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To: USDA Forest Service, USDI Bureau of Land Management

Concerning: RFI on Federal Old-Growth and Mature Forests

To Whom it May Concern

I would like to offer suggestions for how to define old growth and mature stands on National Forest System lands and forest lands managed by the Bureau of Land Management. Most of my experience has been in the forests of Oregon, Washington, Idaho, and western Montana and my suggestions apply only to that part of the county.

I understand defining old growth and mature stands is fraught and some amount of arbitrariness is unavoidable. There are a wide range of conditions that could potentially fit any definition used and the more specific the definition, the fewer stands that may meet that definition. Past definitions have often been too vague or predicated on conditions that did not reflect historical disturbance regimes.

What criteria are needed for a universal definition framework that motivates mature and old-growth conservation and can be used for planning and adaptive management?

Any old growth and mature stand definition should depend on potential site productivity, dominant disturbance regime, and climate. The inclusion of climate is critical as it is also a driver of the dominant disturbance regime(s) and site productivity. Use of the FIA and related databases and potentially the LANDFIRE database can assist with grouping areas into general forest types. However, the climate is changing and altering disturbance regimes and site productivity. As such, any current maps of forest types are likely of limited use for land use planning purposes. However, climate and vegetation modeling can assist in determining where certain forest types are likely to move, assuming a migration pathway exists. Planning and adaptive management should include such modeling to determine where changes are needed, such as opening stands in drying sites to order to allow existing large trees to persist in the face of drought.

However, current models may not adequately reflect how disturbance regimes are changing. Where are warming and wetter winters likely to significantly increase snow breakage? Where are flooding risks altering stands structures and species compositions in riparian areas? Where are insect or disease outbreaks likely to increase or become more severe or what new pests and diseases likely to emerge or become significant? While answering these questions will not help define old growth or mature stands, answering them can assist in understanding what type of old growth or mature stand is likely to develop or persist and what management actions or policy changes may be needed.

For adaptive management purposes, the agencies may need to make use of assisted migration in older to permit the development of mature and old-growth forests of certain species. Human developments and the rate of climate change in combination with seed dispersal distances will result in the inability of some species to migrate quickly enough or to have a path of migration. Further, the agencies will likely need to consider assisted migration of different genotypes of a given species to replace current genotypes that cannot persist in the changing climate. For example, it will likely be necessary to include Douglas-fir genotypes adapted to drier conditions when planting Douglas-fir in northwest Oregon

What are the over-arching old-growth and mature forest characteristics that belong in a definition framework?

Here are my suggestions:

* Tree diameter (80th or 90th percentile diameter?)
* Number/percentage of trees in the stand meeting minimum diameter criteria
* Tree structure (large limbs, bark characteristics, tree crown shape)
* Species composition (single or multiple species)
* Number of canopy layers (fewer on sites with frequent disturbance)
* Understory type (grass, shrub, herb)
* Canopy closure (more open in drier and colder sites)
* Soils
* Dominant disturbance regime(s)

The main over-arching criterion for mature and old growth stands are a dominance of large diameter trees, with the definition of [ldquo]large[rdquo] depending on site productivity and climate. A large diameter subalpine fir is likely of much smaller diameter than a large diameter Douglas-fir. A large diameter Douglas-fir is likely a larger tree in northwestern Oregon and western Washington than in central and southern Idaho. Perhaps the FIA database and other equivalents could be used to select a statistical measure, such as the 80th or 90th percentile diameter, based on existing site types.

What is meant by [ldquo]dominance[rdquo] would also need to be refined. Statistical analysis of existing data would be needed but a potential value may be that 50% or more of the trees within the stand meet the minimum large diameter. That percentage may be lower in a mature stand than in an old growth stand.

Determining the species composition of a mature and old growth stand should depend on site productivity, climate, and disturbance regimes. It may well be that current forest type definitions could still be used with the recognition that where a given forest type may occur could be shifting as the climate changes. In the moister forests, the so-called mixed conifer forests, the definition should recognize that the species composition of the dominant trees can include multiple species. In the area I know best, for the most part we are talking about conifer forests. However, there are areas where deciduous tree species can be a component, such as Oregon white oak along the lower fringe of ponderosa pine forests on the east side of the Cascades and various oaks, maples, and other species in southwest Oregon.

Tree structure refers to the characteristics of the trees meeting the minimum diameter criterion. Descriptions exist for the characteristics of old trees for some species. For conifers, these may mention the presence of large diameter limbs, canopy length or depth (no [ldquo]lollipop[rdquo] trees), whether the top of the crown is flat or pointed (depends on species), how deeply furrowed or flakey the bark is, and similar characteristics. An old growth stand would need to meet more of the criteria or meet them on more trees than a mature stand would.

The number of potential canopy layers in an old growth or mature stand would vary by site productivity and disturbance regime, primarily fire in the area I am most familiar with. More frequent fire would tend to limit the number of canopy layers that can persist. Mixed severity fire regimes may support more canopy layers than frequent or infrequent fire regimes. The former because of removal of younger or smaller trees, the latter because of the degree of shading from the dominant trees. I am unsure how smaller scale disturbances, such as blowdown, snow breakage, or scattered insect/disease mortality should be considered as these events can open holes and allow establishment of another tree layer. It may depend on whether the definition criteria would reply more on coarse-scale disturbances, such as wildfire or epidemic insect outbreaks, or also include finer scale disturbances, such as scattered mortality from whatever cause. In forest types where multiple canopies can be expected, a mature stand could have fewer canopy layers than an old growth stand, but in forest types where only one canopy layer can be expected, average or median diameter of the large trees may be a more suitable

criterion to separate mature from old-growth stands.

Use of understory composition as a component of any old growth or mature stand definition should only be general as climate change affects what species can grow where. Understory definitions may be limited to general categories, such as grass, dry shrubs, moist shrubs, herbs, or similar definitions. Local units may need to experiment with different understory plant species or else simply accept what comes in. Further, as climate changes, populations and densities of unwanted invasive species could become an increasing problem and the agencies will need to develop methods and policies for addressing an expected increase in invasive plants. Addressing invasive plants could be quite difficult as the agencies currently limit the use of herbicides. Training personnel and developing policies using Ecologically based Invasive Plant Management, that considers ecological sites and acknowledges that one-time treatments are usually inadequate, will be needed.

Canopy closure should vary by site productivity and dominant disturbance regime. For example, old spruce-fir stands near or at timberline and old ponderosa pine stands at lower timberline should be quite open, approaching woodland. High canopy closure should be expected only on highly productive sites. Canopy closure should also be based on the number of expected canopy layers.

For too long, foresters have essentially ignored the role soils play in determining what can grow where with a few exceptions, such as the ultramalfic soils in southwest Oregon. Particularly as moisture regimes change, understanding how those changes affect soil moisture regimes, decomposition rates, and soil biota will have an impact on the plant communities that can establish and persist on different sites.

Disturbance regimes can affect what type of mature and old growth forest can develop and persist. In much of the Intermountain West, fire regimes may well be the dominant disturbance type, although drought appears to be emerging as a dominant regime as well. Further, drought regimes can drive other disturbance types, such as fire, insects, and disease. It may well be that in the western US, drought in combination with one or more other disturbance types may be the main driver of what type of mature and old growth forest type can persist. These factors may be particularly important for old growth types that are actually an earlier seral stage, such as ponderosa pine and western white pine. A few species can provide mature and old growth forest functions that are never a climax species, such as western white pine and western larch.

How can a definition reflect changes based on disturbance and variation in forest type/composition, climate, site productivity and geographic region?

Any definition should modify the criteria used based on dominant disturbance regime(s), climate, and site productivity. The FIA and related database and LANDFIRE maps could be used to divide areas into general forest types and publications such as fire ecology guides, ecological site descriptions, and plant association/habitat type guides could be used to further refine the definitions for different geographic areas. However, the agencies need to recognize that any maps of current forest types are of limited use given the rate of climate change. Nonetheless, the definitions may still be useful for understanding what definition to apply in a location as climate and vegetation modeling indicates where general forest types may be moving to.

As climate change affects and creates new disturbance regimes and as species compositions shift it can be difficult to determine the appropriate species composition or dominant tree criteria. The agencies can look to the past, pre-settlement conditions for evidence on which species to expect on what type of site. The agencies need to recognize that existing large trees can persist on sites that currently would not allow the same type of stand to reestablish given changed climate and alter plans accordingly.

What, if any, forest characteristics should a definition exclude?

One mistake made in the past was the conflation of old growth and late successional stand conditions.

Considering these two terms as synonyms failed to account for how disturbance regimes could hold a forest in an earlier successional stage but allow for the development of old growth conditions. For example, old growth ponderosa pine forest could, and likely was, an earlier successional stage found on sites that could have supported Douglas-fir or true fir forests. Similarly, some past old growth forests were dominated by species, such as western white pine or western larch, that would disappear in a late successional stage. Therefore, I suggest that the agencies consider old growth forest and late successional forest as two different types. In some cases, they may be synonymous, but I believe in more cases they will not. A given site may be capable of supporting more than one old growth type depending on disturbance regimes, site productivity, and climate.

A downed log criterion should be used cautiously, if at all. There is simply too much variation to characterize what to expect for downed log extent, distribution, and size. The presence of downed logs depends on the type and extent of past disturbances and how long ago the disturbance(s) occurred. The persistence of downed logs depends on dominant disturbance regime type, decay rates, and the species composition of the downed logs. I have visited several stands that those present agreed were old growth but that lacked above-ground evidence of large numbers of downed logs. About the only consistent thing I can say about downed logs is that in moister forests, the soil often contained a moderate to high degree of punky logs even where few or no downed logs were obvious on the duff surface.

I hope these suggestions are useful. Thank you for the opportunity to comment.

/s/ Louisa Evers