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First name: K. Norman

Last name: Johnson

Organization:

Title:

Comments: Defining Mature and Old-Growth Forests

Jerry F. Franklin and K. Norman Johnson

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USDA Forest Service and USDI Bureau of Land Management have requested input on development of a definition for old-growth and mature forests on Federal Lands and provided a series of five questions. We have organized our input around these five questions followed by recommendations for an inventory to identify those forests.

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

It is not possible to develop a single definition of mature and old-growth forests [hereafter referred to as "older" forests] because the nature of older forests varies markedly with forest type and region. Much of this diversity is encompassed by two broad categories of older forests that differ in their natural disturbance regime and, consequently, in their fundamental structure. These are: 1) older forests developed on sites characterized by infrequent (episodic) severe wildfire and 2) older forests developed on sites characterized by frequent (chronic) low-severity wildfire. We will refer to these as Moist and Dry Forests, respectively. Examples of Moist Forest include coastal Douglas-fir, many eastern hardwood forests, and most western subalpine forests. Examples of Dry Forests include ponderosa pine forests in the Intermountain West and longleaf pine in the southeast. Wind can be a significant disturbance in either of these two categories of forest but we emphasize wildfire here, because frequent (chronic) wildfire is what produces the distinctive composition and structure of Dry Forests.

These two categories of older forests share some common attributes including the: 1) Presence and often dominance of large old trees, large snags, and large down logs, with the definition of "large and old" varying with the forest type and other considerations; 2) Irregularity in the distribution of trees and other vegetation (spatial heterogeneity or patchiness).

Otherwise, the structure of older Dry and Moist Forests in their natural states contrast greatly. Older Moist Forests have high tree densities with diverse tree sizes (including large old trees) and dense canopies that are either continuous or multi-layered. Older Dry Forests commonly have low density stands composed primarily of older trees and relatively open high canopies, except in regeneration patches.

The recognition of two fundamentally different types of forests helps motivate mature and old-growth forest conservation and can be used for planning and adaptive management. Policy in episodically disturbed forest types needs to focus on retention and protection of mature and old-growth forest stands. Policy in frequent-fire forests needs to accommodate and encourage active management to restore and maintain these forests during which existing mature and old trees are retained and their populations are rebuilt.

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

The overarching (i.e., common) characteristics of older forests are: 1) large old trees of one or more species and the dead derivatives of those large old trees - large snags and large down logs; and 2) spatial heterogeneity in the distribution of trees and other vegetation, often evident as patchiness in density and canopy cover, gaps, and

clustering of trees.

An origin-date threshold of the oldest cohort (for example, 1920) is perhaps the best single attribute for defining the forests and trees for consideration in an initial inventory. Stands that have had past partial cutting should be considered if they otherwise meet the definition of mature or old-growth forest. Use of an origin date would ease analysis and implementation. Use of origin date also reduces the potential for future conflict in growing managed forests that incorporate mature and old trees that may be subject to eventual harvest. A mature and old-growth forest policy should encourage foresters to grow mature and old-growth trees as part of their managed forests and not discourage them, which a ban on harvesting any tree over a given age, regardless of origin, would do.

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

First, there must be at least two different general definitions to deal with the fundamental differences in forest structure between older forests on sites that were historically frequently disturbed and older forests on sites historically subject to infrequent or episodic disturbances. That will deal with the major (fundamental) differences in older North American forests related to disturbance regime. Otherwise, the differences recognized among sites, types, etc., in defining mature and old-growth forests should be largely quantitative rather than qualitative.

How can a definition be durable but also accommodate and reflect changes in climate and forest composition?

An adaptive approach to older forest definitions as well as policies for the management of these forests should be utilized. Periodic assessments (monitoring) of these forests will be necessary to identify any fundamental changes in biota, structure, and function and to adjust management approaches needed to maintain the ecosystem functions of older forests in a changing world.

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

Dense, high-biomass forests are not a desirable characteristic that should be included in a definition for older forest on landscapes that were historically subject to frequent fire (Dry Forests). Such forests were, under their natural disturbance regime, dominated by open forests of older and larger trees. Many of these forests have become dense as a result of past management practices including exclusion of fire. Dense Dry Forest stands that still have significant populations of older trees do need to be included in the inventory. However, policies for such Dry Forests need to allow for restoration with the proviso that the older trees must be retained as stand densities are reduced. A policy that does not allow restoration of older Dry Forests will doom the older tree populations; they will be lost through fire, drought, and/or bark beetle attack.

#### A Process for Identifying Older Forests on Federal Lands

We view mapping older forests as a multi-step process. An initial map developed from remote-sensed data will need to undergo significant ground checking if the intention is to use it in implementing policy rather than simply indicating the general location of older forests. A process involving agency field personnel would be appropriate to determine the accuracy of any map to deal with potential errors of both inclusion (forests initially identified but prove not to be older) and exclusion (i.e., older forests that the mapping process failed to identify). In fact, it may be necessary to finalize locations of older forests as local management plans are developed and implemented.

Age of the oldest forest cohort present in candidate forests is an important criterion. For many of the important functional attributes of older forests, it is the old trees, with their distinctive features, that have special functional significance. Large younger trees are not capable of fulfilling many of these functions so presence of large young trees is, by itself, not a useful criterion for identification of older forests. A brief summary of some of the unique attributes of older trees is attached (Attachment #1).

Characterization of older Moist Forests has been most successful using multiple structural and compositional attributes integrated into a numeric index of "old growthedness." This, with an aging of older trees in the stands, has been successfully used by the Washington Department of Natural Resources to identify older forests on lands that they administer in western Washington (see below). Avoid focusing on maximal values of a single attribute (e.g., biomass) in these definitions.

On the other hand, identification of older Dry Forests simply requires the identification of stands with a significant population of older trees. The majority of the Dry Forests have been drastically modified from their historic condition by grazing, logging, and elimination of periodic wildfires. Presence of some of the attributes characteristic of older Moist Forests, such as a high density of large younger trees and multiple canopy layers, are not desirable characteristics of older Dry Forests and should not be utilized to identify mature and old growth Dry Forests in the upcoming inventory; they are primarily a consequence of modern human activity.

Objections sometimes are raised to using age to identify older forests and trees as we propose above on the basis that that will require extensive increment boring of trees. Our experience in the Pacific Northwest is that, with training, the majority of older trees can be accurately determined from external features of trees, such as the bark and canopy structure.

Distinguishing between areas historically subject to frequent fire and those subject to episodic fire (i.e., between Dry and Moist Forests) is an essential step in inventorying older forests. As noted earlier, older forests developed under a frequent fire regime are fundamentally different in their structure from older forests developed on sites subject to infrequent wildfire (Attachment #2). Policy and management ultimately need to reflect those differences. The best way that we have found to distinguish between sites of Dry and Moist Forests is by using forest vegetation zones based upon plant association or habitat type classifications. Such classifications exist for all federal lands, at least in the west and we have attached a map of such zones for the range of the northern spotted owl (Attachment #3). Such classifications were utilized to distinguish the two categories of older forests (Moist and Dry) in recent legislation proposed for conservation of old-growth forests by Senator Wyden, for example, demonstrating their practical use in policy and management.

Washington State Department of Natural Resources successfully used a mapping exercise and evaluations of stands using an old-growth index based on multiple structural attributes to identify old-growth Moist Forests on lands that they manage. This was followed by field checking, which included visits to the relatively few stands that could not be successfully classified without an on-site examination. Identification of older Dry Forests was done by determining whether or not there were significant populations of mature and/or old trees present in stands. It was not necessary for stands to have a dominance of older trees for them to be identified as the older Dry Forest.

Attachment #1. Pages 5 - 12 of comment letter: The Ecological Significance of Older Trees (From Franklin, Johnson, and Johnson. 2018. Waveland Press, Long Grove, IL., p. 32