August 30, 2022

Submitted via https://cara.fs2c.usda.gov/Public/CommentInput?project=NP-3239
Attention Docket ID No.: FS_2022_0003

Christopher French
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RE: Request for Information on Federal Old-growth and Mature Forests; Docket No. FS_2022_0003

Dear Deputy Chief Christopher French and Director Tracy Stone-Manning,

The Nature Conservancy (Conservancy) appreciates the opportunity to comment on the U.S. Department of Agriculture Forest Service and the Department of the Interior Bureau of Land Management's Notice of Request for Information on Federal Old-growth and Mature Forests as defined in the Federal Register on July 15, 2022 (Document Citation: 87 FR 42493; Document Number: 2022-15185; Docket Number: FS_2022_0003).

Since our founding in 1951, the Conservancy has pursued our mission to conserve the lands and waters on which all life depends. Today, we operate in all 50 U.S. states and contribute to conservation outcomes in 78 countries around the world. Guided by science, we create innovative, on the ground solutions to the biggest challenges facing people and nature through ongoing collaborations with Tribal governments, federal and state agencies, agricultural and forest land managers, corporations, and other non-profit conservation groups.

We greatly appreciate the Biden Administration's commitment to strengthen America's forests and employ the power of nature to tackle climate change. Implementing President Biden's Executive Order on Strengthening the Nation's Forests, Communities, and Local Economies has the promise to make a significant contribution to the national effort to tackle the climate crisis. For questions or follow-up on our comments, please contact Alix Murdoch, Senior Policy Advisor for Natural Climate Solutions (alix.murdoch@tnc.org).

Sincerely,

Kameran L Onley

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Response to the Request for Information on Federal Old-growth and Mature Forests

Executive Order 14072, Section 2, establishes policy to restore and conserve the nation's forests, including mature and old-growth forests, and directs the definition, identification, and inventory of these forests. This first task -- defining old-growth and mature forests -- is immensely challenging given the diversity and complexity of forest ecosystems on Federal land across the United States. The Conservancy provides general comments regarding this task and the ecological context for consideration, followed by detailed input on the specific questions posed in the Request for Information on Federal Old-growth and Mature Forests.

1. *General Comments*

Mature and old forests play a critical role in forest ecosystems across the United States. For many regions, historical logging practices led to significant deficits in old forests while timber-focused management paradigms disrupted natural processes which recruit and maintain complex old forest systems. While societal concerns over logging of mature and old trees still exist, ecologically departed conditions of fragmented and homogenized forest landscapes present major threats to the long-term stability and recruitment of old-growth, driven by uncharacteristically severe disturbances and climate-driven drought. The Conservancy acknowledges that we can and should be doing more to ensure that extant old trees and forest systems persist and that forests are restored to a condition that will facilitate future recruitment of old growth in the face of a rapidly changing climate. Defining the characteristics and processes that beget old growth development are critical and we support a nation-wide effort to identify, conserve and promote old growth into the future.

However, defining old-growth and mature forests is an immensely challenging task given the diversity and complexity of forest ecosystems on Federal lands across the United States, resulting from wide variability in the biophysical environment, previous management, and underlying disturbance processes that shape forest development. It is critical that this disturbance dimension of mature and old forest development be central to their definition, identification, mapping, and conservation. Natural disturbance processes shape both forest structure (e.g., vertical and horizontal complexity, patch size, living and dead structures, tree density, size, and age distributions) and species composition (e.g., overstory and understory native species assemblages).

Consequently, a "one-size-fits-all" approach to characterizing mature and old-forests would be counterproductive to conservation by applying inappropriate or over-simplistic strategies. In many forest types, to do so would risk perpetuating the unnatural conditions present following 150+ years of unsustainable forest management practices and ignoring risks to existing and future mature and old forests due to ecologically departed forest conditions. This is particularly germane considering our rapidly changing climate and increasingly severe disturbances in many ecoregions and forest types across the United States. The complexity warrants careful consideration of strategies that conserve and restore existing mature and old forest stands, while also facilitating science-based forest restoration treatments that put ecologically departed forest landscapes on a trajectory to develop resilient, resistant, and climate adaptive future mature and old growth forest. While our comments below expand on ecological dimensions, we encourage you to also seek a broader socio-economic context by actively consulting with forest-dependent communities, Tribes, and other stakeholders before finalizing these definitions.

2. *Ecological Context*

Acknowledging that "mature" forests are not synonymous with old-growth is critical in defining how to adequately distinguish and map old growth characteristics, while identifying mature forests and the restoration of ecological processes needed to recruit them to old-growth stages. Numerous models have been employed to define various stages of forest succession (e.g., Franklin et al 2002, Oliver 1980), including the temporal and spatial changes that beget old-growth structural stages. Old growth forests are defined by the long temporal scales (>150 years) needed to create complex structure, decadence, and persistent legacy structures, in conjunction with episodic or chronic disturbance pressures.

Traditional successional models for moist forest systems assumed an absence of subsequent major disturbances following a given stand-replacing/catastrophic disturbance (e.g., fire or logging). Succession followed from early seral herb/shrub to shade-intolerant tree canopy closure, mature forest development and finally a "climax" old-growth state where large trees die, canopy openings develop, and shade-tolerant late-successional species prevail. However, disturbances processes (at tree, patch, stand, and landscape-scales) are critical in the development of old-growth characteristics and retention of long-lived species across forest systems, especially in systems adapted to frequent fire, biotic-disturbance agents, wind events, and floods.

More recently, chronic and episodic fire has been identified as a predominate process that drives the resilience and resistance of many disturbance-adapted old-growth legacy trees, even in many moist and mesic forest systems where frequent natural fire occurred or indigenous burning practices were commonly employed. Geographic and climatic factors drive productivity across these forest systems, leading to significant variation in disturbance regimes, successional processes, tree species, size and age distributions, course dead wood, and thus old-growth forest structural development (Figure 1). Therefore, no single metric determines the characteristics of old growth across forest systems, leading to complications for the conservation of remaining patches in the face of climate changes and severe disturbances.

As most of the old growth had been logged via clear-cutting or high-grading during the past 150-200 years across the US, what remains are varied-size patches of old-growth trees (larger extant stands being most common throughout the west) within landscapes otherwise dominated by a mix of young and maturing forests (i.e., slowing of mean annual increment and initial development of complexity). Much less remains in the eastern US, and what exists are often smaller isolated patches that are compositionally and functionally altered from their historic state.

While mature forests have the potential to develop into old growth, most forest systems have developed into novel landscapes where predominant disturbance regimes have been majorly altered, leading to destructive feedbacks which reinforce forest homogenization and further loss of old growth during catastrophic disturbance events. This presents two major problems in the face of climate change: (1) loss of remaining old growth due to high-severity fires, insects, and disease from adjacent young/mature forests, (2) lack of old growth recruitment due to the replacement of long-lived and widely spaced fire/drought/insect/disease tolerant species by shade tolerant, but fire/drought/disease intolerant species and invasive species understories.

Historically, open mesic and dry forest systems, where much old growth can still be found, were shaped by under-burning of fine ground fuels during dry summer months, maintaining shade intolerant, thick-bark, fire-resistant trees at or below the capacity of the biophysical environment to sustain them. In

contrast, contemporary mesic and dry forest systems without frequent fire have reached a climax stage at or above biophysical carrying capacity, resulting in heavy accumulation of living and dead fire-prone vegetation, competition induced mortality and proliferation of insects and diseases. Although moist old growth forests are more generally characterized by such climax states and high vertical complexity, landscape patch dynamics have been dramatically altered, and isolated patches are increasingly subjected to edge effects, severe weather events and uncharacteristically large patches of stand replacing fire.

Therefore, proactive restoration including the careful reintroduction of disturbance processes across forest landscapes is critical for the maintenance of current old growth, recruitment of future old growth conditions and retention of disturbance-adapted genetics into an uncertain future.

As the debate over old growth has recently resurfaced over concerns regarding treatments in mature forests, more focus has been placed on ecosystem services provisioning to society, including carbon storage, water regulation and aesthetic/spiritual values, among others. Societal concerns over biodiversity loss and climate change have now also been reapplied to mature forests that have developed post-colonial logging and fire exclusion. Many ecologists, however, are increasingly concerned for the long-term stability of these systems and their ability to develop into old growth without first succumbing to severe fire, drought, insects and diseases and extreme weather events.

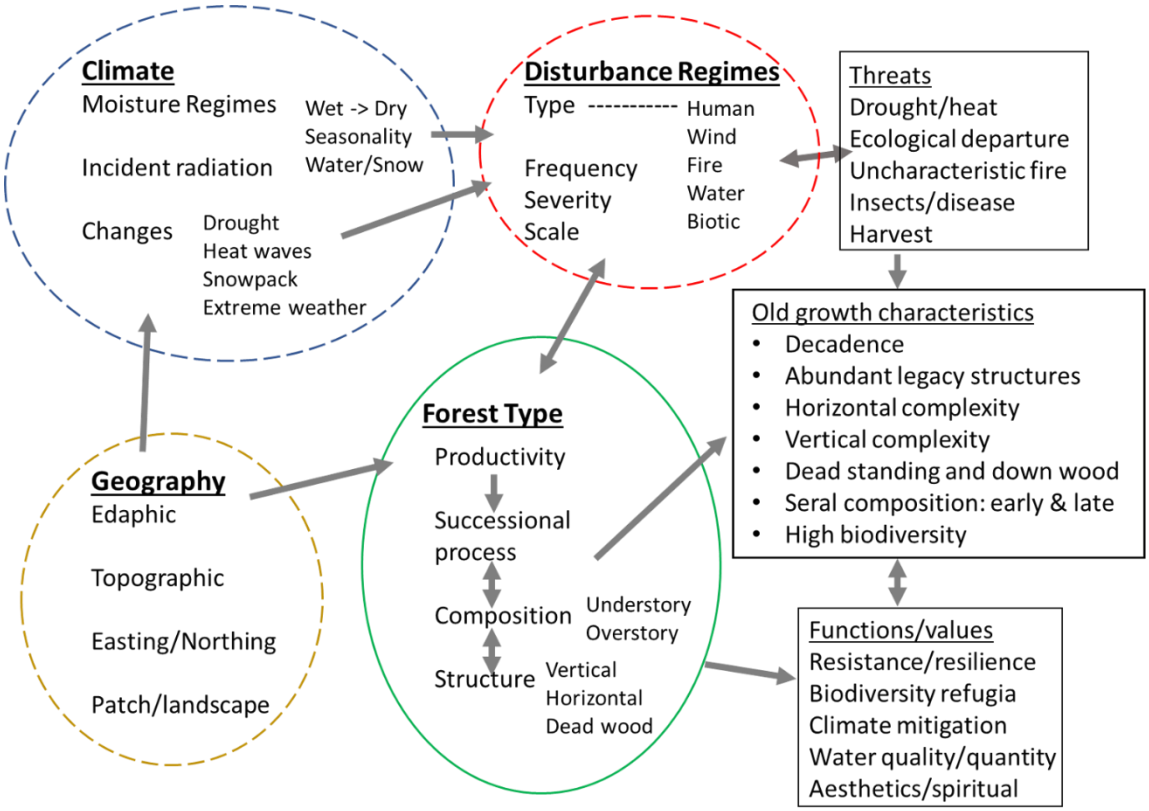

Figure 1. Process diagram depicting the direct and indirect influences of abiotic and biotic factors on old growth characteristics, functions and threats.

3. *Input on the questions posed in the Request for Information (RFI) on Old-growth and Mature Forests*

Within the context provided above, we offer input to the questions posed in the RFI:

Criteria needed for a universal definition framework that motivates mature and old-growth forest conservation and can be used for planning and adaptive management:

- A universal definition framework must incorporate a nationally consistent forest type classification scheme that includes natural disturbance regimes and can be scaled to larger geographies including ecoregions. For instance, we recommend Landfire products (BioPhyiscial Settings, Fire Regime Groups, Existing Vegetation). It should be noted that Forest Inventory Analysis (FIA) and Society of American Foresters (SAF) Forest Types are likely too coarse and unable to account for differences in historic disturbance regimes across systems with similar species composition, if not intersected with ecoregions.
- Strong consideration is needed for not only how to define mature and old-growth, but also how to measure, quantify, and map old-growth forest distributions at appropriate spatial scales. Creating definitions that are not measurable with existing tools at the required scale(s) would be ineffective and likely result in inaccurate products. As such, remotely sensed data (e.g., LiDAR, NAIP-DAP) and methods that can identify and quantify old-growth structural characteristics should be strongly, albeit cautiously, considered, given airborne LiDAR may not be available continuously nor able to quantify old-growth mortality.
- The definition framework must go beyond potential vegetation classifications ("theoretical climax forest") often used by the US Forest Service in land management. Disturbance processes that significantly influence forest structure and species composition and the spatial arrangement of different structures, must be incorporated to achieve sustainable mature and old-forest conservation.
- While forest structure and species composition will be necessary to operationalize "measurable and repeatable" criteria, tree age should be at the core of the definition framework. In some forest types, forest structure and species composition (which vary widely by forest type) may be used as proxy for age, but not in all forest types.
- Old-growth attributes – predominate ecosystem functions, structural complexity (horizontal and vertical), dead standing and down wood, understory diversity and composition, presence of indicator species, etc. - should be included where possible, especially when identifying/verifying old-growth at local scales.

Overarching old-growth and mature forest characteristics that belong in a definition framework:

- Tree age should be at the core of the definition framework, with forest structure and species composition (which vary by forest type) used as a proxy identifier for age within a given forest type and ecoregion. Age criteria should focus on the oldest trees or cohorts within multi-aged stands – not mean or median tree or stand age.
- Morphological characteristics (e.g., bark plate/furrow size, crown shape, height to live crown, canopy profiles, decadent structures) can be used to identify old growth characteristic of individual trees at local scales.
- Structural complexity (high vertical complexity for moist/wet and infrequently disturbed forests, horizontal complexity for dry/mesic and frequently disturbed forests) can be used to differentiate old growth and maturing stands from structurally homogenous early and mid-seral

stands. However, structural factors will vary significantly by forest type (e.g., wet Douglas-fir/western hemlock vs. dry ponderosa pine or dry mixed-conifer).

- Species composition and diversity are critical components of old growth forests. Large old trees that are specifically adapted to the underlying disturbance processes are key, including species defined as early seral by successional climax models (e.g., oaks, long-leaf and short-leaf pines, Douglas-fir, ponderosa pine, western larch). Diverse understory plant communities are also critical and again linked to disturbance processes and many ecosystem functions.
- Biological indicator species associated with old growth can be used to identify relative structure and resource availability as well as the functioning of mature and old growth patches for biodiversity conservation.
- Old-growth classification should consider scale, from trees and patches to stands and landscapes, as different forest types have different structural and spatial arrangements based on historical disturbance regimes, other ecological processes, and historical management. For example, old growth characteristics in moist forest systems may be most quantifiable at the stand-scale due to patchiness of severe historical disturbances while landscape-scale, low-severity disturbances in dry systems created fine-scale heterogeneity at the tree and patch level. Logging also occurred at different scales and intensities across North America (e.g., intensive clear-cutting v. extensive high grading).
- An overarching definition should be based on minimum estimated densities of trees established prior to Euro-American settlement, logging, and fire exclusion. Lower threshold densities may also provide better resilience and adaptation to the effects of anticipated climate changes.
- Species composition and stand structural thresholds consistent with the historically critical disturbance regimes should refine the definition by forest type.

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

- The definition framework should incorporate the concept of ecological departure to describe how current and historical forest conditions differ in terms of forest structure, species composition, and spatial pattern.
- The definition framework should incorporate current and future threats to mature and old forests given current landscape conditions to preclude mature and old-forest conservation that defaults to simply “protecting whatever is there.”
- Consider incorporating a “Resist, Accept, Direct (RAD)” or parallel framework (e.g., Resistance, Resilience, Transformation) when operationalizing the definition of mature and old-growth forests, recognizing that in the face of a rapidly changing climate and increasingly severe disturbances, there will be a need for a triage approach to address threats to existing mature and old forest. This includes the strategic restoration of ecological processes in mature stands that have the potential to recruit into old-growth stages, especially in cases where old-growth mortality is rampant.
- The definition framework should be inclusive of the many benefits that mature and old forests provide, rather than focus on singular resource values. This will facilitate more holistic strategies needed to sustain and optimize the broadest set of values to nature and people.
- In addition to a definition framework that facilitates identification of where mature and old forest exist, we need a framework that quantifies current condition and future threats, and maps patch sizes of mature and old forest to inform appropriate conservation strategies at both stand and landscape scales.

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

- In concept, there could be separate "Historical Range of Variation" and "Future Range of Variation" definitions for mature/old growth for a forest type and ecoregion. The definition should acknowledge that we have a significant deficit of mature and old forests in many landscapes. In order to restore older/complex forest conditions that will be sustainable, we need a definition that integrates both known historically resilient conditions that facilitated the recruitment of mature and old forests as well as desired future conditions that will be resilient in the face of a changing climate.
- It will be important to integrate and regularly update risk to mature and old forests, particularly considering a rapidly changing climate. Ongoing risk assessments will be needed to capture and address threats to existing mature and old forest conservation while also driving appropriate strategies that facilitate development of future mature and old forests where it currently does not exist due to past management.
- Conservation of old trees regardless of species and size is important given genetic diversity and phenotypical plasticity that may confer adaptation to future climate, disturbances, and environmental stressors, especially for plastic species adapted to drought, fire, insects, and disease.
- The age threshold for an old tree will vary by forest type and anthropogenic disturbance history but should generally coincide with establishment prior to Euro-American settlement and associated fire exclusion and/or extensive/intensive logging and reforestation.
- Large trees that had been replanted from selected and modified stock during the 1900's may be predisposed to climatic stressors, given historical selection towards growth and yield and not stress/disturbance tolerance or resilience.

Forest characteristics a definition should exclude (or be used with discretion)

- *Average stand age* is a poor proxy for identifying old growth forests and should be avoided, especially where frequent disturbances historically drove multi-aged forests.
- *Average tree diameter* should not be used in the definition given weak relationship between tree diameter and age across forest types, environments, and tree species. Tree height is a better predictor of age and should be prioritized over average diameter.
- Although *wood volume* directly correlates to carbon storage, high levels of volume may be associated with suppression of regulating disturbance regimes which historically kept many disturbance-adapted forests at or below site capacity. Without disturbance, high volumes of small trees outcompete older trees and reduce the vigor and recruitment of large, disturbance adapted trees into the overstory.
- *Potential Vegetation or Climax Species-Based Forest Classifications*: As stated above, we need to be careful about a definition that forces management towards potential vegetation or climax species in the definition of old forest types, as they can be misleading, particularly in disturbance prone ecosystems.

We commend efforts to tackle the challenging but important task to define old growth and mature forests for the purposes of conducting an inventory and ultimately institutionalizing climate-smart management and conservation strategies. We appreciate the opportunity to offer input and look forward to additional opportunities for engagement in these processes.

Supporting Literature

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