Webinar Brief for Resource Managers

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Patterns of Understory Growth During the First Three Years Following Prescribed Burn

Presented on January 25, 2012 by Dr. Gene Schupp, Plant Ecologist, Utah State University

Project Summary:
Do Wyoming big sagebrush communities respond similarly to fuel reduction treatments across the northern Great Basin? Patterns of native and exotic understory growth during the first three years following prescribed fire, mechanical, tebuthiuron, and imazipic treatments are discussed.

Management Implications

- Imazipic heavily reduces cover of invasive annuals after a burn, allowing sites to reestablish; while it may affect perennials, the effect is short lived and overall rather non-detrimental
- Imazipic is a very good tool to help establish a site after a burn but it should NOT be used for continued management; continued used will breed resistant forms of undesirable plants.
- Gap size is a very important factor in recovery of a site and resistance to invasive grasses; there are thresholds of gap size that will allow and predict a cheatgrass invasion and more research needs to be conducted on identifying thresholds and controlling gap size

Abstract:
Dr. Gene Schupp and colleagues, with support from SageSTEPP, conducted a study examining the vegetation responses to fuel reduction treatments for the first three years following treatment. The sites, spread across the Great Basin, vary in vegetation, soil, climate, and grazing history; however, analysis suggests that there is a strong biological and environmental overlap between the sites, and all sites have the same future of being excluded from grazing. The main question of the study was: Did treatment result in cheatgrass explosion or more healthy recovery? The treatments used included burning, mowing, applying tebuthiuron (a sagebrush focused herbicide), applying imazipic (a pre-growth, annual focused herbicide), as well as establishing control plots; imazipic was applied on all other treatment types in a subplot arrangement. Overall, burning and mowing had significantly less cover than other treatments in all post-treatment years. Imazipic significantly lowered cover and helped to delay increase. There was an increase in herbaceous cover at all sites, and the increase was more severe in more disturbed sites. In terms of sagebrush, mowing overshot the goal of reducing cover but harmed less sagebrush than burning, tebuthiuron has a

subtle effect and has not yet achieved the desired 50% reduction in cover, and the burned plots had very substantial sagebrush mortality (although it varied widely depending upon fire behavior). In terms of the tall grasses, the control had lower cover than the treatments, which were driven strongly upwards in the burning and mowing treatments; it should be noted that the cover increase was due to growth of the plants, not increasing density by recruitment. In terms of the short grasses on the sites, cover was reduced in the first year with imazipic, but recovered in subsequent years, the cover in burned plots didn't change or decrease, but while the growth did increase cover individual plants, and the decreasing density negated that effect. Perennial forbs didn't have much response, regardless of treatments. One of the observations that came out of this study was that cheatgrass invasion is highly predicted by interbasal gap size. The larger the area, the more prone to invasion and erosion the site is at; monitoring gap size can be early warning signs for invasion and reducing gap size needs to be an area of focus for future research. During the study, a fire blazed through areas of treatment, revealing that sites treated with imazipic didn't burn for the most part, while sites that were not treated with the herbicide suffered heavy disturbance. The overall conclusions of the study are that sagebrush is regrowing and recruiting at most of the treated sites, there is a slow increase in native perennials, invasive annual grasses are controlled for 2-3+ years with imazipic, and that imazipic has an intimal negative effect on perennials that is overcome in just a few short years.

Questions:

I am working on a post-wildfire treatment on cheatgrass. What slopes should, or shouldn't I, consider?
We certainly have some evidence from Dave Pyke's group out of Oregon that the more difficult problems you're going to have will be on south facing slopes. The more stressed conditions will be more of a challenge to get perennials to establish and dealing with the cheatgrass. I don't have a rule of thumb for you to use, but all I can say is that cheatgrass is a huge challenge no matter where you are.

How was Imazipic applied and at what rate?
6 oz. per acre applied with a boom-sprayer on an ATV at the level of quarter-acre subplots. This was a practical approach but not something that would be done at a large scale.

Were application rates of Imazipic uniform or did they vary by site?
We went with uniform because effectiveness can be extremely dependent on litter cover, live vegetation cover, and soil characteristics. We went with a uniform across our network of sites and chose a dosage based on literature that said it would be effective under most conditions, and the results show that. We got great control with it, and control lasted for years.

After drill-seeding sagebrush, how long should you wait before treating with Plateau?
I don't really have an answer to that. Perennial grass seedlings differ from species to species in vulnerability. There has been a study that even looked at seeding while applying Imazipic. The evidence supports the ideas that it is more harmful to annuals than to perennials; it will affect perennials, but it is an annual targeting herbicide. We know from treating after seeding that some seedlings are very vulnerable to Imazipic, while others are much less harmed, so effects will be dependent on seeding. Environmental factors can have an effect as well; I believe that, to some extent, the prolonged controlling effect of Imazipic are due to not the persistence in the soil, but to greatly reducing the seed bank of the annuals. In that first year, it's slower to recover so my guess is that, depending on the species being planted, I think you could apply the next year or two years after without a lot of harm, but no one has looked at that in detail.
Plateau is a brand name of Imazipic.

Have you done any treatments that combined Imazipic and seeding? If so, what type of results were you seeing with perennial establishment?
We haven't in this network, we have not, but we have at Golden Spike National Historic Monument. We have a fairly serious problem in the sagebrush community there, with a large sagebrush over story, a lot of cheatgrass, but not very many perennials at all. In an effort to get them more resistant to fire, we are trying to get a better population of perennial grasses in the understory. We seeded both with and without the Imazipic, and got good perennial emergence with the Imazipic. Unfortunately the site went from cool and wet to hot and dry almost overnight at the peak of a grasshopper outbreak and nothing really survived after the first growing season, so we can't say anything beyond "we got good emergence of perennials even in the face of the Imazipic." I think Imazipic is showing what it's promising as a tool, but we need to be careful to use it as intended; there is already some evidence that some of the annual weeds at some of these sites are evolving resistance. It can be useful in some situations, but we can't just use it all the time or it won't be useful in the future.

Is there any relationship between annual grass invasion and soil temperature regime?
I would say perhaps; I haven't given it much thought. We do know that if you go along elevational gradients from the lower, hotter, dryer sagebrush up to the cooler areas with big sagebrush, you have less of a problem with cheatgrass domination of sites. It is definitely more of a problem on warmer soils.

Were there any seeding trials associated with this research project?
No, this network of sites was selected to include a range of tree canopy cover, and had a range in perennial grass coverage in the sagebrush sites. So are question was, if these treatments are applied, how does the existing system respond, and are there particular positions on these gradients of tree or perennial grass cover where we can reliably predict it will improve in condition, vs. predict that if we don't seed, it will deteriorate in condition? So we intentionally didn't seed. We were looking at the response of these sites on the subplot level of monitoring.

Was there any correlation between native perennial species composition and appearance and/or persistence of cheatgrass following treatment?
We haven't looked into that level yet, but it's in the pipe. There are ideas out there that a diverse stand is going to be good at keeping weeds out than a less diverse stand because they might be using more of the available resources because of a variety of rooting patterns or depths etc. Diverse stands, basically, take away more of the available resources. There is also some idea that diversity of vegetation will reduce the diversity of weeds that are able to get into the area or that in areas where we find high native diversity (driven by environmental conditions of the site) we will also see a high diversity of invasives. We are going to start teasing that stuff out, but we haven't looked at it yet.

Were these sites grazed following treatment?
No, and we've contemplated and discussed this issue with managers and partners. All of these sites have grazing history, but all of these sites are protected after treatment from grazing. This causes some issues with the results, because most of the lands we are treating in the West are not going to have the luxury of not being grazed for years to come. But it would have been impossible across the diverse network of sites to have a controlled grazing treatment that would be in any way meaningful, and it would basically be interfering with our ability to see the response to other treatments. Granted, the treatment responses would likely have been different if grazing had been allowed, not all areas could have had the same grazing applied, therefore muddling any signals present. While not grazing is not the norm, it can help us better see the response to the treatments.

Since 6 ounces per acre were applied, and you didn't do trial seeding plots, would you consider seeding following Imazipic herbicide treatment and what results would you expect? Is it best to spray before or after drill seeding?
Based on my knowledge and musings and anecdotal evidence, my strong feeling is that Imazipic out it will have a great effect on the seeds that year; seed the following year when the seed bank for the weeds has been depleted. I want to do more trials with simultaneous vs. delayed and see what results, but my feeling is to reduce the seed bank of the weeds the first year and then seed the year following.

Follow Up: Were you seeding with warm or cool season grasses?
It was mostly cool season grasses.

Will density of desired perennial grass continue to be followed to see if establishment is occurring, especially in the Imazipic plots?
Absolutely as our plan is to follow-up on this initial 5 year study with long term monitoring. We have a 20 year plan. We will be taking some data at every plot every year, and more detailed measurements every three years. This is assuming funding holds out. We won't get the final answers in just the few short years after treatment.

Can you expand on the concept of gap management? What techniques could be used in reducing gap size if monitoring reveals they're increasing?
That is a good question. I understand the concept that you can't do everything because of time/financial/personnel restraints, and that most of our resources are focused on rehabilitation in emergency situations after a burn. Although there is some effort from a few of my colleagues and USGS in Oregon, more energy needs to be focused on augmenting the understory of things that are not in terrible shape to make them more resistant. Some of that is going to be figuring out how to reduce gaps without having to drag a drill seeder across an otherwise healthy sagebrush range. I don't have an answer for that right now, but what you really should do is take the information you have and go out and ask: do we have a potential problem here? This can be revealed using fairly easy measurements. We need to start addressing the question: If we do have a problem, how do we deal with it?

There likely is a fairly strong relationship between annual grass invasion and hydrothermal regimes. At higher elevation, cheatgrass growth and reproduction is limited, although seed germination can occur.
That sounds more like a comment correcting me than a question. Thanks.

Why include woody species in the gap analysis when it's the perennial herbaceous component that contributes most to resiliency?
The woody components do contribute to breaking up those gaps. Obviously when thinking about resiliency in response to a fire, those perennial grasses are going to be more resilient than those shrubs; we saw some of that data when the burn increased the gap sizes. When looking at a site and trying to understand current vulnerability to erosion and invasion based on gap sizes, those woody plants breaking up those larger gaps are still important. What you're focused on is important. If you are looking at resiliency of a system to a fire, you might want to keep track of the gaps between perennial grasses as well as the overall gap distribution, as they will tell you different things. The gaps between perennial grasses might be a better measure of what we're going to have if this site burns, as opposed to what we have now, which is important now.

Do you have recommendations for when to reapply Imazipic to previously treated areas?
I wouldn't want to go down the route of reapplying it to the same site. My hope is for Imazipic to be used to help a site reestablish; if you just keep putting it on every few years, the rapid plant cycle of annuals and strong selection pressure can evolve resistance very rapidly. My advice is to not reapply it to a site; use it as a tool to get a site into better condition or a really bad site to be established to begin with, and then use other methods of control. This is my personal opinion.

Was the amount of precipitation at each site recorded?
Yes, we have weather stations at the sites. The data are not presented, but we are monitoring precipitation, soil temperature, and soil moisture at various depths and associations with plants.

You mentioned soil carbon is negatively correlated with cheatgrass. Is that because carbon ties up soil nitrogen making it less available to be used by annuals like cheatgrass?
It can come from that direction, but there are several studies that suggest with a lot of cheatgrass, it actually increases the depletion of soil carbon. We don't have all the answers, and there is a lack of study, but two studies suggested

strongly that cheatgrass occupation actually increases the loss of carbon from the soil, but a lot of things can be involved.