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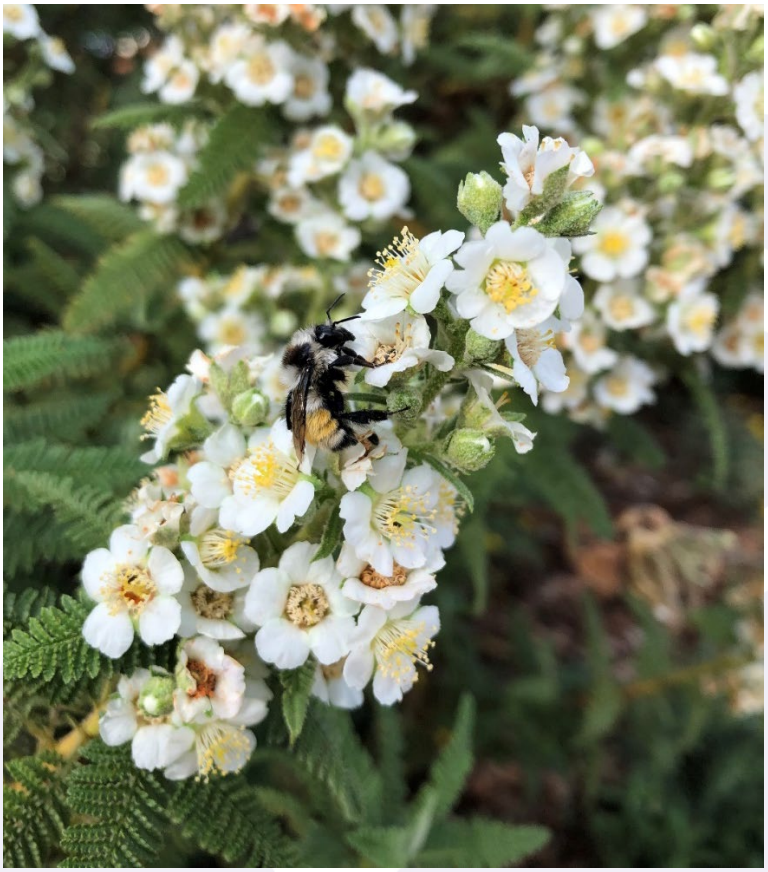
Pollinator Protection Plan for Los Alamos National Laboratory



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Los Alamos NATIONAL LABORATORY

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Photo caption: Hunt's bumble bee (*Bombus huntii*) foraging on Fernbush (*Chamaebatiaria millefolium*)

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1 Introduction

Pollination must occur for a plant to produce fruits, seeds, or young plants. Pollinators are organisms that facilitate plant reproduction by moving pollen from the male part of the flower to the female part of the same or another flower. Pollinators are responsible for helping more than 90 percent of the world's flowering plants reproduce (Ollerton et ak, 2011) and are therefore critical to our food supply as well as to the health and resilience of ecosystems. Animal pollinators include species of ants, bats, beetles, birds, butterflies, flies, and bees. Bees are the dominant pollinators in most ecosystems, and nearly all bees are pollinators. More than 500 species of bees have been reported from New Mexico (Cockerell 1906), and potentially many more bee species occur, but they are either unnamed or understudied (Kazenel et al. 2020). Mounting evidence indicates pollinator species declines all over the world (Zattara and Aizen 2021; Brunet and Fragoso 2024), and consequences in many agricultural areas could be significant (Gallai et al. 2009). Pollinator declines are attributed to loss of habitat, pesticide exposure, diseases, parasites, climate change, and effects of invasive species (Cameron et al. 2016; Wilcox et al. 2019, Kazenel et al. 2024). The Department of Energy's (DOE's) Pollinator Protection Plan is part of a national strategy to protect pollinators and enhance their habitats (Executive Office of the President 2014, DOE 2015.). The purpose of the Pollinator Protection Plan for Los Alamos National Laboratory (LANL) is to identify site-specific guidance that incorporates best management practices as outlined in the DOE Pollinator Protection Plan (DOE 2015).

2 Drivers and Need

The 2024 Laboratory Agenda identifies "Force For Good" as a critical outcome for the institution (LANL 2024). Reducing impacts to pollinator resources through habitat protection, conservation, procurement of local resources, and educational outreach is in alignment with the following supporting initiatives of "Force For Good":

- Protect and enhance LANL's reputation by proactively managing risk and by proactively managing communications with our key stakeholders.
- Demonstrate a culture of integrity in all LANL interactions with our community and public stakeholders.
- Enhance and expand regional educational partnerships to address near- and long-term LANL workforce needs by engaging New Mexico schools, community colleges, and universities.
- Direct procurement efforts to local vendors where possible and develop a strategy to strengthen and improve the capabilities of our local mentor/protégé and other small business subcontractors.

The 2014 presidential memorandum, "Creating a Federal Strategy to Promote the Health of Honeybees and Other Pollinators," called for land-owning federal departments to take immediate action to prevent further pollinator population decline (Volume 79 Federal Register [FR] 35903–35907). This memorandum established a Pollinator Health Task Force that comprised representatives from more than 15 federal agencies, including the DOE. To provide management guidance, the task force developed the Pollinator Research Action Plan (Pollinator Health Task Force 2015a) and the Pollinator-Friendly Best Management Practices for Federal Lands (USDA and USDOI 2015). Additionally, the Council on

Environmental Quality (CEQ) facilitated the creation of a working group to prepare an addendum to the sustainable practices for designed landscapes (CEQ 2020) to provide guidance for creating and maintaining quality habitat for pollinators during new construction, building renovations, landscaping improvements, and in facility leasing agreements at federal facilities and on federal lands (CEQ 2020). In general, managing for pollinators involves providing the basic habitat elements of food, reproduction, and protection. Once provided, these suggested habitat elements should be managed to ensure long-term productivity (USDA and USDOI 2015).

Invertebrate pollinators such as the monarch butterfly (*Danaus plexippus*) and many bumble bee species—including the western bumble bee (*Bombus occidentalis*), Morrison bumble bee (*Bombus morrisoni*), and American bumble bee (*Bombus pensylvanicus*)—are in decline (Cameron et al. 2011; Brower et al. 2012; Pelton et al. 2019; Janousek et al. 2023; James 2024) and have been documented in northern New Mexico (Koch et al. 2012). If preemptive actions are taken, they can guide best management practices and future management actions that could be necessary if species are listed under the Endangered Species Act (ESA). For example, the western bumble bee is a species that is petitioned to be listed under the ESA. New Mexico and some other western states within its historic range are severely lacking survey data to determine occupancy for this declining species (Graves et al. 2020). The U.S. Fish and Wildlife Service decided that federal protections for the western bumble bee may be warranted, and they are currently conducting a status review of the species (USFWS 2016). Monarch butterflies are candidate species under the ESA, and their listing decision will be reviewed annually (USFWS 2020). A listing decision is anticipated in late 2024.

As directed in Section 3, Subsection (a) of 79 FR 35903–35907, the DOE created the Pollinator Protection Plan (DOE 2015). The plan encourages sites to pursue opportunities to protect pollinators and enhance pollinator habitat in all aspects of facility management where consistent with a site's mission. Measures suggested in Section 2, Subsections (a and b) of 79 FR 35903–35907, include

- assessments of the status of native pollinators, including the monarch butterfly and native bees;
- strategies that include native pollinator-friendly plants in seed mixes for maintenance of bees and other pollinators;
- strategies for targeting resources toward areas of high risk, restoration, and enhancement potential by planting pollinator-friendly vegetation and increasing flower diversity; and
- strategies to increase public awareness of the importance of pollinators and the steps that can be taken to protect them.

DOE Headquarters provides direction (personal communication with Beverly Whitehead, Office of Sustainable Environmental Stewardship) that sites are expected to follow the implementation of pollinator-friendly best management practices in the DOE Pollinator Protection Plan (DOE 2015). Many DOE sites across the United States have implemented objectives from the Pollinator Protection Plan set forth by DOE, as well as from the Pollinator Research Action Plan and the Pollinator-Friendly Best Management Practices for Federal Lands.

The purpose of the LANL Pollinator Protection Plan is to

- describe current and future initiatives that address the suggested measures to reduce risks to pollinators,

- reduce potential risk from a pollinator ESA listing by documenting the locations of pollinators on site while implementing conservation measures proactively,
- identify opportunities to improve habitat for pollinators, and
- minimize the impact of LANL activities on pollinator populations when possible.

3 Inventorying Pollinators and Pollinator Habitat at LANL

The Pollinator Research Action Plan (Pollinator Health Task Force 2015a) outlines priority efforts and goals to improve pollinator health and to identify native pollinator species, thereby assessing population patterns and habitat use. The greatest abundance of wild bees is suspected to be in semi-desert, arid shrubland environments, especially within southwestern North America (Carril and Wilson 2023; Koh et al. 2016; Norris et al. 2018). This habitat classification matches some areas of Los Alamos County and the surrounding Pajarito Plateau (Hansen et al. 2018), suggesting that LANL could have abundant wild bee populations. New Mexico's wild bee population is understudied; however, more species of wild bees are known to exist in New Mexico—greater than 1,100—than in all Eastern states combined (personal communication with Dr. Olivia Carril, bee researcher with the National Parks Service). A study from 2018 found that 56 species of bees have been found in 24 Bandelier locations (Carrill 2019). LANL areas that contain relatively high numbers and diversity of bees or other insect pollinators should be identified.

Another key priority research theme is to identify local and regional native plant species mixtures that provide nutrition to pollinators throughout all seasons when they are active, which would allow the adjustment of native seed mixes to maximize their benefit for local pollinators. Identifying and protecting important pollinator habitat should start with recognizing areas that provide high-quality foraging habitat—open landscapes with a variety of native flowering plants that have overlapping blooming times and good sun exposure (Ward et al. 2014). Riparian and canyon ecosystems also provide good pollinator habitat by supporting more mesic flowering plants. Increased plant species richness and abundance are positively correlated with increased bee and pollinator species diversity and abundance (Ebeling et al. 2008). Considering where a seed mix application will be applied—for example, next to a road—could require shorter-height plant species to discourage multiple roadside mowing events. Additionally, some plant species tolerate disturbed areas better than others.

To address these priority efforts and goals set forth by the Pollinator Research Action Plan, objectives for future work at LANL include:

- Identify pollinator species on site using the most recent identification guides (Koch et al. 2012; Williams et al. 2014; Glassberg 2017), and create a pollinator species checklist with pictures, starting with native bees and butterflies.
- Document pollinator species on site or in Los Alamos County that are petitioned to be listed under the ESA or are incorporated into the latest New Mexico Species of Greatest Conservation Need List.
- Collaborate and cross-reference with available information on pollinator species and pollinator plant species from other organizations (e.g., Bandelier National Monument, Valles Caldera National Preserve, New Mexico Xerces Society, Los Alamos Bee City, and PEEC).
- Identify high-quality pollinator habitat based on increased native plant species richness and abundance and/or native pollinator species richness and abundance. Create a map using these data

to show areas of high-quality pollinator habitat at LANL (Hansen et al. 2019). Incorporate the map into sitewide plans, including the Campus Master Plan and the Wildland Fire and Forest Health Plan, that identify high-quality pollinator habitat as areas to protect and restore.

4 Inventorying Monarchs and Milkweed at LANL

Monarch butterflies have declined by an estimated 85 percent over the past 30 years (Figure 1), primarily due to habitat conversion, insecticide and herbicide application, and host plant species loss (Brower et al. 2012; Pelton et al. 2019).

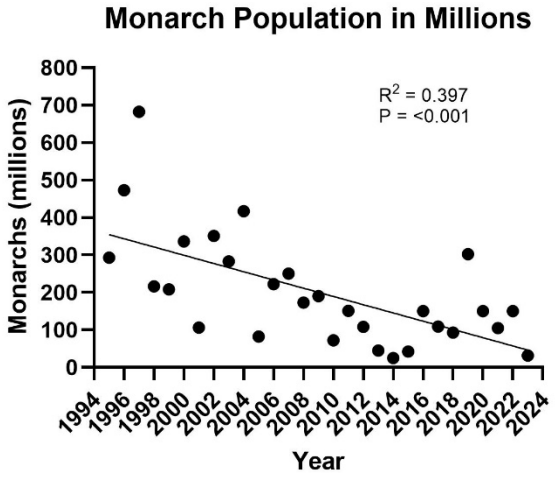

Figure 1: North American monarch butterfly population decline from 1995–2023 (data compiled from World Wildlife Fund Mexico [https://www.wwf.org.mx/noticias/?uNewsID=342230] and Xerces Society [https://www.westernmonarchcount.org/data/]).

Monarchs are currently warranted for listing under the ESA but are not yet listed due to higher-priority listing actions. The U.S. Fish and Wildlife Service will review annually the listing status of monarchs as a candidate species, and when future resources are available, they may be listed as a federally protected species. Monarchs occur in Los Alamos County, breeding from July through October. Monarch caterpillars eat only milkweed plants (*Asclepias* spp.). In Los Alamos County, four common milkweed species occur, and most species emerge in early May (Appendix A). In 2018, LANL began documenting monarch observations and milkweed locations on site. To manage milkweed patches, we will continue to record locations and species of milkweed found on site and collect local seed for propagation. To improve guidelines, reduce institutional risk associated with an ESA listing, and provide information to management/decision makers, we have recorded observations and timing of the monarch life cycle to document when eggs, caterpillars, and adult butterflies are present. Before this initiative, insufficient data existed on monarch life cycle timing for Los Alamos County. We will continue to identify and document onsite monarch observations and milkweed locations to help minimize impacts to the species and the institution. These efforts will better inform management/decision makers to address institutional risk if this species is federally listed in the future.

5 Pollinator Friendly Best Management Practices

5.1 Sitewide Best Management Practices for Pollinators

Pollinator-Friendly Best Management Practices for Federal Lands (USDA and USDOI 2015) recommends best management practices for invertebrate pollinators. One of the objectives of this document is to consolidate general information about practices and procedures to use when considering pollinator needs during project development and management. If a high-quality site is identified in a project area, recommended site-specific prescriptions can be used to lessen the effects of the project and ensure that the habitat is protected. Site-specific prescriptions could include administrative controls, such as roadside vegetation management timing considerations, and physical controls, such as flushing bars on mowers to allow pollinators to escape mowing. During the LANL integrated project review process, LANL biological resources SMEs will encourage pollinator-friendly practices when providing comments to projects that have the potential to impact pollinators.

Key considerations for pollinator habitat conservation and management when consistent with the site mission include

- identification and protection of existing pollinator habitat sites, including no-mow areas;
- identification, collection, and use of local, native seeds for mitigation, restoration, and/or to enhance existing habitat;
- consideration of pollinator resources for integrated roadside vegetation management;
- promotion of pollinator-friendly design principals for sustainable siting; and
- incorporating integrated design principals into sustainable siting (EB Criteria 1.1 and 1.2; CEQ 2020) to preserve or enhance pollinators' habitats.

5.2 Best Management Practices for Monarch Butterfly

Based on data collected during 2018–2024, in Los Alamos County, monarch butterflies lay their eggs from late July through early September. The development of the monarch from an egg to a butterfly takes about 5 weeks, so we can assume that the butterflies from these last eggs will not emerge and start their migration until as late as mid-October. Based on our observations over the last 7 years, we can make preliminary mowing management recommendations (Table 1), although more data are needed for robust management guidelines, especially if the species is federally listed. Milkweed removal and roadside mowing during the breeding season are the main impacts to monarchs in Los Alamos County. During the past 5 years, we have worked with the Wildland Fire program to protect a large patch of milkweed as a seed source for mitigation and restoration projects. We also worked with them to check for any caterpillars or eggs on large patches of milkweed before mowing if outside of the recommended dates.

We recommend that LANL follow best management practices for monarchs, when consistent with the site mission:

- Prioritize mowing activities to occur before July 1, and preferably do not mow from July 1 to October 15. If mowing is necessary during that period, biologists should check the milkweed patches for eggs, caterpillars, and pupae before mowing. See Table 1.

- During the early breeding season (May–June), perform light mowing at a minimum height of 12–16 inches and/or mow milkweed in patches (USDA and USDOI 2015).
- During the breeding season, ensure preservation of some milkweed patches. Prioritize mowing activities to occur during the non-breeding season from October 16 through April 30; during this time, no mowing height limits are recommended for vegetation.
- Plant native milkweed and wildflowers where possible for mitigation and restoration and/or to enhance existing habitat (USDA and USDOI 2015). Use LANL seed mix or incorporate as many species listed in Appendix B as possible from a LANL-approved supplier. Contact LANL biological resources SMEs for guidance on specific seed suppliers.

Table 1. Recommendations for Integrated Roadside Vegetation Management for Monarch Butterflies on LANL Property

Vegetation Management	Dates	Life Stage Impacted
No mowing recommended	July 1–October 15	Eggs, caterpillars, pupae
Light mowing or mow in patches	May 1–June 30	Early eggs
Priority mowing	October 16–April 30	None

5.3 Best Management Practices for Native Bee Species

Recommendations for the management of native bee species on federal lands (USDA and USDOI 2015) include the following:

- Use seed from native forbs, grasses, and other plant species beneficial to local pollinators, and prioritize plant species that will provide continuous blooms from early spring to late fall for use in restoration and mitigation projects. (See Appendix B.)
- Avoid disturbing high-quality habitat areas that contain a variety of native flowering plants.
- Remove invasive species opportunistically. Invasive non-flowering species—particularly invasive Eurasian grasses—do not provide food for pollinators and restrict native-bee-nesting areas.
- When possible, integrate roadside vegetation management, including the following:
  - Mow during non-blooming seasons (late October through April).
  - When summer mowing is necessary, stagger mowing and/or mow in patches to ensure that some nectar flowers are always available and/or cut vegetation high (minimum 12–16 inches).
  - Allow pollinators and other wildlife to escape mower blades by using a flushing bar on the mower.
- Reduce the impacts of herbicides on pollinators (LANL 2017):
  - Use herbicides efficiently and effectively by avoiding blanket applications and treating targeted areas.
  - Avoid damage to non-target plants by using selective herbicides when feasible.

6 Habitat Conservation and Restoration for Native Pollinators

Pollinator populations depend directly on plant populations, especially native plants. Effective habitat restoration must be appropriate for the desired pollinator species, affordable to establish in the short term, and self-sustaining in the long term (USDA and USDOI 2015). To create and enrich pollinator habitat, research and adaptive management are essential to enable

- identification of habitat with the highest potential for pollinator benefits and
- monitoring of the pollinators and habitat to facilitate adaptive management (USDA and USDOI 2015).

Pollinators also need protection from severe weather and require sites for nesting and overwintering, including a variety of ground-nesting areas such as woody plant stems and twigs with pithy centers, abandoned rodent nests, and stands of undisturbed native grass. For nesting, reproduction, and overwintering, native bees require areas that are untilled and unmulched and have some bare ground or woody vegetation. It is also important that nest sites are close to foraging sites because many native bees do not range more than a few hundred feet (USDA and USDOI 2015). Priority should be given to identifying, collecting, and propagating seed from local native forbs, grasses, and other plant species beneficial to local pollinators and using it in restoration and mitigation projects. Removal of invasive species that compete with native nectar flowers can improve pollinator habitat and should be done opportunistically. For reseeding projects, LANL has already incorporated a native seed mix that contains a variety of grasses and forbs for use after ground disturbance. We expanded the biodiversity in the LANL stormwater native seed mix to include recommended species (Appendix B). We have also opportunistically seeded suitable areas—areas that will not be mowed—with native shrubs, nectar flowers (including milkweed), and grasses. We will collaborate with the Wildland Fire and Forest Health programs on habitat restoration projects that support pollinator species, as well as understory diversity, which is important for forest health.

7 Educational Outreach

Outreach opportunities are a key mission included in the Presidential Memorandum (79 FR 35903–35907), which calls for “plans for expanding and coordinating public conservation and education programs outlining steps that federal, state, and private individuals and organizations can take to help address the loss of pollinators.” In addition, “Enhance and expand regional educational partnerships to address near- and long-term LANL workforce needs by engaging New Mexico schools, community colleges, and universities” is a supporting initiative of the “Force for Good” Critical Outcome in the 2024 Lab Agenda (LANL 2024).

To support pollinator health, federal agencies should take advantage of outreach opportunities by collaborating with non-federal entities to study pollinator habitat requirements and to support habitat creation, restoration, and enhancement efforts (Pollinator Task Force 2015b). To this end, EPC-ES SMEs have already established outreach initiatives to implement conservation and education programs regarding how to support pollinator initiatives, including the following:

- Developed a monarch bookmark that outlines its life cycle and shares conservation facts to use for educational outreach events.

- Worked with a local elementary school to apply for a small grant to plant a pollinator garden, which was planted in spring 2020.
- Working with local elementary school teachers to present information to students about how they can help monarchs and other pollinators.
- Participating in Earth Week events at LANL and in the community.
- Tagging late-season monarch adults as part of the Southwest Monarch Study to improve data regarding where New Mexico monarchs overwinter (https://www.swmonarchs.org/).
- Worked with PEEC to build an outdoor exhibit for monarchs and contributed artwork to the exhibit design.
- Worked with PEEC to collaborate on a small grant to plant native milkweed at their location.
- Working with PEEC to create videos, events, presentations, and pamphlets to educate the local community about how they can help monarchs and other pollinators.
- Working with Los Alamos Bee City Committee to contribute to and review pamphlets and information for accuracy to distribute to the local community about how they can help protect pollinators.

In accordance with the Pollinator Partnership Action Plan (2015), we will continue to work with local organizations and schools to educate the public and promote the creation of pollinator habitat locally. In the future, we plan to work with county officials and the open space coordinator to promote pollinator protections such as roadside vegetation management.

8 EPC-ES Deliverables for Pollinator Protection at LANL

Environmental Protection and Compliance Division's Environmental Stewardship group (EPC-ES) is making progress toward deliverables for pollinator protection.

8.1 Accomplishments to Date

- Collaborated with the Wildland Fire and Forest Health program on projects that support conservation and management of pollinator plant species, including milkweed.
- Worked with the Stormwater program to incorporate pollinator species into the engineering standards for ground-disturbance reseeding requirements.
- Completed and began implementation of an invasive species management plan to eradicate non-native species and restore areas with native pollinator species.
- Began identifying bumble bee pollinators that occur on site as part of a student summer project, including surveying for the western bumble bee.
- Continued documenting monarch eggs, caterpillars, and butterflies, as well as milkweed locations on site at LANL.
- Created two no-mow areas in TA-03, targeted to encourage native pollinator plant species to thrive; started removing invasive species and seeding the no-mow areas where needed.
- Created two pollinator gardens: one at TA-03 and one at TA-22; complete with educational signage.

- Continued educational outreach for native pollinator conservation at the Pajarito Environmental Education Center (PEEC) and local elementary schools.
- Continued internal communications to enhance pollinator protection awareness, including articles in LANL today, videos with the social media team, and content at Earth Week events.
- Collaborated with PEEC and the Los Alamos Bee City Committee to build a list of pollinators that have been observed in Los Alamos County based on observations from their iNaturalist project.
- Built web content on the EPC-ES Biological Resources internal website (https://int.lanl.gov/environment/bio/index.shtml).

8.2 Future Deliverables

- Continue to work with internal partners to consider pollinator resources in integrated roadside vegetation management.
- Collaborate with internal partners, including the Wildland Fire and the Forest Health program, on habitat restoration projects that support pollinator species.
- Incorporate pocket prairies—small areas of native forbs and grasses—in patches of open areas that are either bare ground or have dead grass by seeding and transplanting with native forbs and grasses.
- Use native seed mix of forbs, grasses, and other plant species beneficial to local pollinators for use in restoration and mitigation projects when opportunities arise.
- Update the invasive species management plan with new content if needed.
- Continue to identify pollinators that occur on site, and create a pollinator species checklist with pictures; start with native bees and butterflies.
- Continue documenting monarchs and milkweed on site at LANL.
- Using the LANL integrated project review process, LANL biological resources subject matter experts (SMEs) will continue to encourage pollinator-friendly practices when providing comments to projects that have the potential to impact pollinators.
- Prepare the triennial status report of the pollinator protection plan for LANL.
- Update the LANL pollinator protection plan as needed or as species-specific best management practices are established that apply to LANL.
- Identify pollinator protection champions to sponsor work, such as no-mow area initiatives or raised garden bed plantings.
- Investigate the effectiveness of installing solitary bee houses on the landscape.
- Continue internal and external educational outreach for native pollinator conservation.

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Acronyms and Abbreviations

Acronym	Definition
ALARA	as low as reasonably achievable
CEQ	Council on Environmental Quality
DOE	(U.S.) Department of Energy
EPC -ES	Environmental Protection and Compliance – Environmental Stewardship
ESA	Endangered Species Act
FR	Federal Register
LANL	Los Alamos National Laboratory
NNSA	National Nuclear Security Administration
PEEC	Pajarito Environmental Education Center
SME	subject matter expert
TA	technical area
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service

Appendix A Common Milkweed Species (*Asclepias* spp.) in Los Alamos County

Figure A-1: Butterfly Weed (*Asclepias tuberosa*): Plant in well-drained soil in full sun. Once well established, is heat and drought tolerant. Orange or yellow flowers. Height 2–3 feet.

Figure A-2: Showy Milkweed (*Asclepias speciosa*): Grows best with moderate water. Plant in full sun. Once well-established, is drought tolerant and deer resistant. Purple/pink flowers. Height 2–3 feet.

Figure A-3: Spider Milkweed (*Asclepias asperula*): Plant in well-drained soil with full sun. Very low water requirement. Once well established, is heat, drought tolerant, and deer resistant. Height 1–2 feet.

Figure A-4: Horsetail Milkweed (*Asclepias subverticillata*): Grows commonly along roadsides. Full sun. Once well established, is drought tolerant and deer resistant. White flowers. Height 1–3 feet.

Appendix B List of Plant Species for Use at LANL due to Their Pollinator Benefits

Common Name	Species	Plant Type	Percent in LANL Seed Mix	Bloom Time	Mature Height (inches)
Grasses					
Buffalograss	*Buchloe dactyloides*	grass	10	NA	4–6
Prairie junegrass	*Koeleria macrantha*	grass	50–10	NA	6–24
Blue grama, hachita	*Bouteloua gracilis*	grass	30	NA	10–20
Slender wheatgrass	*Elymus trachycaulus*	grass	50–10	NA	12–24
Indian ricegrass, paloma	*Achnatherum hymenoides*	grass	5	NA	12–30
Western wheatgrass	*Pascopyrum smithii*	grass	20	NA	12–36
Little bluestem	*Schizachyrium scoparium*	grass	50–10	NA	12–36
Galleta	*Pleuraphis jamesii*	grass	5	NA	20–40
Arizona fescue	*Festuca arizonica*	grass	50–10	NA	24
Sand dropseed	*Sporobolus cryptandrus*	grass	5	NA	26–48
New Mexico needlegrass	*Stipa neomexicana*	grass	50–10	NA	24–48
Mountain brome	*Bromus marginatus*	grass	50–10	NA	48
Forbs					
Apache plume	*Fallugia paradoxa*	shrub	5	mid	72
Native globemallow	*Sphaeralcea* spp.	perennial	1.70	mid to late	4–40
Scarlet globemallow	*Sphaeralcea coccinea*	perennial	recommended	mid to late	4–16
Fendler's globemallow	*Sphaeralcea fendleri*	perennial	recommended	mid to late	48
Currant-leaf globemallow	*Sphaeralcea grossularifolia*	perennial	recommended	mid to late	14–30
Gooseberry leaf globemallow	*Sphaeralcea grossulariafolia*	perennial	1	mid to late	14–30
Purple aster	*Dieteria canescens*	annual	1.70	mid to late	12–18
Plains aster	*Aster biglovii*	annual	1	mid to late	
Plains coreopsis	*Coreopsis tinctoria*	annual	1.70	mid	1–3
Native prairie clovers	*Dalea* spp.	perennial	1.70	mid	6–36
Woolly prairie-clover	*Dalea lanata*	perennial	recommended	mid	6
Dwarf prairie-clover	*Dalea nana*	perennial	recommended	mid	8
Fox-tail prairie-clover	*Dalea lepornia*	perennial	recommended	mid	12–24
Six-weeks prairie-clover	*Dalea polygonoides*	perennial	recommended	mid	36
Native penstemons	*Penstemon* spp.	perennial	1.70	early mid	6–60

Common Name	Species	Plant Type	Percent in LANL Seed Mix	Bloom Time	Mature Height (inches)
Beardlip penstemon	*Penstemon barbatus*	perennial	recommended	early mid	18–36
James' penstemon	*Penstemon jamseii*	perennial	recommended	early mid	12–18
Palmer's penstemon	*Penstemon palmeri*	perennial	1	early mid	48–60
Sidebells penstemon	*Penstemon secundiflorus*	perennial	recommended	early mid	6–18
Scarlet bugler	*Penstemon barbatus*	Perennial	2	early mid	54
Scarlet gilia	*Ipomopsis aggregate*	perennial	1	early mid	36–72
Rocky mountain penstemon	*Penstemon strictus*	perennial	recommended	early mid	24–36
Blue flax	*Linum lewisii*	perennial	1.70	mid	18–30
Primrose	Primulaceae	perennial	1.70	mid	6–12
Prairie cone flower	*Ratibida columnifera*	perennial	1.70	mid to late	12–24
Blanketflower	*Gaillardia pulchella*	annual/perennial	1.70	mid to late	26
Chamisa	*Chrysothamnus nauseous*	shrub	2.50	late	24–84
Four-wing saltbush	*Atriplex canescens*	shrub	2.50	mid	12–96
Horsetail milkweed	*Asclepias subverticillata*	perennial	recommended	mid to late	15
Showy milkweed	*Asclepias speciosa*	perennial	recommended	mid to late	18–60
Butterfly weed	*Asclepias tuberosa*	perennial	recommended	mid to late	12–24
Spider milkweed	*Asclepias asperula*	perennial	recommended	mid to late	12–36
Rocky mountain beeplant	*Cleome serrulate*	annual	1–3	mid	24–60
Spectaclepod	*Dimorphocarpa wislizeni*	biennial	1–3	early mid	36
Western wallflower	*Erysimum capitatum*	biennial	1–3	early mid	12–48
Scorpion weed	*Phacelia integrifolia*	annual	1–3	early	30
Three leaf sumac	*Rhus trilobata*	shrub	recommended	early	48–84
Cota	*Thelesperma megapotamicum*	perennial	1–3	mid	32
Hairy false golden-aster	*Heterotheca villosa*	perennial	1–3	mid	28
Chocolate flower	*Berlandiera lyrata*	perennial	1–3	mid	12–20
Native sunflowers	*Helianthus* sp.	annual	1–3	mid to late	24–120
Common sunflower	*Helianthus annuus*	annual	recommended	mid to late	39–118
Maximilian sunflower/ New Mexico sunflower	*Helianthus maximiliani*	annual	1–3	mid to late	36–120
Stiff sunflower	*Helianthus pauciflorus*	annual	recommended	mid to late	24–72
Prairie sunflower	*Helianthus petiolaris*	annual	recommended	mid to late	40–60
Dotted blazingstar	*Liatris punctata*	perennial	1–3	mid	12–28
Adonis blazingstar	*Mentzelia multiflora*	perennial	1–3	mid	24–30
Locoweeds	*Oxytropis and Astragulus*	perennial	1–3	mid	4–12
Flexile milkvetch	*Astragulus flexuosus*	perennial	recommended	mid	8–16

Common Name	Species	Plant Type	Percent in LANL Seed Mix	Bloom Time	Mature Height (inches)
Great rushy milkvetch	*Astragulus lonchocarpus*	perennial	recommended	mid	24
Freckled milkvetch	*Astragulus lentiginosus*	perennial	recommended	mid	4–16
Lotus milkvetch	*Astragulus lotiflorus*	perennial	recommended	mid	3–6
Smallflowered milkvetch	*Astragulus nuttallianus*	annual	recommended	mid	24–36
Purple locoweed	*Oxytropis lambertii*	perennial	recommended	mid	4–16
Native groundsels	*Senecio* spp.	perennial	1–3	mid to late	24–54
Desert ragwort	*Senecio eremophilus*	perennial	recommended	mid to late	48
Thread-leaf ragwort	*Senecio flaccidus*	perennial	recommended	mid to late	54
Broom groundsel	*Senecio spartioides*	perennial	recommended	mid to late	48
Wooton's ragwort	*Senecio wootonii*	perennial	recommended	mid to late	24
Native buckwheats	*Eriogonum* spp.	annual/perennial	1–3	mid to late	8–72
Winged buckwheat	*Eriogonum alatum*	perennial	recommended	mid to late	24–60
Annual buckwheat	*Eriogonum annuum*	annual	recommended	mid to late	72
Nodding buckwheat	*Eriogonum cernuum*	annual	recommended	mid to late	24
James' buckwheat	*Eriogonum jamsii*	perennial	recommended	mid to late	8–16
Sorrell buckwheat	*Eriogonum polycladon*	annual	recommended	mid to late	24
Red-root wild buckwheat	*Eriogonum racemosum*	perennial	recommended	mid to late	36
Native thistles	*Cirsium* spp.	perennial	1–3	early to late	72–84
New Mexico thistle	*Cirsium neomexicanum*	perennial	recommended	early to late	72
Parry's thistle	*Cirsium parryi*	perennial	recommended	early to late	80
Wavy-leaf thistle	*Cirsium undulatum*	perennial	recommended	early to late	84
Adonis blazingstar	*Mentzelia multiflora*	perennial	recommended	mid	24–30
Purple geranium	*Geranium viscosissimum*	perennial	5	mid to late	16
Golden tickseed	*Coreopsis tinctoria*	annual	recommended	early to late	24–48
Wild rose	*Rosa acicularis*	shrub	recommended	early	36–120
Hoary tansy-aster	*Dieteria canescens*	perennial	recommended	late	6–30
Bigelow's false tansy-aster	*Machaeranthera bigelovii*	perennial	recommended	mid to late	12–36
Showy goldeneye	*Heliomeris multiflora*	perennial	1	mid	39
Autumn sneezeweed	*Helenium autumnale*	perennial	recommended	late	60
Western yarrow	*Achellia millifolium*	perennial	1–2	early	10–36