

National Seed Strategy and Implementation Plan 2015-2020

The Plant Conservation Alliance participating federal agencies are:

Bureau of Indian Affairs (BIA)
Bureau of Land Management (BLM)
Federal Highway Administration (FHWA)
National Park Service (NPS)
Smithsonian Institution (SI)
United States Botanic Garden (USBG)
United States Department of Agriculture (USDA) Agricultural Research Service (ARS)
USDA Forest Service (USFS)
USDA National Institute of Food and Agriculture (NIFA)
USDA Natural Resources Conservation Service (NRCS)
U.S. Fish and Wildlife Service (USFWS)
U.S. Geological Survey (USGS)

For more information on the Plant Conservation Alliance, its members and activities, please visit <http://www.blm.gov/pca>

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NOTE: This is a preliminary draft for review. Design, layout, technical editing and printing of a final strategy will occur after reviews are completed.

The draft strategy's Action Items name Coordinating Federal Agencies. Additional PARTICIPANTS are welcome and encouraged to add their names to the column labeled Other PARTICIPANTS.

**NATIONAL SEED STRATEGY AND
IMPLEMENTATION PLAN 2015-2020**

Contents

Introduction..... 4

Background and Development..... 5

Vision and Mission 7

 National Seed Strategy Vision 7

 National Seed Strategy Mission..... 7

Guiding Values and Principles..... 7

Goal 1: Identify Seed Needs and Ensure the Supply and Reliable Availability of Genetically Appropriate Seed 8

 Objective 1.1: Assess Plant Production Needs and Capacity of Federal Agencies 8

 Objective 1.2: Assess Capacity and Needs of Private Sector Seed Producers, Nurseries, and Other Partners 9

 Objective 1.3: Increase the Supply and Reliable Availability of Genetically Appropriate Seed..... 10

Goal 2: Identify Research Needs and Conduct Research to Develop Genetically Appropriate Seed and to Improve Technology for Seed Production and Ecosystem Restoration..... 11

 Objective 2.1: Characterize Genetic and Adaptive Variation for Restoration Species to Delineate Seed Zones and Provide Seed Transfer Guidelines 12

 Objective 2.2: Conduct Species-Specific Research on Seed Technology, Production, and Storage .. 13

 Objective 2.3: Conduct Research on Plant Establishment, Survival and Restoration 14

 2.3.1 Identify the limiting steps for plant establishment from seed. 14

 Objective 2.4: Develop Monitoring Techniques and Investigate Long-term Restoration Impacts and Outcomes 15

Goal 3: Develop Tools that Enable Managers to Make Timely, Informed Seeding Decisions for Ecological Restoration 16

 Objective 3.1: Develop Training Programs to Educate Agency Employees on the Use of Genetically Appropriate Seeds for Restoration..... 16

 Objective 3.2: Develop Native Seed Source Availability Data for Use by All Agencies..... 17

 Objective 3.3: Integrate and/or Develop Science Delivery Tools to Support Restoration Project Development and Implementation 17

 Objective 3.4: Use Ecological Assessments and Disturbance Data to Allow Managers to Anticipate Needs and Build Spatially-explicit Contingency Strategies 18

Goal 4: Develop Strategies for Internal and External Communication 19

 Objective 4.1: Conduct Education and Outreach on the National Seed Strategy Using the Plant Conservation Alliance (PCA) Network and Other Interested Stakeholders 19

 Objective 4.2: Distribute and Implement the National Seed Strategy Across Agencies 20

 Objective 4.3: Report Progress, Recognize Achievements, Revise Strategy 20

Literature Cited 22

Acknowledgments..... 23

Glossary 24

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Introduction

Native plant communities are essential to ecosystem integrity and diversity. They also provide ecosystem services that sustain people, communities, and their economies. Yet in recent years, the spread of invasive species, altered wildfire regimes, habitat fragmentation, and climate change have negatively affected many native plant communities and the species that depend upon them. To slow and ultimately reverse these trends, managers and decision makers need a reliable supply of appropriate seed mixtures to facilitate restoration projects.

Restoring native plant communities on a landscape scale poses special challenges. Large acreages often must be replanted quickly to avoid severe erosion or colonization by non-native invasive plants. Adding to the challenges are the expense and difficulty of obtaining and delivering adequate quantities of seed to meet the need, which is often difficult to predict. This seed must be available for use at the right time and in the right place.

Developing the seed stock and the decision tools to aid land managers in finding optimal seed and plant materials for site restoration is a lengthy process. Achieving success on a national scale will involve additional research, improved decision tools and increased communication.

Key will be research, development and the technology transfer required to provide genetically appropriate seed and seedlings for restoring damaged and degraded areas. Genetically appropriate plant materials are those that “will produce plants that are environmentally adapted to a restoration site and that are likely to establish, persist and promote community and ecological relationships” (U.S. Forest Service 2008). In addition, protocols and guidelines are needed for assessing seed quality and for producing high quality seed in agricultural settings while maintaining genetic diversity. Use of high quality, genetically appropriate seed along with improved restoration equipment and strategies will increase our ability to establish successful plantings. The transition from a reliance on non-native stock needs to be guided by coordinated efforts in fundamental and applied research. In addition, new decision support tools and monitoring applications will aid managers throughout the restoration process from planning to assessment.

This document outlines a strategy for achieving these goals, recognizing that success will depend on strong public/private partnerships, funding and increased leadership commitment.

As the lead agency on the Plant Conservation Alliance Federal Committee, the Bureau of Land Management (BLM) worked closely with the Plant Conservation Alliance and others to develop the National Seed Strategy and Implementation Plan 2015-2020 presented here. The strategy’s goals and objectives resulted from the June 2014 National Seed Conference held in Washington D.C. that brought together public and private stakeholders, including members of the Plant Conservation Alliance. The Alliance is an umbrella organization of 12 federal and over 300 non-federal partners who work together to conserve and restore native plant communities across the United States.

This National Seed Strategy is aimed at providing land managing agencies the tools they need to address ecological restoration across the United States. The strategy seeks to develop seed and plant materials that will meet long-term goals to improve the biological and physical conditions at a site, ranging from reclamation to restoration. The term “plant materials” encompasses seed as well as other plant materials, including seedlings and container stock. Use of genetically appropriate plant materials is strongly encouraged; however, this strategy does not preclude the use of non-native plant materials. Non-native species may be needed to achieve site stabilization, fire breaks, weed control, as transitional species for sequential restoration, and to meet restoration objectives. The strategy builds on the achievements and

progress made through the BLM Native Plant Materials Development Program, including Seeds of Success, the consolidation of seed procurement, the ARS National Plant Germplasm System and other public/private efforts to conserve native plant diversity.

The four goals of the National Seed Strategy are:

- Identify seed needs and ensure the supply and reliable availability of genetically appropriate seed.
- Identify research needs and conduct research to develop genetically appropriate seed and to improve technology for seed production and ecological restoration.
- Develop tools that enable managers to make timely and informed seeding decisions for ecological restoration.
- Develop strategies for internal and external communication.

Background and Development

The critical shortage of native plant materials available for seeding following the extensive wildfires of 1999 and 2000 led Congress to establish The Native Plant Materials Development Program (USDI & USDA 2002). The overarching goal was to facilitate development of a long-term program to provide a stable and economical supply of native plant materials for restoration and rehabilitation efforts on public lands. The immediate focus was to increase the availability of diverse native plant materials and to foster more efficient management of that supply. The Program called for a commitment to native plant materials research, production and use that included a recommendation for financial and organizational support from the Department of the Interior (DOI) and the U.S. Department of Agriculture (USDA). In addition, DOI and USDA agencies were directed to improve and expand partnerships in cooperation with the private seed and nursery industry, develop and enhance science delivery to practitioners, and expand outreach and education to the general public.

Much has been achieved since the Native Plant Materials Development Program was established. For example, provisional and species-specific seed zones are seeing greater use in guiding the selection of genetically appropriate seed for ecological restoration projects, thereby increasing the potential for success (Rogers and Montalvo, 2004, Johnson et al.2010). Seed production research has provided cultural practices for growing a wider array of restoration species, while improved equipment, seeding and planting technologies and decision tools provide users with greater flexibility when dealing with complex seeding mixes and site conditions (USDI BLM 2009). In addition, through the Seeds of Success program, collectors have made more than 15,000 native seed collections for use in developing native seed crops and *ex situ* conservation (Haidet and Olwell, In press).

Multiple agencies are collaborating through ecoregional programs to provide plant materials suitable for restoration in specific ecoregions. The Great Basin Native Plant Project led by the Forest Service and BLM, for example, was established in 2002 (Shaw et al. 2012). Its goal is to increase seed availability and develop the knowledge and technology to restore native plant communities across millions of acres of burned lands, with a focus on restoring native sagebrush habitat and increasing native forb production. Partners in the Colorado Plateau (Wood et al. In press) and Mojave ecoregions (DeFalco citation) are

conducting similar programs. Through various research and development projects, seed from more than 200 native plant populations have been made available (USDI BLM 2009).

One of the objectives of this strategy is to create a national network of seed storage warehouses, including USDA and State facilities that would serve all partners and provide both cold and general storage capabilities. BLM, for example, has increased its seed storage capacity from 800,000 pounds to 2 million pounds of seed through the development of the newly established Ely Seed Warehouse in Ely, NV.

Achievement of long-term goals of the Native Plant Materials Development Program will require an even greater commitment to collaboration across agencies and with other partners to share expertise and facilities and to more efficiently produce and utilize plant materials. Leaders of the 12 federal members of the Plant Conservation Alliance met in Washington, DC in June 2014 to celebrate 20 years of plant conservation and to renew the Memorandum of Understanding that established the partnership. The meeting provided a forum for agency staff to initiate discussions on development of a National Seed Strategy to address long term goals for the program. The Plant Conservation Alliance Federal Committee served as the Steering Committee. Members of this Committee, or their representatives, worked with agency experts on the Seed Supply, Research, Decision Tools, and Communication teams to further develop priority objectives and collaborative actions for accomplishing these objectives, and to better describe measurable outcomes.

Implementation of the National Seed Strategy will enhance coordination and forge strong partnerships among agencies, states, tribes, and non-governmental organizations, as well as with the private seed and nursery industry. Such partnerships are vital to the success of ecological restoration efforts. Products and collaborations developed through the Strategy will help land managers select appropriate plant materials to use in public and private ecological restoration efforts at all scales. It also will provide guidance for major federal strategies and initiatives such as the National Fish, Wildlife & Plants Climate Adaptation Strategy (NFWPCAP 2012) and the work of the Pollinator Health Task Force (Office of the White House 2014). Although some of the work is ongoing, full implementation of this strategy will require strong leadership commitment and an interagency budget initiative.

Vision and Mission

National Seed Strategy Vision

The right seed in the right place at the right time.

National Seed Strategy Mission

To ensure the availability of genetically appropriate seed to restore viable and productive plant communities in a changing climate.

Guiding Values and Principles

- Native plant communities provide ecosystem services that sustain people, communities, and their economies.
- Native plant communities are key to ecosystem integrity and provide essential habitat and food sources for wildlife and pollinators.
- Native seed is a critical natural resource asset that deserves greater recognition in light of the ecological challenges of the 21st century.
- Native, locally adapted seed sources are vital for restoration and management because they reflect the evolutionary and adaptive capability of plants in an area.
- Native plants may contain unique properties and the full benefit of these may not yet be recognized but should be preserved for future generations.
- Botanists, plant ecologists, and plant geneticists play a vital role in guiding restoration, reclamation, and rehabilitation of public lands.
- Non-native species may be needed to achieve site stabilization, fire breaks, weed control, as transitional species for sequential restoration, and to meet restoration objectives.
- Interagency collaboration is essential to advance ecological management and research activities, reduce costs and avoid duplication.
- The Departments of Interior, Agriculture, and Transportation acknowledge and value the diversity of partners needed to help manage public lands.
- Federal Agencies support opportunities to:
 - include Tribal, state and local governments, academic institutions and the private sector when addressing restoration issues.
 - improve the availability of genetically appropriate seed required to restore healthy native plant communities.
 - develop strategies and tools for conducting more effective restoration.

- promote research, science delivery and education required to meet new restoration challenges imposed by increasing threats, including climate change.
- communicate the value of native plant communities and restoration to the general public.

Goal 1: Identify Seed Needs and Ensure the Supply and Reliable Availability of Genetically Appropriate Seed

Background/Rationale:

The ability of land management agencies to effectively respond to both emergency and planned restoration needs is highly dependent on the reliable availability of genetically appropriate seed. This requires comprehensive and integrated seed planning and production and storage systems that promote availability of sufficient quantities of suitable plant materials when and where they are needed. Actions to achieve this goal are described below, including needs and capacity assessments, targeted infrastructure investments, increased wildland seed collection and field production, and expanded cooperation and partnerships within and among public and private sectors. Increased financial and organizational support for achieving this work is essential, as is coordination and communication with the private seed industry.

Objective 1.1: Assess Plant Production Needs and Capacity of Federal Agencies

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
1.1.1 Conduct a needs and capacity assessment for each agency providing or using seed. This would include identifying infrastructure assets, staffing and training needs, and evaluating databases and reporting systems.			2015-2016	Emergency and planned restoration seed needs are projected for a 5-year period.
			2015-2016	Agency infrastructure assets are identified and catalogued (e.g., nurseries, extractories, plant materials centers, seed production and storage facilities, etc). Capacity and investment needs are analyzed.
			2015-2016	Databases and reporting systems for seed usage, seed inventory, and field performance monitoring are evaluated for adequacy.
			2015-2016	Staffing and training needs are identified.

1.1.2 Map all agency seed production and storage facilities. Identify products, services, and capacity.			2015-2016	Maps of seed production and storage assets are created. Products, services, production and storage capacities are identified.
1.1.3 Analyze assessment results to identify strengths and take actions to correct deficiencies.			2016-2017	System weaknesses are identified. Specific actions are taken for improving proactive planning capabilities and capacity of federal facilities and agency staff to respond to projected restoration needs.

Objective 1.2: Assess Capacity and Needs of Private Sector Seed Producers, Nurseries, and Other Partners

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
1.2.1 Work collaboratively with private seed producers, nurseries and other private partners to learn how agencies can help them increase seed production capacity.			2015-2020	Actions are recommended and implemented for increasing private sector interest and capacity in collecting or producing native seed (e.g., outreach to expand contractor pools, changes in contract specifications and timelines to minimize risk and uncertainty, annual seed forum, field tours to grower farms, etc.).
1.2.2 Engage federal procurement specialists to assess current contracting regulations and practices to identify strengths and take actions to correct deficiencies.			2015-2017	Improved federal procurement tools to encourage the commercial seed industry to meet seed needs (Indefinite Delivery/Indefinite Quantity Contract, Blanket Purchase Agreement, permitting

				practices, etc.).
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Objective 1.3: Increase the Supply and Reliable Availability of Genetically Appropriate Seed

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
1.3.1 Expand and improve facilities and plant production capacity (based on capacity and needs assessments).			2015-2020	There are adequate facilities and plant production capacity to meet needs.
1.3.2 Improve agencies' capability to plan for seed needs and encourage seed zone use among agencies and program areas (i.e., plan procurements and share seed where appropriate).			2015-2020	Increased planning and coordination within and among agencies and external partners in collecting, propagating, procuring, and sharing plant materials from priority seed zones. Increased use of genetically appropriate seed in both emergency and planned restoration.
1.3.3 Implement alternative seed production methods for 'workhorse' shrub and forb species to augment wildland seed collection (e.g., sagebrush seed orchards).			2015-2020	Reduced damage to wild-land populations, increased adaptation of materials, reduced availability bottlenecks and increased supply of genetically appropriate seed.
1.3.4 Expand collection, conservation, and assessment of native plant genetic resources for use now and into the future through Seeds of Success and other complementary efforts.			2015-2020	Field collection of species population diversity for use in seed zone development, seed production, restoration, and research. Genetic resources are conserved, assessed, and

				distributed through the USDA ARS National Plant Germplasm System and/or other agencies and institutions.
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Goal 2: Identify Research Needs and Conduct Research to Develop Genetically Appropriate Seed and to Improve Technology for Seed Production and Ecosystem Restoration

Background/Rationale:

Use of native plants to restore disturbed communities is essential to provide diversity, improve ecosystem health, facilitate adaptation to climate change and meet resource objectives. Development of genetically appropriate plant materials builds upon the legacy of research on forest tree species conducted to ensure the availability of adapted plant materials to provide long-term sustainability. Research is needed to improve our knowledge of the biology and adaptive genetic variation of current and proposed restoration species. Results of this research can be used to develop and test seed zones and seed movement guidelines for selection of plant materials that are adapted to climatic and other environmental conditions at the planting site and that are resilient to unpredictable environmental disturbances and climate change. Within climate-based seed zones, investigations are identifying plant traits that enhance establishment and persistence within areas of weed invasions or other disturbance types.

Ensuring adequate seed supplies necessitates development of seed technology for restoration species. This includes reliable protocols for seed testing and storage practices for individual restoration species. Knowledge of germination biology and factors controlling seed dormancy is needed to improve success of nursery plantings, agricultural seed production and wildland seedings. Producing seed of restoration species under agricultural conditions, while minimizing loss of genetic diversity, can be challenging. Stand establishment, irrigation requirements, weed control, and harvesting techniques are among the many factors that impact yield. Research to identify pollinator requirements, seed predators and diseases is essential to enable economic seed production.

Improving the success of multi-species restoration seedings and plantings requires an array of interdisciplinary studies that examine such issues as site preparation and soil amendment treatments to control exotics and improve establishment of desirable species. An improved understanding of factors limiting plant establishment from seed or seedlings can aid in devising improved planting strategies for specific communities. Studies of interactions among native restoration species and between restoration species and exotic invasive plant species aid in selecting species, plant material types and planting designs that provide communities that are resistant to weeds, resilient to disturbances and that meet other planning objectives. New seeding equipment or equipment modifications are needed to reduce impacts to biological soil crusts and remnant native species, permit segregation of non-compatible species, and provide flexibility for planting seeds of different sizes at different depths and at different rates. Innovative techniques to incorporate difficult-to-establish species into new or established plantings, particularly exotic or native monocultures, are needed to improve diversity, provide functional ecosystems and meet habitat requirements for pollinators and other wildlife species.

Objective 2.1: Characterize Genetic and Adaptive Variation for Restoration Species to Delineate Seed Zones and Provide Seed Transfer Guidelines

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
2.1.1 Conduct genetic research to assist in the development of seed zones for key species across U.S. ecosystems to enable restoration with adapted populations.			2015-2016	Seed zones developed; key restoration species identified for U.S. ecosystems, with notation of which species are most important to pollinators.
			2016-2020	Complete studies of ecological genetics for major restoration species to identify climate based adaptive plant traits using common garden and reciprocal transplant studies.
			2016-2020	Seed transfer guidelines developed for at least 10 critical restoration species.
			2016-2020	Assess the genetic diversity of selected major restoration species taken from different seed transfer zones to characterize and compare their population structure.
2.1.2. Develop predictive models of climate change effects on target restoration species			2017-2019	Predictive models are used to assess threats to important native plants and

and genetic diversity using 20-year or mid-century climate models.				opportunities for targeting and prioritizing restoration projects.
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Objective 2.2: Conduct Species-Specific Research on Seed Technology, Production, and Storage

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
2.2.1 Conduct seed germination ecology studies and develop seed testing protocols for key restoration species.			2015-2020 2015-2020	Guidelines are established for evaluating seed lots, seed quality and germination of seeds used for restoration. Association of Official Seed Analysts (AOSA) official seed testing rules established.
2.2.2 Develop storage guidelines for restoration species to improve maintenance of seed viability in storage.			2015-2020	Specific guidelines are established for storage of restoration species.
2.2.3 Develop species specific seed and seedling production practices that maintain genetic diversity.			2016-2020 2016-2019	Protocols are developed for production of high quality seed that maintains genetic diversity. Species specific protocols that maintain genetic diversity for nursery stock.

Objective 2.3: Conduct Research on Plant Establishment, Survival and Restoration

<p>2.3.1 Identify the limiting steps for plant establishment from seed.</p> <p>Develop site preparation, seeding and transplant technologies that improve plant establishment and community diversity.</p>			<p>2015-2020</p>	<p>Guidelines and protocols are created for: Optimal species capacity to germinate and establish at non-optimal temperatures and under moisture stress.</p> <p>Development of seed mixes that include species representing multiple seral stages.</p> <p>Improved chemical, mechanical and biological methods for site preparation.</p> <p>Improved seeding and planting equipment and techniques that enhance establishment of restoration species.</p>
<p>2.3.2 Within seed zones, investigate the capacity of native plant materials to establish and persist with invasive species while maintaining plant community diversity and function.</p>			<p>2016-2020</p> <p>2017-2020</p>	<p>Native grass and forb species and populations are identified that potentially establish and persist with weeds.</p> <p>Assessment of benefits/risks of competitive natives on the diversity and function of plant communities and ecosystems.</p>
<p>2.3.3 Advance investigations to diversify exotic forage monocultures by developing techniques to successfully introduce a diversity of native species.</p> <p>Investigate re-seeding strategies that improve degraded sites leading to recolonization by surrounding native plant populations.</p>			<p>2017-2020</p>	<p>Recommendations for enhanced establishment and persistence of native species.</p>

Goal 3: Develop Tools that Enable Managers to Make Timely, Informed Seeding Decisions for Ecological Restoration

Background/Rationale:

Restoration goals must be placed in the context of economic, social and political considerations as well as site-specific ecosystem recovery potential. In addition, managers and decision makers are often faced with having to work with incomplete information and varying availability of native plant materials. New tools are needed to help managers assess the risks, guide the scope, and predict the efficacy of restoration treatments. This would include tools that: 1) help prioritize treatment locations and refine site and species-specific strategies; 2) improve mechanisms to obtain suitable native seed; 3) determine genetically appropriate plant materials and seed zones, in order to maximize restoration success; and 4) assess the appropriate use of non-natives. Manipulation of gene flow, which invariably attends restoration, has risks related to the use of non-local genotypes and non-native species. Potential effects must be clearly defined and disclosed so that informed choices can be made. Addressing these challenges requires syntheses of research on native species ecology and the development of tools to communicate and apply relevant knowledge. Prioritizing efforts and being responsive to emerging information on past successes and failures will help ensure that native plant communities are resilient and resistant to historical and novel stressors.

Objective 3.1: Develop Training Programs to Educate Agency Employees on the Use of Genetically Appropriate Seeds for Restoration

ACTION	COORDINATING AGENCIES	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
3.1.1 Develop a training cadre of multi-disciplinary restoration experts and work with Society for Ecological Restoration to establish a restoration practitioner certification program.		SER	2015 2016-2020	A list of past and current training courses offered across agencies and restoration partners. Gaps identified. Courses and webinars updated or developed.
3.1.2 Expand network of existing restoration and research enclosures and demonstration areas.			2015-2020	1-3 demonstration areas planned per year distributed across ecoregions and provisional seed zones and prioritized by PCA federal committee
3.1.3 Develop resources for managers to highlight successful native plant programs and projects, including site visits.			2015-2020	Ecoregional, interagency site visits, webinars, training and other activities to inform managers on successful native plant projects.

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Objective 3.2: Develop Native Seed Source Availability Data for Use by All Agencies

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
3.2.1 Expand the existing Native Seed Network to include provisional and empirical seed zones.			2016-2020	Provisional and empirical seed zones incorporated into Native Seed Network database and Western Wildland Environmental Assessment Center website.
3.2.2 Expand dynamic web-based, seed selection tool to match seed source with planting site.			2016-2020	Web-based tool that matches seed lot with planting site or project area.
3.2.3 Work with Native Seed Network to post a multi-agency federal seed warehouse network availability list.			2015-2016	Quarterly updates of seed availability. List of commercial growers and nurseries to identify additional partners to increase native species.
3.2.4 Develop and enhance existing federal procurement tools to facilitate multi-agency seed acquisition.			2016-2018	Procurement tool(s) that would facilitate seed acquisition between agencies.

Objective 3.3: Integrate and/or Develop Science Delivery Tools to Support Restoration Project Development and Implementation

ACTION	COORDINATING AGENCIES	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
3.3.1 Analyze policies using a cost/ benefit analysis associated with rehabilitation and restoration decisions.			2015 2016-2020	Survey of existing policy to establish a working model. Apply working model.
3.3.2 Work with agencies and NGOs to identify gaps and available restoration guides and protocols by ecoregion.			2015-2016	Restoration guides and protocols by ecoregion.

3.3.3 Write and distribute interagency ecoregional Native Plant Reports.			Yearly	Native plant project reports are developed and shared for major ecoregions (i.e. Great Basin, Colorado Plateau) that summarize research accomplishments, findings and needs.
3.3.4 Support field implementation of restoration tools.			2016-2020	Ecoregional outreach efforts to educate federal agency staff on above-mentioned tools.

Objective 3.4: Use Ecological Assessments and Disturbance Data to Allow Managers to Anticipate Needs and Build Spatially-explicit Contingency Strategies

ACTION	COORDINATING AGENCIES	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
3.4.1 Identify and inventory available geospatial tools to inform decisions.			2015	Geospatial tool inventory.
3.4.2 Develop a cross-walk to integrate existing agencies' habitat prioritization efforts.			2015 2016-2020	List of on-going and past efforts that explicitly prioritize habitats for restoration and conservation planning. Cross-walk to examples of complimentary collaborative landscape conservation efforts.
3.4.3 Use soil-water modeling that can predict likelihood of seed establishment and persistence.			2016 for field testing; 2017 for Version 1.0	A tool that relates onsite soil conditions to a prediction of restoration success.
3.4.4 Tools for prioritizing seed needs and projects while incorporating factors like disturbance and climate change into			2016-2020	GIS based tools in place to facilitate this process.

decisions.				
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Goal 4: Develop Strategies for Internal and External Communication

Background/Rationale:

Successful implementation of this National Seed Strategy will require broad communication and outreach to inform agency staff and relevant stakeholders about the important shared goals of the strategy and their role in achieving them. It also will require that each agency takes steps to incorporate actions into their own policies and programs. Additionally, an emphasis on evaluation and revision will help ensure the strategy remains relevant and responsive to evolving needs.

Each agency should foster awareness, dialog and collaboration to ensure that appropriate staff members are given opportunities to become fully informed about the strategy and its recommendations, new and existing resources, decision-support tools, and methods identified or made available as a result of strategy implementation.

The importance of meeting the strategy’s goals and the achievement of milestones along the way should be reported to a larger audience and incorporated into agency communications and materials as appropriate. Working together, the agencies should adopt a Communications Plan that outlines how the strategy will be introduced and promoted within and outside of the partner organizations. A Communications Plan would define the communication goals and audiences, and let those help determine the appropriate communication products or methods to be used.

Federal agency personnel and stakeholders will also need methods for providing feedback on the strategy and its implementation, including success stories and recommendations for improvements and future direction.

Objective 4.1: Conduct Education and Outreach on the National Seed Strategy Using the Plant Conservation Alliance (PCA) Network and Other Interested Stakeholders

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
4.1.2 Working with partners, develop a Communication Plan and toolkit for agencies and stakeholders.			2015	Communication plan with individual actions and products used to improve visibility and communication of National Seed Strategy.

Objective 4.2: Distribute and Implement the National Seed Strategy Across Agencies

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
4.2.2 Identify and use mechanisms for implementing the National Seed Strategy in each agency.			2015-2020	Instruction memoranda, native plant policies, information bulletins, handbooks.
4.2.3 Evaluate existing agency native plant policies and identify consistencies and gaps. Develop policy to fill gaps.			2015-2016	A Native Plant Policy template is used to modify or develop federal agency policies to improve consistency and coordination in the use of native seed.
4.2.4 Incorporate the Seed Strategy's goals and key messages into appropriate landscape scale initiatives.			2015-2016	National Seed Strategy goals and key messages are incorporated into relevant initiatives.

Objective 4.3: Report Progress, Recognize Achievements, Revise Strategy

ACTION	COORDINATING AGENCY(IES)	OTHER PARTICIPANTS	TARGET DATE(S)	MEASURABLE OUTPUT(S)
4.3.1 Report on the progress achieved through the Strategy including			2015-2020	Annual reports will provide feedback mechanism for agencies to report progress.

successful native plant projects.				
4.3.2 Recognize and promote achievements through award programs, such as the Interior Dept. Conservation Awards, the BLM Director’s Award or FS Botany Awards.			2015-2020	Increased recognition of the importance of National Seed Strategy implementation across all agencies and partners.
4.3.3 Review and revise the Strategy.			2020	Revised Strategy; actions evolve and are endorsed by agency leaders thru the Plant Conservation Alliance Federal (Steering) Committee.

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Glossary

Adaptation (Adapted)

A change or the process of change in structure or habits by which a species or organism becomes better suited to its environment.

Common Garden Study

An experiment where different genotypes, populations, or varieties are grown together in the same environment such that environmental effects on trait expression are minimized and genetic differences are more readily observed.

Ecological Genetics

The study of how ecologically relevant traits evolve in natural populations.

Ecology

The relationships of organisms to one another and their environments.

Ecosystem

The biota (plants, animals, microorganisms) within a given area, the environment that sustains it, and their interactions.

Ecosystem Services

The benefits people and wildlife obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services such as the regulation of climate, floods, disease, wastes, and water quality; cultural services such as recreation, aesthetic enjoyment, identity, and spiritual fulfillment; and supporting services such as soil formation, photosynthesis, and nutrient cycling.

Establishment

The stage at which the seedling has exhausted the food reserves stored in the seed and must grow, develop, and persist independently.

Ex situ Germplasm Conservation

The technique of conserving all levels of biological diversity outside their natural habitats through such means as botanical gardens, zoos or seed banks.

Gene flow

The transfer of alleles or genes from one population to another.

Genetically Appropriate Plants

Plants environmentally adapted to a restoration site that are likely to establish, persist, and promote community and ecological relationships. Such plants would be: sufficiently genetically diverse to respond and adapt to changing climates and environmental conditions; unlikely to cause genetic contamination and undermine local adaptations, community interactions and function of resident native species within the ecosystem; not likely to become invasive and displace other native species; and not likely to be a source of non-native invasive pathogens; likely to maintain critical connections with pollinators.

Genotype

The genetic makeup of a cell, an organism, or an individual. The genetic code of an organism.

Germination

Events beginning with water uptake by a seed and ending with the beginning of elongation of the embryonic axis through the surrounding structures.

Habitat

The dwelling place of an organism or community that provides the requisite conditions for its life processes.

Invasive Species

A species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Locally Adapted

Plants from an area geographically near a planting site that are environmentally adapted and likely to establish and persist.

Native Species

Indigenous terrestrial and aquatic species that have evolved and occur naturally in a particular region, ecosystem, or habitat. Species native to North America are generally recognized as those occurring on the continent prior to European settlement. They represent a number of different life forms, including conifer trees, hardwood trees and shrubs, grasses, forbs, and others.

Natural Disturbance Regime

The pattern and dynamics of natural disturbance events (e.g., fires, floods, landslides, etc.) that mold the structure and species composition of an ecosystem.

Non-native (or Alien) Species

An organism is considered non-native (alien, foreign, non-indigenous, exotic) when it has been introduced by humans to a location(s) outside its native or natural range. This designation applies to a species introduced from another continent, another ecosystem, another seed zone, and even another habitat within an ecosystem. With respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

Protocol

A standardized method containing detailed steps.

Reciprocal Transplant Studies

Studies using plants from multiple populations of a species that are planted in a set of sites that represent local and non-local climates to test questions of adaptation of the populations to their local environments. Such studies are useful for evaluating the effectiveness of seed transfer guidelines and seed zones. When sites represent extreme environments, these studies have been used effectively to predict how plants will respond to future climate change as climates shift towards new extremes.

Reclamation

Actions to stabilize the terrain, assure public safety, improve aesthetics, and usually to return the land to what, within the regional context, is considered to be a useful purpose. Reclamation projects that are more ecologically based can qualify as rehabilitation or even restoration.

Rehabilitation

Rehabilitation emphasizes the reparation of ecosystem processes, productivity and services, whereas the goals of restoration also include the re-establishment of the pre-existing biotic integrity in terms of species composition and community structure.

Resilience

The degree to which an ecosystem is able to regain structural and functional attributes after it has suffered harm from stress or disturbance.

Resistance

The degree to which an ecosystem can maintain its structural and functional attributes in the face of stress and disturbances.

Restoration

An intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability.

Seed Transfer Guidelines

Recommendations for protecting the integrity of the natural pattern of adaptive variation of wild populations by restricting seed transfer to areas within which seed can be moved about freely with the expectation that they will grow and reproduce successfully and will produce no adverse genecological effects.

Seed Zone

A mapped area with fixed boundaries in which seeds or plant materials can be transferred with minimal risk of maladaptation.

Stakeholder

Stakeholders include individuals, organizations, and intergovernmental partners who are involved in or contribute valuable knowledge to and support for implementing the actions outlined in this strategy, or who may be directly or indirectly impacted by the actions of the strategy. Those who have an interest in the strategy's outcome.

Treatment

A range of actions taken to ameliorate ecosystem damage under the restoration continuum, e.g. reclamation, stabilization, rehabilitation and restoration.

Sources: Aubry et al. 2005, NFWPCAP (2012), NISC (2006), SER (2004), USDI BLM (2009), U.S. Forest Service (2008)

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