Objectives

Understand & project:

Landscape Conditions

Freshwater Habitat

Salmon & Trout
Approach

1. Develop & apply watershed condition metrics

2. Model relationships among salmonids, their freshwater habitats, and landscape features
Approach

1. Develop & apply watershed condition metrics
   - Intrinsic potential
   - Management influences on streams

2. Model relationships among salmonids, their freshwater habitats, and landscape features
Intrinsic Potential

- Describes capacity to provide high quality habitat
- Attributes are static over long time frames
- Values of attributes are species specific

Diagram:

- Valley Constraint
- Mean Annual Flow
- Channel Gradient
High Gradient, Constrained Reaches
Low Gradient, Unconstrained Reaches
Intrinsic Potential to Provide High Quality Habitat for Steelhead

Nestucca Watershed

Tillamook Watershed
Intrinsic Potential to Provide High Quality Habitat for Coho Salmon

Tillamook Watershed

Nestucca Watershed

High
Moderate
Low
High Intrinsic Potential by Land Ownership
Tillamook and Nestucca Watersheds

Steelhead Coho Salmon

PI PNI State BLM USFS Misc.

% Area

Steelhead Coho Salmon
High Intrinsic Potential by Current Land Use
Tillamook and Nestucca Watersheds

% Area

Steelhead  Coho Salmon

Forest  Natural  Agriculture  Rural  Urban  Developed
Management Influences

- Describe possible effects of landuse on streams
- Attributes dynamic over short time frames
- Most attributes are based on forest cover classes

Diagram:
- Large Wood
- Surface Erosion
- Peak Flows
- Debris Flows
- Stream Shade
- Road Density
- Land Use
6th and 7th Field Hydrologic Units (HUs)

- Generated with 10 m DEMs using established guidelines
- Consistent drainage areas
- Match tributary junctions
- Attributed with basin type
- Upstream HUs identified
Management Influences

- Large Wood
- Road Density
- Surface Erosion
- Peak Flows
- Debris Flows
- Stream Shade
- Land Use
Modeled Stream Network

- Derived from 10 m DEMs & a process-based model
- Complete coverage
- Drainage density & spatial extent accurately represented given DEM limitations
- Empirically-calibrated attributes including mean annual flow, stream gradient, valley width, & periodicity
Current Streamside Forest Cover
Tillamook and Nestucca Watersheds

- Perennial Intermittent
  - Open
  - Non-Forest
  - Broadleaf
  - Small-Med.
  - Large
  - Very Large

- Current Streamside Forest Cover

% Area

- Tillamook and Nestucca Watersheds

Perennial

Intermittent

Legend:
- Open
- Non-Forest
- Broadleaf
- Small-Med.
- Large
- Very Large
Current Streamside Forest Cover by Ownership
Tillamook and Nestucca Watersheds

Hectares x 10^3

USFS
BLM
State
PNI
PI

Non-Forest
Open
Broadleaf
Small/Medium
Large
V-large
Management Influences

- Large Wood
- Surface Erosion
- Peak Flows
- Stream Shade
- Debris Flows
- Road Density
- Land Use
Current Probable Landslide Density
Knowles & Sweet Watersheds

- Zero
- Low
- Medium
- High
Probability of Delivery From Debris Flows to Anadromous Fish-Bearing Channels

- Med.-High Probability
- Intermittent
- Perennial
Tool for Prioritizing Hydrologic Units

Intensive Management

Restoration

Evaluate Contextually

Protection

Hydrologic Unit

Management Influences

High

Low

Intrinsic Potential

Low

High
Approach

1. Develop & apply watershed condition metrics
   - Intrinsic potential
   - Management influences on streams

2. Model relationships among salmonids, their freshwater habitats, and landscape features
   - Evaluate watershed condition metrics
   - Identify new relationships
Evaluate Watershed Condition Metrics

• Why?
  – Reflect our best understanding
  – Hypotheses about forestry effects on streams

• Develop statistical relationships with fish and habitat data

• Modify metrics if suggested
Identify New Relationships

• Channel unit feature
  – Mean density of wood in pools

• Landscape characteristics
  – Delineate analytical units for each surveyed reach at 5 spatial scales
  – Overlay analytical units onto landscape coverages

• Best subsets linear regression at each of the 5 scales
Five Spatial Scales

- Differed in extent upstream and upslope of surveyed reaches

- Designed to represent different source areas and processes for delivery of materials to surveyed reaches
Analytical Units at 5 Spatial Scales for the N. F. Elk River Corridor Sub-network Network Corridor Sub-catchment Network Catchment

Analytical Units at 5 Spatial Scales for the N. F. Elk River 2
Stepwise Regression Results for Large Wood Density

Corridor

0.34 (0.03)

Sub-network

0.48 (0.01)

Network

0.41 (0.02)

Sub-catchment

0.58 (0.002)

Catchment

NS

+ % Area M-VL Diameter Trees

- % Area Resistant Sedimentary Rocks

Adj. $R^2$ (P>F)
Relationships Between Landscape Characteristics and Large Wood Density

• Explained in part because:
  – Big trees on land provide large wood to channels
  – Fewer landslides reach streams in sedimentary rock types in Elk River

• Were strongest with landscape characteristics summarized for adjacent hillslopes and smaller streams in addition to fish-bearing reaches
Conclusions

Watershed condition metrics:
• High intrinsic potential for steelhead on public, forested land and for coho salmon on private lands with varying uses
• Intrinsic potential and management influence metrics can identify hydrologic units for protection or restoration

Modeling:
• Multi-scale analyses can suggest areas and processes most tightly coupled to stream habitat for evaluating watershed condition metrics & suggesting new relationships

Spatial data:
• Both approaches require consistent broad-scale data layers
• Results may be compromised by poor quality data such as the currently available road layer