Utah Shrubland Management

The next four newsletters will bring highlights on each of the ranches in our shrub management study. In this volume, we interview ranch owner Bill Robinson who manages cattle in Birdseye, UT with his sons Red and Kim. The Robinsons are actively seeking ways to reduce cover of rubber rabbitbrush, and increase forage for livestock.

CONTENTS

Project Updates

Field crews have been working hard this spring and summer to collect baseline data describing vegetation conditions prior to experimental shrub treatments. Our staff has been out to each of the four study ranches to establish plot locations and take measurements on plant community condition. A big thank you to Sarahi Felix, Jessica Walker, Joe Lamb, Justin Chutich, and Brittany Duncan for all their efforts collecting field data this year!

Establishing Small-Scale Experimental Plots

Four ranches are involved in our evaluation of management techniques, located in Birdseye, Cedar Fort, Bear Lake, and Park Valley. Two, 1-acre experimental study areas have been established per ranch, each on a unique soil type and associated Ecological Site. The study areas were fenced to exclude livestock grazing over the course of the research project.

Justin Churtich, Brittany Duncan, Sarahi Felix, and Joe Lamb measure shrub density and herbaceous cover at Lance Westmoreland's ranch in Park Valley, UT.

Using pin flags and stakes, 120 plots have been marked out in each of the 1-acre study areas. Plots will be assigned a set of treatments including herbicide for shrub removal (either Cimarron Max, Kindra, Rejuvra, Tebuthiuron, or a non-sprayed control); seed mix (traditional mix, standard mix, or a non-seeded control); and mechanical shrub removal (aeration or a no treatment control). Every treatment combination is represented in the study and to obtain an average site effect, each combination is repeated four times. This is a split-split block experimental design (see diagram, pg. 2).

To assess how the combination of herbicide, aeration, and seed mixture are affecting site vegetation, field crews are documenting shrub cover (live and dead), shrub density by species and size class, and herbaceous cover and frequency, in each of the 120 plots. Measurements are taken at approximately peak biomass production and will be repeated at the same time each year until the completion of the study in 2015.

PROJECT DIRECTORS

Dr. Thomas A. Monaco
Research Ecologist
USDA-ARS, Forage and Range Research Laboratory (FRRL)
Logan, UT

Dr. Kari E. Veblen
Assistant Professor
Wildland Resources Department
Utah State University (USU)
Logan, UT

Justin Williams
Research Coordinator,
Rangeland Management Specialist
USDA-ARS, FRRL
Logan, UT

RESEARCH COOPERATORS

Beth Burritt
Extension Assistant Professor
Wildland Resources Department
USU, Logan, UT

Dr. Roger Banner
Associate Professor
Wildland Resources Department
Range & Extension Specialist
USU, Logan, UT

John Cantlon
Government Resource Manager
E.I. du Pont de Nemours and Company
Lakewood, CO

Nevin C. DuPlessis
Crop Protection
E.I. du Pont de Nemours and Company
Salem, OR

Troy Forrest
UDAF Utah Grazing Improvement Program (UGIP)
Field Operations Manager
Northwest Region Coordinator

Ashley Hansen
UDAF UGIP
Wasatch Region Coordinator
Tooele, UT

Jamison Jewkes
Rangeland Management Specialist
USDA NRCS, Randolph Field Office
Randolph, UT

William "Bill" Kral
Crop Protection
E.I. du Pont de Nemours and Company
Twin Falls, ID

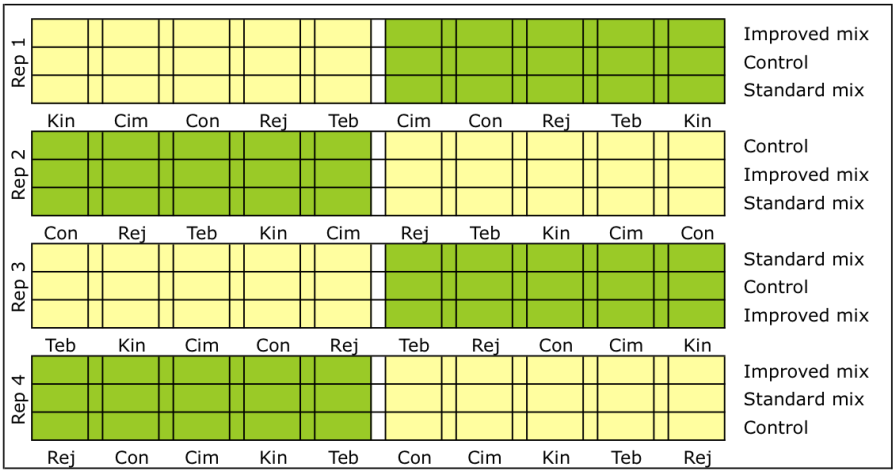
Rebecca Mann
Wildland Resources Department
Graduate Student Research Assistant
USU, Logan, UT

Matthew Phillippi
Rangeland Management Specialist
USDA NRCS, Tooele Field Office
Tooele, UT

Utah Shrubland Management

Volume 2, Summer 2013 **Page 2**

Experimental layout of plots inside fenced exclosures at ranch study areas.



Green areas will receive an aeration treatment, yellow are not aerated. Herbicide treatments include untreated control (con), Cimarron Max (Cim), Kindra (Kin), Rejuvra (Rej), and Spike 20P (Teb). Plant material mixes include unseeded control, improved mix, and standard mix. "Rep" signifies a repeated block of treatments.

Ranch-Wide Herbicide Assessment

The effects of select herbicides on brush reduction will also be assessed at the ranch-wide scale. Ranch owners consulted with staff at UGIP, USDA, and DuPont to select an herbicide to reduce cover of a single target shrub on their property (rubber rabbitbrush, greasewood, sagebrush, or snakeweed). Herbicide applications were finalized this spring; these were applied aerially except at Birdseye, where a tractor-mounted spray system was used.

A 20m transect at the ranch in Cedar Fort, UT.

To assess the herbicide application, twenty permanent, 20m-transects were established within each of the two treatment areas on the ranch. Half of the transects are in control zones that did not receive herbicide application that will allow us to compare chemical treatment vs. no treatment. Along the transects, we measured shrub cover and density (in a 1m-wide belt); herbaceous cover and frequency in five ½-m^2 quadrats; and clipped herbaceous biomass produced in two ½-m^2 quadrats. These measurements will be collected each spring over the course of the study.

Brittany Duncan records herbaceous cover in a ½ m^2 quadrat.

Over time, we will begin to quantify how much the herbicides are reducing shrub cover and subsequently impacting the herbaceous forb and grass community. We will also examine how soil type is influencing the outcome of the treatment. We have already begun to observe herbicide-induced shrub dieback at the Cedar Fort and Birdseye ranches.

Snapshots of the rubber rabbitbrush community on Bill Robinson's ranch in Birsdeye, UT.

Rubber rabbitbrush community on Bill Robinson's ranch, before herbicide treatment. Photo taken September, 2012.

Rabbitbrush community after herbicide treatment. Photo taken July 2013.

Close-up of herbicide induced damage on rubber rabbitbrush foliage. Photo taken July, 2013.

Interview with Bill Robinson, Birdseye, Utah

By Justin Williams

Bill Robinson has been learning new ways to improve his beef and ranching operation every day of his life. With hundreds of acres of rangeland and farmland to manage, there is always something new to learn even after 83 years of learning new tricks. With the help of his sons Red and Kim, Bill farms and raises choice beef cattle on his Birdseye ranch.

"We have to leave the land better than we found it," Robinson said. "I would like to see this land produce more than it currently does, and this rabbitbrush has to go."

Some of Bill's land has a dense cover of rabbitbrush and could be more productive if it were removed. The problem is that rabbitbrush is hard to control once it has established itself on the landscape. Robinson's long-term goals would be to improve this land with a cover of productive range grasses and dry-land alfalfa. After becoming involved with the shrub control research project, Robinson is pleased with the initial results of the large-scale herbicide treatments.

"I am tickled-to-death with how the rabbitbrush is responding to the herbicide." he said.

Bill Robinson pictured at his ranch in Birdseye, UT, with his granddaughter, Kricklyn Pay.

Robinson will be working closely with researchers and collaborators on a best-fit recommended seeding mix for his particular ecological site. Rabbitbrush is a difficult shrub to control, although with a combination of herbicide and re-seeding treatments, the site will be improved.

"We need something to work against the rabbitbrush. These improved plant varieties are what we need." Robinson's confidence in using the resources around him will make for a successful project. "When you don't know the answer, round up people who do!"

USDA ARS

Utah State University

Ecological Sites at the Robinson Ranch in Birsdeye, UT

By Rebecca Mann

Landscape is one of many considerations when identifying ecological site. Pictured is a fenced study area at the Birdseye ranch.

The town of Birdseye is a collection of ranches and homes off of Route 89 in southeastern Utah County, about 20 miles south of Spanish Fork, UT. Between the mountains of the Uinta and Manti-La Sal National Forests, Birsdeye rests in an upper elevation valley, at 5,430 ft. If we take a step back, this town is one component of Utah's high elevation zone defined by the glacier-carved Wasatch and Uinta Mountains, spanning from the Bear River Range near Logan all the way to the Fishlake National Forest near Cedar City in the southwest corner of the state. This region ranges from 4,300 feet to over 10,000 feet in elevation, with precipitation from 12" annually in upland shrub communities to over 35" annually in alpine zones. Why take the time to consider the context in which this ranch lies? First, because a landscape's climate and topography are two primary factors influencing soil formation. In turn, soil and climate define the range of plant communities that can exist on a site. Most critically, a working familiarity of potential vegetation and ecological community dynamics can guide range managers in predicting how the land will respond to particular disturbances and management actions.

Soil pit at the Birdseye ranch, used to identify and describe soil horizons.

The USDA Natural Resource Conservation Service (NRCS) is responsible for characterizing broad ecological regions based on geography, climate, and soils. Each region is termed a Major Land Resource Area (MLRA) and is given a name and a code; the Birdseye ranch falls into a region named "Wasatch Mountains – North", or MLRA 47XA. But to understand the vegetative community potential and dynamics on Birdseye ranch, we must identify a further subdivision within our MLRA, the Ecological Site.

Our project managers and Jamin Johansen from the NRCS visited Bill Robinson's ranch in Birdseye to determine its Ecological Sites. This is an investigative process which involves soil texturing, describing the geographic setting and annual precipitation, and looking for vegetative clues on the landscape. The soils occurring on the ranch were identified as the Ant Flat and Doyce series, which are deep clayey loams with an accumulation of carbonates at about 10 inches depth and a calcic horizon at approximately 20 inches. These soils form in water-deposited sediments and can reach a total depth of over 60 inches; rock fragments in the profile are generally less than 15%. These deep, well-drained soils are suited for agriculture and can support a vigorous shrub, grass, and forb community.

A close look at the vegetation on the Birdseye ranch revealed relics of basin big sagebrush, *Artemisia tridentata* ssp. *tridentata*. Although it is currently only 2-3 feet tall at the ranch site due to grazing and shrub management, this species can commonly reach 5-6 feet in height[1]. In fact, Mr. Robinson recounts that in his early years of operation on this ranch, he would often lose sight of the cattle among the tall shrubs.

Ecological Sites, continued

Basin big sagebrush, over five feet tall in this photo.

Basin big sagebrush is an ecological indicator species in that it typically grows in well-drained soils where deep soil moisture is available to the plants even into August[1]. The presence of Basin Big sagebrush, along with the soil characteristics, and an average of 13.8" of rain per year[2], together identify the broad ranch area as an Upland Loam, Basin Big Sagebrush Ecological Site (coded R047XA308UT).

This is not to say the entire ranch appears the same. Within this designation, we can see fluctuation in the vegetative community that is dependent upon small-scale landscape position. For instance, watershed moisture is funneled through occasional swales on the property, resulting in taller, thicker shrubs than those up on somewhat rockier plateaus. On bench tops, increased drainage results in a drier environment, and some drought-tolerant species appear, such as the shorter Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis).* These landscape positions influence vegetation dynamics and the site's response to disturbances. The two study areas on the Birdseye ranch were placed to represent two extremes of the environmental range, and will allow us to examine how the specific sites impact shrub management outcome.

Current conditions at the Robinson's ranch reflect a history of agriculture and shrub control practices. After the sagebrush was mowed about 8 years ago, rubber and gray rabbitbrush took advantage of the disturbed soil and are now the dominant shrubs, (25% cover), interspersed with occasional snakeweed and relic basin big sagebrush. The understory is composed of Sandberg's bluegrass, crested wheatgrass, western wheatgrass, intermediate wheatgrass, and occasional weedy species such as field bindweed and musk thistle. These modern conditions are an example of how a number of different vegetative "States" may be represented within an Ecological Site. Over several decades, the area shifted from a historic sagebrush and bluebunch wheatgrass-dominated community to a rabbitbrush-dominated community, thus undergoing a "Transition" between States. Restoring forage grasses and reducing rabbitbrush on this disturbed but productive site will require persistence and creative management tactics. This year, Bill Robinson is using Picloram + 2,4-D (Alligare, LLC) to control rabbitbrush population levels.

- To read more about Major Land Resource Areas, visit: ftp://ftp-fc.sc.egov.usda.gov/UT/Range/Utah_MLRAs.pdf
- Ecological Site information is available on the NRCS website. To look up soil types and Ecological Sites for any area, use NRCS's interactive map at: http://websoilsurvey.sc.egov.usda.gov/app/HomePage.htm
- For any further information about Ecological Sites, contact your local NRCS Range Specialist: http://offices.sc.egov.usda.gov/locator/app?state=UT

References

1. Winward, Alma H. "Sagebrush of Colorado: taxonomy, distribution, ecology & management." Colorado Division of Wildlife, Department of Natural Resources, 2004.

2. SOD USA Climate Archive, Western Regional Climate Center, 2013. Web. 8 April 2013. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?utbird

3. Green, Shane A. "Upland Loam (Basin Big Sagebrush) R047XA308UT". Ecological Site Description System. Natural Resources Conservation Service, 10 Dec. 2012. Web. 22 July 2013.

The role of selective herbicides to control shrubs and facilitate the abundance of herbaceous species

By Tom Monaco

All land management decisions involve some level of uncertainty due to the dynamic nature of ecosystems and the inadequacies of a given management application. For example, because shrubland systems are characterized by a high level of natural variability in resilience and productivity, management actions will often yield a mix of expected and unexpected results. This is particularly evident for management objectives that require a reduction in shrub abundance to increase grasses and forbs on permanent rangeland pastures. While this is a reasonably sound management objective based on the underlying assumption that *if shrubs are reduced, herbaceous species will increase,* the desired outcome is highly dependent on whether shrubs are selectively controlled by the proposed land treatments. Here, we describe the concept of herbicide selectivity and provide a brief description of how the herbicide formulation of picloram and 2,4-D was applied at the Birdseye Ranch demonstration area.

Herbicides are one of the most common integrated pest management tools and are frequently used to control shrub density to meet management objectives. However, in order for herbicides to be an effective integrated management tool for shrub reduction, they must be highly selective for shrubs while causing minimal damage to desired plant species. Selectivity, however, is not a simple concept because it depends on complex interactions between herbicide chemistry, plants, environmental conditions, and soil properties. For example, low selectivity may be due to poor herbicide uptake and translocation by target shrubs or unexpected damage to non-target species due to inappropriate application rate or timing. In contrast, high selectivity is possible when herbicides impact specific, vital metabolic processes in the target shrub, but not in the non-target plant species.

Some herbicides have high specificity for broadleaf species, including shrubs, while having minimal impact on grasses. One such selective herbicide for broadleaf control is 2,4-D, an auxin-type growth regulator that has been used for shrub control in the western US beginning in the late 1940s[1]. The positive qualities of 2,4-D include low application expense, low toxicity to animals, and low residual storage in the soil. Picloram is also an auxin-type growth regulator and is commonly applied in mixture with 2,4-D. Similar to 2,4-D, it has relatively high selectivity for woody plants and broadleaf herbaceous species. Furthermore, it is widely accepted that most grasses are resistant to both herbicides, however, the uncertain aspect of their use is that they can potentially injure desirable broadleaf forb species. It is important to note that neither herbicide is designed to adhere to soils, nor do they have residual, pre-emergence effects on plants. Consequently, they must be applied when target shrubs possess actively growing leaves or when young seedlings are emerging, all the while avoiding non-target injury of desirable forb species.

Rabbitbrush-dominated plant community at Birdseye ranch , before treatment with Picloram + 2,4-D.

Intermediate wheatgrass at the Birdseye ranch should remain unaffected by the selective herbicide application.

Some herbaceous species, such as musk thistle, will die back using Picloram + 2,4-D.

FUNDING

Funding for this project is provided by:

- USDA, Agricultural Research Service
- USDA, Natural Resources Conservation Service; Utah Conservation Innovation Grants
- Utah State University, Agricultural Experiment Station
- Contributed products and services from DuPont.

Selective herbicides, continued

Birdseye Ranch Herbicide Treatment

Given the current condition of vegetation at the Birdseye ranch, including very low abundance of desirable forb species, we assumed there was a relatively low risk of non-target herbicide injury through the application of picloram and 2,4-D. Thus, we applied Picloram + 2,4-D (Alligare, LLC) in June 2013 to reduce rubber rabbitbrush, which had taken over grazed pastures at Birdseye Ranch. This herbicide formulation and a non-ionic surfactant were applied with a tractor-drawn sprayer affixed with a 21-ft boom. We used the product-label recommendations for broadleaf and woody plants on rangeland and permanent grass pastures, which equated to an application rate of 7.4 pints/acre using a tank volume of 18 gallons per acre. We used this high tank volume of water carrier because previous research illustrated much greater rabbitbrush mortality and canopy reduction compared to a lower tank volume[2].

Within a 24-hour period, we observed injury symptoms on rabbitbrush, including wilting and curling of the stems and leaves. Looking across treated areas, it was easy to see that rubber rabbitbrush plants were clearly injured, and within 2 weeks most plants appeared brown, and leaves on injured plants were dried. We also observed injury in other broadleaf species, including alfalfa and musk thistle. However, as expected, grass species such as wheatgrasses were unaffected across the treatment areas.

This early assessment suggests that broadleaf weeds such as thistle and the target shrub rabbitbrush show a high percentage of control. With time we anticipate that rabbitbrush plants will continue to die, freeing up resources for the growth of resident grass species. In addition, injured rabbitbrush plants will be unable to produce seed in the fall of 2013. However, there is a good chance that seed banks of rabbitbrush still exist in the soil and may provide the means for seedlings to emerge over the next few years. While some rabbitbrush plants may resprout after our herbicide treatment, our hope is that this treatment will enable herbaceous grass species present at the site to recover to ~25% cover and provide some competition for surviving and newly emerging rabbitbrush seedlings. As past research has shown[3-4], rabbitbrush and bunchgrasses compete for limited resources, and maintaining a strong grass community may help keep rabbitbrush populations in check.

References

1. Hull Jr., A. C., and W. T. Vaughn. 1951. Controlling big sagebrush with 2,4-D and other chemicals. Journal of Range Management 4:158-164.

2. Whisenant, S.G. 1988. Control of threadleaf rubber rabbitbrush with herbicides. Journal of Range Management 41:470-472.

3. Gunnell, K. L., T.A. Monaco, C.A. Call, and C.V. Ransom. 2010. Seedling interference and niche differentiation between crested wheatgrass and contrasting native Great Basin species. Rangeland Ecology & Management 63:443-449.

4. McKell, C.M., and W.W. Chilcote. 1957. Response of rabbitbrush following removal of competing vegetation. Journal of Range Management 10:228-230.