Defining Old-Growth and the Need For Maturing Trees To Buffer Changes In Climate

1). **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 my opinion that a universal definition for old growth is impossible to develop in a manner that will serve all locations equally. In other words, it is not possible to develop a universal definition that generates an equal outcome for all locations because of intrinsic differences that make this physically impossible. This is due to the natural diversity existing between different locations within a given area, between different areas within a given region, and between different regions of the nation.

Definitions for old-growth must, therefore, be developed that at the very least recognize the region in question and at very best the area in question based on physical characteristics (climate and elevation, native vegetation, terrain and geological setting), human history of disturbances, as well as projected future changes based upon current climate modeling (e.g., radical differences between the growing season climates of the western and eastern United States now are modeled to increase into the future).

I will therefore answer the following questions based on the Clinch Ranger District of the Jefferson National Forest, Virginia, in Region 8, while stressing the need to recognize local areas of special significance related to existing biological diversity and climate. I will also address this from the big picture perspective of national and global climate change and from that of Complex Systems Science (CSS) which recognizes by Systems Ecology that a forest is much more than a mere stand of trees.

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

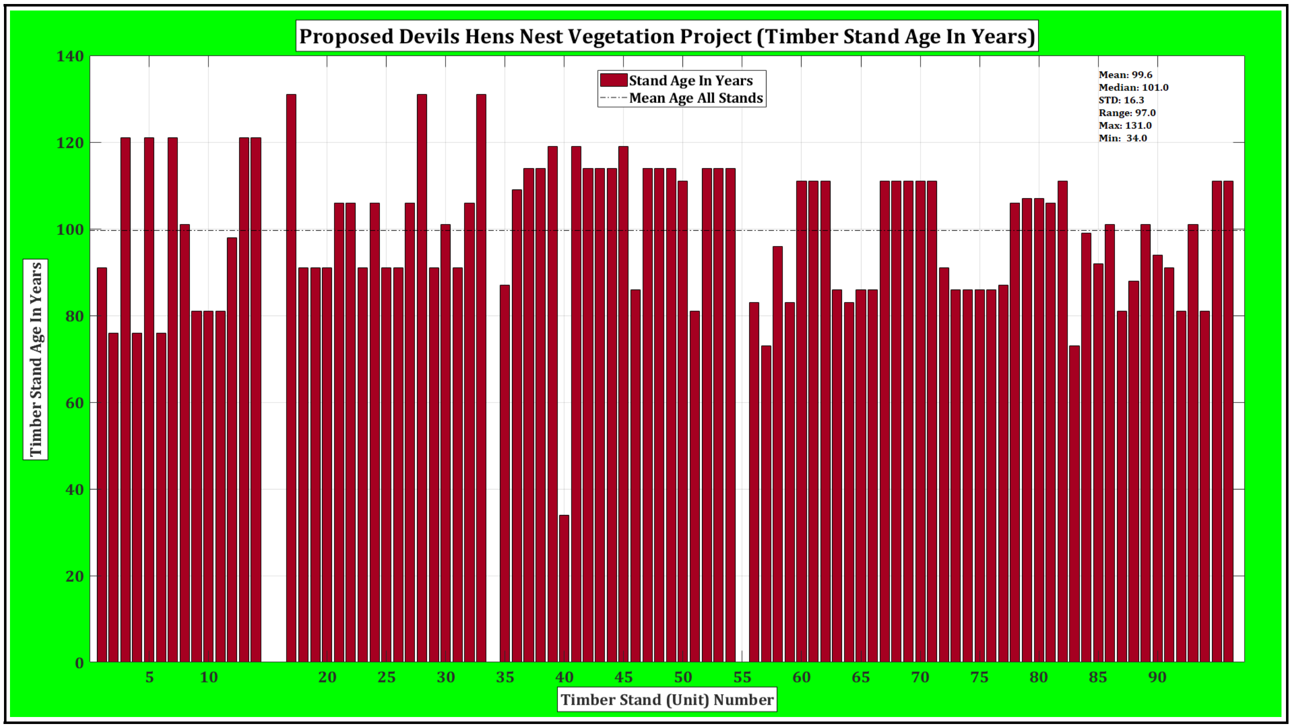
In field research I developed general characteristics to check-off when surveying a given area, and these characteristics can be found in Appendix A of these comments. These are based both upon the existing Region 8 Old Growth Guidance as well as my personal experience and must be applied in a field setting, walking in the forest, and not from satellite and GIS applications (as useful as they are). While all characteristics need not be present in any given stand, more should be present than not in order to classify the area as old-growth or maturing forest.

Areas of maturing forest (80 years or older) around old-growth, if existing, must be included in a definition framework to both enhance the survival of existing older trees as well as to increase the amount of older forests (future old-growth) for carbon sequestration against changing climate.[1]

The old-growth section of the Monongahela National Forest Land and Resource Plan (2006) is very applicable and is a reference for this question. This portion of that plan is of particular importance to my area of the Clinch Ranger District in Virginia:

> "**Adjacency and Scale**. Vital to old-growth management is consideration of neighboring forest stands relative to the size of old-growth patches. In the eastern United States, old-growth patches are not widely distributed across the landscape. One objective for managing old growth is to identify and protect remnant patches so that over time they remain viable. A related objective is to promote future old growth by identifying older adjacent second-growth patches that can eventually develop into old growth and thereby expand the effective size and function of the remnant patches."
>
> *Appendix B of Monongahela National Forest Land and Resource Plan, 2006.*

Just by establishing buffers around maturing forest or patches of old-growth would eliminate some projects currently being proposed by the USDA Forest Service, as exemplified on the Clinch Ranger District by the Devils Hens Nest Vegetation Project where mean project-age trees are 100 years old.



Extracted from the Project Scoping KMZ File

This area and much of the High Knob Massif in southwestern Virginia has extraordinary potential to now become secondary old-growth around smaller patches of existing old-growth. This illustrates why the old-growth definition must include and recognize neighboring forest stands and locations such as the High Knob Massif which possesses exceptional potential to become secondary, future old-growth.

In addition, there is a great need to recognize the big picture of where old-growth or potential future old-growth and maturing forests are located with respect to surrounding landscapes outside the USDA property. Again, the High Knob Massif exemplifies this as it rises above the Appalachian coalfields in southwestern Virginia and southeastern Kentucky where widespread logging, surface mining, and gas well development has occurred in addition to clearing of forests for both agriculture and urban-private developments. Large tracts of biomass clear-cutting on private and commercially owned lands have also recently deforested thousands of acres in the High Knob Massif itself. Collectively, this greatly increases the need to keep USDA Forest Service lands intact to promote mature and old-growth forests.

Summary Answer for Questions 1 and 2

There is not a one-size-fits-all definition for old-growth and maturing forest (a universal definition that generates an equal outcome is not physically possible). Boots on the ground will be required to identify these areas in the field using already established criteria for each region of the nation. These areas, once identified, must be expanded (if possible) to develop buffer zones around these old-growth and maturing forests to help ensure their future survival and to promote future old-growth. The local-regional setting respective to the surrounding (non-USDA) landscape must be recognized & weighted.

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

Any definition must recognize on-the-ground conditions where maturing and existing old-growth is currently located with respect to any surrounding landscape disturbances on private and non-USDA, commercially owned lands (reference Question 2), then answer the following questions:

A). Is the area of maturing forest and/or old-growth within an already recognized zone of biodiversity, or does it drain into an ecologically important zone of biological diversity?

B). Does the area of maturing forest and/or old-growth contain globally or nationally recognized forest types of significance, such as Mixed-Mesophytic and Northern Hardwoods, or connect to contiguous forest that transitions into these forest types?

C). Is the USDA Forest Service on-the-ground classification of the area in question wrong ecologically and biologically (e.g., classifying Mixed-Mesophytic as Oak-hickory in far southwestern Virginia)? In other words, has it been classified based on the USDA Forest Service preference for commercial timber production as directed by existing forest management plans?

D). Is this process occurring on individual Forest Service districts under the existing framework of an outdated Forest Management Plan that does not recognize climate change and complex systems science?

E). Is the area of maturing forest and/or old-growth within an area of exceptional climate with respect to either wetness or dryness for the state in which it exists?

F). Is the area of maturing and/or old-growth within a location that naturally functions as a climate change buffer with respect to its topographic setting (e.g., a cold air collecting basin or a large mass of mountain that is naturally cooler and wetter than surrounding areas)?

G). Is the area of maturing forest and/or old-growth within or connected to a forest type projected to undergo significant changes due to changing climate, increasing the need for protection or expansion of this forest being surveyed?

H). Has site productivity in the habitat and climate of the area being surveyed been degraded by past USDA Forest Service projects, or has nearby significant landscape disturbances added pressure (e.g., increased breeding bird pressure on the survey area due to displacement from previously existing forest tracts nearby) to the survey area that could be ameliorated by increasing the buffer around old-growth or allowing maturing forests of the survey area to become future old-growth?[2]

Answers to these questions will then allow ranking, with each YES answer adding weight and each NO answer subtracting weight from the importance of maturing and old-growth forests existing on-the-ground for the location being surveyed. Areas of higher importance must be protected, and if the existing conditions permit must also be expanded or buffered to increase the ability of these areas to withstand future changes in climate that will occur. Whether warming or cooling, climate is always changing. Intact, complex forests are best able to withstand and buffer these changes across time.[3]

While this is applicable to computer-GIS ranking, due to incorrect, current USDA Forest Service habitat assessments (such as labeling mixed-mesophytic and/or northern hardwoods as oak-hickory) it is critical that on site assessments also be included. It is also critical that this be done outside the scope of old, outdated Forest Service Management Plans which do not recognize current understanding of climate change and complex systems science (e.g., the Jefferson National Forest Management Plan of 2004 features priorities which are wildly inappropriate to changing climate and new, proven science related to forest management of complex systems).

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

This is a complex issue by definition, given that the systems in which old-growth and maturing forests exists are complex and tremendously varied. No single universal definition is possible that will adequately accomplish this goal in a way that justly recognizes and treats each area and region since both existing climate and predicted future climate change will be varied between areas and regions.

It is for this reason that the identification of old-growth and maturing forests must be done on a local and regional basis, using characteristic criteria specific to each region, then ranked by a protocol such as proposed in Question 3 to identify local areas of higher conservation importance with respect to both existing old-growth and maturing forests (and, if possible, for their expansion into the future).

Best current science clearly demonstrates that old-growth and maturing forests store the most carbon, both above ground in biomass and below ground in roots and complex networks of mycelium, and that they can best function as buffers against changing climate when located inside larger forest tracts of contiguous, undisturbed intact forests possessing complex subterranean networks.[4,5,6,7,8,9,10,11,12,13,14,15,16,17]

A durable definition can only be achieved if it recognizes these facts. It can only become durable if old, out-dated USDA Forest Management Plans are abandoned that direct forest habitats to be "pushed" against their natural states (for example, attempts on the Clinch Ranger District to change rich, mixed-mesophytic forests into oak-hickory deemed most desirable for timber harvest in what is the wettest terrain[18] of Virginia where mixed-mesophytic is what Braun (1950)[19] identified long ago as the natural climax or mature state). With respect to existing old-growth or maturing forests of potential, future old-growth, this means adopting a largely Proforestation management framework which allows trees standing in locations where the mean stand age is now 80 years or older to continue standing and to mature within their natural, existing conditions without fragmentation.[20]

A durable definition can be achieved if it recognizes that old and maturing trees have intrinsic value, and are part of extremely complex systems that buffer changes and whose value to humans extend far beyond and above any commercial value obtained by cutting these trees and fragmenting their habitat.

5). **What, if any, forest characteristics should a definition exclude?**

The main exclusion should be a lower limit for old-growth and maturing forest size. In other words, all old-growth and maturing forests are critically important in light of changing climate and widespread disturbances across non-USDA Forest Service lands, such that no lower threshold should be set. All of existing old-growth trees and maturing forests should be accepted and protected by this process.

Summary of Answers

The directive of Executive Order 14072 is to take action to conserve and protect old-growth and maturing forests on USDA and BLM public lands. This is long past due and has lagged far behind other efforts working to address changing climate and biodiversity degradation.

A universal, one-size-fits-all, definition is not physically possible due to large local to regional to national variations in all Climate (Earth) System components.[21] For this reason, on-the-ground surveys will be necessary to identify all forests 80 years or older (by mean age) for conservation and addition to a national proforestation management plan under Executive Order 14072. In this way, maturing and existing old-growth forests can continue to mature, store carbon, and become increasingly complex to increase their natural buffering capacity to changing climate. In addition, this will simultaneously act to protect and conserve biological diversity critical to sustaining all life on planet Earth.

The USDA must recognize the widespread and large-scale landscape disturbances on all private and commercially owned lands surrounding public lands and use a big picture, right-brain perspective that clearly understands how this makes conservation and proforestation of USDA public lands, especially those possessing maturing and old-growth forests, absolutely critical. A single example from my area of southwestern Virginia beautifully illustrates this issue.

County Land Area (Square Miles)

Wise:	403.19
City of Norton:	7.48
Scott:	535.53
Lee:	435.52
Dickenson:	330.53
Total:	1712.25 square miles = 1,095,840 acres

United States Forest Service Public Land (Acres by County)

Wise:	36,272
Scott:	34,580
Lee:	11,335
Dickenson:	8,235
Total:	90,422 or 141.28 square miles

Percent of total land in USFS Public Domain:

141.28 / 1712.25 = 0.0825 or 8.25%

If adding the City of Norton, Big Stone Gap (Big Cherry Basin), Appalachia, and Coeburn the total potential land that could be allowed to develop into old growth is approximately 8.9% .

Even if allowing all USDA public land of the Clinch Ranger District to mature and become old-growth, it would only comprise 8.25% of the total landscape. This is the reality. Instead of clearly understanding how critical this issue is, the USDA instead is proposing to fragment a 13,087-acre area of the High Knob Massif with 133 timber units (including burning in this wettest terrain of Virginia) where the existing mean-age of all trees is 100 years. This is a classic left-brain action that does not recognize current needs. This proposed action is directly and blindly in opposition to mitigation of climate change and preservation of biological diversity (since fragmentation of forests introduces invasive species and edge habitat specialists that act to degrade it).

The USDA Forest Service, in particular, now has the opportunity to abandon the old ideology of managing a forest like a crop, and instead to recognize the present-day need for the protection of maturing forests, in addition to any existing old-growth, to help buffer changing climate, protect and conserve water quality and biodiversity, promote outdoor recreation, and improve human well-being[22] for the general benefit of planet Earth.

Appendix A

Characteristics of Old-Growth and Maturing Forests

☐At least some large diameter trees that function as hubs (Mother Trees) for the forest ecosystem (these trees have mycelial connections to surrounding trees and vegetation).

☐ Rich fungal diversity with many different species (may be visible as mushrooms).

☐ Rich and often increasing bryophyte diversity (mosses, liverworts, hornworts).

☐ Significant (especially in mesic or otherwise favorable sites) herbaceous diversity, which may include abundant ferns and/or shrubs and understory sapling trees.

☐ Increases in fauna (e.g., bird species) dependent on interior forest habitats (assuming the area of, or surrounding, old-growth and maturing forest is not already fragmented).

☐An uneven age structure and canopy, with variations in ages common around an average unit age of 80 years that increases significantly on individual trees.

☐ Increase in mean basal area [total cross-sectional area of all stems within a timber stand as measured at breast height, per unit of land area (typically square feet per acre)]. It is, however, important to recognize that some very old trees may not be that big due to site and/or climate conditions, as well as other factors that often change over time.

☐Low taper rate along the trunk (bole) of largest trees from base to crown.

☐Large crown spread but fewer total limbs (versus younger trees), with crown limbs present being relatively large in diameter and possibly deformed (twisting) in character.

☐Dramatic (often radical) changes in nature of bark on trees of the same species (e.g., smooth-rough at young age to old scaly-flaky to balding-smoother at great, old age).

☐Tree deformities may be present due to storms or lack of prior harvest selection (e.g., the tree was allowed to grow because it was deemed to not be commercially valuable).

☐Abundant and increasing downed woody debris (logs, limbs, etc) over time.

☐Scattered pit-and-mound topography generated by downed trees that may or may not still be present due to decomposition (some trees may also be standing on stilted roots).

☐Light gaps created by canopy openings due to downed or broken trees.

☐An intrinsic or conscious feel to the forest that is different from typical woodlands.

References and Notes

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21). Major components of the Climate (Earth) System include: Atmosphere, Biosphere, Cryosphere, Hydrosphere, Lithosphere, and Anthroposphere.

22). The benefit to human well-being of having intact forests will far outweigh any benefits obtained by the few who may benefit from logging on public lands, given the widespread logging occurring on private and commercially owned lands which supply the bulk of wood products. Most USDA public logging products have traditionally lost money on the Clinch Ranger District and other forests such as the Tongass (largest national forest in the system). Given that landscape disturbances are widespread, there exists a great need for places without them. USDA public lands are the best option and, even if not considering the existing need to buffer climate and protect biodiversity, should recognize this for the general and direct improvement of the human mental and physical condition.