Range of Variability (RV): Natural (NRV), Historic (HRV), Current (CRV), and Future (FRV)

Nathan Poage, Ph.D.
NE Oregon Area Ecology Program, USFS
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Hudec (2019), used and modified with permission
**Terminology**

- **NRV** - Ecological conditions, and the spatial and temporal variation in these conditions, that are relatively unaffected by people, within a period of time and geographical area appropriate to an expressed goal.

- **HRV** - Simply NRV when the reference period is prior to what defines current conditions, often pre-European settlement.

- **FRV** - Estimated range of some ecological condition or process that may occur in the future; especially relevant when the effects of anthropogenic stressors are high.

*Hudec (2019), used and modified with permission*
Establishing Reference Conditions

***** ONLY SHOWN AS AN EXAMPLE !!! *****
Figure 1 – The range of variation (RV) helps us decide whether existing amounts of vegetation composition, structure, and density, when summarized for a landscape-scale analysis area, are occurring within a characteristic range (Aplet and Keeton 1999, Morgan et al. 1994, Swanson et al. 1994). This diagram shows the ecological trajectory of an ecosystem component (the solid line) varying through time because the phrase “range of variation” is meant to encompass more than just the extreme values (the upper and lower limits, shown as dashed lines) (diagram modified from Morgan et al. 1994).
NRV Departure Analysis and Land Management

• USFS uses Natural Range of Variability (NRV) and Departure Analysis to define management goals.
  • Maintain conditions within NRV.
  • Restore current conditions to reflect NRV.

• Directly relevant to the Eastside Screens and the “21-inch Rule” → NEXT SLIDE...

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Figure 1 – The range of variation (RV) helps us decide whether existing amounts of vegetation composition, structure, and density, when summarized for a landscape-scale analysis area, are occurring within a characteristic range (Aplet and Keeton 1999, Morgan et al. 1994, Swanson et al. 1994). This diagram shows the ecological trajectory of an ecosystem component (the solid line) varying through time because the phrase “range of variation” is meant to encompass more than just the extreme values (the upper and lower limits, shown as dashed lines) (diagram modified from Morgan et al. 1994).
Regional Forester Amendment #2 of June 12, 1995 established interim riparian, ecosystem, and wildlife standards for timber sales (these standards are referred to as the "Eastside Screens"). Items 5 and 6 of the Eastside Screens require that a range of variation approach be used when comparing historical reference and current conditions, incorporating the best available science.

The range of variation guidance used on the Wallowa-Whitman National Forest was issued December 12, 1995.

The enclosed document, Range of Variation Recommendations for Dry, Moist and Cold Forests, by David Powell, May 2010, incorporates the best available science and will now replace that 1995 guidance. All future forest vegetation planning work should utilize the range of variation tables in this document. For forest vegetation planning projects that are underway, the decision to use the new range of variation guidance is at the discretion of the Deciding Official for the project.
Sources: Based on O’Hara and others (1996), Oliver and Larson (1996), and Spies (1997).

**Table 3:** Range of variation information for forest structural stage, expressed as percentages.

<table>
<thead>
<tr>
<th>Potential Vegetation Group</th>
<th>SI</th>
<th>SE</th>
<th>UR</th>
<th>OFSS</th>
<th>OFMS</th>
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</thead>
<tbody>
<tr>
<td>Cold Upland Forest</td>
<td>20-45</td>
<td>10-30</td>
<td>10-25</td>
<td>5-20</td>
<td>10-25</td>
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<tr>
<td>Moist Upland Forest</td>
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<td>20-30</td>
<td>10-20</td>
<td>10-20</td>
<td>15-20</td>
</tr>
<tr>
<td>Dry Upland Forest</td>
<td>15-25</td>
<td>10-20</td>
<td>5-10</td>
<td>40-60</td>
<td>5-15</td>
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Powell (1998, revised 2010)
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Conducting NRV Departure Analysis

FSVeg = Field Sampled Vegetation → “Stand Exams”

FSVeg Spatial and Data Analyzer → ArcGIS Add-In/Extensions

1. Nearest Neighbor Imputation to project stand exams
2. Run Forest Vegetation Simulator (FVS) in batch mode
3. Conduct NRV departure analysis
State-and-Transition Models

Simplified Forest Ecosystem Model

Early Seral → Mid Seral → Late Seral

U-shaped arrows indicate possible transitions in opposite directions.
**State-and-Transition Models**

- **Cover Type**
- **Structural Stage**
- **Age**

<table>
<thead>
<tr>
<th>Forest</th>
<th>1_Early-Seral</th>
<th>0 - 24</th>
<th>(Time)</th>
<th>Forest</th>
<th>2_Mid-Seral</th>
<th>25 - 99</th>
<th>(Time)</th>
<th>Forest</th>
<th>3_Late-Seral</th>
<th>100 - 9999</th>
</tr>
</thead>
</table>

(Probabilistic Transition; e.g., Stand-Replacing Fire)

**Early-Seral (12%), Mid-Seral (38%), Late-Seral (50%)**

- **Landscape** = 100, 1-acre cells
- **Simulation Iterations** = 5 iterations per scenario
- **Simulation Length** = 200 years
- **Scenario A** = 1% chance of stand-replacing fire / year
- **Scenario B** = 4% chance of stand-replacing fire / year
Scenario A

Early 12%, Mid 38%, Late 50%: Fire 1%

[Timelines and Graphs]

- Forest_1_Early-Seral
- Forest_2_Mid-Seral
- Forest_3_Late-Seral

[Data Included: Early 12%, Mid 38%, Late 50%, Fire 1%]
Scenario B

Early 12%, Mid 38%, Late 50% : Fire 4%

State Classes Proportion
Forest_1_Early-Seral

State Classes Proportion
Forest_2_Mid-Seral

State Classes Proportion
Forest_3_Late-Seral

[35 Early 12%, Mid 38%, Late 50% : Fire 4% (20) @ 15-Jul-2020 1:25 PM]
Scenario A
Fire = 1% chance / year

Scenario B
Fire = 4% chance / year
A Closing Thought...

Reference Range of Variability (RRV)
Questions?