Evidence-based Conservation Systematic Review

Ecological Restoration Institute

Effectiveness of Wet Meadow Restoration Projects *May 2012*

Introduction

High-elevation streamside or spring-fed wet meadows (i.e., montane meadows, riparian meadows, sedge meadows) occur in numerous locations in forests throughout the Southwest. Wet meadows are exceptionally valuable ecosystems because they provide biodiversity, critical hydrologic connectivity with adjacent upland forests, and a range of other ecosystem services.

Despite their ecological and social value, wet meadows are one of the most degraded ecosystems in the Southwest. They have been used extensively for grazing livestock, have become the sites of many small dams and stock tanks, and have had roads built through or adjacent to them. Many of these meadows occur in watersheds that have been rated as having impaired function or as functioning at risk, according to the U.S. Forest Service's Watershed Condition Framework (http://www.fs.fed.us/publications/watershed/).

Fortunately, there is considerable interest in the restoration of wet meadows. Several restoration projects have been completed recently or are underway in the region, sometimes at considerable expense and with minimal monitoring. Before many new projects are initiated, we felt it was important to review what has been done to date, as well as related hydrological and ecological research that has been published in order to help inform future wet meadow restoration efforts.

Systematic Review

A systematic review was carried out following the Centre for Evidence-based Conservation guidelines (http://www.environmentalevidence.org/Authors.htm). The primary goal was to evaluate the effects of wet meadow restoration projects on geomorphology, hydrology, soils, and plant species composition. A secondary goal was to determine the effects of wet meadow restoration projects on biodiversity.

Results

The literature search yielded 48 published studies directly about wet meadow restoration (i.e., investigating an operational-scale restoration project) or indirectly (i.e., investigating the recovery of soils or vegetation following grazing on small research plots). Of the 48 studies, only 25 were published in peer-reviewed journals and most of those evaluated restoration indirectly.

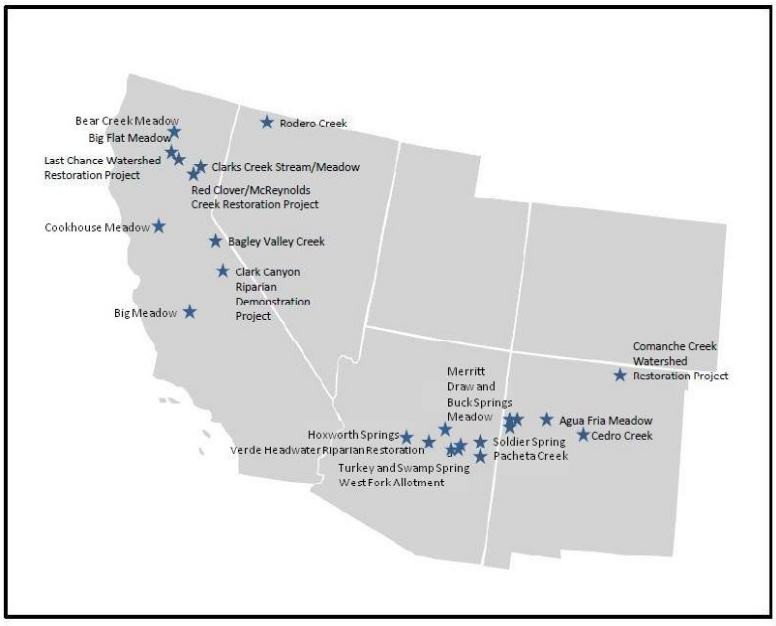

Figure 1: Wet meadow restoration sites

The Ecological Restoration Institute is dedicated to reversing declines in the condition of forested communities throughout the Intermountain West, particularly those affected by severe wildfires and insect outbreaks. Our efforts focus on science-based research of ecological and socio-economic matters related to restoration as well as support for on-the-ground treatments, outreach, and education.
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Twenty-seven operational-scale wet meadow restoration projects were identified, with the majority in Arizona and California (Figure 1). A wide range of restoration techniques were used, ranging from small-scale manipulations of stream channels (e.g., riffle structures) to large-scale projects that create an alternating series of ponds and earthen dams ("ponds-and-plugs") within a degraded gully. Water flows from the pond-and-plug structures onto the meadow surface, and then into a remnant or created stream channel. Other common restoration techniques included fencing to exclude livestock (and sometimes native ungulates), other forms of grazing management, and revegetation approaches, such as seeding and transplanting seedlings.

Most of the studies reported that restoration was fully or partially effective, at least in the short-term. However, the lack of quantitative data, especially data extending more than a year or two after project implementation, greatly limits the ability to determine how effective restoration has truly been in practice.

Conclusions

While much of the evidence about the effectiveness of wet meadow restoration projects is not of the highest quality and considerable caution is warranted, it is nevertheless apparent that good progress has been made during the past 10 to 20 years in wet meadow restoration in the Intermountain West. In particular, significant contributions have been made in restoring highly degraded wet meadow systems that are characterized by deep, wide, and relatively straight gullies. There is also substantial evidence that the pond-and-plug approach is an effective technique for restoring many aspects of these systems, albeit at the cost of creating new structural elements (ponds) that are not necessarily natural features of wet meadows.

While it is understood there are serious constraints on managers' time and resources, there is a clear need to allocate additional effort to project documentation, including more formal, longer, and better-designed monitoring programs. One way to improve project outcomes and documentation is for practitioners to work with scientists from government agencies, local universities and colleges, and other organizations. Many important lessons could have been learned, and mistakes avoided, if more effort had been put into documenting both successes and failures of past projects.

Images from the Pacheta Creek wet meadow restoration project in south-central Arizona on White Mountain Apache lands. The photo on the left shows tribal members and Forest Service researchers assessing the site in July 1995 prior to implementing treatments to decrease stream downcutting and bank erosion. The photo on the right shows the improved condition of the creek and meadow in August 2007. *Photos courtesy of Jonathan Long, Sierra Nevada Research Center, Pacific Southwest Research Station, U.S. Forest Service*

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