Rangeland FAQ Series

Science and Solutions for the Range

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Pioneer Plant Species for Intermountain Rangeland Restoration

Would a carpenter go to work without a saw? Would a surgeon go into an operation without a scalpel? It's possible that ecological restorationists in the Intermountain West are doing just that. The Intermountain West is faced with massive scale ecological degradation due to the invasion of exotic annual grasses and the subsequent fire feedback loop they create, costing the region in lost resources and dollars. But are we overlooking a tool that may prove to be extremely useful? **Early seral, referred to as pioneer species, are a natural component of a healthy landscape but restorationists pay them little attention.**

Cheatgrass infestation is now a major concern among landowners and land managers in western states. Millions of acres have already been invaded, and much of this land has reached a state where cheatgrass is the dominant species. In 2020, it was estimated that exotic annual grasses dominated approximately 19 million acres of the Great Basin.[1]

Cheatgrass succeeds in invading landscapes dominated by sagebrush steppe communities by capitalizing on key growing traits. First, cheatgrass uses available water more efficiently than our native species by sprouting at lower temperatures early in the season. Second, cheatgrass can grow in extremely high densities reaching as many as 10,000 plants per square meter.[2] Cheatgrass also perpetuates its own dominance by creating continuous fine fuel beds that create perfect conditions for wildfires which benefit cheatgrass more than many other species on the landscape.[3] But mother nature may have provided us with a tool that we've failed to utilize in this challenge.

Key Point

Following disturbance, semiarid, western plant communities naturally respond in a series of steps that develop over time. First to appear is a flush of colonizing or pioneer species. These are typically annuals or short-lived perennials that quickly establish on the site and pave the way for slower establishing species. Over time, the longer-lived species that managers typically desire, sometimes referred to as the "climax community" reestablish from surviving root systems, soil seed banks, or from seed dispersal from adjacent sites. This process is known as plant succession.

Our common restoration practices, however, tend to skip the colonizer step and attempt to establish climax species directly after disturbance.

When is a Weed not a Weed?

A weed is commonly defined as a plant interfering with our land management objectives for both conservation and agricultural production. However, there may be instances when a plant is unwanted in an area only because someone else has called it a weed. **Unfortunately, some of our native pioneering species have been called weedy, because of their presence on disturbed roadsides and poorly managed range and pasture.**

These pioneering species behave and grow similarly to many of the region's exotic grass invaders, allowing them to be more competitive, yet this group of plants hasn't been used to its full potential largely because of the perception that they are weedy. However, those "weedy" traits may be exactly what is needed. Manipulating succession may put us on the path to better ecosystem resilience and resistance to invasion.

Contact: Karen Launchbaugh, Rangeland Center Director: 208.885.4393 | range@uidaho.edu

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University of Idaho Rangeland Center

What is Succession Management?

Pioneer species fill an important niche in space and time, reducing post-disturbance erosion potential and offering food sources for pollinators and other wildlife until later species become fully established.

Succession in our western rangelands occurs slowly, decades to centuries if left alone.[4] The current practice of seeding climax species seed mixes in post-disturbance landscapes may create an undesirable gap in time between the removal or control of invasive weeds and the establishment of the desired native plant community.[5,6] This gap in time creates a vacuum in which invasive species may quickly colonize or re-establish themselves where they once were.

There have been many studies that have shown pioneer plant species to be very effective at competing against and even suppressing invasive species. Several native annual Intermountain wildflowers were found to be highly competitive against cheatgrass in controlled studies.[7] For example, bristly fiddleneck reduced cheatgrass biomass, while fiddleneck and western tansymustard reduced cheatgrass seed production by nearly 80%. In a similar greenhouse study, Perry[8] found the annual native forbs, annual ragweed and common sunflower reduced biomass of several weeds including cheatgrass, Canada thistle and whitetop. Herron[9] likewise found a significant reduction in weed cover in plots seeded with colonizing native annuals compared to climax species. Additionally, Uselman[10] showed native pioneers generally had earlier germination and better survival than late seral natives, implying that they fill a similar functional group to cheatgrass than climax species. They concluded that the use of early seral species may improve early seedling survival in Great Basin seeding efforts.

By manipulating the species present after disturbance, managers can ensure that all niches (space and time) are filled (Fig. 1). Doing so reduces the opportunities available for invasion by unwanted exotic species.

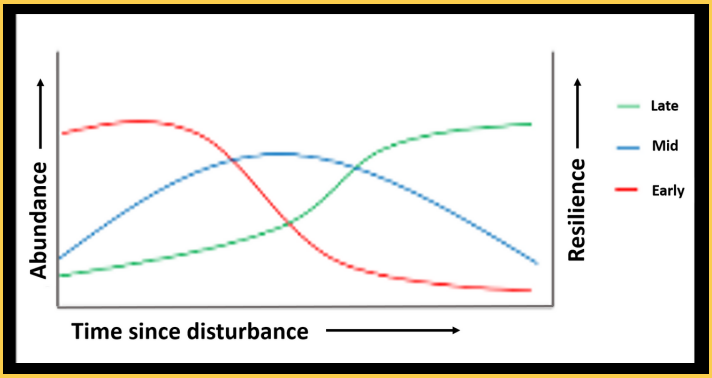

Figure 1. Following disturbance, early seral species quickly establish providing initial resilience. The early species then decrease in abundance as mid-seral perennial species increase. The ultimate "climax" community in the Intermountain West is often a mixture of late-seral shrubs and long-lived perennial grasses. Each seral group provides cover and resilience for a period in time following disturbance. Seeding climax-only seed mixtures leaves a resilience gap allowing for establishment and proliferation of weeds.

Written by Derek Tilley,[1] April Hulet,[2] and Brad Stokes [3]
[1]University of Idaho, College of Natural Resources; [2]Brigham Young University, Plant and Wildlife Sciences Department; [3]University of Idaho Extension

What Species Fill This Role?

Figure 2. Intermountain roadside can provide clues as to which species act as colonizers in disturbed areas.

On any stretch of highway in the Intermountain Region (Fig. 2), it becomes obvious which native species are still managing to persist and thrive in disturbed conditions in the presence of invasive weeds. This space often sees heavy traffic, soil compaction, and repeated mowing as well as periodic fire from mowing sparks or cigarettes. There is typically a high presence of invasive weeds like cheatgrass and tumble mustard, but one also sees a unique community of native species. Rubber rabbitbrush often makes up the overstory, especially further from the road where mowing is less frequent. Grasses often include sand dropseed and purple threeawn. There are often upright native biennial and annual forbs like curlycup gumweed, common sunflower and bristly fiddleneck, and there may be a component of flat, spreading forbs like bigbract verbena. As one moves further away from the roadside, the plant community transitions, sometimes very distinctly, to a perennial dominated system.

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Intermountain Pioneer Species

Bottlebrush squirreltail
(Elymus elymoides)

Growth Type: Grass
Precipitation (in): 8-18
Soils: Fine-Coarse
Seeding Depth (in): 1/4-1/2
Seeds/lb: 220,000
Seed Rate (lb/ac): 6
Pollinators: Ground nesting bees
Life Span: Short-lived perennial

Sand dropseed
(*Sporobolus cryptandrus*)

Growth Type: Grass
Precipitation (in): 7-12
Soils: Med-Coarse
Seeding Depth (in): 0-1/4
Seeds/lb: 5,300,000
Seed Rate (lb/ac): 1
Life Span: Perennial

Rubber rabbitbrush
(*Ericameria nauseosa*)

Growth Type: Shrub
Precipitation (in): 7-16
Soils: Med-Coarse
Seeding Depth (in): 0-1/8
Seeds/lb: 693,000
Seed Rate (lb/ac): 0.5
Pollinators: Native bees, butterflies
Flowering Time: Late summer
Life Span: Perennial

Bigbract verbena
(Verbena bracteata)

Growth Type: Mat forming forb
Precipitation (in): 10-16
Soils: Med-Coarse
Seeding Depth (in): 0-1/8
Seeds/lb and Seed Rate (lb/ac): unknown
Pollinators: Bees, bumblebees, butterflies
Flowering Time: Summer
Life Span: Annual, short-lived perennial

Curlycup Gumweed
(*Grindelia squarrosa*)

Growth Type: Forb
Precipitation (in): 6-16
Soils: Fine-Coarse
Seeding Depth (in): 0-1/4
Seeds/lb: 410,000
Seed Rate (lb/ac): 3
Pollinators: Native bees, butterflies
Flowering Time: Late summer
Life Span: Biennial

Photo Credit: Derek Tilley

Bristly fiddleneck
(*Amsinckia tessellata*)

Growth Type: Forb
Precipitation (in): 8-30
Soils: Med-Coarse
Seeding Depth (in): 0-1/4
Seeds/lb: 4,000,000
Seed Rate (lb/ac): 0.5
Pollinators: Native bees
Flowering Time: Summer-Fall
Life Span: Annual

Common Sunflower
(Helianthus annuus)

Growth Type: Forb
Precipitation (in): 8-16
Soils: Fine-Coarse
Seeding Depth (in): 1/4-1/2
Seeds/lb: 81,000
Seed Rate (lb/ac): 13
Pollinators: Native bees, butterflies
Flowering Time: Late summer
Life Span: Annual

Hoary and Tansyleaf Tansyaster
(*Machaeranthera canescens* and *M. tanacetifolia*)

Growth Type: Forb
Precipitation (in): 6-14
Soils: Med-Coarse
Seeding Depth (in): 0-1/4
Seeds/lb: 1,300,000
Seed Rate (lb/ac): 2
Pollinators: Native bees, butterflies
Flowering Time: Late summer
Life Span: Biennial

Globemallow
(*Sphaeralcea* ssp.)

Growth Type: Forb
Precipitation (in): 7-15
Soils: Fine-Coarse
Seeding Depth (in): 0-1/4
Seeds/lb: 500,000
Seed Rate (lb/ac): 2
Pollinators: Native bees, butterflies
Flowering Time: Early summer
Life Span: Perennial

Multilobed Groundsel
(*Senecio multilobatus*)

Growth Type: Forb
Precipitation (in): 9-20
Soils: Med-Coarse
Seeding Depth (in): 0-1/4
Seeds/lb: 900,000
Seed Rate (lb/ac): 3
Pollinators: Native bees, butterflies
Flowering Time: Early summer
Life Span: Biennial