U.S. Department of the Interior and U.S. Department of Agriculture: Reforestation Goals and Assessments, and a Climate-Informed Plan to Increase Federal Seed and Nursery Capacity

As Directed by Executive Order 14072

April 2023

Introduction

On Earth Day, April 22, 2022, President Biden declared, "We can and must take action to conserve, restore, reforest, and manage our magnificent forests here at home and, working closely with international partners, throughout the world." Executive Order 14072.

In Executive Order 14072 (EO 14072) the President charged the Secretaries of the Interior and Agriculture with developing: (i) a Federal goal to meet agency-specific reforestation targets by 2030, including an assessment of reforestation opportunities on Federal lands and through existing Federal programs and partnerships, and (ii) in collaboration with Federal, State, Tribal, and private-sector partners, a climate-informed plan (building on existing efforts) to increase Federal seed collection and to ensure seed and seedling nursery capacity is sufficient to meet anticipated reforestation demand. This report addresses Sections 2(d)(i) and 2(d)(ii) of the EO.

Executive Summary

Reforestation is at the core of efforts to ensure healthy and resilient forests. Among the variety of forest management practices, tree establishment has the greatest potential to store carbon.[1]

Severe threats to forested landscapes continue to escalate in size, frequency, and intensity. Uncharacteristic wildfire, insect infestations, diseases, drought, flooding, invasive species, and climate change endanger forests and create a need for restoration and reforestation. Severely burned areas are vulnerable to debris flow, which can endanger communities, and invasive species, which, along with climate change, increases the risk of forests not growing back and instead converting to grasslands and shrublands.

The U.S. Department of the Interior (DOI) and U.S. Department of Agriculture (USDA) recognize the urgency to increase the rate of reforestation and collaborate with partners to integrate research and technology in deployment of climate-informed reforestation techniques to meet these unprecedented needs. Climate-informed reforestation incorporates the best available science to plan for, monitor, tend, and adaptively manage seedlings so they establish successfully in current climates and persist in projected future climates. Climate-informed reforestation is designed to foster resilient, healthy, and productive forests that sustain ecosystem services, economic values, carbon sequestration, and stable carbon pools.

Reforestation needs are increasing in both acres and complexity. Several factors are driving this change. The scale and intensity of the wildfires is increasing. For example, in 2020 and 2021, wildfires increased reforestation needs by over 1.5 million acres, primarily in California and Oregon. The high temperature at which those fires burned reduced natural regeneration and increased reliance on costlier and more labor-intensive site preparation and planting. Reforestation is increasingly needed in remote locations, such as high elevation headwaters, that are difficult and expensive to access. And labor markets, fuel prices, and other factors have increased the per-acre cost of reforestation. In some locations, reforestation costs have more than doubled over the last few years.

To succeed at scale, Federal public land management agencies must use the best available science and data and work in collaboration with reforestation partners to escalate our infrastructure and accomplishments exponentially. Recognizing that the opportunities to accelerate the pace and scale of tree establishment are often shared across management jurisdictions, USDA and DOI must collaborate with Tribes, States, and private landowners. This is a guiding principle in the USDA Forest Service's National Forest System Reforestation Strategy.[2]

Increasing workforce capacity is critical. In Fiscal Year (FY) 2022-2023, the Forest Service is hiring 100 to 200 additional staff agency-wide with a focus on nursery and seed facilities, genetics, and contracting, as well as entry-level reforestation foresters in field units. In addition, FY 2022-2023 investments are laying the groundwork for increasing reforestation accomplishments in FY 2024 and beyond: the Forest Service committed $5 million to the Indian Youth Service Corps for reforestation; funded $20 million through the Conservation Corps to amplify reforestation initiatives and build a reforestation workforce pipeline; invested $35 million in rehabilitating aging National Forest System nursery and seed infrastructure; and announced nearly $10 million for State nursery expansion and native seed partnerships. The Forest Service is also developing project proposals with seven Federally recognized Indian Tribes totaling $3.25 million for seed collection and nursery expansion.

The Forest Service National Nursery System currently delivers about 28 million tree and native plant seedlings annually, of which about 5 million seedlings are grown for other Federal agencies, States, and Tribal partners. This system could deliver 11 million additional seedlings annually if fully staffed. Although the System has space to produce 70 to 90 million seedlings annually, reaching full capacity would require addressing workforce and infrastructure constraints. Here too, partners are vital: in FY 2022, the Forest Service leveraged $7 million from four national reforestation partners to support reforestation projects using 16.5 million seedlings on national forests in 22 states and Puerto Rico.

In accordance with EO 14072, DOI and USDA developed the following agency-specific, public land reforestation targets by 2030, totaling over 2.3 million acres. As described below, these targets reflect current and anticipated capacity, funding, and infrastructure investments. Additional available resources would lead to more acres reforested.

Agency	2030 Target (acres)
Bureau of Land Management (BLM)	136,300
U.S. Fish & Wildlife Service (FWS)	122,000
National Park Service (NPS)	20,000
Bureau of Indian Affairs (BIA)	240,000

USDA Forest Service, National Forest System (NFS)	1,800,000

In addition to establishing public land agency targets, EO 14072 directed the Secretaries to provide an assessment of reforestation opportunities on Federal lands and through existing Federal programs and partnerships. The Secretaries interpret that to include Federal programs that support voluntary reforestation on State, Tribal, and private land where most reforestation opportunities exist. Importantly, USDA and DOI have not set reforestation targets for State, Tribal, and private land. Further, as detailed below, State, private, and urban data is based on Forest Service Forest Inventory and Analysis data, and all lands may not be appropriate under established programs.

Agency	Opportunity Assessment of Voluntary Reforestation (acres)
Office of Surface Mining Reclamation and Enforcement (OSMRE)	265,000
State Timberland	5,100,000
Private Timberland	51,400,000
Riparian Buffers in Important Surface Drinking Water Watersheds (Private and Tribal)	5,700,090
Urban Reforestation	7,800,000

Part 1(a) REFORESTATION TARGETS ON DOI AND USDA PUBLIC LANDS

Trees can be established through natural regeneration or by planting. Natural regeneration, where new trees establish naturally by seeds or sprouting from stumps or roots, currently accounts for about 90 percent of the Nation's annual tree establishment. Natural regeneration can occur passively, that is without directed assistance such as site preparation, or actively, with direct assistance. Tree planting can either be reforestation—establishment of trees on existing forested land—or afforestation—establishment of trees on non-forested land or on former forested land where trees have been absent for longer than 50 years.

As the public land agencies continue to build capacity, including through partnerships and collaboration, it is anticipated that accomplishments will accelerate. Nevertheless, because of increasing reforestation costs combined with anticipated effective doubling of the acreage requiring reforestation due to wildfire and other extreme events, even the substantial increase of funding through sources such as The Repairing Existing Public Land by Adding Necessary Trees (REPLANT) Act will not be sufficient to fully address the backlog and future needs. It is

imperative therefore, that we optimize for innovation and collaboration in all aspects of the reforestation pipeline from seed collection and seedling nurseries, to planting and monitoring. The recommendations in Part 2 of this report will be a valuable starting place to support reforestation acceleration.

a. DOI – Bureau of Land Management

Total Backlog	Average Annual Reforestation Accomplishments	Target By 2030
89,000 acres	5,875 acres	136,300 acres

The BLM manages approximately 58 million acres of forest and woodlands. In western Oregon (Oregon and California Railroad Revested Lands) 2.4 million acres of forest and woodlands are managed under the Oregon and California Act.[3] Public domain lands consist of nearly 56 million acres of forest and woodlands composed of about 9 percent commercial forest lands, 68 percent pinyon and juniper woodlands with greater than 10 percent cover, and 23 percent interior Alaska boreal forest and black spruce woodland.

In general, western Oregon forest management personnel conduct the greatest amount of reforestation, including planting after severe disturbances such as wildfire and regeneration after harvest to ensure sustained-yield timber production. For public domain forestry, planting in Alaska and in pinyon juniper woodlands is rare even though those are the largest acreages of forest and woodland under BLM management. Most of the reforestation activity in the public domain lands occurs in forests with commercial species after severe disturbance such as wildfire.

To develop its 2030 reforestation target, the BLM determined an average annual acreage for reforestation based on current resources and capacity, and also identified opportunities to increase reforestation by addressing the current backlog of lands needing reforestation. The annual average acreage was calculated from the past 10 years of reported annual reforestation accomplishments; it represents the anticipated reforestation activities for the years 2023-2030, including response to severe disturbances such as wildland fire. For the reforestation backlog estimate, the BLM surveyed field offices to identify areas impacted by fire and other disturbances. Field offices were provided geospatial wildfire perimeter and forest vegetation classification products to help with the assessment. The BLM estimated approximately 89,000 additional acres that, if reforested, would advance the goals of the EO, however, that would require additional resources.

The BLM expects reforestation of the backlog to be feasible by 2030 going forward based on current capacity and expected appropriations. The target would require additional funding. The FY 2024 President's budget request included increases to support field foresters, seedling procurement, planting contracts, and cone collection contracts. BLM will continue to seek additional resources to meet this target.

b. DOI – National Park Service

Total Backlog	Average Annual Reforestation Accomplishments	Target By 2030
1.6 million acres	3,000 acres	20,000 acres

The NPS reforestation backlog was calculated by taking the average of annual reforestation completed in the last 5 years plus the estimated acreage burned in the last 5 years. Of the 1.6 million backlog, NPS estimates 1.5 million acres of natural regeneration. NPS calculated that estimate by combining the acres of NPS lands burned in the last 5 years with an estimation of natural regeneration on all NPS lands. The remaining 100,000 acres would require planting.

The average accomplishments are derived from a National Fire Plan Operations and Reporting System (NFPORS) data pull: over the last 5 years, NPS performed approximately 17,000 acres of active restoration and reforestation on burned areas. The NPS does not maintain reforestation targets. Rather, it pursues reforestation through specific projects, wildfire activities, and natural regeneration. These figures are only estimates based on compilation of the best available data. The NPS does not track or report this exact data on an annual basis.

Those areas where hand or machine planting can occur are dependent on project funding and capacity to accomplish reforestation goals and objectives. Addressing the backlog would require significant additional funding. The 2030 target does not indicate an ability to go beyond current reforestation annual accomplishments.

c. DOI – U.S. Fish and Wildlife Service

Total Backlog	Average Annual Reforestation Accomplishments	Target By 2030
336,000 acres	1,500 acres	48,000 acres

Approximately 20 million acres of forests grow within the National Wildlife Refuge System. Most (about 17 million acres) are in Alaska with the remaining 3 million acres across the lower 48 states and Hawaii. Alaska's contribution to FWS's reforestation backlog is difficult to assess because of the remote nature of its forests and subsequent lack of data. Additionally, this analysis excluded Puerto Rico and the Virgin Islands because forest cover information was not readily available. Data assumptions calculated from several data sources were tested against regional forest expertise from the FWS Forest Ecology Working Group. With additional funding for 50 personnel, annual seedling purchases, and site preparation contracts, the FWS could address the planning, implementation, monitoring, and post planting needs.

Reforestation targets account for both hand or machine planting and natural regeneration opportunities over the next eight years. Natural forest regeneration within the National Wildlife Refuge System is considered a management action. If high quality and abundant natural regeneration is nonexistent after disturbances, the FWS analyzes whether hand or machine

planting needs and costs will be necessary. Areas determined to be appropriate for hand or machine planting because of inadequate natural regeneration may depend on additional funding and capacity to accomplish reforestation goals and objectives.

d. DOI – Bureau of Indian Affairs

Total Backlog	Average Annual Reforestation Accomplishments	Target By 2030
458,000 acres	16,000 acres	240,000 acres

The Bureau of Indian Affairs (BIA) provides technical and financial assistance services to approximately 313 Tribes with forested reservations. The BIA has approximately 545,000 acres of trust forest lands in need of reforestation. Based on a 10-year (2011-2021) average, the BIA and Tribes reforest 16,000 acres annually. While some Tribes have tribal reforestation crews, most Tribes utilize contractors for reforestation projects. Current funding for reforestation is not sufficient to eliminate the backlog. To eliminate the backlog by 2030, annual accomplishments would need to increase to 68,500 acres, requiring an additional $20 million dedicated to reforestation. Additional capacity is also needed for human resources, environmental compliance and archaeology, geospatial analysis, contracting officers, and awarding officials.

Tribal reforestation data is submitted by the Tribes to the BIA regions. Backlog acres are prioritized by the Tribes and the regions, considering the availability of funding.

A near term focus for the BIA is assisting Tribes in expanding greenhouses and production capacity. Most of the Tribes involved in forestry, reforestation, and seedling production are members of the Intertribal Timber Council. Additional opportunities to revamp and expand tribal seedling production could help fill gaps in supply.

e. USDA – National Forest System, U.S. Forest Service

Total Backlog	Average Annual Reforestation Accomplishments	Target By 2030
3.6 million acres	190,000 acres	1.8 million acres

Severe threats to forested landscapes continue to escalate with wildfire alone driving approximately 80 percent of reforestation needs on NFS lands. A substantial portion of the 3.6 million acres of reforestation backlog on NFS lands stems from recent wildfires. In 2020 and 2021, more than 2.5 million acres of NFS lands burned with high severity, compounding the acres previously identified and verified as needing reforestation. The total reforestation need through 2030, including the current backlog and new needs created primarily through wildfire, is

projected to be more than 7 million acres. During the last decade, only 6 percent of post wildfire planting needs were addressed annually, which is insufficient to sustain the forests on which we depend. The Repairing Existing Public Land by Adding Necessary Trees (REPLANT) Act is bringing additional resources to support reforestation and provides a down payment on addressing the backlog. However, even with REPLANT, funding is insufficient to address both the backlog and anticipated new reforestation needs. Nonetheless, REPLANT provides a crucial down payment to accelerate reforestation, and similar investments of this kind are needed across land management agencies to meet the need and opportunity that reforestation presents.

The Forest Service's National Forest System outlines the goals and objectives necessary for successful reforestation on national forests. These goals and objectives build a robust framework to increase the pace and scale of reforestation to address existing needs, anticipate future events, and meet the provisions of the recently passed REPLANT Act. The Reforestation Strategy's six goals emphasize the importance of strategic communication and developing a shared understanding of reforestation, and they describe actions needed throughout the reforestation process including expanding reforestation workforce capacity, seed production, nursery capacity, and related infrastructure. The Forest Service will develop national and regional 10-year implementation plans with specific actions for each goal.

The Forest Service's estimate of total current reforestation needs (3.6 million acres) is derived from the verified needs within the Forest Service Activity Tracking System (FACTS) database (2.5 million acres at the end of FY 2022) and regional projections of additional existing acres from disturbances that have occurred but have not been fully assessed. The projection of more than 7 million acres of total reforestation need through 2030 includes the current need plus a projection of new needs accruing through 2030. The target of 1.8 million acres by 2030 is based on current costs, capacity, and projected available resources. The Forest Service will develop annual targets to support achieving the target of 1.8 million acres beginning in FY 2024. In addition, the FS will continue to evaluate opportunities to increase potential reforestation accomplishments as available resources, partnership opportunities, capacity, and costs change. Additional disturbances could impact reforestation needs, response timeframes, and costs.

Part 1(b) REFORESTATION OPPORTUNITIES THROUGH EXISTING FEDERAL PROGRAMS

a. **DOI – Office of Surface Mining Reclamation and Enforcement**

OSMRE	Estimation of Reforestation Total Opportunity
Sites subject to Title IV of SMRCA	27,500 acres
Sites not subject to Title IV	237,500 acres

The Office of Surface Mining Reclamation and Enforcement (OSMRE) investigated the feasibility of vegetation enhancements on reclaimed mine sites subject to Title IV of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), as well as mine sites not subject to that title. OSMRE does not track revegetation data; therefore, revegetation potential can only be estimated. OSMRE considered Title IV mine sites, i.e., sites abandoned or not adequately

reclaimed before enactment of SMCRA, including sites with a specific feature in need of reclamation.

OSMRE identified as many as 22,000 Title IV sites that might provide revegetation opportunities. Approximately one-half of these sites are in the west or midwest and are generally not formerly forested ecosystems. Reforestation of one-half of these sites, which are located primarily in the Appalachian Coal Basin, would be a natural and acceptable land use. Based on OSMRE experience, typically 50 percent of the landowners of these sites opt for reforestation. Thus, OSMRE estimates 27,500 acres of Abandoned Mine Land (AML) available for reforestation, mostly in the eastern U.S.

In addition, OSMRE looked for mine sites not subject to Title IV that have post-mining land uses conducive to the restoration of native habitats such as forestland, wildlife habitat, and undeveloped land. Most of these mine sites were reclaimed with techniques available at the time and have resulted in excessive soil compaction and aggressive ground cover that can hinder the establishment of native habitat. OSMRE identified as many as 14,000 older reclaimed sites nationwide and 5,000 bond forfeiture sites that could be examined for revegetation opportunities. OSMRE estimates 237,500 acres of non-Title IV mine lands available for reforestation, mostly in the eastern U.S.

The Bipartisan Infrastructure Law (BIL) Mined Land Provision (Public Law No. 117-58, section 40804(b)(8)) provides funding to the Forest Service and DOI to support reforestation on formerly mined private land. The Abandoned Mine Land Economic Revitalization program and the Watershed Cooperative Agreement Program could serve as models for the distribution of funds to States, Tribes, non-governmental organizations, and other qualifying entities. These models achieve environmental improvements as a complement to the existing SMCRA regulatory and AML programs. Moreover, the Appalachian Regional Reforestation Initiative (ARRI) and Green Forests Work serve as models for cooperation with non-governmental organizations and other entities interested in and available to support and enhance vegetation on reclaimed mine sites. Together, these two organizations have planted over 5 million trees on 9,000 acres over the last fourteen years. OSMRE's ARRI would like to expand these types of partnerships to scale mine land reforestation.

b. USDA – Opportunities on State and Private Timberland

	Estimation of Reforestation Opportunity
State	Total understocked acres: 5.1 million (700,000 non-stocked; 4.4 million poorly stocked)
Private	Total understocked acres: 51.4 million (5.9M non-stocked; 45.5 million poorly stocked)

The Forest Service utilized its Forest Inventory and Analysis (FIA) data set to analyze potential reforestation opportunities on state and private timberland. These acres do not necessarily reflect private landowner interest, and not all lands are appropriate for reforestation under established

programs. The FIA program defines timberland as forest land that is not reserved (i.e., not permanently prohibited from timber production) and productive (capable of producing at least 20 cubic feet of wood per acre per year). Forest land includes all land that has at least 10 percent canopy cover of live trees or that has had at least 10 percent canopy cover in the past (USDA Forest Service 2018). With these definitions, FIA data totals 385.7 million acres of timberland on state and private lands.

This analysis used the most recent publicly available FIA data (2006-2022) to estimate the acres of potential opportunity for reforestation or supplemental planting on state and private land across all U.S. states and territories. Two forest stocking classes were considered: non-stocked, which may provide an opportunity of reforestation; and poorly stocked, which may benefit from supplemental planting. FIA plots that meet the definition of forest land but have less than 10 percent cover of trees, saplings, and seedlings at the time of sampling are classified as "non-stocked," and those with 10-34 percent cover are classified as "poorly stocked" (USDA Forest Service 2018[4]). Some non-stocked areas may regenerate naturally over time, and poorly stocked areas may similarly experience a natural increase in tree cover. Other areas may require planting or seeding to reestablish tree cover or increase the rate of recovery. Moreover, areas with recent disturbances provide additional reforestation and supplemental planting opportunities, and areas that are not currently considered forest land provide opportunities for afforestation. An alternative study, Reforestationhub.org,[5] uses a different method to identify a higher number of acres, about 130 million acres on private lands, as having a reforestation opportunity.

c. USDA – Opportunities on Private and Tribal Riparian Buffers

	Estimation of Reforestation Opportunity on Riparian Lands in Important Surface Drinking Water Areas
Private	5.7 million acres
Tribal	90,000 acres

Riparian areas (e.g., lands adjacent to rivers, streams, creeks, canals, lakes, and other surface waters) are prime locations for riparian forests buffer or other agroforestry practices. Opportunities exist on tribal and private acres. (Private ownership includes corporate, non-governmental organizations, local associations, private conservation land, conservation easements, and individual and family lands.) The USDA Forest Service, in collaboration with the USDA Natural Resources Conservation Service (NRCS), assessed riparian areas in the continental U.S. to identify lands where trees, shrubs, and/or grasses could be planted or enhanced to filter water running off cropland to improve water quality. These estimates are based on a 33 foot (10 meter) wide riparian area and do not account for historical land cover, such as native grasses, site-level feasibility, or ecological value of establishing riparian forest buffers.

The riparian areas used for this estimate were generated for the Buffering America's Waterways Tool.[6] A 10-meter-wide riparian area around all streams and waterbodies was generated using flowline and waterbody data from the National Hydrography Dataset Plus.[7] Each of these buffer areas was overlain on the 2020 Global Land Use/Land Cover cropland classifications layer to

calculate the total acreage of cropland within the 10-meter riparian area.[8] These estimates do not include pastureland adjacent to streams and waterbodies.

The Protected Areas Database (CBI edition 2016) was used to determine the land ownership (private or Tribal) for each riparian area opportunity.[9] The Buffering America's Waterways Tool further prioritizes riparian areas using the National Forests to Faucets 2.0 Assessment watershed importance data.[10] By combining importance to surface drinking water data with the percent riparian area that is cropland, the Buffering America's Waterways Tool identifies riparian area in watersheds important to surface drinking water that have greatest opportunity for improving water quality by establishing perennial vegetation between croplands and water bodies. Only watersheds with an index of 50 or higher in the Buffering America's Waterways Tool were used for these estimates. Watersheds with an index greater than 50 are generally more important for surface drinking water due to large or multiple surface drinking water systems downstream or higher precipitation amounts leading to more runoff potential and pollution risk.

d. USDA – Farm Bill Conservation Programs

Conservation Reserve Program (CRP): The USDA Farm Service Agency's (FSA) CRP is a voluntary program that contracts with agricultural producers and private landowners to establish conservation covers, such as grasses or trees, on environmentally sensitive agricultural land to aid in controlling soil erosion, improve water quality, and develop wildlife habitat. CRP was authorized by the Food Security Act of 1985 and reauthorized by the Agricultural Improvement Act of 2018 (the 2018 Farm Bill). The 2018 Farm Bill established an enrollment ceiling of 27 million acres by 2023. USDA's 2023 Budget includes $2.47 billion in annual funding to carry out the CRP. Technical assistance for CRP tree practices is provided by the Forest Service through State forestry agencies, the NRCS, or technical service providers.

Tree practices on marginal lands, such as forested riparian buffers along water bodies, can be a powerful tool to address water quality and erosion challenges. As of December 2022, CRP enrollment was 23 million acres. Based on the approximately 4 million acres available for enrollment, plus 2 million acres that are scheduled to expire in FY 2023, about 6 million acres are available for enrollment in FY 2023. Based on CRP enrollment history, approximately 7 percent of total CRP enrollment is dedicated to tree practices, a trend that FSA expects to continue and potentially expand, particularly through Continuous CRP[11].

Emergency Forest Restoration Program (EFRP): The EFRP administered by the FSA provides payments to eligible owners of nonindustrial private forest land to carry out emergency measures to restore land damaged by a natural disaster. EFRP signup is activated by a local county and State committee, and signup periods are announced locally. Applicants receive technical assistance through an onsite inspection performed by State forestry agencies, provided through an agreement between FSA and the Forest Service. Funding is provided to the Forest Service for technical assistance through this agreement. Financial assistance varies from fiscal year to fiscal year; in FY 2022 the financial assistance was $44.5 million. After forest restoration practices are identified, approved participants perform restoration activities and may receive cost-share reimbursement once restoration activities are complete. Cost-share of up to 75 percent of out-of-pocket costs are provided up to a payment limitation of $500,000.

Environmental Quality Incentives Program (EQIP): EQIP, administered by the USDA NRCS, provides technical and financial assistance to agricultural producers and forest landowners to address natural resource concerns. NRCS works one-on-one with producers to develop a conservation plan that outlines conservation practices and activities to help solve on-farm resource issues. Producers implement practices and activities in their conservation plan that can lead to cleaner water and air, healthier soil, and better wildlife habitat, all while improving their agricultural operations. Outreach efforts to participants potentially eligible for forestry practices will continue. NRCS will strive to maintain the same level of forestry practice enrollment while looking to have continued growth. Forestry practices include alley cropping, multistory cropping (forest farming), riparian forest buffers, silvopasture, windbreak establishment, and windbreak renovation.

NRCS obligations for EQIP vary from year to year; in FY 2022, obligations were $35.3 million. The estimation of reforestation opportunity, 51.4 million acres (5.9 million non-stocked; 45.5 million poorly stocked) is derived from the Forest Service Forest Inventory and Analysis (FIA) data set as described in Part1(b). As noted, reforestation opportunity does not necessarily reflect private landowner interest, and not all lands are appropriate for reforestation under established programs.

Conservation Stewardship Program (CSP): The Conservation Stewardship Program (CSP) administrated by the NRCS is the largest conservation program in the U.S. with more than 70 million acres of productive agricultural and forest land enrolled. NRCS works one-on-one with producers to develop a conservation plan that outlines and enhances existing efforts, using new conservation practices or activities, based on management objectives for their operation. Producers implement practices and activities in their conservation plan to expand on the benefits of cleaner water and air, healthier soil, and better wildlife habitat, all while improving their agricultural operations. CSP obligations vary from year to year; in FY 2020 obligations totaled $9.98 million; in FY 2021, $17.70 million; and in FY 2022, $36.08 million.

The estimation of reforestation opportunity, 51.4 million acres (5.9 million non-stocked; 45.5 million poorly stocked) is derived from the FIA data set as described in IV. Part1(b)a; as noted, reforestation opportunity does not necessarily reflect private landowner interest, and not all lands are appropriate for reforestation under established programs.

e.   **USDA – Urban Reforestation Assessment**

	Estimation of Reforestation Opportunity
Urban	7.8 million acres[12]

Urban trees are important for health, wealth, and climate change response. Trees cool our cities and towns naturally, clean the air, reduce energy consumption, sequester carbon, improve mental health, and potentially increase property values. Urban forestry is also a job generator. Trees in cities reduce surface temperatures by as much as 45 percent and provide additional natural

cooling via evapotranspiration. In the contiguous U.S., urban trees store over 708 million tons of carbon (approximately 12.6% of annual carbon dioxide emissions in the U.S.).[13] Additional data on the co-benefits of urban trees can be found on the Forest Service, American Forests, and National Association of Regional Councils website: Vibrant Cities Lab.[14]

The primary Forest Service urban forestry program is the Urban and Community Forestry Assistance Program (UCF) established under section 9(c) of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. 2105(c)). UCF is a technical, financial, and educational assistance program delivering nature-based solutions to ensure a resilient and equitable tree canopy in areas where more than 84 percent of Americans live. The Inflation Reduction Act, subtitle D, section 23003(a), allocated $1.5 billion to provide multiyear, programmatic, competitive grants to State and local governments, the District of Columbia, an agency or governmental entity of an insular area governments, Indian Tribes, and nonprofit organizations through the UCF for tree planting and related activities.

UCF is a covered program under the USDA's Justice40 Initiative established through Executive Order 13985. To advance the mission of Justice40, proposals that deliver 40 percent of the benefits of IRA investments through established partnerships with local organizations working to support disadvantaged communities experiencing low tree canopy and environmental justice will receive priority consideration. On April 12, 2023, the Forest Service issued a Notice of Funding Availability[15] soliciting proposals to advance the direction of the IRA. Along with the open grant funding opportunity, the Forest Service is providing up to $250 million to States and territories to further local efforts to support urban communities through equitable access to trees and the benefits they provide. The funding for State and territory forestry agencies will be administered as subgrants to reach disadvantaged communities, as determined by the Climate and Economic Justice Screening Tool.[16]

Potential opportunities for reforestation on urban land in the U.S. is based on estimated urban available green space of 25.8 million acres, of which 7.8 million acres may provide opportunities for reforestation.[17] For this analysis, urban available green space is defined as the amount of grass and soil area not covered with tree canopies and potentially available for planting. The acreage is calculated using the land area (not including water) of the geopolitical units derived from the U.S. Census cartographic boundary data and National Land Cover Database (NLCD). This value is determined by subtracting the acres of tree canopy cover from the total green space. Total green space is an estimate of pervious cover (i.e., grass, soil, or tree-covered areas) and was derived by taking the total area minus impervious and water cover.

The area of potential reforestation opportunity is estimated by adjusting available green space based on NLCD (2016) land cover class. Agriculture, wetland, and medium and high density developed areas are assumed to have zero acres of reforestation potential. In urban land classified as forest or shrub/scrub, 77.3 percent of the total available green space is assumed to be able to be planted. For all other land cover classes (low intensity/open space, developed, barren and grass/herbaceous), 27 percent of the total land area is classified as having no reforestation potential.[18]

Part 2: A CLIMATE-INFORMED PLAN TO INCREASE SEED AND NURSERY CAPACITY

a. Introduction

Extreme wildfire and other large scale disturbance events threaten our forests. Since 2002, invasive pests have killed 40 million ash trees in Michigan and tens of millions more throughout the Northeastern U.S. In 2022, an estimated 36 million trees were standing dead in California, killed by the cumulative impacts of extended drought, overstocked conditions, and insects and diseases. This is the highest count of dead trees since 2016, and it adds to the 127 million trees that were killed during the 2012-2016 drought, which has since fueled some of the most devastating wildfires in U.S. history.

The pace of climate change is exceeding the natural adaptation abilities of many tree species. For example, almost 20 percent of all Sierra Nevada conifer species are now mismatched with their current climate conditions. This rapid rate of change demands a different approach to traditional forest practices by adopting advances in climate adaptation science regarding tree and forest establishment. Climate change challenges conventional tree establishment practices. Adaptation requires a sharpened, climate-informed approach to ensure that newly established trees thrive. This may mean assisting some species, populations, or genotypes beyond their current range to help ensure current and future forests are better matched with future climates and are more resilient to climate mediated stressors such as drought and pests.

The Reforestation Pipeline

Successful tree establishment through natural regeneration or planting depends on a sequence of events and begins years before the physical tree establishment event occurs. This chain of events, or pipeline, includes planning and assessment; ensuring seed availability; growing seedlings; preparing the site; tree establishment; and monitoring and tending for the long-term. Each of these main steps has an embedded sequence of events as well. Broken links anywhere in these interconnected chains diminishes or impedes results. Critical to achieving these steps is developing and maintaining a well-trained, well-supported cadre of professionals.

Delayed reforestation is costly. Large fire scars, especially those near communities and other infrastructure, are highly susceptible to flash flooding and debris flows as rainfall is no longer absorbed by the forest and instead quickly runs off. These areas require immediate revegetation to avoid damage and potential loss of life as well as potential negative impacts on drinking water supplies. After wildfires, reestablishing trees can stabilize soil on hillsides and mountains and reduce the risk of debris flow while contributing to other desired reforestation benefits (e.g., carbon sequestration, productivity, effective wildlife habitat). Timely reforestation within fires scars is critical as it can take a few years to a decade for plants to establish depending on the severity of the wildfire and local climate. Delays in reforestation projects, such as planting seedlings out of desired times of year, can decrease seedling survival and growth.

Seeds are necessary for both natural regeneration and tree planting. Seed fall contributes to natural regeneration, whereas seed collected in the forest or tree seed orchards produce seedlings

for planting. Climate change is increasing the need for seed diversity as plant species are being affected by altered climatic conditions and ecosystem processes. For example, Washington State Department of Natural Resources reports that it relies on more than 335 genetically appropriate seed sources to ensure proper placement of seedlings across their variety of climate zones and elevation bands. Seed orchards provide an economically efficient supply of high quality and genetically diverse seed for reforestation. Climatic changes are affecting the location of seed zone boundaries with some boundaries likely shifting substantially. Without updating, a strict following of exiting seed zones could lead to forests that are poorly adapted to future conditions, decreasing productively and climate resilience.

In addition to seed collection, seed must be processed and stored. Seed collectors with the technical skills to clean and treat seeds and seed extractories to process seeds are both in short supply. Seed banking (i.e., seed storage) is often managed by public agencies. For example, all Forest Service nurseries and seed extractories have seed banks. Gaps in seed inventories exist that could worsen with the complexity of changing climate-based seed zones.

Currently, forest and conservation nurseries annually distribute about 1.3 billion seedlings, resulting in about 2.2 million acres of tree planting annually. This level is down from the zenith of two billion seedlings annually in the mid-1980's. New or refurbished nurseries are coming online, particularly in the private sector, and this added capacity is critical and will need to continue across the federal, state, tribal and private sectors.

Depending on species, location, and planting objective, container and bareroot seedlings can be ready for outplanting in as little as 6 to 12 months but may require 2 to 4 years. Current seedling production is highest in the Southeastern U.S., followed by the Pacific Northwest. Private industry grows the most seedlings (94 percent), followed by states (4 percent) and the Federal government (2 percent). Nearly all seedlings grown by the Federal government are produced in the six NFS nurseries. For decades, DOI and USDA have used source identified information to record seed collections and deploy seed on the landscape. This information has come from decades of research that helps to ensure that land managers are planting the right seed in the right place.

USDA National Forest System National Nursery System

This network includes six nurseries, most with seed processing capabilities, and two stand-alone seed extractories. The USDA Forest Service National Nursery System provides seed and seedling services to USDA and DOI, while also supporting other Federal, State, and Tribal entities throughout the U.S. It currently delivers about 28 million tree and native plant seedlings annually, of which about 5 million seedlings are grown for non-Forest Service Federal agencies, States, and Tribal partners. This system could deliver 11 million additional seedlings annually if fully staffed. Although available space could produce 70 to 90 million seedlings annually, reaching full capacity requires addressing workforce and infrastructure constraints.
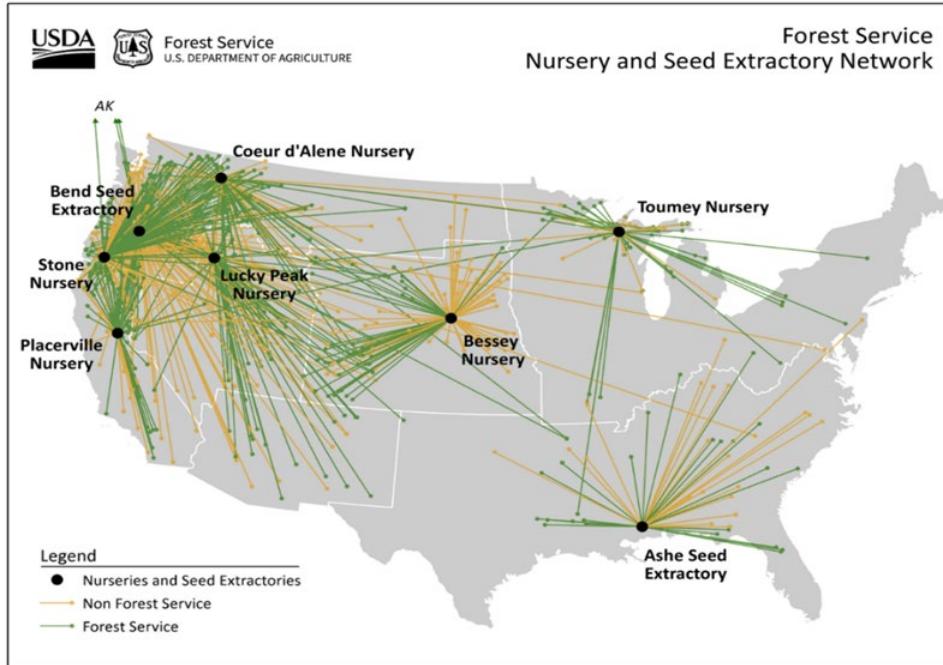
The USDA National Forest System, National Nursery System provides seed and seedling services to USDA and DOI, while also supporting other federal, state, and tribal entities throughout the US.

DOI Seed Warehouses

BLM Regional seed warehouses (in Ely, NV and Boise, ID) currently do not store tree seed. On average, BLM seed warehouses offer seeds of over 200 different types of grasses, forbs, and shrubs, depending on market availability and crop/collection conditions. The Ely and Boise seed warehouses have the capacity to store 2.1 million pounds of seed, which is about one-fifth of the total storage needed for BLM restoration from fire and other disturbances. The BLM estimates it needs another 1 billion pounds of native seeds for its projected acreages in need of restoration. However, cold storage is best for tree seed, and BLM warehouses have limited cold storage.

b. **Summary of Feedback from Engagement Sessions and Outreach**

In response to EO 14072, USDA and DOI hosted two engagement sessions (February 15 and 16, 2023). The first included about 40 representatives of State forestry agencies, and the second included about 50 attendees representing preeminent academic researchers, private reforestation companies, and numerous non-governmental organization partners, among others. In addition, the USDA Office of Tribal Relations led an engagement session with representation from Tribal forestry experts and Tribal reforestation-focused partners (February 23, 2023). Discussion topics explored how to bring efficiencies to public-private partnerships; provide market-signals and other predictive analyses to better enable seed and nursery sectors to scale up; increasing funding and technical assistance for private landowners interested in voluntary reforestation, especially

historically underserved landowners; and the need to better integrate Indigenous Traditional Ecological Knowledge including viewing reforestation more holistically than just tree planting.

c. Recommendations

Prior to EO 14072, the BLM commissioned a report from the National Academy of Sciences, Engineering, and Medicine: An Assessment of Native Seed Needs and the Capacity for their Supply[19], which was released in January 2023. Many of the report's recommendations have application here. In addition, in response to USDA Secretarial Memorandum 1077-004[20], USDA is preparing a suite of recommendations for working as OneUSDA to increase climate-informed tree establishment, cone and seed collection, and nursery capacity to meet demands. Finally, in July 2022, the Forest Service issued the National Forest System Reforestation Strategy: Growing and Nurturing Resilient Forests[21]. Common themes emerged from these reports and from the public engagement sessions including the need for formal and informal forums for collaboration among the Federal partners and with non-Federal partners. In addition, there is agreement amongst all sectors and partners that the scope and scale of reforestation requires best available science and employment of cutting-edge technologies. Needed investments are far ranging including improving infrastructure and supporting additional well-trained professionals at levels commensurate with the scale of reforestation needs.

Given these in-depth and department-specific guidance documents, the recommendations included herein are focused on opportunities for high-level, cross-departmental actions. The recommendations are organized around four themes:

1. Coordinate Interagency Processes
2. Increase Climate-adapted Seed Supply & Optimize Seed Processing and Storage
3. Optimize Nursery Operations
4. Prioritize Workforce Development

1.0: Coordinate Interagency Processes

1.1: Establish an Interagency Working Group (IWG) that facilitates sustained interagency coordination of seed collection and supply, nursery infrastructure and related reforestation efforts. Departments of the Interior (DOI) and Agriculture (USDA) will co-lead an interagency working group comprised of other Federal agencies and offices with reforestation equities. The IWG would be charged with implementation of the reforestation directives of the EO and with coordinating with key stakeholders to help advance the EO's reforestation objectives. Specific actions of the IWG could include:

- identify opportunities to use existing authorities and existing or future authorized and appropriated funds to promote efforts to achieve reforestation targets and objectives;

- identify statutory, regulatory, and other limitations that constrain Federal action in furtherance of reforestation targets and opportunities, and recommend potential administrative and legislative actions to remedy such limitations;

- collaborate with State, local, and Tribal partners to achieve reforestation targets and opportunities;

- identify bottlenecks in regional supply chains and explore streamlined protocols and procedures across Federal agencies including for Federal partners to sell, trade, donate seed, seedlings, or surplus material; establish processes for enabling partners to collect seed on Federal lands; and, where appropriate, protocols for coordination of investments.

- develop and implement a methodology to track and measure Federal activities related to agency-specific reforestation targets and Federal support for Tribal, State, and private reforestation through Federal programs and partnerships; and,

- share science, tools, or new technology that can support climate-informed reforestation.

1.2. Develop a reforestation MOU between DOI and USDA to identify specific areas of cooperation between departments. In addition to the enhanced coordination through the multi-departmental IWG, DOI and USDA should establish an MOU specific to sharing of procurement and property services and grants and agreements to increase efficiency between DOI and USDA. A reforestation MOU between DOI and USDA could serve as the umbrella mechanism, with national level USDA Indefinite Delivery Indefinite Quantity contracts, blanket purchase agreements, partnership agreements, or other inter-agency funding agreements serving more specific opportunities.

1.3: Explore formalized interagency partnerships and shared prioritization with the Environmental Protection Agency (EPA), DOI, and USDA to combine remediation authorities with reforestation authorities. The Infrastructure Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (BIL) Mined Land Provision (Public Law 117-58, Section 40804(b)(8)) provides funding to the Forest Service and DOI to support reforestation on formerly mined private land. This provides the opportunity for OSMRE and the Forest Service to complement EPA's remediation authorities to restore private forests. Partnerships and agreements are needed to share location data for remediated sites. State Forestry Agencies are instrumental in providing outreach and technical assistance to private landowners, train foresters on mined land restoration activities, and provide financial assistance to landowners for site preparation, tree establishment, and maintenance. With current BIL 40804(b)(8) funding, the Forest Service and OSMRE are exploring reforestation project opportunities with the EPA on non-Federal remediated mined lands and supporting projects in Appalachia to reforest former coal mined land.

2.0: Increase Climate-adapted Seed Supply & Optimize Seed Processing and Storage

2.1: Increase investments in seed orchards. Seed orchards are an efficient and economical source of high-quality seed. Many orchards would benefit from increased management in order to optimize high-quality seed production. New seed orchards are needed to augment or replace aging seed orchards, especially for species with seeds that store poorly and require annual predictable harvest. Investments in seed orchards should include:

- **Inventory existing seed orchards within the USDA and DOI to determine maintenance and revitalization needs.** Assessing the condition of seed orchards, including their vulnerability to wildfire, is vital to understanding existing infrastructure.
- **Compile a directory of other Federal, private, State or Tribal seed orchards.** Multiple Federal, State, and Tribal land management agencies as well as private industry and tree improvement cooperatives operate seed orchards. Sharing this information can facilitate opportunities for seed to be shared across land ownerships. Partners could include State Forestry Agencies, Tribes, universities, and other entities who would conduct and report on seed orchards on non-Federal land.
- **Foster shared learnings to enable states and tribes to invest in seed orchard revitalization.** Several states, including Washington State for example, are utilizing funds generated from forest management to kickstart seed orchard revitalization.

2.2: Establish a national tree seed collection permit system for Federal lands. Developing, standardizing, and improving the permit process for commercial tree seed collection with consistent product plans will expand seed collection opportunities for non-Federal entities, including Tribes, on Federal lands.

2.3: Use and promote tools for climate-informed seed deployment. While well-developed tree seed zones and provisional zones for native plants are known for some parts of the country, some areas need reevaluation or new guidance. Using existing, vetted tools for climate-informed seed selection and deployment such as the USDA Forest Service Seedlot Selection Tool should be prioritized.

2.4: Align seed collections with commonly used metrics to source identify all seed in storage and incentivize collecting and tracking this information. A variety of metrics (geolocation, seed zones, and/or county of origin) are employed to source-identify seed that is collected and eventually planted. With climate change, collecting and tracking precise seed source information (i.e., GPS coordinates and elevation) will be critical to ensure alignment of genetically appropriate seed, climate, and reforestation site to minimize maladaptation and promote healthy resilient forests. Private seed collectors may not wish to share this information for proprietary reasons, but this practice should be incentivized by requiring source identification of any seed purchased by Federal agencies or used in federally funded or matched programs. Standardized seed data metrics, especially geolocation, should be identified in collaboration with Federal agencies, Tribal entities, State Forestry Agencies, and other partners.

2.5: Collaborate with landowners to enhance knowledge of the value of quality cone and seed collection. To meet reforestation demands, seed will need to be collected from all lands. Working with partners (e.g., National Association of State Foresters, National Association of Conservation Districts, Forestry Extension Programs of Land Grant Universities, as well as private companies active in this space) outreach to non-Federal landowners to increase the knowledge of the value of seed and requirements for source identification. Outreach strategies should acknowledge a history of proprietary concerns by private entities against sharing geolocation data to protect investments.

2.6: Develop an online seed sharing marketplace and a "real time" seed crop availability information management system. A searchable online tree seed marketplace that is organized

by geographic region, and identify suitable seed deployment areas under climate change, may facilitate climate-adapted sharing of seeds among Federal, Tribal, State, and commercial nurseries. Seed banks with known surpluses and needs would use the site to facilitate meeting needs across all lands. Through engagement sessions, many partners noted the need for timely sharing of information about seed harvesting status given that seed collection opportunities are often unpredictable and short-lived. Examples of real-time notifications, such as the Inter-agency Incident Information Management System (InciWeb) could form the model for a "real time" seed collection opportunity system. A challenge grant, perhaps through challenge.gov, should be issued to solicit innovation.

3.0: Optimize Nursery Operations

3.1: Increase financial assistance to non-Federal nurseries that provide plant materials.
USDA and DOI should consider opportunities to increase the allocation of funding, including Bipartisan Infrastructure Law (BIL) funds (section 40804(b)(9)) made available for non-Federal land revegetation, to invest in Tribal and State nurseries, including, where appropriate, non-commercial tree species and non-tree species. In addition, an assessment of existing loan programs and grant program that could be used to support new nurseries or nursery expansion should include the USDA's Rural Development and Farm Service Agency.

3.2: Assess Federal, State, and Tribal seed and nursery capacity. This assessment would inform a USDA-USDOI MOU to share resources and would provide project planners information on potential resources available for their project. The National Tribal Timber Council, the National Association of State Foresters, and the private sector should be invited to collaborate on the assessment, recognizing that this participation is strictly voluntary. This information will also enable a more accurate assessment of current and future seed inventory needs, recommend uniform data collection and recording metrics, and explore barriers to seed transfer among land ownerships. This assessment could also be basis for development of a seed-sharing marketplace among Federal, Tribal, State, and private nurseries.

3.3: Develop an online seedling sharing marketplace and "real time" seedling availability management system. Not all seedlings grown in nurseries are planted and too often excess seedlings are disposed of for lack of buyers. Complementary to Recommendation 2.6, an online marketplace or automated notification system could provide real time inventories of surplus seedlings to promote efficient use of seedlings. Particular attention should be paid to encouraging smaller and mid-sized nursery participation. A challenge grant, perhaps through challenge.gov, should be issued to solicit innovation.

3.4: Invest in nursery infrastructure and equipment, ensuring overall sustainability, energy and labor efficiency, worker safety, physical security, and deferred maintenance are addressed. Many U.S. nursery operations across all sectors have aged facilities in need of constant maintenance, have physical security concerns, and use energy inefficiently. In keeping with Executive Order 14057: *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, Federal nurseries should lead on changes to increase energy efficiency and more sustainable practices. The 2021 National Renewable Energy Laboratory report to the National Forest System provides foundational recommendations for basic efficiency upgrades. A more comprehensive assessment will strategically align improvements to maximize gains specific to

nursery operation and renewable energy (e.g., improved appliance efficiencies, sustainable energy capture [wind, solar], mechanization and automation, recycling programs [materials, water, etc.], improved irrigation).

3.5: Conduct a nursery industry assessment to identify non-proprietary reforestation sustainability and efficiency innovations. The billion-dollar private nursery industry works to identify innovations in production efficiencies, reduce overhead costs, and provide high-quality, salable products. In consultation with the private sector, non-proprietary practices, procedures, equipment, and infrastructure should be evaluated. As Federal nursery facilities are upgraded or replaced, wherever possible, equipment should be standardized to increase procurement efficiency and potential sharing of equipment and knowledge across facilities. Many innovations may be immediately transferrable to reforestation nurseries; others will require testing and adaption ensure genetically appropriate, high-quality seedlings.

4.0: Prioritize Workforce Development
All forms of reforestation, from initial planning to seed collection and nursery production, to monitoring established trees, require a diverse workforce with specialized knowledge. This workforce includes employees, contractors, and partners. Across Federal agencies, reforestation staffing levels have declined, along with institutional knowledge. As the pace and scale of tree establishment (i.e., reforestation, agroforestry, and afforestation) increases, more trained personnel and skilled contractors will be needed. The Federal agencies are not alone in this respect; workforce issues are identified as the primary limiting factor to increasing nursery production regardless of sector.

4.1: Explore shared or term-limited staffing to meet immediate needs. USDA and DOI reforestation programs share many capacity needs from engineering, acquisition, and contracting expertise to geneticists and silviculturists. As both Departments ramp up, they should explore opportunities for shared or term-limited detail staffing to meet the expected surge in infrastructure and reforestation projects. The Departments should also explore Open Opportunities (openopps.usajobs.gov), a resource for cross-departmental capacity sharing to further meet short-term needs.

4.2: Engage with the Department of Labor and the Department of Homeland Security to document the current H-2A/B employee contribution to Federal, Tribal, State, and private forest sector work. This analysis should document anticipated needs across forest sectors and develop a tree establishment strategy that provides potential solutions to shortfalls in meeting tree growing, planting, and post-planting tending, concomitant with addressing issues of worker social justice. Indications are that wage increases are insufficient to incentivize and attract a workforce to the challenging working environments required for seed collection, nursery production, tree planting, and post-planting care. Alternative incentives may require the subsidization or development of critical support infrastructure and/or social programs to provide career pathways for workers to the forestry sector.

4.3: Strengthen relationships with Corps Facilities. The IWG should explore possible partnerships with Federal and State conservation corps including AmeriCorps National Community Civilian Corps. Corps, including public lands and youth corps, are actively engaged in many forest management activities, including reforestation. The dual mission of Corps is to

provide personal and professional development experiences for participants and to support the mission of the relevant Federal agency or other sponsor. These could include hands on work at various facilities or in the field with cone collection or out-planting. These facilities have programs that would foster training for Job Corps students that would also be candidates for workforce entry.

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[3] Pursuant to the O&C Act, BLM must manage O&C timberlands "for permanent forest production, and the timber thereon shall be sold, cut, and removed in conformity with the [principle] of sustained yield for the purpose of providing a permanent source of timber supply, protecting watersheds, regulating stream flow, and contributing to the economic stability of local communities and industries, and providing recreational [facilities] . . . ." 43 U.S.C. § 2601.

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