy data for adaptive management or for retrospective analyses of effects of land management actions on physical, hydrological, and ecological patterns and processes is considerable and just beginning to be realized.

**Keywords:** adaptive management, Bureau of Land Management, land treatment, restoration, rehabilitation, soil.

Rangelands 39(1):1–9

doi 10.1016/j.rala.2016.12.001

Published by Elsevier Inc. on behalf of The Society for Range Management.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Grazing Service aimed to increase forage quality and quantity for livestock production on public rangelands by removing native shrubs and sowing grasses. The Grazing Service merged with the General Land Office to form the Bureau of Land Management (BLM) in 1946, about the time the BLM began keeping records on land treatments, or those areas where vegetation or soil was manipulated intentionally. These treatments were generally planned and implemented to address local needs and concerns, but collectively began to influence vegetation across vast ecoregional landscapes. The Federal Land Policy and Management Act of 1976 mandated multiple-use management of public lands, including preserving their various natural resource values. To meet these federal mandates, treatments have become progressively more complex as resource managers attempted to accomplish multiple objectives, such as post-wildfire rehabilitation of vegetation, stabilization of soils, control of invasive plant species, reduction of hazardous fuels, and production of livestock forage. In the last 25 years, a greater emphasis has been placed on ecological restoration or “the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.”<sup>1</sup>

The sagebrush steppe ecosystem in the Great Basin has become a focal area for landscape conservation and ecological restoration.<sup>2</sup> The Great Basin is the largest desert in North America, spanning over 50 million ha, with nearly 60% managed by the BLM. This cold desert was once dominated by native perennial grasslands, salt desert scrublands, sagebrush-steppe shrublands, pinyon-juniper woodlands, and, at higher elevations, mixed conifer forests. Sagebrush steppe is the dominant vegetation type in the region, but it is also considered one of the most endangered ecosystems on the continent.<sup>3</sup> Vast areas of the Great Basin now also contain nonnative, seeded perennial grasslands planted as forage for livestock; nonnative, invasive annual grasslands perpetuated by frequent fires; and irrigated croplands.<sup>4,5</sup> Wildfire size and frequency have increased at lower elevations in the Great Basin,

The U.S. Department of the Interior has a long history of conducting land treatments on millions of hectares of public rangelands. Established under the Taylor Grazing Act of 1934, the

in part because of cheatgrass (*Bromus tectorum*), an invasive annual grass that was introduced from Asia in the late 1800s.<sup>6–8</sup> At higher elevations, native pinyon and juniper woodlands have encroached into sagebrush steppe shrublands in response to favorable climates and effective fire suppression.<sup>9</sup> The cumulative effects of altered fire regimes, invasive annual grasses, and human land use have resulted in the widespread degradation, loss, and fragmentation of Great Basin habitats. Today, land and resource managers are working closely with scientists to reverse this ecological erosion, backed by policies such as the Department of the Interior’s Secretarial Order 3336 (2015), which aims to enhance the protection, conservation, and restoration of sagebrush-steppe ecosystems.

The long and varied history of vegetation management in the Great Basin, from improving livestock production to restoring native ecosystems, is unprecedented in both scope and scale in North America and might be considered one of the grandest field experiments ever created. The vast number, variety, and spatial extent of land treatments on public rangelands in the Great Basin provide a unique opportunity to study restoration implementation, results, and effectiveness, as well as other ecological topics that take advantage of these de facto field experiments. These treatments provide thousands of potential study sites for scientists interested in addressing basic and applied ecological questions related to topics such as 1) successional patterns and processes of plant, soil, and wildlife communities; 2) responses of communities and ecosystems to natural and human caused disturbance; and 3) factors influencing ecological restoration. Retrospective analyses also can help land managers evaluate past treatments and improve future restoration actions through adaptive management practices or by using past results to inform future actions. The outcome of these studies could guide policy decisions and allocation of resources for land management activities.

Land treatments on public lands in the Great Basin have been underutilized for adaptive management and research because data on treatment locations, activities, and outcomes were poorly organized and inaccessible. Traditionally, treatment data were stored in file cabinets and computers at the local field or district office that conducted the treatment, making procurement of the necessary documentation and spatial records difficult, costly, and time consuming.<sup>10</sup> Specific details about treatments (e.g., seed mix species and application rates) were difficult to obtain even when access to spatial information was available. To date, most analyses of land treatments have been short-term studies of individual or a select few treatments (e.g., Pyke et al.<sup>11</sup>). While these studies can yield meaningful results, their inferences are often limited to a single treatment at one location. Multiple treatments with similar characteristics are often required to increase inferences beyond the single site, but this requires having multiple treatments covering multiple locations. To effectively and efficiently study multiple treatments at larger spatial and temporal scales, a single repository that houses all treatment data and allows for it to be queried was needed. To accomplish this goal, the U.S. Geological Survey (USGS)

partnered with BLM to design and implement the Land Treatment Digital Library (LTDL).

## Development of the Land Treatment Digital Library

The LTDL was created by USGS to catalog legacy land treatment data for the BLM throughout the western United States.<sup>12</sup> The LTDL is a sophisticated database that contains data in text, tabular, spatial, and image formats. Original data were collected from BLM Field and District Offices (administrative units) and converted to digital formats. These data included project plans, implementation reports, monitoring information, maps, and photographs of land treatments. Specific data about treatments, such as type of treatment, date implemented, and area treated, were extracted from the documentation (see Welty and Pilliod<sup>13</sup>) and entered into the database so that they could be queried. Spatial representations of the area treated were created in a geographic information system. Original documentation was stored in portable document format (.pdf) and archived as a link within the database. All data were made accessible through the internet.<sup>i</sup> The highly organized and standardized data allow for rapid, specific, and repeatable queries or searches of information. Additionally, interactive maps allow users to search and portray land treatments for an area of interest relative to recognizable land features, such as roads and towns.

The BLM requested the development of this tool because of the need for resource managers to compile and synthesize information about land management actions at multiple spatial and temporal scales for internal and external data calls (e.g., Freedom of Information Act requests), project planning, adaptive management, and the development of ecoregional assessments, land use plans, and resource management plans. The USGS was interested in the development of the LTDL for research needs, such as identifying potential study sites during experimental design or stratifying sampling on the basis of treatment type (e.g., seeding, prescribed fire), seeded species, and other variables of interest.

The LTDL mirrors the terminology used by BLM for its vegetation management actions, especially the practice of nesting one or more “treatments” within each “project.” Each treatment has specific management objectives and, collectively, the set of treatments within a project has a desired goal or outcome that is usually more holistic and representative of the landscape level. For example, a post-wildfire rehabilitation project may include an herbicide application treatment to reduce competition from noxious weeds, a seeding treatment to help establish desirable plant species and compete with weeds, and a livestock closure treatment to protect new seedlings from herbivory. These various treatments may or may not overlap spatially within the project area.

## A Synthesis of Land Treatments in the Great Basin

We summarized data from the Great Basin to highlight the scope and scale of land treatment information in the LTDL and discuss how this information can be used for

<sup>i</sup> Access the Land Treatments Digital Library at <https://ltdl.wr.usgs.gov/>.

Download English Version:

<https://daneshyari.com/en/article/5745372>

Download Persian Version:

<https://daneshyari.com/article/5745372>

[Daneshyari.com](https://daneshyari.com)