Webinar Brief for Resource Managers

Great Basin Fire Science Delivery | 1664 N. Virginia St./MS 0186, Reno, NV 89557 | 775-784-1107 | emb@cabnr.unr.edu

Hydrologic Response to Fuels Treatments on Encroached Sagebrush-Steppe

Presented on May 2, 2012 by Jason Williams, Hydrologist, USDA, ARS Northwest Watershed Research Center

Management Implications

- Short term increases in runoff and erosion are worth the long term benefits of using prescribed fires on fuels in terms of hydrology
- Cutting significantly reduces erosion in the long run
- An area will become hydrologically unstable at and above 60% bare ground cover

Project Summary:
Jason Williams, hydrologist with the USDA Agricultural Research Service Northwest Watershed Research Center, presents his latest research findings on hydrologic response to fuels treatments on woodland encroached sagebrush steppe. He discusses his research on small and large scales.

Abstract: Hydrology is an important aspect of any ecosystem, and how the hydrology of an area responds to management needs to be understood so that the least detrimental effects can be incorporated. To study the effects of treatment, Jason et al. conducted rainfall experiments at the small scale (oscillating arm) and large scale (stand pipe). They applied each scale to different sites all across the Great Basin where management was reducing pinyon-juniper stands; fire and cut/drop/shred and control were the three conditions simulated. The results showed that fine scale runoff was similar to large scale amounts, but that the small scale erosion was at a lower level than the large scale plots. The interspaces, which increase as more PJ invades an area, account for a large portion of the increased runoff and erosion on woodlands over sagebrush-steppe. The trees also helped to make the soil more water repellent, leading to more runoff and concentrated flow patterns. They found that there is a threshold of about 60% bare ground that will lead exponential increase in erosion and concentrated flow, along with making an area hydrologically unstable. They found that the only treatments that had any significant difference in reducing runoff and erosion were prescribed fire and cutting. In the short term, however, burning did increase erosion 20 fold, but that was only in the first few years after treatment; compared to other sites at an ecologically significant amount of time (i.e. time for site to recover from treatment and progress along vegetation community's successional path), prescribed fire reduced runoff and erosion the most.

Questions:

It appears as if a site approaches its vegetative climax state, erosion increases. Therefore, what would be an appropriate method to maintain the site at an intermediate successional stage?

There is a lot to that question and some of that is more in the realm of plant ecology. The dates do tell us however that runoff and erosion are strongly linked to vegetation, and we've known that for quite some time. Monitoring and management of the vegetation to get the desired effects in terms of runoff and erosion will require knowledge of how the plant communities are going to shift. So looking at state transition models would be a good idea of predicting how that's going to change. We can look at runoff and erosion for these scenarios and line up plant management with that.

Followup: Within the mastication process, what was the mortality index of the associated grasses?

That's a better question for Bruce Roundy, since he has been conducting research on this for some time. I really don't know the answer.

What is the history of grazing on these sites?

I don't know specific details for each of these sites, but I know they had excluded grazing for a substantial period before they conducted these studies. **Is there some way someone could find out?** Jim McKiever is probably the best person to contact, and there are probably specific managers for the specific sites who would know; Jim is a good first point of contact.

What was the application rate of simulated rainfall? Was there a rate threshold where soil erosion accelerated?

That is a good point. These are static intensity storms, so we did two application rates: a "dry run" of 64 millimeters per hour, and a "wet run" of 102 millimeters per hour that we ran after the dry run on the same plot. Someone looking at this data shouldn't be looking for a threshold, but rather the magnitude of differences for the different conditions, which tells you a lot about the processes and dictates the response. Today, I presented data from the dry and wet runs, but mostly the wet runs; there is probably some threshold between 64 and 102 where you would start to see a major shift.

Have the effects of microbiotic crusts on infiltration rates and erosion been considered in this or other USDA hydrologic studies?

We didn't see any evidence on our sites that there was any significant developments on that, but there are other studies that have looked at that.

How do long term effects from burning compare to long term effects from cutting? Does one have more impact than the other?

We don't know that yet, but it would be good to monitor these sites to find out. Even what we have now are just short term results. I don't know of any studies that are looking or have looked long term at runoff, erosion, and infiltration on any vegetation type. Again, I think the vegetation community is going to dictate the long term response more than the type of treatment you had. How will your treatment effect your plant community, and how will your plant community change? That's going to be what dictates erosion, runoff, and infiltration in the long run, and as infiltration changes, soil moisture changes, which changes your plant communities; they are all linked together.

In the Phase II to Phase III sites, what was the biomass of the trees? Did you notice any differences due to biomass load? That's not something we measured as part of our study, or within SageSTEP, but I believe Robin Tosh and some others have done some work on it. We primarily looked at how the plant community changed and what the understory makeup was and mortality of shrubs to get at what phase we were in.