BRUSH MANAGEMENT TOOLKIT -- A PRACTICAL GUIDE

Developed by the University of Arizona School of Natural Resources and the Environment and the Altar Valley Conservation Alliance

Funded by the Western Sustainable Agriculture Research and Education Professional Development Program

10/4/2018 Draft - Work in Progress

Section A. Treatment Descriptions and Resources

TREATMENT INFORMATION	**BRUSH MANAGEMENT TREATMENTS**									
	FIRE		**MECHANICAL**				**HERBICIDE**			
	Wildfire	**Prescribed**	**Grubbing**	**Chaining**	**Pulling**	**Hand-cutting**	**Aerial**		**Hand spray**	**Stump**
							Foliar spray	**Soil applied pellets**		
Treatment description	Fire ignited naturally or unplanned human cause. Wildfire allowed to "let burn" becomes prescribed natural fire.	Planned fire conducted according to a prescribed fire plan	Machine pushes trees over to expose roots and kill tree	Two machines pull a large chain across ground that pulls trees out of ground to expose roots and kill tree.	Specialized machine pulls tree out of ground to expose roots and kill tree	Trees cut by hand, usually with chainsaw	Herbicide applied from air using plane or helicopter	Herbicide applied from air using plane or helicopter	Herbicide applied to individual trees using backpack sprayer	Cut stump treated with chemical herbicide or diesel
Treatment combinations or maintenance tools		Maintenance tool following other methods				Paired with chemical stump treatment			Maintenance following more intensive treatments	Paired with hand-cutting
Tools / materials	Fire Incident Command team & resources - trained people, vehicles, tools, air support, water & chemical resources	Fire Incident Command Team & resources - trained people, vehicles, tools	Bulldozer, trained operator, diesel fuel	Multiple bulldozers, chains, trained operators, diesel fuel	Excavator or other heavy machinery, plucking attachment, trained operator, diesel fuel	Trained sawyers, chainsaw, fuel	Trained pilot, specialized plane or helicopter, ground support, chemicals, water	Trained pilot, specialized plane or helicopter, ground support, chemicals, water	Trained applicator, backpack or OHV with spraying device, chemical, chemical marker, diesel- or oil-based mix agent	Trained applicator, spraying device, chemical, mix agent, marker agent
Specialized training or permits	Minimal "Red Card" fire certification, plus additional training for other fire team jobs	Prescribed fire plan. Minimal "Red Card" fire certification, plus additional training for other fire team jobs					If chemical is restricted, then Certified Grower Permit for landowner, Certified Applicator license for chemical applicator.			

Section B. Planning Considerations

TREATMENT INFORMATION	BRUSH MANAGEMENT TREATMENTS									
	FIRE		MECHANICAL				HERBICIDE			
	Wildfire	Prescribed	Grubbing	Chaining	Pulling	Hand-cutting	Aerial		Hand spray	Stump
							Foliar spray	Soil applied pellets		
	Indiscriminate - most frequent in spring / summer "fire season" when conditions are hot and dry; note that wildfire and prescribed fire resources are often one and the same. Wildfire emergency can trump prescribed fire plans, creating logistical complexity for prescribed fire implementation.	Prescribed fire plan describes required temperature and weather conditions - seeks balance between hot dry conditions necessary to achieve goals and safety / fire management factors. These conditions often coincide with wildfire season, resulting in scarce resources.	Anytime	Anytime	Anytime	If used in combination with stump treatment, must do at time that is within prescription of the chemical being used for stump treatment	Season can have impact on plant conditions necessary for successful treatment	Season can have impact on plant conditions necessary for successful treatment	Season can have impact on plant conditions necessary for successful treatment	If used in combination with hand cutting, must do within prescription associated with the chemical -- varies with chemical.
Season	Any project is likely to require a 6 - 24 month planning / permitting process prior to implementation. Permitting requirements for all treatments will vary depending on land ownership, funding source, and involved parties. Possibilities include: federal National Environmental Policy Act, Endangered Species Act, National Historic Preservation Act, and Clean Water Act; State Land Treatment or Applications to Place Improvements, and others.									
Planning and permitting	Consider Air Quality permitting factors									
Permitting factors		NEPA requirements would be triggered by land ownership and/or project partners and funding. Note that land management treatments supported by NRCS programs have been addressed by NEPA.								
National Environmental Policy Act (NEPA)		Consideration of endangered species and general wildlife habitat should be a planning factor. Permitting and possible survey complexity will be a factor of land ownership and project partner or funding source, and whether these trigger a federal nexus.								
Endangered Species Act (ESA)		Cultural resources likely to be a concern in areas where there is ground disturbance, for example development of a fire line needed for implementation of prescribed fire plan. Surveys may be required.	Survey for and mitigation of cultural resource issues likely to be a planning / permitting factor due to occurrence of ground disturbance. Land ownership and degree to which project partners or funding trigger permitting needs may also be a factor.			Cultural resource concerns minimal to none due to absence of ground disturbance.				

TREATMENT INFORMATION	BRUSH MANAGEMENT TREATMENTS									
	FIRE		MECHANICAL				HERBICIDE			
	Wildfire	Prescribed	Grubbing	Chaining	Pulling	Hand-cutting	Aerial		Hand spray	Stump
							Foliar spray	Soil applied pellets		
National Historical Preservation Act (ie cultural resources)	Fire point of origin determines lead agency ~ generally managed with interagency groups.	Fire jurisdiction critical factor during planning. Interagency fire resources can be used to conduct fire. There are also private companies that provide these services.								
Fire management jurisduction	Indiscriminate. Fire's point of origin determines which organization has management authority for the fire.	Cross boundary projects possible, and contingency planning likely to require cross boundary planning	Single land owner or cross boundary possible	Single land owner or cross boundary possible	Single land owner or cross boundary possible	Single land owner or cross boundary possible	Single land owner or cross boundary possible - can be economic and logistical advantages to grouping several small projects into a larger project.	Single land owner or cross boundary possible - can be economic and logistical advantages to grouping several small projects into a larger project.	Single land owner or cross boundary possible	Single land owner or cross boundary possible
Land ownership (+ leased or deeded)	Indiscriminant. Fire's point of origin determines which organization has management authority for the fire.	Cross boundary projects possible, and contingency planning likely to require cross boundary planning	Single land owner or cross boundary possible	Single land owner or cross boundary possible	Single land owner or cross boundary possible	Single land owner or cross boundary possible	Single land owner or cross boundary possible - can be economic and logistical advantages to grouping several small projects into a larger project.	Single land owner or cross boundary possible - can be economic and logistical advantages to grouping several small projects into a larger project.	Single land owner or cross boundary possible	Single land owner or cross boundary possible

Section C. Treatment Impacts

TREATMENT INFORMATION	BRUSH MANAGEMENT TREATMENTS									
	FIRE		MECHANICAL				HERBICIDE			
	Wildfire	Prescribed	Grubbing	Chaining	Pulling	Hand-cutting	Aerial		Hand spray	Stump
							Foliar spray	Soil applied pellets		
Target specificity	Indiscriminate	Indiscriminate; can protect key areas	Specific	Indiscriminate	Specific	Specific	Indiscriminate - will affect all dicot species in leaf at time of application	Indiscriminate - will affect all dicot species over several years	Specific, but there can be some drift to non-tar get species	Specific
Woody species size and canopy density	Indiscriminate	Effectiveness will vary with shrub / tree size and fire characteristics - higher temps and dryer conditions would increase burn effectiveness	Useful for varying sizes and densities	Useful for varying sizes and densities	Useful for varying sizes and densities.	Useful for varying sizes and densities	Useful for varying sizes and densities.	Useful for species like creosote and whitethorn on calcareous soils	Useful for varying sizes and densities	Useful for varying sizes and densities
Understory species, Grasses (monocots) annual/perennial, cover, production, native	Indiscriminate	Requires understory vegetation as fuel for fire - absence of fuel can prevent use of tool.	Consider whether treatment will affect valuable understory (monocot) species. Consider whether understory seed source available and/or whether additional seeding necessary							
Understory species, invasive grasses / forbs	Consider whether treatment will result in an increase in rates of spread of invasive grasses and forbs									
Understory species, Forbs, shrubs (dicots) cover, production, value for forage, habitat	Consider whether treatment will affect valuable understory (dicot) species						Indiscriminate - will affect non-target dicot species at time of application	Persistent in soil - will affect non-target dicot species over several years	Specific, but there can be some drift to non-target species	Specific
Precipitation	Indiscriminate	Seek implementation window when winter rains sufficient to support perennial understory vegetation vigor - keep vegetation regrowth following fire in mind.					Soil moisture conditions must be met for successful treatment of some chemicals			

TREATMENT INFORMATION	BRUSH MANAGEMENT TREATMENTS									
	FIRE		**MECHANICAL**				**HERBICIDE**			
	Wildfire	**Prescribed**	**Grubbing**	**Chaining**	**Pulling**	**Hand-cutting**	**Aerial**		**Hand spray**	**Stump**
							Foliar spray	**Soil applied pellets**		
Soil	Indiscriminate	Consider stabilization of area with rock erosion control structures prior to burning if erosion of concern	Soil type and the degree to which it hinders or provides for site productivity should be a significant factor during planning. Expensive treatments may be most appropriate in highly productive soils. Less productive soils may benefit more from projects that encourage water infiltration.							
							Note that some chemical prescriptions require particular soil types.			
Slope	Indiscriminate - wildfire may be the only practical treatment in steep or mountainous areas.	Address via fire plan	Increased slopes would impact machine operation safety.	Increased slopes would impact machine operation safety.	Increased slopes would impact machine operation safety.			Slopes above 12% are safety hazard for pilots		
Hydrology	Indiscriminate	See Soil comments	Note that woody vegetation debris can be utilized for gully erosion remediation.				Drainages generally excluded from aerial application plans.	Drainages generally excluded from aerial application plans.		
								For chemical treatments, research product effects on groundwater, and consider conservative approach appropriate to project area.		
			Note that drainage areas are generally not cleared, to provide for wildlife habitat. Projects could consider a "thinning" rather than "clearing" in these areas.							
Historic cultural resources	Indiscriminate	Mitigate via fire plan and general project plan - projects with ground disturbance likely to have higher risk or complexity.								
Present day improvements	Indiscriminate	Mitigate via fire plan and general project plan.								

Section D. Monitoring

Consider project goals, cost, and related monitoring strategies. Also consider whether long-term logistical, personnel, and economic commitment to monitoring is possible.

Method	Relative Cost	Level of Technical Knowledge Required
Repeat Photography	Low	Low
Data-based comparison of pre-treatment and post-treatment conditions	Low	High
On-the-ground field monitoring	Medium	High
Aerial imagery with drone flights	Medium	High