HOW VEGETATION MANAGEMENT IS AFFECTED BY SITE QUALITY

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What can be influenced??

- Conifer Growth
- Conifer Survival
- Efficacy
- Species Composition
- Chemical Prescription
- Cost
- Return on Investment
What is the most important reason to control competing vegetation??

• Conifer survival and growth
  – So how do the effects of vegetation management vary between sites??
    • Real vs. perceived site index
    • Percent vs. absolute growth
    • Competition thresholds
The Garden of Eden Experiment
Bob Powers PSW

- Focused on ponderosa pine
- Replicated over a wide variety of sites across northern California
- Complete factorial treatment structure that included:
  - Total vegetation control with herbicides
  - Fertilization
  - Insect control
  - Non Treated
  - All combinations of herbicide, fertilization and insect control treatments
- Evaluated over twenty years
<table>
<thead>
<tr>
<th>Plantation</th>
<th>Site Index (height at 50 years) from:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Natural (Feet)</td>
<td>Planted</td>
<td>Natural (Meters)</td>
</tr>
<tr>
<td>Feather Falls</td>
<td>100</td>
<td>138</td>
<td>30</td>
</tr>
<tr>
<td>Whitmore</td>
<td>75</td>
<td>100</td>
<td>23</td>
</tr>
<tr>
<td>Elkhorn Ridge</td>
<td>56</td>
<td>75</td>
<td>17</td>
</tr>
</tbody>
</table>
CUMULATIVE VOLUME PRODUCTION ON THREE GARDEN OF EDEN SITES FREE OF WEED COMPETITION

PLANTATION AGE (yrs)

VOLUME (m³ ha⁻¹)

Feather Falls

Whitmore

Elkhorn

VOLUME (ft³ ac⁻¹)
Control

ELKHORN RIDGE

Herbicide + Fertilization
VOLUME TREND AT ELKHORN RIDGE

VOLUME (m$^3$ ha$^{-1}$) vs. PLANTATION AGE (yrs)

- Herb + Fert
- Herbicide
- Fertilize
- Control

5 m$^3$ ha$^{-1}$ yr$^{-1}$
FEATHER FALLS

Control

Herbicide + Fertilization
VOLUME TREND AT FEATHER FALLS

19 m³ ha⁻¹ yr⁻¹
(32 over last 10 yrs)
Balderston Plantation
Bob Powers PSW

- Precursor to Garden of Eden Experiment
- Two soil types on the same location
  - Mariposa (poor site)
  - Cohassett (high site)
- Treatments
  - Non treated
  - Vegetation removed
  - Fertilized
  - Vegetation removed + fertilized
- Plots were re-measured 37 years after treatment
Balderston Ponderosa Pine Stand
Volume 37 Years After Treatment

![Bar chart showing volume (ft^3/ac) for different treatments: Control, Brush Removed, Brush Removed + N + Retreated. Mariposa and Cohassett sites are compared.](chart-image)
So What?

- Percent growth increases from vegetation control are greatest on poor sites.
- However, absolute volume growth response is largest on good sites.
- The best money spent would therefore be on good sites.
- However….. Without adequate vegetation control on poor sites, there will be no plantation.
Competition Thresholds

- How much competition is too much??
  - Depends on the site quality
- Conifers can deal with more competition on higher site ground
- On poor sites (dry east side Cascades) as little as 15% cover can kill a first year plantation
Competition Thresholds for Ponderosa Pine on a Poor California Site – Oliver, 1984

Figure 2—At brush coverages greater than about 30 percent, periodic annual diameter increment of ponderosa pine planted at a poor site was similar regardless of spacing.
<table>
<thead>
<tr>
<th>Site Quality</th>
<th>PP Survival</th>
<th>% Tot Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>60.0</td>
<td>52</td>
</tr>
<tr>
<td>Moderate</td>
<td>93.0</td>
<td>93</td>
</tr>
<tr>
<td>High</td>
<td>97.0</td>
<td>97</td>
</tr>
</tbody>
</table>

Ponderosa Pine First Year Survival on Three Different Sites in the Non Treated Controls
You Should Be Able to Develop Your Vegetation Management Strategy Based on the Site

- Site Index
- Aspect
- Annual Precipitation
- Soil Type
- Elevation
Site Index

High Site Doug fir / Tanoak?

Low Site P Pine / White Oak and Whiteleaf Manzanita?
Influence of Site Index

• Competing vegetation is adapted to specific sites
• High sites are generally comprised of large, fast growing difficult to control species
• Low sites are generally comprised of drought adapted species with thick cuticle layers and are extremely water efficient
• They also tend to be the most competitive for water
• Complete vegetation control may not be necessary on very good sites and almost always needed on poor sites
Aspect

North-facing slope

South-facing slope
Influence of Aspect

- Aspect will not only influence the type of competing vegetation present on a site but conifer species as well.
- South slopes are usually harsher sites, with shallower soils and hardy vegetation adapted to dryer conditions.
- Aspect will affect what conifer species are planted and therefore what herbicides can be used based on conifer tolerance.
- South aspects usually require more vegetation control for establishment than wetter and cooler north slopes.
Annual Precipitation
Influence of Annual Precipitation

- Annual precipitation will influence what season you can apply certain herbicides (soil actives)
- It will also influence the size and type of vegetation present
- Conifers will put up with higher amounts of competition on wetter sites
Soil Type
Influence of Soil Type

- Soil type can affect how herbicides work and behave in the environment.
- Soil organic matter can bind to soil active herbicides and reduce their efficacy.
- Well drained soils with low organic matter can be more conducive to herbicide movement, especially on steep slopes in wet areas.
- Soil type has a strong influence on the vegetation complex present.
Elevation
Influence of Elevation

• Elevation can influence the season of application for soil active herbicides
  – Generally high elevation sites where soil moisture mostly comes in the form of snow are treated in the fall versus low elevation units that are treated in the spring
• Vegetation complexes will change with elevation
• Application seasons are shorter the higher the elevation
• Site quality can also be influenced by elevation
So How Do You Take in All of This Information and Develop a Vegetation Management Strategy Based on Site Quality??

- Your vegetation management objectives should be the same regardless of site.
- It’s how you go about achieving those objectives that may differ by site.
- If you choose to log poor site ground, you still have an obligation to reforest it.
- The trick is to do it as efficiently and effectively as possible while making it a worthwhile investment.
- It’s easy to justify greater investments on good sites, but it’s also way too easy to justify NOT investing on poorer sites.
So How Do You Achieve All of This??

- You have to utilize ALL of the available tools in the vegetation management arsenal to be effective and efficient (products, equipment, application methods, timing, etc)
- A one size fits all approach does NOT work
- Success of a vegetation management program is not measured strictly in how much did it cost!
- Efficacy, stand growth, stocking level and cost all need to be considered
- The overall goal should be to achieve the best vegetation control in the most effective and efficient manner possible
So What are the Options??

• Aerial vs Ground Applications
  – Aerial is low cost, but not always the most effective
    • Currently ground waving wand applications are rivaling helicopter costs and can be used for more applications than just residual herbaceous treatments

• Pre-Harvest Site Preparation
  – Pre-treating woody brush and hardwoods at least one year prior to logging
  – Allows use of the most effective products without regard for conifer tolerance
  – Treated vegetation is undisturbed at treatment and efficacy is dramatically improved and long lasting
  – Hands down the most effective method of woody brush control period.
  – Broadcast, directed or hack and squirt methods
  – Allows lower use rates of residual herbicides for herbaceous control at planting
  – Improves soil moisture as units site fallow the season prior to planting
So What are the Options??

• Application Timing
  – Don’t try to control everything in the world with one treatment to reduce application costs!
  – Foliar treatments should be applied from late spring to late summer
  – Residual herbicides for herbaceous control should be applied in either the fall or the spring depending on elevation
  – Putting a residual herbicide out in June the summer prior to planting serves no purpose whatsoever
So What are the Options??

- Alternative Application Methods That May Be More Effective
  - Directed ground spray applications
  - Hack and Squirt Applications
  - Waving wand broadcast applications
  - Basal bark treatments
  - Spot gun treatments
  - Aerial
  - Be Creative
So What are the Options??

• **Product Choice**
  – On poorer sites maybe focus on lower cost products that achieve the desired results (ie Atrazine vs Velpar, 2,4-D vs Garlon, etc)
  – Use the products for what they were designed for (ie Imazapyr for brush control, not residual herbaceous control)
  – Conifer tolerance. Utilize products that achieve the desired vegetation control but won’t cause a replant situation (ie Cleantraxx, Esplanade F, Atrazine on larch, true firs, cedar, etc)
  – Know what vegetation is on your site and choose products that are appropriate (ie you don’t want to use Cleantraxx, Esplanade F or Atrazine on a site that is dominated by perennial grass for example)
So What are the Options??

• Site Preparation vs. Release
  – Hands down, the best and most effective money you can spend is on good site preparation!!!!
  – Trees stressed from the start will NEVER grow like free to grow trees from the beginning
  – My favorite reforestation quote of all time “If you have a large release program, you’re probably f#$@&* up” - Mike Newton – Oregon State University
Conclusions:

• Be creative: Don’t get locked into one system fits all
• Focus on site preparation vs release
• Anticipate what vegetation issues will occur on each site
• Be efficient but effective with your treatments
• Utilize the whole toolbox!
• Put in some long term growth plots that demonstrate the effect of good vegetation management
• Don’t use the excuse “We can’t afford to treat this site.” Figure out a way to do it efficiently!