Forest Management **Introduction Forest** Ecology BRIAN MORRIS, PHD. APRIL 23, 2016

Overview

Safety

Ecology

Tree Physiology

Tree Identification

Forest Types

Succession

Silviculture

Treatments



Safety

2014 BLS National Census of Fatal Occupational Injuries

- Logging workers topped the BLS list
 - 109.5 per 100,000 workers
- Farmer/Ranchers/Agriculture ranked 6th
 - 26 per 100,000 workers





Safety

"Despite the industry's strong emphasis on safety, logging workers have a high rate of occupational injuries. Most fatalities occur through contact with a machine or an object, such as a log." (BLS, 2016)



Safety

Most important task?

• Going home!

What can you do?

- PPE
 - Hard hat
 - Boots
 - Hi-Vis
- Communication
- Be Prepared

Chainsaws

- PPE
- Maintenance



Geologic Background

The totality or pattern of relations between organisms and their **<u>environment</u>** (Webster Dictionary)



Environment

- Physical Components
- Biological Components



Biologic Components



11.40

Physical Components

Physical Components

- Climate
- Soils
 - Glacial
 - Volcanic



Tree Physiology



Trees need resources

Photosynthetically Active Radiation (PAR) (i.e. sunlight...)

Water

Macro Nutrients

• N, P, K, S, Ca, Mg

Micro Nutrients

• Fe, Mn, Cu, Zn, B, Cl, Mo

Liebig's Law of the Minimum



Leaves grow trees

Leaves are factories

- Leaf stomata are the factory doors
 - Take CO2 in and release H20
 - H20 release is transpiration
 - Pathogens can block the doors (i.e. Swiss needle cast)
- More factories -> More doors -> More evapotranspiration
- Transpiration results in vapor pressure deficit which "pulls" water from soil
 - The water also brings minerals/nutrients
 - Think dry sponge...

Water Loss From Trees

Stomata open to breath

- Open stomata lose water
- Stomata close in times of water stress (i.e. late fall)
- If soil water is high enough, stomata stay open, even when hot
 - Water is pulled from soil to leaves and evaporated from leaves
 - Soil water goes down...
 - Leaf and soil are hydraulically connected

Too much water?

Soil Water (old Ag terms)

- Wilting Point
 - Roots can no longer extract water from soil (late fall)
- Field Capacity
 - Soil-water adhesion = gravity
 - i.e. water does not move down, out of soil
- Saturation
 - Water will flow down with gravity out of soil
- Soil is a sponge...

Water impacts trees

Water needed for photosynthesis

- Lack of water, drought stress
 - Late fall

Too much water limits root respiration

• Trees don't grow without root respiration

Trees lose water

• Every time they open their mouths

How do trees impact water?



Surface and sub-surface water

Surface water

- Hortonian Overland Flow
 - (i.e. infiltration excess)
- Saturation excess overland flow

Subsurface water

- Vast majority of stream water source
- Q = P (ET + S)
 - Q = stream discharge
 - ET = Evapotranspiration
 - S = Storage (i.e. aquifer)

Evapotranspiration

$\mathsf{ET} = \mathsf{T} + \mathsf{I} + \mathsf{E}$

- T = transpiration
- I = interception
- E = soil/open water evaporation

Following harvest

- Leaf area greatly reduced
 - T and I...
- Less soil cover and shade
 - E...
- ET Can be 50-60% of Precipitation
- ET recovers within 15 years
 - (Jassal et al., 2009)

Interception can be a game changer



Trees and Water

Trees need water

- Photosynthesis
- Act as a big sponge
- Release water through stomata

Interception reduces soil water

More leaves – More ET

Bigger trees = less water

Soil water reduced by trees

- Interception
- Transpiration

Soil Evaporation increased when soil cover is limited

Trees decrease soil moisture

Provide slope stability

Water Age and Source

Hewlett Multiple Source Area Concept

• Stream water varies in age

How do you age water?

- Atomic signatures
- Pollution
- Nuclear weapons...

Trees and Water





FIGURE 1. Headwater Stream Length, as a Proportion of Total Stream Length Within Each 8 Digit HUC Watershed, in the U.S., Excluding Alaska, as Computed Querying the NHD RAD v2.0 for Reaches That Have No Other Inflowing Streams at the 1:100,000 Scale. The NHD RAD v2.0 Does not Capture Streams Under 1 mile (i.e., 1.61 km) in Length.

From: Nadeau and Rains, 2007

Riparian Zones

Functions

- Stream Bank Stability
- Regulation of Nutrient Loading
- Stream Shading
- LWD Recruitment
- Sediment Filtering
- Terrestrial Habitat
 - Snags
 - Riparian Down Wood



Tree Identification

Dendrology

http://dendro.cnre.vt.edu



Douglas fir

Pseudotsuga menziesii

Central CA to BC

Leaf – Evergreen, single needle (0.75-1.25")

Fruit – 3-4" long, Mouse backside

Slender re-brown twig

Smooth gray bark develops into thick, furrowed brown

Poor self pruner



Western Hemlock

- Tsuga heterophylla
- Northern BC to Northern CA
- Shade Tolerant
- Pioneer to climax species
- Leaf evergreen flat single needle (1/4-3/4")
- Fruit small woody egg shape (1")
- Bark thin brown to black with superficial scales
- "Sleepy" top
- Image credit: http://dendro.cnre.vt.edu



Western Redcedar

Thuja Plicata

Northern BC to Northern CA

Shade Tolerant

Intermediate to climax species

Leaf – persistent scale like (1/16-1/8")

Fruit – small woody cone (1/2")

Bark thin fibrous, stringy and reddish

"Sleepy" top

UNGULATE DAMAGE!!!!



Sitka Spruce

Picea sitchensis

Northern BC to Northern CA

Wet soil

Intermediate to Climax

Leaf – evergreen 4-sided and pointy (1")

Fruit – oblong cones (1.5-3.5")

Bark is thin and scaly (corn flakes)

Pokey



Silver fir

Abies amabilis

Northern BC to OR

Can live in shade, grow best in full light

Intermediate to climax

Leaf – flat (1") dark green on top, silver bottomHockey stick

Fruit – upright near top (3-6")

Bark is thin grey-green with resin blisters

Becomes gray and scaly with age



Noble fir

Abies procera

Central WA to N. Oregon Cascades (>2000ft)

Natural regeneration in shade, grow best with sun

Leaf – flat (1") dark green on top, blueish on all sides
Hockey stick

Fruit – upright near top (4-6")

Bark is thin grey-green with resin blisters

Becomes gray-purple and scaly with age



Red Alder

Alnus rubra

SE AK to Central CA Coast

Shade intolerant (roads and ditches...)

Intermediate

Leaf – alternate, ovate, serrated margins (3-6")

Fruit – small semi-woody cone (1/2-1")

Bark – Ash gray and thin, white splotches





Big Leaf Maple

- Acer macrophyllum
- S. BC to N. CA

Prefers sunlight

Leaf – alternate, simple, palmately lobed (6-12")

Fruit – Double samaras with wings 1.5-2"

Bark – Smooth and gray when young

• Brown and furrowed with age

Important habitat species (epiphytic plants, squirrels, etc





Western White Pine

Pinus monticola

S. BC to Central CA, ID, MT

Prefers sunlight

- Leaf Blue/green needle, bundles of 5 (2-4")
- Fruit Large cylindrical cone, curved (5-12")
- Bark Smooth and gray/green when young
 - Gray/purple and 2" thick when older

WWP Blister Rust!



Succession

Stages of Forest Development

- Disturbance
- Pioneer Species
- Intermediate Species
- Climax Species
- Disturbance

Ecology – Succession



From Franklin and Spies (1991)

Disturbance



Pioneer Species





Intermediate Species





Disturbance

Art and science of managing forests

- Ecology
- Tree Physiology
- Succession
- Silvics/Dendrology
- G&Y Modeling

Telling the story of the stand

Silvicultural Systems

Even Aged Systems

- Clear Cut
- Shelter Wood/Seed Tree
- Etc.

Uneven Aged Systems

- Single tree selection
- Group Selection
- Etc.



Objectives, Objectives, Objectives

Objectives

- Financial
- Habitat
- Aesthetics
- Functional System
- Combination?

Financial Objectives



−Sum of PNW 4% → Sum of MBF

Habitat Objectives

- Species of Choice (e.g. NSO, MM, etc.)
- Multi Species



Aesthetic Objectives

• What do you like to look at?



Objectives are not exclusive

- You may need to prioritize
- Maximize X
 - Given Constraints A,B,C,etc



Treatments

Scale

• Backyard vs. Landscape



Reforestation

Current Vegetation

- Field
 - Soil Properties
 - Chemical
 - Physical
 - Competing Vegetation
 - Browse
- Forested
 - Competing Vegetation
 - Browse

Species Selection







Young Stand Improvement



Older Stand Treatments



Thank you.