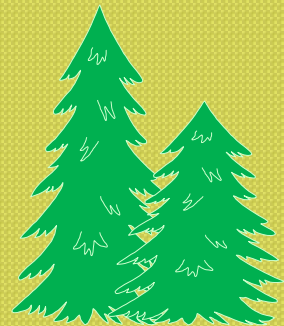
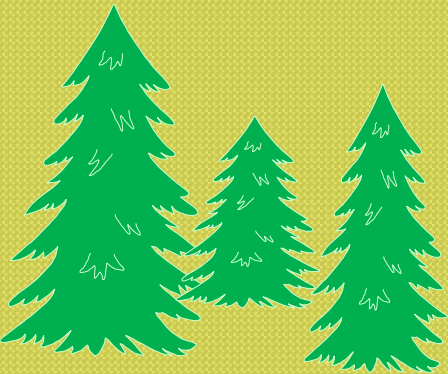


Relationship between Nutrition and Forest Productivity

Utilization Treatment ---Short and Long Term---

2007 IFTNC Annual Meeting

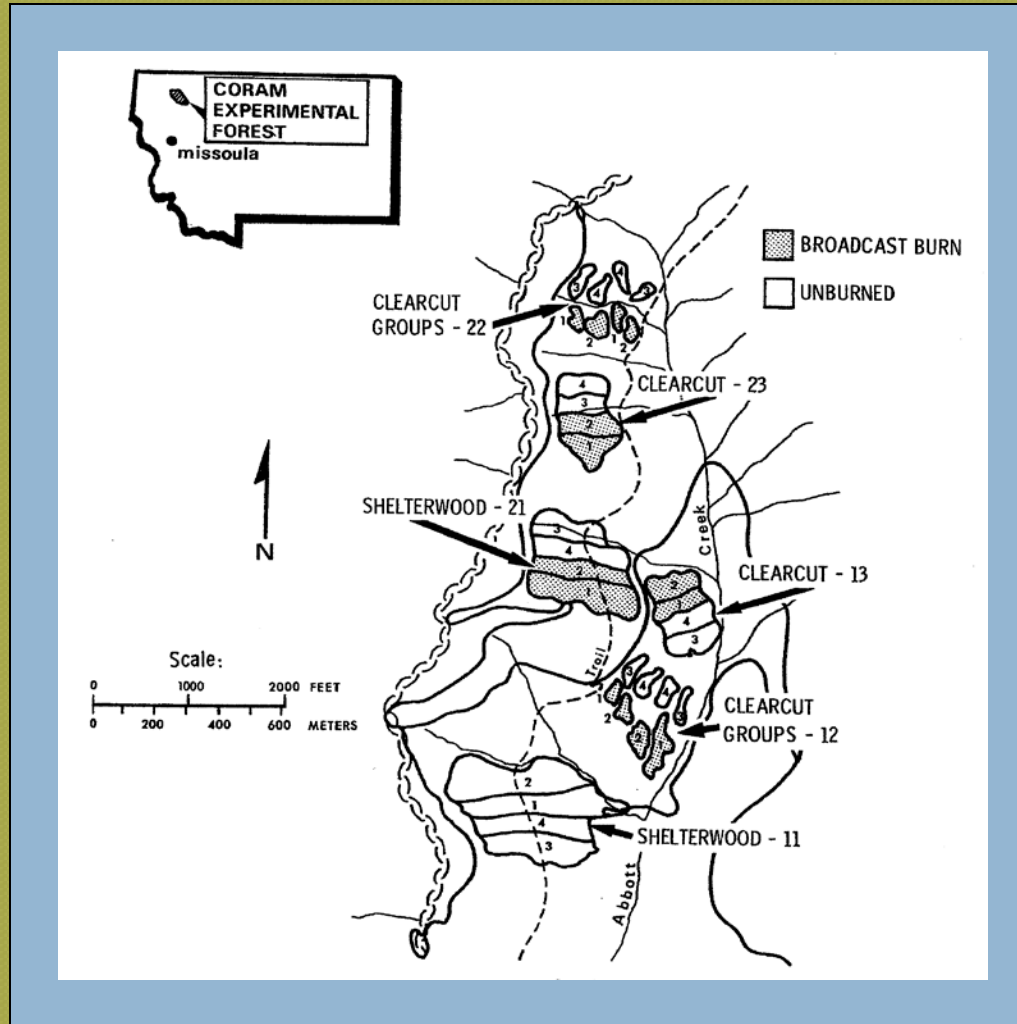
T. M. Shaw and L. R. Johnson



Nutrition Effects on Future Forest Productivity

- **Goal** - Evaluate the effects of silvicultural practices on forest nutrient status and subsequent forest growth and yield.
- **Objective** – Two phase examination of forest nutrient status and productivity with Phase I being “retrospective” on sites that were previously harvested at various levels of biomass removal and Phase II on new sites to be harvested.

Coram Experimental Forest Logging Study



Coram Experimental Forest Logging Study

Silvicultural Treatments

- Shelterwood
- Clearcut
- Group Selection

Utilization Treatments

- Low/Burn – Remove sawtimber to 7" dbh, 8' length, one-third sound
- Medium/Burn – Remove all material to 3" diameter, 8' length, and one-third sound.
- Medium/No Burn – Remove all materials to 3" diameter, 8' length and one-third sound
- High/No Burn – Remove all timber to 1" diameter

Coram Experimental Forest Logging Study



Utilization Harvest Treatment

Cut all trees 7 inches d.b.h. and over, except designated shelterwood trees. Remove all material (live and dead, standing and down) to 3 in. top, 8 ft. long and 1/3 sound.

Not burned.

Coram Experimental Forest Logging Study

2006 Biomass and Nutrient Summary

- There were no **strong** biomass or nutrient differences shown between utilization treatments 30 years after harvest.
- CWD levels were much higher on the control than all utilization treatments.
- Nutrient levels did tend to be lower on the low utilization-burn treatment than other utilization treatments.
- Clearcut soil N concentrations were higher when not burned.
- Forest floor nutrient concentrations were lower on the clearcut than the shelterwood cut.
- Douglas-fir foliar N, S and B concentrations were noticeably lower than regional averages or critical levels at the Coram study site.

Effects of harvest and residue treatments on natural regeneration and long-term sapling dynamics in larch-fir forests (Goodburn, IF'TNC 2006)

Table 1: Average total heights (m) of planted Douglas-fir and Engelmann spruce by harvest and residue treatments

	Species	Clearcut	Group Selection	Shelterwood
Moderate Utilization, Burned	Douglas-fir	5.7	5.4	4.0
	Engelmann spruce	3.9	3.6	3.2
Standard Utilization, Burned	Douglas-fir	6.0	6.1	2.7
	Engelmann spruce	4.2	4.2	2.8
Intensive- fiber Utilization, Unburned	Douglas-fir	4.7	4.5	2.2
	Engelmann spruce	2.8	2.8	2.5

Average total height growth of planted conifers was lower in the Intensive utilization / unburned treatment across all harvest regimes.

Effects of harvest and residue treatments on natural regeneration and long-term sapling dynamics in larch-fir forests (Goodburn, IFTNC-2006)

Average tallest heights (m) of established natural regeneration in 2001 by harvest and residue treatments, Coram Experimental Forest, Montana.

	Species	Clearcut	Group Selection	Shelterwood
Low Utilization/ Burned	Western larch	2.1	4.0	2.7
	Douglas-fir	3.3	3.4	1.5
Moderate Utilization, Unburned	Western larch	8.5	5.7	0.5
	Douglas-fir	1.8	1.6	1.0
Moderate Utilization, Burned	Western larch	4.9	2.8	2.7
	Douglas-fir	3.7	2.5	1.2
Intensive-Utilization, Unburned	Western larch	1.7	2.6	2.1
	Douglas-fir	2.2	1.6	1.5

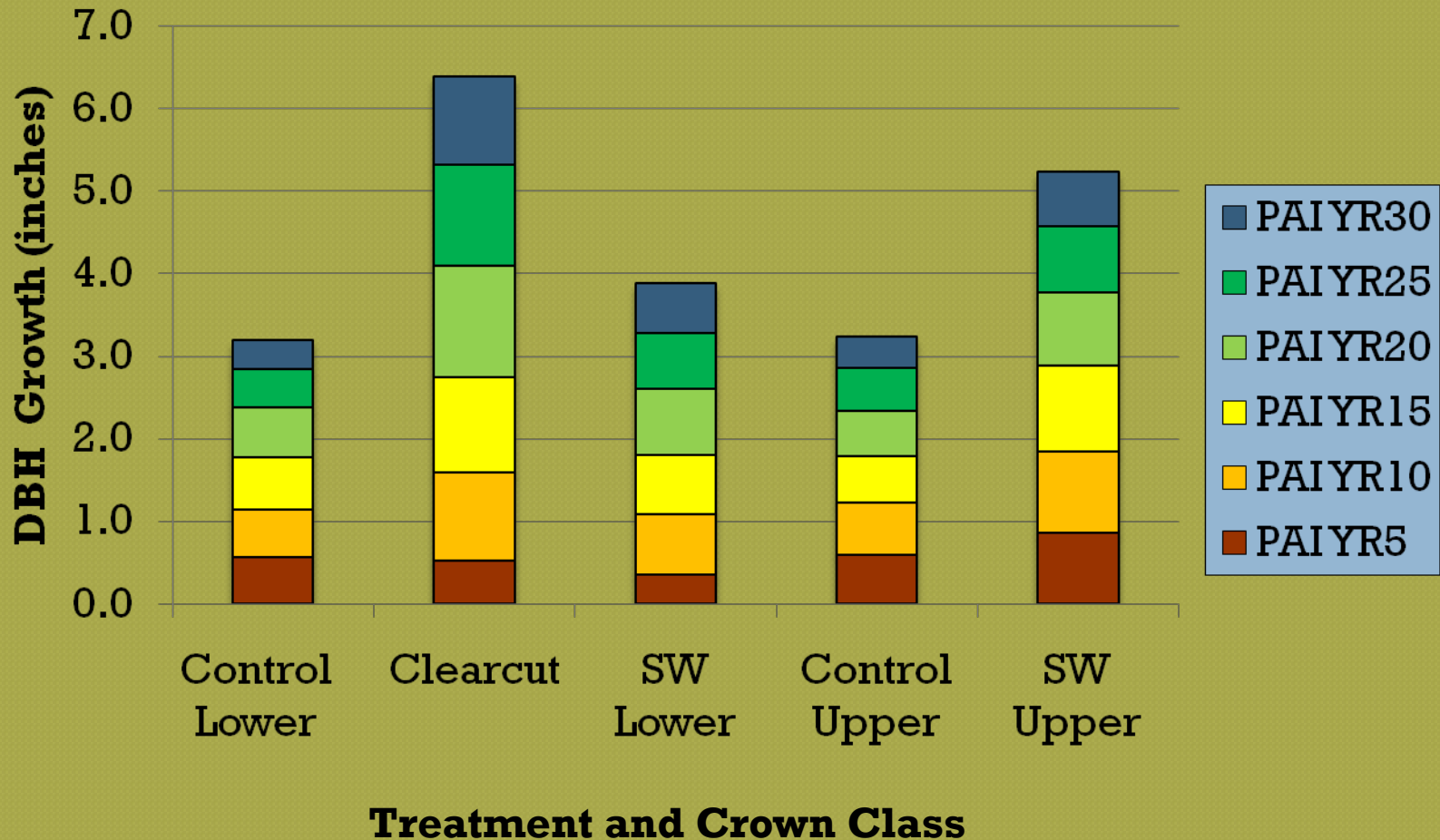
Average total height of natural regen Douglas-fir highest in the two utilization treatments that were broadcast burned.

Effects of harvest and residue treatments on natural regeneration and long-term sapling dynamics in larch-fir forests (Goodburn, IFTNC-2006)

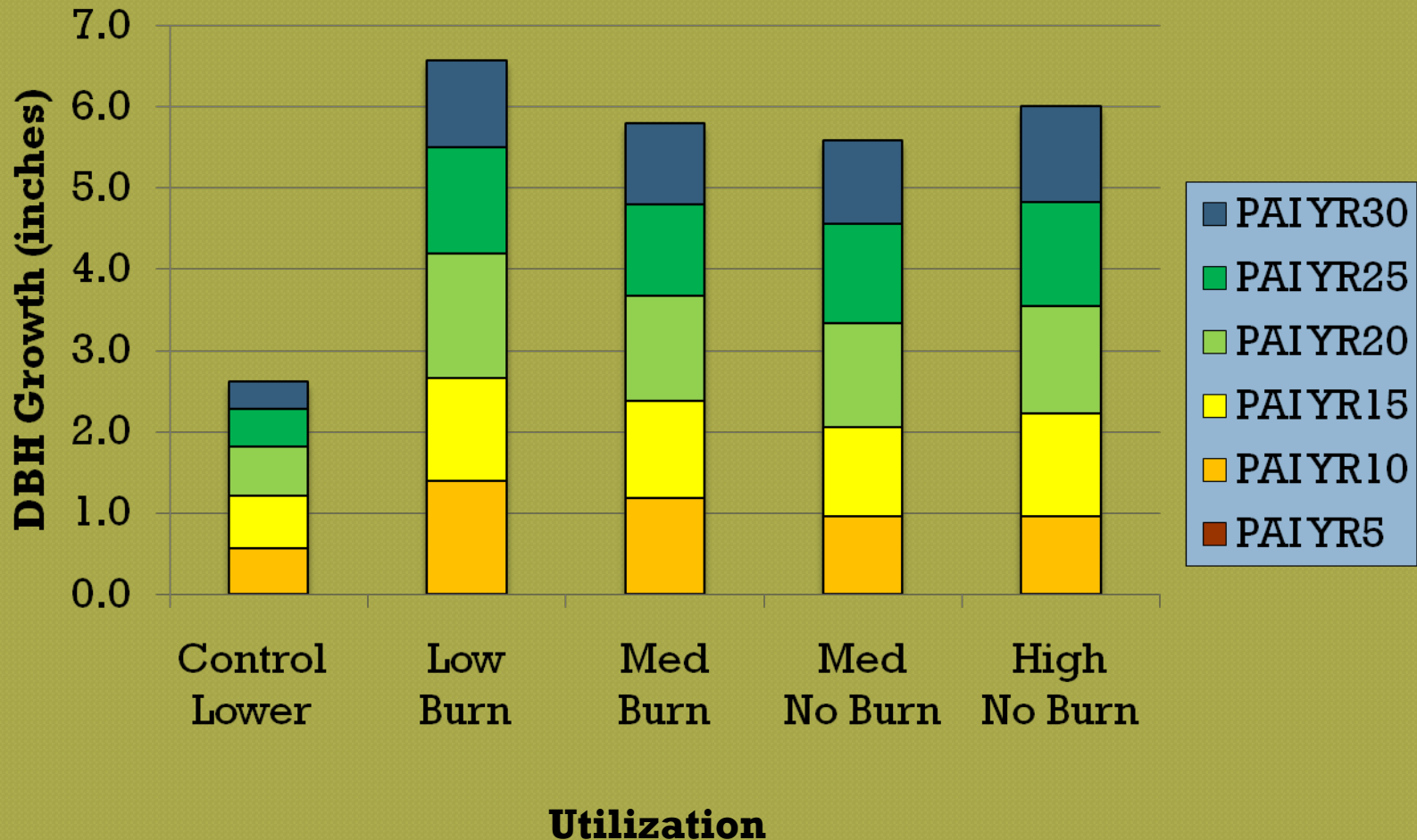
2006 Summary

- Trends in Nutrient availability/loss are not clearly associated with utilization options.
- Growth response of saplings across all harvest treatments was somewhat lower on Intensive utilization/Unburned treatment.
- Heights of saplings 25 years after treatment show trends, but are not strongly correlated (statistically) with residue utilization treatment.
- May be confounded by variation in early establishment and reduced competition.

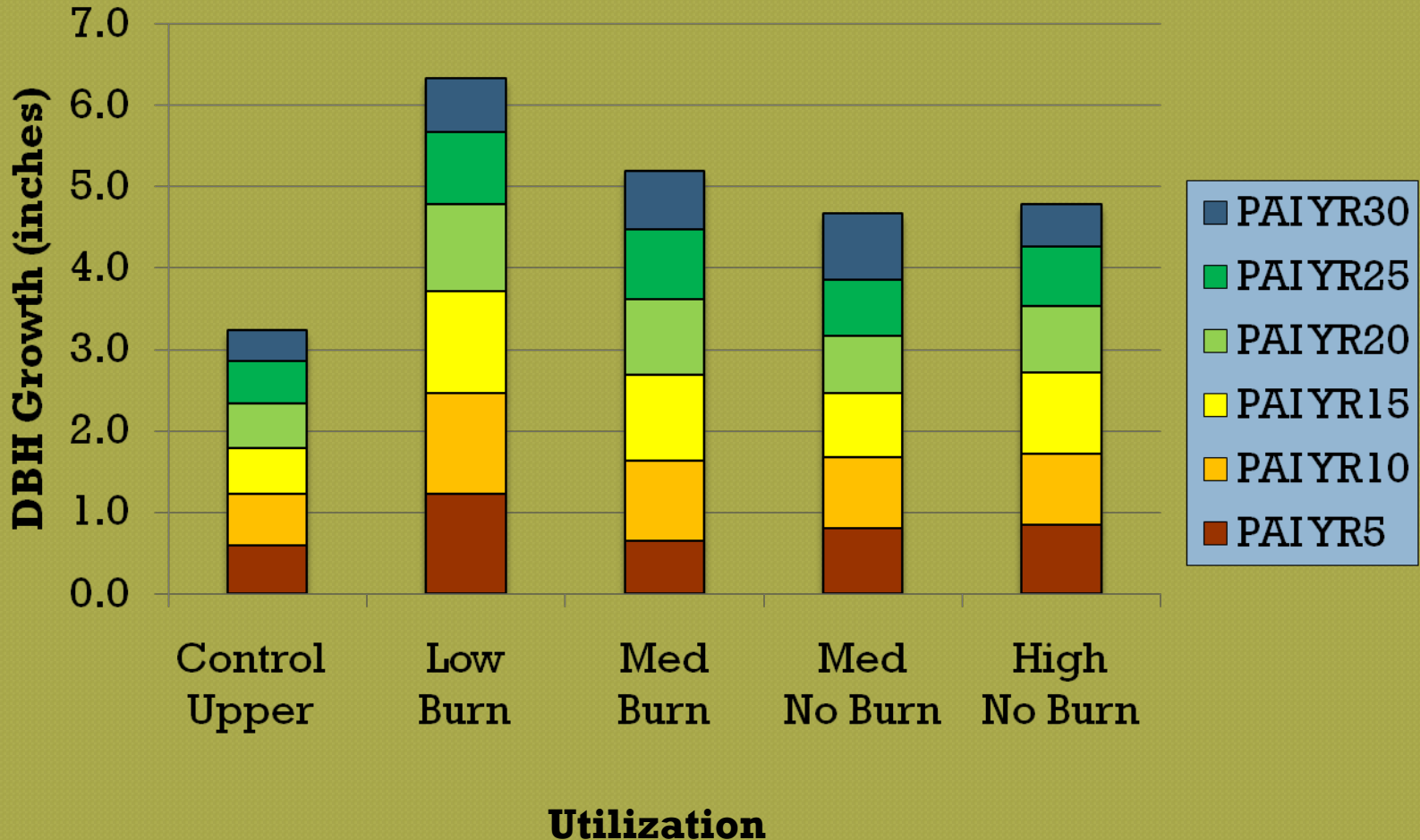
Coram Douglas-fir 5-Year PAI DBH by Stand Treatment and Crown Class 5-30 Years after Treatment



Coram Douglas-fir 5-Year PAI DBH Clearcut by Utilization 10-30 Years after Treatment



Coram Douglas-fir 5-Year PAI DBH Shelterwood Upper Crown by Utilization 5-30 Years after Treatment



Coram Experimental Forest Logging Study

2006 Growth Summary

-Diameter growth was highest for both the clearcut and shelterwood silvicultural treatments on the burn utilization treatments.

-Shelterwood upper crown class diameter growth was significantly higher for the low/burn utilization than the high /no burn utilization.

- IFTNC nutrient levels and growth results were similar to results reported by Goodburn, 2006.

Nutrition Effects on Future Forest Productivity

Phase I – 2004-2006 Retrospective Summary

UI Experimental Forest



THPL/Granite

Treatments

Shelterwood
Seed Tree
Clearcut

Harvesting

Whole Tree
Bole Only

Coram



ABLA/Metasediment

Treatments

Shelterwood
Clearcut

Utilization

Low/Burn
Med/Burn
Med/No Burn
High/No Burn

Bertha Hill



THPL/Metasediment

Treatments

Clearcut
Whole Tree

Site Preparation

Pile Burn
Broadcast Burn
Skid Trail
Scalp

Nutrition Effects on Future Forest Productivity

Phase I - Retrospective Nutrient Summary

- Soil, forest floor and foliar nutrient levels varied by treatment and nutrient across study sites.
- In general, nutrient levels did not consistently show strong associations with the different silviculture or utilization treatments .
- Nutrient levels did tend to differ between treatments at the extreme ends (ie. – burn -v- no burn, scraped –v- undisturbed, low utilization –v- high utilization...).
- Nutrient differences between treatments were expressed early for study sites where this could be measured, but were not always consistent by nutrient or expected patterns

Nutrition Effects on Future Forest Productivity

Phase I – Retrospective Growth Summary

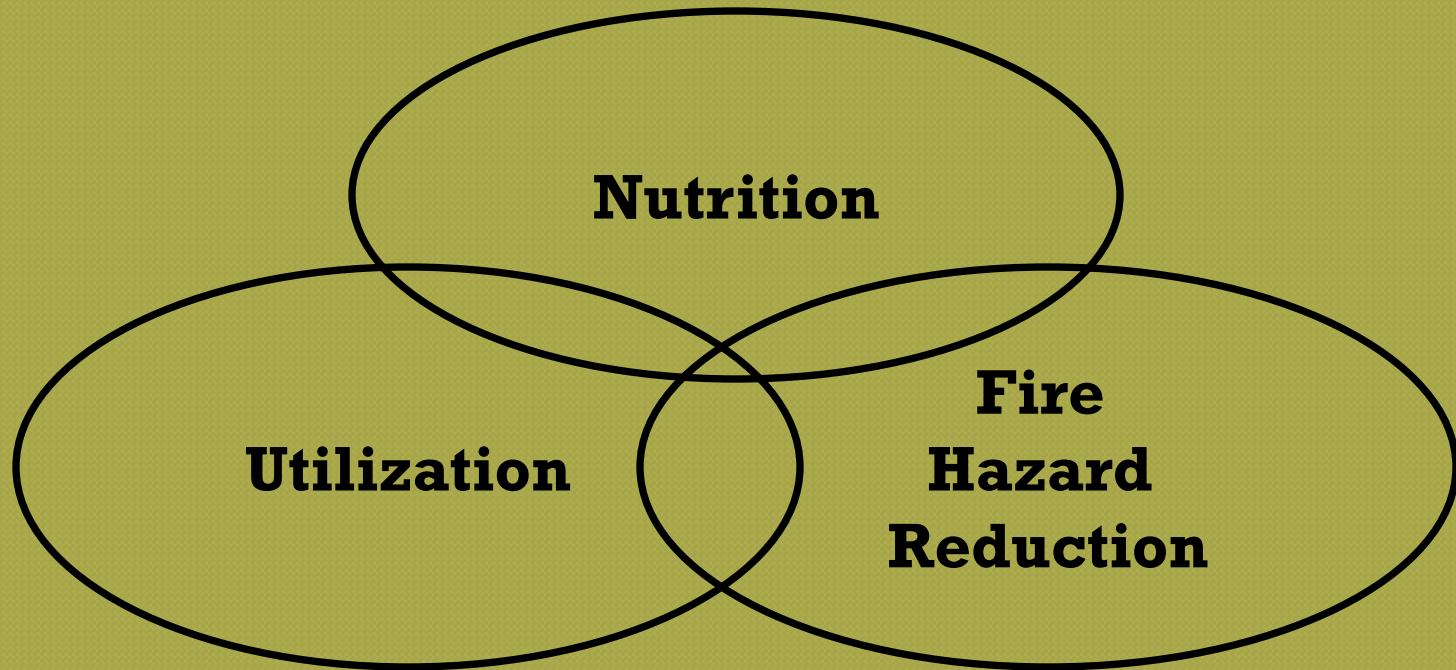
- Trends in growth response were not always clearly correlated with nutrient levels by treatment across retrospective study sites.
- Growth response across sites was not always strongly associated with the silviculture or utilization treatment.
- Growth response differences between treatments were expressed early for all study sites, but differences did not always continue over time.
- All three retrospective studies did show significant growth response treatment differences between the extreme ends (ie. – whole tree –v- bole only, low utilization –v- high utilization, undisturbed –v- scalped) for the first 5-10 years.
- Burn treatments at Coram and Bertha Hill showed increased growth over no burn treatments.

Nutrition Effects on Future Forest Productivity

Phase I – Retrospective Comments and Conclusions

- Retrospective case studies supplied a wide array of information from different silviculture, harvest, and site prep types.
- Case studies supplied immediate information on nutrient capital and stand growth over time.
- Realize that site variation is dependent on many factors such as rock type, vegetation series or species mix.
- Although there appears to be common trends in the studies, these are case studies and that limits statistical analysis.

The Challenge



Consider these Suggestions



- *Over winter slash before doing additional site-prep treatments to allow both leaching and additional breakage when handling*
- **Don't be so "tidy" – consider prescription and utilization options that retain the high nutrient components on the site -- leave cull and sub-merchantable sizes on site**

- *In prescribed burns, avoid hot burns that volatilize and remove nutrients from the site*
- *In excavator piling keep piles scattered and relatively small – provide prescription guidelines for piling*
- *The percentage residue left on site will depend on volume of harvest, utilization standards, time of year*

Nutrition Effects on Future Forest Productivity

Phase II – New Sites

- Establishment of long-term experiments coordinated with existing and planned harvest activities
- Allow replicated statistical design associated with rock and vegetation series
- Can be used to supply immediate information on nutrient capital in harvested areas
- Monitor changes in stand growth over time between harvest types

Nutrition Effects on Future Forest Productivity

Phase II – New Sites

-UI Experimental Forest

- Replicated
- Whole tree versus cut-to-length
- Cedar/Granite



-Potlatch (Scared Turkey)

- Replicated
- Whole tree versus cut-to-length
- Cedar/Granite

