A Statutory or Regulatory Definition of Two Forest Archetypes Applicable to Federal Forest Policy Nationwide: Frequent-Fire Forests and Infrequent-Disturbance Forests

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Abstract

This paper proposes the recognition of two forest archetypes for purposes of setting federal forest policy to optimize carbon storage and sequestration, biological diversity, and watershed integrity. For Pacific Northwest federal forests, a common management distinction is made between "dry" and "moist" forest types. As one looks to the greater range of forest types nationwide, the terms and distinction become less useful. A more useful distinction is between "frequent-fire" and "infrequent-disturbance" forest types. The climate, ecology, and geography (including location, slope, and aspect) of a forest determines whether it represents the "frequent-fire" archetype or the "infrequent-disturbance" archetype (with conifer and deciduous subarchetypes).

While physical characteristics generally drive the definition of and distinction between the two nationwide forest archetypes, past and current management practices drive the appropriate form of conservation for each going forward. For the infrequent-disturbance forest, where little or no human disturbance has occurred, no logging of mature and old-growth stands is the appropriate approach. For the frequent-fire forest, where past high-grade logging, fire exclusion, and/or livestock grazing have often resulted in stands with unnaturally high numbers of mostly small trees per acre and unnaturally low numbers of large old trees on those acres, management for scientifically sound restoration is appropriate. In the infrequent-disturbance forest, it is all about the conservation of forest stands, while in the frequent-fire forest, it is all about the conservation of large and old trees.

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Introduction

As public lands conservationists seek statutory and/or regulatory protection of federal forests throughout the United States, from the Alaskan rainforest to the Hawaiian and Puerto Rican tropics, any new federal forest policy should be responsive to the significant ecological differences among the diverse forest types represented in these federal forests. In addition, such policy needs to acknowledge the differing management histories of different forest archetypes. To meet the goals of carbon storage and sequestration along with conservation of biological diversity, management of such forests will also need to differ going forward.

It is both ecologically and politically clear that accommodations must be made for management of conifer forests whose structure, composition, and function are driven by frequent fire. Traditionally, distinguishing between dry forests and moist forests has been a workable construct when considering the forests of the Pacific Northwest. However, not all forests in the United States are conifer forests or easily fit on a strict dry-moist continuum, where a line can be drawn that specifies different management directions for each type. In those situations, site-specific approaches are needed to identify and responsibly manage the forest based on ecological needs.

The Need for Different Management Directions for Moist and Dry Forests

To conserve biological diversity, protect watersheds, and remove carbon pollution from the atmosphere, the best course of action for forests generally known as "moist" is to simply stop logging them (generally known as "proforestation" [2]). Perhaps not surprisingly, this simple and elegant management prescription does not work in many cases for forest types generally known as "dry." Dry forests are characterized by frequent, beneficial fire. Fire exclusion through active suppression and livestock grazing that removes fine fuels—as well as high-grade logging of the most valuable trees, which have tended to be species most resistant to fire—has resulted in forests significantly outside the historical range of variation. In these cases, restoration techniques including judicious logging of mostly small trees can be helpful. Thus, management directions must necessarily be different for the moist and dry forest types.

The Need for Revision of the Dry-Moist Bifurcation

The construct of dry versus moist forest types arose first in the Pacific Northwest, where the distinction is relatively clear and almost all forests are dominated by conifers. As can be seen in Appendix A, arguments still ensue as to where exactly to draw the line between the two. When attempting to define and distinguish moist forest types from dry forest types in legislative language, Senator Ron Wyden (D-OR) specified plant association groups that characterize each type. This was just for western Oregon (notice that the legislative language hedged and said that the "moist grand fir" or "moist white fir" [as opposed to their *dry* counterparts] could be either managed as dry or moist forest areas), and mainly lower-elevation western Oregon forests at that. Imagine trying to do this for the entire nation. Conservationists don't want to go there.

In any event, the dry-moist bifurcation breaks down as one takes a national perspective on forests. Much of the forestland in the United States is dominated by broad-leaved deciduous species, not conifer species, which are most common in the Pacific Northwest. Even in what are

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[2] Moomaw WR, Masino SA and Faison EK (2019) Intact Forests in the United States: Proforestation Mitigates Climate Change and Serves the Greatest Good. Front. For. Glob. Change 2:27. doi: 10.3389/ffgc.2019.00027

relatively "dry" deciduous forests, the major large-scale stand-replacing event is not fire but wind. (Small-scale disturbances to the stand include insects and disease.)

Two New Forest Archetypes and Related Conservation Strategies

Preeminent forest scientists Jerry Franklin and Norm Johnson gave us the dry-moist construct (and heavily influenced Senator Wyden in the aforementioned legislation). In their new forestry textbook (co-authored with Debora Johnson), *Ecological Forest Management*, [3] they describe three forest archetypes for the United States based on disturbance regimes and major tree species:

> • *Conifer-dominated forests initiated by infrequent (episodic) severe wildfire*
> • *Hardwood-dominated forests initiated by infrequent (episodic) severe windstorms*
> • *Conifer-dominated forests characterized by frequent (chronic) wildfire* [4]

Though the three forest archetypes proposed by Jerry Franklin et al. have nationwide applicability, in terms of conservation it is still the case for the two infrequent-disturbance forest types that the best conservation strategy is preservation: do not log them. For the frequent-fire forest type, often the best conservation strategy is a restoration approach that (1) lets most residual large trees continue to grow in size and age, (2) allows for and/or reintroduces fire, (3) prevents livestock grazing, and (4) practices a forestry that restores the natural species composition and density until nature, through chronic fire, can again fully regulate the forest archetype. The latter can include judicious logging with adequate sideboards.

Thus, I propose two new forest archetypes (with one archetype having two subarchetypes) to drive management directions nationwide: frequent-fire forests and infrequent-disturbance forests (conifer and deciduous. New federal forest policy should emphasize the conservation of older forests. It is appropriate to focus such policy on stand-level conservation of infrequent-disturbance forest archetypes and tree-level conservation of frequent-fire forest archetypes. (See my concurrent paper entitled "Defining the Minimum Age of a Mature Forest in Either Legislation or Regulation.")

Defining the New Bifurcation in Statute and Regulation

The following definitions, applicable to both legislation and regulation, are proposed:

> (a) DEFINITIONS.—
>
> (1) FREQUENT-FIRE FOREST TYPE.—The term "frequent-fire forest type" means a type of forest that in its generally natural condition is dominated by conifers and characterized by frequent (chronic) wildfire. Examples include ponderosa pine–dominated forests, longleaf pine forests, pitch pine–hardwood forests, and various pine species–oak species forests, as generally described in Part 3 of Chapter 3 of the forestry textbook *Ecological Forest Management* (Waveland Press, 2018).

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[3] Franklin, Jerry F., K. Norman Johnson, and Debora L. Johnson. *Ecological Forest Management*. Long Grove, IL: Waveland Press, 2018.

[4] To understand these three forest archetypes, including their commonalities, differences, and gradations, I refer you to *Ecological Forest Management*, in particular Part 3 of Chapter 3, "Important Natural Forest Archetypes" (pages 64–82).

(2) INFREQUENT-DISTURBANCE FOREST TYPE.—The term "infrequent-disturbance forest type" means a type of forest that in its generally natural condition is either:

(i) CONIFER-DOMINATED FOREST.—Conifer-dominated forests initiated by infrequent (episodic) disturbances (usually fire, but also wind, volcano, insects, or pathogens), most typically, but not exclusively, found in the western United States and Alaska. Examples include Sitka spruce forests, Douglas-fir–western hemlock forests, lodgepole pine forests, jackpine forests, red and eastern white pine forests, and subalpine fir–Engelmann spruce forests, as generally described in Part 3 of Chapter 3 of the forestry textbook *Ecological Forest Management* (Waveland Press, 2018).

(ii) HARDWOOD-DOMINATED FOREST.—Hardwood-dominated forests initiated by infrequent (episodic) events (usually wind, but also fire, insects, or pathogens), most typically found in the eastern United States. (In cases where fire is a more important agent of disturbance, conifer trees are more significant components of such forests.) Examples include maple forests, beech forests, ash forests, walnut forests, and oak forests, as generally described in Part 3 of Chapter 3 of the forestry textbook *Ecological Forest Management* (Waveland Press, 2018).

Incorporating by reference a very specific and limited part of the textbook *Ecological Forest Management* would allow managers to learn and apply the two major archetypes (and the conifer and deciduous subarchetypes) to the multitude of forest types found in the United States but would not give the agencies license to practice the kinds of silviculture detailed elsewhere in the book.

Legislative Definition of "Moist," "Dry," and "Mixed" Forest Types Found in the Proposed Oregon and California Land Grant Act of 2015

Senator Ron Wyden (D-OR) (with Senator Jeff Merkley, D-OR, cosponsoring) introduced the proposed Oregon and California Land Grant Act of 2015 (S.132; 114th Congress). The legislation prescribed management by "forestry emphasis area," either "moist" or "dry." However, two plant association groups (Moist Grand Fir and Moist White Fir) are included in the definitions of *both* emphasis areas, and this overlap is handled by deeming forests with these plant association groups "mixed forests." The definition of "mixed forest" allows the Secretary (the Bureau of Land Management) to call such a forest either "moist" or "dry" "to align with the designations of adjacent [plant association groups]."

Here are the criteria the bill proposes be used in deciding how to designate a forest:

(B) MOIST FORESTRY EMPHASIS AREA.—For purposes of this subsection, land in the Moist Forestry Emphasis Area generally—
(i)(I) would have historically experienced infrequent wildfires at intervals that are greater than 100 years; and
(II) these wildfires would have included significant areas of partial or complete stand-replacement intensity; and
(ii) dominated by 1 or more of the following plant association groups:
(I) The Western Hemlock (*Tsuga heterophylla*) series.
(II) The Sitka Spruce (*Picea sitchensis*) series.
(III) The Western Red cedar (*Thuja plicata*) series.
(IV) The Pacific Silver Fir (*Abies amabilis*) series.
(V) The Mountain Hemlock (*Tsuga mertensiana*) series.
(VI) The Subalpine Fir–Engelmann Spruce (*Abies lasiocarpa–Picea engelmannii*) series.
(VII) The Tanoak (*Lithocarpus densiflorus*) series.
(VIII) The Moist Grand Fir (*Abies grandis*) plant association group.
(IX) The Moist White Fir (*Abies concolor*) plant association group.

(C) DRY FORESTRY EMPHASIS AREA.—
For purposes of this subsection, land in the Dry Forestry Emphasis Area generally—
(i)(I) would have historically experienced relatively frequent wildfires; and
(II) these wildfires would have been predominantly low or mixed in severity; and
(ii) dominated by 1 or more of the following plant association groups:
(I) The Moist Grand Fir (*Abies grandis*) plant association group.
(II) The Moist White Fir (*Abies concolor*) plant association group.
(III) The Ponderosa Pine (*Pinus ponderosa*) series.
(IV) The Oregon White Oak (*Quercus garryana*) series.
(V) The Douglas-fir (*Pseudotsuga menziesii*) series.
(VI) The Jeffrey Pine (*Pinus jeffreyi*) series.
(VII) The Dry Grand Fir (*Abies grandis*) plant association group.
(VIII) The Dry White Fir (*Abies concolor*) plant association group.

(D) MIXED FORESTS.—
(i) IN GENERAL.—For purposes of this subsection, the Secretary may consider land that contains a Moist Grand Fir or a Moist White Fir plant association group as Moist Forestry Emphasis Area or Dry Forestry Emphasis Area based on the condition of the land, landscape context, or management goals.
(ii) MIXED FORESTS.—For land that meets criteria under both subparagraphs (B) and (C), the Secretary may choose to categorize the land as either Moist Forestry Emphasis Area or Dry Forestry Emphasis Area to align with the designations of adjacent covered land.