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Subject: Range of Variation Direction for Forest Vegetation Project Planning

To: S.O. Staff and District Rangers

Forest Plan Amendment #11 established interim riparian, ecosystem, and wildlife standards for timber sales (these standards are referred to as the "Eastside Screens"). The Eastside Screens, items 5 and 6 specifically, require that a range of variation (RV) approach be used when comparing reference (historical) and current conditions, and that the RV approach be based on best available science.

The Forest issued a memorandum (Blackwood 1998) establishing consistent RV information for the Eastside Screens amendment. The 1998 letter also established a consistent basis for determining biophysical environments, another Screens requirement. The science information supporting the 1998 letter was current as of the mid 1990s.

The RV information in this letter is based on best available science as of today. Therefore, this letter supersedes the memorandum of December 11, 1998 (Blackwood 1998). All future forest vegetation planning efforts should utilize the RV information provided in tables 1-3 of this letter. The forest structure information (table 2) should now be used for the Eastside Screens structure analysis (item 5 A in Forest Plan Amendment #11). **Do not continue using the 1998 letter**.

Note that this letter does not change or modify the Eastside Screens amendment in any way; it is fully consistent with the Eastside Screens.

Background and Context

The range of variation is defined as the range of conditions likely to have occurred in the Blue Mountains prior to Euro-American settlement in the mid 1800s. Forest Service handbook and manual direction recommends that an RV approach be used when comparing current and desired conditions during project planning (see FSH 1909.12, section 43.13 – Range of Variation; and FSM 1920, section 1921.73a – Ecosystem Diversity).

The Eastside Screens require an RV analysis for forest structural stages only. The handbook and manual direction, however, recommends using an RV approach when analyzing structure, species composition, and processes.

Revised RV Information

This letter provides revised RV information for three ecosystem components: species composition (table 1), forest structure (table 2), and tree density (table 3); the revised information was based primarily on disturbance process modeling using the Vegetation Dynamics Development Tool (VDDT). [The Blue Mountains VDDT model incorporates many processes, including wildfire, forest insects (defoliators, bark beetles), silvicultural practices, and plant succession in the absence of disturbance.]

Table 1: Range of variation information for species composition (forest cover types).

Forest Cover Type[1]	Potential Vegetation Group		
	Dry UF	Moist UF	Cold UF
	Range of Variation (Percentage)		
Western juniper	0-5	0	0
Ponderosa pine	50-80	5-15	0-5
Douglas-fir	5-20	15-30	5-15
Grand fir	1-10	15-30	5-15
Western larch	1-10	10-30	5-15
Lodgepole pine	0	25-45	25-45
Subalpine fir and spruce	0	1-10	15-35
Whitebark pine	0	0	0-10
Western white pine	0-5	0-5	0

Source/Notes: Derived from disturbance process modeling using the Vegetation Dynamics Development Tool. Potential vegetation group is described in Powell et al. (2007); UF = Upland Forest.

[1] Cover types consist of the following existing vegetation coding combinations:

Western juniper: JUOC and mix-JUOC
Ponderosa pine: PIPO and mix-PIPO
Douglas-fir: PSME and mix-PSME
Grand fir: ABGR and mix-ABGR
Subalpine fir and spruce: ABLA, PIEN, mix-ABLA, and mix-PIEN
Western larch: LAOC and mix-LAOC
Lodgepole pine: PICO and mix-PICO
Whitebark pine: PIAL and mix-PIAL
Western white pine: PIMO and mix-PIMO

Table 2: Range of variation information for forest structural stages.

Potential Vegetation Group	Stand Initiation	Stem Exclusion	Understory Reinitiation	Old Forest Single Story	Old Forest Multi-Story
	Range of Variation (Percentage)				
Cold Upland Forest	20-45	10-30	10-25	5-20	10-25
Moist Upland Forest	20-30	20-30	10-20	10-20	15-20
Dry Upland Forest	15-25	10-20	5-10	40-60	5-15

Source/Notes: Derived from disturbance process modeling using the Vegetation Dynamics Development Tool. Potential vegetation group is described in Powell et al. (2007).

Table 3: Range of variation information for tree density classes.

Tree Density Class (expressed as basal area, in ft^2/acre at 10″ QMD)	Potential Vegetation Group		
	Dry UF	Moist UF	Cold UF
	Range of Variation (Percentage)		
Low (dry: <45; moist: <90; cold: <70)	40-85	20-40	15-35
Moderate (dry: 45-70; moist: 90-135; cold: 70-110)	15-30	25-60	20-40
High (dry: >70; moist: >135; cold: >110)	5-15	15-30	25-60

Source/Notes: Derived from Powell (2009c). Potential vegetation group is described in Powell et al. (2007). QMD is quadratic mean diameter.

RV estimates derived using VDDT modeling were compared with other RV sources to determine if they are consistent with what has been used in the Blue Mountains during the last 20 years. The other sources used for this comparison are:

- Caraher Report (Caraher et al. 1992)
- Eastside Forest Ecosystem Health Assessment (Lehmkuhl et al. 1994)
- Eastside Forests Scientific Society Panel (Henjum et al. 1994)
- Ecosystem components assessment for the interior Columbia Basin ecosystem management project (ICBEMP) (Quigley and Arbelbide 1997)
- Landscape-level comparison of historical and current conditions for ICBEMP area (Hessburg et al. 1999)
- Terrestrial vertebrate source habitat assessment for ICBEMP area (Wisdom et al. 2000)
- Historical range of variability estimates for central Idaho (Morgan and Parsons 2001)
- Analysis of pre-management era patterns of forest structure for mixed-conifer forests (Hessburg et al. 2007)
- Sub-basin modeling for the Upper Grande Ronde River (INLAS) (Hemstrom et al. 2007)
- Fire and fuel model scenario planning for northeastern Oregon (Wales et al. 2007)

The RV comparison focused on the abundance and distribution of old-forest (late-old) structure by potential vegetation group. The other sources found that the estimated RV for historical levels of old forest on dry upland sites in the Blue Mountains varied from 10-80%; the VDDT estimate of 45-75% is within this range. The other sources found that the estimated RV for historical levels of old forest on moist upland sites in the Blue Mountains varied from <10-60%; the VDDT estimate of 25-40% is within this range (Countryman and Justice 2009).

RV and Climate Change

Some people believe that the RV concept should be abandoned because future conditions are predicted to be much warmer and drier than historical conditions in response to climate change. Continuing with the RV approach may still be the best option, however, as described here:

"Some feel that HRV may no longer be a viable concept for managing lands in the future because of expected climate warming and increasing human activities across the landscape. Today's climates might change so rapidly and dramatically that future climates will no longer be similar to those climates that created past conditions. At first glance, it may seem obvious that using historical references may no longer be reasonable in this rapidly changing world. However, a critical evaluation of possible alternatives may indicate that HRV, with all its faults and limitations, might be the most viable approach for the near-term because it has the least amount of uncertainty.

Given the uncertainties in predicting climatic responses to increasing CO_2 and the ecological effects of this response, we feel that HRV time series derived from the past may have significantly lower uncertainty than any simulated predictions for the future. We suggest it may be prudent to wait until simulation technology has improved to include credible pattern and process interactions with regional climate dynamics and there has been significant model validation before we throw out the concept and application of HRV" (Keane et al. 2009: 1033-1034).

RV Analysis Procedures

Before initiating a planning process, an analyst should develop an understanding of reference conditions for the planning area, preferably by consulting historical maps characterizing species composition, forest structure, and stand density.

The Forest made considerable investments over the last 20 years to locate and digitize relevant historical mapping, including maps derived from General Land Office survey notes collected in the 1880s (Powell 2008); thematic maps depicting forest conditions in 1900, 1914-16, 1935-36, 1953-60, and 1987-88 (Powell 2009b); and topical maps portraying wildfires, insect outbreaks, and other disturbance processes (Powell 2009a, 2009b).

After reviewing reference condition information to establish an historical context, an analyst should complete an RV analysis for species composition, forest structure, and tree density (at a minimum). Please consider the following recommendations when conducting an RV analysis.

1. Information about the background and principles of the RV concept is provided in a white paper (Powell 2010). The white paper provides more detail about the following steps.
2. Use an appropriate size of analysis area (a minimum of 15,000 to 35,000 acres), although areas larger than 35,000 acres are appropriate and preferable for an RV analysis.
3. Stratify the vegetation data into potential vegetation groups (see Powell et al. 2007).
4. Classify existing vegetation information into the same cover type, structural stage, and density class categories used in tables 1-3.
5. Calculate existing percentages of cover types, structural stages, and density classes for the analysis area, as stratified by potential vegetation group.
6. Determine if current conditions are within or outside the range of variation by comparing the calculated existing percentages with the RV percentage ranges for each category.
7. Use a spatial analysis to determine where current conditions depart from RV, which can help prioritize projects because we lack the capacity to implement every possible project.
8. Consider how ecosystem components interact (is the OFSS structural stage associated mostly with the ponderosa pine forest cover type?), and use these insights to identify how current conditions deviate from desired conditions.
9. From a temporal standpoint, consider an area's recent disturbance history and then decide if an RV analysis is appropriate at this time. An RV analysis was not completed for the Tower Fire because much of the 52,000-acre analysis area experienced uncharacteristic fire effects (more stand-replacing severity than is typical for fire regime 1), so the resulting composition, structure, and density did not reflect a landscape in dynamic equilibrium with its inherent disturbance regime.

Literature Cited in This Letter

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In the future, this letter may be revised or withdrawn in response to Forest Plan revision, climate change adaptation strategies, new science findings, and other circumstances.

If you have questions about the RV information (tables 1-3) or how to apply the RV concept, please contact Dave Powell (541-278-3852).

/s/ Kevin Martin
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cc: David C Powell