Angora Fire: What will the future forests be?

Lake Tahoe
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Forest Restoration Alternatives

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Acknowledgements

To Richard Harris and
Herb Baldwin for photos

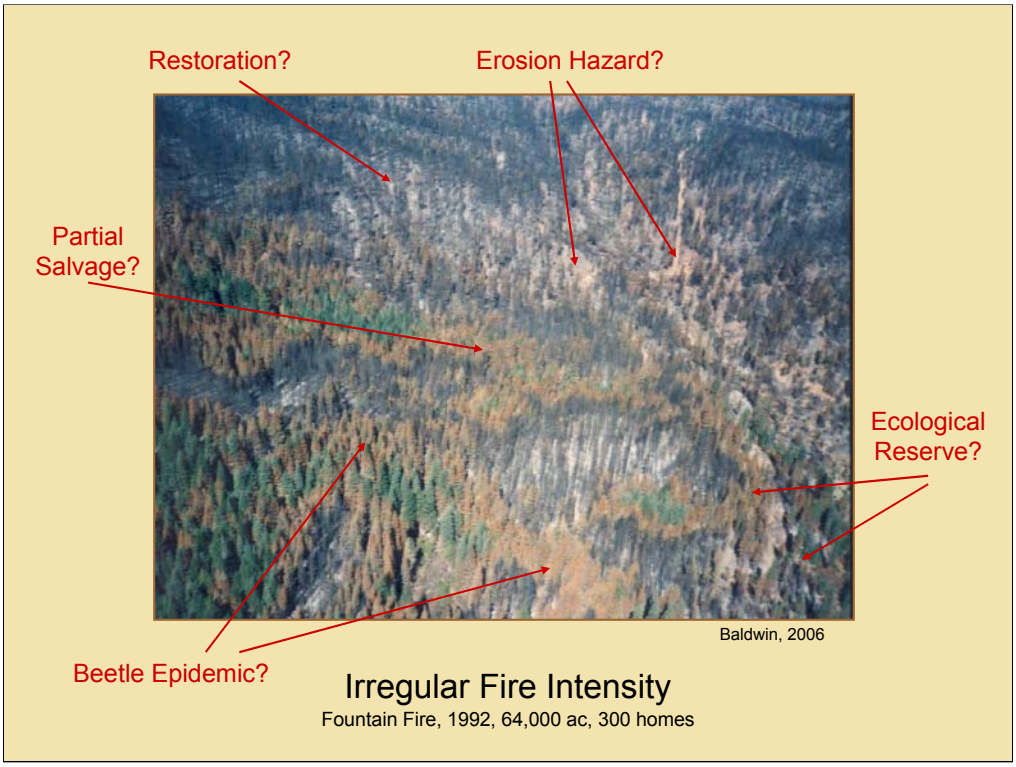
Take Home Messages

- Post-fire assessment by interdisciplinary team
- Assess risk of doing nothing vs. treatments
- Identify mosaic of desired future stand conditions
- Plan sequence of treatments (kinds, levels, timing)
- Monitor to permit adaptive management
- Evaluate success of meeting desired conditions

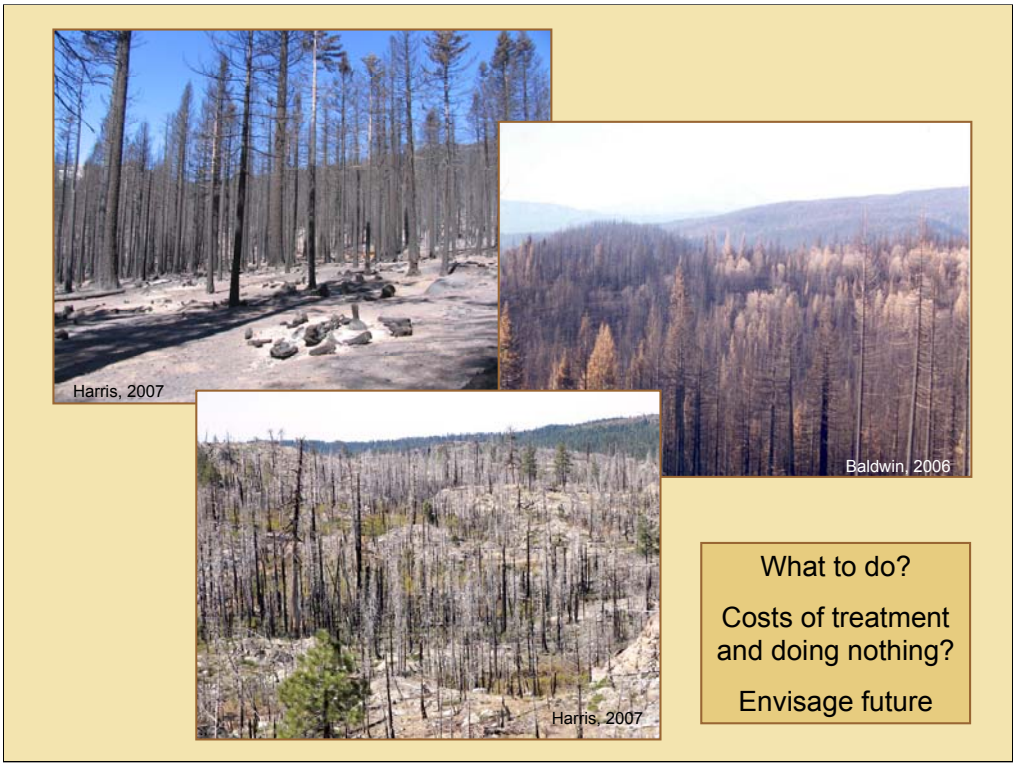
1. Post Fire Assessment by interdisciplinary team

- Condition – immediately after burn
  - severity of burn
  - potential for erosion, sedimentation
  - ecology and habitat
  - human considerations
  - map mosaic of conditions

It is essential, immediately after the wildfire, to have an assessment of stand conditions carried out by an interdisciplinary team.



Fire intensity is commonly irregular. This leaves the landscape with a mosaic of conditions varying from unburned to complete combustion. The area is then mapped to show the location of areas of special concern or in possible need of treatment.



Burned areas are evaluated regarding opportunities and constraints for action. What are the ecological and societal costs of doing nothing vs. applyng treatments? What will these areas look like 10-20 years in the future with and without treatment?

Erosion Potential

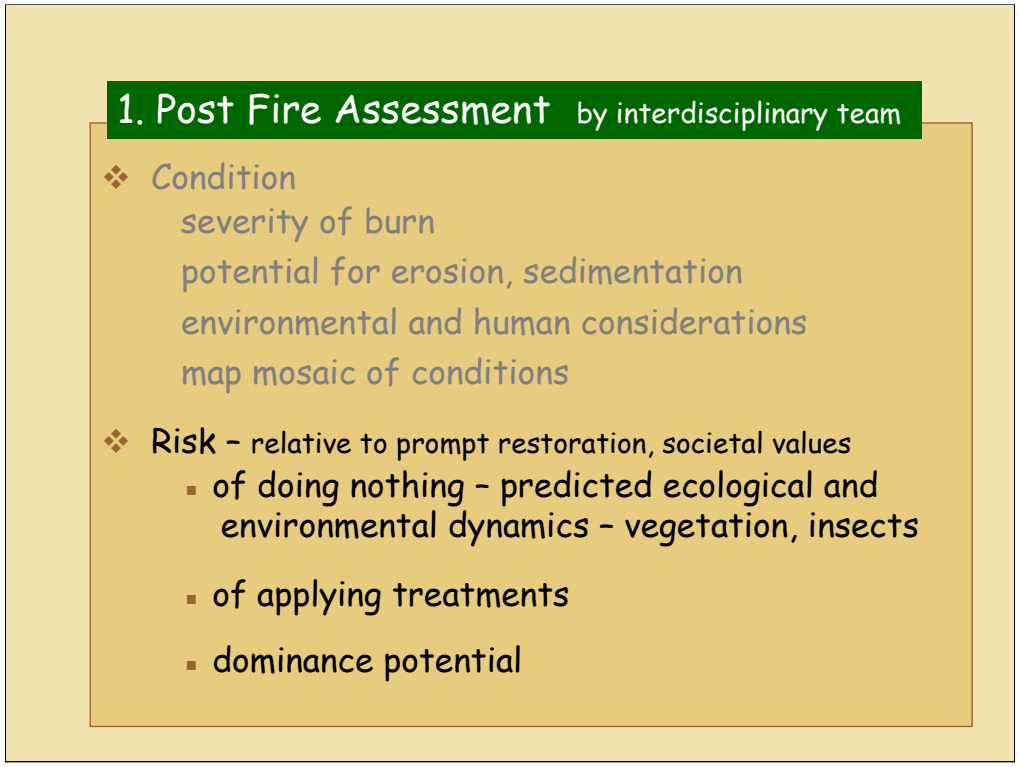
Baldwin, 2006

Envisage consequences of doing nothing

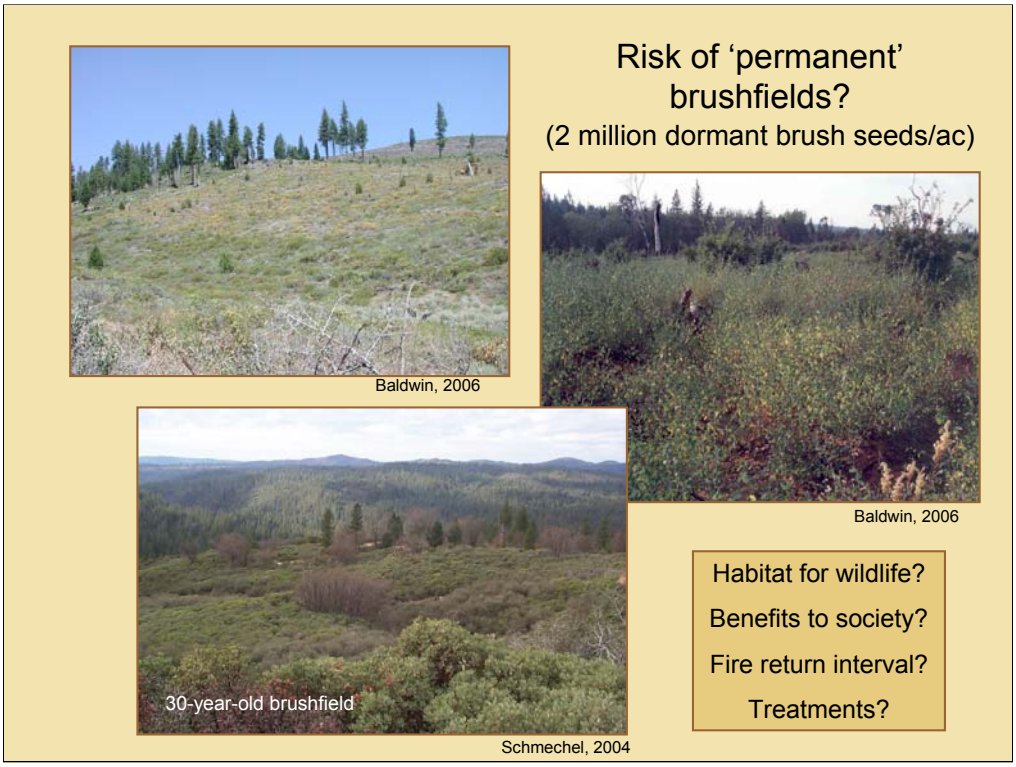
Baldwin, 2006

Loss of site productivity? (depends on soil depth)
Where does sediment go?

Both slides show high potential for surface erosion. What will these areas look like 5-10 years from now if no action is taken? The area on the left will likely become a deep gully; the area on the right will likely have severe bank slumping and the road will become unusable. The sediment will rapidly move downhill and enter any nearby stream unless prevented by the buffer strip.



After evaluating condition, it is important to evaluate the risk of both doing nothing and carrying out treatments. This requires a knowledge of forest succession and potential for insect infestation. Any treatment has both ecological and societal advantages as well as consequences. The relative capacity of vegetation to dominate a site will be discussed later.



It has been shown that forest soils can have 2 million viable brush seeds per acre – even in stands of 200-year-old trees where no shrubs are evident. After a fire or other disturbance, these seeds germinate and the site rapidly becomes dominated by shrubs. Conifers may eventually break through, but brushfields commonly become permanent as successive fires repeat the sequence of brushfield formation. In early stages of growth, brushfields provide important browse for deer, but in the above illustrations most of the foliage is inaccessible to deer. Some portion of the landscape with brush cover is aesthetically desirable as it adds to diversity, but whole landscapes of brush, similar to whole landscapes of even-aged conifer, is generally not aesthetically pleasing. [Comments on brush vs. trees from the stanpoints of water yields and carbon sequestration could be left to subsequent Q&A].

Reality Check!

Revegetation after Four Stand-Replacing Fires in the Lake Tahoe Basin

Madroño 45(1) 1998. W.H. Russell, J. McBride, and R. Rowntree

None planted

All sites were, or will be, dominated by shrubs for 50-75 years

Year Burned	Tree Age (yrs)	
1890s	21-95 (70)	aerial photos in 1940 showed no trees 72% tree cover after >100 years
1937	20-54 (39)	<10% tree cover after 50 years
1978	Too small	<10% tree cover after 30 years
1987	Too small	<10% tree cover after 20 years

Importance of stand-replacing fires for:
canopy gaps, habitat heterogeneity, species diversity

Need to include (or simulate? JAH) as part of management

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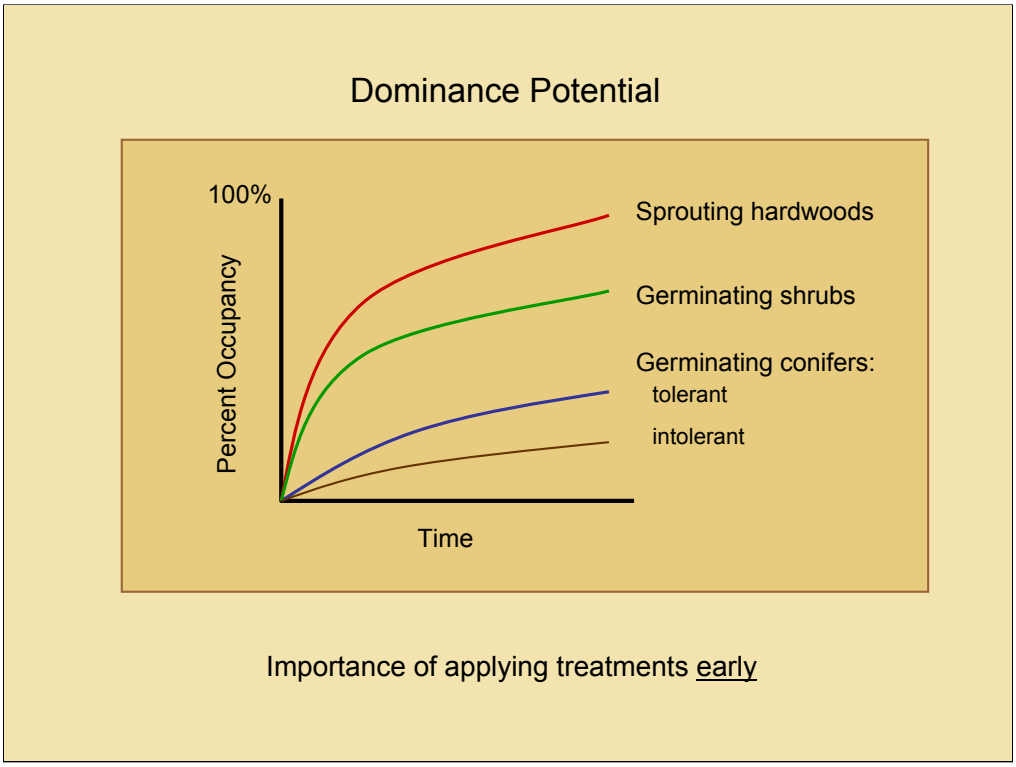
What might have been done 5 years ago?

What is the future of this stand in 10 years, 20 years?

Are any treatments warranted?

Once a burned area has been left for several years, options for treatment are greatly reduced because costs become prohibitive. In viewing a stand such as this, it is important to be able to appraise rate of change, which depends on site productivity. In this case, a future visitor would probably see only a few snags left standing and the area would likely be a brushfield. Is this in society's best interest?



Sprouting hardwoods and germinating shrubs have a much greater capacity for dominating a site than slower growing conifers. Knowing this makes it clear that any treatment to give conifers an advantage must be taken very early before hardwoods and shrubs become established and when costs of treatment are lowest.

Baldwin, 2006

What are the futures of these two plants in 10 years, 20 years?

Relative capacity to capture soil water?

Relative rate of production of leaf area and root volume?

Relative dominance potential?

Treatment?

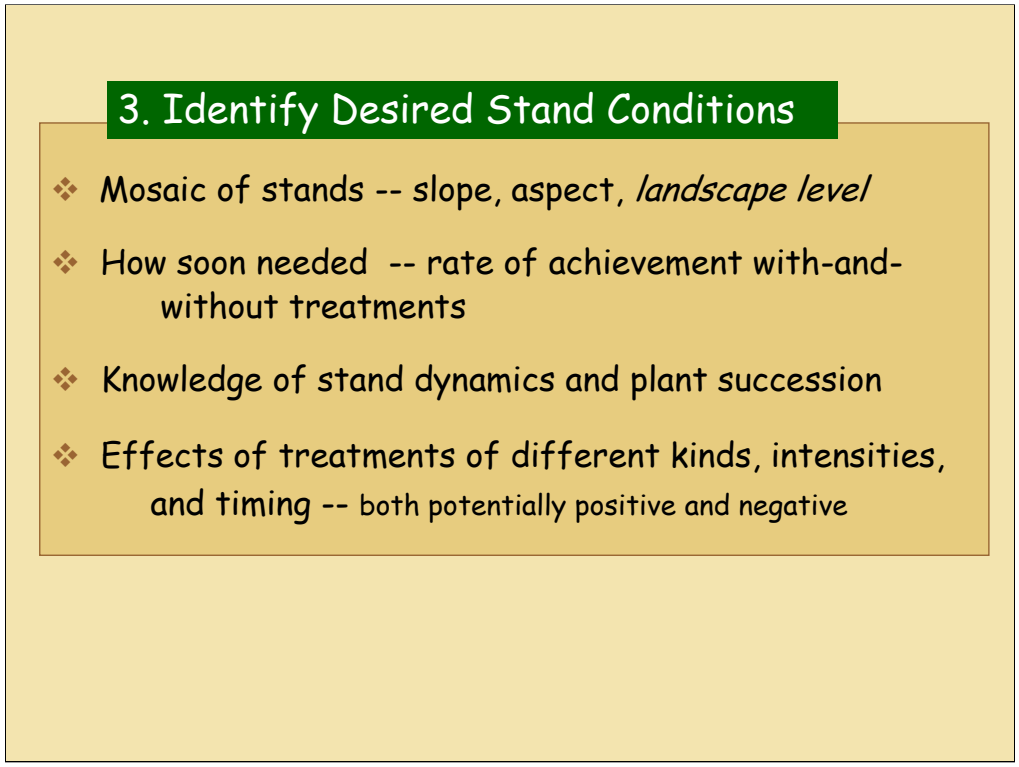
It is clear that this area will be rapidly dominated by shrubs and that the planted conifer will become suppressed or die. One can also see that the shrub has a much higher capacity to capture available soil water, a higher rate of leaf and root production, and will dominate the site. Any treatment at this stage will be expensive and difficult. To give the planted conifer an advantage it must be planted immediately after the burn before the shrubs become established.

1. Post Fire Assessment by interdisciplinary team

- Condition
  - severity of burn
  - potential for erosion, sedimentation
  - environmental and human considerations
  - map mosaic of conditions
- Risk – relative to restoration, societal values
  - of doing nothing – predicted ecological and environmental dynamics, dominance potential
  - of applying treatments
- Costs of alternatives – environmental, dollars

The final task for the interdisciplinary team is to evaluate the environmental and societal costs of both doing nothing and applying treatments.

The post-burn area needs to be mapped showing areas of special concern and possible treatment – varying between the two extremes of total reserve to total treatment.



The next task of the interdisciplinary team is to identify each mapped zone in terms of desired future stand condition. Emphasis should be placed on landscape characteristics and ownership constraints and goals. Each component area will likely vary in terms of urgency of action. The rate at which desired stand conditions can be obtained depends on site productivity. The consideration of ecological effects (positive and negative) and costs of alternative treatments will differ depending on the kind, intensity, and timing of the treatment

4. Salvage ?

- What proportion ?
  - Values for retention:
    - habitat
    - avoid disturbance of soils and fuel distribution
  - Values for removal:
    - reduce overall fire hazard
    - offset restoration costs
    - meet society's wood and energy needs
- Effect on reaching desired future conditions
- If it's to be done, must be done immediately
  - loss of wood value, avoid disturbance of regeneration

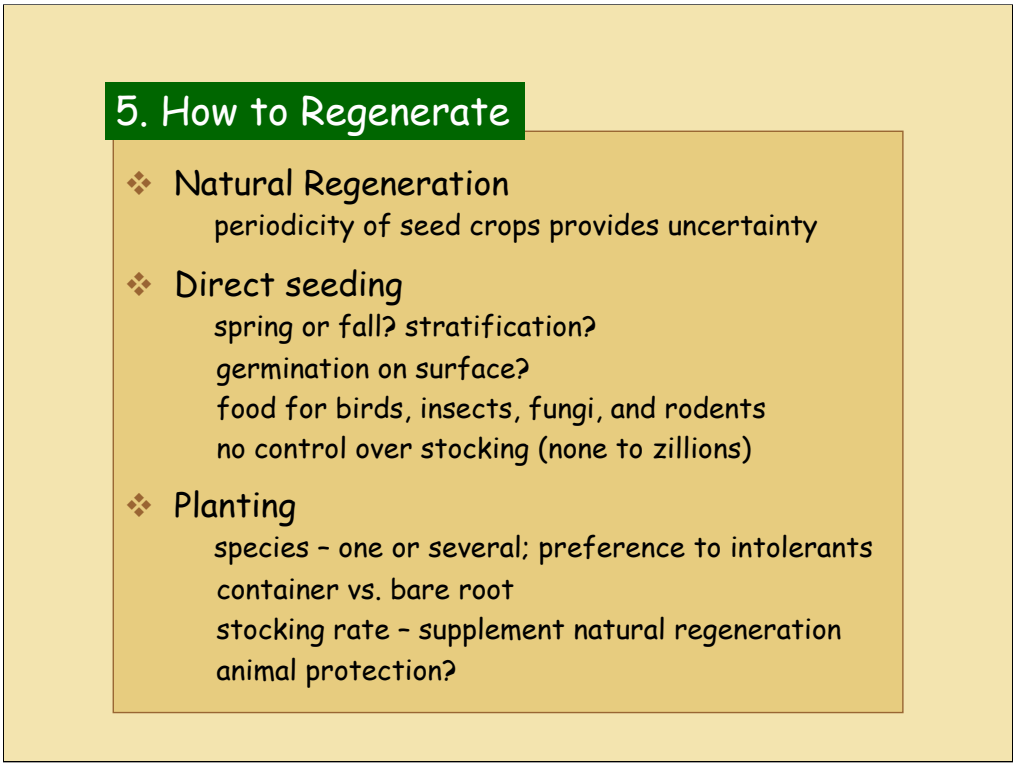
The pros and cons of effects of salvaging dead and dying trees need to be evaluated. Quite likely, some snags should be left for wildlife habitat and others should be harvested to offset costs of restoration.

Baldwin, 2006

Tree could provide products or be laid on contour to reduce erosion and provide habitat

Tracked vehicle has low potential for compaction if soil is dry

If some snags are cut, they could be used for wood products or left on the slope to retard erosion. Modern equipment has little impact on soil compaction if used when soils are dry.

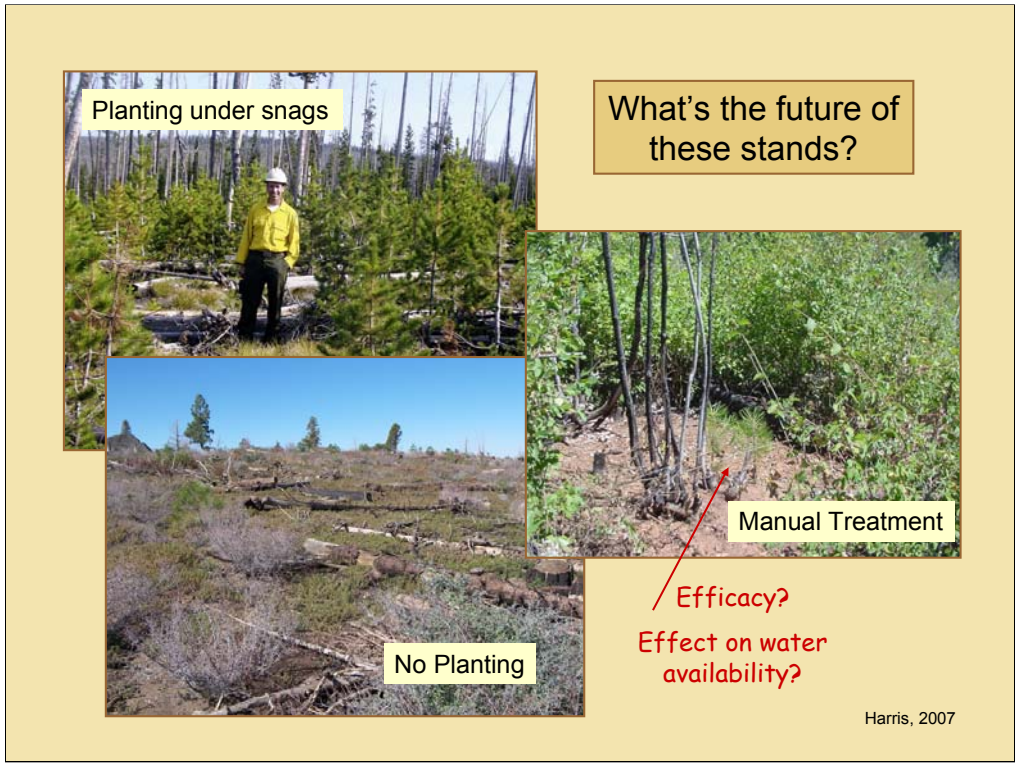


Natural regeneration will likely occur, but due to irregular seed periodicity the seed may fall after shrubs have become established. Direct seeding by hand or by helicopter was common in the 1960s but shown to be ineffective due to animal predation and lack of control of stocking. Immediate planting of conifers is highly desirable, especially planting of shade intolerant trees. The number of trees planted will depend on expectations of natural seeding, sprouting of hardwoods, and opportunities for cost-effective subsequent thinning.

6. Site Preparation

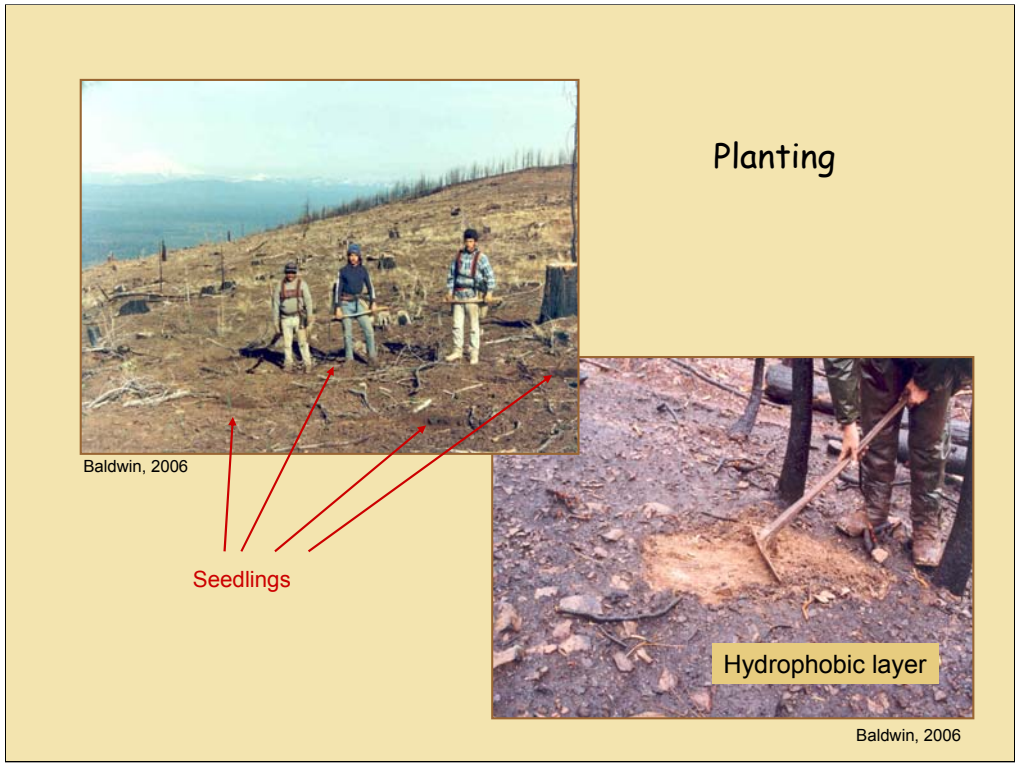
- Minimum necessary to ensure regeneration has temporary advantage
- Reallocation of site resources (especially water)
- Spot vs. areal
- Piling and burning – machine or by hand
- Mastication
- Effect on soil productivity
- Keep soil in place! Soil the most important resource

Site preparation is a technique designed to provide the desired vegetation with an advantage and increase its dominance potential. It is designed to give desired vegetation preference to limited resources – especially water. Techniques include spot, areal, piling and burning, and mastication. Emphasis should be placed on choosing the technique having minimum site impact while providing conditions favoring the desired vegetation mix. In all cases, it is critical to keep the soil in place and not to diminish site productivity.

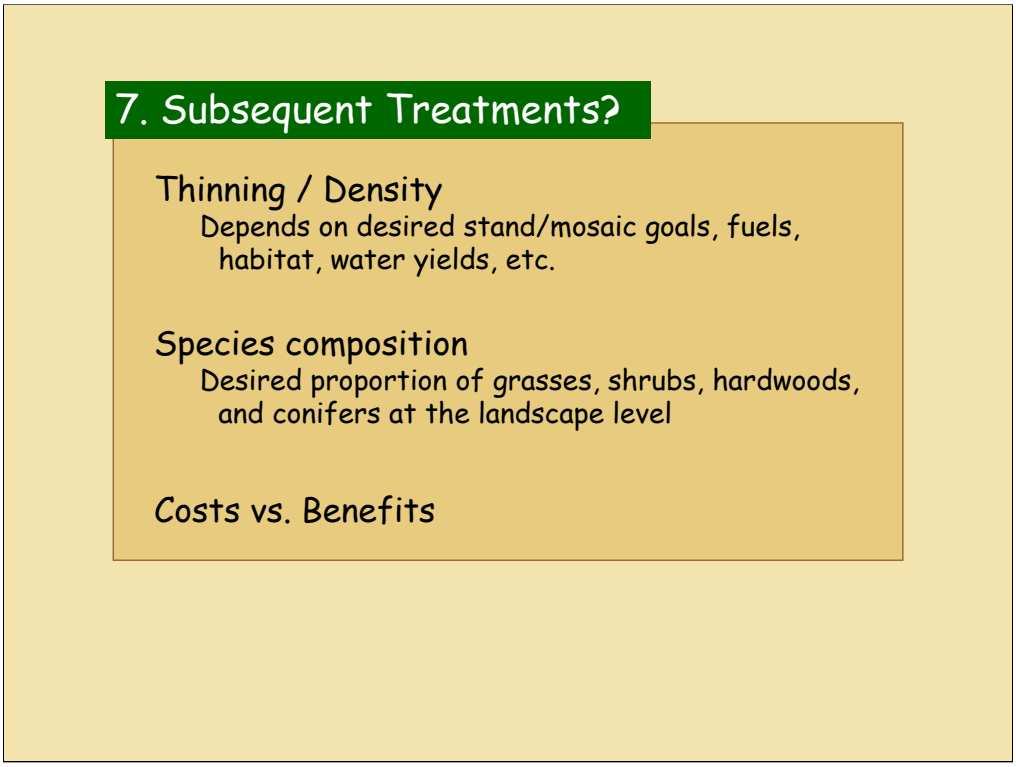


Planting under snags is fine and this stand will likely become well-stocked with mixed-species vegetation. The brushfield will likely remain dominated by brush with a few isolated conifers. The manually treated area on the right is probably a waste of effort as soil is certainly dominated by shrub roots and the area will rapidly be a closed-canopy brushfield.

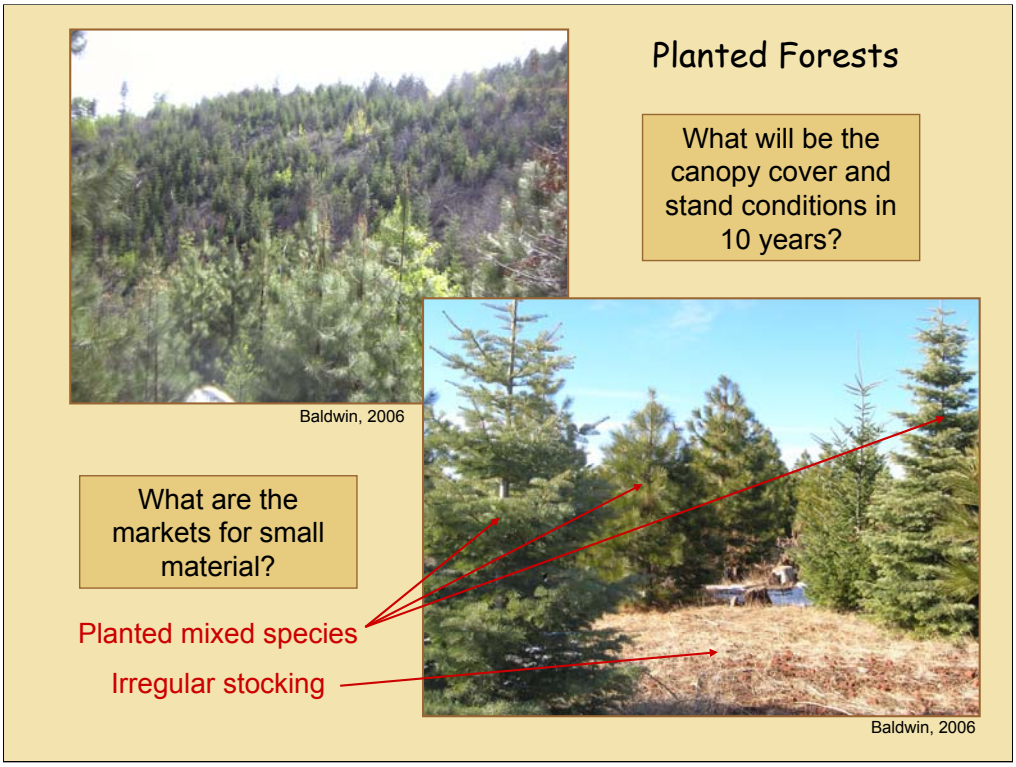
Mastication is costly and certainly reduces fuels. It would be considered where fire hazard is high and where direct sun is needed to enhance growth of shade-intolerant trees. Without further treatment the site would likely revert to a brushfield.



To give planted trees an advantage over shrubs, the burned area should be planted immediately. The photo on the right shows planting on industrial forest land on which dead and dying trees were salvaged. The image on the right shows a burned area with a surface layer of ash and with deposition of water-resistant oils. These hydrophobic areas are resistant to water moving into the soil profile, which results in greater surface runoff. They also deter natural regeneration making planting a desirable option.



After burned sites are revegetated, subsequent treatments depends on needs to secure particular stand conditions and vegetation mix. Young forests are very amenable to treatment and a wide array of stand conditions, age classes, and species mixes can be attained – providing funds are available or small material can be converted into products having cash value.



Even though planting is commonly done using one or two conifer species, the resulting forest stand is commonly a mixture of species, size classes, and with a variety of ground cover vegetation. These stands could be made more uniform or more diverse depending on desired future condition.

8. Determining Success

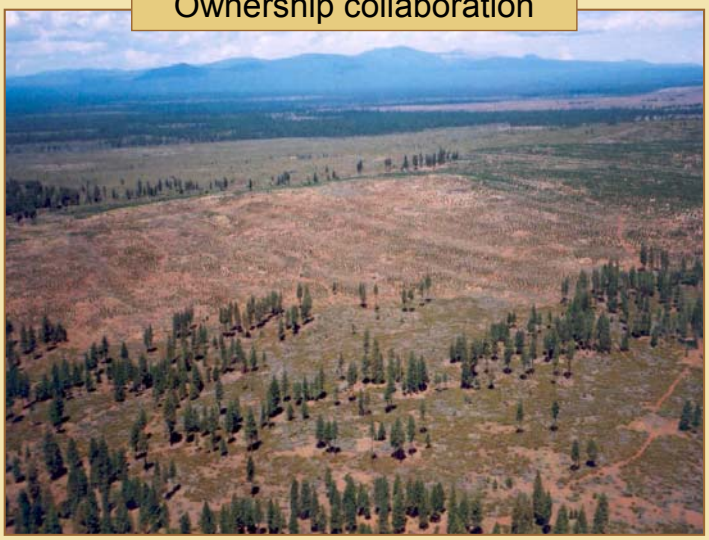
Achieving desired mosaic of stand conditions within desired time frame

Monitoring / adaptive management

Success in restoration after a burn is enhanced by monitoring and using adaptive management that changes with the way in which each mosaic in the stand develops. The most rapid change occurs on the most productive sites.

Landscape Analysis

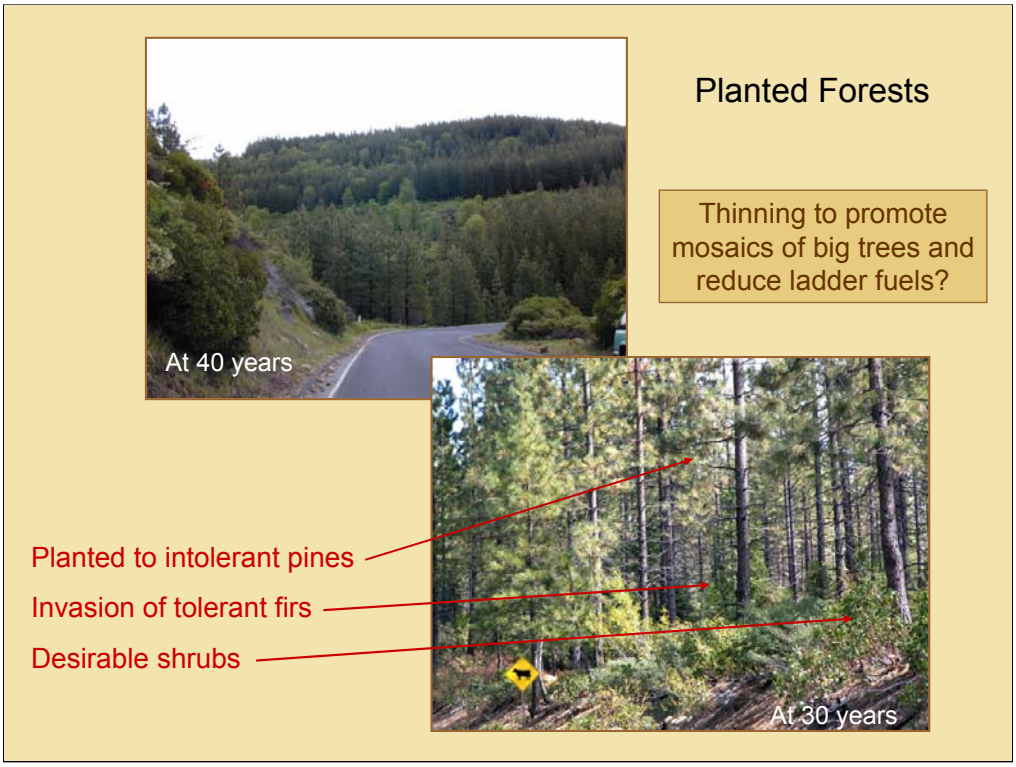
Ownership collaboration



Baldwin, 2006

From an ecological viewpoint, progress towards restoration after a burn needs to be evaluated on a landscape level and with consideration to the goals and objectives of the mix of land ownership.

Planted forests commonly begin being simple and relatively uniform, but the simple structure can be retained or made complex by making openings that encourage invasion of diverse vegetation. Opportunities for treatment commonly depend on obtaining value from the sale of small material for products, biomass, or energy.



After 30 or 40 years, it is often impossible to tell that restoration began as a planted stand. In both cases, the stands probably need irregular thinning to enhance wildlife habitat and to lower fire hazard.

Summary -- for effective restoration

1. Prompt post-fire assessment of condition
2. Assess risk of doing nothing vs. treatment (+ve & -ve)
3. Identify:
   - desired future mosaic of conditions and rate of attainment
   - reserves, etc., and priorities for treatment
   - areas and proportion of salvage harvesting (mitigate impacts)
   - costs and source(s) of funding
4. Plan sequence of treatments (kinds, levels, timing)
5. Monitor to permit adaptive management
6. Evaluate success of meeting desired conditions

Summarizing the approach to successful post-burn restoration.


Thank you