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Plants for Pollinator Habitat in Nevada

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Bumble bee (*Bombus* sp.)on sunflower (*Helianthus annua*). (NRCS Photo by Eric Eldredge)

Sweat bee (family Halictidae) on sunflower (*Helianthus annua*). (NRCS Photo by Eric Eldredge)

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I. Introduction

This Technical Note provides guidance on how to plan, create, and protect habitat for pollinators in Nevada. Pollinators are an integral part of the environment and agricultural systems; they are important for at least 35 percent of global crop production (Klein et al., 2007). The majority of flowering plants, up to 85% worldwide, rely on an animal pollinator to transfer pollen in order to set seed and reproduce. Pollinators include bees, butterflies, beetles, moths, wasps, flies, ants, bats, and hummingbirds. This technical note focuses on native bees, the most important group of pollinators in North America, and also addresses the habitat needs of butterflies and other beneficial insects.

Worldwide, there are an estimated 20,000 species of bees (Michener, 2000), with approximately 4,000 species native to the United States (Winfree et al., 2007). The domesticated European honey bee (*Apis mellifera*) has been managed by humans in Europe and Asia for thousands of years, and was brought to North America in 1622 by European immigrants.

While the introduced honey bee is still the most important crop pollinator in the U. S., it is in decline nationally and worldwide because of diseases and other factors (National Research Council, 2007). Bacterial diseases like foulbrood, fungal diseases like chalk brood, parasites like tracheal mites and varroa mites, and a mysterious condition known as "colony collapse disorder" threaten the honey bee industry, making native pollinators more important than ever to the future of American agriculture.

Native bumble bees, which are very effective pollinators, have also been managed for pollination of crops. Bumble bees are active at cooler temperatures or during cloudy weather, conditions in which honey bees are rarely active. Bumble bees also employ buzz pollination, a technique to release pollen from the anthers of plants such as tomato, eggplant, cranberry, or blueberry. Honey bees, which do not perform buzz pollination, are less effective pollinators of such crops. However, several North American bumble bee species, including the Western bumble bee (*Bombus occidentalis*), a species that occurs in Nevada, have undergone severe declines in recent years (Cameron et al. 2011). The leading hypothesis is that declining species are more susceptible to a pathogen thought to have been accidentally introduced from Europe through commercial bumble bee production (Cameron et al. 2011; Velthuis and van Doorn 2006).

Native bees are often specialized for foraging on particular flowers, such as squash, berries, or orchard trees (Tepedino 1981; Bosch and Kemp, 2001; Javorek et al., 2002). This specialization results in more efficient pollination and the production of larger and more abundant fruit from certain crops (Greenleaf and Kremen, 2006; Klein et al., 2007). Native bee crop pollination is worth an estimated $3 billion annually in the U.S. (Losey and Vaughan, 2006).

Undeveloped areas on and close to farms can serve as long-term habitat for native pollinators. Protecting, enhancing, or providing habitat is the best way to conserve native pollinators and, at the same time, provide pollen and nectar resources that support local honey bees. On farms with sufficient natural habitat, native pollinators can provide all of the pollination for some crops (Kremen et al., 2002; Kremen et al., 2004). Native bees and other insects can help to pollinate food crops if we can provide the habitat they need to maintain healthy populations. Native pollinators can also help to keep our ecosystems healthy by cross-pollinating plants, increasing plant species genetic diversity. Using native plants in gardens and landscaping can help support healthy populations of native pollinators.

Habitat enhancement for native pollinators on farms, especially with native plants, can provide multiple benefits. In addition to supporting pollinators, native plant habitat may attract beneficial insects that feed on crop pests and lessen the need for pesticides on the farm (Barbosa, 1998; Landis et al., 2000; Nicholls et al., 2000; Lee et al., 2001; Van Emden, 2003; Olsen and Wackers, 2007; Kremen et al. 2007). Pollinator habitat can also provide habitat for other wildlife, such as birds (Belfrage et al., 2005), serve as windbreaks, help stabilize the soil, and improve water quality (Wratten et al. 2012). Pollinators have two basic habitat needs: a diversity of flowering plants, and egg-laying or nesting sites. The NRCS can assist landowners with providing pollinator habitat by suggesting appropriate plants and offering advice on how to manage the habitat. This document provides a three step approach to pollinator conservation: (1) advice on recognizing existing pollinator habitat, (2) steps to protect pollinators and existing habitat, and (3) methods to further enhance or restore habitat for pollinators.

II. Incorporating Pollinator Conservation in Nevada

The NRCS uses a three-phase, nine-step planning process to assist clients (individuals, groups, and units of government) in developing, implementing, and evaluating conservation plans on agricultural lands, urban areas, or other lands. This document addresses the resource concerns associated with pollinator habitat conservation planning by following these easy steps:

Phase I

Collection and Analysis – Planners work with clients to better understand pollinator conservation problems and identify opportunities to improve pollinator habitat.

1. Identify Problems and Opportunities

2. Determine Objectives

3. Inventory Resources

4. Analyze Resource Data

Phase II

Decision Support – Planners work with clients to develop alternatives that protect existing pollinators and their habitats and recommend appropriate conservation practices to develop additional habitats.

5. Formulate Alternatives

6. Evaluate Alternatives

7. Make Decisions

Phase III

Implementation and Evaluation – Planners work with clients to apply enhancement, restoration and management practices identified in the conservation plan, and then monitor the response of pollinators.

8. Implement the Plan

9. Evaluate the Plan

When providing conservation planning assistance, the planner should:

1. Recognize the interconnections between the planning unit, larger areas outside of or encompassing the planning unit (e.g. watersheds), and smaller areas within the planning unit (e.g. roadsides, fence lines, ditch banks). For these levels consider (a) the consequences of proposed actions, (b) the cumulative effects of proposed actions and (c) the needs of each level.

2. Think of the planning area in terms beyond its administrative, jurisdictional, and geographic boundaries.
3. Consider the short-term and long-term effects of actions.
4. Consider the client's and society's economic needs and goals.
5. Consider all of the client's enterprises and the interactions between them.
6. Respect the rights and responsibilities of private landowners.
7. Facilitate the creation of a desired future condition that meets individual and societal needs.
8. Recognize that human welfare depends on sustained natural resources.
9. Base assistance on the best current knowledge, science, and technology.
10. Incorporate the knowledge gained from previous planning, implementation, and evaluation efforts.
11. Cooperate with others in collecting, assembling, and evaluating data.
12. Utilize the resources and expertise of others.
13. Identify, prevent, and mitigate, to the greatest extent practicable, disproportionately high and adverse human health or environmental effects of planning assistance on minority and low-income populations.

III. Recognizing Existing Pollinator Habitat

In Phase I of the planning process, many growers will already have habitat for native pollinators on or near their land. Having semi-natural or natural habitat available significantly increases pollinator populations (Kremen et al., 2004; Williams and Kremen, 2007). Habitats such as field edges, roadsides, and ditch banks can provide both nesting and foraging sites (Carvell, et al., 2004; Hopwood, 2008). Woodlots, conservation areas, utility easements, farm roads, and other untilled areas may also contain good habitat. Often, marginal areas, unproductive for crops, may help support agricultural productivity as pollinator habitat (Morandin and Winston, 2006).

A. Existing Plant Composition

To assess existing pollen and nectar resources, it is important to look at the plant resources on and around a landowner's property, and determine which plants can be useful to bees and other pollinators. These plants include insect-pollinated crops, as well as the flowers and even weeds in areas such as ditches, roadsides, natural areas, and fallowed fields. Insect-pollinated crops, by supplying nectar and pollen, may help support native pollinators (Banaszak, 1992). However, for pollinators to be most productive, nectar and pollen resources are needed outside of the crop bloom period.

If a plant is not a noxious weed (Appendix I, p. 33-34) that must be controlled, growers might consider letting some of the native or non-native plants that are present bloom prior to the crop bloom, mow them during crop bloom, then let them bloom again afterward. For example, dandelions, clover, and other non-native plants are often good pollinator plants (Free, 1968; Mosquin, 1971). If flowering plants are mowed when the crop is in bloom, the grower must weigh the benefits of mowing against potential negative effects on pollinators. In addition to pollinators, the predators and parasites of many types of insect pests are also attracted to flowers, enhancing biological pest control.

Table 1. General native pollinator habitat requirements

Pollinator	Food	Shelter
Solitary bees	Nectar and pollen	Most nest in bare or partially vegetated, well-drained soil; others nest in tunnels in dead standing trees, or excavate the pith of stems; some construct domed nests of mud, plant resins, saps, or gums on rocks or trees.
Bumble bees	Nectar and pollen, prefer blue flowers, earlier and later in the season than other bees	Most nest in small cavities (approximately softball size), often in abandoned rodent burrows or under clumps of grass, but can be in hollow trees, bird nests, or walls.
Butterflies and Moths – Egg	Non-feeding stage	Usually on or near larval host plants.
Butterflies and Moths – Larva	Leaves of larval host plants	Larval host plants.
Butterflies and Moths - Pupa	Non-feeding stage	Protected site such as a bush, tall grass, a pile of leaves or sticks or, in the case of some moths, underground.
Butterflies and Moths – Adult	Nectar; some obtain nutrients and minerals from rotting fruit, tree sap, animal dung and urine, carrion, clay deposits, and mud puddles.	Protected site such as a tree, bush, tall grass, or a pile of leaves, sticks or rocks.
Hummingbirds	Nectar, insects, tree sap, spiders, caterpillars, aphids, insect eggs, and willow catkins. Prefer red flowers with a deep corolla.	Trees, shrubs, and vines.

[Adapted from: Native Pollinators. Feb. 2006. Fish and Wildlife Habitat Management Leaflet. No. 34.]

In plant communities on the margins of cropland, an effort should be made to conserve very early and very late blooming plants. Early flowering plants provide food for bees emerging from hibernation and late flowering plants help bees build energy reserves for winter (Pywell et al., 2005).

Small bees may fly only two hundred meters, while large bees such as bumble bees forage a mile or more from their nest (Gathmann and Tscharntke, 2002; Greenleaf et al., 2007). A diversity of flowering crops, plants on field margins, and plants up to a half mile away can provide the steady supply of blooming flowers to support a resident population of pollinators (Winfree et al., 2008).

B. Nesting and Overwintering Sites

To support populations of native bees, protecting or providing nest sites is as important as providing flowers (Tscharntke et al., 1998; Cane, 2001; Potts et al., 2005). Similarly, caterpillar host plants are necessary for butterflies, if that is a management goal (Feber et al., 1996).

Bees can adapt to landscapes in which nesting and forage resources are separated

(Cane, 2001), but it is preferable to have nesting and forage habitat components close together (Westrich, 1996).

Native bees often nest in inconspicuous locations. For example, many dig tunnels in bare soil, others occupy tree cavities, and some chew out the soft pith of stems like elderberry, sumac, and blackberry to make nests (O'Toole and Raw, 1999; Michener, 2000). It is important to recognize and retain naturally occurring nesting sites whenever possible and to create new ones where appropriate.

About 70 percent of North America's native bee species, or about 2,800 species, are ground- nesting bees. These bees need direct access to the soil surface (Potts, et al., 2005) to excavate and access their nests. Ground-nesting bees seldom nest in rich soil, so poor soils may provide good sites. The great majority of ground-nesting bees are solitary, though some will share the nest entrance or cooperate to excavate and supply the nest (Michener, 2000). Some other species nest independently, but with large aggregations of bees excavating nests in the same area.

Approximately 30 percent (around 1,200 species) of bees in North America are solitary wood nesters. Generally, these bees nest in abandoned wood borer tunnels in logs, stumps, and snags. A few chew out the pith of woody plant stems and twigs (Michener, 2000), and in the case of the large carpenter bee, agave or even soft pine. Dead limbs, logs, or snags should be preserved wherever possible. Some wood-nesters also use materials such as mud, leaf pieces, or tree resin to construct their nests (O'Toole and Raw, 1999).

Bumble bees are the native bees usually considered to be social. There are about 45 species in North America (Kearns and Thomson, 2001). They nest in cavities such as abandoned rodent burrows, under grass clumps, or in the ground (Kearns and Thompson, 2001). Leaving patches of rough undisturbed grass in which rodents nest can create future nest sites for bumble bees (McFrederick and LeBuhn, 2006). Bunch grasses provide better nesting habitat than sod-forming varieties.

A secondary benefit of flower-rich foraging habitats is the provision of egg-laying sites for butterflies and moths. They lay their eggs on the plant the larvae will feed on (Croxton et al., 2005; Feber et al.; 1996; Ries et al., 2001). Some butterflies rely on a single species or genus for host plants. Monarch (*Danaus plexippus*) butterfly larvae for example, feed only on milkweed (*Asclepias* spp.); others, such as swallowtails (*Papilio* spp.) use a wide range of plants, including species of trees, shrubs, and forbs (Scott, 1986). In order to provide egg-laying habitat for the highest number of butterflies and moths, growers can provide plants that are used by a number of species. Those plants can be supplemented with host plants for more specialized species. Consult a book on your region's butterfly fauna or contact local experts to learn species-specific needs.

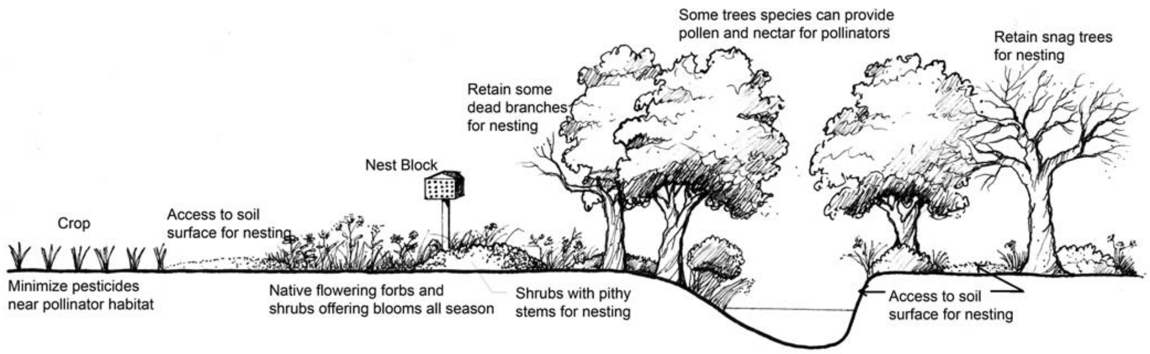


Figure 1. Enhancing Nest Sites for Native Bee Crop Pollinators.
Vaughan and Black. 2006. Agroforestry Note 34.

IV. Protecting Pollinators and Their Habitat

When farmers and landowners recognize the potential pollinator habitat on their land, they can then work to protect those resources. In addition to conserving the food and nest sources of their resident pollinators, farmers can reduce mortality of the pollinators themselves. While insecticide applications are an obvious threat to beneficial insects, other farm operations or disturbances such as tilling and burning can also kill pollinators (Kim, et al., 2006).

A. Use Pesticides Carefully

Indiscriminate pesticide use may be detrimental to a healthy community of native pollinators. Insecticides can kill pollinators (Johansen, 1977), but sub-lethal doses can reduce their foraging and nesting behaviors (Thompson, 2003; Decourtye et al., 2004; Desneux et al., 2007), preventing effective pollination. Herbicides can kill plants that pollinators depend on when crops are not in bloom, thus reducing the amount of foraging and egg-laying resources available (Kremen, 2002; Tscharntke et al., 2005).

If a pesticide is needed, it should be applied to target pests and sites according to the pesticide label. Every precaution should be taken to prevent drift, and broad-spectrum insecticides should be avoided if possible (Zhong et al., 2004). Similarly, crops should not be sprayed while in bloom, and keeping fields weed free can help keep pollinators from venturing into the crop if it needs to be sprayed outside of the bloom period. Nighttime spraying, when bees are not foraging, is one way to reduce bee mortality (Riedl et al., 2006; Tew, 1997; Johansen and Mayer, 1990). Periods of low temperature may also be good for spraying since many bees are less active. However, the residual toxicity of an insecticide may last longer in cool temperatures. For example, dewy nights can cause an insecticide to remain wet on the foliage and be more toxic to bees the following morning (Tew 1997; Johansen and Mayer 1990).

While pesticide labels often list hazards to honey bees, potential dangers to native bees are generally not listed. Also, honey bee colonies can be covered or removed from an application area, whereas native bees must continue to forage and nest in the area.

The use of selective insecticides that target a narrow range of insects, such as *Bacillus thuringiensis (Bt) kurstaki* strain for butterfly and moth larvae, or other *Bt* strains that are effective on beetle larvae may reduce or prevent harm to pollinators.

Generally, dusts that may become mixed into the pollen bees collect to feed larvae are more hazardous than liquid formulations (Riedl et al., 2006). Alternatives to insecticides are available for some pests, such as pheromones for mating disruption, and kaolin clay barrier sprays for some fruit crops. University of Nevada, Reno Cooperative Extension personnel can often assist with the selection of less toxic control practices.

Landowners who grow native plants for pollinator habitat will also inevitably provide habitat for many other beneficial insects that help control pests naturally, and may experience fewer pest outbreaks that reach an economic threshold justifying an insecticide application.

In addition to providing pollinator habitat, conservation plantings such as windbreaks, hedgerows, and headlands can be effective barriers to reduce pesticide drift from fields (Ucar and Hall, 2001; Longley and Sotherton, 1997). Spray drift can occur either as spray droplets or volatilization. Factors effecting drift include weather, application method, equipment settings, and spray formulation (Ozkan, 2000). The risk of pesticide drift increases with warmer air temperature, wind, convection currents, and during temperature inversions.

Wind drift can be minimized by spraying during early morning or in the evening when wind speed is often lower. However, even a light wind can cause considerable drift if nozzle pressure is too high, nozzles are worn, or the spray boom is too high. Some pesticide labels provide guidelines on acceptable wind speed and equipment for spraying the product.

Spray application methods and equipment settings also strongly influence the potential for drift. Since small droplets are most likely to drift long distances, aerosol fog and mist blower applications should be avoided when possible. Standard boom sprayers should be operated at the lowest effective pressure for the nozzles and with the boom set as low as possible for uniform pattern. Drop nozzles can be used to deliver insecticide within the crop canopy where it is less likely to be carried by wind currents (Ozkan, 2000). Regardless of the chemical formulation or type of application equipment used, the equipment must be properly calibrated to apply the labeled rate of pesticide.

B. Minimizing the Harm from Mowing, Haying, Burning, or Grazing

Only a portion of pollinator habitat should be burned, mowed, grazed, or hayed at any one time in order to protect overwintering pollinators and foraging larvae and adults (Black et al., 2008), as well as other wildlife. This will allow for re-colonization of the disturbed area from nearby undisturbed areas, an important factor in the recovery of pollinator populations after disturbance (Hartley et al., 2007). To maximize pollinator foraging and egg-laying, field activities should be avoided while plants are in bloom (Smallidge and Leopold, 1997).

C. Protecting Ground Nesting Bees

To protect nest sites of ground-nesting bees, tilling (Shuler et al., 2005) and flood-irrigating areas of bare or partially bare ground that may be occupied by nesting bees should be avoided. Grazing can also disturb ground nests (Gess and Gess, 1993; Vinson et al., 1993). Similarly, using soil fumigants to control diseases (such as *Verticillium* wilt), or covering soil with plastic mulch could be detrimental to ground nesting bees (Agrios 2005; Yeates et al., 1991). Weed control alternatives to tillage include the use of selective herbicides, flame weeders, and hooded sprayers for between-row herbicide applications.

D. Protecting Wood-Nesting Bees

Wood-nesting bees make their homes in the abandoned tunnels of wood-boring beetles and the pithy centers of many woody plant stems. Dead limbs and trees can be left to provide habitat, so long as they do not pose a risk to property or people. Planting shrubs with pithy or hollow stems, such as elderberry, raspberry, and blackberry, supports the solitary bees that nest in dead stems.

E. Protecting Bumble Bees

Near-surface or subsurface disturbances during the growing season, such as fire, mowing, tilling, and grazing can harm bumble bee nests. Maintain areas free of these practices to support bumble bee populations. Leave hollow logs and dead trees, which can also be home to bumble bees.

V. Enhancing and Developing New Pollinator Habitat

Landowners who want to actively increase the population of pollinators can increase the available habitat to include a range of plants that bloom throughout spring, summer, and fall. Such habitat can take the form of designated pollinator fields, orchard floor plantings, windbreaks with flowering trees and shrubs, riparian and rangeland re-vegetation areas, flowering cover crops, and flowering green manure crops.

Native plants are preferred for their adaptation to the area, greater wildlife value, and their co-evolution with native pollinators (Kearns et al., 1998). Additionally, while bees will use some non-native species, they appear to prefer to forage on native plants (Williams et al. 2011; Morandin and Kremen, 2012). Non-native plants may be suitable on disturbed sites, for specialty uses such as cover cropping, and where native plants are not available. Mixtures of native and non-native plants can also be used, provided the non-native species do not become weedy.

A. Site Selection

Site selection for installing new pollinator-enhancement habitat should begin with a thorough assessment of the site including slope, shade, and soil conditions, but must also consider land ownership, easements, neighboring land uses and available resources.

1. ASPECT: In general, level ground with full sun offers the most flexibility. Slopes may be acceptable as long as erosion can be controlled during the installation process. Unless the site is located near a large body of water, west-facing slopes in many climates are often subject to hot afternoon sun and drying winds. Under such conditions west-facing slopes tend to be naturally dominated by grasses, which are usually of little food value to pollinators, but may provide nest sites for ground-nesting bees and bumble bees.

2. SUN EXPOSURE: The planting design should allow sun-loving plants to remain in full sun as the habitat matures. Plantings can also be installed in several phases, by planting shade-loving herbaceous plants beneath trees and shrubs as they develop. Generally, plants will flower more and provide more nectar and pollen in partial to full sunlight rather than full shade.

3. SOIL CHARACTERISTICS: Soil type is also an important consideration when selecting a site, with some plants favoring particular soil textures such as sand, silt, clay, or loam. Drainage, salinity, pH, organic matter content, and bulk density are some other factors that will influence plant establishment. Many of these factors can be determined from local soil surveys, and the

NRCS Web Soil Survey http://websoilsurvey.nrcs.usda.gov/app. Planning should emphasize the use of plants that will be adapted to the particular soil conditions.

Fertility, soil pathogens, and previous residual herbicide use should also be considered during the planning process (Packard and Mutel 1997). Soil fertility is important during early plant establishment, especially on previously cropped land. As the habitat matures, few if any inputs should be required, especially if native plants are selected. Previously cropped soil may have pathogens that inhibit plant development. Where such conditions exist, pathogen-resistant plant species should be considered. Also, rhizobium bacteria are essential for the successful establishment of legumes, and seed should be inoculated. Soil active herbicides with a long half-life in the soil, or applied at soil-sterilant rates, can inhibit seed germination and establishment of transplants. Chemicals, soil pathogens, beneficial microorganisms, and soil fertility can be tested by soil laboratories. A preliminary planting of a wide range of species can be conducted to determine the plants best suited to the site.

4. ADJACENT LAND USE: Along with exposure and soil conditions, adjacent plant communities and existing land use activities should be considered. Even if weeds are eliminated before planting, the presence of weeds adjacent to the restored habitat may result in a persistent problem that requires ongoing management (Steinauer et al., 2003).

5. USING OTHER LAND: Other land, such as pivot corners, field edges, roadsides, and fence lines, can be managed for pollinator plantings. While tree roots may cause a problem on septic drain field sites, annual flowering forb roots will generally not penetrate pipes or clog systems. As an added benefit, plants on these sites may help absorb nutrients from wastewater. Ditch banks and field buffer strips can also include pollinator-friendly flowering plants (Carvell et al., 2004).

6. SIZE AND SHAPE: The larger the planting area, the greater the potential benefit to pollinators. One-half acre is considered minimal for enhancement, with larger areas providing greater benefits (Morandin and Winston, 2006; Kremen et al., 2004). With herbaceous plantings, a circular or square planting minimizes the edge around the enhancement site and may reduce invasion by weeds. Often, rectangular to linear plantings along a ditch, field edge, or road will be more practical.

B. Habitat Design

When designing a pollinator planting, first consider the overall landscape and how the new habitat will function with adjacent crops and land uses. Then focus on specifics of the planting, such as species diversity, bloom time, plant density, and the inclusion of grasses for weed control and soil stabilization.

1. LANDSCAPE CONSIDERATIONS: The first step in habitat design should be a consideration of how the area can work within the adjacent landscape features. The new habitat should be close enough to crops requiring pollination to be of significant value. The flight distances of small native bees may be as little as 600 feet, while bumble bees may forage up to a mile from their nest. Plants that produce best with bumble bees for pollination, such as raspberries and tomatoes, can benefit from pollinator habitat that far from the field, but even bumble bees will be more efficient when the nesting habitat is as close to the crop as possible.

Similarly, is the new habitat located near existing pollinator populations that can spread into the new area? Fallow areas and existing unmanaged landscapes can make a good starting place for habitat enhancement. In some cases these areas may already have abundant nest sites, such as dead trees or undisturbed soil, but lack the nectar and pollen resources to support a large bee population. Be aware of the existing habitat and consider improving it with additional pollinator plants or nesting sites, or constructing new enhancement areas nearby.

2. DIVERSE PLANTINGS: Diversity is important in the design of pollinator enhancement areas. Flowers should be available throughout the entire growing season, especially when the crops needing pollination are not in bloom. It is desirable to include plants with different flower colors, sizes and shapes as well as varying plant heights and growth habits to encourage the greatest numbers and diversity of pollinators (Frankie et al., 2002; Potts et al., 2003; Ghazoul, 2006; Potin et al., 2006). Most bee species are generalists, feeding on a range of plants throughout their life cycle.

Butterflies and moths have a long tongue that can probe tubular flowers. Bees favor flowers that are purple, violet, yellow, white, and blue, butterflies visit most colors (Procter et al., 1996), while flies are more attracted to white and yellow flowers (Stubbs and Chandler, 1978). By having several plant species flowering at once, and a sequence of plants flowering through spring, summer, and fall, habitat enhancements can support a wider range of pollinator insects that fly at different times of day and of the season (Feber et al., 1996; Tscharntke et al., 1998; Potts et al., 2003).

Diverse plantings that resemble natural native plant communities are also more resistant to pests, diseases, and weeds and will give the most pollinator benefits over time (Tilman et al., 2006). Species found in association with each other in local natural areas are likely to have similar light, moisture, and nutrient needs so that when these species are put into plantings they are more stable (Biondini, 2007).

3. PLANT DIVERSITY AND BLOOM TIME: Plant diversity can also be measured by the number of plants flowering at any given time. One study showed that when eight or more species of plants with different bloom times were at a single site, it attracted more bees and a greater diversity of bee species (Frankie et al., 2002). Ideally, at least three different pollinator plants within each of three blooming periods: early, mid, or late season are recommended (refer to the tables in Appendix III for more information). Therefore, at least nine flowering species should be used in pollinator enhancement sites. Studies have shown that the diversity of bee species continues to increase with increasing plant diversity (Tscharntke et al., 1998; Carvell, 2002; Frankie et al., 2002).

It is especially important to include plants that flower early in the season. Native bees such as bumble bees and some sweat bees produce multiple generations each year. More forage available early in the season will lead to greater reproduction and more bees in the middle and end of the year. Early forage may also encourage bumble bee queens that are emerging from hibernation to start their nests nearby, or simply increase the success rate of nearby nests (Carvell et al., 2007). Conversely, it is also important to include plants that flower late in the season to ensure that queen bumble bees are strong and numerous going into winter hibernation (Hines and Hendrix, 2005; Pywell et al., 2005).

Plant clusters of a single species when possible. Research suggests that a clump of at least nine square feet (a square 3 ft by 3 ft, or a circle 3 ft 5 in diameter) of an individual species, forming a solid block of color when it is in bloom, is more attractive to pollinators than the same flowers scattered throughout a planting. Because bees forage more efficiently when the travel distance between flowers is reduced, larger single-species blocks of more than 25 square feet (a square 5 ft by 5 ft, or a circle 5 ft 8 in diameter) may be more efficient for attracting pollinators and providing nectar and pollen (Frankie et al., 2002).

4. IRRIGATED SITES: Plantings should include a minimum of nine (9) flowering plant species including forbs, vines, shrubs, and trees. Plantings should also include at least one bunch grass adapted to the site in addition to the three or more forbs or shrubs from each of the three bloom periods: spring, summer, and fall - refer to the tables in Section II. Care should be taken to select a grass that will not take over the pollinator planting site.

5. NON-IRRIGATED SITES: Plantings should include at least one native bunch grass adapted to the site in addition to the two or more flowering forbs or shrubs from each of the three bloom periods: spring, summer, and fall - refer to the tables in Section II. This results in a minimum of 7 plant species per planting. Native plant communities generally contain at least one grass or sedge. The grasses or sedges often provide potential nesting sites for bumble bees, and provide shelter and overwintering sites for beneficial insects (Kearns and Thompson 2001; Purtauf et al., 2005; Collins et al., 2003). The combination of grasses and forbs is more resistant to weed invasion (Vance et al., 2006). Grasses also produce fuel loads suitable for burning, if that is part of the long-term management plan. Where fire is not wanted, or when one function of the planting is to provide a fire break, grasses should be widely spaced non-rhizomatous species and should stay green late in the season to be less likely to support a fire.

Select a grass that will not take over the pollinator planting site. Tall, rhizomatous grasses may crowd out some forbs and cool season grasses may be more competitive for early soil moisture than warm season grasses. Seeding rates for grasses, particularly dominant species, should be less than seeding rates for forbs to increase forb establishment (Dickson and Busby, 2009), or grasses can be started in pots and transplanted as plugs after forbs are established.

C. Plant Selection and Seed Sources

Choose plants that are compatible with the site where they will be planted. The plant tables in Appendix III provide appropriate pollinator plants for Nevada.

1. NATIVE PLANTS: Native plants are adapted to the conditions where they naturally occur and native bees are adapted to the native plants found in their habitats.

Native wildflowers have several advantages over many of the introduced species that are usually grown in the urban landscape. Native wildflowers are well adapted to the soils and climate, have low water use after establishment, and require little or no fertilizer. They generally do not become weedy, are relatively free of pest and disease problems, and have potential to reseed and persist.

Conversely, many common horticultural plants do not provide pollen or nectar sufficient to support pollinators. Native plants generally provide shelter and food for wildlife. (Summerville et al., 2007; Tinsley et. al 2006; Waltz and Covington, 2004). Using native plants will help provide connectivity to native plant populations, particularly in regions with fragmented habitats. By providing connectivity for a species to cross pollinate across the landscape, the potential is increased for genetic diversity, helping the population adapt to changes.

2. SEED SOURCES: When available, native plants and seed should be from a "local eco-type" (Aldrich, 2002). Local eco-type refers to seed and plants harvested from a local source. Plants from local sources are adapted to local conditions (Lippit et al., 1994). If possible, commercial seed should be certified. Seed certification provides a number of quality standards, including properly identified species, germination rate, and a minimum of weed seed or other contaminants.

3. TRANSPLANTS: In addition to seed, urban or irrigated Nevada pollinator sites can be planted with plugs, or in the case of woody plants, container grown, containerized, bare-root, or balled-and-burlapped transplants. Plugs of herbaceous plants grown on site or purchased from a nursery can have the advantages of rapid establishment and earlier flowering than plants from seed. The cost of producing and transplanting plugs can be prohibitive in large plantings, and transplants may need mulch or supplemental water to overcome transplant shock and become established (Packard and Mutel, 1997).

Woody plants also undergo a period of transplant shock and need similar care. In general, container grown and balled-and-burlapped woody plants have a higher survival rate and are available in larger sizes. They are also generally more expensive than bare-root or containerized plants. Containerized trees and shrubs are plants that were either hand-dug from the ground in a nursery setting, or were harvested as bare-root seedlings, then placed in a container and allowed to grow for some period of time. Although the cost of containerized plants is typically low, they should be examined for sufficient root mass before purchase to ensure successful establishment (Shigo, 1991). Trees and shrubs may need to be pruned at transplanting to balance the leaf area to the root system.

D. Creating Artificial Nest Sites for Native Bees

There are many ways to provide nesting sites for different kinds of native bees, such as drilled wooden blocks, bundles of paper straws, or bare soil. The Xerces Society's Pollinator Conservation Handbook (Shepherd et al., 2003) provides detailed information on how to build artificial nest sites. Increasing nesting opportunities should result in at least a short-term increase in bee numbers (Steffan-Dewenter and Schiele, 2008).

Most native bees nest in the ground. The requirements of the alkali bee (*Nomia melanderi*) are so thoroughly researched that artificial nesting sites can be created to provide pollination for alfalfa seed production. Unlike the alkali bee, the precise conditions needed by most other ground-nesting bees are not as well known. Some species nest in the ground at the base of plants, and others prefer smooth, bare ground. Landowners can create conditions suitable for a variety of species by allocating areas of undisturbed, untilled ground and/or constructing designated areas of semi-bare ground, or soil mounds stabilized with bunch grasses and wildflowers. Such soil might be excavated from drainage ditches or silt traps. Different species of bees may require different soil conditions, although research shows that many ground nesting bees use sandy, loamy sand, or sandy loam soils.

In general, these constructed ground nest sites should receive full sunlight, and vegetation should be removed to make accessible patches of bare ground. Once constructed, these nest locations must be protected from digging, grazing, irrigation, and traffic.

Colonization of the nest sites will depend upon which bees are in the area, their successful reproduction and population growth, and the suitability of nearby sites. Ground-nesting bee activity can be difficult to observe because there is often little above-ground evidence of the nests. Tunnel entrances may resemble small ant mounds, and can range in size from less than one-eighth inch in diameter to almost one-half inch in diameter, depending on the species.

In contrast to ground-nesting bees, other species such as leafcutter and mason bees naturally nest in beetle tunnels and similar holes in dead trees. Artificial nests for these species can be created by drilling a series of holes in wooden blocks. A range of hole diameters may allow a diversity of species to nest, providing more diverse pollination over a longer season.

Such blocks should be constructed of untreated wood, and the holes should be at least 4 inches up to 6 inches deep. Holes should not be drilled all the way through the block, and should be spaced one-half to three-quarter inch apart so that bees returning to the block from foraging can easily find their own nest tunnel.

Nest blocks should be in an enclosure protected from rain, with the open side of the block facing east to receive morning sunlight. Large blocks tend to attract more bees than small ones, and colonization is often more successful when blocks are in or on a large visible landmark such as a building, rather than on a fence post or tree.

In addition to wooden blocks, artificial nests can be constructed with bundles of paper straws, cardboard tubes, or sections of reed or small diameter bamboo cut so that a node forms the end wall of the tunnel.

Extensive information on constructing native bee nests is available. In order to be sustainable, artificial nests need to be replaced every year or two to prevent the build-up of bee parasites and diseases (Bosch and Kemp, 2001).

VI. Management of New Pollinator Habitat

Habitat plantings for pollinators should remain as undisturbed as possible throughout the growing season so that adult bees can gather pollen and nectar to provision nests for larvae. Management activities such as grazing, haying, burning, or mowing should be conducted only in the winter months or outside the growing season. To maintain the habitat for pollinators, establish a system for managing a percentage of the site each year on a three year (33 percent of area) to five year (20 percent of area) rotation. This improves the opportunity for re-colonization of the disturbed habitat by bees from the surrounding undisturbed area (Black et al., 2008).

Controlled, rotational grazing may be an option for managing the plant community. Grazing should only occur during winter and animals must be removed before all of the vegetation is trampled or eaten. The controlled grazing can be conducted with a three year (33 percent of area) to five year (20 percent of area), or longer, rotation schedule of grazing (Carvell, 2002).

The NRCS supports the use of native species in many conservation practices that involve seeding or transplanting. Selecting pollinator-friendly native plants for these practices can provide added conservation benefits. Many conservation practices also can support the inclusion or management of nest sites for native bees.

Tables 2 and 3 give many conservation practices and the pollinator requirements they support.

Table 2. Pollinator Habitat and NRCS Conservation Practices

Conservation Practice (Units)	**Code**	**Improvement to Pollinator Habitat**
Channel Bank Vegetation (Ac.)	322	Can include flowering trees, shrubs, and forbs. Channel banks provide an opportunity to supply early-flowering willow and, in dry areas, late flowering native forbs (e.g. *Euthamia occidentalis*).
Conservation Cover (Ac.)	327	Can include diverse forbs (e.g. legumes) to increase plant diversity and prolong bloom to provide nectar and pollen throughout the season.
Conservation Crop Rotation (Ac.)	328	Can include rotation plantings that provide forage for pollinators (e.g. various legumes, *Eriogonum* spp., *Penstemon* spp., etc.). Moving insect-pollinated crops no more than 250 meters (750 feet) during the rotation may help maintain local populations of native bees that have grown because of a specific crop or conservation cover. Growers may want to consider rotations that include diverse crops blooming through the season to support pollinator populations. Growers might also consider eliminating or minimizing insecticides and/or using bee-friendly insecticides in cover crop rotations.
Constructed Wetland (Ac.)	656	Constructed wetlands can include plants that provide pollen and nectar for native bees. Some genera with obligate or facultative native wetland species include: *Rosa*, *Salix*, *Rubus*, *Crataegus*, *Spirea*, and *Cornus* .
Contour Buffer Strips (Ac.)	332	Can include diverse legumes or other forbs that provide pollen and nectar for native bees. In addition, the recommendation to mow only every two or three years to benefit wildlife also will benefit nesting bumble bees. To protect bumble bee nests, mowing should occur in the late fall when colonies have died for the year and queens are overwintering.
Cover Crop (Ac.)	340	Can include diverse legumes or other forbs that provide pollen and nectar for native bees. Look for a diverse mix of species that overlap in bloom timing to support pollinators throughout the year. Some examples of cover crops that are utilized by bees include clover *Trifolium* spp., and buckwheat (*Fagopyrum* spp.)
Critical Area Planting (Ac.)	342	Can include plant species that provide pollen and nectar for native bees and other pollinators.

Table 2. Pollinator Habitat and NRCS Conservation Practices

Conservation Practice (Units)	Code	Improvement to Pollinator Habitat
Early Successional Habitat Development/Management (Ac.)	647	This management practice is important for maintaining prime open and sunny habitat for pollinators. Note: To minimize damage to pollinator populations, disturbance practices should be implemented only every 2 to 3 years and, ideally, on only 33% or less of the overall site. This allows for re-colonization from non-treated habitat. For example, mowing 1/3 of the site on a 3-year cycle. When possible, mowing should be in winter when pollinators are inactive.
Field Border (Ft.)	386	Can include diverse legumes or other forbs that provide pollen and nectar for native bees. Strive for a mix of forbs and shrubs that come into bloom at different times throughout the year. Site management (for example, mowing) should occur in late fall to minimize harm to pollinators. Note: If a goal is to create potential nesting habitat for bees, mowing, with no tillage, can maintain access to the soil surface that may provide nesting habitat for ground-nesting solitary bees. Alternatively, allowing native bunch grasses to grow on field edges may provide nesting habitat for bumble bees.
Filter Strip (Ac.)	393	Can include legumes or other forbs that provide pollen and nectar for native bees. Look for a diverse mix of plant species that bloom at different times throughout the year. Site management by mowing or burning should occur in late fall or winter to minimize harm to pollinators.
Forest Stand Improvement (Ac.)	666	Can help maintain open understory and forest gaps that support diverse forbs and shrubs that provide pollen and nectar for pollinators. Standing dead trees may be drilled with 4 to 6-inch deep holes to provide nesting sites for bees.
Grassed Waterway (Ac.)	412	Can include diverse legumes or other forbs that provide pollen and nectar for native bees. In dry regions, these sites may be able to support flowering forbs with higher water requirements and thus provide bloom later in the summer.

Table 2. Pollinator Habitat and NRCS Conservation Practices

Conservation Practice (Units)	Code	Improvement to Pollinator Habitat
Hedgerow Planting (Ft.)	422	Can include forbs and shrubs that provide pollen and nectar for native bees with diverse species that bloom at different times. Bee nesting sites may be incorporated, including bare ground or wooden block nests. Including strips of bunch grasses and forbs along the edge of the hedgerow may provide nesting opportunities for bumble bees. This practice also can help reduce drift of pesticides onto areas of pollinator habitat.
Herbaceous Wind Barriers (Ft.)	603	Can include forbs and shrubs that provide pollen and nectar for native bees. Choose a diverse mix of plant species that come into bloom at different times throughout the year.
Pasture and Hay Planting (Ac.)	512	Can include legumes (e.g. alfalfa, clover, sainfoin) or other forbs that provide pollen and nectar for native bees.
Integrated Pest Management (Ac.)	595	Biological pest management can include plants that attract beneficial insects that predate or parasitized crop pests. These plantings can also benefit pollinator species. Plants commonly used for pest management that also benefit bees include: yarrow (*Achillea* spp.), phacelia (*Phacelia* spp.), and sunflowers (*Helianthus* spp.). Can include legumes or other forbs that provide pollen and nectar for native bees. Use a diverse mix of plant species that bloom at different times through the year. This practice also may be used to encourage landowners to adopt pest management practices that have a reduced impact on pollinators.
Prescribed Burning (Ac.)	338	Can benefit pollinators by maintaining open, early successional habitat. Note: (a) only 30% or less of a site is burned at any one time to allow for recolonization by pollinators from adjacent habitat and (b) burn when plants have dried in fall or winter and pollinators are inactive.
Residue and Tillage Management, No-Till/Strip Till/Direct Seed (Ac.)	329	Standing crop residue can protect bees that are nesting in the ground. Tillage destroys nests or prevents emergence of adult bees the following year.
Range Planting (Ac.)	550	Can include diverse legumes, other forbs, or shrubs that provide pollen and nectar for native bees.

Table 2. Pollinator Habitat and NRCS Conservation Practices

Conservation Practice (Units)	Code	Improvement to Pollinator Habitat
Restoration and Management of Rare and Declining Habitats (Ac.)	643	Can be used to provide diverse local native forage (forbs, shrubs, and trees) and nesting resources for pollinators. Many specialist pollinators that are closely tied to rare plants or habitats may significantly benefit from efforts to protect rare habitat. In addition, certain rare plants require pollinators to reproduce. Note: Only pollinator plants from the rare ecosystem you are trying to restore or manage should be planted.
Riparian Forest Buffer (Ac.)	391	Can include trees, shrubs, and forbs especially chosen to provide pollen and nectar for pollinators. This practice also can help reduce drift of pesticides onto areas of pollinator habitat.
Riparian Herbaceous Cover (Ac.)	390	Can include diverse forbs that provide pollen and nectar for native bees. In the Great Basin some shrubs and forbs flower in the late summer and fall, when bees need forage most.
Stream Habitat Improvement and Management (Ac.)	395	Plants chosen for riparian areas can include trees, shrubs, and forbs that provide pollen and nectar for pollinators. Maximizing plant diversity along riparian corridors will result in more pollinators and other terrestrial insects to feed aquatic life.
Streambank and Shoreline Protection (Ft.)	580	Vegetation used for streambank protection can include trees, shrubs, and forbs chosen to provide pollen and nectar for pollinators.
Tree/Shrub Establishment (Ac.)	612	Can include trees and shrubs selected to provide pollen and nectar for pollinators, or host plants for butterflies.
Upland Wildlife Habitat Management (Ac.)	645	Can include managing for pollinator forage or pollinator nest sites, such as nest blocks or snags for cavity nesting bees, or overgrown grass cover for bumble bees.
Wetland Enhancement (Ac.)	659	Wetland and adjacent upland can include trees, shrubs, and forbs chosen to provide pollen and nectar for pollinators. Snags can be protected or bee nest blocks installed. Some forbs used for enhancement will require pollinators to reproduce.
Wetland Restoration (Ac.)	657	Wetland and adjacent upland can include trees, shrubs, and forbs chosen to provide pollen and nectar for pollinators. Snags can be protected or nest blocks for bees installed. Some forbs used for restoration will require pollinators to reproduce.

Table 2. Pollinator Habitat and NRCS Conservation Practices

Conservation Practice (Units)	Code	Improvement to Pollinator Habitat
Prescribed Grazing (Ac.)	528	Can help maintain late successional habitat and its associated flowering plants. Rotation grazing 30% or less can sustain and improve pollen and nectar resources and potential pollinator nesting sites. Exclude livestock when pollinators are active.
Wetland Wildlife Habitat Management (Ac.)	644	Wetland and adjacent upland can include trees, shrubs, and forbs chosen to provide pollen and nectar for pollinators. Snags can be protected or nest blocks for bees installed.
Windbreak/Shelterbelt Establishment (Ft.)	380	Can include trees, shrubs, and forbs chosen to provide pollen and nectar for pollinators. Can also be a site to place nesting structures for native bees. Windbreaks and shelter belts can also reduce drift of pesticides onto or off of a site. If used for pesticide drift reduction, Windbreaks should be designed to NOT attract pollinators (Adamson et al., 2012).
Windbreak/Shelterbelt Renovation (Ft.)	650	Can include trees, shrubs, and forbs chosen to provide pollen and nectar for pollinators. If appropriate, dead trees and snags may be kept or drilled with holes to provide nesting sites for bees.

Table 3. Pollinator Requirements and NRCS Conservation Practices

<table>
<tr><th>Pollinator Resource</th><th colspan="2">Code and Conservation Practice (Units)</th></tr>
<tr><td>Nest sites (stable ground, holes in wood, cavities for bumble bees, or overwintering sites for bumble bee queens)</td><td>322 Channel Bank Vegetation (Ac.)
656 Constructed Wetland (Ac.)
332 Contour Buffer Strips (Ac.)
342 Critical Area Planting (Ac.)
386 Field Border (Ft.)
422 Hedgerow Planting (Ft.)
409 Prescribed Forestry (Ac.)
329 Residue and Tillage Management, No-Till/Strip Till/Direct Seed (Ac.)
643 Restoration and Management of Rare and Declining Habitats (Ac.)</td><td>391 Riparian Forest Buffer (Ac.)
612 Tree/Shrub Establishment (Ac.)
645 Upland Wildlife Habitat Management (Ac.)
659 Wetland Enhancement (Ac.)
657 Wetland Restoration (Ac.)
644 Wetland Wildlife Habitat Management (Ac.)
380 Windbreak/Shelterbelt Establishment (Ft.)
650 Windbreak/Shelterbelt Renovation (Ft.)</td></tr>
<tr><td>Forage (diverse sources of pollen and nectar that support pollinators from early in the spring to late in the fall)</td><td>311 Alley Cropping (Ac.)
322 Channel Bank Vegetation (Ac.)
327 Conservation Cover (Ac.)
328 Conservation Crop Rotation (Ac.)
656 Constructed Wetland (Ac.)
332 Contour Buffer Strips (Ac.)
340 Cover Crop (Ac.)
342 Critical Area Planting (Ac.)
386 Field Border (Ft.)
393 Filter Strip (Ac.)
412 Grassed Waterway (Ac.)
422 Hedgerow Planting (Ft.)
603 Herbaceous Wind Barriers (Ft.)
379 Multi-Story Cropping (Ac.)
512 Pasture and Hay Planting (Ac.)
595 Pest Management (Ac.)
409 Prescribed Forestry (Ac.)
528 Prescribed Grazing (Ac.)
550 Range Planting (Ac.)</td><td>643 Restoration and Management of Rare and Declining Habitats (Ac.)
391 Riparian Forest Buffer (Ac.)
390 Riparian Herbaceous Cover (Ac.)
381 Silvopasture Establishment (Ac.)
395 Stream Habitat Improvement and Management (Ac.)
580 Streambank and Shoreline Protection (Ft.)
585 Stripcropping (Ac.)
612 Tree/Shrub Establishment (Ac.)
645 Upland Wildlife Habitat Management (Ac.)
601 Vegetative Barriers (Ft.)
659 Wetland Enhancement (Ac.)
657 Wetland Restoration (Ac.)
644 Wetland Wildlife Habitat Management (Ac.)
380 Windbreak/Shelterbelt Establishment (Ft.)
650 Windbreak/Shelterbelt Renovation (Ft.)</td></tr>
<tr><td>Pesticide protection (refuge from spray, buffers to drift, etc.)</td><td>322 Channel Bank Vegetation (Ac.)
656 Constructed Wetland (Ac.)
342 Critical Area Planting (Ac.)
422 Hedgerow Planting (Ft.)</td><td>391 Riparian Forest Buffer (Ac.)
657 Wetland Restoration (Ac.)
380 Windbreak/Shelterbelt Establishment (Ft.)</td></tr>
<tr><td>Site management for pollinators</td><td>647 Early Successional Habitat Development or Management (Ac.)
595 Pest Management (Ac.)
338 Prescribed Burning (Ac.)
409 Prescribed Forestry (Ac.)
528 Prescribed Grazing (Ac.)</td><td>643 Restoration and Management of Rare and Declining Habitats (Ac.)
645 Upland Wildlife Habitat Management (Ac.)
644 Wetland Wildlife Habitat Management (Ac.)</td></tr>
</table>

VII. Plant Selection

Appendix III contains tables with information about native and non-native trees, shrubs, wildflowers, and grasses to consider for plantings to enhance pollinator habitat. The information is provided to help select plants for a particular site. To find species that are suitable for your project, consult the Nevada Major Land Resource Area (MLRA) map in Appendix II, p.42.

Additional information such as the county distribution and cultural requirements based on plant characteristics for various species is available on the USDA PLANTS database (http://plants.usda.gov/). The PLANTS website also has Plant Guides for many of the native plant species that can be used for pollinator habitat.

Native plants may cost more than non-native alternatives at the nursery, but over the long-term native plantings can be more cost-effective for pollinator enhancement. Native plantings also have the added benefit of enhancing native biological diversity and are the best choice to build populations of native pollinators (Frankie et al. 2002; Samways 2007).

The species lists in Appendix III Tables 1 through 5 are not intended to be all-inclusive. Other plants listed in the references may also provide habitat benefits to pollinators.

A. Trees and Shrubs for Pollinator Enhancement

Tree and shrub plantings may be designed for a number of concurrent purposes, such as wildlife enhancement, stream stabilization, windbreak, and/or pollinator enhancement (Henry et al. 1999). Appendix III lists some of the native tree and shrub species that you might consider. Try to overlap bloom periods, and choose plants suited to site conditions in the MLRA.

B. Forbs

There are many forbs (wildflowers) to choose from when designing pollinator enhancement. Some are plants that you could also use to enhance conditions for pollinators as the base of one or both sides of a hedgerow, in riparian buffers, windbreaks, alley cropping, field border, ditch bank, or range planting. Appendix III suggests some native perennial forbs that are listed in the USDA PLANTS database as being routinely commercially available. The MLRA occurrence is based on PLANTS distribution maps county data, which are based primarily on the literature, herbarium specimens, and confirmed observations. However, not all populations have been documented, so some gaps in the distribution maps may not be true. Choose species adapted to your area and site conditions that will provide overlapping bloom periods. The forbs table is organized by bloom period from early to late.

C. Grasses and Sedges to Include in Herbaceous Mixtures

Herbaceous plantings should include at least one grass or clump-forming sedge adapted to the site, in addition to forbs that will be planted. Including a grass or sedge in the planting mixture will help exclude weeds, stabilize the soil, provide overwintering habitat for beneficial insects, food for larvae of some butterflies, and nest sites for bumble bees (Svensson et al. 2000; Kells and Goulson 2003).

Tall grasses crowd out forbs more easily than short grasses. Planting specific areas with higher rates of forbs interspersed with grass areas will reduce the competition by grasses. Seeding rates for grasses should usually not exceed seeding rates of forbs in seeding mixes (Dickson and Busby 2009).

D. Plant Species for Cover Crops, Green Manure, Forage, and Pollinator Plantings

A number of plant species used for cover crops, insectaries, green manure, or short-term plantings are productive forage sources for pollinators. Some of these species could reproduce and spread to become weedy, so you will want to choose appropriate species for your needs and monitor their development on your site.

Cover crops are generally established for seasonal vegetative cover and soil conservation. They reduce erosion and weed competition, and improve soil organic matter and tilth (Eldredge, 2012). They may be part of a rotation as a harvested crop or they may be inter-planted between rows in orchards or vineyards to enhance soil organic matter and nutrients. Nitrogen-fixing legumes are often used in cover crop mixtures to increase soil fertility. Flowering cover crops may also provide good pollen or nectar sources for bees and other beneficial insects.

Pollinator plantings may be placed as a block inside of a crop, along the edge, or outside of a crop to attract beneficial insects to the crop for biological control by predators or parasites of crop pests (Colley & Luna 2000). Beneficial insects can be much more abundant in pollinator plantings than where such habitat is absent. Some of these plants can also provide good pollen or nectar sources for bees. These may be annual plantings or, for perennials, permanent plantings along the outer rows within the field or outside but adjacent to the crop field. The principles of enhancement for pollinators also generally apply to pollinator plantings, such as including a diversity of patches or blocks of flowers that bloom through the entire growing season to provide a steady supply of nectar.

The species suggested in Appendix III are commonly used in farm practices and presumed to be widely available in the marketplace. These plants generally do best in a full sun location and many require irrigation. Fertilizer requirements can vary widely depending on the soil test result, and legumes require inoculation.

E. Garden Plants

This type of planting will generally be a more permanent planting outside but adjacent to cropland. The pollinator habitat enhancement principles will also apply; such as including patches of a diversity of flowers that bloom through the entire growing season to provide a steady supply of nectar and pollen. Also, when selecting plant varieties, keep in mind that the simple-flowered cultivars generally provide greater nectar and pollen rewards than multi-petaled (double petal) varieties.

Some plants suggested in Appendix III are commonly available as garden plants. These species will generally do best in full sun and may require irrigation and supplemental fertilizer. Establishment of perennial plants may take a few years, but they can often last for an extended period of time. One strategy is to plant annual and perennial garden plants together, with the annual plants providing immediate benefits the first year, while the perennial plants become established (Szalai 2001).

VIII. Site Preparation, Planting, and Maintenance of New Pollinator Habitat

Developing new pollinator habitat to implement a conservation practice requires some basic horticultural knowledge. The following section describes the fundamental techniques of site preparation, planting, and initial maintenance. Standard agricultural equipment can be used in many cases, however some planting techniques (for example, drill seeding native plants) may require some equipment modifications, or specialized field implements which can often be rented or borrowed from local cooperatives, hardware stores, or conservation groups.

Site preparation is one of the most important, and often inadequately addressed, components for project success. It may require several seasons of effort if invasive or noxious weeds must be controlled prior to planting. To establish either herbaceous or woody vegetation, more time or effort spent eradicating weeds will result in higher success rates.

Weed removal can be performed in three ways, used alone or in combination: (1) tillage with hand tools or machinery, (2) use herbicide, or (3) solarization using clear plastic. The appropriate method to use will depend on the size of the area, the farm operation (i.e. conventional or organic), equipment availability, and the existing weed species. All herbicide applications must follow the label.

A. Site Preparation for Woody Plants

Planting sites shall be properly prepared based on soil and vegetative conditions listed below. Avoid planting on sites that have had recent application of soil active herbicides that may be harmful to the planned species. Check the labels of herbicides applied to the site in the previous one to two years for replant restrictions and carryover characteristics prior to initiating tree planting. If pesticides are used, apply within Federal, State, and local regulations. Follow all label directions and heed precautions listed on the label. On sites treated with pesticides, especially tilled sites, consult the label for the re-entry interval and any health risks from handling treated soil or breathing dust. Site preparation may include the whole field, strips, or patches. Individual site preparation (scalp area) for each tree/shrub should provide a minimum 3-foot diameter circle, or a minimum 3- foot by 3-foot square planting spot (1.5 feet to each side of the planted stock). The planting area must be free of living sod and perennial weeds before planting.

In general, hedgerows or plantings of woody species require significantly less site preparation than herbaceous plants. Once weeds are eradicated or controlled, efforts can focus on the removal of undesirable existing woody species with weed wrenches, machetes, chainsaws, and branch loppers. Many undesirable woody plants will re-sprout after they are cut back to ground level. For permanent removal, sprouts require repeated cutting to deplete energy stored in the root system, or the freshly cut stumps may be treated with a herbicide labeled for that use. Herbicides labeled for use on woody plants are usually applied to foliage or on freshly cut stumps. Several non-selective herbicides are also labeled for wetland-emergent woody plants. University of Nevada, Reno Cooperative Extension personnel can often assist with the selection of appropriate control practices.

B. Site Preparation for Herbaceous Plants

Site preparation for herbaceous plants can be significantly more complex. Generally the site should be free of existing weeds, weed seed that has not yet germinated, and debris that will inhibit planting operations. Perennial weed seed and rhizomes need to be killed. Annual and biennial weed seed may also be present, and it may take several years of management before a forb planting site can be free of weeds.

Weed removal can be performed in three ways, used alone or in combination: (1) tillage with hand tools or machinery, (2) use herbicide, or (3) solarization using clear plastic. Shallow tillage of the soil prior to planting is not as likely bring up additional weed seed. The appropriate site preparation method to use will depend on the farm operation (conventional or organic), equipment availability, and the existing weed pressure. Cropped lands that have been cultivated for several years are generally lower in weed pressure.

1. SITE PREPARATION USING TILLAGE: Existing vegetation can be removed with hoeing or using a garden type rototiller on small areas. Larger acreage may require agricultural equipment such as tractor-mounted rototiller, disk, spring-tooth cultivator with sweeps, or a scraper blade.

2. SITE PREPARATION USING HERBICIDES: Existing weeds can be reduced with non-persistent, non-selective herbicides. This low cost approach can be effective, even on large areas, with minimal labor. Herbicide applications must follow the instructions on the product label. It may be necessary to mow some weeds before herbicide treatment, so that new growth is exposed to the herbicide. Some herbicides can be applied as soon as weeds are actively growing in spring, or when weeds reach the growth stage listed on the label.

If mechanical drill seeding is planned for no-till sites, the area may be rolled with a cultipacker prior to planting if there is a significant amount of stubble. After a non-selective herbicide application, planting can be done as soon as the label allows it.

3. SITE PREPARATION WITH SOLARIZATION: Smothering existing vegetation with plastic sheet is an option on small areas. Often the plastic will need to be left in place for at least a growing season before all the vegetation under it is dead. Black plastic can be used, however clear plastic that is UV stabilized may result in greater soil heating, and more successful destruction of weeds and weed seed. The site should be mowed or debris raked in the spring so the surface is smooth, with no stems that could puncture the plastic. High tunnel plastic, or other types of UV stabilized plastic should be laid smooth, and the edges buried to prevent airflow underneath the plastic. Greenhouse tape can be used to repair any rips in the plastic. The plastic can be removed in the fall and planting can take place immediately.

C. Planting and Initial Establishment

Planting methods vary depending on the type of pollinator enhancement being created; woody or herbaceous plants, and the planting conditions; an untilled field versus a cultivated seedbed. Before any digging, especially near roads, buildings, railroads, or utility easements, the local utility companies should be contacted to be certain no underground wires or gas lines are nearby. Pollinator plantings must also avoid utility, road, and irrigation easements, unless allowed by a written agreement between the entity holding the easement and the landowner. In some cases, pollinator plantings can reduce maintenance costs for roads and ditch banks.

1. WOODY PLANTS: Trees and shrubs can be planted when local nursery stock is available and the soil can be worked, although planting during hot weather will require more careful follow-up care. Planting depth is critical. Woody plants should be planted at or slightly above the depth they grew at the nursery. This will allow for settling, prevent the formation of stem-girdling roots, and improve oxygen availability to the roots. Remove rocks from the hole and do not line the bottom of the hole with gravel (Shigo 1991).

Prepare a hole 2 to 3 times as deep as the root mass or soil ball, and 1-2 times wider. The sides of the hole should be roughened in clay soils. Small holes can be hand dug, though for larger tree transplants or balled-and-burlaped nursery stock, a truck or tractor mounted hydraulic tree spade may be more convenient.

Regardless of the type of nursery stock, care should be taken not to damage the roots during the installation process. Balled-and-burlaped and containerized plants should only be moved by the container or soil ball, never by the stem. After placing them in the planting hole, backfill balled-and-burlaped plants to 1/3 the height of the soil ball, tamping the soil to remove air pockets. Next, with a knife and a wire cutter remove as much of the wire cage, burlap, and twine as possible without allowing the soil ball to fall apart. Unwind or prune any roots that wrap around the soil ball. Finish filling in the hole, tamping the soil in. Water thoroughly to reduce transplant shock.

Bare-root plants should be installed immediately to prevent drying of the roots. When placing the plant in the hole, the roots should be straightened and spread out evenly before backfilling.

Container grown trees should be removed from their pot before planting, and any rootbound plants (roots growing in a spiral around the inside of the container) should be returned to the nursery. For those container plants that were not planted upon delivery from the nursery, unwind the roots, if possible, or make shallow vertical cuts through the rootmass. Encircling roots that are not unwound or pruned may continue to expand and eventually kill the tree (Johnson and Hauer 2000). Following root correction, container grown stock can be planted in the same way as balled-and-burlaped plants. Water thoroughly to reduce transplant shock.

Adding mulch around the base of trees and shrubs can help maintain soil moisture and suppress weeds. Wood chips are a good mulch material and can be applied in a 3-6 inch layer radiating 3-6 feet from the base of the plant. The mulch should not directly contact the trunk.

Most newly planted trees and shrubs do best without staking. Trunk movement caused by wind helps develop proper trunk taper and resilient root systems (Shigo 1991). If stakes must be used because the plant cannot stand on its own, or in very windy areas, loose webbing or soft, non-abrasive strap or hose should pad the rope or wire holding the trunk loosely between the stakes, allowing for movement. The stakes and bracing materials should be removed as the trunk grows.

Animal damage can be a problem for small woody plants. Where this occurs, trunks can be protected with plastic cylinders or hardware cloth. Small woody plants can be planted inside plastic grow tubes. Some newer tubes are manufactured from plastic that breaks down in sunlight after several seasons.

2. PLUGS AND CONTAINER PLANTS: Most native herbaceous plants can be installed throughout the growing season if water is available, otherwise October through January is a good time to plant plugs and containerized plants when the plant is dormant. Plugs dry out quickly in their containers and should be watered often and kept out of wind and sun if they cannot be planted immediately. To plant, dig a hole deeper than the container, being sure to go through any hardpan, and back fill to the same depth as the container. Remove the plant from the container, and position the base of the plant slightly below the surrounding soil surface. Fill the hole surrounding the plant, and cover the potting mix completely with soil to prevent moisture from evaporating from the exposed surface of the potting mix. First year transplants may benefit from a 3-inch thick layer of straw or leaf mulch after going dormant in the.

3. **SEEDING IN A CULTIVATED SEEDBED**
For some flowering forbs, fall planting is best. Many plant seeds require damp and cold conditions (stratification) to break dormancy. Additionally, winter precipitation may help the settle seeds into the soil.

For seeding larger areas, an ATV mounted seed spreader, or tractor-mounted drop seeder or spreader can be used. Depending on the agitators in the seed box and the seed mix, rice hulls may be added to help prevent seed from segregating by size. Follow the equipment manufacturer's instructions on this process (Steinauer et al. 2003, St. John et al. 2005).

For most broadcast (either mechanically or by hand) plantings, the seed can be mixed uniformly together into a single mix. When the drill has two or more seed boxes there is an advantage to placing larger seeds in one compartment and smaller seeds in another. This prevents the small seeds settling in the seed box and being planted sooner than the larger seeds, but requires calibration of each seed box.

Seeding with a drill equipped with press wheels helps ensure good seed contact with the soil. After broadcast seeding, the soil should be lightly harrowed and pressed with a cultipacker, field roller, or the tires of a truck or tractor (Steinauer et al. 2003).

Newly planted bare soil should be protected with a layer of weed-free straw or hydro-mulch to reduce erosion and help retain moisture. Straw should be spread at 1 to 1.5 ton to the acre, thinly enough to see bare ground through the mulch to allow for seedling emergence.

4. **DRILL SEEDING A NO-TILL SEEDBED:** No-till drills allow planting on rough soil, which is advantageous in soils with buried weed seed that could germinate if brought to the surface by cultivation. Drills provide more precise planting depth and spacing, and require less seed for the same area, than broadcast seeding. Even though cultivation is not necessary when using a no-till drill, growers should harrow or cultipack the soil before planting if there is a significant amount of stubble (Steinauer et al. 2003). No-till seeding in fall favors the development of flowering forbs and grasses.

For no-till planting, specialized equipment may be required. In rough, brushy, or rocky rangeland conditions, agricultural no-till drills generally will not work. Instead, special range drills, such as those manufactured by Tye or Truax are often required (Steinauer et al. 2003). Range drills are becoming more widely available, as conservation groups, often hunting clubs, are purchasing them. These groups may rent their seed drill to other land owners.

D. Management

One of the great advantages of using native plants for pollinator habitat enhancement is that once the native plants are established, maintenance is minimal compared to non-native flowers. Frequent disturbance of pollinator habitat can be detrimental to insect populations. The time consuming task of irrigating the new planting diminishes quickly as the habitat becomes established. Nutrient cycling in plant ecosystems reduces the need for supplemental fertilizer, and eventually the only maintenance necessary will be weeding.

1. **IRRIGATING NEW PLANTINGS:** Once established, locally adapted native plants usually do not need supplemental water. However, depending on the species and season, newly transplanted trees, shrubs, and forbs may require irrigation, the amount depending on the species and precipitation. The seed vendor or a local nursery can often provide guidance on water requirements. Over-irrigating can be as harmful to native plants as under-irrigating.

Germination and seedling survival for seeded native species also benefits from irrigation during the first months after planting. Non-native plants, such as cover crops, may require greater amounts of water, sometimes through the growing season.

Except during drought, native plants in their natural habitat should not require irrigation once they become established. With or without supplemental water, some native perennial seeds may take several seasons to germinate. Although this may seem like a drawback, it allows for removal of faster germinating weeds.

2. WEED CONTROL: If they are mulched, woody plants and transplanted forbs are usually protected from weed encroachment during early establishment.

Seeded areas of native perennials need more protection, especially from annual and biennial weeds during establishment (all perennial weeds should have been destroyed prior to planting). One way to control these weeds is by mowing to a height higher than the native forb seedlings several times during the first growing season. The number of times mowing will be required depends on the weed species present, and how quickly they grow (often dependent on precipitation). Mowing can be done when the weeds reach 12 inches tall. This will prevent most weeds from flowering, except weeds like yellow star-thistle that re-sprout when mowed too early (Steinauer et al. 2003).

For small areas, a walk-behind sickle bar mower is often better than a rotary mower, which may bog down in thick vegetation. Sickle bar mowers can be rented at many hardware stores. For large areas, a tractor mounted flail mower shreds the cut weeds into small pieces. Weeds can also be spot treated with a selective or non-selective herbicide using a backpack sprayer, taking care to avoid desirable species, or brushed with a non-selective herbicide using a wick applicator. Weeds should not be pulled during the first year when the surrounding native seedlings are developing their root systems.

In the early spring of the second year, before plant emergence, the previous season's debris should be mowed and raked away. If perennial weeds were destroyed prior to planting, and annual weeds were controlled during the first year of growth, the majority of the remaining weeds may be biennial species. These plants develop a basal rosette during their first year, and then flower during the second year before dying. The control tactic is to wait until most of the biennial weeds are about to flower, then mow, if it is possible to mow without damaging the native pollinator plants. On small areas, the flower stalks of biennial weeds can be cut with a string trimmer, or treated with herbicide to prevent them from producing seed. Appendix I (p. 33-34) lists the designated noxious weeds in Nevada.

3. MONITORING: Assessing practices to meet a management objective is done through monitoring the response of the target species. When the target species are pollinators, monitoring the newly managed, restored or enhanced areas can provide some information as to the success of the landowner's efforts. Monitoring native pollinators' nesting sites and the available sources of pollen and nectar throughout spring, summer, and fall can provide some information on the preferences of the native pollinators for that area.

Techniques in monitoring native bee abundance and diversity include conducting observations during different seasons of the year, netting bees visiting flowers, and photographing pollinators for identification. Clear, close-up digital images can be emailed to the USDA-ARS Logan Bee Lab (Jim.Cane@ars.usda.gov) for identification. It is necessary to distinguish between introduced honey bees and native bees. Native bees should be identified with enough precision to know what nesting sites they inhabit. The BugGuide website (http://bugguide.net) hosted by Iowa State University provides a variety of tools for identifying native bees and other insects. The Citizen Scientist Pollinator Monitoring Guide (http://www.xerces.org/wp-content/uploads/2010/06/CA_CSM_guide.pdf) can be used to collect data on bee diversity and abundance and monitor changes over time. The Pollinator Habitat Assessment Form and Guide (http://www.macdnet.org/Pollinator%20Habitat%20Assessment-sec.pdf) can be used to identify and evaluate specific habitat features valuable to pollinators. To document the amount of pollen and nectar available and estimate potential nesting sites, line-point transects can be used to estimate the amount of bloom and the percent of bare ground (potential nest sites for ground-nesting bees) and nesting tunnels (for tunnel nesting bees). Monitoring will allow NRCS staff to quantify native bee populations on a property, help growers recognize the native bees visiting their crops, and develop a standardized measure of the native bees on the land.

Additional Information

Additional publications providing information on pollinator habitat conservation are listed below.

Publications for Additional Information

Adamson N, Ward T, and Vaughan M. 2012. Designed with pollinators in mind. Inside Agroforestry (special issue on windbreaks). 20(1):8-10. http://www.unl.edu/nac/insideagroforestry/vol20issue1.pdf

Black, S.H., N. Hodges, M. Vaughan and M. Shepherd. 2008. Pollinators in Natural Areas: A Primer on Habitat Management http://www.xerces.org/pubs_merch/Managing_Habitat_for_Pollinators.htm

Riedl, H., E. Johnson, L. Brewer, and J. Barbour. 2006. How to Reduce Bee Poisoning From Pesticides. PNW Extension Publication 591. Oregon State University, Corvallis.

Society for Range Management. 2011. Rangelands. Special Issue on Pollinators. Volume 33, Issue 3. http://www.srmjournals.org/toc/rala/33/3

The Xerces Society and The Smithsonian Institution. 1990. Butterfly Gardening: Creating Summer Magic in your Garden, 208 pp. San Francisco: Sierra Club Books.

USDA, NRCS and FS, M. Vaughan and S.H. Black. 2006. Agroforestry Note – 32: Sustaining Native Bee Habitat for Crop Pollination," USDA National Agroforestry Center. http://www.unl.edu/nac/agroforestrynotes/an32g06.pdf

USDA, NRCS and FS, M. Vaughan and S.H. Black. 2006. Agroforestry Note – 33*:* Improving Forage for Native Bee Crop Pollinators. USDA National Agroforestry Center. http://www.unl.edu/nac/agroforestrynotes/an33g07.pdf

USDA, NRCS and FS, M. Vaughan and S.H. Black. 2006. Agroforestry Note – 34: Enhancing Nest Sites for Native Bee Crop Pollinators. USDA National Agroforestry Center. http://www.unl.edu/nac/agroforestrynotes/an34g08.pdf

USDA, NRCS and FS, M. Vaughan and S.H. Black. 2006. Agroforestry Note – 35: Pesticide Considerations for Native Bees in Agroforestry. USDA National Agroforestry Center. http://www.unl.edu/nac/agroforestrynotes/an35g09.pdf

USDA-NRCS. Conservation Security Program Job Sheet: Nectar Corridors, Plant Management EPL 41. www.wv.nrcs.usda.gov/programs/csp/06csp/JobSheets/nectarCorridorsEL41.pdf

USDA, NRCS, Idaho Plant Materials Technical Note 2: Plants for Pollinators in the Intermountain West. sc.egov.usda.gov/ID/programs/technotes/pollinators07.pdf

USDA, NRCS. 2001. Creating Native Landscapes in the Northern Great Plains and Rocky Mountains 16pp. http://www.mt.nrcs.usda.gov/technical/ecs/plants/xeriscp/

USDI, BLM. 2003. Technical Reference 1730-3. Landscaping with Native Plants of the Intermountain Region. 47pp. http://www.id.blm.gov/publications/TR1730-3/index.htm

US EPA and USDA. 1991. Applying Pesticides Correctly, A Guide for Private and Commercial Applicators. USDA Agriculture Extension Service.

U.S. Fish and Wildlife Habitat Management Leaflet Numbers 14, 15, and 34; "Butterflies", "Ruby-throated Hummingbird" and "Native Pollinators", respectively. http://www.whmi.nrcs.usda.gov/technical/leaflet.htm

Vaughan, M., M. Shepherd, C. Kremen, and S. Black. 2007. Farming for Bees: Guidelines for Providing Native Bee Habitat on Farms. 2^{nd} Ed. Portland, OR: Xerces Society for

Invertebrate Conservation. 44 pp. http://www.xerces.org/Pollinator_Insect_Conservation/Farming_for_Bees_2nd_edition.pdf

Xerces Society for Invertebrate Conservation. 2011. Attracting native pollinators: Protecting North America's bees and butterflies. North Adams, MA: Storey Pub.

Websites for Additional Information

Bug Guide at Iowa State University
    http://bugguide.net
Citizen Scientist Pollinator Monitoring Guide
    http://www.xerces.org/wp-content/uploads/2010/06/CA_CSM_guide.pdf
Lady Bird Johnson Wildflower Center database, plants with special value to pollinators
    http://www.wildflower.org/collections/
Logan Bee Lab list of plants attractive to native bees
    http://www.ars.usda.gov/Main/docs.htm?docid=12052
Pollinator friendly practices
    http://www.nappc.org/PollinatorFriendlyPractices.pdf
Pollinator Conservation Resource Center, Mountain Region
    http://www.xerces.org/pollinators-mountain-region/
The Pollinator partnership
    http://www.pollinator.org/
Urban bee gardens
    http://nature.berkeley.edu/urbanbeegardens/index.html
USDA ARS Logan Bee Lab
    www.loganbeelab.usu.edu
U.S. Fish and Wildlife Service Information
    http://www.fws.gov/pollinators/Index.html
U.S. Forest Service Pollinator Information
    http://www.fs.fed.us/wildflowers/pollinators/index.shtml
The Xerces Society Pollinator Conservation Program
    http://www.xerces.org/pollinator-conservation/
Xerces Society Pollinator Habitat Assessment Form and Guide
    http://www.macdnet.org/Pollinator%20Habitat%20Assessment-sec.pdf

Additional Information on Native Plants

Considerations in choosing native plant materials
    http://www.fs.fed.us/wildflowers/nativeplantmaterials/index.shtml
Guide for native plant establishment
    http://www.prairieplains.org/restoration_.htm
Selecting Native Plant Materials for Restoration
    http://extension.oregonstate.edu/catalog/pdf/em/em8885-e.pdf
Species lists by ecological region and plant communities
    http://www.nativeseednetwork.org/

Appendix I - Noxious Weeds in Nevada.

A plant may become a weed outside of its native range, and some plants may be considered weeds wherever they occur. When developing pollinator enhancement sites, it is important that weedy species are not planted intentionally or accidently.

Noxious weeds in each state are defined by law in that state. Noxious weeds already present in the site being considered for pollinator habitat must be controlled as the first step in site preparation.

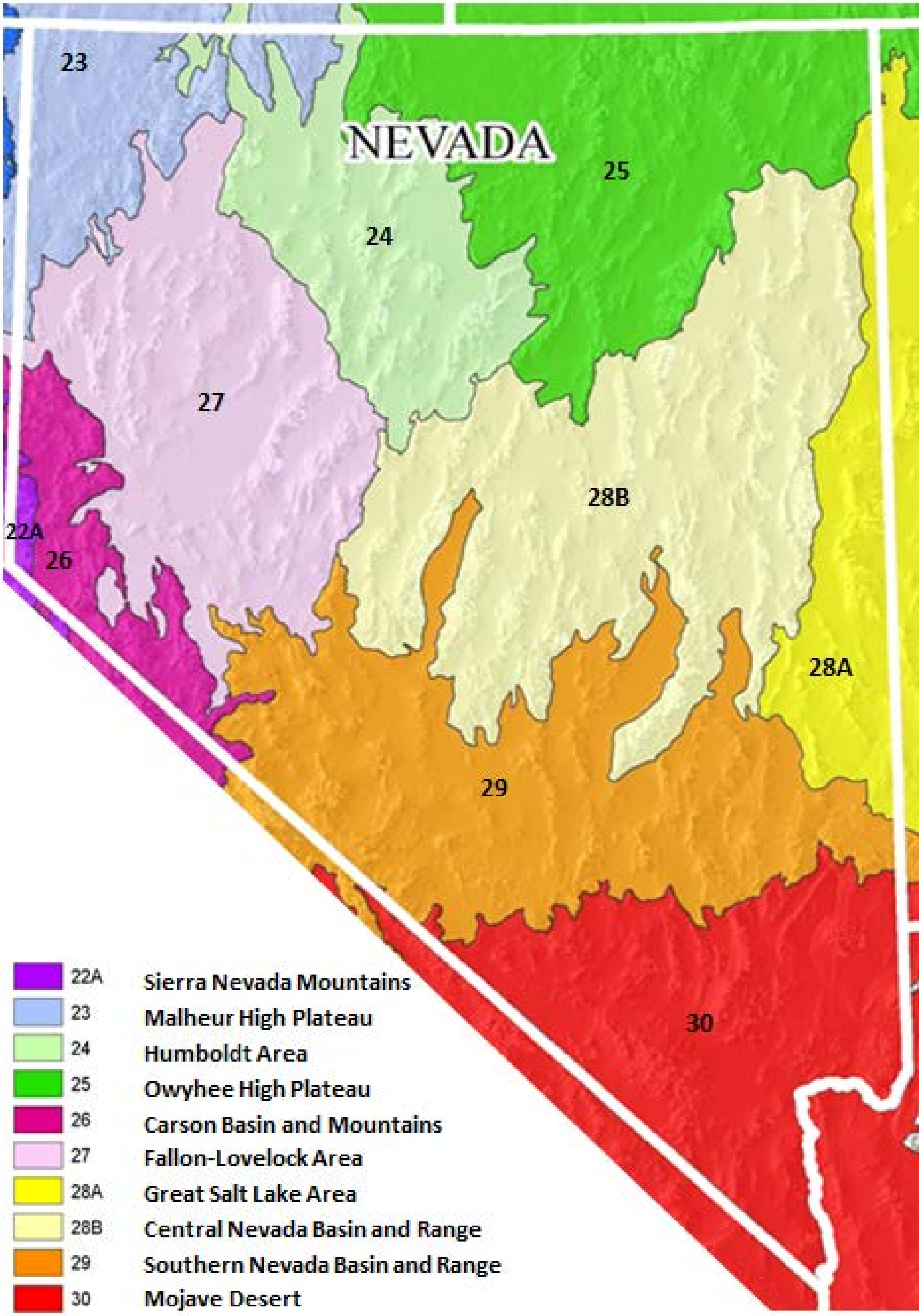
In Nevada, noxious weeds are divided into three categories:

Category A: Weeds absent or of limited distribution in Nevada; actively excluded from the state, and actively eradicated wherever found; control is required by the state in all infestations.
Category B: Weeds established in scattered populations in Nevada; actively excluded where possible, actively eradicated from nursery stock dealer premises; control is required by the state where populations are not well established or previously did not occur.
Category C: Weeds currently established and generally widespread in Nevada; actively eradicated from nursery stock dealer premises; control is at the discretion of the state quarantine officer.

Noxious Weeds in Nevada	
Category A Weeds:	
Common Name	**Scientific name**
Camelthorn	*Alhagi camelorum*
Mayweed chamomile	*Anthemis cotula*
Giant reed	*Arundo donax*
Red star-thistle	*Centaurea calcitrapa*
Iberian starthistle	*Centaurea iberica*
Spotted knapweed	*Centaurea masculosa*
Maltese star-thistle	*Centaurea melitensis*
Yellow star-thistle	*Centaurea solstiltialis*
Squarrose knapweed	*Centaurea virgata*
Rush skeletonweed	*Chondrilla juncea*
Common crupina	*Crupina vulgaris*
Houndstongue	*Cynoglossum officinale*
Goats rue	*Galega officinalis*
Hydrilla	*Hydrilla verticillata*
Black henbane	*Hyoscyamus niger*
Klamath weed	*Hypericum perforatum*
Dyer's woad	*Isatis tinctoria*
Dalmation toadflax	*Linaria dalmatica*
Yellow toadflax	*Linaria vulgaris*
Purple loosestrife	*Lythrum salicaria, L.virgatum* and cultivars
Eurasian water-milfoil	*Myriophyllum spicatum*
African rue	*Peganum harmala*

Noxious Weeds in Nevada	
Category A Weeds (continued):	
Common Name	**Scientific name**
Green fountain grass	*Pennisetum setaceum*
Sulfur cinquefoil	*Potentilla recta*
Austrian fieldcress	*Rorippa austriaca*
Mediterranean sage	*Salvia aethiopis*
Giant salvinia	*Salvinia molesta*
Sow thistle	*Sonchus arvensis*
Austrian peaweed	*Sphaerophysa salsula / Swainsona salsula*
Syrian bean caper	*Zygophyllum fabago*
Category B Weeds:	
Russian knapweed	*Acroptilon repens*
Sahara mustard	*Brassica tournefortii*
Musk thistle	*Carduus nutans*
Diffuse knapweed	*Centaurea diffusa*
Leafy spurge	*Euphorbia esula*
Scotch thistle	*Onopordum acanthium*
Carolina horse-nettle	*Solanum carolinense*
White horse-nettle	*Solanum elaeagnifolium*
Medusahead	*Taeniatherum caput-medusae*
Category C Weeds:	
Hoary cress	*Cardaria draba*
Water hemlock	*Cicuta maculata*
Canada thistle	*Cirsium arvense*
Poison hemlock	*Conium maculatum*
Perennial pepperweed	*Lepidium latifolium*
Johnson grass	*Sorghum halepense*
Salt cedar (tamarisk)	*Tamarix spp*
Puncture vine	*Tribulus terrestris*

Appendix II - Map of Major Land Resource Areas (MLRAs) in Nevada.



Appendix III - Plant Tables.

Table 1. - Trees and Shrubs for Pollinator Habitat. Listed by the season they are in bloom.

Bloom Period	Tree or Shrub Scientific Name	Tree or Shrub Common Name	Nevada MLRA	Flower Color	Growth Habit	Height, Mature (ft)	Soil Texture Fine	Soil Texture Medium	Soil Texture Coarse	Irrigation Required	pH range	Salinity Tolerance
Late Winter	*Ambrosia dumosa*	burrobush	29 30	Yellow	Shrub, Subshrub	2	No	Yes	Yes	Low	7-8.5	Medium
Late Winter	*Arctostaphylos pungens*	pointleaf manzanita	30	White	Shrub, Subshrub	12	No	Yes	Yes	Medium	5.7-7	None
Late Winter	*Baccharis sarothroides*	desertbroom	30	Yellow	Shrub	12	Yes	Yes	Yes	Low	7-8.5	Medium
Early Spring	*Ceanothus greggii*	desert ceanothus	30	Blue	Shrub	7	Yes	Yes	Yes	Medium	6.2-8.5	Low
Early Spring	*Ceanothus prostratus*	prostrate ceanothus	22A 23 26	Purple	Shrub, Subshrub	0.5	No	Yes	Yes	High	7.1-8.5	Low
Early Spring	*Cercocarpus ledifolius*	curl-leaf mountain mahogany	all	Yellow	Tree, Shrub	20	No	Yes	Yes	Medium	5.5-8.7	None
Early Spring	*Jamesia americana*	fivepetal cliffbush	30	White	Shrub	6	No	Yes	Yes	Medium	7-8.5	Low
Early Spring	*Krameria erecta*	littleleaf ratany	29 30	Purple	Shrub, Subshrub	2	No	Yes	Yes	Low	7-8.5	Low
Early Spring	*Ledum glandulosum*	western Labrador tea	23 25 26	White	Shrub	4.5	Yes	Yes	No	High	4.6-7	Low
Early Spring	*Populus fremontii*	Fremont cottonwood	22A 23 24 26 27 28B 29 30	White	Tree	90	Yes	Yes	Yes	High	6-8	Low
Early Spring	*Prunus fasciculata*	desert almond	29 30	White	Shrub	6	No	Yes	Yes	Medium	7-8.5	Low
Early Spring	*Purshia tridentata*	antelope bitterbrush	all	White	Shrub	6	No	Yes	Yes	Medium	5.6-8.4	None
Early Spring	*Rhus trilobata*	skunkbush sumac	25 28A 28B 29 30	Yellow	Shrub	4	No	Yes	Yes	Medium	6.5-8.2	Medium
Early Spring	*Ribes lacustre*	prickly currant	24 27 28B	Purple	Shrub	3	No	No	No	Medium	5-7.8	None
Spring	*Cornus sericea* ssp. *sericea*	redosier dogwood	all	White	Tree, Shrub	12	Yes	Yes	Yes	High	4.8-7.5	None

Bloom Period	Tree or Shrub Scientific Name	Tree or Shrub Common Name	Nevada MLRA	Flower Color	Growth Habit	Height, Mature (ft)	Soil Texture Fine	Soil Texture Medium	Soil Texture Coarse	Irrigation Required	pH range	Salinity Tolerance
Spring	*Hymenoclea monogyra*	singlewhorl burrobrush	23	White	Shrub, Subshrub	2	No	Yes	Yes	Low	6.1-7.9	
Spring	*Krascheninnikovia lanata*	winterfat	all	Yellow	Shrub, Subshrub	2	Yes	Yes	Yes	Low	6.6-8.5	High
Spring	*Philadelphus microphyllus*	littleleaf mock orange	27 28A 28B 29 30	White	Shrub	15	No	Yes	Yes	Medium	7-8.5	None
Spring	*Purshia glandulosa*	desert bitterbrush	24 25 27 28A 28B 29 30	Yellow	Shrub	5	No	Yes	Yes	Low	6.8-8	Medium
Spring	*Robinia pseudoacacia*	black locust	22A 23 28A 29	White	Tree	60	Yes	Yes	Yes	High	4.6-8.2	Medium
Spring	*Rubus parviflorus*	thimbleberry	22A 23 25 26	White	Subshrub	4	Yes	Yes	No	High	4.8-7.2	None
Spring	*Sambucus nigra* ssp. *cerulea*	blue elderberry	all	White	Shrub, Tree	23	No	Yes	Yes	Medium	4.9-7.5	None
Mid Spring	*Adenostoma fasciculatum*	chamise	30	White	Shrub	10	Yes	Yes	Yes	Low	4-6	Medium
Mid Spring	*Baccharis salicifolia*	mule-fat	30	Yellow	Shrub	10	Yes	Yes	Yes	Medium	7-8.5	High
Mid Spring	*Coleogyne ramosissima*	blackbrush	29 30	Yellow	Shrub	6	No	Yes	Yes	Low	5.9-8	Low
Mid Spring	*Crataegus douglasii*	black hawthorn	25	White	Tree, Shrub	15	Yes	Yes	Yes	High	4.8-7.5	None
Mid Spring	*Eriogonum sphaerocephalum*	rock buckwheat	23 24 25	Yellow	Shrub, Subshrub	1	No	Yes	Yes	Medium	6-8.6	Low
Mid Spring	*Mahonia repens*	creeping barberry	25 28A 28B 29 30	Yellow	Shrub, Subshrub	2	No	Yes	No	High	5.5-7.5	Low
Mid Spring	*Prunus emarginata*	bitter cherry	22A 23 30	White	Tree, Shrub	80	No	No	Yes	High	6.2-7.8	None
Mid Spring	*Prunus virginiana*	black chokecherry	all	White	Tree, Shrub	25	Yes	Yes	Yes	High	5.2-8.4	Medium
Mid Spring	*Purshia stansburiana*	Stansbury cliffrose	24 25 28A 28B 29 30	White	Tree, Shrub	25	No	Yes	Yes	Medium	7-8.5	Low
Mid Spring	*Ribes aureum*	golden currant	all	Yellow	Shrub	10	No	Yes	No	Medium	6-8	None

Bloom Period	Tree or Shrub Scientific Name	Tree or Shrub Common Name	Nevada MLRA	Flower Color	Growth Habit	Height, Mature (ft)	Soil Texture Fine	Soil Texture Medium	Soil Texture Coarse	Irrigation Required	pH range	Salinity Tolerance
Mid Spring	*Ribes inerme*	whitestem gooseberry	22A 23 24 25 26 27 28A 28B 29	Green	Shrub	8	No	Yes	Yes	Medium	6-7.5	None
Mid Spring	*Tetradymia spinosa*	shortspine horsebrush	all	Yellow	Shrub, Subshrub	3.2	Yes	Yes	Yes	Medium	6.5-8.2	Medium
Late Spring	*Amelanchier utahensis*	Utah serviceberry	all	White	Tree, Shrub	15	Yes	Yes	Yes	Medium	5.6-8.4	None
Late Spring	*Arctostaphylos patula*	greenleaf manzanita	22A 23 26 27 28A 28B 29	White	Shrub	6	No	Yes	Yes	High	5.5-7.6	None
Late Spring	*Arctostaphylos uva-ursi*	kinnikinnick	22A 23 25 28B	Purple	Shrub, Subshrub	0.5	No	Yes	Yes	High	5.5-8	Medium
Late Spring	*Cercocarpus montanus*	alderleaf mountain mahogany	28A 29	White	Tree, Shrub	15	No	Yes	Yes	Medium	6-8	None
Late Spring	*Chilopsis linearis*	desert willow	30	Purple	Tree, Shrub	25	No	No	Yes	Low	6.6-10	Low
Late Spring	*Fallugia paradoxa*	Apache plume	29 30	Purple	Shrub	6	No	Yes	Yes	Low	7-8	Medium
Late Spring	*Gleditsia triacanthos*	honeylocust	23 24 26	Yellow	Tree, Shrub	70	Yes	Yes	No	High	4.8-8	Medium
Late Spring	*Grayia spinosa*	spiny hopsage	all	Red	Shrub, Subshrub	3	Yes	Yes	Yes	Medium	6.5-9	High
Late Spring	*Kalmia microphylla*	alpine laurel	23 25	Purple	Shrub, Subshrub	1	No	Yes	Yes	Medium	6-7.3	None
Late Spring	*Physocarpus malvaceus*	mallow ninebark	25	White	Shrub	15	Yes	Yes	Yes	High	6-7.5	None
Late Spring	*Ribes nevadense*	Sierra currant	22A 26	Red	Shrub	6	No	Yes	Yes	Medium	6-7.5	None
Late Spring	*Ribes roezlii*	Sierra gooseberry	22A 23 26	White	Shrub	5	No	Yes	Yes	Medium	6-7.5	None
Late Spring	*Ribes viscosissimum*	sticky currant	22A 23 25	White	Shrub	3.5	No	Yes	Yes	High	5.8-8.4	None
Late Spring	*Robinia neomexicana*	New Mexico locust	28A 29 30	Purple	Tree, Shrub	25	Yes	Yes	Yes	Medium	7-8.5	Low

Bloom Period	**Tree or Shrub Scientific Name**	**Tree or Shrub Common Name**	**Nevada MLRA**	**Flower Color**	**Growth Habit**	**Height, Mature (ft)**	**Soil Texture Fine**	**Soil Texture Medium**	**Soil Texture Coarse**	**Irrigation Required**	**pH range**	**Salinity Tolerance**
Late Spring	*Rosa woodsii*	Woods' rose	all	Red	Subshrub	3	No	Yes	Yes	Medium	5-8	Low
Late Spring	*Salvia dorrii* ssp. *dorrii*	purple sage	all	Blue	Shrub, Subshrub	2.5	No	Yes	Yes	Medium	6.5-8	Low
Late Spring	*Shepherdia argentea*	silver buffaloberry	22A 23 24 25 26 27 28B 29	Yellow	Tree, Shrub	18	No	Yes	Yes	High	5.3-8	High
Late Spring	*Shepherdia canadensis*	russet buffaloberry	25 28A 28B	Yellow	Shrub	6	No	Yes	Yes	High	5.3-8	Medium
Late Spring	*Symphoricarpos oreophilus*	mountain snowberry	23 24 25 28A 28B 29 30	White	Shrub	5	Yes	Yes	No	Medium	5.2-7.5	Low
Early Summer	*Amelanchier alnifolia*	Saskatoon serviceberry	22A 23 24 25 26 27 28A 28B	White	Tree, Shrub	15	Yes	Yes	Yes	Medium	4.8-8.4	Low
Early Summer	*Arctostaphylos nevadensis*	pinemat manzanita	22A 23 26	White	Shrub, Subshrub	2	No	Yes	Yes	High	6-8.4	None
Early Summer	*Ceanothus cordulatus*	whitethorn ceanothus	22A 23 26 28B	White	Shrub	8	No	Yes	Yes	High	7-8.5	Low
Early Summer	*Ceanothus velutinus*	snowbrush ceanothus	22A 23 24 26 25 28B	White	Tree, Shrub	10	No	Yes	Yes	High	6.5-8.3	None
Early Summer	*Ribes cereum*	wax currant	22A 23 24 26 27 28B 29 30	White	Shrub	3	No	Yes	Yes	High	6.5-7.5	None
Early Summer	*Ribes montigenum*	gooseberry currant	22A 23 24 25 26 28A 28B 29 30	Red	Shrub	1	No	Yes	Yes	Medium	7-8	None
Early Summer	*Vaccinium scoparium*	grouse whortleberry	25	Red	Shrub, Subshrub	2	No	Yes	Yes	High	5-7	None
Early Summer	*Vaccinium uliginosum*	bog blueberry	23 25	Purple	Shrub, Subshrub	2	No	Yes	No	High	4.5-5.7	None
Mid Summer	*Chamaebatiaria millefolium*	desert sweet	22A 23 24 25 26 28A 28B 29 30	White	Shrub	6	No	Yes	Yes	High	7-8	None

Bloom Period	Tree or Shrub Scientific Name	Tree or Shrub Common Name	Nevada MLRA	Flower Color	Growth Habit	Height, Mature (ft)	Soil Texture Fine	Soil Texture Medium	Soil Texture Coarse	Irrigation Required	pH range	Salinity Tolerance
Mid Summer	*Eriogonum fasciculatum*	Eastern Mojave buckwheat	29 30	White	Shrub, Subshrub	3	No	Yes	Yes	Medium	7.5-8.5	Medium
Mid Summer	*Eriogonum microthecum*	slender buckwheat	all	Purple	Shrub, Subshrub	1.1	No	Yes	Yes	Medium	5.8-8.5	None
Mid Summer	*Fendlera rupicola*	cliff fendlerbush	30	White	Shrub	6	No	No	Yes	Medium	7-8.5	None
Summer	*Chrysothamnus viscidiflorus*	yellow rabbitbrush	23 24 26 29 30	Yellow	Shrub	3	No	Yes	Yes	Medium	7-8.5	Medium
Summer	*Cornus sericea* ssp. *occidentalis*	western dogwood	22A 23 26	White	Tree, Shrub	16	Yes	Yes	Yes	High	4.8-7.5	Medium
Summer	*Lonicera involucrata*	twinberry honeysuckle	23 25	Yellow	Shrub	10	Yes	Yes	No	High	5.5-8	None
Summer	*Sorbus scopulina*	Greene's mountain ash	25 28A 28B	White	Tree, Shrub	12	No	Yes	Yes	Medium	5.6-7.3	None
Late Summer	*Holodiscus discolor*	oceanspray	22A 23 24 25 26 28B	White	Shrub	12	Yes	Yes	Yes	Medium	6.5-7.5	None
Late Summer	*Holodiscus dumosus*	rockspirea	all	White	Shrub	3	No	Yes	Yes	Medium	7-8	None
Late Summer	*Rubus idaeus* ssp. *strigosus*	grayleaf red raspberry	25 28B 29	White	Subshrub	4	No	Yes	Yes	Medium	5-7.5	None
Late Summer	*Tetradymia canescens*	spineless horsebrush	all	Yellow	Shrub, Subshrub	4	No	Yes	Yes	Low	7-8	None
Late Summer	*Tetradymia glabrata*	littleleaf horsebrush	22A 23 24 25 26 27 28A 28B 29	Yellow	Shrub, Subshrub	12	No	Yes	Yes	Low	7-8	None
Winter	*Encelia farinosa*	brittlebush	29 30	Yellow	Shrub, Subshrub	5	Yes	Yes	Yes	Low	7-8.5	None
Indeter-minate	*Fouquieria splendens*	ocotillo	30	Red	Shrub	10	No	No	Yes	Low	7-8.5	None

Table 2. - Perennial Forbs for Pollinator Habitat. Listed by the season they are in bloom.

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Early Spring	*Anemopsis californica*	yerba mansa	29 30	White	1.5	Long	High	6.5 - 9	Medium
Early Spring	*Artemisia ludoviciana*	white sagebrush	all	White	3	Short	Low	6 - 9	High
Early Spring	*Cardamine oligosperma*	little western bittercress	29 30	White	1.7	Short	Medium	5.5 - 7	None
Early Spring	*Cardamine pensylvanica*	Pennsylvania bittercress	23 25 29	White	1.5	Short	Medium	4.8 - 6.8	None
Early Spring	*Delphinium glaucum*	Sierra larkspur	22A 23 25	Purple	8	Short	High	5.6 - 7	None
Early Spring	*Hydrophyllum capitatum*	ballhead waterleaf	22A 23 26 24 25	Purple	1	Moderate	High	6.4 - 7.8	None
Early Spring	*Lomatium canbyi*	Canby's biscuitroot	23 26	White	0.8	Short	Low	6 - 8.5	Low
Early Spring	*Lomatium cous*	cous biscuitroot	23 24 25	Yellow	0.8	Short	Low	6 - 8.5	Low
Early Spring	*Lomatium macrocarpum*	bigseed biscuitroot	23 24 25 28A 28B	White	0.5	Short	Low	6 - 8.5	Low
Early Spring	*Lomatium triternatum* var. *macrocarpum*	nineleaf biscuitroot	23	Yellow	3.2	Moderate	Medium	6.5 - 8.9	Low
Early Spring	*Lomatium triternatum* var. *triternatum*	nineleaf biscuitroot	25	Yellow	2.2	Moderate	Medium	6.5 - 8.8	Low
Early Spring	*Sagina saginoides*	arctic pearlwort	all	White	0.3	Moderate	High	6 - 7.5	None
Early Spring	*Sphaeralcea ambigua* ssp. *ambigua*	apricot globemallow	29 30	Orange	5	Short	Low	7.5 - 8.5	Medium
Early Spring	*Sphaeralcea ambigua* ssp. *monticloa*	desert globemallow	22A 24 26 27 28A 28B 29 30	Orange	6	Short	Low	7.5 - 8.6	Medium
Early Spring	*Taraxacum officinale*	common dandelion	all	Yellow	0.5	Short	Medium	4.8 - 7.5	None
Mid spring	*Agoseris aurantiaca var. aurantiaca*	orange agoseris	23 25	Orange	1	Short	Medium	6.6 - 7.5	None
Mid spring	*Agoseris aurantiaca var. purpurea*	orange agoseris	28A 28B 29	Orange	2	Short	Medium	6.6 - 7.6	None

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Mid spring	*Agoseris glauca* var. *laciniata*	false agoseris	all	Yellow	1	Short	Medium	6 - 8	None
Mid spring	*Angelica arguta*	Lyall's angelica	23 24 25 26	White	6	Moderate	High	6.5 - 7.5	None
Mid spring	*Antennaria microphylla*	littleleaf pussytoes	all	White	1	Short	Low	5.9 - 7.8	Low
Mid spring	*Arabis holboellii var. retrofracta*	second rockcress	all	Purple	2	Short	Medium	5.4 - 7.4	None
Mid spring	*Arnica fulgens*	foothill arnica	23 25	Yellow	2	Moderate	Medium	6.2 - 9	None
Mid spring	*Astragalus purshii var. tinctus*	woollypod milkvetch	all	White	0.6	Moderate	Low	5.6 - 7.5	Low
Mid spring	*Balsamorhiza hookeri var. hirsuta*	hairy balsamroot	22A 23 26	Yellow	1.1	Moderate	Medium	6.6 - 9	Medium
Mid spring	*Balsamorhiza hookeri var. neglecta*	neglected balsamroot	22A 23 24 25 26 27 28A 28B 29	Yellow	1	Moderate	Medium	6.6 - 9	Medium
Mid spring	*Castilleja hispida*	harsh Indian paintbrush	23 23	Red	1.5	Short	Low	6 - 8	None
Mid spring	*Claytonia perfoliata*	miner's lettuce	22A 23 24 25 26 27 28B 29 30	White	1	Short	Medium	6 - 7	None
Mid spring	*Delphinium andersonii*	Anderson's larkspur	all	Purple	2	Moderate	Low	6 - 8	None
Mid spring	*Erysimum capitatum var. capitatum*	sanddune wallflower	all	Yellow	2.5	Short	Medium	6 - 8.5	Low
Mid spring	*Gentiana calycosa*	Rainier pleated gentian	25	Blue	0.6	Short	Medium	5.6 - 7.5	None
Mid spring	*Geranium richardsonii*	Richardson's geranium	25 28B	Purple	3	Short	High	6.1 - 7.6	None
Mid spring	*Geranium viscosissimum*	sticky purple geranium	22A 23 24 25 26 27 28A 28B	Purple	3	Short	Low	7 - 8	None
Mid spring	*Hedysarum boreale* ssp. *boreale* var. *boreale*	Utah sweetvetch	24 25 28A 28B	Red	2	Moderate	Medium	5.2 - 8	Low
Mid spring	*Heliotropium curassavicum var. oculatum*	seaside heliotrope	22A 23 24 26 27 28A 28B 29 30	White	1.2	Moderate	Medium	6.5 - 8.5	High
Mid spring	*Heuchera cylindrica*	roundleaf alumroot	24 25	White	6	Short	Low	7 - 8	None
Mid spring	*Lepidium montanum var. canescens*	mountain pepperweed	all	Yellow	0.8	Short	Low	6 - 8	Low

Bloom Period	**Perrenial Forb Scientific Name**	**Wildflower Common Name**	**Nevada MLRA**	**Flower Color**	**Mature Height (ft)**	**Lifespan**	**Irrigation Required**	**pH Range**	**Salinity Tolerance**
Mid spring	*Lupinus nevadensis*	Nevada lupine	22A 23 24 26 27 28A	Blue	1.2	Moderate	Medium	6.4 - 8	Low
Mid spring	*Maurandella antirrhiniflora*	roving sailor	30	Purple	0.8	Moderate	Medium	6.8 - 9	Low
Mid spring	*Menyanthes trifoliata*	buckbean	23 25	White	0.8	Moderate	High	4.8 - 6.5	None
Mid spring	*Mimulus guttatus*	seep monkeyflower	all	Yellow	2.5	Short	High	6 - 8	None
Mid spring	*Oenothera flava*	yellow evening primrose	23 25	Yellow	2.5	Short	Medium	6 - 7.8	None
Mid spring	*Paeonia brownii*	Brown's peony	22A 23 24 25 26 28B	Red	1.5	Moderate	Medium	6 - 8	None
Mid spring	*Penstemon newberryi*	mountain pride	22A 26	Red	1	Long	Low	6 - 7.5	None
Mid spring	*Perideridia gairdneri ssp. borealis*	Gardner's yampah	25 28B	White	4	Moderate	High	6 - 7.5	None
Mid spring	*Phacelia hastata var. hastata*	silverleaf phacelia	all	White	2	Moderate	Medium	6.1 - 7.3	None
Mid spring	*Polygonum bistortoides*	American bistort	22A 23 24 25 26 28B	White	1.5	Moderate	High	6.5 - 8	None
Mid spring	*Polygonum viviparum*	alpine bistort	25 28B	White	1	Moderate	High	6.5 - 9	Medium
Mid spring	*Ranunculus alismifolius var. alismifolius*	plantainleaf buttercup	22A 23 24 25 26 28B	Yellow	2	Long	High	6 - 7.5	None
Mid spring	*Ranunculus glaberrimus*	sagebrush buttercup	23 24 25 28B	Yellow	0.5	Short	High	6 - 7.5	None
Mid spring	*Senecio hydrophiloides*	tall groundsel	25 28B 29	Yellow	0.8	Moderate	High	5 - 7.5	None
Mid spring	*Senecio integerrimus var exaltatus*	lambstongue ragwort	22A 23 24 25 26 27 28A 28B 29	Yellow	1.1	Moderate	Medium	6.5 - 8.5	Low
Mid spring	*Sidalcea neomexicana ssp. crenulata*	salt spring checkerbloom	24 25 28A 28B 29	Purple	2.5	Moderate	High	6.2 - 7.8	None
Mid spring	*Sphaeralcea munroana*	Munro's globemallow	22A 23 24 25 26 27 28A 28B 30	Orange	2.5	Moderate	Low	6.3 - 8	Low
Mid spring	*Trifolium macrocephalum*	largehead clover	23 26	Purple	2	Short	Low	6.2 - 7.1	Medium
Mid spring	*Wyethia amplexicaulis*	mule-ears	23 24 25 28B	Yellow	2.5	Long	Medium	6.2 - 7.6	None
Spring	*Agoseris grandiflora*	bigflower agoseris	22A 23 24 25 26	Yellow	1.8	Short	Medium	5.8 - 7.3	None
Spring	*Antennaria corymbosa*	flat-top pussytoes	23 25 26	White	1	Short	High	6 - 8	None
Spring	*Aquilegia formosa*	western columbine	all	Red	3	Short	Medium	6 - 7.5	None
Spring	*Argentina anserina*	silverweed cinquefoil	22A 23 24 25 26 28A 28B 29 30	Yellow	0.5	Short	High	7 - 8	Low

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Spring	*Helianthella uniflora*	oneflower helianthella	24 25 27 28A 28B 29	Yellow	2	Short	Low	7 - 8	None
Spring	*Mentha arvensis*	wild mint	all	White	2.6	Short	Medium	5 - 7	None
Spring	*Mimulus cardinalis*	scarlet monkeyflower	22A 23 26 30	Red	2.5	Moderate	High	6 - 7.2	None
Spring	*Mimulus primuloides* var. *primuloides*	primrose monkeyflower	22A 23 25 26 28A 28B 29	Red	1.5	Short	High	6 - 7.2	None
Spring	*Nuphar lutea ssp. polysepala*	Rocky Mountain pond-lily	22A 23 26	Yellow	4	Short	High	5 - 8	None
Spring	*Osmorhiza occidentalis*	western sweetroot	22A 23 24 25 26 27 28A 28B	Yellow	4	Moderate	Medium	5.2 - 7.5	Low
Spring	*Sphaeralcea coccinea* ssp. *elata*	scarlet globemallow	25 28A 28B	Red	1.5	Short	Low	6.5 - 8.4	Medium
Spring	*Trifolium longipes* ssp. *hansenii*	Hansen's clover	22A 24 25 26 27 28A 28B	Purple	0.5	Short	Medium	5.6 - 6.8	None
Late Spring	*Achillea millefolium var. occidentalis*	western yarrow	all	White	3	Moderate	Medium	6 - 8	Low
Late Spring	*Agastache urticifolia*	nettleleaf giant hyssop	22A 23 24 25 26 27 28B	Red	5	Long	Medium	6 - 8	Low
Late Spring	*Antennaria anaphaloides*	pearly pussytoes	25	White	2.5	Short	Medium	5.8 - 7.9	Medium
Late Spring	*Antennaria dimorpha*	low pussytoes	22A 23 24 25 26 27 28A 28B	Purple	0.3	Short	Low	5.8 - 7.8	Low
Late Spring	*Antennaria luzuloides*	rush pussytoes	23	White	2	Long	Medium	5.4 - 7.4	None
Late Spring	*Arabis ×divaricarpa*	spreadingpod rockcress	22A 23 24 25 26 27 28B	Purple	3	Short	Low	5 - 7	None
Late Spring	*Arabis drummondii*	Drummond's rockcress	23 24 25 28A 28B	White	2	Short	Medium	5.4 - 7.4	None
Late Spring	*Arnica cordifolia*	heartleaf arnica	23 24 25 26	Yellow	1.5	Short	High	6 - 8	None
Late Spring	*Astragalus filipes*	basalt milkvetch	22A 23 24 25 26 27 28A 28B 29	White	2	Moderate	Low	5.8 - 7.3	Low
Late Spring	*Astragalus lentiginosus var. diphysus*	freckled milkvetch	25 28A 28B 29	Yellow	1.4	Moderate	Low	5.7 - 7.4	Medium
Late Spring	*Balsamorhiza sagittata*	arrowleaf balsamroot	22A 23 24 25 26 27 28A 28B	Yellow	2	Long	Medium	6.5 - 8	Low
Late Spring	*Cardamine cordifolia*	heartleaf bittercress	25 28A 28B	White	1.5	Moderate	High	6 - 7.5	None

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Late Spring	*Castilleja applegatei*	wavyleaf Indian paintbrush	22A 23 24 25 26	Red	1.5	Moderate	Low	6.3 - 7.8	Low
Late Spring	*Crepis modocensis ssp. modocensis*	Modoc hawksbeard	22A 23 24 25 26 27 28A 28B	Yellow	1.4	Moderate	Low	5.5 - 7.4	Low
Late Spring	*Crepis occidentalis spp. occidentalis*	largeflower hawksbeard	all	Yellow	0.9	Moderate	Low	5.7 - 7.5	Low
Late Spring	*Crepis runcinata spp. imbricata*	fiddleleaf hawksbeard	22A 23 24 25 26 27 28A 28B	Yellow	1	Short	Medium	6.5 - 9.5	Medium
Late Spring	*Dodecatheon pulchellum spp. pulchellum*	darkthroat shootingstar	24 25 26 28A 28B	Purple	2	Moderate	Medium	6 - 7.8	None
Late Spring	*Erigeron compositus*	cutleaf daisy	22A 23 24 25 26 27 28A 28B	White	1	Moderate	Low	6.1 - 8.1	Low
Late Spring	*Erigeron eatonii var. nevadincola*	Eaton's fleabane	22A 23 24 25 26 27 28A 28B	White	0.8	Moderate	Low	6.5 - 8.8	Low
Late Spring	*Erigeron linearis*	desert yellow fleabane	23 24 25	White	1	Moderate	Low	6.5 - 8.8	Low
Late Spring	*Erigeron peregrinus*	subalpine fleabane	24 24 25	Purple	2	Moderate	High	6.4 - 7.5	None
Late Spring	*Eriogonum elatum var. elatum*	tall woolly buckwheat	22A 23 24 25 26 27 28B	White	3	Moderate	Low	6 - 8.5	Low
Late Spring	*Eriogonum marifolium*	marumleaf buckwheat	22A 23 24 26	Yellow	0.8	Moderate	Low	6 - 7.5	None
Late Spring	*Eriogonum strictum ssp. proliferum*	Blue Mountain buckwheat	23 24 25	Yellow	2.2	Long	Low	6 - 8.6	Low
Late Spring	*Galium boreale*	northern bedstraw	25	White	3	Moderate	Medium	5 - 7.2	None
Late Spring	*Geum macrophyllum*	largeleaf avens	22A 23 24 25 26 27 28A 28B 29	Yellow	2	Moderate	Medium	5 - 7	None
Late Spring	*Glaux maritima*	sea milkwort	25 28A 28B 29	White	0.9	Moderate	High	6.5 - 8.8	None
Late Spring	*Glycyrrhiza lepidota*	American licorice	24 25 28B 29	White	4	Moderate	High	5.5 - 8	None
Late Spring	*Hydrophyllum occidentale*	western waterleaf	23 24 26 27	White	1.5	Short	Medium	6.2 - 7.5	None
Late Spring	*Ipomopsis aggregata ssp. aggregata*	scarlet gilia	all	Red	3	Moderate	Low	7 - 8.5	Low
Late Spring	*Lithospermum ruderale*	western stoneseed	23 24 25 28A 28B 29 30	White	1.5	Long	Low	6 - 7.8	Low
Late Spring	*Mertensia ciliata var. ciliata*	tall fringed bluebells	24 25 28A 28B	Blue	2	Moderate	High	6.2 - 7.2	None

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Late Spring	*Mertensia ciliata var. stomatechoides*	tall fringed bluebells	22A 23 26 27	Blue	3	Moderate	High	6.2 - 7.3	None
Late Spring	*Microseris nutans*	nodding microseris	23 24 25 26	Yellow	2	Short	Medium	6 - 7.2	None
Late Spring	*Mirabilis multiflora*	Colorado four o'clock	29 30	Purple	2	Moderate	Low	6.5 - 8.5	Low
Late Spring	*Monarda fistulosa ssp. fistulosa var. menthifolia*	mintleaf bergamot	22A 23 26	Purple	3	Moderate	Medium	6.5 - 8.5	None
Late Spring	*Oenothera caespitosa ssp. marginata*	tufted evening primrose	all	White	0.5	Short	Low	6.5 - 8	Medium
Late Spring	*Oenothera pallida ssp. pallida*	pale evening primrose	24 25 28A 28B 29 30	White	2	Long	Low	6 - 8	None
Late Spring	*Osmorhiza depauperata*	bluntseed sweetroot	25 28A 28B 29 30	White	2	Moderate	Medium	5 - 8	None
Late Spring	*Packera cana*	woolly groundsel	22A 23 24 25 26 28A 28B	Yellow	1.5	Moderate	Low	6.5 - 8.5	Low
Late Spring	*Pedicularis groenlandica*	elephanthead lousewort	23 25	Purple	2.5	Short	High	5.8 - 7.2	None
Late Spring	*Penstemon acuminatus*	sharpleaf penstemon	22A 23 24 25 26 2728B	Blue	2	Moderate	Low	6 - 8	Low
Late Spring	*Penstemon deustus var. pedicellatus*	scabland penstemon	all	Yellow	2	Long	Low	6 - 8	Low
Late Spring	*Phlox diffusa ssp. subcarinata*	spreading phlox	22A 23 24 25 26 28B	Purple	0.5	Moderate	Low	6.5 - 8.5	None
Late Spring	*Phlox longifolia ssp brevifolia*	longleaf phlox	all	Purple	1.2	Long	Low	6.5 - 8.5	Low
Late Spring	*Polemonium occidentale*	western polemonium	22A 23 24 25 26 27 28A 28B 29	Purple	3	Moderate	High	4.6 - 7	None
Late Spring	*Potentilla arguta*	tall cinquefoil	23 24 25	Yellow	3	Short	Medium	6 - 8	None
Late Spring	*Potentilla diversifolia*	varileaf cinquefoil	23 24 25 26 28B	Yellow	3	Moderate	Medium	7 - 8	None
Late Spring	*Potentilla glandulosa ssp. nevadensis*	Nevada cinquefoil	22A 23 24 25 26 27 28A 28B 29	Yellow	1.5	Moderate	Low	7 - 8	None
Late Spring	*Ranunculus cymbalaria*	alkali buttercup	all	Yellow	1	Moderate	High	6.5 - 8	Medium
Late Spring	*Ranunculus longirostris*	longbeak buttercup	22A 23 24 25 26 27 28A 28B 29	Yellow	1	Short	High	5 - 8	None
Late Spring	*Ranunculus sceleratus var. multifidus*	cursed buttercup	22A 23 24 25 26 28B 29	Yellow	2	Short	High	4.8 - 8.4	Low

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Late Spring	*Sidalcea oregana ssp. oregana var. nevadensis*	Oregon checkerbloom	23 24 25 28A 28B	Purple	4.5	Moderate	High	6.4 - 8	None
Late Spring	*Sphaeralcea grossulariifolia ssp. grossulariifolia*	gooseberryleaf globemallow	22A 23 24 25 26 27 28A 28B 29	Red	2	Moderate	Low	5 - 7	None
Late Spring	*Stellaria longifolia*	longleaf starwort	25 29	Green	1.5	Moderate	High	4 - 6.5	None
Late Spring	*Trifolium wormskioldii*	cows clover	22A 23 24 25 26 27 28A 28B 29	Red	3.5	Moderate	Medium	6.2 - 7	Medium
Late Spring	*Valeriana occidentalis*	western valerian	24 25 28A 28B 29	White	3	Moderate	High	6 - 7.8	None
Late Spring	*Vicia americana*	American vetch	all	Purple	1.3	Moderate	Low	5.9 - 7.2	None
Late Spring	*Wyethia mollis*	woolly mule-ears	22A 23 26 28B	White	2.5	Long	Low	6.5 - 8.5	None
Early Summer	*Achillea millefolium var alpicola*	common yarrow	23 25 26 29	White	3	Moderate	Medium	6 - 8	Low
Early Summer	*Aconitum columbianum*	Columbian monkshood	22A 23 24 25 26 28B 29	Blue	5	Moderate	High	5.4 - 7.2	None
Early Summer	*Anaphalis margaritacea*	western pearly everlasting	22A 23 25 28B	Yellow	3	Short	Medium	6 - 7.5	None
Early Summer	*Anemone multifida*	Pacific anemone	25	Yellow	2	Short	Medium	6 - 7.5	None
Early Summer	*Arnica chamissonis*	Chamisso arnica	22A 23 24 25 26 28A 28B 29	Yellow	2.5	Short	High	6 - 7.2	None
Early Summer	*Arnica latifolia*	broadleaf arnica	23 25	Yellow	2	Moderate	High	6 - 7.2	None
Early Summer	*Arnica longifolia*	spearleaf arnica	23 24 25 28B	Yellow	2	Moderate	High	6 - 8	None
Early Summer	*Asclepias speciosa*	showy milkweed	all	White	6	Long	Medium	5 - 7	None
Early Summer	*Chaenactis douglasii var. douglasii*	Douglas' dustymaiden	all	White	1.6	Short	Low	5.8 - 7	None
Early Summer	*Crepis acuminata ssp. acuminata*	tapertip hawksbeard	22A 23 24 25 26 27 28A 28B 29	Yellow	3	Short	Low	6 - 7.8	Low
Early Summer	*Desmanthus illinoensis*	Illinois bundleflower	30	White	3	Long	Medium	5 - 8	None
Early Summer	*Eriogonum umbellatum var. nevadense*	sulphur-flower buckwheat	22A 23 24 25 26 27 28A 28B 29	Yellow	1	Long	Low	6.5 - 9	High

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Early Summer	*Eucephalus engelmannii*	Engelmann's aster	25	White	6	Long	Medium	5.9 - 7.3	None
Early Summer	*Gutierrezia sarothrae*	broom snakeweed	22A 23 24 25 26 28A 28B 29 30	Yellow	1.5	Moderate	Medium	6 - 8	Low
Early Summer	*Heracleum maximum*	common cowparsnip	22A 23 24 25 26	White	8	Short	High	5.4 - 7.3	None
Early Summer	*Hypericum anagalloides*	tinker's penny	23 24 25	Yellow	0.8	Short	High	6 - 8	None
Early Summer	*Iliamna rivularis var. rivularis*	streambank wild hollyhock	24 25 28B	White	6	Long	Medium	6 - 8.5	None
Early Summer	*Lomatium dissectum*	fernleaf biscuitroot	23 24 25 26 28B	Purple	15	Short	Low	6.5 - 7.5	None
Early Summer	*Lupinus sericeus spp. sericeus var.sericeus*	silky lupine	25 28B	Blue	6	Short	Low	7 - 7.5	None
Early Summer	*Menodora scabra*	rough menodora	30	Yellow	1	Moderate	Low	6.6 - 8.4	Low
Early Summer	*Penstemon eatonii ssp. eatonii*	firecracker penstemon	23 24 28A 28B 29	Red	4	Short	Low	7 - 8	None
Early Summer	*Potentilla gracilis var. fastigiata*	slender cinquefoil	22A 23 24 25 26 27 28A 28B 29	Yellow	2.4	Moderate	Low	4 - 7.5	None
Early Summer	*Ranunculus eschscholtzii*	Eschscholtz's buttercup	23 25 28B	Yellow	1	Short	Medium	6.2 - 8	None
Early Summer	*Ranunculus macounii*	Macoun's buttercup	23 24 25	Yellow	1	Short	Medium	5 - 8	None
Mid Summer	*Astragalus canadensis var. brevidens*	shorttooth Canadian milkvetch	22A 23 24 25 26 27 28A 28B	White	0.5	Short	Medium	6 - 8	None
Mid Summer	*Berula erecta*	cutleaf waterparsnip	all	White	2.8	Moderate	High	4.9 - 6.9	None
Mid Summer	*Epilobium glaberrimum spp. fastigiatum*	glaucus willowherb	23 24 25 28B	Purple	2	Moderate	Medium	6.1 - 7.5	None
Mid Summer	*Helianthus nuttallii*	Nuttall's sunflower	25 25 27 28A 28B 29 30	Yellow	10	Moderate	Medium	5.9 - 7.5	None
Mid Summer	*Heterotheca villosa var. scabra*	hairy false goldenaster	24 25 28A 28B 29 30	Yellow	3	Short	Low	6 - 7.5	Low

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Mid Summer	*Lycopus asper*	rough bugleweed	23 27 29		2.1	Moderate	High	6 - 8	Low
Mid Summer	*Mentzelia albicaulis*	whitestem blazingstar	all	White	3.5	Short	Medium	6 - 8.4	Low
Mid Summer	*Oenothera elata spp. hirutissima*	Hooker's evening primrose	all	Yellow	5	Short	High	5.5 - 7.5	None
Mid Summer	*Oxyria digyna*	alpine mountainsorrel	23 24 25 26 28B	Green	1	Moderate	Medium	6 - 8	None
Mid Summer	*Parnassia fimbriata*	fringed grass of Parnassus	23 24 25 28B	White	1.2	Moderate	High	6 - 8	Low
Mid Summer	*Parnassia palustris*	marsh grass of Parnassus	25 26 29 30	White	2.2	Long	High	6 - 8	None
Mid Summer	*Penstemon rydbergii oreocharis*	herbaceous penstemon	22A 23 24 25 26 28B	Blue	3	Moderate	Low	6 - 8	None
Mid Summer	*Penstemon speciosus*	royal penstemon	22A 23 24 25 26 27 28A 28B	Blue	2.5	Long	Low	6.4 - 8	None
Mid Summer	*Perideridia parishii*	Parish's yampah	22A 23 25 26	White	2.5	Moderate	High	6 - 7.5	Low
Mid Summer	*Prunella vulgaris ssp. lanceolata*	lance selfheal	22A 23 25 26	Purple	1.5	Moderate	Medium	5.4 - 8	None
Mid Summer	*Ranunculus flammula*	greater creeping spearwort	23 25	Yellow	1.5	Short	High	6 - 7.5	None
Mid Summer	*Senecio triangularis*	arrowleaf ragwort	22A 23 24 25 26	Yellow	4	Long	High	6.2 - 7.8	None
Mid Summer	*Veronica americana*	American speedwell	all	Blue	0.8	Short	High	5.7 - 7.5	None
Summer	*Apocynum cannabinum*	Indianhemp	22A 24 25 26 28A 28B 29 30	White	3.3	Moderate	High	4.5 - 7	None
Summer	*Arenaria kingii ssp. compacta*	King's compact sandwort	22A 23 24 25 26 27 28A 28B 29	white	0.7	Short	Low	5.9 - 8	None
Summer	*Arnica ×diversifolia*	rayless arnica	25	Yellow	1.3	Moderate	High	6.3 - 7.8	None
Summer	*Arnica amplexicaulis*	clasping arnica	25 28B	Yellow	2.5	Short	High	6 - 7.3	None
Summer	*Arnica mollis*	hairy arnica	22A 23 24 25 28A 28B 29	Yellow	2	Moderate	High	5 - 7	None
Summer	*Astragalus agrestis*	purple milkvetch	23 24 25 28B	Purple	1	Short	Low	6.3 - 7.7	None
Summer	*Balsamorhiza serrata*	serrate balsamroot	23 24	Yellow	1	Short	Low	5.8 - 7	None

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Summer	*Eriogonum wrightii*	bastardsage	30	White	2	Long	Low	6 - 8	Low
Summer	*Geum rossii var. turbinatum*	Ross' avens	25 28B	Yellow	0.4	Short	Low	4.5 - 5.6	None
Summer	*Lobelia cardinalis*	cardinalflower	29 30	Red	5.9	Moderate	Low	5.8 - 7.8	None
Summer	*Lupinus ×alpestris*	Great Basin lupine	25 28A 28B 29 30	Purple	2.2	Long	Low	5.7 - 7.5	Low
Summer	*Lupinus caudatus ssp. caudatus*	tailcup lupine	all	Blue	5	Short	Low	7 - 8	None
Summer	*Ranunculus hyperboreus*	high northern buttercup	25	Yellow	1	Short	Medium	5 - 7	Low
Summer	*Stellaria umbellata*	umbrella starwort	23 24 25 28B	White	1	Moderate	High	6 - 7.5	None
Late Summer	*Astragalus curvicarpus var. curvicarpus*	curvepod milkvetch	22A 23 24 25 26 27 28B	Yellow	0.4	Short	Low	7 - 8	None
Late Summer	*Erigeron filifolius*	threadleaf fleabane	23	Purple	1	Short	Low	6 - 7.5	None
Late Summer	*Eurybia integrifolia*	thickstem aster	23 25	Purple	3	Short	Low	6 - 7.5	None
Late Summer	*Euthamia occidentalis*	western goldentop	23 24 26 27	Yellow	6	Long	Medium	4.5 - 7	None
Late Summer	*Geum triflorum*	old man's whiskers	23 25 28B	Purple	1.5	Short	Medium	6 - 7.5	None
Late Summer	*Lupinus argenteus ssp. argenteus*	silvery lupine	all	Blue	1.5	Short	Low	7 - 8	None
Late Summer	*Solidago canadensis var. salebrosa*	rough Canada goldenrod	22A 23 24 25 28A 28B	Yellow	3.5	Long	Medium	4.8 - 7.5	None
Late Summer	*Solidago missouriensis*	Missouri goldenrod	25 29	Yellow	3	Short	Low	5.5 - 7.5	Low
Late Summer	*Solidago multiradiata var. scopulorum*	manyray goldenrod	23 25 28A 28B 29	Yellow	1	Short	Low	5 - 7.3	None
Late Summer	*Symphyotrichum lanceolatum ssp. hesperium var. hesperium*	white panicle aster	22A 23 24 25 26 27 28B	Yellow	6	Long	High	5.8 - 7.4	None
Fall	*Asclepias incarnata*	swamp milkweed	29	Red	4.9	Moderate	High	5 - 8	None
Fall	*Helenium autumnale*	common sneezeweed	24 25	Yellow	4.9	Moderate	Medium	4 - 7.5	Low
Indeterminate	*Gaillardia pulchella*	Indian blanket	30	Yellow	2	Short	Medium	7 - 8.5	None

Bloom Period	Perrenial Forb Scientific Name	Wildflower Common Name	Nevada MLRA	Flower Color	Mature Height (ft)	Lifespan	Irrigation Required	pH Range	Salinity Tolerance
Indeterminate	*Linum lewisii var. lewisii*	Lewis flax	all	Blue	2.5	Moderate	Medium	5.6 - 8.4	Low
Indeterminate	*Nitrophila occidentalis*	boraxweed	all	Purple	1	Long	Medium	7 - 10	High
Indeterminate	*Pluchea odorata var. odorata*	sweetscent	30	Purple	4.9	Short	Medium	4.5 - 7	Low
Indeterminate	*Rorippa sinuata*	spreading yellowcress	22A 23 24 25 26 28B 30	Yellow	1	Short	Medium	5 - 8.5	None
Indeterminate	*Solidago gigantea*	giant goldenrod	23 25	Yellow	8.2	Moderate	Medium	4 - 8	None

Table 3. - Grasses, sedges, and rushes for Pollinator Habitat. Listed by the season they are in bloom.

Bloom Period	Monocot Scientific Name	Common Name	Nevada MLRA	Active Growth Period	Growth Form	Lifespan	Low Growing Grass	Drought Tolerance	Min. Precip. (in.)	pH Range	Salinity Tolerance
Early Spring	*Danthonia californica*	California oatgrass	23 25	Fall, Winter and Spring	Multiple Stem	Short	Yes	Medium	6	6-7	Low
Early Spring	*Leymus cinereus*	basin wildrye	all	Spring	Bunch	Long	No	Medium	8	5.6-9	High
Mid Spring	*Bouteloua eriopoda*	black gramma	30	Summer and Fall	Stoloniferous	Moderate	No	High	7	7-8.7	Low
Mid Spring	*Elymus lanceolatus ssp. lanceolatus*	thickspike wheatgrass	24 25 27 28A 28B 29	Spring and Summer	Rhizomatous	Moderate	Yes	High	8	6.6-8.4	Medium
Mid Spring	*Festuca rubra*	red fescue	22A 23 24 25 26 27 28B 29 30	Spring and Fall	Rhizomatous	Long	Yes	Medium	30	5-7.5	Low
Mid Spring	*Poa palustris*	fowl bluegrass	23 25 28B 30	Spring and Summer	Bunch	Moderate	Yes	Low	28	4.9-7.5	Low
Mid Spring	*Sisyrinchium idahoense*	Idaho blue-eyed grass	23 24 25 28B	Spring and Summer	Single Crown	Moderate	No	Low	10	6.4-8.2	None
Spring	*Bromus ciliatus*	fringed brome	23 24 25 28A	Spring and Summer	Bunch	Long	No	Low	12	5.5-7.5	Low
Spring	*Bromus marginatus*	mountain brome	22A 23 24 25 26 28A 28B 29 30	Spring and Summer	Bunch	Short	No	Medium	10	5.5-8	High
Spring	*Juncus mexicanus*	Mexican rush	23 26 27 29 30	Spring and Summer	Rhizomatous	Moderate	No	Low	8	6.2-8.2	High
Late Spring	*Achnatherum hymenoides*	Indian ricegrass	all	Spring, Summer, Fall	Bunch	Short	No	High	6	6.6-8.6	Low
Late Spring	*Calamagrostis canadensis*	bluejoint	23 25 26 28B	Spring	Rhizomatous	Long	No	Low	14	4.5-8	None
Late Spring	*Calamagrostis rubescens*	pinegrass	25	Spring and Summer	Rhizomatous	Moderate	Yes	Low	16	5.5-8	None
Late Spring	*Calamagrostis stricta ssp. inexpansa*	northern reedgrass	all	Spring and Summer	Rhizomatous	Long	Yes	Low	26	5.5-8	Medium

Bloom Period	Monocot Scientific Name	Common Name	Nevada MLRA	Active Growth Period	Growth Form	Lifespan	Low Growing Grass	Drought Tolerance	Min. Precip. (in.)	pH Range	Salinity Tolerance
Late Spring	*Carex atherodes*	wheat sedge	25	Spring and Summer	Rhizomatous	Long	No	Low	12	4.5-7.2	None
Late Spring	*Carex disperma*	softleaf sedge	23 25 28 29	Spring and Summer	Stoloniferous	Moderate	No	Low	14	4.5-6.5	Low
Late Spring	*Carex praegracilis*	clustered field sedge	22A 23 24 25 26 28A 28B 29 30	Spring and Summer	Rhizomatous	Long	No	Low	10	5.3-6.8	None
Late Spring	*Carex scopulorum ssp. bracteosa*	mountain sedge	23 25 28 29	Spring and Summer	Rhizomatous	Moderate	No	Low	8	6.8-7.5	Medium
Late Spring	*Carex simulata*	analogue sedge	23 24 25	Spring and Summer	Rhizomatous	Moderate	No	Low	8	6-7.5	Medium
Late Spring	*Danthonia intermedia*	timber oatgrass	25	Spring and Summer	Bunch	Short	Yes	Medium	6	6-7.8	Medium
Late Spring	*Deschampsia elongata*	slender hairgrass	22A-28A	Spring and Summer	Bunch	Short	Yes	Medium	10	6-7.8	Medium
Late Spring	*Eleocharis palustris*	common spikerush	all	Spring	Rhizomatous	Moderate	No	Low	16	4-8	Low
Late Spring	*Elymus canadensis*	Canada wildrye	25 27	Spring, Summer, Fall	Bunch	Short	No	Medium	20	5-7.9	Medium
Late Spring	*Elymus trachycaulus ssp. trachycaulus*	slender wheatgrass	all	Spring	Bunch	Moderate	No	High	8	5.6-9	Medium
Late Spring	*Festuca arizonica*	Arizona fescue	30	Spring	Bunch	Moderate	No	Medium	10	6.5-7.5	None
Late Spring	*Juncus mertensianus*	Merten's rush	23 24 25 28A 28B 29	Spring and Summer	Rhizomatous	Moderate	No	Low	10	6-8	None
Late Spring	*Juncus nevadensis*	sierra rush	23 25	Spring and Summer	Rhizomatous	Moderate	No	Low	10	6-7.8	None
Late Spring	*Koeleria macrantha*	prairie junegrass	22A 23 24 25 26 27 28A 28B 29	Spring and Fall	Bunch	Short	No	High	14	6-8	None
Late Spring	*Leymus triticoides*	beardless wildrye	all	Spring, Summer, Fall	Rhizomatous	Long	No	High	7	6-9	High

Bloom Period	Monocot Scientific Name	Common Name	Nevada MLRA	Active Growth Period	Growth Form	Lifespan	Low Growing Grass	Drought Tolerance	Min. Precip. (in.)	pH Range	Salinity Tolerance
Late Spring	*Muhlenbergia glomerata*	spiked muhly	27	Spring, Summer, Fall	Rhizomatous	Short	No	Low	30	5.3-7.5	Medium
Late Spring	*Phleum alpinum*	alpine timothy	23 24 25 28B 29	Spring and Summer	Bunch	Moderate	Yes	Low	16	5-7.5	None
Late Spring	*Pleuraphis rigida*	big galleta	30	Spring and Summer	Rhizomatous	Long	No	High	5	6-8	Low
Late Spring	*Poa secunda*	Sandberg bluegrass	all	Spring	Bunch	Moderate	No	High	8	6-8	Low
Late Spring	*Puccinellia nuttalliana*	Nuttall's alkaligrass	23 24 25 28B 29	Spring and Summer	Rhizomatous	Short	No	Low	24	6.5-8.5	High
Early Summer	*Bouteloua gracilis*	blue gramma	28-30	Summer and Fall	Bunch	Moderate	No	High	8	6.6-8.4	Medium
Early Summer	*Carex viridula ssp. viridula*	little green sedge	28B 29	Spring and Summer	Bunch	Moderate	No	Low	8	4.5-7.5	High
Early Summer	*Elymus glaucus*	blue wildrye	23-26	Spring, Summer, Fall	Bunch	Moderate	No	High	16	5.8-8.5	Medium
Early Summer	*Festuca idahoensis*	Idaho fescue	22A 23 24 25 26 27 28A 28B 29	Spring	Bunch	Long	No	Low	12	5.6-8.4	None
Early Summer	*Glyceria striata*	fowl mannagrass	all	Spring	Rhizomatous	Short	No	Low	10	4-8	None
Early Summer	*Hesperostipa comata ssp. comata*	needle and thread	all	Spring	Bunch	Moderate	No	High	5	6.6-8.4	None
Early Summer	*Hordeum brachyantherum*	meadow barley	all	Spring and Summer	Bunch	Moderate	No	Medium	20	6-8.5	Medium
Early Summer	*Juncus articulatus*	jointleaf rush	23 25	Spring and Summer	Rhizomatous	Moderate	No	Low	18	4.8-7.5	Low
Early Summer	*Juncus longistylis*	longstyle rush	23 25 28A 28B 29 30	Spring and Summer	Rhizomatous	Moderate	No	Low	8	6-8	Medium
Early Summer	*Pseudoroegneria spicata ssp. spicata*	bluebunch wheatgrass	23-25 28B 29 30	Spring, Summer, Fall	Bunch	Long	No	High	8	6.6-8.4	Low

Bloom Period	Monocot Scientific Name	Common Name	Nevada MLRA	Active Growth Period	Growth Form	Lifespan	Low Growing Grass	Drought Tolerance	Min. Precip. (in.)	pH Range	Salinity Tolerance
Mid Summer	*Eleocharis acicularis var. acicularis*	needle spikerush	23 25 29	Spring, Summer, Fall	Rhizomatous	Moderate	No	Low	14	4.5-7	Medium
Mid Summer	*Juncus torreyi*	Torrey's rush	22A 23 24 25 26 27 28B 29 30	Summer	Rhizomatous	Long	No	Low	14	4.5-6.5	Low
Mid Summer	*Pascopyrum smithii*	western wheatgrass	all	Spring, Summer, Fall	Rhizomatous	Long	Yes	High	8	4.5-9	High
Mid Summer	*Pleuraphis jamesii*	James' galleta	25-30	Summer	Rhizomatous	Long	No	High	6	6.6-8.4	Medium
Mid Summer	*Sporobolus airoides*	alkali sacaton	all	Spring and Summer	Bunch	Moderate	No	High	5	6.6-9	High
Summer	*Carex aquatilis*	water sedge	23 25 28 29	Summer	Bunch	Long	No	Low	15	4-7.5	None
Summer	*Eleocharis obtusa*	blunt spikerush	23	Spring	Rhizomatous	Short	No	Low	18	4.1-8.7	None
Summer	*Juncus drummondii var. drummondii*	Drummond's rush	23 25	Summer	Bunch	Long	No	Low	32	5.4-7	None
Summer	*Juncus ensifolius*	swordleaf rush	23 24 25 28A 28B 29	Summer	Rhizomatous	Moderate	No	Low	8	6-8	Medium
Late Summer	*Andropogon glomeratus*	bushy bluestem	30	Summer	Bunch	Moderate	Yes	Low	35	5-6.3	Low
Late Summer	*Juncus confusus*	Colorado rush	23 25 28B 29	Spring and Summer	Bunch	Moderate	No	Low	10	6-8	Medium
Late Summer	*Muhlenbergia mexicana*	Mexican muhly	25 27	Spring, Summer, Fall	Rhizomatous	Short	No	Low	20	5.5-7.5	None
Late Summer	*Spartina gracilis*	alkali cordgrass	all	Spring and Summer	Rhizomatous	Long	Yes	Medium	12	7-9.5	High
Indeter-minate	*Bothriochloa barbinodis*	cane bluestem	30	Summer and Fall	Bunch	Short	No	High	12	7-8.2	Low
Indeter-minate	*Leersia oryzoides*	rice cutgrass	23	Summer	Rhizomatous	Moderate	No	Low	12	5.1-8.8	None

Table 4. - Crop plants for Pollinator Habitat. Listed by the season they are in bloom.

Bloom Period	Plant Scientific Name	Crop Common Name	Flower Color	Duration	Mature Height, (ft)	Adapted Fine Textured Soils	Adapted Medium Textured Soils	Adapted Coarse Textured Soils	Irrigation Required	pH Range	Salinity Tolerance
Late Winter	*Trifolium subterraneum*	subterranean clover	White	Annual	0.5	Yes	Yes	No	Low	5.0-8.0	Low
Early Spring	*Kummerowia striata*	Japanese clover	Purple	Annual	1.3	Yes	Yes	Yes	Low	4.9-7.3	Low
Early Spring	*Lotus corniculatus*	bird's-foot trefoil	Yellow	Perennial	2.4	Yes	Yes	Yes	Medium	5.0-8.0	High
Early Spring	*Onobrychis viciifolia*	sainfoin	Red	Perennial	2.5	No	Yes	Yes	Medium	6.0-8.5	Medium
Early Spring	*Sanguisorba minor*	small burnet	Red	Perennial	1.3	Yes	Yes	Yes	Medium	6.0-8.0	Medium
Early Spring	*Trifolium incarnatum*	crimson clover	Red	Annual	1.5	Yes	Yes	Yes	Medium	5.5-7.5	None
Early Spring	*Vicia sativa*	garden vetch	Purple	Annual	4	No	Yes	Yes	High	6.0-7.0	Low
Early Spring	*Vicia villosa*	winter vetch	Purple	Perennial	1.5	Yes	Yes	Yes	Medium	6.0-7.5	Low
Spring	*Brassica napus*	canola	Yellow	Annual, Biennial	4	No	Yes	Yes	Medium	6.0-7.2	Low
spring	*Camelina sativa*	camelina	Yellow	Annual, Biennial	2.5	No	Yes	Yes	Low	5.0-7.0	Medium
Spring	*Linum usitatissimum*	flax	Blue	Annual	2.5	No	Yes	Yes	Low	5.0-7.5	Low
Spring	*Medicago sativa*	alfalfa	Purple	Perennial	2	Yes	Yes	No	High	6.0-8.5	Medium
Spring	*Medicago sativa ssp. falcata*	yellow flowered alfalfa	Yellow	Perennial	2	Yes	Yes	No	Medium	6.0-8.6	Medium
Spring	*Mentha arvensis*	wild mint	White	Perennial	2.6	Yes	Yes	No	High	5.0-7.0	None
Spring	*Pisum sativum*	pea, winter pea	White	annual	2	No	Yes	Yes	Medium	5.5-7.0	Low
Spring	*Raphanus sativus*	forage radish, oil radish	Pink	Biennial	2	No	Yes	Yes	Medium	6.0-7.5	Low

Bloom Period	Plant Scientific Name	Crop Common Name	Flower Color	Duration	Mature Height, (ft)	Adapted Fine Textured Soils	Adapted Medium Textured Soils	Adapted Coarse Textured Soils	Irrigation Required	pH Range	Salinity Tolerance
Spring	*Vicia lutea*	smooth yellow vetch	Yellow	Annual	2	Yes	Yes	No	Medium	5.5-6.9	None
Late Spring	*Brassica rapa*	turnip	Yellow	Annual, Biennial	3	Yes	Yes	Yes	High	5.0-8.0	Medium
Late Spring	*Coronilla varia*	crownvetch	Purple	Perennial	3	No	Yes	Yes	Medium	4.8-7.8	None
Late Spring	*Trifolium fragiferum*	strawberry clover	Purple	Perennial	0.5	No	Yes	No	High	6.0-8.6	High
Late Spring	*Trifolium hybridum*	alsike clover	White	Perennial	2	Yes	Yes	No	High	5.6-7.5	Low
Late Spring	*Trifolium pratense*	red clover	Red	Biennial, Perennial	2	Yes	Yes	Yes	Medium	5.5-7.6	Low
Late Spring	*Trifolium repens*	white clover	White	Perennial	0.5	Yes	Yes	No	Medium	5.2-8.0	Low
Late Spring	*Vicia americana*	american vetch	Purple	Perennial	1.3	No	Yes	Yes	Low	5.9-7.2	None
Early Summer	*Astragalus cicer*	cicer milkvetch	White	Perennial	3	Yes	Yes	No	High	6.0-8.5	Medium
Early Summer	*Chamaecrista fasciculata*	partridge pea	Yellow	Annual	2.4	No	Yes	Yes	Medium	5.5-7.5	None
Early Summer	*Fagopyrum esculentum*	buckwheat	White	Annual	1.5	No	Yes	Yes	Low	4.6-6.6	None
Early Summer	*Trifolium ambiguum*	Kura clover	White	Perennial	1.5	Yes	Yes	No	Medium	5.7-7.4	None
Summer	*Guizotia abyssinica*	niger thistle	Yellow	Annual	3	Yes	Yes	No	High	5.5-7.9	Low
Summer	*Melilotus alba*	white sweetclover	White	Perennial	5	Yes	Yes	Yes	Medium	6.5-8.0	High
Summer	*Melilotus officinalis*	sweetclover	Yellow	Perennial	6	Yes	Yes	No	Medium	6.5-8.2	High

Bloom Period	Plant Scientific Name	Crop Common Name	Flower Color	Duration	Mature Height, (ft)	Adapted Fine Textured Soils	Adapted Medium Textured Soils	Adapted Coarse Textured Soils	Irrigation Required	pH Range	Salinity Tolerance
Summer	*Solanum lycopersicum var. lycopersicum*	tomato	Yellow	Annual	6	Yes	Yes	No	High	5.5-7.0	Medium
Summer	*Solanum melongena*	eggplant	Purple	Annual	4	No	Yes	Yes	High	5.5-7.2	Low
Summer	*Vicia faba*	fava bean	White	Annual	4	Yes	Yes	Yes	Medium	4.5-8.3	Low
Summer	*Vigna unguiculata*	cowpea	Purple	Annual	2.5	Yes	Yes	No	Medium	6.0-8.0	Medium
Summer	*Helianthus annuus*	common sunflower	Yellow	Annual	9	Yes	Yes	Yes	Medium	5.5-7.8	Medium
Mid Summer	*Cichorium intybus*	chicory	Blue	Perennial	2	Yes	Yes	Yes	High	6.0-7.5	None
Mid Summer	*Fagopyrum tataricum*	Tartary buckwheat	White	Annual	1.4	No	Yes	Yes	Low	4.6-6.5	None
Mid Summer	*Glycine max*	soybean	Purple	Annual	3	Yes	Yes	Yes	Medium	5.5-7.8	Medium
Late Summer	*Carthamus tinctorius*	safflower	Yellow	Annual	3	Yes	Yes	Yes	Medium	4.0-7.0	Medium
Late Summer	*Helianthus tuberosus*	Jerusalem artichoke	Yellow	Perennial	9.8	No	Yes	Yes	Low	4.0-7.0	Low

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