United States Department of Agriculture
NATURAL RESOURCES CONSERVATION SERVICE
Biology Technical Note No. MT-20 (Rev. 9)
December 2018

BIOLOGY TECHNICAL NOTE

Creating and Enhancing Habitat for Pollinator Insects

About two-thirds of the world's crop species depend on insects for pollination, which accounts for approximately 35 percent of the food and beverages we consume. The United States grows more than 100 crop plants that need or benefit from pollinators. Without these pollinators, only crops that are wind- or self-pollinated, such as wheat and corn, would be productive. Pollinators are key to the function of many terrestrial ecosystems because they enhance plant reproduction. Almost 90% of flowering plants require an animal, mostly insects, for pollination. The resulting seeds and fruits provide food for countless wildlife species from songbirds to grizzly bears. Pollinators and other insects associated with diverse habitat plantings also can provide pest control for plants and keep plant communities productive. In turn, plants provide food and cover for numerous pollinator, wildlife, and livestock species, help stabilize the soil, and improve water quality.

Figure 1. Bee on lacy phacelia (NRCS photo).

In Montana, many species of insects, as well as some birds, provide pollination services. Bees are the most efficient and important pollinator group because they collect and transport pollen (Figure 1), unlike most other flower visitors that are focused on finding nectar. There are over 4,000 species of bees in North America. The honey bee, an introduced species from Europe, is the best known and most economically important commercial pollinator. In Montana, although the exact number is unknown, the number of native bee species is likely in the hundreds and includes mining bees, mason bees, sweat bees, leafcutting bees, carpenter bees, and at least 28 species of bumble bees that are all prolific pollinators. Native bees and honey bees pollinate both native and introduced plant species. However, a recent United States Geological Survey study on Conservation Reserve Program (CRP) lands found that native bees use native plants for 71% of their plant visits while non-native honey bees pollinated introduced plants like alfalfa and sweet clover for 79% of their plant visits.

Pollinators are threatened worldwide by habitat loss and fragmentation, pesticide exposure, disease, parasites, and the introduction of exotic organisms. This has serious economic implications for humans and for ecosystem diversity and stability. The roles of honey bee and native bee pollinators are critical if crop production levels are to be maintained in the long term. Pollinators are increasingly important as the number and acreage of crops dependent on insect pollination services are steadily growing.

The Natural Resources Conservation Service (NRCS) helps landowners develop and enhance pollinator habitat by encouraging them to establish an array of plants that flower throughout the entire growing season. Creating high quality habitat for pollinators provides a source of nectar for adult pollinators, a diversity of herbaceous material for immature pollinator life stages, and herbaceous material for nesting. Additionally, adult bees need diverse flowering plants from which they can collect pollen to feed to larval bees.

Pollinator habitat also can support other beneficial insects, such as predators and parasitoids that attack crop pests and help in pest control. To be most abundant, these valuable insects need alternative food sources when their prey is lacking. Increasing the abundance of flower nectar or pollen will also help them to live longer, lay more eggs, and produce more offspring. This habitat may also give them a safe refuge from pesticides or other disturbances that can lower their numbers in working landscapes.

Pollinator habitat can be created or enhanced by addressing a few basic habitat requirements of insect pollinators including a:

- Site selected and managed for undisturbed soil and shelter for nest sites and over-wintering
- Pesticide-free environment
- Diversity of plants with a range of bloom periods

The NRCS already offers many opportunities to create and enhance habitat for pollinators using existing programs and practices. Conservation practices can (a) include diverse flowering plants that provide sequential bloom throughout the growing season, (b) allow for creation or protection of nest sites such as snags, brush piles, stable untilled ground, or small cavities, (c) increase areas of unsprayed natural habitat, and (d) create buffers or barriers that help to reduce pesticide drift.

Pollinator habitat can be incorporated into conservation practices that are designed to provide a range of other benefits such as increasing plant species diversity, site productivity, and site stability. For example, Conservation Cover (327), Contour Strips (332), and Cover Crops (340) can all supply pollinator habitat while benefiting soil health and minimizing erosion. Wetland Restoration (657), Critical Area Planting (342), Windbreak Establishment (380), and Range Planting (550) can include pollinator plants while improving habitat, forage, and site stability. Riparian Forest Buffer (391) and Tree or Shrub Establishment (612) can increase pollinator nesting habitat while stabilizing sites prone to wind or water erosion.

Site Selection and Management: Important considerations in pollinator habitat site selection include habitat size and shape, location in the landscape, canopy cover, and site management. Pollinator habitat that is big, round, and close to other pollinator habitat is better than small, uneven shapes that are isolated in a landscape. The large round size minimizes the area-to-edge ratio and limits impacts from adjacent land uses and the encroachment from weeds. However, linear planting corridors are often more practical (e.g. windbreaks, fence line, field borders) (Figure 2). If possible, place pollinator habitat near small, diverse crop fields where non-crop habitat is more abundant and avoid placement within large single crop fields.

When determining the location of pollinator habitat, consider the distance from pollinator nest sites to foraging sites. Insects may nest or overwinter in hollow plant stems, holes bored in live or dead wood, bunchgrasses, soil and leaf litter, rodent burrows, or in untilled, un-mulched, partially bare ground. It is important to have nesting and foraging habitat in the same area. Most native bees forage a short distance from their nest. Large bees can forage a mile or more from the

nest while small to medium bees will travel 200 to 500 yards, respectively. In general, bees are more efficient at foraging and reproducing if they have a shorter distance to fly to flowering plants. Sun exposure is also important for pollinator habitat because pollinators need to see the sky to navigate. Select sites that have an open canopy with few trees and full sun at least part of the day. Also consider herbicide and pesticide drift when selecting a site for pollinator habitat. When possible, place habitat in areas where chemicals aren't widely used (ex: adjacent to rangeland) or in locations that are protected from chemical drift by vegetative buffers.

Figure 2. Pollinator habitat planted adjacent to organic crop fields. Since pesticides are not used in these fields, it was best to integrate the habitat directly into the fields where pollination and pest control services are most needed. (Xerces Society photo).

Make sure pollinator habitat will be managed in a way to ensure long-term productivity of pollinator insects and plants. Pollinator insects need sheltered, undisturbed places for nesting and over-wintering habitat. Surface and subsurface disturbance can be harmful to pollinators because roughly 70% of native bees are ground nesting. Burning can eliminate all larval, nesting, and pupating pollinator insects. The health and sustainability of many native bee populations relies on some areas left permanently void of tillage activities. Habitat selected for pollinators should also have minimal mowing, burning, haying, or grazing until after the bloom period so flowers are available as a nectar source and succulent herbage can be utilized by insect larvae. The habitat may be part of a haying, grazing or burning rotation as long as part of the habitat remains undisturbed.

Pollinator plants can be promoted and maintained through on-going site management. Flowering plants (forbs) are generally shorter lived than grasses, therefore forb species must be allowed to flower, produce seed, and have their seed incorporated into the soil for stand longevity. Grazing can be used as a tool to incorporate forb seed into the soil. Grazing or mowing can also be timed

to favor specific pollinator plants. For example, short duration early summer grazing can reduce grass cover while opening the canopy for flowering plants. Invasive species can decrease the diversity of desired forbs on a site. Prevent the spread of invasive plants and implement control while infestations are small by spot clipping, spot spraying using a selective herbicide, or through grazing management.

Best management practices for promoting pollinator habitat include the following:

- For large scale pollinator habitat, leave at least one-third of the habitat undisturbed until after the first frost when plants have bloomed and set seed. This will maintain habitat and floral resources while pollinators are active. Be aware of the surroundings because large scale pollinator habitat may extend across fencelines.
- For small-scale pollinator habitat, leave at least one-half of the habitat undisturbed until after the first frost in the fall when plants have bloomed and set seed.
- Use low and moderate grazing utilization levels for short durations to limit nest disturbance and maintain flowering plants.
- After plant establishment, rotate livestock grazing on one-third to one-fourth of the pollinator habitat management area in a season, leaving other areas ungrazed to provide habitat for pollinator insects. Grazing may be combined with adjacent pastures to achieve an area of non-disturbance within a grazing prescription.
- Avoid cutting or grazing flowering plants during the bloom season. Cut, mow or graze during the non-blooming season.
- Mow/hay at reduced speeds (8 mph) to allow pollinators to move, use a high cut height (8 to 16 inches), and avoid cutting at night.
- When burning, burn no more than one-third to one-half of the site, leave small unburned patches within the burned area (the burned area should be a mosaic of burned and unburned ground), and avoid high intensity (hot) fires.
- Schedule prescribed burns on a three- to six-year rotation between October and February.
- Allow adequate time for habitat recovery after grazing, mowing, or burning.
- Prevent the spread of and manage invasive species through spot clipping, spot spraying using a selective herbicide, or using grazing management.
- Use timed grazing to promote desired species and incorporate forb seed into the soil.

Pesticide-free Environment:
Pesticides applied to farms, fields, lawns, gardens, and roadsides can directly kill pollinators, impair their reproduction, compromise their mobility, and indirectly reduce the diversity and abundance of flowering plants on which they rely. Similarly, pesticide drift from adjacent land uses can impact pollinators and their habitat. Bees collecting contaminated pollen, nectar, or nesting materials can be impacted, and ground nesting bees in and adjacent to crop fields have a high potential for contact exposure.

Figure 3. When using pesticides, increase droplet size and keep spray booms low to reduce drift and the risk of injury to pollinator insects. (USDA photo)

It can take several years for pollinators to recover to their pre-spraying levels, especially if pesticide residue remains in the plants, soil, and water, potentially resulting in long-term exposure to pollinators.

Pesticide impacts can be prevented or minimized by using the following best management practices.

- If possible, use an integrated pest management (IPM) system to reduce, eliminate or limit pesticide use. Use scouting and monitoring to determine if and when pest pressure warrants chemical management. Use non-pesticide management strategies such as hand-cutting, mowing, intercropping, crop rotation, and biological control to prevent or manage weeds and pests.
- Maintain barriers or buffers (e.g. vegetative buffers, non-blooming windrow species, floating fabrics) between treated areas and pollinator habitat or hives. If pollinator habitat is near or adjacent to areas that will be sprayed, then the pollinator habitat needs to be wide enough to minimize drift effects from insecticide applications. For example, if pollinator habitat has crop or hayland on one side, the pollinator planting should be at least 125 feet wide. If there is crop or hayland on both sides, the pollinator plantings should be increased to at least 250 feet wide.
- Identify hive locations and coordinate application timing with apiary arrival and departure dates. Maintain communication between beekeepers and growers.
- Apply pesticides when fewer pollinators are active. For example, spray in the nighttime or at lower temperatures when bees are not active or foraging.
- Avoid applying insecticides on pollinator-attractive plants during their bloom period.
- When possible, use products with low toxicity ratings for bees, shorter residual toxicity, and use the minimum recommended dose of all products. Check the pesticide label's Environmental Hazards section for information on bee toxicity and residual toxicity.
- Always follow the pesticide label.
- Take measures to avoid or reduce pesticide drift including increasing droplet size (i.e. use drift reduction nozzles, adjust pressure, and avoid aerial spraying), calibrate sprayers, apply only during optimal temperatures and wind speeds (2 to 9 mph), use a drift reducing adjuvant, and keep spray booms stable and low (Figure 3).
- Turn off sprayers near water sources and between application sites.

Diversity of Plants: To provide habitat for diverse insects, provide a diversity of plants for foraging and nesting materials (Figure 4). Planting a diversity of plant species will increase the probability that floral resources are available throughout the growing season. When selecting pollinator plants for seeding or planting, make sure the species is adapted to the site and use at least one forb or shrub species from each of the three bloom periods: early (April, May, June), middle (July, August), and late (September, October) season. Bloom period may vary slightly depending on planting dates and environmental conditions. Also, select plant species with different flower size, shapes, colors, and heights to attract a diversity of insects.

Figure 4. Alternate row pollinator planting of grasses and forbs (NRCS photo).

It is easier for pollinators to find groupings (clumps at least 3 feet wide) of individual plant species because they can detect the flowering plant more quickly. Grouping species also helps reduce energy used for foraging and increases the efficiency of pollination since bees and other insects will easily move among flowers of the same plant species. Bumble bees, in particular, demonstrate flower constancy. When drill seeding, consider planting individual flowering species in rows, or alternate two rows of forbs with two rows of grasses. For small-scale pollinator plantings, an alternative to seed is to establish containerized plants. This has the advantage of quick establishment and more immediate pollinator habitat value.

Herbaceous pollinator plantings should include at least one bunchgrass species. Grasses are wind-pollinated but do provide a pollen or nectar source for pollinator insects and may prevent weed spread by occupying the site. Grasses are host plants to insects (e.g. butterflies) and provide nesting and overwintering sites. For example, bunchgrasses provide nesting habitat for bumble bees and other insects.

The proportion of grass and forb species in a seed mix will depend on the pollinator planting objectives, NRCS and Farm Service Agency (FSA) programmatic guidelines, and interactions of seeded species. For most seedings, slender wheatgrass should not exceed 5% due to its quick establishment that can slow or suppress other species. Consider planting robust grass species (e.g. basin wildrye, Russian wildrye, tall wheatgrass) in alternate rows or at low rates as they have the potential to shade out forbs. Similarly, native and introduced species may not be compatible in the same planting when sown together but may be well suited to alternate row plantings (Figure 4).

Pollinator insect habitat can be created at the small-scale (target area) or the landscape-scale. Target area plantings of herbaceous or woody species increase pollinator habitat in relatively small focused areas for the greatest effect for the acres involved. Examples of target area plantings include pivot corners, small fields, crop field borders, strip-cropping, windrows, riparian herbaceous cover, and demonstration gardens. Target area plantings should have a high proportion of forbs or appropriate woody species.

Landscape scale plantings are rangelands, grasslands or pastures where a landowner is interested in creating or enhancing pollinator habitat and plant diversity. Species selection and composition should reflect the adjacent habitat and desired species diversity. Refer to NRCS Ecological Site Descriptions as guidance for the plant community. In general, increase the forb component of a seed mix to a minimum of 25% composition. Seedings can be used in conjunction with NRCS

conservation programs and practices that may require a greater percentage of forbs in the seed mix. Review and follow specific program and practice guidelines for the fiscal year.

Tables 1 through 4 provide seed mix examples for target area and landscape scale pollinator plantings in Montana, and Tables 5 through 8 provide pollinator-friendly native and introduced forb, grass, and shrub species seeding and planting information for designing pollinator habitat. Use these tables as guidance and work with your Area Rangeland Specialist or Plant Materials Specialist for specific questions. Start creating a seed mix by selecting species appropriate for your Ecological Site and precipitation zone. Select forb and grass species that meet your site objectives (e.g. forage and pollination), are proven to establish well in Montana, and/or are new species you're interested in testing. Reference Plant Materials Technical Note 46 for proven cultivars, and use the Perennial Seed Calculator for developing seed mixes by percent composition and the number of seeds/ft^2. Reference NRCS Plant Materials Technical Notes for more information on species selection, site preparation, seed size, pure live seed (PLS = germination x purity) seeding rates, planting methods, seeding times, use of cover crops, and more.

Table 1. Pollinator-friendly native species mix for target area planting in Montana's eastern plains. This example has 80% forbs species composition (81% proportion of forbs seeds/ft^2).

Common Name	Genus	Species	PLS lb/acre	% Mixture	Seeds/ft^2	Total PLS lb/ac
Western wheatgrass	*Pascopyrum*	*smithii*	10.0	10	2.1	1.0
Green needlegrass	*Nassella*	*viridula*	6.0	10	2.6	0.6
White prairie clover	*Dalea*	*candida*	4.0	25	6.4	1.0
Lewis flax	*Linum*	*lewisii*	3.5	20	4.7	0.7
Prairie coneflower	*Ratibida*	*columnifera*	2.0	20	5.5	0.4
Maximilian sunflower	*Helianthus*	*maximiliani*	4.0	15	3.4	0.6
			TOTAL	100%	**24.8**	**4.3**

Table 2. Pollinator-friendly introduced species mix for target area planting in Montana. This example has 75% forbs species composition (76% proportion of forbs seeds/ft^2).

Common Name	Genus	Species	PLS lb/acre	% Mixture	Seeds/ft^2	Total PLS lb/ac
Pubescent wheatgrass	*Thinopyrum*	*intermedium*	10.0	25	4.6	2.5
Sainfoin (without pods)	*Onobrychis*	*viciafolia*	34.0	30	4.4	6.3
Small burnet	*Sanguisorba*	*minor*	15.0	25	4.7	3.8
Birdsfoot trefoil	*Lotus*	*corniculatus*	3.0	20	5.8	0.6
			TOTAL	100%	**19.5**	**13.2**

Table 3. Pollinator-friendly native species mix for landscape scale planting in Montana's eastern plains. This example has 25% forbs species composition (25% proportion of forbs seeds/ft^2).

Common Name	Genus	Species	PLS lb/acre	% Mixture	Seeds/ft^2	Total PLS lb/ac
Western wheatgrass	*Pascopyrum*	*smithii*	10.0	20	4.3	2.0
Green needlegrass	*Nassella*	*viridula*	6.0	20	5.1	1.2
Thickspike wheatgrass	*Elymus*	*lanceolatus*	7.0	20	4.9	1.4
Big bluegrass	*Poa*	*secunda*	2.0	10	4.0	0.2
Slender wheatgrass	*Elymus*	*trachycaulus*	7.0	5	1.1	0.4
Maximilian sunflower	*Helianthus*	*maximiliani*	4.0	5	1.1	0.2
Purple prairie clover	*Dalea*	*purpurea*	3.5	5	1.3	0.2
Lewis flax	*Linum*	*lewisii*	3.5	5	1.2	0.2
Prairie coneflower	*Ratibida*	*columnifera*	2.0	5	1.4	0.1
White prairie clover	*Dalea*	*candida*	4.0	5	1.3	0.2
			TOTAL	100%	**25.7**	**6.0**

Table 4. Pollinator-friendly introduced species mix for landscape scale planting in Montana. This example has 50% forbs species composition (52% proportion of forbs seeds/ft^2).

Common Name	Genus	Species	PLS lb/acre	% Mixture	Seeds/ft^2	Total PLS lb/ac
Intermediate wheatgrass	*Thinopyrum*	*intermedium*	10.0	25	4.5	2.5
Pubescent wheatgrass	*Thinopyrum*	*intermedium*	10.0	15	2.8	1.5
Tall wheatgrass	*Thinopyrum*	*ponticum*	10.0	10	1.8	1.0
Sainfoin (without pods)	*Onobrychis*	*viciafolia*	21.0	15	2.2	3.2
Small burnet	*Sanguisorba*	*minor*	15.0	15	2.8	2.3
Lewis flax	*Linum*	*lewisii*	3.5	10	2.4	0.4
Cicer milkvetch	*Astragalus*	*cicer*	8.0	10	2.3	0.8
			TOTAL	100%	**18.8**	**10.9**

Table 5. Pollinator-friendly native and introduced shrub species and their bloom periods.

Common Name	Scientific Name	Full Rate PLS lb/ac	Minimum Precip (inch)	Bloom Period			Availability[2]	Relative Cost[3]
				Early	Middle	Late		
Native Shrubs								
American plum	*Prunus americana*	C[4]	16	■			E	L
Antelope bitterbrush	*Purshia tridentata*	5.0	10	■	■		F	M
Black hawthorn	*Crataegus douglasii*	C	16	■			G	L
Chokecherry	*Prunus virginiana*	C	14	■			E	L
Douglas spirea	*Spiraea douglasii*	C	16	■			F	M
Elderberry	*Sambucus canadensis*	C	10		■	■	G	L
Golden currant	*Ribes aureum*	C	12	■			E	L
Ninebark	*Physocarpus malvaceus*	C	16	■			G	L
Oregon grape	*Mahonia repens*	1.0	15	■	■		G	M
Rabbitbrush, green	*Chrysothamnus viscidiflorus*	C	6		■	■	G	L
Rabbitbrush, rubber	*Ericameria nauseosa*	1.0	6		■	■	G	L
Redosier dogwood	*Cornus sericea*	1.0	18	■	■	■	E	L
Sandcherry	*Prunus pumila*	C	12	■			G	L
Serviceberry	*Amelanchier alnifolia*	C	12	■			E	L
Shrubby cinquefoil	*Dasiphora fruticosa*	1.0	14	■	■		G	L
Silver buffaloberry	*Shepherdia argentea*	C	12	■			E	L
Silverberry	*Elaeagnus commutata*	C	16	■			E	L
Skunkbush sumac	*Rhus trilobata*	C	8	■	■		E	L
Snowberry, common	*Symphoricarpos albus*	3.0	12	■	■		E	L
Snowberry, western	*Symphoricarpos occidentalis*	3.0	12	■	■		E	L
Willow	*Salix species*	Cuttings	Wet	■			E	L
Woods' rose	*Rosa woodsii*	C	12	■	■		E	L
Introduced Shrubs								
Almond, Russian	*Prunus tenella*	C	10	■			E	L
Crabapple	*Malus sylvestris*	C	16	■			E	M
Nanking cherry	*Prunus tomentosa*	C	14	■			E	L
Russian sage	*Perovskia atriplicifolia*	C	10	■	■		E	M
Siberian peashrub	*Caragana arborescens*	C	12	■			E	L

[1]Bloom periods: early (April, May, June), middle (July, August), and late (September, October)

[2]Availability: E - Excellent, G - Good, F - Fair, L - Low

[3]Relative cost: H - High, M - Medium, L – Low

[4]C = container plants

Table 6. Pollinator-friendly native forb and legume species and their bloom periods.

Common Name	Scientific Name	Full Rate PLS lb/ac	Minimum Precip (inch)	Bloom Period[1]			Availability[2]	Relative Cost[3]
				Early	Middle	Late		
Native Forb and Legume Species								
American vetch	*Vicia americana*	33.0	10				F	M
Black-eyed Susan*	*Rudbeckia hirta*	0.8	16				G	M
Blanketflower*	*Gaillardia aristata*	6.0	9				E	L
Beebalm	*Monarda fistulosa*	1.0	15				F	M
Blazing star, dotted	*Liatris punctata*	7.5	15				L	H
Blazing star, ten-petal	*Mentzelia decapetala*	3.3	10				L	H
Evening primrose	*Oenothera biennis*	1.4	10				G	M
Flax, Lewis*	*Linum lewisii*	3.5	8				E	L
Goldenrod, Canada[4]	*Solidago canadensis*	0.5	15				L	H
Goldenrod, gray[4]	*Solidago nemoralis*	2.0	15				L	H
Goldenrod, Missouri[4]	*Solidago missouriensis*	1.0	15				L	H
Goldenrod, stiff	*Oligoneuron rigidum*	1.4	15				G	L
Hairy goldenaster	*Heterotheca villosa*	3.2	10				L	H
Leadplant	*Amorpha canescens*	1.0	15				F	H
Lupine, silky[5]	*Lupinus sericeus*	20	10				F	M
Lupine, silver[5]	*Lupinus argenteus*	8.6	10				F	M
Milkvetch, Canada	*Astragalus canadensis*	4.0	12				G	H
Milkweed, common[6]	*Asclepias syriaca*	17.0	15				F	H
Milkweed, swamp[6]	*Asclepias incarnata*	15.0	15				F	H
Milkweed, showy[6]	*Asclepias speciosa*	15.0	16				F	H
Mountain goldenbanner	*Thermopsis montana*	7.3	10				L	H
New England aster	*Symphyotrichum novae-angliae*	1.4	15				G	M
Indian paintbrush, Wyoming	*Castilleja linariifolia*	0.3	10				F	H
Penstemon, beardstongue	*Penstemon grandiflorus*	4.0	8				G	H
Penstemon, fuzzytongue	*Penstemon eriantherus*	3.0	8				F	M
Penstemon, narrowleaf	*Penstemon angustifolia*	3.5	9				G	M
Prairie clover, purple*	*Dalea purpurea*	3.5	12				E	M
Prairie clover, white*	*Dalea candida*	4.0	10				G	M
Prairie coneflower*	*Ratibida columnifera*	2.0	9				E	M
Prairie spiderwort	*Tradescantia occidentalis*	7.0	10				L	H
Purple coneflower*	*Echinacea angustifolia*	9.0	10				G	M

Common Name	Scientific Name	Full Rate PLS lb/ac	Minimum Precip (inch)	Bloom Period[1]			Availability[2]	Relative Cost[3]
				Early	Middle	Late		
Native Forb and Legume Species								
Rocky Mountain beeplant*	*Cleome serrulata*	13.5	10				F	M
Scarlet globemallow	*Sphaeralcea coccinea*	2.0	6				F	H
Silverleaf phacelia*	*Phacelia hastata*	7.0	8				L	H
Sticky geranium	*Geranium viscosissimum*	1.4	10				F	H
Sunflower, Maximilian*	*Helianthus maximiliani*	4.0	12				E	L
Sunflower, stiff*	*Helianthus pauciflorus*	12.8	13				E	L
Sulfur flower buckwheat	*Eriogonum umbellatum*	8-10	8				L	H
Sweetvetch, northern	*Hedysarum boreale*	25.0	12				F	H
Sweetvetch, silver	*Hedysarum boreale*	24.0	12				G	M
Yarrow*	*Achillea millefolium*	0.5	8				E	L

[1]Bloom periods: early (April, May, June), middle (July, August), and late (September, October)
[2]Availability: E - Excellent, G - Good, F - Fair, L - Low
[3]Relative cost: H – High, M - Medium, L - Low
[4]Goldenrods have a reputation of being weedy due to their rhizomatous growth. However, in stable rangeland environments they seldom achieve problematic densities.
[5]Livestock poisoning and birth defects can result from the consumption of lupines.
[6]Milkweeds may be toxic to horses and livestock if consumed at 0.2% to 2% of an animals body weight. Toxicity of milkweed species ranges from relatively nontoxic to highly toxic.
*Species that consistently establish well in Montana based on Plant Materials studies and field plantings.

Table 7. Pollinator-friendly introduced forb and legume species and their bloom periods.

Common Name	Scientific Name	Full Rate PLS lb/ac	Minimum Precip (inch)	Bloom Period			Availability[2]	Relative Cost[3]
Introduced Forb and Legume Species				**Early**	**Middle**	**Late**		
Alfalfa	*Medicago sativa*	5	10				E	L
Birdsfoot trefoil	*Lotus corniculatus*	3	15				E	L
Buckwheat[4]	*Fagopyrum esculentum or sagittatum*	40 - 50	13				E	L
Camelina	*Camelina sativa*	3 - 5	13				E	L
Canola	*Brassica napus*	5 - 8	13				E	L
Cicer milkvetch	*Astragalus cicer*	8	14				E	L
Clover, Alsike	*Trifolium hybridum*	1.5	16				E	L
Clover, red	*Trifolium pretense*	4	14				E	L
Clover, strawberry	*Trifolium fragarium*	4	17				E	L
Clover, white	*Trifolium repens*	4	14				E	L
Flax, blue	*Linum perenne*	4	10				E	L
Flax, common	*Linum usitatissimum*	20 - 30	8				E	L
Mustard, yellow	*Brassica* spp.	8 - 14	13				E	L
Phacelia	*Phacelia tanacetifolia*	4	10				E	L
Rapeseed	*Brassica napus*	2 - 3	13				E	L
Safflower	*Carthamus tinctorius*	15 - 30	12				E	L
Sainfoin	*Onobrychis viciafolia*	21	12				E	L
Small burnet	*Sanguisorba minor*	15	14				E	L
Sunflower	*Helianthus annuus*	2 - 3	12				E	L
Sweet clover, white[5]	*Melilotus alba*	4	9				E	L
Sweet clover, yellow[5]	*Melilotus officincalis*	4	9				E	L
Vetch[6]	*Vicia* spp.	25 - 30	12				E	L

[1]Bloom periods: early (April, May, June), middle (July, August), and late (September, October)
[2]Availability: E - Excellent, G - Good, F - Fair, L - Low
[3]Relative cost: H - High, M - Medium, L - Low
[4] NRCS does not recommend planting buckwheat in areas of rotation with or adjacent to wheat production within two calendar years of wheat planting.
[5]NRCS recognizes that sweet clover (*Melilotus* spp.) is an important species for honey bee forage. However, due to concerns about invasiveness and potential poisoning of livestock and wildlife especially when hayed, NRCS should limit the recommendation.
[6]Montana NRCS does not recommend hairy, common, or other vetches as a component in any pollinator or cover crop mix in areas in rotation with or adjacent to lentil production within two growing seasons after planting lentils or other pulse crops because of the potential to contaminate the lentil crop. Montana NRCS will also not recommend vetch in conservation plantings that will be grazed.

Table 8. Commonly used pollinator-friendly native and introduced grass species. See Plant Materials Technical Note MT-46 for additional species.

Common Name	Scientific Name	Full Rate PLS lb/ac	Minimum Precip (inch)	Preferred Selection	Availability[1]	Relative Cost[2]
Native Grasses						
Bluegrass, big	*Poa secunda*	2.0	10	Sherman	E	L
Bluestem, big	*Andropogon gerardii*	8.0	12	Bison, Bonilla, Champ	G	L - M
Bluestem, little	*Schizachyrium scoparium*	4.0	12	Badlands, Blaze	E	L - M
Fescue, Idaho	*Festuca idahoensis*	2.5	12	Joseph, Nezpurs, Winchester	G	L - M
Indian ricegrass	*Achnatherum hymenoides*	5.0	8	Rimrock, Nezpar	E	L
Needlegrass, green	*Nassella viridula*	6.0	12	Lodorm, Cucharas	E	L
Sideoats grama	*Bouteloua curtipendula*	6.0	10	Killdeer, Pierre, Butte	G	L - M
Switchgrass	*Panicum virgatum*	3.0	12	Dacotah, Forestburg, Sunburst	E	L
Wheatgrass, bluebunch	*Pseudoroegenaria spicata*	7.0	10	Goldar, Anatone, P7	E	L
Wheatgrass, slender	*Elymus trachycaulus*	7.0	10	Copperhead, Pryor	E	L
Wheatgrass, Snake River	*Elymus wawawaiensis*	7.0	8	Secar	G	L
Wheatgrass, thickspike	*Elymus lanceolatus*	7.0	7	Bannock, Critana	E	L
Wheatgrass, western	*Pascopyrum smithii*	10.0	10	Rosana, Rodan	E	L
Wildrye, basin	*Leymus cinereus*	7.0	8	Trailhead, Washoe	E	L
Introduced Grasses						
Fescue, hard	*Festuca*	2.0	12	Durar	G	L - M
Fescue, sheep	*Festuca ovina*	2.0	10	Covar	G	L - M
Wheatgrass, intermediate	*Thinopyrum intermedium*	10.0	12	Oahe, Manifest, Rush, Reliant	E	L
Wheatgrass, pubescent	*Thinopyrum intermedium*	10.0	11	Luna, Manska	E	L
Wildrye, Russian	*Psathrostachys juncea*	6.0	8	Bozoisky, Mankota, Swift	G	L - M
Wheatgrass, tall	*Thinopyrum ponticum*	10.0	10	Alkar, Jose, Largo, Orbit	E	L

[1]Availability: E-Excellent, G-Good, F-Fair, L-Low
[2]Relative cost: H-High, M-Medium, L-Low

References

Dolan, A., C. Delphia, and L. Kerzicnik. 2016. Bumble bees in Montana. Montana State University MontGuide MT201611AG. Bozeman, MT. 4 p.

FSA Handbook – Agricultural Resource Conservation Program, 2-CRP (Rev. 5).

Lee-Mader, E., J Hopwood, L. Morandin, M. Vaughan, and S. H. Black. 2014. Farming with Native Beneficial Insects: Ecological Pest Control Solutions. Storey Publishing, North Adams, MA.

Mader, E., M. Shephard, M. Vaughan, S.H. Black, and G. LeBuhn. 2011. Attracting Native Pollinators: Protecting North America's Bees and Butterflies. Storey Publishing, North Adams, MA.

NRCS. 2015. Using 2014 Farm Bill Programs for Pollinator Conservation. Technical Note No. 78, 3rd Edition.

NRCS. 2005. Native Pollinators. Fish and Wildlife Habitat Management Leaflet, Number 34. USDA, Natural Resources Conservation Service, Washington, DC. 10 p.

Oregon State University. 2006. How to Reduce Bee Poisoning from Pesticides. Pacific Northwest Extension Publication, PNW 591.

Pollinator Health Task Force. 2015. National Strategy to Promote the Health of Honey Bees and other Pollinators. The White House, Washington, DC. 64 p.

Smart, M. and C. Otto. 2018. Progress report of honey bee forage and USDA conservation land monitoring conducted by USGS Northern Prairie Wildlife Research Center under Interagency Agreements 17IAMRECRPHB1 and 673A7514178. 21 p.

CONSERVATION RESERVE PROGRAM (CRP) POLLINATOR HABITAT GUIDELINES (CP42) FY 2019[1]

Farm Service Agency (FSA) has received an approved *"Alternate Standard for species diversity"* for CRP Pollinator Habitat Conservation Practice (CP42) to be implemented in arid areas of Montana. The *"Alternative Standard"* pollinator plantings, requires at a minimum, at least one (1) native bunchgrass, at least three (3) forb, legume, and/or shrub species, with at least one flowering in each of the three bloom periods, and that selected species be adapted to the site. Species are to be selected from the species tables above and consider the following:

1. The practices eligible for CP42 are, CP1, CP2, CP3A and CP42.
2. Enrollment in CP42 is limited to a maximum of 100 acres per farm. Conservation Reserve Enhancement Program (CREP) contracts are NOT subject to this limitation.
3. When established on large fields, CP42 should be used with other CRP conservation practices.
4. Large planting blocks are preferred over strips. Block plantings must be a minimum of 0.5 acre in size with maximum acreage set on a per farm basis.
5. When establishing smaller acreages, strip plantings must be a minimum of 20 feet wide and a minimum of 0.5 acre.
6. Each CRP field must have at least a 0.5 acre of CP42 pollinator planting.

General CP42 Practice Requirements:

1. All grass plantings must be native and non-sod forming. Bunchgrasses are preferred as they provide nesting habitat for native bees. Grasses are encouraged, but not required, in seed mixes.
2. Forb, legume and/or shrub species are encouraged to be native, but beneficial introduced flowering plants (e.g., alfalfa and clover) may be part of the mix if:
   - Each introduced species is less than 10% of the PLS seed mix.
   - The total of introduced species does not exceed 20% of the PLS seed mix.
   - Grasses do not exceed 25% of the PLS seed mix.
   - State certified seed shall be used for CP42 where practicable.
   - No trees may be enrolled or seeded/planted into CP42.
3. Woody habitat, such as brush piles and downed tree structures, if included in the CRP plan may be included. Woody habitat should not exceed 1,500 square feet per acre or exceed one acre in total.
4. Soil loss cannot exceed soil loss tolerance levels. Precautions for areas of concentrated flow and areas prone to wind erosion should be taken. In many cases, double seeding the specific area with a grass other than a bunchgrass will be sufficient. Examples of grass species to use for this purpose include western wheatgrass, streambank wheatgrass, or sideoats grama.
5. Noxious weeds and other undesirable plants, insects, and pests shall be controlled to avoid adverse impacts on surrounding land.
6. Periodic maintenance (management activity) **must** be performed to assure that grass litter does not suppress pollinator-friendly plants. Management activities **must** be completed before the end of year six of the CRP-1 contract (2-CRP Par 428).
7. If pollinator-friendly plants are present over the entire CRP field, maintenance can be performed according to policy in Montana Notice CRP-857, the 2-CRP (Rev. 5) Montana Amendment 7, Paragraph 428 and Exhibit 11 for CP42. For fields larger than 80 acres, a

[1] Consult current fiscal year guidance when planning projects.

management activity may be performed on 60% of the acreage in year six and the remaining 40% in year seven of the CRP-1 contract. For 15 year contracts, management activities must be completed by the end of year nine of the CRP-1 contract. The State Technical Committee (2016) approved an allowance for up to a 10% acreage increase in acres to be permitted. In **NO** case should a management activity be performed on 100% of the acres in a single year.

8. If pollinator-friendly plants are established in separate areas (and are less than 80 acres) from the primary seeding area, then maintenance activities may be performed on the entire CP42 acreage if done after the first killing fall frost and prior to April 15.
9. Although Mid-Contract-Management activities are required, they cannot be completed during the established Primary Nesting Season for Montana (May 15–July 15).
10. CP42 **CANNOT** to be harvested or grazed by domestic livestock for the life of the CRP-1 contract (2-CRP Exhibit 11).
11. Appropriate management activities associated with pollinator habitat include: Residue Management (includes: light disking, and harrowing < 4" deep) or Prescribed Burning. Mowing is generally an inadequate means of disturbance for pollinator habitat, except to remove annual weeds during establishment or to facilitate a prescribed burn or light disking.

Example 1. Native seed mixture for pollinator habitat.

Genus	Species	Common Name	Bloom Period	Full Stand PLS lb/ac	% Mixture	Total lb/ac PLS
Achillea	*millefolium*	Yarrow	E - L	0.5	5	0.1
Linum	*lewisii*	Blue flax	E - M	3.5	10	0.4
Ribes	*aureum*	Golden current	E	Hand plant	10	Container
Dalea	*purpurea*	Purple prairie clover	E - L	3.5	10	0.4
Gaillardia	*aristata*	Blanketflower	M - L	6.0	10	0.6
Ratibida	*columnifera*	Prairie coneflower	M - L	2.0	10	0.2
Liatris	*punctata*	Dotted blazing star	M - L	7.5	10	0.8
Helianthus	*maximiliani*	Maximilian sunflower	M - L	4.0	10	0.4
Achnatherum	*hymenoides*	Indian ricegrass	--	5.0	25	1.3

HONEY BEE POLLINATOR INITIATIVE (HBPI) EQIP GUIDELINES FY 2019[2]

USDA and NRCS are increasing efforts to support honey bee health. The HBPI will provide floral forage habitats that directly benefit hive nutritional health as part of an overall effort to increase the health of the honey bee. The plant species provided in the MT-2017 Honey Bee Fact Sheet provide recommended species for honey bee forage. Emphasis is on identifying species to promote honey bee forage for resident honey bees and for migratory beekeepers who summer bees in this part of the country from June through September.

HBPI Guidance is as follows:

- NRCS staff should consider site-specific requirements, compatibility with other species, the ability for these species to address primary resource concerns, potential for weediness, and toxicity concerns when making species recommendations with landowners.
- Eligible areas must be located within a one mile radius of a registered apiary or a sufficiently documented apiary. An apiary is defined as five or more hives.
- An HBPI contract must have at least one CORE practice scheduled. Supporting practices may be installed where needed to meet the identified resource concern. Review the most recent bulletin for the practice list.
- All seedings and plantings must meet the minimum width requirements indicated in the HBP Screening Criteria Worksheet.
- The seed mix cannot exceed 50% grasses. Forbs will be planted at twice the normal seeding rate.
- All species must be listed in the Plant Materials Technical Note MT-46, Biology Technical Note MT-20, or the Honey Bee Fact Sheet. If a desired species is not on these lists, a waiver must be requested from the State Resource Conservationist.
- Grazing cannot occur on planted sites until after the end of the late bloom period. If haying, a minimum of 50% of contracted acres must follow the “delayed haying” scenario. A minimum stubble height of six inches is required if haying is planned.
- Monitoring is offered under the HBPI. If ranking points were received, then the participant must monitor throughout the blooming periods in two week intervals (refer to Montana NRCS Honey Bee Habitat Effort Monitoring Protocol). The participant must provide the completed forms to NRCS on an ongoing basis. This data will be collected and used to design better planting mixes and provide essential information to the landowner to use in lessening the effects of pesticide application and drift. Monitoring data is required when certifying this practice for payment.

[2] Consult current fiscal year guidance when planning projects.