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Comments: Dear Chief Moore and Director Stone-Manning:Defenders of Wildlife, a nonprofit conservation organization representing nearly 2.2 million members and supporters nationwide, appreciates the opportunity to respond to the Bureau of Land Management (BLM) and U.S. Forest Service request for information focused on defining federal old-growth and mature forests (87 Fed. Reg. 42493, July 15, 2022). The request for information follows President Biden's April 22, 2022, Earth Day Executive Order on Strengthening the Nation's Forests, Communities, and Local Economies (EO 14072), directing BLM and the Forest Service to "define, identify, and complete an inventory of old-growth and mature forests on Federal lands" within one year.Once the inventory is complete, the agencies will develop policies that "institutionalize climate-smart management and conservation strategies that address threats to mature and old-growth forests" (EO 14072 Secs. 1 and 2(c)(iii)). Thus, the agencies' effort to establish a definitional framework for old-growth and mature forests is a critical step towards developing durable policy that conserves those forests to help confront the climate and biodiversity crisis and provide other ecological and social benefits.This letter provides detailed support for and explanation of the following suggestions:[bull] Criteria for Definitional Frameworko Incorporate ecological integrity into the old-growth and mature forest definition framework to provide guideposts for establishing monitoring metrics and triggers for adaptive management.o Establish monitoring indicators and thresholds as the basis for monitoring progress toward ecological integrity.o Incorporate focal species monitoring into definitional framework and old-growth and mature conservation policy.o Include all old-growth and mature forest types in definitional framework and inventory.[bull] Overarching old-growth and mature forest characteristicso Use the Forest Service's old-growth regional descriptions as a starting place for definition development and update as necessary with the latest best available science.o Include carbon stores in old-growth and mature forest definitions.o Include biodiversity, connectivity, and climate refugia in old-growth and mature forest definitions.o Consider the habitat requirements of focal species to inform the development of mature forest definitions.o Consult with a range or scientists, including independent scientists, to define or describe mature forest characteristics.[bull] Addressing disturbanceo Capture post-disturbance forest legacy characteristics in old-growth and mature forest definitions.[bull] Forest characteristics that should be excluded from a definitiono Avoid setting a minimum area size for old-growth and mature forest definitions.o Avoid automatically removing stands that have received human treatment (e.g., logging, mining, leasable mineral development) from consideration as old-growth and mature forest.[bull] Forthcoming policyo Assure that old-growth and mature forest conservation policy is connected to definitions that reflects ecological integrity and results in durable protections.BackgroundThe BLM and Forest Service bear management responsibility for about 18% of the U.S. land base and about 25% of the country's forested land. These agencies will play a pivotal role in mitigating and adapting to the effects of climate change while providing ecosystem services, including long-term carbon storage and climate regulation (36 C.F.R. [sect][sect] 219.10 and 219.19). They have also established policies requiring them to help stem the extinction and biodiversity crises by managing old-growth and mature forests to contribute to the recovery of threatened and endangered species and conserve populations of other species at risk (36 C.F.R. [sect][sect] 219.8, 219.9, and 219.19; BLM Manual 6840).The Forest Service manages 193 million acres of land across 154 national forests. Of that, 145 million constitutes forested land, which is about close to 20% of the nation's total forested land (Oswalt et al. 2019). Some of the main forested ecosystems of the National Forest System (NFS) include hemlock and Sitka spruce of Alaska, redwoods of the Pacific Northwest, mixed conifer of California, Northern Rocky Mountain's lodgepole pine, high elevation spruce-fir in the Southern Rockies, the Southwest's ponderosa pine and pinyon-juniper, longleaf pines of the Southeast, and mixed hardwoods across the East. National forests store 30% of U.S. forest carbon. Forests, particularly older forests, play an outsized role as carbon storage banks, and a large majority of the nation's remaining forests exhibiting old forest conditions occur primarily on NFS lands. For example, the Tongass National Forest in Alaska, which contains ~5 million acres of old growth forests, stores 44% of all carbon stored by U.S. national forests (DellaSala. 2021).The BLM administers 245 million acres of public land across the United States. Of these 245 million acres, about 56 million acres are

forested and encompass a diverse array of ecosystems from boreal forests in Alaska, mixed conifer forests in the O&C lands, and to pinyon-juniper and other arid forests across the interior west. See Attachment. To our knowledge, the BLM has never tried to comprehensively inventory old-growth and mature forests on the lands it manages, and thus EO 14072 presents an excellent opportunity for BLM to increase its ecological and spatial understanding of these important forest systems, especially the forested systems in more arid landscapes (e.g., pinyon junipersystems) that have not received as much attention regarding their old and mature forest characteristics as, for instance, the mixed conifer forests in the Pacific Northwest.With the need to tackle the climate and biodiversity crises, BLM's and Forest Service's statutorily mandated challenge to provide for sustainable multiple uses, including wildlife conservation, and establish conservation programs for threatened and endangered species has never been starker. The number of federally protected species that occur on the multiple-use lands continues to rise.1 Climate change is significantly stressing and degrading forest ecosystems around the country. Past management, particularly the historical liquidation and present deficit of old and large fire-resistant trees, have weakened the resiliency and reduced the ecological integrity of most U.S. forests. Continuedunsustainable logging coupled with fire suppression and exclusion policies continue to further degrade and reduce the adaptive capacity of U.S. forests.Request for Information responsesThe discussion below addresses the questions related to defining old and mature forests included in the request for information.[bull] 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?Recommendation: Incorporate ecological integrity into the old-growth and mature forest definition framework to provide guideposts for establishing monitoring metrics and triggers for adaptive management.The request for information does not explain the distinction between "definition" and "definition framework." To be useful for planning and adaptive management, we are interpreting this idea of a framework as the scaffolding necessary to establish what conservation means and how to determine if conservation is being achieved. To that end, the definitional framework should address structural, compositional, functional, and connectivity characteristics and, importantly, must include monitoring indicators, thresholds, and triggers.Grounding an old-growth and mature forest definition framework in the concepts of ecological integrity (generally, ecosystem health) provides parameters for conservation in planning and adaptive management and/or a durable old/mature forest conservation rule. Forest conservation and management activities that progress toward integrity should result in advancing carbon sequestration and storage, biodiversity conservation, and climate resilience, which are goals of EO 14072. The ability to monitor progress toward desired ecological conditions depends on metrics, which include thresholds that trigger adaptative action (see Nie and Schultz 2012; Wurtzebach and Schultz 2016).The Forest Service's planning rule definition of ecological integrity provides a well-reasoned basis for selecting characteristics for old and mature forest definitions.2 The Forest Service defines ecological integrity as[t]he quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function, connectivity, and species composition and diversity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence. (36 CFR 219.19)The Forest Service planning directives provides examples of these characteristics (FSH , ch.10, 1909.12(13), Exhibit 01). Relevant compositional characteristics can include distribution and extent of vegetation/forest types (i.e., spruce-fir or lodgepole pine), tree species diversity and richness, at-risk species presence and abundance, distribution and extent of soil types, and road density. Structural characteristics may constitute tree size and vertical and horizontal distribution, forest successional stage (e.g., early seral, mature, or old), distribution and density of dead wood, and forest patch3 size and connectivity. Functional characteristics may refer to patterns of disturbance (e.g., wildfire, insect ordisease outbreaks, or timber harvest), stand development and succession, and fire regime. Examples of connectivity characteristics include patch adjacency or connectivity, "[a]vailable habitat to enable native species to move throughout the plan area, and cross into adjacent areas, to use habitat that fulfills their life cycle needs (for example, breeding, foraging, sheltering)," or habitat fragmentation.Additionally, retaining and enhancing carbon storage and biodiversity conservation are purposes of EO 14072. We suggest carbon storage and sequestration be included as functional characteristics of old-growth and mature forests. We also recommend that pathways to climate refugia be included as a connectivity characteristic, because refugia are essential for enabling plant and animal species from accessing suitable habitat as ranges shift due to climate change.Recommendation: Establish monitoring indicators and thresholds

as the basis for monitoring progress toward ecological integrity.Monitoring provides a process of accountability to support a functional, effective adaptive management program. Monitoring has been an afterthought or abandoned in natural resource management over the years (Lindenmayer and Likens 2010). But only by employing a robust and well-funded monitoring program can managers determine the efficacy of management and conservation actions (and the need for changes via adaptive management) in the face of uncertainty, especially given climate change effects.Responsive and timely adaptive management depends on triggers embedded in monitoring questions. According to Schultz et al. (2012: 4), a trigger point is "a threshold value for a monitoring state variable (e.g., percent area occupied by a given focal species within a national forest planning area) that, when exceeded, triggers a particular management response." Effective monitoring methods that include appropriate performance metrics will enable tracking climate-driven and management changes so that the plans, projects, and other activities can be adjusted if necessary.Recommendation: Incorporate focal species monitoring into definitional framework and old-growth and mature conservation policy.The Forest Service uses the focal species concept in its planning rule and requires that forest plans employ focal species monitoring (36 CFR 219.12(5)(iii) and 219.19). The purposes of focal species are to permit "inference to the integrity of the larger ecological system to which it belongs" and provide "meaningful information regarding the effectiveness of the plan in maintaining or restoring the ecological conditions to maintain the diversity of plant and animal communities in the plan area" (36 CFR. 219.19). Focal species candidates are those that are either known or hypothesized to be particularly sensitive to forest management actions and/or climate disruptions (Silvano et al. 2017). Incorporating this well-established concept into the definitional framework would leverage existing analyses and make the definition more effective in protecting wildlife habitat.Recommendation: Include all old-growth and mature forest types in definitional framework and inventory.While certain forest types have garnered considerable attention for their old growth (e.g., pacific northwest forests), other forest types - for instance, the more arid forests such as pinyon-juniper ecosystems[mdash]have not:Old [pinyon juniper] woodlands usually differ in structure and function from postsettlement woodlands thus adding diversity at the community and landscape levels. Although considerable research has been conducted in old-growth for other conifer species, work addressing old-growth in juniper and pinyon woodlands is very limited. In addition, the concern over the rapid expansion of juniper and pinyon woodlands during this century has overshadowed the presenceand values of these presettlement woodlands. Ancient woodlands are frequently overlooked in management plans and inventories where they are often lumped with postsettlement stands. (Miller et al. 1999)Including pinyon-juniper forests would ensure policy improvements protect these important systems, which provide wildlife habitat, vegetative cover, watershed protection, and traditional food and medicine gathering in federal landscapes across the interior west (See Bombachi and Pejchar (2016) for assessments of wildlife studies). Helpful resources for pinyon-juniper ecosystems include:o Rick Miller, Robin Tausch, and Wendy Waichler, 1999. Old-Growth Juniper and Pinyon Woodlands. In: Monsen, Stephen B.; Stevens, Richard, comps. 1999. Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15-18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.o M. Lisa Floyd, 2021. Status and Trends of Pi[ntilde]on-Juniper Vegetation in the western United States. Report to Defenders of Wildlife. May 14, 2021. (Attached)[bull] What are the overarching old-growth and mature forest characteristics that belong in a definition framework?Recommendation: Use the Forest Service's old-growth regional descriptions as a starting place for definition development and update as necessary with the latest best available science.The Forest Service began developing descriptions of its old-growth forests by region in the late 1980s. National forests have used these regional descriptions to develop management plan standards and guidelines. Descriptions include similar standard attributes. For example, Region 8 provided the following list of attributes (Gaines et al. 1997: 2):[bull] Large trees for the species and site.[bull] Wide variation in tree sizes and spacing.[bull] Accumulations of large-sized dead standing and fallen trees that are high relative to earlier stages.[bull] Decadence in the form of broken or deformed tops or boles and root decay.[bull] Multiple canopy layers.[bull] Canopy gaps and understory patchiness.However, the scientists involved with developing these initial Forest Service descriptions of old-growth forest characteristics understood the need for improvements with new knowledge and technology. For example, Kaufman et al. (1992: 1) noted the following in the report describing Southwest and Rocky Mountain conditions,Improved inventory procedures are needed, including both remote-sensing technology and conventional on-the-ground procedures. Where will tomorrow's old growth be

found, and how soon will younger stands attain old-growth conditions? Pathways of forest succession into old growth are poorly known for most forest types. We need better knowledge about how disturbances such as fire, insects, forest diseases, exotic organisms, pollution, and changing
climate affect old growth and forest succession.Consistent with these observations, regional descriptions as updated by more recent and improved science and informed by Indigenous Traditional Ecological Knowledge (ITEK)4 could help build a solid definitional framework.We also recommend including carbon stores, associated species, connectivity, climate refugia, and forest legacies into updated definitions. See these recommendations below.Recommendation: Include carbon stores in old-growth and mature forest definitions.In EO 14072, President Biden stated, "[m]y Administration will manage forests on Federal lands, which include many mature and old-growth forests, to promote their continued health and resilience; retain and enhance carbon storage [hellip] ." Accumulated carbon in old-growth forests is highest in the largest trees in a forest stand and the soils of older forests (Leverett et al. 2021; Mildrexler et al. 2021; Hudiburg et al. 2009); including these elements in the definition would help achieve the goals of EO 14072.The joint IPBES-IPCC report emphasized that the biodiversity and climate crises are linked (P[ouml]rtner et al. 2021). The adaptive capacity of most ecosystems will be exceeded if climate warming is not kept well below 2[deg]C. Conversely, healthy ecosystems can play an important role in climate mitigation by sequestering carbon. Biodiversity plays an essential role, in that each species contains unique adaptations yet interacts with other species in a web of dependencies. When species disappear from an ecosystem, those that depend on them for food, pollination or other needs also begin to disappear. This dynamic can decrease overall productivity and resilience, and eventually ecosystems can experiencecollapse. Such ecosystem collapses accelerate climate change and worsen its effects. Dreiss et al. (2022) found that while carbon-rich forests can provide important habitat and climate change buffers, one does not necessarily imply the other.Recommendation: Consider the habitat requirements of focal species to inform the development of mature forest definitions.Research continues to refine methods and criteria for selecting focal species to help identify meso- and fine-scale ecosystem components required for suites of species and to assess ecological integrity (Wiens et al. 2008; Lindenmayer et al. 2015; Crosby et al. 2020; see also USFWS 2015). The US Fish and Wildlife Service (USFWS 2015) developed a technical guide that outlined criteria for selecting environmental indicator species, e.g., they should be monitorable, sensitive to specific change, and representative of beneficiary species. The USFWS technical guide noted that surrogate species can be used as components in multi-metric indices, such as the Index of Biotic Integrity, to(1) classify environments; (2) select measurable attributes that provide reliable and relevant signals about the biological effects of management action or of other human activities; (3) to support monitoring; and (4) to communicate this information to the public and policymakers" (citing, Karr 1981, 2006; Karr and Chu 1997).Carroll et al. (2001) proposed using multiple carnivore species over one umbrella species, including Canada lynx, fisher, and marten[mdash]all associated with mature forests. Squires et al. (2020) studied lynx habitat selection at multiple spatial scales in what was considered part of the core lynx area in the San Juan mountains after the spruce-beetle epidemic had significantly changed forest conditions, reducing live canopy cover. Such studies may help scientists understand the attributes that must be retained, such as downed wood and snags, to maintain suitable habitat in forests that have been significantly changed by disturbance, especially disturbance exacerbated by climate change.Researchers have recently suggested using multiples species or species communities as indicators instead of a single focal species (Loman et al. 2021). Several scientists have probed the value of bird communities as indicators (Burgas et al. 2014; Pakkala et al. 2014; Rempel et al. 2016; Crosby et al. 2020; Virkkala et al. 2022). Burgas et al. (2014), for example, found raptors to be useful focal species for identifying areas of high biodiversity that might benefit from protection. Rempel et al. (2016) proposed pairing landscape pattern and process indicators along with species indicators, in this case several forest birds, to assess ecological integrity and guide management action. Virkkala et al. (2022) utilized remote sensing, including airborne laser scanning, to predict suitable nesting habitat distribution across old-growth forests of Finland for six bird focal species, including birds of prey and woodpecker species. Creating models that integrated fine-scale habitat requirements of different old-growth associates enabled identifying the conditions necessary to support these indicator species and identifying areas of high biodiversity value across large landscapes. Other researchers have suggested birds of prey as indicators, such as the boreal owl[mdash]a winter resident of the Southern Rockies.Identifying and using meso- and finer-scale ecosystem characteristics required by effective

surrogates that go beyond coarse-filter analysis focused on simple structural elements (e.g., tree size and/or age) and tree species composition to map mature and old-growth forests may help assure that habitat conditions necessary for imperiled species to persist are maintained or restored.Recommendation: Consult with a range or scientists, including independent scientists, to define or describe mature forest characteristics.The current effort is particularly important because the Forest Service and BLM do not have definitions or descriptions for mature forests. Some scientists contend setting a standard age threshold or mature forests is not possible (See Martin et al. 2016), while others have suggested all forests over 80 years should be considered mature (Dellasala 2022). Incorporating the views of the foremost experts in forest ecology and other relevant disciplines, including non-agency scientists, wildlife biologists and ecologists, and experts in ITEK would help ensure the agencies are drawing from the best available science. The products of these consultations should be shared with the public.[bull] How can a definition reflect changes based on disturbance and variation in forest type/composition, climate, site productivity and geographic region?Recommendation: Capture post-disturbance forest legacy characteristics in old-growth and mature forest definitions.Disturbance from wildfires and insect and disease outbreaks are natural and necessary for creating and maintaining wildlife habitat. For example, post-fire forests continue to store carbon and provide biological legacies that are important to capture in a definition. While small amounts of carbon stored in live and dead trees may be lost in disturbance events, most is retained in biological legacies, including snags, dead and down wood, charcoal, and live remnant trees. Spies et. al. (2018) found after an extensive literature review that postfire management should promote natural recovery, retain old, large trees and snags, and protect soils against compaction and erosion (see page 178).Salvage logging alters postfire vegetation structure by reducing the basal area and density of live and dead trees (McIver and Otmar 2007) and decreasing the persistence of remaining snags (Russell et al. 2006) and altering the microclimate of a site (Maran~o[acute]n-Jime[acute]nez et al. 2013). What's more, once a tree dies, it functions as a snag, down log(s), mulch, and charcoal in soils for a period that can far exceed the period spent as a live tree (DeLuca and Aplet 2008),although those dynamics vary widely based upon moisture and fire regimes. Cumulatively, these reductions result in decreases in live and dead biomass (Donato et al. 2013) and reduced soil carbon. (Spies et al. 2018)Including post-disturbance forests in the definition framework could ensure that it captures important carbon sinks and areas with other valuable characteristics.[bull] What, if any, forest characteristics should a definition exclude?Recommendation: Avoid setting a minimum area size for old-growth and mature forest definitions.In some areas, old trees and old-growth ecosystems may exist only in small areas due to recent or persistent logging and/or recent high-intensity fires or other disturbances. In such circumstances, patches of old-growth are still worth saving, especially if the surrounding areas could, with proper management, become part of a connected older forest landscape. Because larger areas provide the best and most secure habitat for resident wildlife and fish species, forests surrounding small (less than 100 acres or so) patches of old-growth should, to the extent practicable, be managed to increase the size of older forest patches.Recommendation: Do not exclude all stands that have received human treatment (e.g., logging, mining, leasable mineral development) from consideration as old-growth and mature forest.Depending on the history and intensity of treatments, stands can recover to display old-growth characteristics. This will particularly be true of eastern national forests and some lower-elevation national forests in the West, where the growing season is long enough and the sites are sufficiently productive to allow relatively rapid recovery. Excluding such areas would unduly limit the definitional framework.ConclusionThe climate and biodiversity crises accentuate the need for conservation and restoration of old and mature forests wherever they are found. Conserving old-growth and mature forests is important for long-term carbon storage and biodiversity and is one important way that the land management agencies can contribute to our overarching national goals of limiting global warming over pre-industrial levels and protecting 30% of the nation's land and waters by 2030, as directed in Executive Order 14008 on Tackling the Climate Crisis at Home and Abroad. The ultimate goal is a durable conservation policy that offers long-term benefits to wildlife and people by protecting our unique forest ecosystem. Defining and inventorying old-growth and mature forests is an important step forward, and we appreciate the opportunity to respond to the request for information. Please do not hesitate to reach out if we can provide further explanation or information.Sincerely,Lauren McCainSenior Federal Lands Policy AnalystATTACHMENT: Status and Trends of Pi[ntilde]on-Juniper Vegetation in the western United StatesSources citedBLM (Bureau of Land Management). 2008. Budget Justification: 2008 General Statement.Bombaci, S. and Pejchar, L., 2016. Consequences of pinyon and juniper woodland reduction

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