Natural Resources and Environmental Issues

Volume 16 Shrublands: Wildlands and Wildlife Habitats

Article 26

1-1-2011

Post-burn Resprouting in Bigtooth Maple (Acer grandidentatum): A Case Study

Beth L. Corbin

Douglas H. Page

Follow this and additional works at: http://digitalcommons.usu.edu/nrei

Recommended Citation

Corbin, Beth L. and Page, Douglas H. (2011) "Post-burn Resprouting in Bigtooth Maple (Acer grandidentatum): A Case Study," *Natural Resources and Environmental Issues*: Vol. 16, Article 26.

Available at: http://digitalcommons.usu.edu/nrei/vol16/iss1/26

This Article is brought to you for free and open access by the Quinney Natural Resources Research Library, S.J. and Jessie E. at DigitalCommons@USU. It has been accepted for inclusion in Natural Resources and Environmental Issues by an authorized administrator of DigitalCommons@USU. For more information, please contact becky.thoms@usu.edu.



Post-burn Resprouting in Bigtooth Maple (Acer grandidentatum): A Case Study

Beth L. Corbin¹ and Douglas H. Page²

ABSTRACT

Bigtooth maple (Acer grandidentatum) is a common component of mountain shrub communities throughout Utah and is sometimes an abundant component in northern Utah. It typically grows with Gambel oak (Quercus gambelii), either as a co-dominant, or sometimes replacing Gambel oak on mesic sites. Historically, the oak/maple cover type is believed to have had relatively short firefree intervals (perhaps no longer than 30-80 years and sometimes shorter). Today it is often the dominant vegetation type in wildland urban interface zones of northern and central Utah. There has been some perception that bigtooth maple is a poor sprouter following fire. However, we have observed prolific postfire sprouting for bigtooth maple in northern Utah. This case study was conducted to quantify our observations. Study sites were associated with two prescribed fires and one wildfire in the Wasatch Mountains of Wasatch County, Utah. Pre and post-burn bigtooth maple sprouts were counted in 10 to 19, 0.004-ha (0.01acre) plots per site. Post-burn sprout numbers and survival on all sites support the conclusion that bigtooth maple recovers from fire by vegetative regeneration from root and crown sprouting and is thus well adapted to relatively high frequency fire regimes. These findings should facilitate management of landscapes where bigtooth maple is a significant component.

INTRODUCTION

Bigtooth maple (*Acer grandidentatum*), also called canyon maple, is a common and sometimes abundant component within the mountain shrub community commonly called "oakbrush" (or oak/maple brush) in the forests and woodlands of Utah. It often grows with Gambel oak (*Quercus gambelii*), either as a co-dominant, or in its place, replacing Gambel oak in canyon bottoms and moister areas. In the northern Wasatch Mountains (Cache County, UT), Gambel oak is replaced entirely by bigtooth maple, which forms extensive stands. The oak/maple brush community is dominant along the Wasatch Front in the wildland urban interface zone, and is common upward into the Wasatch Mountains to about 2,450 m (8000 ft) in elevation.

Historically, the oak/maple cover type is believed to have had fire return intervals of about 40-60 years of primarily stand-replacing fires (Havlina 2003). Fire regimes in the oak/maple zone have been altered since settlement times by elimination of Native American burning, fire suppression,

and grazing removal of fine fuels (Bradley et al 1991). As a result, oak/maple stands may be more extensive than they were 75 to 150 years ago (Ibid).

Bigtooth maple is usually a multi-stemmed small tree or large shrub in Utah, typically 4-8 m (12-25 ft) tall but occasionally exceeding 12 m (40 ft) in height (Welsh et al 2003). It is deciduous, and often provides spectacular fall colors. The root system is shallow but wide-spreading. Although it produces abundant seed on average every 2 to 3 years, most reproduction is vegetative, by layering (Uchytil 1990). In the field, seedlings seldom survive (Tollefson 2006). Although all native maples will sprout from the base, the degree varies with species and plant age (Zasada and Strong 2003).

PROBLEM STATEMENT

The Forest Service's Fire Effects Information System (www.fs.fed.us/database/feis) is a web-based database of taxonomy, distribution, management considerations, botanical and ecological characteristics, fire ecology, and fire effects references, by species. The Fire Effects Information System's (FEIS) previous record for *Acer grandidentatum* was updated in 1990, and included very little information on post-fire sprouting (Uchytil 1990). Specifically, it suggested that bigtooth maple is a poor sprouter.

We have observed bigtooth maple sprouting prolifically after wildfires and prescribed burns on the Uinta and Wasatch-Cache National Forests. Our personal observations lead us to believe that the sprouting vigor of bigtooth maple is relatively close to that of Gambel oak, as the post-fire species mix appears to closely mimic the pre-fire mix. Thus we identified a need to document this response in order to provide reliable information to update the FEIS, and in 2004 collected the field data presented below.

The FEIS record has been recently updated, with a substantial increase in references, and includes good information on bigtooth maple's sprouting ability (Tollefson 2006). Our observations (presented here) provide additional documentation on bigtooth maple's sprouting response following fire.

In: Wambolt, C.L. et al. comps. 2011. Proceedings – Shrublands: wildlands and wildlife habitats; 2008 June 17-19; Bozeman, MT. NREI, volume XVI. S.J. and Jessie E. Quinney Natural Resources Research Library, Logan, Utah, USA.

¹Beth Corbin, Uinta-Wasatch-Cache National Forest, Ogden, UT ²Douglas Page, Bureau of Land Management, Cedar City, UT

LITERATURE REVIEW

We conducted a literature review in 2004 to determine whether relevant published information exists that was either developed after the 1990 FEIS record, or was missed by the FEIS compiler. We found very little on bigtooth maple at all (for example: Buchmann et al 1997; Tankersley pers. Com¹), and nothing on its resprouting ability.

Work by Harper et al (1985) in central and northern Utah suggested that bigtooth maple may be invading Gambel oak stands on drier upland sites, presumably due to fire suppression. Harper et al state that:

Unfortunately, there appear to be no observations on either the relative frequency of fire along drainage ways and on adjacent open slopes in our area nor on the relative frequency and vigor of maple sprouting after fire on such contrasting sites (p 15).

By contrast, the 2006 FEIS record located several references on bigtooth maple sprouting following fire, including "vigorously" sprouting and stands that "return quickly" to prefire species composition (Tollefson 2006).

METHODS

We are documenting a case study of bigtooth maple sprouting following two prescribed fires and one wildfire in the Wasatch Mountains of the Uinta National Forest. The Cascade Springs I Prescribed Fire of April 2000 burned about 376 ha (930 acres) on National Forest lands. The Cascade II Prescribed Fire (and wildfire) of September 2003 burned about 3,150 ha (7,800 acres), mostly National Forest and State Park lands. The Wasatch Mountain wildfire of August 1990 burned about 1,200 ha (3,000 acres), mostly of Wasatch State Park lands. All fires are in Wasatch County, Utah, and within the Provo River watershed.

Sites were selected from each fire based on access, vegetation type (dominated by oak/maple), and fire intensity (overstory stand replacement areas). Two to three transects were sampled in each fire in August 2004. Transects were on specified compass directions from each starting point. Distances were measured by pacing. At 1-chain (20 m) intervals, a 0.004 ha (100th a) circular plot was checked. If no bigtooth maple were present (either sprouts, dead stems, or mature stems), a "no" was recorded and we moved on to the next plot. For plots that had or still contained maple, the plot center was moved to the nearest maple clump and the following was recorded:

- Pre-fire stems of maple: For each stem diameter at 15 cm (6 in.) stump height, status (dead, healthy, unhealthy), and burn intensity [unburned, light charring (<25 percent of bole diameter at any point), mod/heavy charring (25-95 percent charring), intense charring (>95 percent bole charring)].
- Post-fire sprouts: Number of live sprouts, number of dead sprouts, average diameters and heights of live and dead sprouts 15 cm (6 in.). Dead sprouts were indicative of maple that sprouted post-fire, but did not survive.
- Basic topographic site information (ridgetop, hillslope, or drainage bottom; slope and aspect).

A minimum of 10 plots containing maple from each fire were evaluated. Up to 19 plots containing maple per fire were recorded. Plots were not permanently marked.

Data analysis consisted of comparing pre-burn and postburn maple stem density, using a paired Student's T-test. Assumptions were made for independent sampling and normal distributions with equal variation of the population data, which appears to be the case.

OBSERVATION SUMMARY

Sprouting

Pre-burn and post-burn stem data are summarized for the three fires in table 1. We found that nearly all (95 percent) of the plots with pre-burn bigtooth maple had post-fire sprouts. Results were similar for the percentage of clumps (95 percent) and individual stems (96 percent) that had associated sprouts. The number of stems per plot of post-burn sprouts was significantly higher than the pre-burn stems per plot, using a paired Student's T-test. We did not find a correlation between pre-burn stem size and post-burn sprouting performance, but our few non-sprouting stems constitute a very small sample. Based on these numbers, it appears that bigtooth maple is well adapted to sprouting after fire.

One apparent seedling (second-year, but only about 1.5 inches tall) was found on a plot in the Wasatch Mountain Fire. Otherwise, all regeneration was from sprouts. Most sprouts were stump sprouts originating within about 15 to 30 cm (6 to 12 in.) of the stump), but some root sprouts originating more than 30 cm (12 in.) from the stump were also found.

A small number of dead sprouts were observed, mostly in the older (Wasatch Mountain) fire. Natural competitive self-thinning through age/size/density-related mortality on the high number of sprouts present is to be expected.

¹Tankersley, Boyce. e-mail to Beth Corbin July 30, 2004 re: summary of his Master's Thesis work on Growth and Propagation of Acer grandidentatum Nutt. from Texas A&M University, 1981.

Intensity

Nearly all of the plots were intensely burned, and all preburn stems in the plots were dead and appeared to have been killed immediately by the fire. Most stems were rated as intensely burned, with a few rated moderate/heavy charring. In the Wasatch Mountain Fire, about half of the plots had sprouts where no parent stem was seen, presumably because either the stem was totally consumed, was small and had decomposed, had been covered by litter or soil, or it had fallen and rolled away in the intervening 16 years since the fire. In the more recent Cascade fires, standing dead maple was visible at all sprout clumps.

Topography

See table 2 for the number and percent of plots containing maple that were found in various topographic positions for each fire. No correlation between topographic position and resprouting was apparent, since plots in all topographic positions had sprouts. The two plots with maple that did not resprout were on lower slopes in the Cascade II fire. Not all topographic positions were equally or randomly sampled, since we chose overstory stand replacement areas with a high maple component.

CONCLUSIONS AND IMPLICATIONS

Based upon the plot data collected on these three fires in Wasatch County, Utah, we conclude that bigtooth maple is well adapted to resprouting after fire. It appears that its sprouting vigor is similar to that of Gambel oak. Sprouting vigor may be related to site quality and pre-fire stem vigor. It is reasonable to surmise that the sprouting ability of both bigtooth maple and Gambel oak is related to their adaptation to ecosystems where fire has played a frequent role.

ACKNOWLEDGEMENTS

We would like to thank the following individuals who took the time to review and make critical comments on drafts of this document. Dr. James N. Long, Professor of Silviculture, Utah State University. Stanley G. Kitchen, Research Ecologist, USFS, Provo. Lauren B. Shapiro, Fire Ecologist, Uinta National Forest, Provo.

Table 1—Sprouting observation summary.

Fire	Number of plots with maple	Number of maple plots with sprouting	Number of maple clumps with sprouting	Number of individual stems with sprouting	Average number of stems/plot pre-burn	Average number of stems/plot post-burn ^a	Average diameter of pre-burn stems (inches)
Wasatch	19 out of	19 out of	90 out of 90	86 out of 86	4.5	43.3	2.8"
Mountain	22 sampled	19 sampled	observed	observed	(range	(range	(range
(August 1990)	(86%)	(100%)	(100%)	(100%)	0 to 17)	4 to 131)	0.6 to 6.5")
Cascade I (April 2000)	14 out of 70 sampled (20%)	14 out of 14 sampled (100%)	24 out of 24 observed (100%)	75 out of 75 observed (100%)	5.4 (range 1 to 13)	30.6 (range 8 to 87)	2.9" (range 0.2 to 6.4")
Cascade II	10 out of	8 out of 10	19 out of 26	44 out of 53	5.3	30.6	1.6"
(September	16 sampled	sampled	observed	observed	(range	(range	(range
2003)	(63%)	(80%)	(73%)	(83%)	2 to 12)	0 to 99)	0.2 to 5.3) b

^a The difference between pre-burn number of stems per plot and post-burn number of stems per plot is statistically significant at p = 0.05 for all three fires.

Table 2—Topography. Plots with maple were found in the following topographic positions:

Fire	ridgetop	upper slope	mid-slope	lower slope	drainage bottom
Wasatch Mountain	3/19 16%		16/19 84%		
Cascade I		3/14 21%	1/14 7%	9/14 64%	1/14 7%
Cascade II				6/10 60%	4/10 40%

^b Pre-burn stems that sprouted (n = 44) averaged 1.6" diameter (range 0.2-5.3"), while stems that did not sprout (n = 9) averaged 1.4" diameter (range 0.4-3.7"). These differences are not statistically significant at p = 0.1.

2008 Shrublands Proceedings 200 NREI XVI

REFERENCES

- Bradley, A.F., Noste, N.V., Fischer, W.C. 1991 Fire ecology of forests and woodlands in Utah. Gen. Tech. Rep. INT-287. Ogden, UT: USDA Forest Service, Intermountain Research Station. 128 p.
- Buchmann, N., Kao, W-Y., Ehleringer, J. 1997. Influence of stand structure on carbon-13 of vegetation, soils, and canopy air within deciduous and evergreen forests in Utah, United States. Oecologia; Vol. 110, no. 1 (March 1997): 109-119.
- Harper, K.T., Wagstaff, F.J., Kunzier, L.M. 1985. Biology and management of the Gambel oak vegetation type: a literature review. General Technical Report INT-179. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 31 p.
- Havlina, D. 2003. Fire Regime Condition Class (FRCC) Interagency Handbook Reference Conditions for Interior chaparral (CHAP5). 8/12/03. http://www.frcc.gov/docs/PNVG/West/CHAP5_Description.pdf
- Tankersley, B. e-mail to Beth Corbin July 30, 2004 re: summary of his Master's Thesis work on Growth and Propagation of *Acer grandidentatum* Nutt. from Texas A&M University, 1981.

 Tollefson, J.E. 2006. Acer grandidentatum. *In*: Fire Effects Informaion System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http:www.fs.fed.us/database/feis/[accessed 2007, September 6. Uchytil, R.J. 1990. Acer grandidentatum. *In*: Fire Effects Information System, [Online]. USDA, Forest Service, Rocky Mountain Research Station, Fire Science Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [accessed 2004, August 10.

 Welsh, S.L, Atwood, N.D., Goodrich, S., Higgins, L.C. 2003. A Utah Flora, Third Edition. Provo, UT: Brigham Young University. 912 p Zasada, J.C., Strong, T.F. 2003. *Acer* L. *In*: Bonner, F.T. and Nisley, R.T. Woody Plants Seed Manual. Forest Service, Washington, DC. 24 p.