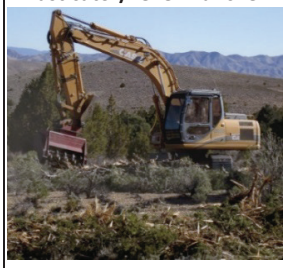
How to Remove Conifers

First and foremost, management decisions should be based on the project goals, site conditions, and desired outcomes (see Miller et al. 2014a). There are various trade-offs and risks to consider when selecting the most appropriate management option (Table 1). Primary techniques used to manage conifers are prescribed fire and mechanical treatments (e.g., chainsaw cutting, masticators, and feller-bunchers). It may be desirable to use a combination of techniques to meet short and long term goals.

Table 1. Common conifer treatment options, costs, and trade-offs (adapted from SageSTEP 2011). It may be necessary to implement a combination of techniques over time to achieve desired results in the short and long term. Consult local experts for information when considering other treatment options (e.g., chaining, bulldozing).

Treatment Option	Costs	Advantages	Disadvantages
No Treatment 	-No expenditure of funds in short term, but deferred treatment option becomes increasingly expensive as woodland succession progress	-No disturbance -No change to aesthetics -No operational risk	*Allowing transition from Phase 1 to 3:* -Increases risk of severe wildfire -Decreases and eliminates understory vegetation -Increases risk of invasive weed dominance -Accelerates soil erosion -Reduces available soil water -Decreases habitat for shrub-steppe wildlife -Significantly reduces AUMs for grazing
Prescribed Fire 	**Low end:** $10-$25/ac **High end:** $125-$175/ac **Influencing factors**: **Vegetation Type:** Low Cost: Grass; Medium Cost: Shrub; High Cost: Closed woodland **Size of Treatment Area:** Per acre costs decrease as treatment area increases **Operational Difficulty:** Burn units on steep slopes, with mid-slope control lines, or adjacent to homes will have higher costs	-Effectively reduces fuel loads and intensity of future wildfire -Closely mimics natural processes -Removes small trees which can greatly extend the time period before retreatment -Works well on relatively cool and moist sites with adequate herbaceous vegetation -*Phase 1 and 2:* Perennial herbaceous cover may increase 2-3 fold within 3 years -*Phase 3:* May result in increases in herbaceous cover but response unpredictable. Risk of weed invasion and treatment failure increases	-Liability and smoke management concerns -Imprecise and variable treatment as fires may burn hotter or cooler than planned -Narrow time period for application -Non-sprouting shrubs lost; recovery often 2-4 decades -Increases weed risk, especially on warmer and drier sites and sites with depleted perennial grasses -*Phase 3:* Initial thinning required to carry fire. Seeding typically needed. Not appropriate on warm-dry sites with depleted perennial grasses
Chainsaw Cutting 	**Low Cost:** $10–$40/ac **High Cost:** $100–$175/ac **Influencing factors**: **Tree Density:** Cost increases with density of trees to be cut **Terrain:** Steep terrain and distance from roads or difficult accessibility may increase cost **Post-Cut Treatment:** If trees are to be stacked, chipped, burned or scattered, cost increases with labor intensity. Removal of downed trees for firewood or biomass can reduce or eliminate post-cut cost	-Shrubs maintained; little ground disturbance -Precise treatment with ability to control target trees and cut boundary extent -Wide window for implementation -Cut trees can be left on site to protect soil and herbaceous vegetation -Little risk of weed dominance, except on warmer sites with limited perennial grasses -Altered fuel structure can aid in fire suppression -*Phase 1 and 2:* Prevents loss of understory vegetation. Slight-to-moderate increases in production over time -*Phase 3:* May result in considerable increases in herbaceous production but response unpredictable	-Fuel loads unchanged in short term without additional post-cut treatment -Small trees may be missed, which shortens treatment lifespan -*Phase 2 and 3:* High density of cut trees left on site can limit mobility of large herbivores and smother and kill desirable plant species. Invasive weeds can increase on warmer sites where perennial grass response is limited, but seeding may reduce weed risk. Leaving cut trees on site increases fire hazard and intensity especially in first two years before needles drop
Heavy Equipment: Masticator/Feller-Buncher 	**Cost:** $200–$500/ac **Influencing factors**: **Tree Density:** Cost increases with density of trees to be cut **Terrain:** Steeper slopes and rough terrain increase cost and can even prohibit use of machinery **Fuel Prices:** High fuel prices and remoteness of treatment site increase cost **Post-Cut Treatment:** Feller-buncher: Removing piles can increase cost. Removal of piles for firewood or biomass can reduce or eliminate post-cut cost	-Shrubs impacted, but mostly maintained -Precise treatment with ability to control target trees and cut boundary extent -Flexibility in timing of treatment -Slight risk of weed dominance due to disturbance, especially on warmer sites with limited perennial grasses -Mastication can be very effective in reducing fuel loads -Feller-buncher allows for bundling of cut tree piles facilitating post-treatment removal -Altered fuel structure can aid in fire suppression -Reduces need for additional post-cut treatment -*Phase 1 and 2:* Prevents loss of understory vegetation. Slight-to-moderate increases in production over time -*Phase 3:* May result in considerable increases in herbaceous production but response unpredictable	-Utility very limited in steep, rough or rocky terrain, roadless areas, and when soils are wet -Small trees and green limbs on downed trees often left, which shortens treatment lifespan -Piles or mulch chips can increase fire intensity if burned; risk of weeds and erosion can be reduced with seeding -*Phase 1:* Typically cost prohibitive for widely scattered trees -*Phase 2 and 3:* High density of chips or piles left on site can smother and kill desirable plant species. Long-term effects of mastication mulch is unknown. Invasive weeds can increase on warmer sites where perennial grass response is limited but seeding may reduce weed risk