EDITOR'S CHOICE *RANGELAND ECOLOGY & MANAGEMENT*

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Using locally-adapted seeds to restore native plants and arthropods following plant invasion and drought

Adam Mitchell, Andrea Litt, and Forrest Smith

Although the evidence is not overwhelming, humans are the most intelligent creatures on the planet. Therefore, it is believed we are the designated stewards of the Earth's natural resources. Many of us believe it is our responsibility to pass on the Earth to future generations in a better ecological condition than that in which we inherited it. One worldwide tenet is that fostering healthy ecosystems will naturally foster healthy human communities because the interdependence is strong and directly linked. Programs aimed at improving natural environmental systems enhance the well-being and quality of life for people as well. One wonderful example involves rural communities and restoration of native plant communities.

Frontier areas of the western United States were once vibrant and healthy. They thrived on the dedication of farmers and ranchers who worked hard and carefully used the available natural resources. Small farms and ranches provided the economic basis for rural communities to grow into active towns and the center of social events needed and enjoyed by rural citizens. Over the past century, rural communities have diminished and are teetering on the edge of extinction. Rural communities of the western US have become far too difficult for anyone to make enough money to raise a family and small farm bankruptcy is far more common than success. Land ownership has shifted to a few larger farms and ranches to capitalize on the economies of scale to survive. Opportunities for young adults have emerged primarily in the urban areas of the country and the lure of the cities and its amenities have caused major changes in demographics from rural areas.

As our worldwide tenet predicts, environmental and ecological issues are at the root cause of rural abandonment. These ecological problems have been growing in rural areas. Invasive species have invaded millions of acres throughout prime rangelands and forest ecosystems, primarily annual grasses, but also knapweeds. These invasive species invade healthy functioning ecosystems and reduce their ability to provide the necessary goods and services they provide to rural communities, including wildlife habitat, recreation, and the storage and release of water and carbon. As a result of this invasion, recurring fires pose a chronic and mounting threat to the integrity of these ecosystems. Initial estimates from a decade ago suggested >25% of sagebrush steppe rangeland has been lost as a result of altered fire cycles and invasive annual grasses. Even under current best management practices, models suggest altered fire cycles and invasive annual grasses will destroy over 100,000 hectares of sagebrush steppe each year.

Long-term drought combined with the over allocation of groundwater has created a very serious ecological problem in arid- and semi-arid regions worldwide. Water for irrigated agricultural has become severely limited and many farmers do not have the water needed to grow a commercially viable crop. Regulatory agencies have been forced to regulate water use in areas with declining ground water levels. Lowering water tables and lessening water flows also impacts rivers, streams, and lakes, which are central to the wildlife inhabiting these regions.

About 4 years ago, a collaborative working group of optimists joined together to address these serious issues. Their concept was to apply the healthy ecosystems begets healthy communities tenet to a frontier region of the rural West. The High Desert Partnership working groups determined that creating a local source-identified native seed production and landscape-scale restoration industry throughout the northern Great Basin would directly address these issues. This industry would provide a structure and platform for many new business start-ups creating new jobs with living wages in the native plant seed collection, cleaning, production, storage, and on-the-ground restoration. Local native seed sources are essential to restoring degraded and invaded plant systems, which is the only way to recover healthy functioning ecosystems. At the same time, restoration of native plants can reduce the number of out-of-control wildfires, while recovering essential habitat for wildlife and livestock. And, finally, native plant seed production provides a new high-valued crop that requires substantially less irrigation than the primary crop, alfalfa, and will conserve our precious underground water resources. This working group developed a non-profit

organization called EcoSource Native Seed & Restoration, where the members provide the guidance and governance of the industry at the beginning and grows to support improved natural ecosystems and foster healthy rural communities in the region (Ecosourcenativeseeds.com). Increasing the use of native plants in restoration and the availability of native plant seeds that are generically appropriate for specific ecological sites is designated as a major priority of most agencies, tribes, and landowners.

It is critical that restorationists understand the value and benefits of establishing genetically appropriate native plants and how those native plants effect native insects and other animals as ecosystems restoration occurs. The Editor's Choice for *Rangeland Ecology & Management* Volume 77 is the beginnings of researchers helping to understand the processes and effects of ecosystem restoration using locally grown native plants. In this Editor's Choice article, Adam Mitchell, Andrea Litt, and Forrest Smith investigated the effects of using locally sourced native seeds during restoration in southern Texas. They believed that adding native, locally adapted seeds to favor establishment of native plant communities could provide a better restoration strategy for restoring these rangelands. They explored the efficacy of soil disturbance and the addition of native seeds to restore native plant and arthropod communities in landscapes dominated by Kleberg bluestem (*Dichanthium annulatum* [Forssk.] Stapf, Old World bluestem grasses, OWB) in summers 2011- 2013. Their study coincided with severe drought in the region. They compared vegetation and arthropods on disked plots with and without native seed (experimental plots), as well as plots within adjacent, undisturbed OWB monocultures. Adding native seeds increased cover of native plants and reduced cover of OWBs relative to unseeded plots and undisturbed OWB monocultures. Most of the plants recorded in seeded plots were not included in the seed mix. The researchers hypothesized that arthropods may have been consuming the added seeds, rather than the seed bank, permitting native plants in the seed bank to establish. Adding native seeds also increased arthropod species richness, which was more pronounced as drought severity decreased. During severe drought, arthropod abundance in experimental plots was comparable to undisturbed OWB monocultures, despite the absence of vegetation after disking. However, as drought subsided, undisturbed OWB monocultures had more arthropods than experimental plots. Nonnative arthropods, particularly herbivores, were positively associated with OWBs, and adding native seed was associated with reduced dominance of both OWBs and nonnative arthropods. Reducing dominance of OWBs by adding native seed also was associated with reduced dominance of some predators that consume nonnative arthropod prey. Understanding how communities respond to multiple disturbances seems especially important to inform restoration strategies given that changes in climate patterns and establishment of invasive species are likely to be more common and widespread.

Please look at this excellent paper in *Rangeland Ecology & Management* Volume 77. An entire new industry is emerging in rural communities, and they are proving the tenant that healthy ecosystems beget healthy rural communities.

Thank you,

Roger Sheley
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