What is TSI?
• Operations conducted after stand initiation and prior to the regeneration cut.
• Goals
  – Enhance Growth
  – Enhance Vigor
  – Improve Quality
  – Control Composition

Why do TSI?
• Most commercial species grow at slower rate initially than brush/sprouts from competition.
• The better the site quality, the higher the competition between species.
TSI Operations

- Release Operations
  - Weeding, Cleaning, and Liberation Cuts
- Stand Improvement Operations
  - Salvage and Sanitation Cuttings
- Wood Quality Improvements
  - Pruning
- Site Improvement Operations
  - Fertilization, Irrigation, Prescribed Burning

Release Objectives

- Protect young trees from suppression.
- Improve species composition in young communities.
- Reduce crowding of desirable species in dense stands.
- Enhance growth and development of select species.

Weeding

- Post-regeneration establishment; during seedling stage.
- Reduces herbaceous density
- Operations:
  - Mechanical
    - Grubbing or hoeing
  - Chemical Application
    - Basal or Foliar spraying
Cleaning

- Used during the sapling stage to free selected trees from competition
- Remove undesirables and poorly formed trees
- Material removed is of comparable age class

Liberation Cuts

- Similar to Cleaning yet fewer trees removed and from an older age class.

Release Results

- Increased volume (300% in Texas study)
- Increased height (68% in Norway spruce)
- Improved survival (73% in Doug-Fir)

- All varies w.r.t. site quality, species, and intensity of treatments.
Improvement Operations

- Conducted in stands past the sapling stage in an effort to improve composition and quality of the stand.
- Can be used on any species or age combination.
  - Resembles a selection thinning in even-age
- Not an effort for regeneration.
- Neglected or mismanaged stands

Salvage Cuttings

- Used to remove killed trees or those in danger of mortality.
- Utilizes material which otherwise would have been lost.
- Improves stand health by removing diseases or pests.
### Salvage Cut Types

- **Simple Salvage**
  - Removal of dead trees
  - Not many decisions to make
  - Common after fire, ice, wind, and insects
  - Requires artificial regeneration to replace due to lack of seed trees
- **Pre-salvage**
  - Not common in south
  - Uses classification scheme to predict anticipated losses before next cutting cycle.
  - Based on tree form and vigor.

### Sanitation Cuts

- Differ from Salvage w.r.t. being a precautionary mechanisms.
- Improves health by stopping or reducing the buildup of pathogens.
- Simply cutting low vigor trees does not qualify. Must examine potential financial losses.

### Sanitation in the South

- Recommended control technique for southern pine beetle.
Remember!

- There is no substitute for a thorough understanding of the life history of the invasive species/pathogen.
- Both methods must be implemented without delay to re-establish order on a site.

Wood Quality Operation

- Pruning
  - Ideal for large product rotations
    - Saw-logs and veneer logs
  - More common in Europe and Australia
    - Evidenced in Washington on Weyerhaeuser land
  - Success rests on ability to select proper trees and keep them growing at a good rate to rotation.

Natural Pruning

- Death of limb caused by shading and density.
- Shedding of limbs by saprophytic fungi
- Occlusion of limb stub depending on growth rate.
Why Prune?

- Speeds up natural process
- Produces maximum proportion of clear lumber
- Produces tight knots
- Prevents disease
- Reduces fire hazard
- Easier to work in, pleasing appearance

Effects on Tree

- Growth
  - Can be reduced if photosynthetic surface is greatly reduced.
  - Diameter growth more affected than height.
  - Form Class ----- Bole Taper
- Other Factors
  - Wound Healing
  - Pitch Pockets
  - Rot
  - Epicormic Branches

How to Prune

- Prune to LCR of 33% to 50%
- Cuts flush with bole; no stubs left.
- Remove all dead branches and live branches to 2” diameter.
- Most prune only first 16 feet
- Prune in dormant season to prevent damage and insect problems.
Considerations

• Number of trees to prune — final crop trees?
• Crown class and diameter of trees — after crown differentiation has occurred
• Growth Rate — faster growing trees
• Site and Age — young stands & better sites

Returns from Pruning

• Positive returns (4-7% on investment)
• Increases with addition of thinning.
• Thinning can be heavier than otherwise possible with some species.
• Keep records (photographs) of pruned stands to receive full value of clear material.