Piñon and Juniper Tree Mastication Effects in the Great Basin and Colorado Plateau

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Sagebrush plant communities invaded by piñon and juniper (PJ) are losing understory vegetation and increasing in woody fuel loads as tree canopies increase in size. Some land managers are masticating or shredding trees to reduce fuel size and better control fire. They prefer PJ mastication over other tree reduction methods for several reasons: PJ mastication involves less risk than prescribed fire, is often seen as less hydrologically or ecologically-disruptive than chaining, reduces fuel structure and fire spread better than cutting, and is highly versatile in application from thinning to clearing. PJ mastication can also be implemented during most seasons as long as the soil is not too wet; short-term soil compaction may occur however, the mulch residue produced has been found to increase infiltration in interspaces (Cline et. al. 2010).

In order to provide land managers with a better understanding of the ecological effects and treatment effectiveness of mastication in PJ types, the Joint Fire Science Program funded a three year research project (2011-2013) to Bruce Roundy and colleagues at Brigham Young University in the Plant and Wildlife Sciences Department. Their retrospective study covers masticated PJ woodlands across the Great Basin and Colorado Plateau that have been treated over the last eight years (figure 1). Sites include PJ woodlands found on both BLM and USFS lands that have often been seeded pre-mastication by the Utah Division of Wildlife Resources. A follow-up assessment of SageSTEP Utah woodland plots is also included in the study.

Their focus is to determine the effects of mastication and fire after mastication on woody fuels, vegetation, and soils (figure 2). It is hypothesized that masticated tree residue will decrease over time in relation to the amount of initial biomass and incidence of summer precipitation, and that masticated stands dominated by piñon will decompose faster than those dominated by juniper. Understory vegetation response after mastication and after burning of masticated areas will most likely depend on residual vegetation at the time of mastication.

Because this is a retrospective study, researchers utilized NAIP imagery (National Agricultural Imagery Program, 1-m pixel resolution) and Feature Extraction (object-based image analysis software; ENVI 4.5) to pair untreated and masticated areas on the same ecological sites with similar initial tree cover. Once tree cover was extracted for each site, individual subplots were randomly selected and paired that represented multiple PJ invasion gradients (figure 3).

In addition to site and subplot selection, NAIP imagery is being used to determine pre-treatment tree cover and biomass for masticated subplots. All trees rooted within the untreated subplot are measured (tree height, crown base height, longest crown diameter, and the perpendicular diameter) and biomass is calculated using Tausch's equations (2010). Regression equations are then developed for the untreated subplots using tree cover estimates derived from imagery and ground-measured biomass. This equation is applied to masticated

subplots to determine pre-treatment tree biomass. Similar techniques have been used to estimate tree biomass from tree cover derived from imagery using SageSTEP data (r^2 = 0.94, n = 64 subplots; Hulet et al. *in preparation).*

Vegetation and fuel data were collected during the summer of 2011 at 25 sites; data collection will occur at the remaining sites in 2012. Preliminary results suggests that perennial grass and shrub cover increased in masticated subplots most likely due to an increase in available resources (figure 4 a&b). Also, weed invasion was minimal on most subplots however, a slight increase was observed where cheatgrass was present prior to treatment (figure 4 c).

Results from this study will be presented at scientific and professional meetings in conjunction with publications in rangeland focused journals starting winter 2012. For additional information about this research, contact Bruce Roundy (bruce_roundy@byu.edu), Jordan Bybee (jordanbybee@gmail.com), or April Hulet (april.hulet@gmail.com).

References:

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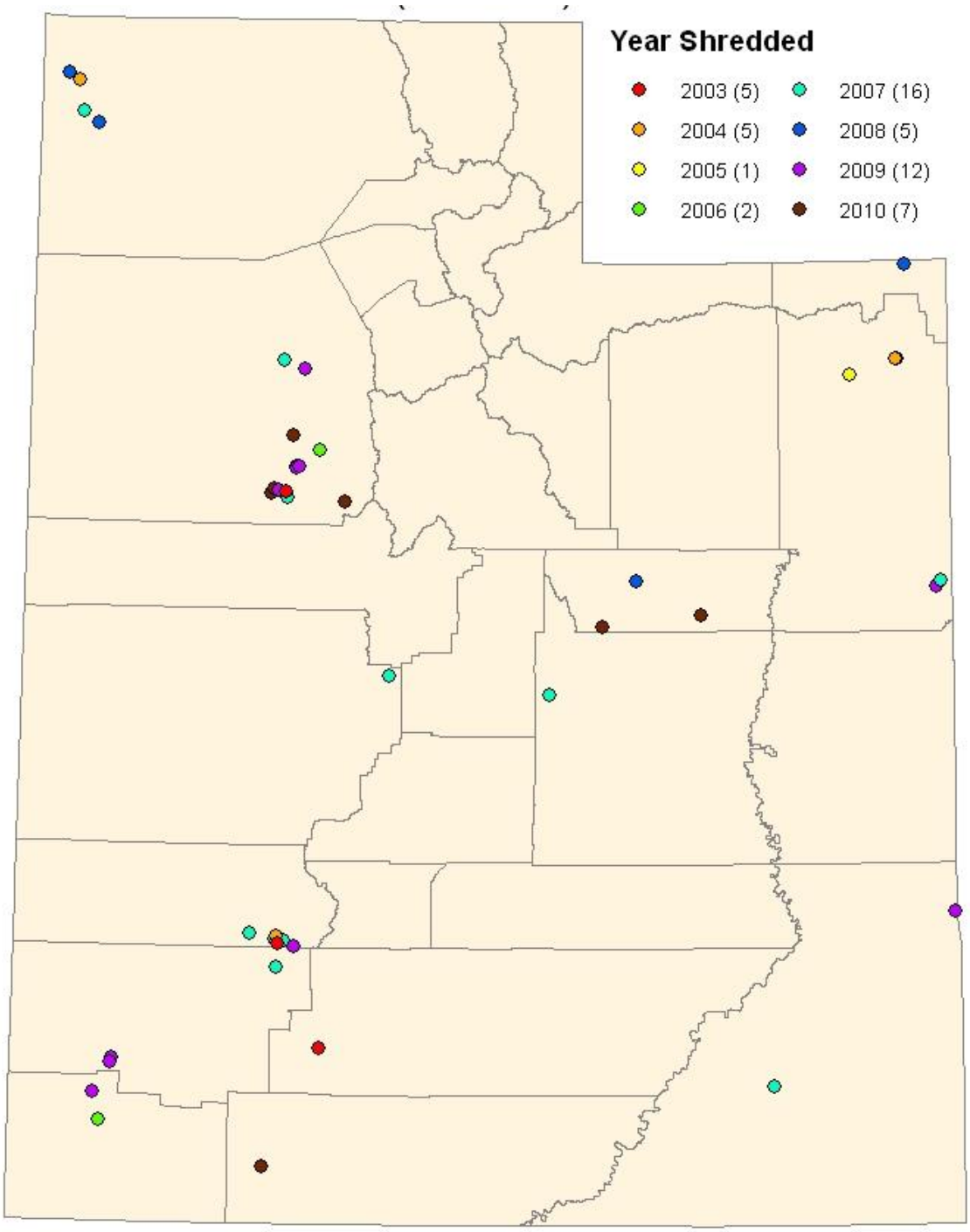

Figure 1. Study sites across the Great Basin and Colorado Plateau in Utah (53 total), including year of PJ mastication treatment. Sites represent phase I, II and III of PJ woodland invasion found on BLM and USFS lands.

Figure 2. Photos above show a phase III PJ woodland site contrasted with a phase III PJ woodland site that was masticated in 2007. The study focus is to determine effects of mastication on: 1) fuel structure, potential fire behavior, the amount of fuel biomass loss over time; 2) understory vegetation responses; and 3) soil carbon and nitrogen.

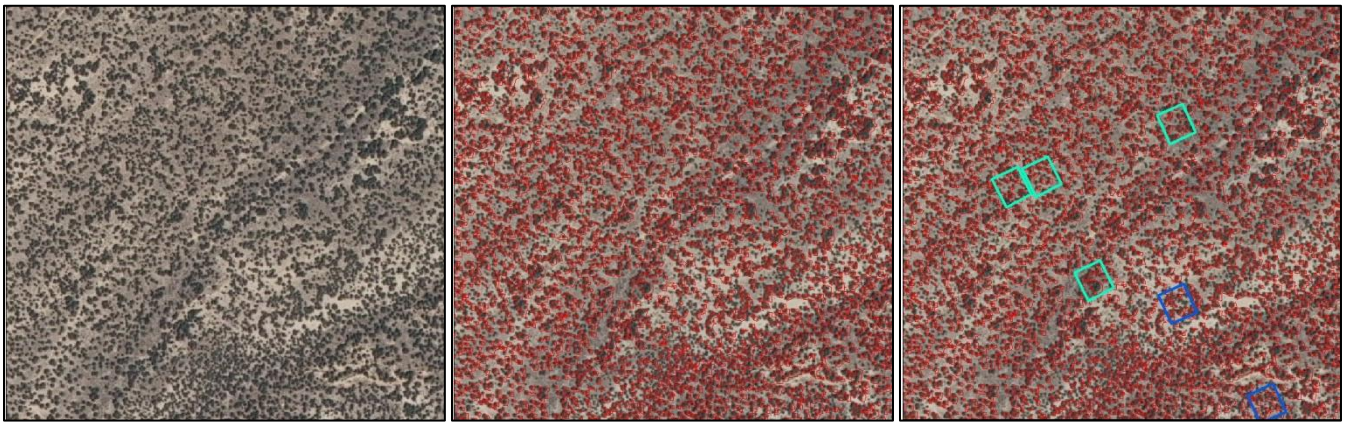

Figure 3. NAIP imagery is used to pair untreated and masticated areas based on initial tree cover and ecological site. (A) NAIP imagery (1-m pixel resolution). (B) Classified trees using Feature Extraction software (ENVI 4.5). (C) Paired subplots with similar tree cover calculated using ArcGIS.

Figure 4. (A) Phase III PJ woodland treated in 2004; perennial grass cover generally increased in treated subplots compared to untreated subplots. (B) Phase II PJ woodland treated in 2006; shrub recruitment was higher in treated subplots, particularly in phase I and II where sagebrush was present. (C) Phase III PJ woodland treated in 2007; annual weeds (primarily cheatgrass) increased in treated subplots however, where residual perennial species were present, weeds were minimal.