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Comments: There is ample scientific research confirming that Old Growth forests essential role in habitat for biodiversity, carbon sequestration, water quality and quantity. It is critical that we protect our remaining old growth in the United States and inspire countries around the world to do the same. It is imperative that we immediately protect all old growth and mature forests. We need to start selecting for cooler, moist climates which Old Growth and Mature forests provide. Old Growth trees populations are dwindling and need the opportunity to continue to grow and mature trees are the old growth of the future, we need to cultivate old growth forests. It is crucial that we end commercial timber sales across our national forests in order to properly preserve, protect and keep the intended promise of president Biden's Earth Day Executive Order.
Even areas that have been burned, retain more carbon, water and habitat and all National Forest and BLM lands with old growth and mature trees need to be excluded from timber sales regardless of whether they have been burned.

This comment period is responsive to Executive Order 14072 which specifically identifies the protection of forests to store carbon. At roughly 80 years of age, carbon storage ramps up in most forested stands due to tree maturity. According to recent research, an 80-year stand age limit would likely capture at least 40% of the carbon stores accumulated in the largest trees because carbon stocks increase dramatically as forests mature (Stephenson et al. 2014, Mildrexler et al. 2020, Law et al. 2022. DellaSala 2015., Frey 2016., Betts. 2017).Old-growth and mature forests throughout the West support similar characteristics, but with
varying levels of abundance. For example, the moist older forests of the Pacific Northwest often support relatively long fire return intervals and high growth rates. This creates older forests with closed canopy conditions, large diameter trees, an abundance of large snags and downed trees, and multi-layered canopy structure. Drier pine forests support more open groves of pine trees with less tendency to accumulate large quantities of snags or downed wood. These pine forest maintains groupings or groves of relatively even-aged older trees, with patches of regeneration, dry bunchgrass habitat, and some understory shrub species. Meanwhile lodgepole pine may be relatively dry, but cool and maintains denser, closed forest conditions as they mature. Oak woodland on the other hand can accumulate downed wood, snags and decadence very slowly and often does not support extensive closed canopy conditions. Instead canopy conditions are often very diverse, ranging from open savannah form groves, to relatively even-aged stands of stump sprouting hardwoods.

Some forests have evolved with fairly frequent, mixed severity natural disturbance processes, while other locations have evolved with relatively infrequent, but often very severe natural disturbance processes that create overstory tree mortality and alter forest characteristics through disturbance and succession.
The following characteristics of mature and old-growth should be used in the definition framework for President Bidens Earth Day Executive Order and should be defined relative to the plant community in which they are located. For example, as described above different forest communities will contain different concentrations of these characteristics, but the following characteristics can be used to define mature and old-growth forest throughout the federal land system.
* Large Snags: Large snags can be abundant at different quantities in different forest types, but in general large snags are a characteristic of mature or old-growth forest habitats. In mature forest snags will either be present in sufficient quantity or they will contain sufficient forest habitat to adequately recruit snags for old-growth forest

development. This requires stand and tree redundancy, where enough trees are present on site to allow for mortality from natural disturbance processes and snag recruitment. It also requires maintaining stand density sufficient to sustain some level of inter-tree competition, canopy cover and enough trees per acre to allow for tree mortality as a stand transitions overtime from mature to old-growth forest conditions. In moist forests both snags and downed wood can be quite abundant, while more open, arid forests and woodlands snags would be relatively less abundant.

Additionally, the definition of large snags can be relative. In more productive forest types including more coastal or moist Douglas fir forests, most mixed conifer forests, and other more productive forest types, large snags could be defined as those over 20" in diameter, while in oak woodlands and arid pine forests large snags could include those down to 12" diameter. Obviously, the size and frequency of snags will vary depending on forest types, precipitation levels and soil types, but mature stands are generally in the processes of recruiting adequate snag habitat, while old-growth forest often supports relatively abundant snag habitat. Either way, snags are important characteristics of mature and old forest habitat and in many cases the largest, oldest forest structures standing in a forested environment are the snags that have lived a long, productive life and now as they decay create some of the most important wildlife habitats.

* Coarse downed wood: Coarse downed wood is an important characteristic of mature and old forest habitat. Old-growth forests often contain significant coarse wood, which has accumulated over many years and through many natural disturbance events. These natural disturbance processes often create flushes of tree mortality and can accelerate the development of old-growth characteristics if mixed severity events also leave enough living forest cover to sustain a mosaic of age-classes including old-growth trees, tree groupings, groves or forests.

Drier, more open woodlands and forests will naturally generate less coarse wood and in fire prone forests downed wood is also subject to repeated fire events which can reduce coarse wood abundance. Thus, like snags, the size, frequency and complexity of coarse downed wood habitat is relative and will be impacted by general stand productivity, slope position, solar exposure, plant community, soil types, and other conditions. Some mature and old-growth forests will sustain, develop and build large quantities of coarse downed, while other habitats will sustain less due to lower levels of productivity or more active

fire regimes. Either way, coarse downed wood creates important wildlife habitats and is vital for both water retention and ongoing soil productivity.

In fact, a study conducted in southwestern Oregon following an extended drought and large wildfire event demonstrates the importance of downed wood as a water reserve in both living forests and in habitats that have sustained stand replacing disturbance events. Living forests generate coarse wood incrementally through small scale natural disturbance patterns that create new snags and as old snags or live trees fall to the forest floor. In a stand replacing disturbance (either wildfire, windthrow, or bark beetle outbreaks) snag habitat and in turn coarse downed wood is developed in pulses that are important for habitat complexity, soil productivity, regeneration following that disturbance event, wildlife, and water retention through extended drought events. They are also important because at times they are the only input of snags and coarse downed wood for many decades, until forest habitats can again mature and begin producing a new cohort of large diameter snags and downed wood.

Coarse wood retention and recruitment is important for both maintaining the health of existing old forest habitats and recruiting additional old forest habitat by allowing mature forests to develop additional old-growth characteristics including coarse downed wood. It is also a characteristic of old-growth forest and most mature forest have at least begun

recruiting adequate coarse wood.
* Large diameter trees: Obviously, large diameter trees are an important component of mature and old-growth forest habitat, but the size and/or definition of a large diameter tree will change depending on the productivity of the site, the annual precipitation, soil conditions, solar exposure, slope position, historical land management patterns, historic disturbance patterns and other factors. In the arid forests of the West, potential tree diameter and height can be very different depending on site conditions and tree species. Yet, in the moist forests of the Pacific Northwest individual or mean tree diameter can be potentially far greater. Some woodlands such as oak habitats and some pine habitats, as well as some alpine or subalpine forest associations simply do not grow large diameter trees or trees of stature, but they can become quite old and successionally developed nonthe-less. In general, in the moist forests of the Pacific Northwest trees over 20" diameter should be considered large diameter trees due to their relative lack of abundance (from historic logging and natural disturbance processes) and due to physiological and structural changes that often occurring in trees roughly 80 years of age and older and over 20" diameter. Trees over 20" diameter should be retained and all stands over 80 years of age should be protected from commercial logging. This should apply to the moist forests of western Oregon, western Washington, northwestern California and portions of northern Idaho. Additionally, we believe the 20" diameter rule and 80 year old stand age protections should be extended to forests in the arid West, east of the Cascade Mountains and should be considered in other arid forest types dominated by pine, dry site Douglas fir, and white fir. We would defer to local ecologist and forest scientist to determine the

applicability of this rule in the arid, interior mountain West and in dry forest habitats in Montana, Idaho, Utah, Colorado, New Mexico, Arizona and other locations.. In these less productive forests, we believe the 80 year rule should also apply, but the diameter definition of large diameter trees may need to adjusted downward.
* Interlocking branch structure: Like all characteristics of mature and old forest, the importance of interlocking branch structure is relative. In the moist forests of the Pacific Northwest and in many mixed conifer plant associations interlocking canopy structure is an important component of mature or old-growth habitat. The habitat complexity and canopy conditions created by interlocking branches and canopy habitat is highly important in maintaining the unique habitats and species found in complex, old forest habitats throughout the Pacific Northwest.
Interlocking canopy structure also provides important habitat features including denning and resting habitat for species like the Humboldt marten and Pacific fisher, nesting, roosting and foraging habitat for the Northern spotted owl, habitat for northern spotted owl prey species such as red tree voles and flying squirrel, and contributes to the canopy conditions that allow so many species to thermoregulate and find thermal cover. Species such as great grey owls, black bear, ungulates, song birds, raptors, terrestrial salamanders and nearly every other species benefits from closed canopy habitats that remain cooler in the summer heat and both warmer and less snow covered in the winter storms.
In moist, closed forests interlocking branch structure and complex canopy interactions are a regular and dominant feature of mature and old-growth forest, while in more arid plant communities and sites, interlocking canopy structure many be associated with clumps, groves or groupings of large overstory trees. Either way, interlocking branch structure (including mistletoe bromes) and the habitat features this structural condition provides are important for late successional wildlife species and is an important characteristic of mature and old forest habitat.
* Canopy cover: Canopy cover and closed canopy conditions is often a very important characteristic of mature and old forest habitat. Obviously, as groves of younger trees

develop and age, canopy cover generally increases, unless checked by natural disturbance agents.

In moist forests, most mature and old-growth forests sustain significant canopy cover and generally support closed canopy stand conditions between 60% and 100%. The high canopy, relatively dense tree structure and interlocking branching are important characteristics of mature and old forest structure.

In mixed conifer stands canopy cover can also often be quite extensive in mature and oldgrowth stands, but will be layered or stratified into a higher, more dominant conifer canopy of massive old growth trees and a lower canopy of mature hardwood species such as madrone, live oak, tanoak, black oak, white oak or other species. In these stands conifer spacing can be fairly large between groves of groupings, but canopy cover conditions can be quite dense. In other locations and often in more productive sites

succession will develop conifer dominated stands with less of a hardwood canopy component. This same pattern is evident in mature stands but stands contain smaller trees and less developed old forest structure.

The time is now to clearly define our old growth and mature forests and give them adequate protections they desire because of their important role in ecosystem function of our planet as a whole.