

Promoting Pollinators On Your Place

A Wyoming Guide

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Promoting Pollinators on Your Place: A Wyoming Guide

by Scott Schell, Jennifer Thompson, Jeff Edwards, Jacelyn Downey, Justina Russell
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POLLINATORS IN WYOMING

Wyoming is a state of vast vistas. Far-reaching stretches of short-grass prairie, rocky badlands, sagebrush steppe, mountain foothills, and alpine meadows greet our eyes while traveling the state and gladden many hearts. Miraculous as these majestic sights are, one would miss many equally amazing experiences if you ignored the miniature in our landscapes. While taking a hike, repairing fences, weeding the garden or doing other daily tasks, some time taking a closer look will repay your attention manifold.

First, look around for flowers in these landscapes – the bold and beautiful that strike the eye immediately or the miniature jewels that take some more concentrated looking to locate. There are usually flowers to be found unless deep in drought or outside the growing season:

The bright blossoms of yellow prairie coneflower scattered about the grass-dominated prairies, and the spectacular blossoms of blazing star springing to life on our roadsides. Up higher and drier on the windswept, knobby tops of rocky hills, you can find the star-like white flowers of prickly sandworts or other jewel-toned, cushiony flowers hugging the ground. Or consider the paintbrush and sego lilies dotting sage-covered hillsides on the way up to open parks where you will find bright blue or purple lupines and penstemons flowering exuberantly amongst tall stands of

Got older eyes?

Most pollinators are on the move – now you see them, now you don't! Others are pretty darn small. This can make identification even more challenging for those of us with older eyes (Pass me my reading glasses someone!).

Don't let this get in your way. Catching the critters in a jar or other container is one way to get up close. Another way (possibly with less effort) is to use a camera! Go outside, get by some flowering plants and start clicking away! A point-and-shoot or phone/tablet camera with good macro capabilities will allow you to examine those insects at your leisure and as up-close as the resolution will allow. You will get lots of blurry images! Just take lots of pics and throw away the lousy ones. Your eyes will indeed be opened to the amazing life that is going on out in your backyard, rangeland, crop land, or meadow. You'll be "seeing" better than ever!

pine or spruce. Closer to home, those purple or yellow flowers bedecking the mustardy weeds you haven't gotten around to pulling next to the garden.

Now take another minute or two to take a closer look at the animals pollinating them. Often, the insects that pollinate the flowers on Wyoming's varied environments are just as beautiful as the blossoms. For example, in early spring at lower altitudes, the many brightly marked bumble bee (*Bombus*) species will be out and about busy visiting early blooming plants such as pasqueflower and currant bushes. Bumble bees are ubiquitous pollinators and continually visit many of Wyoming's flowers through the summer and into the fall, ending with the late-season blossoms of rabbitbrush and asters. In May and June, Wyoming's vast rolling hills of sagebrush, normally a gray-green color, will have large splashes of bright yellow and purple when the balsamroot and lupine flowers are in full bloom. A close examination will often reveal the beautiful metallic blue-black mason bees (*Osmia* spp.) amongst many other insect species busy gathering pollen and sipping nectar. The beautiful, delicate yellow flowers of plains prickly pear cacti will attract the equally beautiful metallic emerald green sweat bees (Halictidae).

Occasional moisture-rich spring weather will cover the prairies for a short time with the translucent white-flowered prairie primrose, a favored plant of the white-lined sphinx moths (Sphingidae). When the scarlet globe mallow flowers open in mid-summer, the many digger bee species will be ready to collect pollen. The nesting activity of bees in their family, Andrenidae, can attract your attention away from the flowers to barren, hard-packed, patches of earth. Some female digger bee species prefer that habitat for industriously excavating tunnels and chambers in which their offspring develop. The larvae feed on the harvested pollen, pupate, and then await the next flowering season underground.

Flowering reaches its peak in the alpine meadows at the height of summer. Many species of the aptly named flower flies (Syrphidae), along with many other insects, will be ready to visit the flower species blooming during the short, intense growing season at high altitude. There will also be many moth species present for the “night shift” of pollination services. Night and day, from spring through the fall in Wyoming, close observation reveals pollinators to those who stop to look into the flowers.

SO WHAT ARE THESE CREATURES UP TO?

Understanding a little bit about how pollination occurs will help you understand the complex interactions of these miniature animals and the flowers that support them. Pollination is truly a wondrous thing – it is part of what keeps the cycle of life for plants (and ourselves) in motion. Pollination is the process that many plants use to reproduce – whether our glorious native wildflowers, the trees that clothe our mountains and protect our watersheds, the grass that saves our soil from erosion and feeds

Bee watching

The number and kind of bees you observe will vary through time when bee watching. Studies have shown native bee populations can change monthly (as most solitary species only have one generation per year, their adults active for only three to six weeks before they die) and between years. In these studies, bee populations commonly double or halve between years. So if you don’t see as many of your favorite bees as usual and begin to worry about their decline – wait until next year and see who shows up! Variation in precipitation from year-to-year can have profound effects on bee’s food supply!

and shelters our wildlife and livestock, and the vegetables, fruits, herbs, and grains that feed us. Pollination is the process by which pollen (tiny grains often yellowish in color) is moved from a flower’s anthers (male structures) to a plant’s sticky stigma (female part of a flower). Once there, the male gametes combine with the

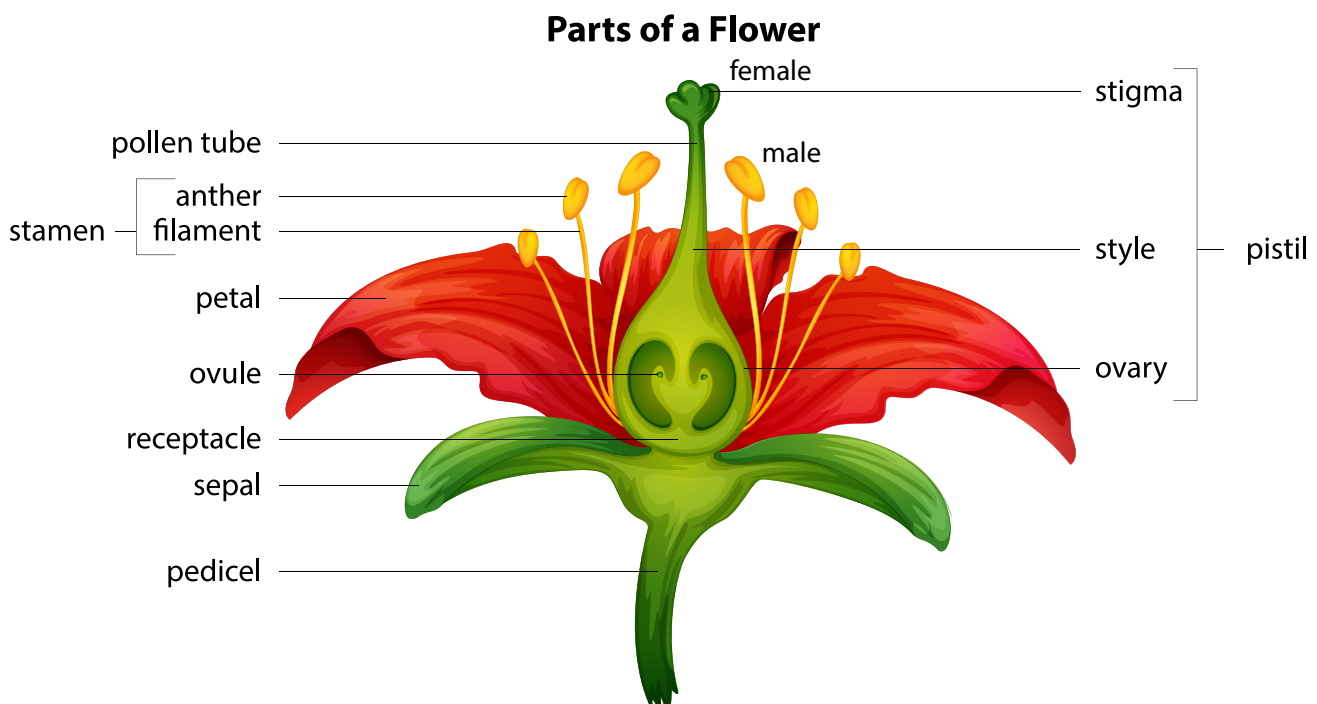


Figure 1. Parts of a flower.
Illustration: Tanya Engel and BlueRingMedia/shutterstock.com

female ovules to ultimately produce one or more seeds (Figure 1).

Pollination can happen via a number of different routes – pollen can be blown by the wind (many trees, sagebrushes, and grasses in Wyoming take advantage of this), moved by the water (some aquatic plants), or get inadvertently transported by an animal visiting a flower. Some flowers pollinate themselves, or can set seed without any pollination (e.g., dandelion).

We will focus on insects and birds (hummingbirds) in Wyoming that act as pollinators. Any animal visiting a plant flower is generally looking for food, either protein (pollen) or carbohydrate (nectar), and sometimes shelter, a mate, or even prey. Plants provide pollen and nectar “rewards,” in part, as a way to attract pollen carriers to their flowers. Pollination is not usually an intentional act but appears to be a secondary result of moving pollen within the same flower or carrying pollen from one flower to another while the visitor forages for food. Efficient insect pollinators generally have hairy bodies – examples include bees, moths, and some butterflies and flies. Pollen easily “sticks” (generally via electrostatic charge or oily coatings) to the body hairs and is moved from place to place.



Pollen sticks to the hairs of this bumble bee visiting a purple poppy flower.
Photo: Jennifer Thompson

INSECT POLLINATORS

Bees

Bees are the most important pollinators in Wyoming. The Superfamily Apoidea, in the Order Hymenoptera, is the scientific category for all bees. There are approximately 4,000 species of native bees in North America. There are known to be 43 different genera and an estimated 800 species of bees in Wyoming. Almost all of the bee species depend on pollen they gather (often mixed with nectar) to feed their larvae. The exceptions are the cuckoo bees and a few other behaviorally similar species, which sneak into other bee species' nests where they lay their eggs. Their larvae eventually kill the host larva and eat its provision of pollen and nectar. The majority of bee species have bodies covered with branched hairs with a static charge that is thought to help them efficiently gather pollen from the flowers they visit. Flower nectar is also used by the adult bees for food energy.

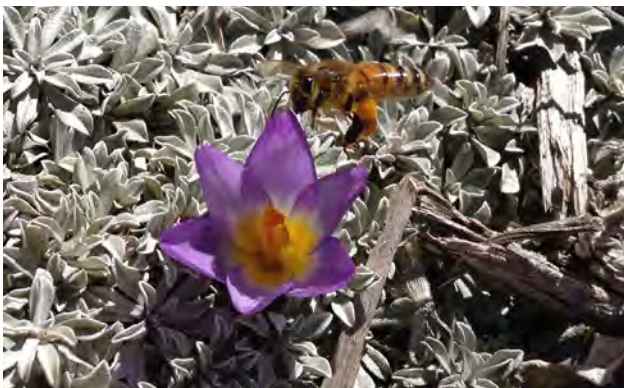
Bees can be grouped by the substrate in which they nest. Some nest in pre-existing cavities, such as the tunnels left in deadwood by wood-boring beetles. Others hollow out pithy centers of plant stems such as sumac. Bumble bees build nests in abandoned rodent nests or in hollows aboveground or in grass tussocks; however, the majority of bee species in Wyoming nest underground.

Bees are often categorized by how social they are – on a continuum of sociality that ranges from completely solitary to very social. If they are solitary bees, the female bee creates and provisions a nest herself. If social (such as honey bees and bumble bees), bees work together to create and provision a nest and do a variety of other tasks. Some sweat bees represent intermediate steps between fully solitary and fully social. Most bee species in Wyoming are solitary ground nesters. (Though these nests may be grouped together in one area as aggregations.)

There's a lot we don't know about native bees in Wyoming! However, due to the amount of interest and funding that has been going into this area, we are gaining knowledge at light speed (perhaps not about native bees in Wyoming, but bees in general). In our region – along with some folks at the University of Wyoming who are looking into various bee topics – there is a very active bee research group with the USDA-Agricultural Research Service in Logan, Utah, one of whom started his bee research at the University of Wyoming. As is the nature of science, a really clear picture will take awhile to emerge on a variety of issues involving bees.



Honey bee on native buckwheat flowers.
Photo: J. Thompson

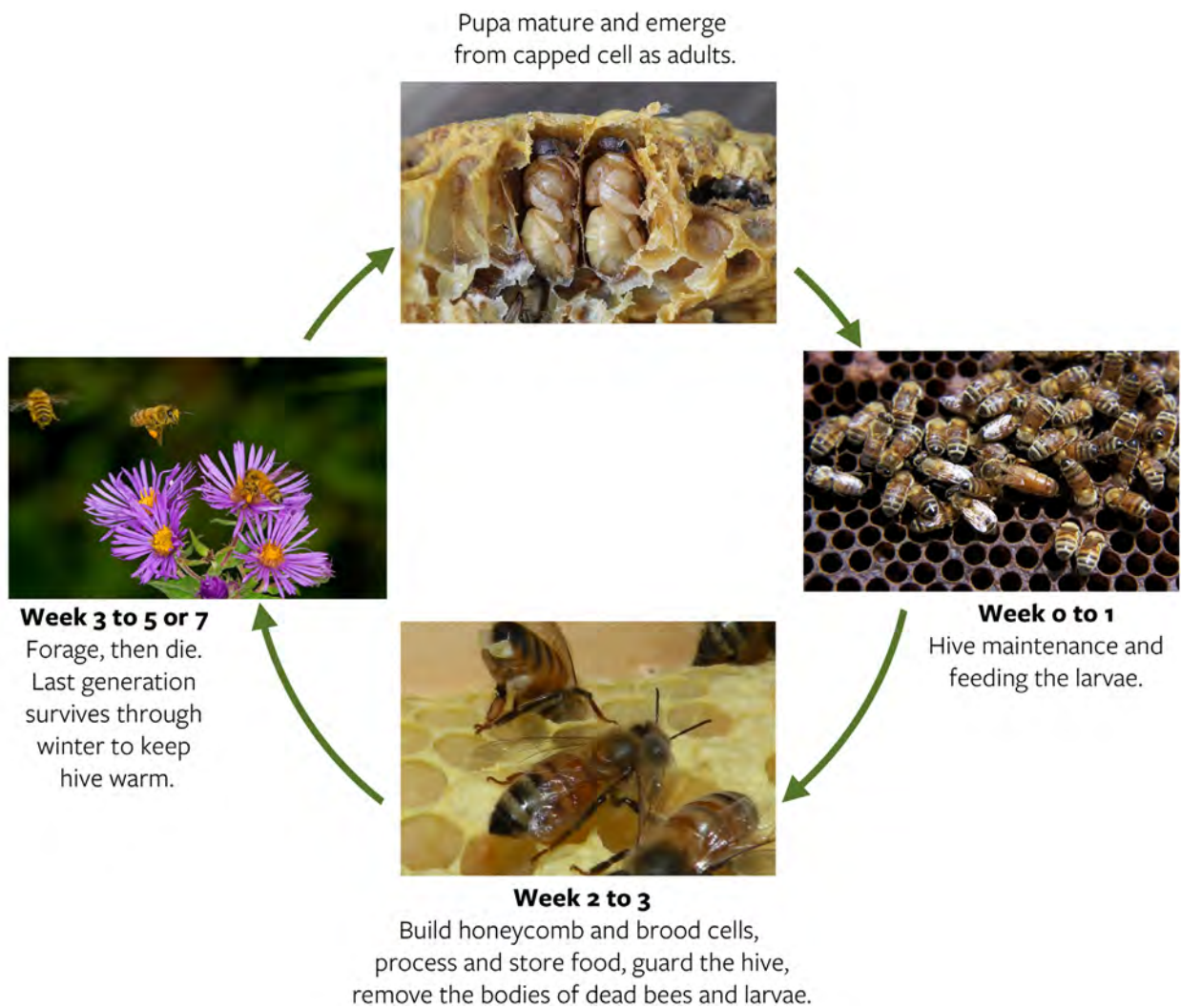


Honey bee making the rounds on early spring crocus flowers.
Photo: J. Thompson

European honey bee – *Apis mellifera*

European honey bees are most easily recognized by their golden brown coloration, hairy bodies, elbowed antennae, and method of transporting pollen as moistened pellets on their hind legs. These bees are highly visible, highly social, and very well known. European honey bees are not native to North America and are one of the two bee species most recognizable and important to agriculture in Wyoming (the other being the alfalfa leafcutter bee). These bees live in colonies (in hives) managed by humans to help pollinate agricultural crops and produce honey. The colonies consist of thousands of sterile, unmated workers and one fertile queen bee. Honey bee workers can fly up to 2 miles from their hives foraging for food. They collect pollen onto structures on their hind legs called corbiculae, or “baskets.” The pollen is brought back to the hive as food for the developing brood (rest of the colony).

Nectar is imbibed and later regurgitated in the hive, where it is fed to the colony or converted to honey and stored. Surplus honey is harvested by bee keepers. These bees (the non-Africanized types) are not aggressive but may sting when provoked. A good rule of thumb around honey bees is to let them do their job. If you do not mess with them, they will not mess with you. (See section “Beekeeping in Wyoming” for more information on honey bees and beekeeping, page 46.)



Adult honey bee stages

Photo: Clockwise: Whitney Cranshaw, Colorado State University; Carl Dennis, Auburn University; Jessica Louque, Smithers Viscient; David Cappert. Courtesy bugwood.org.

HONEY BEE LIFE CYCLE

- The duration of the egg, larval, and pupation into adult worker honey bee is usually between 18 to 24 days.
- An adult worker bee starts out performing hive maintenance and feeding the larvae the first week.
- After two weeks, the worker bee then starts building honeycomb and brood cells by secreting beeswax and shaping into hexagonal cells. They also receive the food from foraging worker bees for processing and storage, guard the hive, and remove the bodies of dead bees and larvae from the hive.
- At three weeks, worker bees enter the last phase of their lives as foragers to gather the food stores needed to keep the colony alive during the winter. The worker bees produced in the spring and early summer die before they are 8 weeks old.
- The worker bees produced at the end of the summer live the longest. They will spend the winter eating honey and shivering to create enough body heat to keep the queen bee at a temperature at, ideally, over 94 F.

Bumble bee – Apidae

Bumble bees can be quite large and hairy and considered “robust.” Queens in particular are easily recognized by their size and shape but also by the yellow, black, and sometimes orangey-red coloration. These native bees are very common and very important pollinators of flowers that have deep nectaries (plant structures where nectar is produced) – because they often have very long tongues. Over 20 species of bumble bees are in Wyoming. They are well-adapted to our often harsh climate and are able to pollinate flowers of hardy native plants in climatic extremes (cold and wind) in which the European honey bee cannot function. Bumble bees are capable of flying to gather pollen on days when the air temperature is well below 50 degrees. Honey bee workers can’t leave their hive and stay aloft when air temperatures are that cold.

Most bumble bees nest in the ground in a colony founded in the early spring by one queen. These colonies are far smaller than honey bee colonies (a couple dozen to a couple hundred workers depending on species, versus the thousands in honey bee colonies). These nests can be in places such as abandoned rodent burrows or under bunch grasses. Pollen and nectar are stored in saclike “honey pots.” In the spring/early summer, very large queen bumble bees may be seen flying around, collecting pollen and nectar from a wide variety of flowers for her first brood. Once these much smaller (because of limited food supplies) female worker bees emerge, the queen will stay in the nest. The next generation(s) of workers are usually larger than the first generation, due to the increased food supply provided by more workers. Toward the end of the season, the colony produces new queens and male bumble bees. All of the colony dies off at the end of the year except for new mated queens. These queens will hibernate over winter a few inches underground in a hibernacula the bee has excavated or under layers of mulch or leaf litter, and emerge the next spring to found new

colonies. As with honey bees, these bees are not aggressive but may sting when provoked or their nests disturbed.



The bumble bee *Bombus huntii* pollinating pasque flowers on a chilly day in late April.

Photo: Scott Schell



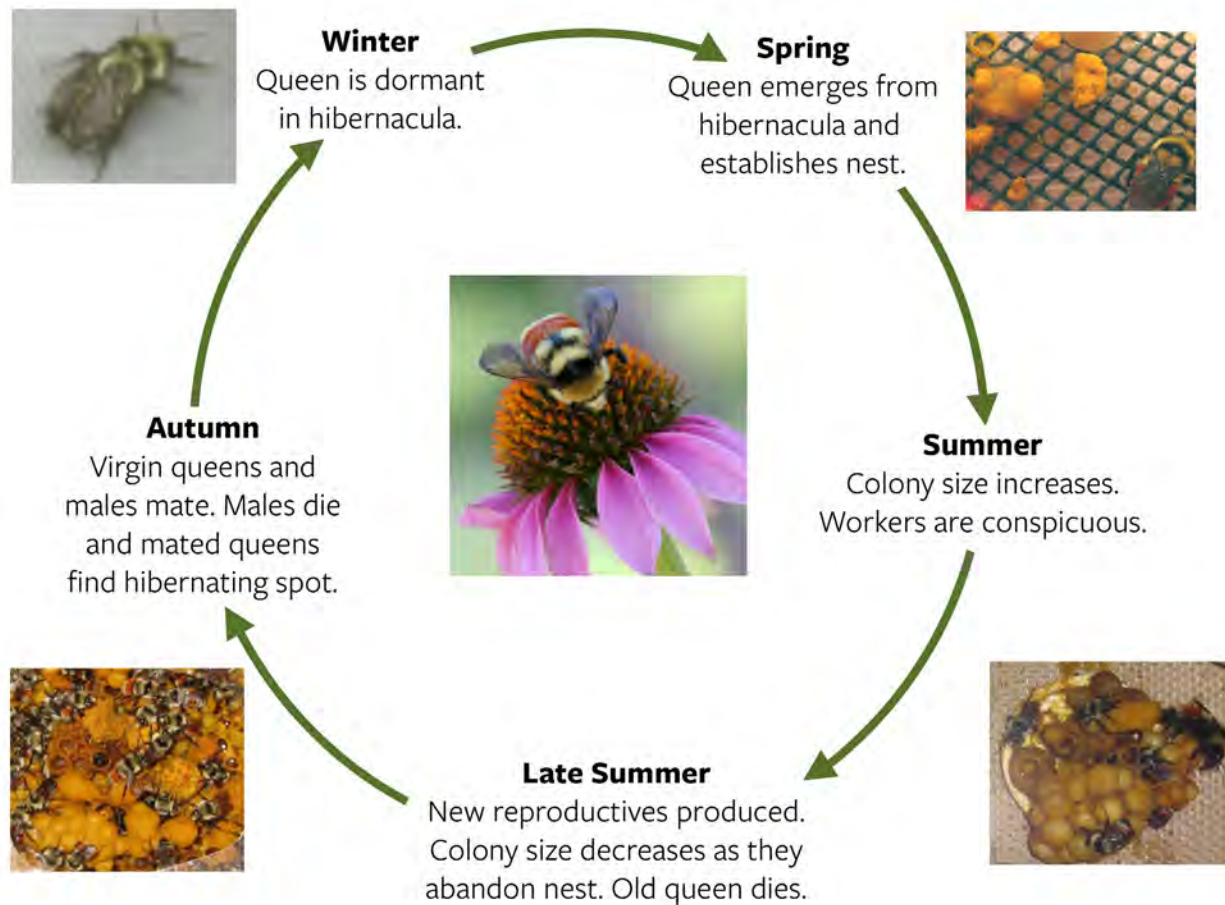
Bumble bee leaving a crocus flower.

Photo: J. Thompson



Bumble bees working on a nest.

Photo: Krasowit/shutterstock.com



The life cycle of *B. huntii*
James Strange, USDA-ARS

BUMBLE BEE LIFE CYCLE

- The young queen bumble bee emerges from her winter hibernacula (a small cavity usually excavated in the soil) in the early spring and feeds on flower nectar and searches for a suitable nest site to rear her brood.
- Once a suitable site for a nest is found, the queen makes a wax honey pot to hold nectar (food collected for herself) while she raises her first daughters. The queen actually incubates her eggs by bringing her hairless abdomen into contact with them and shivering to generate body heat. She can maintain their temperature between 75 and 93 F while the air temperatures around her in the nest are as low as 37 F. The eggs will hatch on top of a ball of pollen the queen gathered to feed her first brood of larvae.
- Once the first daughters are adults, they start to forage on flowers to gather more pollen and some nectar and assist their mother in rearing more offspring. In the late summer, new queens and male bumble bees are reared. The now old queen and worker daughters eventually die.
- The males leave the nest to mate with the new queens in the area and then die off, too. The new queens forage on late-season flowers to build up body fat and search for a suitable place to dig a hibernacula.

Leafcutter bee – Megachilidae

The family that includes leafcutter bees and mason bees in Wyoming is represented by natives plus several non-native bees. The alfalfa leafcutter bee (*Megachile rotundata*), which is native to Europe, is a highly efficient and specialized pollinator of alfalfa and is used in the state to produce alfalfa seed. Farmers provide large open-faced plywood nesting shelters in their fields for alfalfa leafcutter bees. Leafcutter bees are fairly stout-bodied bees. The females use a brush of pollen-collecting hairs beneath their abdomens called the scopa to transport dry pollen back to their nests (so they often can be identified in part by their golden yellow tummies). They are solitary bees (each female has her own nest tunnel) but may tolerate grouping their nests together in a common area, like a village, in tunnels left by beetles in dry wood, in the pithy stems of plants like roses, or occasionally in the soil. Many leafcutter bees cut out pieces of leaves (from plants such as lilac, serviceberry, redbud, and rose) or occasionally from petals to line, partition, and cap their nest tunnels. Removal of tissue from these plants (leaving distinctive, uniformly sized circular or oblong holes) usually does not seriously harm the plants. At the nest, loads of collected pollen is mixed with nectar and formed into a pasty loaf. A large egg is laid onto the pollen provision and the chamber sealed with more leaf disks. This process is repeated until the space is filled.

The white grub-like larvae hatch from the eggs and feed on the pollen mass. Larvae grow rapidly through several moults. Within two weeks, the provision is consumed and the larvae spin a silken cocoon in which they will pass the winter as a post-feeding larva. The next growing season, they pupate, then emerge as adults, the bees in the outer cells (males) emerging before the inner females. This order can be arranged because female bees can control fertilization of each egg; unfertilized eggs result in males. Males emerge first to wait for the females to come out and mate. Adult female leafcutter bees live up to five or six weeks.



Leafcutter bee
Photo: Jeff Edwards



Holes cut out of California poppy flower petals by leafcutter bees.

Photo: J. Edwards



This bee board provided by farmers is full of holes leafcutter bees use as nests.

Photo: P. Fulton, Fulton Farms



Leafcutter bee taking a piece of leaf down into its nest in the ground between flagstones in a garden path. Note the golden pollen on scopa beneath abdomen.

Photo: J. Thompson



Aggregation of digger bee nests.
Photo: Howard Ensign Evans, Colorado State University, Bugwood.org



Sweat bee, *Halictus rubicundus*, in an early species tulip.
Photo: J. Thompson

Solitary, ground-nesting bees (sweat bees, long-horned bees, mining bees, digger bees, and others)

Most native bees in Wyoming are solitary ground nesters. These bees excavate their nests in the ground. Often, these nests consist of a tunnel with cells that branch off of it. The bee places a pollen mass in the cell, lays one egg on or near it, and then seals off the cell. There can be one cell in the nest or many depending on the species of bee. Many of these bees spend most of their lives underground, emerging as adults to spend the next three to five weeks creating and stocking their own nests before dying.



Sweat bee on 'Purple Dome' aster flower in fall.
Photo: J. Thompson

Sweat bee – Halictidae

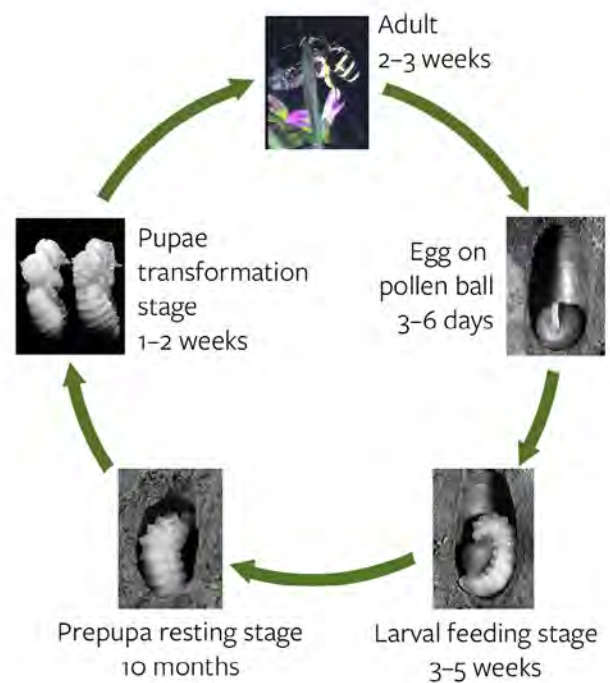
Halictids are small- to medium-sized bees. Some are brightly metallic in appearance, others are fairly plain. There are nearly 500 species in North America, and they are usually the most abundant bees in Wyoming. Socially, they range from solitary (though they may group their nests together in one area) to primitively social behavior. Most nest in burrows in the ground that terminate in a single cell. These bees play a critical role in plant pollination. Some members of this group are attracted to people perspiring and are known as sweat bees. These bees are not aggressive but may sting when provoked.



Sweat bee on bachelor button (cornflower).
Photo: J. Edwards



Life cycle of the alkali bee (*Nomia melanderi* Cockerell)
Illustration: Art Cushman, USDA Systematics Entomology Laboratory,
Bugwood.org



Life cycle of a solitary ground nesting bee.
James Cane, USDA-ARS

AN EXAMPLE OF SOLITARY GROUND NESTING BEE LIFE CYCLE

The alkali bee life cycle is an example of one of many ground nesting, solitary bee species.

- Male and female alkali bees spend the winter underground and pupate in individual brood cells that their mother dug and provisioned the previous summer.
- Rising soil temperatures and moisture levels trigger the emergence of the adult alkali bees, which should occur at the same time as the flowering of suitable food plants, usually starting in June.
- The female bees will forage as far as 5 miles from the moist, bare, salty soil that is critical habitat for their brood rearing tunnels. The males mate with females as they excavate their tunnels and only forage for nectar for food for themselves.
- Once the main tunnel is dug to an acceptable depth, the female excavates a brood cell and lines it with a water-resistant oral secretion. She then provisions it with a ball of pollen, deposits an egg, and seals the chamber off from the main tunnel. She does this, ideally, at the rate of one a day when abundant flowers are just a short flight away. Although she works by herself on her nest tunnels, many other alkali bee nests will be crowded into the same preferred soil habitat.

With an estimated 800 species of bees in Wyoming, many of which can look pretty similar to each other, it can be difficult to identify many bees. The Wyoming Natural Diversity Database, University of Wyoming Department of Zoology and Physiology, and UW Biodiversity Institute are working on an identification guide to Wyoming bees. When complete, the guide will be available through the UW Biodiversity Institute's Shop webpage at <http://bit.ly/biodiversity-shop>

Thank you to Christine Bell, graduate student at the University of Wyoming, for her expert bee identification and other native bee knowledge.



Mining bee on a fernbush flower.
Photo: J. Thompson



Female long-horned bee on a Mexican hat flower. Note the large amount of pollen on the lower leg.
Photo: J. Thompson



Mining bee on a sunflower. Note the pollen carried on the upper leg.
Photo: J. Thompson



Male long-horned bee on a sunflower.
Photo: J. Thompson



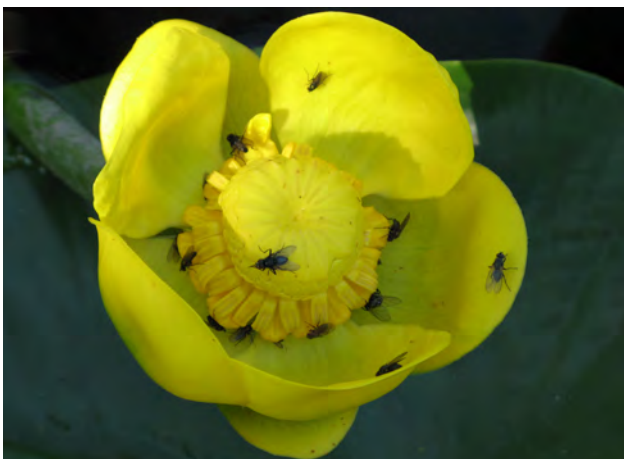
This male wool carder (*Anthidium manicatum*) bee vigorously defends his territory around some hens and chicks flowers.
Photo: J. Thompson

Other Non-native Bees

Several non-native bees (such as the honey bee and some leafcutter bees) have been imported into the U.S. and managed for purposes beneficial to human beings. Other non-native bees are accidentally introduced and can be problematic, and some are hard to distinguish from their native relatives. One of these is a non-native wool carder bee (*Anthidium manicatum*) from Europe (there are native wool carder bees, named for the characteristic way in which they collect plant fibers for their nests), which is highly territorial and will defend its territory from other native bees.

FLIES

Flies, the Order Diptera, are insects often viewed negatively because of a few abundant pest species that plague people. However, over 17,000 species of flies are found in North America, and most are innocuous or beneficial to humans. Many fly species are effective pollinators. Aptly named flower flies (family Syrphidae), bee flies (family Bombyliidae), and species from several other fly families, visit flowers as adults for nectar meals and get a dusting of pollen in return that they transfer to the next flower they visit. Big round eyes, quite short antennae, and two wings (rather than four) distinguish flies from bees or wasps.



This yellow pondlily has a scent that is very attractive to flies that pollinate it.
Photo: S. Schell

Flower fly – Syrphidae

There are approximately 950 species of Syrphid flies or flower flies in North America. Syrphids can be found almost everywhere, but different species occur in different habitats. Adults are often found hovering near flowers. With 950 species, they come in a variety of shapes and sizes. Many are brightly colored and resemble bees and wasps. Syrphids do not bite or sting. Syrphid fly adults visit flowers to feed on nectar and pollen. The larvae of many of these species are predacious and feed on aphids and other small, soft-bodied insects.



Syrphid fly on fernbush flower. Note big eyes and stubby, short antennae.
Photo: J. Thompson



This syrphid's coloring resembles that of a honey bee.
Photo: J. Thompson



A flower fly (Syrphidae), whose coloration mimics a bald-faced hornet, visiting flowers in a Wyoming mountain meadow.
Photo: S. Schell



This flower fly (Syrphidae) that mimics the coloration of a yellowjacket wasp is pollinating a mountain gentian flower.
Photo: Alexandre Vsevolodovitch Latchininsky

Tachnid fly – Tachinidae

Tachnid flies are parasitoids. They lay eggs on other insects. The larvae then hatch out of the egg and consume the insect host. They suppress many insect pests but also attack butterfly caterpillars. The adults can be most readily identified by the many stiff bristles that stick out of their abdomens. The adults visit flowers to drink nectar and can move pollen around as they do.



Tachnid fly visiting an alpine aster in the garden.
Photo: J. Thompson



The black bristles on this fly really stand out against its orange abdomen as it visits catmint flowers.
Photo: J. Thompson

Other fly pollinators



A bee fly (Bombyliidae) is depositing larvae in a soil crack that will seek out and feed on grasshopper egg pods. The proboscis on the adult fly is for nectar feeding on flowers.
Photo: Alexandre Vsevolodovitch Latchininsky



A bottle fly (Calliphoridae) on oregano flowers.
Photo: J. Thompson



A green bottle fly (Calliphoridae) getting a dusting of pollen while seeking nectar.
Photo: A. V. Latchininsky

BUTTERFLIES AND MOTHS

Almost all butterflies and moths, which feed as adults, depend on flower nectar as a source of energy. Caterpillars are the juvenile form of butterflies and moths. Caterpillars eat plant leaves before pupating to become adults. Some species of moths only feed as caterpillars and as adults live off stored body fat to mate and produce eggs.



Caterpillar of monarch butterfly ready to make cocoon on butterfly weed.

Photo: Sue Felix/shutterstock.com

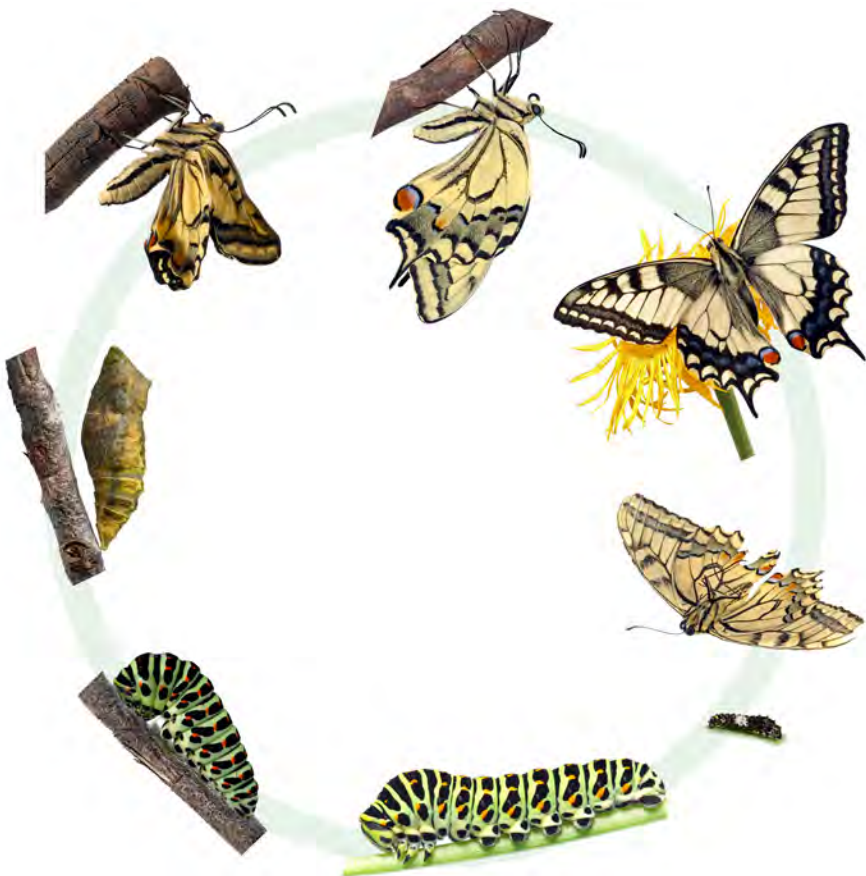
Butterflies

The superfamily Papilionoidea includes almost all of people's favorite colorful species of butterflies. They range from palm-sized swallowtails to dime-sized blues. North America has over 700 species of butterflies. Many butterfly species prefer flat or "umbrella"-shaped flowers and frequently transfer pollen as they walk on top of the flowers. In general, a quick way to determine if an insect is a butterfly (rather than a moth) is the presence of enlarged segments, a knob, at the end of thread-like antennae. All common moths lack knobs on the end of their thread-like or plumose (feathery) antennae.

Moths

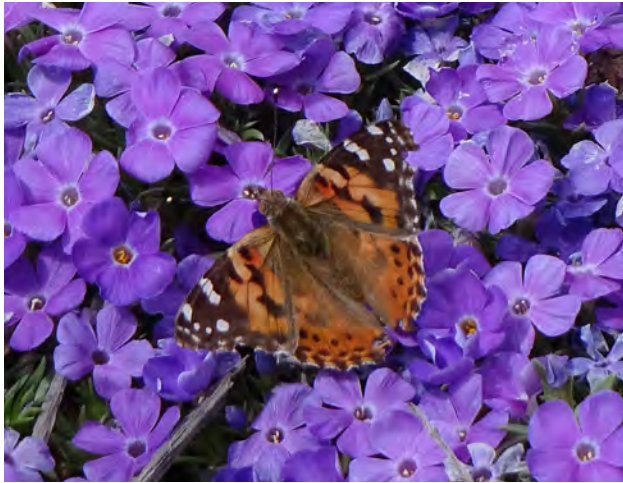
Very diverse and numerous moth species from the Noctuoidea, Geometroidea, Bombycoidea, and Pyraloidea superfamilies are major "night-shift pollinators" that visit flowering plants. Not all flowering plants keep

their flowers open at night to allow for nocturnal pollination; however, some plants, such as Hood's phlox, common starlily, or some evening primrose species, do. The white or light yellow coloring of these flowers help the night-flying insects find them. The handful of noctuid species, commonly called miller moths, are an ubiquitous example of important, native, nocturnal pollinators.



Life cycle of the swallowtail butterfly.

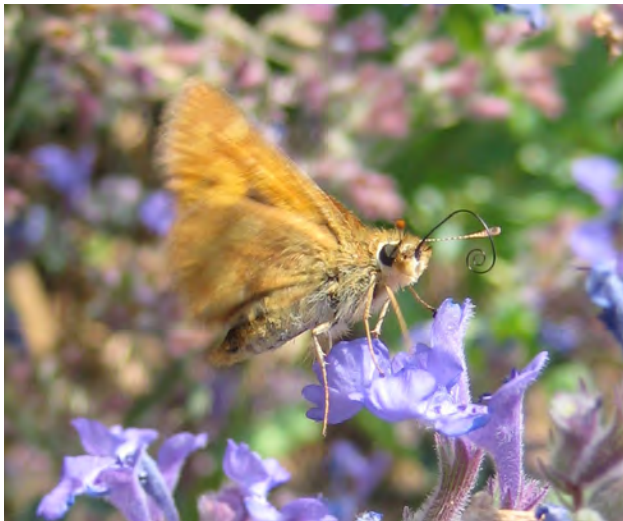
Photo: jps/shutterstock.com



Painted lady butterfly feeding on *Phlox kelseyi* flowers.
Photo: J. Thompson



This swallowtail from the family Papilionidae transfers pollen with its feet and proboscis as it feeds.
Photo: A. V. Latchininsky



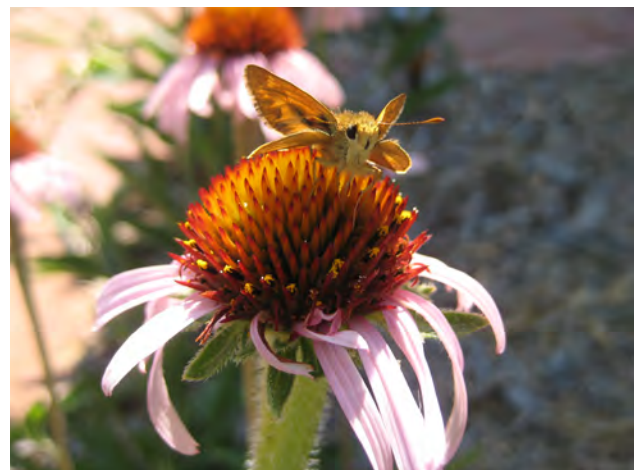
Proboscis on a skipper butterfly is unrolling to feed on catmint flowers.
Photo: J. Thompson



The hairy body on this wood nymph butterfly (Satyridae) collects pollen as it feeds on this flower.
Photo: S. Schell



Cabbage white butterfly. The caterpillars of this non-native butterfly can be a pest on cole crops (broccoli, cauliflower, cabbage and others).
Photo: J. Thompson



Skipper butterfly on narrow-leaved coneflower. Note "knobs" on end of antennae.
Photo: J. Thompson



Hawkmoth visiting a native white-tufted evening primrose (*Oenothera caespitosa*).
Photo: J. Thompson



The plumose (feathery) antennae on this owlet moth help to identify it as a moth, not a butterfly.
Photo: J. Thompson



Miller moth. Note thin antennae without "knobs" on ends.
Photo: alsutsky/shutterstock.com



This blanketflower moth (*Schinia masoni*) has cryptic coloring, which allows it to blend in, hiding from predators. It is found in Colorado and Wyoming.
Photo: Helen Coates

BEETLES

There are beetles, the order Coleoptera, that utilize pollen and flower structures as food. The longhorned flower beetles (Cerambycidae, subfamily Lepturinae) and checkered flower beetles (Cleridae), are two types of beetles regularly found on flowers. They are called “mess-and-soil pollinators” because they often chew on the flower structures.



This checkered flower beetle (Cleridae) has cut off a few anthers on this flower as it was feeding. The beetle's hairy body will carry pollen to the next flower it visits.
Photo: S. Schell

Checkered Flower Beetle (Cleridae)

Some species of checkered flower beetle also use the flowers for their method of reproduction. The female beetles will deposit eggs in flowers. These eggs will stick to the bodies of ground nesting, solitary bee species when they visit the flower. The beetle's egg will be carried back to the bee's nest and hatch. The checkered beetle larvae will then feed on the bee's larvae.

Subfamily Lepturinae (Flower Longhorns)

The flower longhorn beetles are quite diverse in North America with an estimated 200 species in the continental United States. Most flower longhorn beetles have the characteristic very long antennae, a thorax that is broader

at the front and tapers to the rear, giving them a “broad shouldered” appearance. These beetles' thoraxes are often very hairy, which is conducive to transporting pollen. They are usually noticed when they are actively feeding on flowers in daylight. The flower longhorns beetle do physical damage to the flower as they feed but also end up pollinating the undamaged structures of the flowers. The flower longhorns beetle are often associated with plants in the carrot family but are not used intentionally for pollination of cultivated crop plants in this family, such as carrot, parsnips, and parsley.



A longhorned flower beetle (Cerambycidae) feeding on a flower. The thorax on many of these brightly colored species is hairy, which aids in transferring pollen to the next flower they visit.
Photo: S. Schell



A longhorned flower beetle on a curlycup gumweed flower.
Photo: J. Thompson

Tumbling Flower Beetle (Mordellidae)

These beetles have a characteristic wedge-shape and humped-back body. Most are black or mottled grey and covered in very fine short hairs. These beetles are common on composite flower types. They can be quite active when disturbed and usually “tumble” from the flower while attempting to get away. The larvae live in decaying wood, and some of the beetles are predaceous.



Tumbling flower beetle
Photo: KurtG/shutterstock.com

You can view more photos of pollinating insects in Wyoming by visiting <http://bit.ly/wypollinators>

BIRD POLLINATORS – WYOMING HUMMINGBIRDS

Watching hummingbirds' aerial acrobatics or hearing their trilling flight can be enjoyable and rewarding. As they swoop around visiting flowers, these birds are also acting as pollinators. Pollen grains dust the feathers around their faces as they insert their long beaks and tube-like tongues into flowers probing for nectar. The pollen is then transferred to the next flower they visit.

The three most common hummingbirds in Wyoming are the Rufous hummingbird (*Selasphorus rufus*), broad-tailed hummingbird (*Selasphorus platycercus*), and calliope hummingbird (*Stellula calliope*). These species stick around for the summer, consuming nectar from native plants and garden flowers, while other species of hummingbird are migrants passing through our state to distant locations.

Broad-tailed hummingbird *Selasphorus platycercus*

Broad-tailed hummingbirds are common summer residents found from late April through early September. They breed in foothills and mountain ranges throughout Wyoming. They follow the blooming patterns of montane wildflowers, beginning at lower elevations and moving up to higher elevations as summer progresses. The female builds a nest out of lichens, cottonwood seeds, and plant fibers.



Male broad-tailed hummingbird
Photo: Dec Hogan/shutterstock.com

Calliope hummingbird *Stellula calliope*

Calliope hummingbirds are common summer residents found May through September in willow and riparian areas of the northwestern mountain ranges of Wyoming. This is North America's smallest hummingbird. They weigh less than three \$1 bills. Despite its tiny size, it is able to survive at high elevations exposed to extreme cold temperatures at night by entering into a state of torpor, or temporary metabolic shutdown, to conserve energy.



Calliope hummingbird
Photo: Tom Reichner/shutterstock.com

Rufous hummingbird *Selasphorus rufus*

Rufous hummingbirds are common migrants found mid-June through mid-September in all the foothill and mountainous areas of Wyoming. Adult males are extremely territorial and will aggressively defend a feeder from all other hummingbirds. During their long migrations, Rufous hummingbirds make a clockwise circuit of western North America each year. They move up the Pacific Coast in late winter and spring, reaching Washington and British Columbia by May. As early as July, they may start south again, traveling down the chain of the Rocky Mountains.

Black-chinned Hummingbird *Archilochus alexandri*

The Black-chinned hummingbird is a rare summer resident found mostly in southwest



Rufous hummingbird
Photo: Tim Zurowski/shutterstock.com

Wyoming late May through early August in deciduous and juniper woodlands near streams. In courtship, males performs “pendulum” displays, flying back and forth in wide U-shaped arc, making whirring sounds on each dive. They also buzz back and forth in short flights in front of perched females.



Male black-chinned hummingbird
Photo: Melani Wright/shutterstock.com

PROMOTING POLLINATORS ON YOUR PLACE

by Jennifer Thompson, Jacelyn Downey, and Scott Schell



Early summer flowering plants in a residential garden.
Photo: J. Thompson

Based on what you now know about some of the pollinator lifecycles and their habitat requirements, what might you do around your property to encourage these creatures?

PLANTS FOR FOOD

Happily, the interests of pollinators and many humans generally align in one way – we like flowers! Increasing the number and types of flowers available at any one time and throughout the pollinators’ foraging seasons can benefit us both in many ways.

Flowering plants can be planted around homes and yards to increase pleasure in our landscapes. They can be planted near our vegetable and fruit plots to try to increase production and provide homes for beneficial insects – whether small vegetable gardens or bigger specialty crop or farmers market operations (and whether those vegetables are planted in outside plots or under hoop houses with opened sides). They can be planted near or in a few trees or orchards to help support fruit tree pollinators. They also can be planted to help provide resources to help pollinate larger acreages of pumpkins, sunflowers, or raspberries.

Plants in Landscapes – flowers

Increasing flowering plants in landscapes can be a lot of fun! You don’t have to have a “pollinator garden” to encourage pollinators. Many gardeners who love plants already have lots of flowers in their gardens. If this sounds like you, take a look at the existing landscape (by thinking back about what blooms when or by taking pictures once every week or two from early spring to fall one year) and consider if there are times during the growing season when not much is in bloom. If you think – “Yes! There isn’t much going on in early spring or late summer,” start looking for ways to add flowering plants (trees, shrubs, perennials, or annuals) to fill those down times and provide a resource for foraging pollinators.



Spring
Photo: J. Thompson



Summer
Photo: J. Thompson



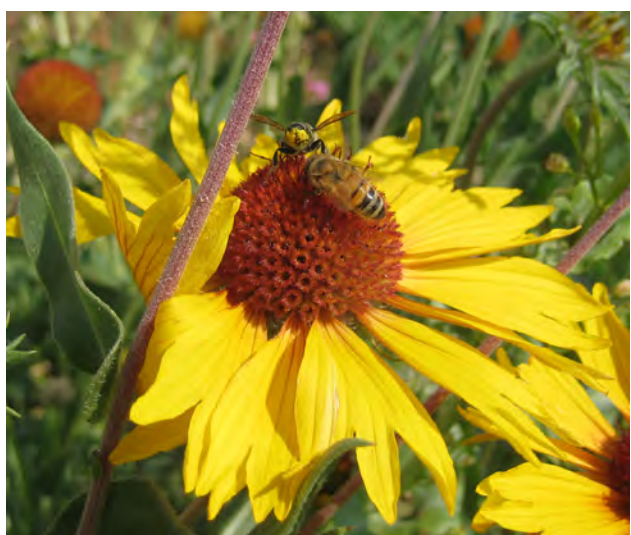
Late summer/fall
Photo: J. Thompson

If starting a garden from scratch, gardeners are often advised to plant three kinds of plants that will bloom in each part of the growing season (spring, summer, late summer/fall).

If there is space and you want to plant large clumps of each kind of flowering plant, go for it. Many bees are particularly “faithful” and



Bumble bees mob 'Autumn Joy' sedum late in the summer.
Photo: J. Thompson



Honey bee and leafcutter bee visiting native plant, blanketflower (*Gaillardia aristata*).
Photo: J. Thompson



Butterflies and a wide array of other pollinators visit non-native 'Walker's Low' catmint heavily.
Photo: J. Thompson

will stick to one kind of flower while foraging. This can increase efficiency of their foraging activities; however, don't let a small space dim your enthusiasm – bees and other pollinators still want your flowers. The more the merrier!

Natives vs. cultivated varieties

This is another choice not to get too stressed out about depending on which pollinators draw your interest. Many native plants are fantastic landscape plants and provide a host of benefits to the gardener and the environment, including their many adaptations to local conditions (which can translate to less fussing needed on your part). However, if you have ever been around a flowering, mostly-sterile catmint variety such as 'Walkers Low' on a sunny day, you know many pollinators do not seem to discriminate in the least against these non-native plants when foraging for nectar. They can even love weeds, including some of the exotic invasive ones! (However, we humans generally don't due to their negative effects on native habitats, cultivated crops, and sometimes livestock.) We'll have a better basis with which to choose plants as more research occurs and we learn more about the behavior and foraging preferences of our native pollinators. You can do your own research in the yard (or at a neighbor's or at the park or on a hike!) by observing which plants seem to be a hit with pollinators over the years. If a cultivated variety, are the pollinators going for it? If not, do you have other plants flowering at the same time to keep them fed?

Flowering plants and pollinators tables

The plant bloom table (page 34) lists typical bloom periods for plants growing in the Laramie area (7,200-foot elevation). This type of information can help you plan out a landscape that provides food for pollinators throughout the growing season. When these plants bloom in your area depends on a number of factors:

At what elevation are you? In general, many lower elevation areas warm up faster in the spring, get hotter, and stay that way longer in

the summer and into fall. This will likely shift all the bloom start times to an earlier date.

What kind of year is it? Each year is different! The type of weather dished out each year can greatly affect when plants bloom or if they bloom at all (no bloom as a result of nasty hail storms, drought, and late and early frosts is a periodic part of life for many parts of Wyoming).

Are your plants in a sunny, warm area, or in a cooler, shadier area in your yard? Plants in sunnier, warmer areas will generally bloom earlier than those in cooler, shadier areas. You can use this fact to your advantage, planting the same type of plant in both locations (if the plants are adapted to both areas) to lengthen the flowering season of these plants for pollinators.

How much do you irrigate? Irrigation can sometimes lengthen the blooming period of plants and allow some of them to re-bloom after the first flush of flowers has gone by (if your growing season is long enough).

BEES

Bees are a varied lot! Some bees such as honeybees visit a wide variety of flowers for nectar and pollen. Other bees, such as some of our native solitary bees, visit just a few families or genera of plants for the pollen they use to provide provisions for their young, while being less selective about nectar.

Our native bees have a variety of tongue lengths that may influence which types of flowers they visit for nectar. Flowers with very deep corollas or “spurs,” such as on Columbine flowers, are often visited by bees, such as some bumble bees, that have very long tongues and are able to reach the nectar. However, shorter-tongued bees sometimes get around this! Shorter-tongued bumble and carpenter bees (and others) have been observed to cut a slit at the bottom of flower corollas to get to the nectar without taking the usual route through the flower. This practice is called nectar robbing. Other bees, such as honeybees, will then also

There is nothing inherent in all flower varieties produced by plant breeders (amateur or professional) that means bred plants will not be beneficial for pollinators. In the few studies on this subject to date, scientists chose flowers they thought would have issues and compared them to other flowers. There are some cultivated flowers, such as very “doubled” varieties where petals have replaced all the parts that pollinators use. These won’t have much to offer pollinators but if they make you happy, just make sure the pollinators have lots of other flowers to forage on. You will both be happy! If in doubt about a plant – plant it and then observe. Do pollinators visit it in your area?



Bumble bees happily visited these doubled marigolds in late summer. Note the reproductive parts of the flower visible in the flower’s center.

Photo: J. Thompson

take advantage of these openings to get at the nectar as well when the first “robber” departs.

Butterflies often like to visit flatter-shaped flower types, where pollen is moved around on their feet.

What does this all mean for gardeners? Planting flower beds and vegetable gardens containing a variety of flower types and

forms, with something blooming all through the season, can host a variety of pollinators in a yard.

Locating existing nesting sites

Do you have areas nearby that provide nesting habitat for native bees? We are still learning about many bees' nesting habits. Most of our native bee species in Wyoming are ground-nesters. Many species appear to like to dig their nesting tunnels in patches of bare or sparsely vegetated ground. (Some like sandy, loose soil, and others like hard-packed soil. Some like bare dirt, and others prefer some pebbles scattered on the surface – don't get too hung up about having the right soil type or surface.) Look for these areas around your place and notice if there are any holes (sometimes with piles of dirt around them that aren't ant hills) indicating nesting bees may be present.



Close-up of entrance to solitary bee nest.
Photo: J. Thompson



Natural nesting habitat.
Photo: J. Thompson



Leafcutter bees decided the holes in this home's siding provided a great spot to crawl in and nest.
Photo: J. Thompson

Nesting areas don't have to be fancy; they can be areas alongside roads and alleys, dirt piles left over from excavations, unused lots in or around town, or native rangeland, for example.

Other native bees like to nest in holes left by wood-boring beetles or in the old, pithy stems of plants like raspberry and sumac.

Are there some of these on or near your place? Bumble bees tend to be cavity dwellers, often inhabiting abandoned rodent burrows and/or under bunch grasses, and sometimes above ground in places like unoccupied bird houses.

Observing native bees closely will show some flying close to the ground where there are no flowers, or flying near old branches. This type of observation may help you locate where they are nesting. If you locate a nesting area, consider protecting it from significant disturbances, such as tillage. Although most types of Wyoming native bees (other than bumble bees and some sweat bees) are solitary nesters, some will nest in "aggregations," a bunch of solitary nests in the same location.

Creating nesting habitat

You can try to create nesting habitat for bees. For those bees that like to nest in old beetle tunnels in wood, create tunnels out of bundled reeds, bamboo, pithy old stems, and other materials that are hollow but have natural or artificial ends to the tunnels.

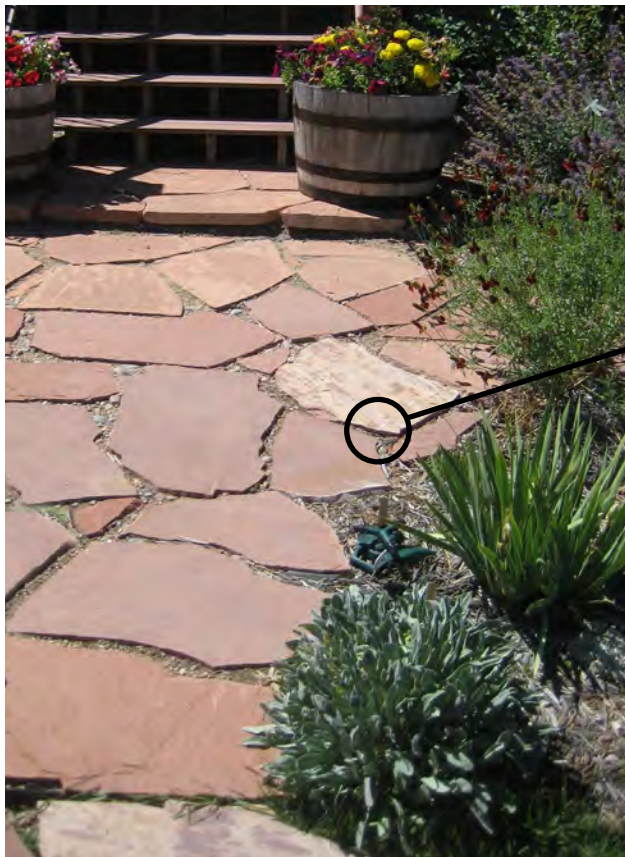
You can also drill holes in logs (stop before drilling all the way through) or other pieces of

wood to provide nesting locations. Different bees like different diameter holes. There are many online sites providing instructions for creating nesting blocks. Nesting kits can be purchased if you don't care to make your own. Artificial nests for bumble bees can also be created, but the odds they will be adopted by these bees may be low. Keep sanitation in mind whatever type of structure you create. Over time, bee pests and pathogens may accumulate in these structures, so periodic sanitization after bee emergence or discarding the structure periodically may be needed to keep from spreading disease and pests. Currently, the Xerces Society (an advocacy organization for invertebrates) suggests leaving small bundles of pithy stems of bamboo (four to six per bundle) about for nesting and then discarding them if they haven't broken down in a year or two. Whether helping out native bees with created nesting structures or cultivating honey bees, if

you are not willing to invest time and effort in pest and disease control, reconsider providing nesting structures.

For ground nesting bees, you may decide to deliberately leave some piles of dirt after a home or farm/ranch project. These may require some weed control if you want to avoid creating new sources of weed seed on your place, and wind-driven soil erosion may be another issue. Some bees nest well in areas where the bare dirt has some rock mulch. Or just maintain some small areas without much vegetation. There may be plenty of nesting habitat already available if your place is close enough to a natural area, abandoned lots, dirt alley ways, etc.

For more information on nesting and gardening, see *Gardening and Landscaping Practices for Nesting Native Bees*, and *Gardening for Native Bees in Utah and Beyond*, both University of Utah Extension publications.



Leafcutter bee nest in home's front walkway.
Photo: J. Thompson



Close-up of entrance to nest.
Photo: J. Thompson



Insect shelter with bamboo stalks.
Photo: lcrms/shutterstock.com

BUTTERFLIES

Many flowers and shrubs planted to support bees will also provide nectar sources for adult butterflies and some moths. In addition to nectar providing flowers, many butterfly species need leaves of deciduous trees and shrubs upon which their larvae feed. The light defoliation on branches done by some caterpillars won't kill trees and is necessary for the butterflies' survival.

The list of flowers, shrubs, and trees that have been observed to provide food sources for caterpillars/larvae is lengthy. They can be found in various butterfly and moth guides or on the Butterflies and Moths of North America (BAMONA) website at www.butterfliesandmoths.org. Click on the "Regional Checklists" and then click on the insect of interest.

OTHER INSECTS

The larval habitat requirements of some pollinator insect species are hard to produce artificially. For example, many species of flower flies' larvae are voracious predators of aphids. Every healthy landscape will have some aphids; however, you don't need to purposely encourage aphids to be food for flower fly larvae. You can minimize or entirely avoid using insecticides and let the aphid predators naturally suppress them. Using pest-specific and short-term control methods will help protect insect pollinators. Protecting the life of perennial plants like trees and shrubs is necessary, but most aphids and leaf-feeding insect pests won't kill a plant otherwise unstressed. If a particular annual flower species in your garden has bad pest problems, try a different species in its place the next year.

HUMMINGBIRDS

Hummingbirds are specialized for nectar-eating, evident by long bills and grooved tongues ideal for probing flowers. They are visual selectors, meaning they rely on color and shape to select flowers rather than scent.



Firecracker penstemon (*Penstemon eatonii*) flowers.
Photo: J. Thompson

They are especially attracted to red or orange tubular flowers in addition to other flowers rich in nectar.

Which flowers to plant to benefit hummingbirds also depends on when these feathered wonders visit your area. For example, many hummingbirds love *Penstemon eatonii* (firecracker penstemon), with its bright-red tubular flowers. However, this plant has often finished blooming in places such as Worland when many hummingbirds arrive. In other places, such as Laramie, these plants are still going strong and are a powerful attractant for hummingbirds. Some time spent observing these birds and chatting with neighbors who grow lots of flowers can help guide plant selections.

Lodging, nesting and resting

Hummingbirds prefer to nest near a ready supply of nectar and other food. You can also encourage them to nest in your yard by maintaining some shrubbery and small deciduous trees in which they can seek protective cover, especially around the edges

of your yard. They build their tiny, expandable nests on tree limbs and other small horizontal surfaces, often constructing them from lichens and spider webs.

You can encourage their visits by having plenty of safe places for hummingbirds to rest and sleep. Hummingbirds often perch to rest or survey their territories; some spots should be in the open and obvious for territorial birds, while others should be in protected areas, hidden from view and buffered from cooler overnight temperatures.

Hummingbirds like to bathe frequently – even in the pools of droplets that collect on leaves. If feasible, you can provide your yard with a constant source of water from a drip fountain attachment or a fine misting device. A misting device is an especially attractive water source for hummingbirds. Take steps to ensure these water sources don't create breeding habitat for mosquitoes.

Other food sources for hummingbirds

Insects

Hummingbirds need protein from pollen and insects to maintain their bodies and grow new feathers. Hummingbirds are specialized aerial hunters and can snatch small insects in the air. Hummingbirds also glean insects from leaves and spider webs.

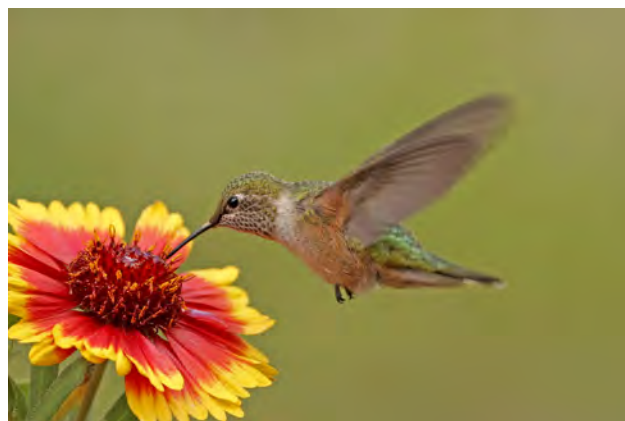
Use minimal pesticides. Spiders and insects (arthropods) are an important part of an adult bird's diet, and young hummingbirds still in the nest are almost exclusively fed arthropods.

Make sure your yard contains insect-pollinated flowers as well as hummingbird-pollinated plants.

Hang a basket with overripe fruit or banana peels close to a hummingbird feeder to attract tiny fruit flies.

Nectar feeders (hummingbird feeders)

Backyard hummingbird feeders provide hummingbirds with nectar critical to their survival, especially during fall and spring



Broad-tailed hummingbird female (*Selasphorus platycercus*) feeding.

Photo: Don Mammoser/shutterstock.com

Here are some more Wyoming natives, in addition to those listed in the bloom date table, page 34, that are said to attract hummingbirds:

Common Name	Scientific Name
Hawthorn	<i>Crataegus</i> spp.
Yucca	<i>Yucca glauca</i>
Elderberry	<i>Sambucus nigra</i>
Twinberry honeysuckle	<i>Lonicera involucrate</i>
Western snowberry	<i>Symphoricarpos occidentalis</i>
Bearberry	<i>Arctostaphylos uva-ursi</i>
Rocky Mountain phlox	<i>Phlox multiflora</i>
Blue Columbine	<i>Aquilegia caerulea</i>
Crimson Columbine	<i>Aquilegia formosa</i>
Cutleaf coneflower	<i>Rudbeckia laciniata</i>
Desert paintbrush	<i>Castilleja angustifolia</i>
Wyoming paintbrush	<i>Castilleja linariaefolia</i>
Yellow paintbrush	<i>Castilleja flava</i>
Fireweed	<i>Chamerion angustifolium</i>
Longleaf phlox	<i>Phlox longifolia</i>
Spreading phlox	<i>Phlox diffusa</i>
Bush penstemon	<i>Penstemon fruticosus</i>
Platte River penstemon	<i>Penstemon cyananthus</i>
Rydberg's penstemon	<i>Penstemon rydbergii</i>
Whipple's penstemon	<i>Penstemon whippleanus</i>
Mintleaf beebalm	<i>Monarda fistulosa</i>
Nuttall's larkspur	<i>Delphinium nuttallianum</i>
Wild mint	<i>Mentha arvensis</i>
Rocky Mountain lily	<i>Lilium philadelphicum</i>

migration. Follow these steps to ensure your yard is a safe and nutritious stopover for hummingbirds:

- Hang several feeders far enough apart hummingbirds cannot see one another; this will prevent one bird from dominating the rest.
- Fill the feeders with sugar water made by combining four parts hot water to one part white sugar, boiled for one to two minutes. Never use honey, artificial sweeteners, or red dye.
- Hang feeders in the shade to prevent the sugar solution from fermenting.
- Be sure to change sugar water regularly – before it gets cloudy, or about twice a week in warm weather.
- Clean feeders with a solution of one part white vinegar to four parts water about once a week. If your feeder has become dirty, try adding some grains of dry rice to the vinegar solution and shake vigorously. The grains act as an abrasive. Rinse your feeder well with warm water three times before refilling with sugar solution.



Black-chinned hummingbird on feeder perch.
Photo: Martha Marks/shutterstock.com

Check websites Hummingbirds at Home and eBird to find out when the first hummingbird sightings occur each spring, and hang your feeders up a couple of weeks before that. In the fall, keep feeders up for two weeks after you see the last bird using it.

Feeding Hummingbirds FAQs

Q: Are there any downsides to supplying a hummingbird feeder to the birds in my yard?

A: No. Your hummingbird feeder will be a supplemental source of nectar for your local hummingbirds and can help them through times when there aren't as many nearby blooming flowers available.

Q: Do I need to buy special food for my hummingbirds?

A: No. The best (and least expensive) solution for your feeder is a 1:4 solution of refined white sugar to tap water. That's ¼ cup of sugar in 1 cup of water. Bring the solution to a boil, then let it cool before filling the feeder. You can make a larger batch and refrigerate the extra solution; just remember to bring it up to room temperature before you re-fill the feeder.

Q: Should I put red coloring in the nectar solution?

A: No. Red coloring is not necessary. Natural nectar itself is a clear solution.

Q: Are hummingbirds attracted to red-colored things?

A: Yes, hummingbirds are attracted to red, as well as other brightly colored objects, because they have learned to associate high-quality nectar with red flowers.

Q: Should I use brown sugar, honey, or molasses instead of white sugar?

A: No, only use refined white sugar. Other sweetening agents have additional ingredients that can prove detrimental to the hummingbirds. Never use artificial sweeteners to make hummingbird nectar.

Q: How often should I empty and clean the feeder?

A: In hot weather, the feeder should be emptied and cleaned twice per week. In cooler weather, once per week is enough. If your hummingbirds empty the feeder with greater frequency, clean every time it's empty. Cleaning with hot tap water works fine, or use a weak vinegar solution. Avoid using dish soaps, as this can leave residue in the feeder.

Q: When should I put out my hummingbird feeder?

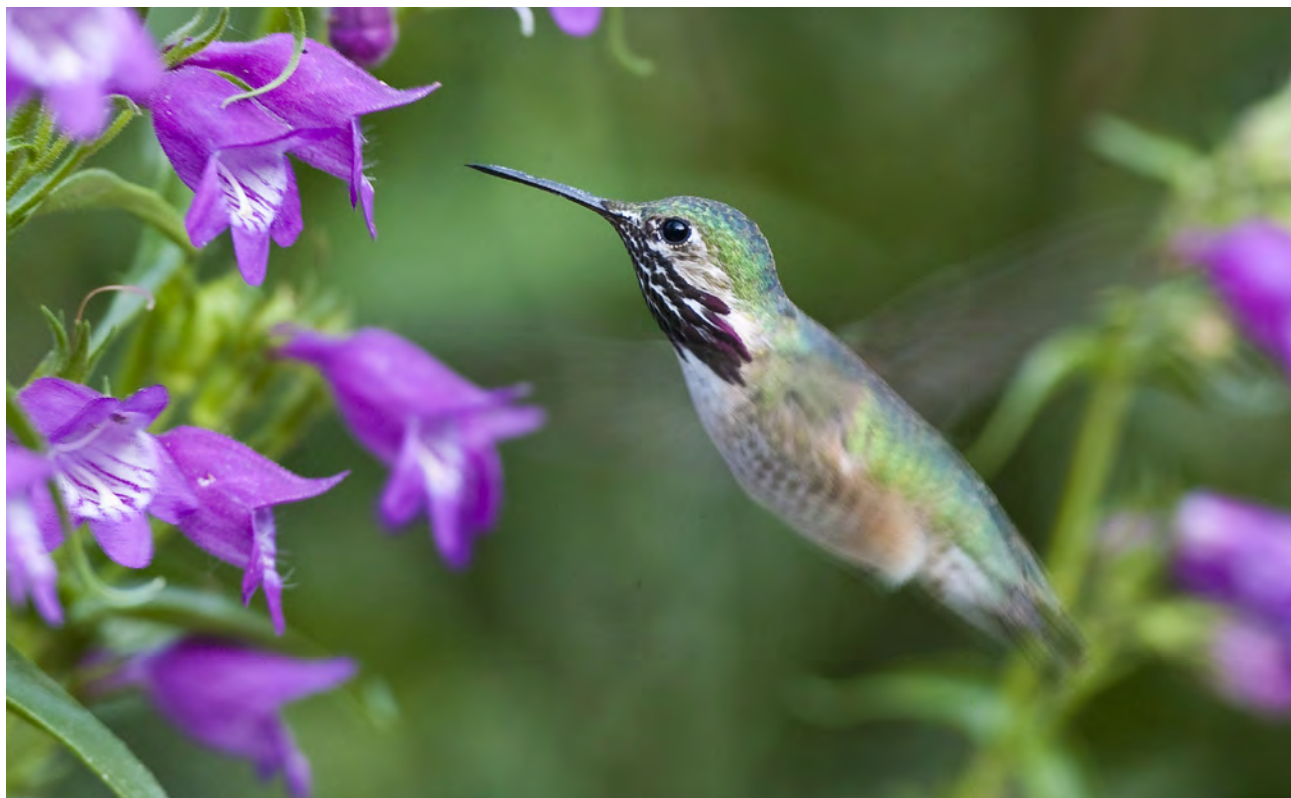
A: In most areas of North America where hummingbirds leave during the winter, it's best to put the feeder out about a week before they normally arrive in your yard. This date varies regionally. If you don't know when your birds usually arrive, check with your local Audubon center, chapter, or local bird club.

Q: When should I take down my feeders in the fall?

A: You can leave your feeders out for as long as you have hummingbirds around. You can even continue to provide the feeder after your hummingbirds disappear – late migrants or out-of-range species can show up into early winter. Follow the guidelines for keeping the feeders clean, even if the nectar goes untouched. Always discard any unused nectar in the feeder when you take it down for cleaning.

Q: Won't it make my hummingbirds stay too late if I continue to leave the feeder out for them?

A: No. Hummingbirds are migratory species and are genetically programmed to head south in the fall. It's not a lack of nectar source or colder weather that makes them leave – they know it's time based on changes in the length of the day and angle of the sun.



Calliope hummingbird on penstemon.
Photo: Kenneth Rush/shutterstock.com

PLANNING A LANDSCAPE WITH A CONTINUAL SUPPLY OF FLOWERING PLANTS

EXAMPLE PLANT BLOOM DATES AND INFORMAL POLLINATER OBSERVATIONS IN LARAMIE

By Jennifer Thompson

Genus	Species/variety	Common name
Bulbocodium	vernum	Spring meadow saffron
Crocus	(many varieties)	Crocus
Iris	reticulata	Snow iris 'Pixie' and others
Pulsatilla	patens	Pasqueflower, native
Chionodoxa	forbesii	Glory-of-the-snow
Pulsatilla	vulgaris	Pasqueflower, non-native
Daffodil	'Jetfire'	Daffodil 'Jetfire'
Tulipa	humilis 'China Coral'; puchella 'Persian Pearl'; tarda	Tulip (botanical or species type)
Daffodil	'King Alfred'	Daffodil 'King Alfred'
Muscari	armericum	Grape hyacinth
Tulipa	'Decora'	'Decora' tulip
Tulipa	batalini 'Bright Gem'; clusiana chrysantha	Tulip (botanical or species type)
Thymus	'Pink Chintz'	'Pink Chintz' thyme
Clematis	scottii	Sugarbowl clematis
Thymus	doerfleri 'Bressingham Pink'	'Bressingham Pink' thyme
Tulipa	'Little Beauty'	Tulip (botanical or species type)
Geranium	cinereum 'Purple Pillow'	Hardy cranesbill 'Purple Pillow'
Oenothera	caespitosa	White tufted evening primrose
Penstemon	halli	Hall's penstemon (beardtongue)
Eriogonum	'Kannah Creek'	Sulfur buckwheat, 'Kannah Creek'
Erodium	manescavii	cranesbill
Heuchera	sanguinea 'Ruby Bells'	Coral bells 'Ruby Bells'
Nepeta	'Walker's Low'	Catmint 'Walker's Low'
Penstemon	barbatus; eatonii	Beardlip penstemon; Firecracker penstemon
Salvia	'May Night'	'May Night' meadow sage
Thymus		Thyme, culinary (french, german, etc); 'Spicy Orange'
Penstemon	grandiflorus	Large beardtongue
Penstemon	strictus; clutei	Rocky Mountain; Sunset penstemon
Thymus	'Elfin'	'Elfin' thyme
Stanleya	pinnata	Desert prince's plume
Penstemon	palmeri	Palmer's beardtongue (also known as Pink wild snapdragon)
Dalea	pupurea	Purple prairie clover
Dianthus	giganteus	Pink
Gaillardia		Blanket flower
Ratibida	columnifera	Upright prairie coneflower
Zauschneria	garrettii	Garrett's firechalice
Callirhoe	involucrata	Poppy mallow
Alcea	rosea	Hollyhock
Rudbeckia	hirta	Black-eyed susan

Pictures and more information (such as spreading tendencies or toxicity to livestock) on these plants can be found in Appendix 1 at bit.ly/plantsfrombloomlist. This document also contains example seedlists for wildflower plantings.

Some observed pollinator visitors*	April	May	June	July	Aug	Sept	Oct
honey bees							
bumble bees, honey bees							
honey bees							
bumble bees, honey bees							
honey bees							
bumble bees, honey bees							
bumble bees, honey bees							
bees							
bumble bees, honey bees							
honey bees, bumble bees							
bees							
bees							
bees							
bumble bees							
bees							
bees							
bumble bees							
hawk moth, bees							
bees							
leafcutter bees, bees							
bees, bumble bees							
hummingbirds							
honey/bumble bees, butterflies, syrphids, hummingbirds							
bees, hummingbirds							
bumble bees, honey bees, leafcutters, other native bees							
honey bees, bumble bees, other bees							
bees							
bumble bees, bees, hummingbirds							
bumble bees, bees							
honey bees, bumble bees							
bees, hummingbirds							
honey bees, lots of bumble bees							
bees, hummingbirds							
bumble bees, honey bees, leafcutter bees							
bumble bees, longhorn bees, leafcutter bees, digger bees							
hummingbird							
bumble bees							
bumble bees, honey bees, leafcutters - use petals also							
bumble bees, bees, flies, bee fly							

Genus	Species/variety	Common name
Echinacea	angustifolia	Narrow-leaf coneflower
Veronica	spicata	Veronica or Spiked speedwell
Monarda	‘Fireball’; ‘Petite Delight’	Bee balm ‘Fireball’; ‘Petite Delight’
Alcea	rugosa	Hairy hollyhock
Oregano		
Asclepias	tuberosa; incarnata	Butterfly weed; Swamp milkweed
Echinacea	purpurea	Purple coneflower
Solidago**	‘Golden Baby’	Goldenrod ‘Golden Baby’
Mirabilis	multiflora	Colorado four o’clock (blooming will end with frost)
Gentiana	parryi, septemfida hybrids	Gentians
Ipomopsis	aggregata	Scarlet gilia
Liatris	punctata	Dotted blazing star
Sedum	‘Autumn joy’	‘Autumn Joy’ sedum
Salvia	azurea	Blue sage
Symphyotrichum**	novae-angliae ‘Purple Dome’	New England aster ‘Purple Dome’
Colchicum	‘Lilac Wonder’	Autumn crocus ‘Lilac Wonder’
Colchicum	autumnale ‘Pleniflorum’; ‘Rosy Dawn’	Autumn crocus ‘Pleniflorum’; ‘Rosy Dawn’

*Some informally observed pollinators in Laramie, Wyoming. There may be more pollinators that visit than are recorded here.

**Only one year’s observation for bloom dates

Bloom dates and duration will vary by location in the state (elevation, temperatures, etc), type of year (hot/cool, dry/wet, etc.), and location in the landscape (plants in sunny, hot areas will likely bloom earlier than those in cooler, shadier areas).

Perennials noted to be especially attractive to a wide variety or large number of pollinators

Agastache		Choose types hardy enough for your area
Catmints	Walker’s Low’, ‘Six Hills Giant’	Choose sterile, vegetatively propagated varieties or reseeding may be an issue
Goldenrods	‘Golden Baby’ and others	Some goldenrods spread vigorously via rhizomes
Globethistle	<i>Echinops</i>	Some reseed quite a bit
Lavender		Only hardy in parts of the state
Aster	New England ‘Purple Dome’ and many other types of asters (some species of aster are rhizomatous)	
Oregano		Varieties vary in hardiness
Penstemon	Rocky Mountain and others	Firecracker (eatonii) for hummingbirds
Purple coneflower	Echinacea	
Purple prairie clover		
Salvia	‘May Night’ or other <i>S. nemorosa</i>	Deadhead to control reseeding
Sedum	‘Autumn Joy’ and others	
Thymes		

Annuals – generally bloom in summer, depending on location and planting date

Calendula		
Cilantro		
Cleome	<i>serrulata</i>	Rocky Mountain bee plant
Cosmos		
Phacelia	<i>tanacetifolia</i>	
Poppies		
Sunflower		

Some observed pollinator visitors*	April			May			June			July			Aug			Sept			Oct		
bees , butterflies																					
bumble bees, bees																					
hummingbirds																					
leafcutter bees, bumble bees, honey bees																					
lots!, honey bees, bumble bees, leafcutter bees, other bees, flies, etc.																					
bees, butterflies																					
bumble bees, butterflies																					
bumble bees, honey bees, small native bees																					
hawk moth																					
bumble bees																					
hummingbird																					
bumble bees, butterflies, hummingbirds																					
bumble bees, honey bees, bees love it																					
hummingbirds, bumble bees, hawkmoths, honey bees																					
honey bees, many other bees																					
bumble bees, honey bees, leafcutters																					
bumble bees, honey bees, leafcutters																					



Painted lady butterfly feeding on purple *Phlox kelseyi* flowers.
Photo: J. Thompson

Some flowering trees and shrubs beneficial to pollinators

Shrubs

Genus	Species/variety	Common name	Bloom time	
Amelanchier	alnifolia	Serviceberry	Spring	
Philadelphus	lewisii	Lewis' Mock orange	Spring	
Prunus	besseyi	Sand cherry	Spring	
Prunus	besseyi 'Pawnee Buttes'	'Pawnee Buttes' creeping sand cherry	Spring	
Rhus	aromatica var trilobata	Three-leaf sumac	Spring	
Ribes	aureum	Golden currant	Spring	
Shepherdia	argentea	Silver buffaloberry	Spring	
Syringa	vulgaris	Lilac	Spring	
Rosa	woodsii	Woods' rose	Early summer	
Amorpha	canescens	Leadplant	Summer	
Potentilla	fruticosa	Potentilla	Summer	
Rubus		Raspberry	Summer	
Chamaebatiaria	millefolium	Fernbush	Late summer	
Caryopteris	x clandonensis	Blue mist spirea	Late summer	
Ericameria	nauseosa	Rubber rabbitbrush	Late summer	Can spread vigorously, deadhead. Occasionally reported as toxic to livestock.

Trees

Genus	Species/variety	Common name	Bloom time	
Acer	ginnala	Amur maple	Spring	
Acer	grandidentatum	Bigtooth maple	Spring	
Acer	negundo	Boxelder	Spring	
Aesculus	glabra	Ohio buckeye	Spring	
Crataegus	crus-galli	Thornless cockspur hawthorn	Spring	
Crataegus	mollis	Downy hawthorn	Spring	
Gleditsia	triacanthos v. inermis	Honey locust	Spring	
Gymnocladus	dioicus	Kentucky coffeetree	Spring	
Prunus	americana	American plum	Spring	
Prunus	cerasus 'Bali'	'Ball' cherry or Evans cherry tree	Spring	
Prunus	virginiana	Chokecherry	Spring	Can be toxic to livestock.
Robinia	pseudoacacia	Black locust	Spring	
Salix	amygdaloides	Peachleaf willow	Spring	
Salix	pentandra	Laurel leaf willow	Spring	
Tilia	americana	American linden	Summer	
Tilia	cordata	Littleleaf linden	Summer	

For more information on these and other trees and shrubs for Wyoming visit www.barnyardsandbackyards.com and click on "Landscaping."

BEEES, CROPS, & YOU!

(AKA “WHAT HAPPENED TO MY CUCUMBER TO MAKE IT LOOK LIKE A MUTANT?”)

By Jennifer Thompson and Jeff Edwards

Bees are crucial pollinators in the development of many fruit crops and several crops grown for seed production.

In Wyoming, they help pollinate fruit trees and shrubs (apples, cherries, Nanking cherries, currants, for example), strawberries, raspberries, squash, pumpkins, melons, cucumbers, sunflowers, tomatoes, and alfalfa for seed production. Poor pollination could be the culprit if you ever had small, miss-shaped fruit! (Although no fruit at all on fruit trees and shrubs is often the result of late freezes in our state, when fruit blossoms are more vulnerable to cold temperatures.)

For many bee-pollinated fruits and vegetables, fruit set (the chance a blossom will turn into a fruit) and fruit size will often increase with an increased number of bee visits to the flower.

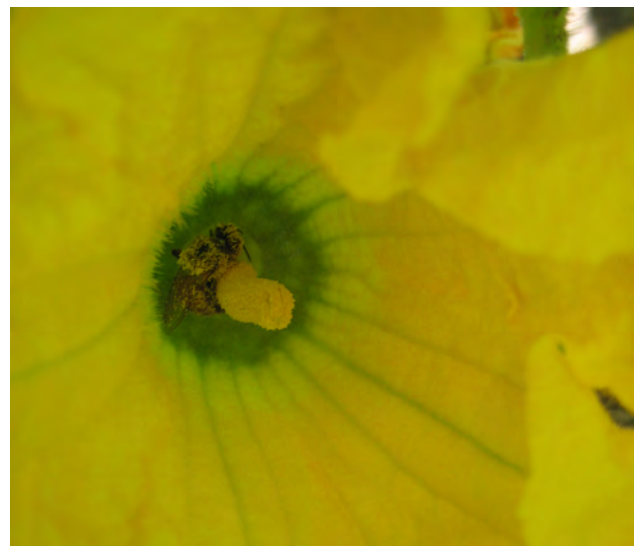
Most people are familiar with the work of managed honey bees when it comes to pollinating food crops. However, native bee populations can also contribute significantly to good pollination of food crops, sometimes outperforming honey bees on a per-bee basis.

A few examples:

Tomato flowers produce very little or no nectar, but they do produce pollen. This pollen is held in such a way it is released when the flower is shaken by the wind or through the vibrations produced by insects. Bumble bees are very effective at tomato pollination because they are able to carry out this “buzz-pollination.” A study on ‘Sungold’ cherry tomatoes in California showed visitation by native bees increased fruit set by approximately 45 percent, relative to wind pollination. Also on average, the weight of the tomatoes was nearly doubled. Bumble bee



Bumble bee “buzz-pollinating” tomato flower.
Photo: J. Thompson



A honey bee gets well coated with pollen while visiting squash flowers.
Photo: J. Thompson

colonies are often placed inside greenhouses for tomato production. Having healthy populations of bumble bees and other native bees around tomato plants (in the garden or in an open high tunnel) can help increase your fruit production.

Some native bees are also more efficient pollinators on a bee-to-bee basis than honey bees as many female native bees out foraging are deliberately collecting pollen for their young. This deliberation ensures they will contact and transport pollen from one plant to another. Honey bees also collect pollen, but nectar is a bigger focus for them than for native bees, making them less effective at pollen transfer on a per-bee basis. Blue orchard bee (*Osmia lignaria*), native to the western U.S., is a commonly cited example of this efficiency as 250–300 females will pollinate an entire acre of apple or cherry trees.

Many bees are generalists – they visit and pollinate many different types of plants, while others are more specialized. In states neighboring Wyoming, squash bees can be major pollinators of plants in the curcubit family. The male bees hang around and often sleep in squash blossoms, waiting for female squash bees to show up, and mate. They pollinate the squash flowers in this process. These bees also tend to nest underground in fields where squash are grown, providing an



'Bali' cherry in bloom.
Photo: J. Thompson

Many herbs, allowed to flower, are great pollinator plants for speciality crop producers.



Thyme
Photo: J. Thompson



Oregano
Photo: J. Thompson



Cilantro
Photo: J. Thompson

ever-larger population of bees each year if squash continue to be grown in that area.

Non-native alfalfa leafcutter bees are managed by alfalfa seed producers in our state to produce abundant seed set on a plant species honey bees don't efficiently pollinate. In nearby western states (and previously in Wyoming around the Riverton area), the native, solitary, ground-nesting alkali bee *Nomia melanderi* nests in huge "bee beds" (aggregations of nesting tunnels) in very salty areas of the northern end of the Great Basin. Alfalfa seed producers value these bees and actively promote the welfare of these bee beds – some have been in place for over 50 years.

Vegetable seed is produced in our state for seed companies. Insect pollination is critical for production of many different kinds of vegetable seed.

Native bees can also increase the pollinator effectiveness of honey bees. Studies have shown many native bees "harass" honey bees, causing them to move more often between rows of plants or between trees. This is helpful in those crops where cross-pollination increases fruit or seed set (many fruit trees and shrubs, hybrid sunflower seed production, for example).

So in addition to the use of honey bees, promoting the well-being of native bees can help provide crops (as well as many local native plants) a sufficient supply of pollinators.

IF YOU ARE GROWING FRUITS OR VEGETABLES THAT NEED POLLINATION, HOW CAN YOU PROMOTE NATIVE BEES ON YOUR PLACE?

Easy steps

The easiest, first step in promoting bees is to take stock of the foraging and nesting habitat available on your property (or nearby). Do you have plants flowering throughout the growing season? Pollinators need a consistent supply of



Alkali bee beds. Each mound is a nest entrance.
Photo: James Cane, USDA-ARS



Alkali bee nest entrance.
Photo: J. Cane, USDA-ARS



Nomia melanderi female digging a nest.
Photo: J. Cane, USDA-ARS

Pesticides and Bees

Many pest problems can be managed without the use of pesticides; however, there may be times when immediate action is necessary, and using a pesticide is the best option. All insecticides, some herbicides, and several fungicides, whether organic or synthetic, are toxic to insects. Read, understand, and follow the instructions on product labels if you chose to use pesticides to control issues in shrubs, flowerbeds, gardens, or crops. If you have difficulty reading the fine print, all product labels are available electronically and can be downloaded to a computer with Internet access. (Some sites include <http://bit.ly/label-db> and <http://bit.ly/read-label>) The product label will let you know if a particular product is toxic to bees.

Things to keep in mind when applying pesticides:

- Most pesticides should be applied when bees and other insects are less active – this means applications should be made about 30 minutes before dusk.
- For honey bees, pesticide applications can also be made in the morning as long as there is a three-hour window before the temperature gets above 50 degrees Fahrenheit.
- Certain pesticides that are highly toxic to bees are not to be applied to blooming plants.
- Avoid pesticide drift onto nearby flowering plants. Creating a 20-foot, no-spray buffer zone at the edge of crop fields can help reduce accidental bee kills.
- Be certain to wear all the recommended Personal Protective Equipment (PPE) as stated on the label, calibrate your application equipment, and follow the product instructions for use.

The EPA now requires the following label on all pesticides with known toxicity to pollinators:

THE NEW EPA BEE ADVISORY BOX

On EPA's new and strengthened pesticide label to protect pollinators

PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators. Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar. Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat.
- Minimize drift of this product onto beehives can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at: <http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx>

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: www.aspc.org. Pesticide incidents can also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: bee@epa.gov

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

The new bee icon helps signal the pesticide's potential hazard to bees.

Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.

EPA

Read EPA's new and strengthened label requirements: <http://go.usa.gov/jHH4>

food (flowers) to maintain healthy populations. These can be ornamentals, native plants, crop plants that have bolted, or flowering cover crops. If so, take steps to promote the flowering of these plants on your property (or at least make sure you don't take steps that decrease it).

Are there nearby areas that provide nesting habitat for native bees? Native bees often build ground nests or nest in hollow stems of plants. See the section "Promoting Pollinators On Your Place," page 24, to get some ideas on where to look and see if you already have existing bee nesting habitat.

It is helpful when thinking about nesting habitat to remember many of the smaller native bees don't seem to travel great distances from nesting areas to forage (bumble bees and honey bees can go much farther). Ditch banks,

These flower strips, planted between alfalfa and fescue, are part of a University of Wyoming research project looking at beneficial insect habitat plantings.



Plants in this annual planting include plains coreopsis, cornflower, cosmos, dill, and calendula.

Photo: Makenzie Pellissier



Plants in this perennial planting include blanket flower and bee balm.

Photo: M. Pellissier

roadside habitat, and other areas with untilled soil can be important nesting sites in areas of intense cultivation. Having nesting or bee forage plants within 500 feet (for the smaller bees) to a half-mile of crops appears to be beneficial to crop pollination.

More challenging steps

Bee Forage (food)

Plant and maintain flowering plants. This can be cultivated ornamental plantings of native or non-native plants – annuals, perennials, shrubs, and trees. These plantings can also be:

- Wildflower patches, large or small,
- Flowering trees, or shrubs grown as hedgerows or windbreaks, and
- Blooming cover crop plantings (with species not closely related to the crop you are trying to grow if you are concerned about the accidental promotion of crop diseases or pests).

Think about providing a succession of blooming plants to keep pollinators well-supplied when planning these plantings. See the section "Promoting Pollinators On Your Place," page 24, for information to help you plan this succession of blooms. See Appendix 1 online for example lists of wildflower planting seed mixes.

For example, some orchards have adopted the practices of planting clovers and other cover crop species below fruit trees. These cover crops are selected to bloom before or after fruit trees blossom, or they are mowed during fruit tree bloom time so bees will concentrate on the fruit blossoms.

If interested in creating wildflower plots, plant them as close to crops as is reasonable. These can be planted in areas of a farm that are least productive or not in use (such as the corners of pivots). They can be planted near hoop houses (with sides or ends that will be open for pollinators to enter and exit), but far enough away not to import too many pests. (Although these patches can harbor other

insects beneficial to crop pest control, not just crop pests.) Bunch grasses can be included in these wildflower plantings to help reduce soil erosion, weed competition, and to provide possible nesting habitat for bumble bees. Effective wildflower plots require planning, significant initial effort, and maintenance. See the sidebar, “Tips to increase the odds your wildflower planting from seed is successful.” on page 45, for more information.

FINANCIAL HELP FOR POLLINATOR PLANTINGS

The USDA-Natural Resources Conservation Service has financial assistance available to help establish pollinator plantings on agricultural land on which agricultural products or livestock are raised. Funding is available through the Environmental Quality Incentives Program (EQIP) and Conservation Stewardship Program (CSP). To receive funding, you must apply and your application must rank high amongst local priorities. Visit with your local USDA-NRCS district conservationist (http://bit.ly/wyo_nrcs) to see if your project would be a good fit for these programs and to determine eligibility requirements and deadlines for project submission.

NESTING HABITAT

See the section “Promoting pollinators on your place” on page 24 for ideas to create additional nesting habitat.

PURCHASING BEES FOR RELEASE ON YOUR PLACE

If considering buying bees to release on your property, think through this very carefully. Raising bees for sale so they do not contain some parasites, pests, or diseases, is very difficult. When buying bees, you may be getting more than you wanted. So if you do not have a very strong reason to purchase bees, your efforts

might be better spent in promoting the welfare of the ones already in your locale. Give them flowers, they will come!

ADDITIONAL INFORMATION

Farming For Bees: Guidelines for Providing Native Bee Habitat on Farms, Xerces Society. <http://bit.ly/farmingforbees>

Gardening and Landscaping Practices for Nesting Native Bees, James H. Cane, Utah State University Extension Fact Sheet <http://bit.ly/nestingnativebees>

Crop Pollination by Bees, Keith S. Delaplane, D. R. Mayer, D. F. Mayer, CABI, 2000

Pollination in the Agricultural Landscape: Best Management Practices for Crop Pollination, Thomas S. Woodcock, Canadian Pollination Initiative (NSERC-CANPOLIN), University of Guelph, 2012. <http://bit.ly/croppollination>

Plants for Pollinators in the Intermountain West, USDA Plant Materials Technical Note <http://bit.ly/plantsforpollinators>

Plant Materials for Pollinators and Other Beneficial Insects in Eastern Utah and Western Colorado, USDA Plant Materials Technical Note. <http://bit.ly/pollinatormaterials>

Seeding Pollinator Plots, USDA Natural Resources Conservation Service, Plant Materials Center, Bismarck, North Dakota <http://bit.ly/pollinatorplotseed>

Tips to increase the odds your wildflower planting from seed is successful.

Wildflower plantings from seed can provide some nice benefits – one of the biggest is the support of pollinators. However, wildflower plantings require careful planning, preparation, and follow-up to be successful. (Not to mention a little help from nature in the form of precipitation if doing a dryland planting.) Here are some tips as you think about a wildflower planting.

Before you plant

Weed control pre-planting

Weed control is critical (preferably with as much as possible before planting). Try to avoid planting into areas with large weed “seed banks” in the soil. Find out what weeds are in the area, how long they’ve likely been there producing seed, and how easy they are to kill. It can take over a year to get really weedy areas ready to plant. Controlling weeds amongst desirable wildflower species is very difficult in large areas.

Buying seed

Wildflower mixes often contain non-native species or highly competitive native species and may spread outside the planting area – know what you are getting. Consult your local University of Wyoming Extension, USDA-Natural Resources Conservation Service, or weed and pest or conservation district office if you have questions. Knowing how competitive the wildflowers are and expecting the number of plants of each kind to vary over the years in long-term plantings is helpful – nature is never static.

Quality wildflower seed of species native to your area can be expensive – demand often outstrips supply. You may need to place your order early to get what you want.

Consider adding some bunch grasses for bumble bee nesting habitat, weed competition, and ground cover.

Some wildflowers can be toxic to livestock if eaten (such as larkspur, for example).

Try to include a variety of species that will bloom in spring, summer, and late summer/fall to provide a long foraging season for pollinators.

Planting and germination

Fall planting is generally the preferred method (to allow for adequate precipitation – hopefully – and “cold stratification,” which increases the germination of some species). However, if you live in an area with reliable late-spring moisture, then spring planting may work.

Late winter/spring moisture is critical for germination – plantings are more likely to succeed when some supplemental irrigation is possible if needed.

Find pictures of seedlings of the wildflowers so you will be able to tell friend from foe when they germinate.

Patience is a virtue with native wildflower seed – some may not germinate until two or more years have passed. Weed control can be a challenge during this period.

Transplant alternative

Consider using wildflower transplants if the area is small and you want to know exactly what you are going to get. This is usually more expensive unless you start them yourself. Small transplants may be hard to find. These plants will need care (such as adequate water) for the first couple of years.

Bite off only as much as you can chew – wildflower plantings usually involve ongoing effort. Poorly planned and maintained plantings may become a weed fest. Think twice before doing plantings in existing areas with native vegetation in reasonable shape. Instead, consider managing the area in a way that promotes native plant health. The bees will thank you for it!

For more information on wildflower plantings

“Ten Rocky Mountain native you can grow,” Susan Winslow, *Barnyards & Backyards* magazine, Spring 2015 issue pgs 11-13. <http://bit.ly/rockymountainnatives>

[Online Appendix 1 – contains example seed mixes](#)

BEEKEEPING IN WYOMING

SO YOU WANT TO BE A BEEKEEPER

By Justina Russell

So you want to be a beekeeper ... you aren't alone.

More and more Wyomingites would like to try their hand at beekeeping. The number of Wyoming's hobbyist beekeepers who maintain a small number of hives for home honey production or local sales, pollination of home gardens and orchards, or for the simple enjoyment of having one of nature's most interesting insects buzzing about in their backyards, is on the rise.

The major role honey bees play in pollination is one of their greatest benefits. Their presence significantly increases production of fruit trees, vegetable gardens, agricultural crops, and wild plants throughout the world. Honey bees are believed to pollinate, in part or in whole, more than 100 agricultural crops within the United States, adding up to about a \$10 billion value each year and accounting for approximately one-third of the foods we consume daily. Without honey bees, our diets would be less diverse, and the cost of some of our favorite foods like seeds, nuts, legumes, fruits, and vegetables would be higher.

Outside of pollination, bees provide a wealth of other resources. Honey is the most obvious, but products derived from beeswax such as cosmetics, health remedies made from pollen, royal jelly (queen food), and propolis (bee glue made from plant resins); candles; inks; polishes; and paints are also prominent in today's consumer markets. Wyoming beekeepers

can enjoy all of these benefits whether through extra income – a single, strong hive on moderate forage may yield roughly 40 pounds of honey or around \$200 to \$250 per year (see Wyoming Department of Agriculture [WDA] annual honey report for financial specifics); through the consumption of local honey or through increased production of local fruits, vegetables, berries, and native plants.

Beekeeping in Wyoming can present many challenges due to our harsh winters, short growing seasons, arid climate, small volume of flowering plants during key foraging times, and the variety of pests and diseases affecting colonies throughout the country. Yet, with proper management, keeping a few honey bee colonies on a farm, ranch, small-acreage property, or town lot can provide numerous benefits.

Before beginning rearing bees, a hobbyist should first and foremost consider their primary objectives: whether to manage colonies for honey, pollen, and wax products for personal use and/or sale, or to manage them for pollination services, or just enjoyment, like a pet.

This section is an introduction to beekeeping and designed to help new and beginning beekeeper's become successful at wrangling bees in Wyoming. The basics of honey bee biology, hive dynamics, getting started, and ways of maintaining healthy, productive colonies will be covered.

LIFE IN THE COLONY

Being somewhat familiar with life in a honey bee colony is important in order to know how best to manage them. Honey bees are not native to the United States. Most honey bees available for purchase today originated in Europe and began to be imported approximately 400 years ago when early settlers entered North America from Europe. Unlike many native bee species, honey bees are social insects that live together in large, well-organized family units. A colony of bees consists of three castes:

A **queen**, the only breeding female in the colony. Her primary role is to lay eggs and populate the hive. She is capable of laying half a million eggs in her one- to three-year lifespan. Her secondary role is to produce pheromones that control and limit egg laying by other bees in the colony.

Female worker bees (30,000–50,000 in a healthy colony) whose tasks include foraging, care of the brood (larvae) and queen, hive cleaning, and hive defense.

Male drone bees (around a few thousand in the spring to just a few hundred in the fall), whose only function is to mate with a queen bee.

The three classes of bees function as a single entity to maintain an efficient hive. Reproduction and colony strength depend on the queen, the quantity of food stores, and the size of the worker bee force, which requires the collective efforts of the entire colony. If one part is threatened, the entire colony will react.

GETTING STARTED

Regulations

Anyone wishing to own bees in Wyoming must be aware of pertinent WDA statutes. In general, beekeepers must (no matter where they are located – even in town) register hives with the WDA before April 1 of each year; failure to do so can result in hefty fines. Accurate legal descriptions of hive locations must be provided so the WDA can determine if newly established

hives could interfere with proper feeding and honey flow at existing apiary sites or if they have the potential to transfer bee disease and parasites. These laws have been put in place to protect the welfare of the bees and the livelihoods of commercial bee keepers. Hobbyist beekeepers can keep up to five hives before having to pay a licensing fee of \$25.

Specific WDA regulations are covered in detail under Title 11 at <http://bit.ly/wyostatutes>.

In addition, bee enthusiasts should check local city ordinances, as not all Wyoming towns allow the keeping of bees within city limits. As a courtesy, potential beekeepers may also want to discuss their plans for raising bees with their neighbors. Some people have a fear of bees or may have a deadly allergy to bee venom. However, it is interesting to note honey bees normally only sting to defend themselves or their colonies. If managed with adequate precautions, most beekeepers are rarely stung. Over time, bees become accustomed to their keepers, making them less likely to sting during hive maintenance and harvest.

Owner Responsibility

Remember there is as much responsibility attached to keeping bees as there is with the ownership of other animals, as pets, or for profit.

The following additional honey bee resources are available online:

Wyoming Apiary Statutes (select Chapter 11)

- <http://bit.ly/wyostatute-chp11>

Wyoming New Apiary Application

- <http://bit.ly/apiarylocation>

Wyoming Request for registration of pollination apiary

- <http://bit.ly/pollinationapiary>

Wyoming Apiary Location Map

- <http://bit.ly/2vOWBfo>

Keeping bees versus other animals allows for a bit more flexibility during owner absences since they can care for themselves, unaided for many weeks during certain times of the year. However, it is irresponsible and unethical for a beekeeper to poorly manage or neglect colonies by not treating for pests and disease or by allowing colonies to starve or become unhealthy in any way.

Materials & Supplies

Acquiring all of the materials and supplies needed before installing bees is wise. Purchasing an all-inclusive beekeeping kit is one of the



Simple Langstroth beehive with bottom board and deep super brood chamber and entrance, inner cover, second deep super and telescoping cover with syrup feeder, smoker, beetle trap, and hive tool.

Photo: Meister Photos/shutterstock.com

easiest ways to get started. Presently, kits retail for \$200 to \$400, price depends on what all is included and if the kit comes pre-assembled. Most kits contain the basic materials needed to start a colony of bees; e.g., all hive components, protective equipment, and hive working tools. To save money, hives can be built at home using scrap lumber. Typical North American hive designs, such as Langstroth and Dadant hives, are readily available online and in beekeeping books for those wanting to put their woodworking skills to the test.

GETTING BEES

There are four primary ways to obtain bees: purchase a package of bees, purchase a nucleus or “nuc” colony, purchase an already established hive, or capture a swarm. Each approach has advantages and disadvantages, and the desired method will largely depend on personal preferences, time, and resources available. Nonetheless, novices are often encouraged to start with packages or nucs, since these colonies are smaller and allow a beginner to advance in hive management skills and confidence as the colony size increases. Beginners should also seriously consider starting with two active hives full of bees, which allows for the manipulation of hive components between colonies to help curb potential problems. For instance, a beekeeper with two hives can place a frame full

Typical materials needed in first year of beekeeping and present costs associated with each.

Materials	Approximate Cost
Hive kit (bottom board, 1 deep super, 10 deep frames, 1 honey super, 10 honey frames, queen excluder, lid, hive tool, smoker, gloves, veil)	\$300
Bees (packages or nucs)	\$125
Pest and disease control	\$60
25 lb. bag sugar and pollen supplementation	\$65
Basic honey extraction kit (6 gallon pail, honey sieve, capping scratcher, cold uncapping knife, 5 gallon mesh filter bag, and comb capper)	\$100
Total	\$650 for one hive. Double the cost for two hives—minus the cost of the honey extraction kit – only one extraction kit would be needed for two hives.

of honey from one hive into a hive that may be lacking honey reserves to help the second hive survive the winter. Or a weaker colony may be strengthened by the transfer of a frame of brood from a stronger colony. However, when moving hive components between colonies, a beekeeper must be extremely careful to not transfer potential bacterial diseases and should always medicate when moving brood or honey stores between hives.

Packages

Packages containing 3 to 5 pounds of adult bees and a mated queen are ordered and shipped in early spring. Orders should be placed in the fall or at the latest early January, as demand is high and supplies often limited. Packages can be shipped through the U.S. Postal Service, or they can be picked up on site. If shipped through the

postal service, postal workers should be notified of the expected delivery date so bees do not sit in storage for any length of time. In Wyoming, there are very few bee suppliers, so bees may need to be purchased from adjacent states such as Colorado or Utah. Purchasing and picking up bees from a nearby state versus having them shipped from the Midwest or back east is advantageous, as it cuts down on bee death in transport, shipping costs, and accidental introduction or spread of diseases new to the area. Often, regional suppliers provide a specific pickup date in spring when bees will be ready for transport. Some local beekeepers will haul numerous packages for neighbors for a nominal fee, which saves on transportation costs.

Ways to acquire bees

	Package	Nuc	Established hive	Swarm
Present cost	<ul style="list-style-type: none"> Moderate: \$90–\$120 	<ul style="list-style-type: none"> Moderate: \$120–\$160 	<ul style="list-style-type: none"> Expensive: hive + bees = \$500 	<ul style="list-style-type: none"> Free!
Hive condition, bee and queen health, and disease and pest prevalence	<ul style="list-style-type: none"> Transport stress can cause bees to arrive nearly dead Queen usually not related to the workers can result in swarming or supercedure Usually free of pests and disease (inspected in state of origin; guaranteed by supplier) 	<ul style="list-style-type: none"> The bees are related to each other and often to the queen, which reduces the chances of swarming and supercedure Usually free of pests and disease, as long as new comb is used to build the frames (inspected in state of origin; guaranteed by supplier) 	<ul style="list-style-type: none"> The hive may have an old queen that needs replaced Bees could be harboring large populations of mites or diseased comb 	<ul style="list-style-type: none"> There is no control over the stock and genetics of the bees captured The bees may be carrying disease and pests
Hive body size	<ul style="list-style-type: none"> Allows for flexibility in hive body size 	<ul style="list-style-type: none"> Does not allow for any flexibility in hive body size 	<ul style="list-style-type: none"> Allows for flexibility in hive body size 	<ul style="list-style-type: none"> Allows for flexibility in hive body size
Management and upkeep	<ul style="list-style-type: none"> Easy option for beginners – small, more manageable colony Bees will have to be fed until the start of the primary nectar flow, adding to the cost 	<ul style="list-style-type: none"> Easy option for beginners – small, more manageable colony 	<ul style="list-style-type: none"> A quicker timeline will be required since the hive is starting out with a larger population Hive could be split into two hives if strong enough. 	<ul style="list-style-type: none"> There is no guarantee bees will be acquired when needed
First-year honey crop	<ul style="list-style-type: none"> Will probably not have a crop the first year since colony needs time to develop 	<ul style="list-style-type: none"> If nectar flow is strong can produce a honey crop in the first year because the colony already has brood (baby bee eggs) 	<ul style="list-style-type: none"> If colony is healthy, should produce a good crop of honey in the first year 	<ul style="list-style-type: none"> Hard to predict if a honey crop will be produced the first year

Nucleus (nuc) Colonies

Nucleus colonies are essentially miniature hives. They contain four or five frames of bees in all stages of development – brood, adult bees, a laying queen, and some honey and pollen stores. The nuc colony will usually develop into a strong colony by mid-summer as long as it is not infected with mites or disease and once moved into a full-sized hive body and given supplemental feed.

Many states require bees be inspected in their state of origin to help lessen the possibility of spreading disease new to the area; however, purchased colonies may contain bees with mites and small hive beetles, as these species are often ubiquitous in bee colonies. A good dealer will indicate the possibility of the presence of mites and be willing to help if the problem is severe. Whether purchasing packaged bees or nucs, a



A beekeeper installs a new package of bees in a hive.
Photo: Lindsay Snow/shutterstock.com



Nucleus behind the glass.
Photo: Lipatova Maryna/shutterstock.com

good practice is to ask a bee supplier about the condition of the bees before purchase.

Established hives

When purchasing an established hive, a beekeeper will obtain all the hive components, frames with established comb, some honey reserves, and a good population of honey bees. Avoid purchasing hives with weak colonies and equipment in poor condition. There is always the risk of purchasing an established hive infested with disease and pests. This option is recommended for more experienced beekeepers better able to recognize a healthy colony.

Swarms

Capturing a swarm of bees to be introduced into your own beekeeping setup is relatively easy. Since the bees are in search of a new home, swarms are usually very docile and cluster on tree limbs, shrubs, or fence posts, for example. They can simply be relocated into a box or bucket with a tight-fitting lid and then be shaken into an open hive body or placed at the entrance of an empty hive where they will hopefully enter on their own after a few minutes. Swarms should be requeened as soon as possible since old queens are the cause of most swarms.

Requeening is an important strategy in maintaining a healthy hive through all stages of development. Requeening simply means replacing the old queen with a new, mated queen that will consistently lay eggs and secrete a high level of pheromones. Queens can usually be purchased and shipped within a three-to four-day period. The older, reigning queen should be removed and the replacement queen that arrives in a small cage should be positioned near the brood nest for several days to give the colony time to accept her. Once it appears the new queen can be released into the colony without being attacked by the worker bees, she can be released from the cage. A simple approach is to use a piece of marshmallow to close the entrance of the queen cage. After

several days, the queen will have had time to distribute her pheromones and when the workers chew their way through to release her, the colony should be accustomed to her scent and thus accept her as their new queen.

Replace queens older than three years to keep colonies healthy and avoid queen infertility. Colonies with young queens are nearly twice as vigorous as colonies with aged queens. There are various reasons why a beekeeper may consider requeening and a number of methods a beekeeper can employ to ensure a bee colony accepts a new queen. Beginning beekeepers are advised to familiarize themselves with the requeening concept as they will most likely need to requeen at some point.



Swarm of bees visiting an apple tree.
Photo: Sally Wallis/shutterstock.com



Bees gathered after a swarm.
Photo: N. Pieporan



Transferring a swarm.
Photo: Nancy Piepropan

DIFFERENT TYPES OF BEES

A beekeeper has a number of options when selecting a stock or type of bee. All honey bees found in the United States are from the same species – *Apis mellifera*. From this species, various genotypes have been bred for specific, desirable traits. Some of the most common subspecies available, such as Italians, Caucasians, and Carniolans, are suitable for backyard beekeeping. Some newer subspecies developed through interbreeding and selection, like Russians, Minnesota Hygienic, and SMR bees, are selected for greater mite resistance and/or improved hygienic (hive cleaning and grooming) behavior, which results in colonies being able to rid their hive of pests and pathogens more quickly. Each subspecies has advantages and disadvantages, so talk with potential suppliers and other beekeepers about what stock to choose based on management objectives.

BEE YARD LOCATION

A beekeeper must have access to a variety of floral resources within a 1- to 3-mile foraging radius to successfully raise bees in Wyoming. This could include a combination of either flowering trees, native flowering vegetation such as rabbitbrush, various wildflowers, suitable cultivated flowers, irrigated crops like alfalfa and clover, or even escaped weeds such as thistles. Most Wyoming towns are apt for raising bees because of the many varieties of trees, shrubs, and flowers growing within their boundaries. Locations near crops, particularly alfalfa, are also excellent for raising a few colonies of honey bees. Placing hives in the desert prairie with no additional floral resources will most certainly end in disaster. It is recommended to keep no more than four hives on a property of a quarter acre or less to ensure adequate floral resources and to prevent robbing from other colonies when multiple hives are present.

Bee stocks and their characteristics

Bee stock characteristics	Italian	Caucasian	Carniolan	Russian	Buckfast
Color	Light	Dark	Black	Gray	Medium
Gentleness	Moderate	High (sometimes described as the gentlest of all honey bees)	High	Low-moderate	Low-moderate
Disease and pest resistance	Some resistance to European foulbrood	Some resistance to European foulbrood	Some resistance to American foulbrood	Varroa and tracheal mite resistance due to genetics and hygienic behavior	Tracheal mite resistance
Spring buildup of colony	Good	Very low	Very good	OK	Low
Swarming prevalence	OK	Low	High	OK	Low
Honey production	Very good	Low	Good	OK	Good
Overwintering ability	Good	OK	Good	Very good	Good
Other traits	<ul style="list-style-type: none"> • Strong inclination to rob other hives • Considered good housekeepers 	<ul style="list-style-type: none"> • Forage at lower temperatures and less favorable climatic conditions than Italians • Produce large amounts of propolis (bee glue), which makes the hive difficult to work 	<ul style="list-style-type: none"> • Excessive swarming can be an issue, but they do not have a high tendency to rob and are good comb builders 	<ul style="list-style-type: none"> • Queen cells are always present, which, can make management more difficult • Perform better when not in the presence of other bee strains 	<ul style="list-style-type: none"> • If left unmanaged for one or two generations, they can become very aggressive. • Better suited for cold, wet climates (like England, where they were originally bred)

A good rule of thumb for an apiary site is anywhere a camping tent might be placed: level, close to water, out of the wind. If people find the site suitable to inhabit, then bees probably will be happy to camp there, too. Honey bees are most active from mid-morning to mid-afternoon so position hives in an area where they will receive adequate sun exposure to maximize nectar and pollen collection – a south or southeast exposure is ideal. However, on hot days bees will often cluster outside the hive and not work, so providing some light shade is desirable. Also providing protection from prevailing winds is recommended. Bees need a steady supply of fresh water. A hive of bees will use a quart or more a day in hot weather. If no natural source of water is nearby, be sure to install a clean, reliable water source, such as a birdbath with a floating board or large rock for bees to land on. Hives should be raised off the ground with either a hive stand or other easily procured materials, such as cinder or wood blocks, to allow airflow, prevent moisture buildup, and to discourage predators. Small mammals like skunks and raccoons are less likely to raid a hive when they are forced to rise up on their hind legs and expose their bellies to stings. A large rock or brick(s) on the top of a hive will help keep top covers secure from gusty Wyoming winds.

If worried about concerns from neighbors, consider constructing a fence or hedgerow at least 6 feet high and several feet from the hive entrance to force bees to fly above head level, thereby reducing bee-pedestrian encounters. When bees leave their home, there is little incentive for them to fly more than about 6 feet high, unless there is a barrier that forces them to fly up almost immediately upon leaving the hive. When placing hives, be aware bees fly in the same flight pattern every day and can “spot” cars, clothes, or buildings in their path with body waste, which can accumulate quickly and become unsightly.

HIVE HUSBANDRY

Once a colony is installed, a beekeeper will employ a variety of techniques to ensure development of a strong colony with ample honey production. Carbohydrate and protein supplementation, swarm management, disease and pest monitoring and mitigation, and winter hive management are essential to achieving maximum colony numbers in time to take the most advantage of flower nectar when it becomes available. If possible, the inexperienced hobbyist is encouraged to pair with a more seasoned beekeeper when carrying out hive management tasks the first time.

Feeding Bees

The timing of prime nectar flow depends upon a specific location and can vary from year to year, but typically in Wyoming begins in late spring to early summer and continues through mid- to late summer when most flowering plants are in full bloom. Beekeepers should monitor food stores and colony expansion in the early spring months when Wyoming weather can



Feeder with a few bees.
Photo: Justina Russell



Inside hive frame feeder.
Photo: J. Russell



Bee hive components and tools

Hive bodies. Hive bodies are the standard boxes that make up a beehive. Hive body, brood chamber, super, or bee box all mean the same thing – a housing structure for bees. The difference in name comes from how each is used.

A) Honey super box. Placed on top of the brood chamber where harvestable honey is produced. Comes in two sizes: shallow ($5 \frac{3}{8}$ inches) and medium ($6 \frac{5}{8}$ inches). A third, small size exists ($4 \frac{3}{4}$ inches) but is used only for the production of honeycomb. Honey supers are shorter than hive bodies because smaller boxes are lighter and easier to handle when full of honey. Super simply refers to their superior placement in the hive configuration – above the brood chamber.



B) Brood chamber. The tallest compartment in a hive is $9 \frac{5}{8}$ inches tall and is reserved for housing the queen and “immature bees” – the brood; this box is also referred to as the deep super, brood nest, or hive chamber.



C) Inner and outer covers. Two-part system used for weatherproofing a hive



D) Entrance reducer. A small piece of wood placed at the entrance of a hive protects a weak colony from being robbed of honey by a stronger colony, reduces drafts during winter months, and prevents small animals like mice from entering.



E) Feeder. Many styles available; used to feed a 1:1 water/sugar syrup mixture when nectar not available; also used to feed water in summer months.



Foundation. Sheets of hexagonal, imprinted beeswax used to encourage bees to build a uniform comb within frames.

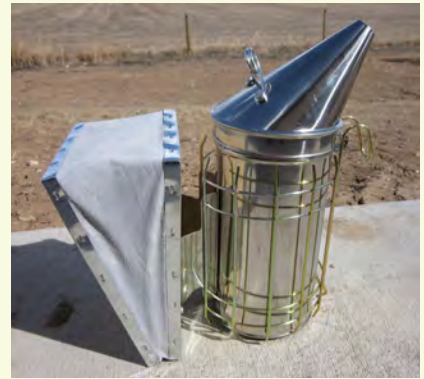


Frames. Square, wooden structures designed to support a comb of beeswax.



Hive tool. Used to open hives and remove frames without damaging wood. Note: Bees fill gaps in hives with propolis or “bee glue” making it necessary to pry apart hive components during hive inspection and harvest.

Veiled bee hat. Large veil that drapes over a plastic helmet or hooded bee suit (full bee suit used to protect entire body from stings).



Bee smoker. A small fire container with bellows used to puff smoke on bees during harvest. Smoke produces a feeding response in bees; when a bee has a full belly, it is less likely to sting.



Gloves. Leather with cotton sleeves all the way to the elbow.

still be very cool, wet, and windy to ensure there is enough food for the rapidly growing bee population.

Colonies can be vulnerable to starvation if the weather inhibits flight activity this time of year. When bees starve, they die in the cells of the comb and are very difficult to remove. These combs and frames often become moldy, preventing further use, representing an economic loss and potential loss of the whole colony. Supplemental feeding of a 1:1 sugar-to-water mixture (by weight or volume) is highly recommended. Supplemental feeding (2:1 sugar to water syrup) will also be necessary in the fall to help colonies prepare for winter. A good rule of thumb is that anytime a colony has less than 20 pounds of food (three full-depth frames of honey or the equivalent), the bees should be fed.

Pollen supplementation may also be necessary in fall and spring. Honey bees derive protein, vitamins, minerals, and some carbohydrates from pollen, and no single flower source provides all nutrients needed so bees must visit a variety of flowers. Placing bought or homemade pollen patties in a hive will help with brood production, particularly if spring weather is bad for long periods of time.

In the west where pollen supplies are less in the late summer and fall, pollen substitutes given at this time will produce plumper winter bees with more stored nutrient reserves. These bees will winter better and rear more brood in the spring. To determine if a colony is more

likely to survive the winter, a standard-sized hive can be carefully lifted from behind in the fall to check if it weighs close to 100 pounds due to ample honey and pollen stores.

Swarm Management

Swarming is when a queen bee leaves the hive with a large number of worker bees (approximately 60 percent) to start a new colony. Swarming primarily occurs in the spring within a two- to three-week window depending on the location, yet occasional swarms can happen throughout the honey-producing season. In the process of swarming, the original single colony reproduces to two and sometimes more colonies. Swarming is a natural, instinctive behavior of honey bees to reproduce and create new colonies; however, colonies that swarm rarely recover their numbers in time to produce a decent honey crop. Successful swarm management is essential for honey production and should remain a primary focus of any successful beekeeper.

Several factors can contribute to swarming, including overcrowding in the hive, a failing queen, poor ventilation, a bee subspecies' propensity to swarm, and an imbalance in the age structure of the worker bees. One of the most effective spring swarm management techniques is to create ample room in a hive. This can be done by manipulating the hive components to create more space for brood rearing and nectar storage or by splitting an over-populated colony into two separate hives.

Pests, Diseases, Parasites & Predators

Honey bees have historically had issues combating a number of diseases, parasites, pests, and predators. Through proper diligence, the majority of bee pests and predators can be adequately controlled. Bears can be kept at bay by the placement of electric fencing, and mice can be deterred by installing screen or entrance reducers on hive entryways.

However, various diseases and two parasitic mites, the Varroa and the tracheal mite,



Queen bee in the center. It's larger than other worker bees and marked by blue paint.

Photo: Konstantin Gushcha/shutterstock.com

introduced to the U.S. in the 1980s, are of serious concern for honey bee keepers.

The Varroa mite is now recognized as the most damaging, widespread pest to honey bees in the United States and perhaps most of the world. These mites are an external parasite that feed on the blood of brood and adult bees, severely weakening the colony over time. Similarly, the tracheal mite feeds on its host's blood, but lives in the breathing tube of honey bees. Colonies entering winter with a high mite population are less likely to survive.

Diseases can be grouped into two main categories: those affecting the brood and those affecting adult bees. Common brood diseases include American foulbrood (AFB), European foulbrood (EFB), sacbrood, and chalkbrood. Adult diseases include viruses and parasites, such as Nosema.

Constant monitoring and timely management of disease and mites is critical to maintain healthy hives. Diseased bees or those colonies infected with mites almost never make it through an extended cold period of sub-zero temperatures like we often see in Wyoming. For specifics on how to identify and treat specific honey bee maladies, see "Integrated Hive Management for Colorado Beekeepers," <http://bit.ly/csu-beebook>.

The type of bee you keep in your hive can affect the amount of pest/disease management you will need to do (see Types of Bees section).



Varroa destructor mite on a honey bee pupa (*Apis mellifera*)
Photo: Mirko Graul

If not interested in putting in the time to monitor and deal with honeybee health issues, reconsider whether you want to take on beekeeping, even as a hobby. Poorly managed hives are not only a disservice to the bees you manage, they can spread diseases and pests to other people's hives. Beekeeping takes time and requires a fair amount of effort, which should be taken into consideration before undergoing this endeavor.

Hive Winterization

Beekeeping can be challenging in any environment but even more so in Wyoming's cold, high, semi-arid plains. Hobbyists should be prepared for the potential die back of approximately 30-50 percent of a colony in the winter. Due to the combination of Wyoming's frequently adverse overwintering conditions and the present reality of widespread pest and disease problems, it has become increasingly difficult to get even strong colonies through the winter. In fact, many commercial beekeepers no longer overwinter their colonies in Wyoming. Instead, they harvest their honey and replace them with queen-right (a colony that contains a healthy, laying queen) packages and nucs in the spring. This may actually be a good practice for novices to consider, especially if they experience hive death or considerable dieback year after year.



Hives that have been winterized with tarpaper.
Photo: J. Russell

During an average summer, the amount of honey from a colony raised from a 3-pound package of bees or a two to three frame nucleus will provide enough honey to overwinter the colony, as well as enough to cover package costs through honey sales, plus a small surplus for personal consumption. Any yield less than this means it is probably not worth trying to get the colony through the winter. In essence, colonies in poor condition as winter approaches are not worth trying to preserve and should be combined or replaced.

If a colony is strong going into a Wyoming winter, there should be some attempt made to winterize the hive. This includes keeping hives out of the wind; making sure they are placed in a high, sunny location with good drainage; attempting to rid colonies of pests and disease in the fall; manipulating hive components so bees have less space to heat; reducing the hive entrance to 1 or 2 inches; and possibly insulating hives with tarpaper or black plastic.

If hive bodies are wrapped, a beekeeper must pay careful attention to proper hive ventilation to prevent moisture condensation, which can quickly kill a colony of bees. To ensure adequate air flow, it is recommended to use a slotted inner cover or top cover with a 3/8-inch handhold beneath a moisture absorption board, both placed under a metal telescoping cover. Opening hives for inspection during the winter months where exposure to freezing temperatures could be deadly is not recommended in Wyoming.

Becoming a successful beekeeper can be rewarding. Backyard bees provide a natural, nutritious product and can be enjoyable to watch and care for; however, beekeeping is not a totally carefree activity. Investigating this subject well before you begin and setting realistic expectations for the resources (time, money, effort) you will expend can reward the hobbyist beekeeper with a very satisfying experience and one of nature's sweetest treats!

Timeline of a year of beekeeping in Wyoming

Activity	Active beekeeping season in Wyoming											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Order, clean, repair, paint equipment	x	x								x	x	x
Supplemental feeding			x	x	x				x	x	x	
Install packages					x	x						
Check queen, brood, and colony health bi-weekly					x	x	x	x	x			
Check for swarm cells; add brood chamber, if necessary					x	x	x					
Add honey supers						x	x	x				
Harvest honey								x	x			
Monitor for pests and disease (e.g., Varroa mites, nosema, American foulbrood, European foulbrood, tracheal mites, chalkbrood, etc.) and treat if necessary			x	x	x	x	x	x	x	x		

RECAP OF BEEKEEPING CHALLENGES

So you want to be a beekeeper in Wyoming ... Challenges to Consider

Beekeeping can be challenging in any environment but even more so in Wyoming's cold, high desert plains. Wyoming's harsh winters, short growing season, arid climate, and small volume of flowering plants during key foraging times can present many challenges to the beekeeping enthusiast.

Many parts of Wyoming lack the amount and breadth of floral resources that allow honey bees to thrive. The sagebrush prairie habitat prevalent throughout most of the state does not produce enough flowers during the active season for honey bees to survive. Depending solely on Wyoming's natural vegetation for bee forage is simply not an option. A beekeeper must have access to a variety of floral resources within a 1- to 3-mile foraging radius to successfully raise bees in Wyoming. This could include a combination of either flowering trees, native flowering vegetation such as rabbitbrush, various wildflowers, suitable cultivated flowers, irrigated crops like alfalfa and clover, or even escaped weeds such as thistles. Most Wyoming towns are suitable locations for raising bees because of the many varieties of trees, shrubs, and flowers growing within their boundaries. Locations near crops, particularly alfalfa, are also excellent for raising a few colonies of honey bees. However, placing hives in the semi-arid prairie with no additional floral resources will end in disaster.

A good rule of thumb is to keep no more than four hives on a property of a quarter acre or less to ensure adequate floral resources and to prevent robbing from other colonies when multiple hives are present. Because of Wyoming's relatively short growing season, bees will also need supplemental feed of nectar and pollen (sugar syrup and pollen patties) in the spring and fall so bees will be able to produce ample amounts of honey and stay healthy throughout the year. Wyoming's arid climate will require a beekeeper to provide a steady supply of water if hives are not near a natural water source.

Hobbyists should be prepared for the potential die back of approximately 30–50 percent of a colony in the winter. Making some attempt to winterize a hive is extremely important in Wyoming. This includes keeping hives out of the wind; making sure hives are placed in a high, sunny location with good drainage; attempting to rid colonies of pests and disease in the fall; manipulating hive components so bees have less space to heat; reducing the hive entrance to 1 or 2 inches; and possibly insulating hives with tarpaper or black plastic. Opening hives for inspection during the winter months where exposure to freezing temperatures could be deadly is not recommended in Wyoming.

Be aware that to keep honey bees healthy, you may need to use pesticides within the hive.

APPENDIX 1

PLANT PORTRAITS FOR SELECTED PLANTS FROM THE BLOOM LIST

Plants are ordered by bloom time. For more details, refer to the complete bloom list, “Planning a landscape with a continual supply of flowering plants” on page 34, which lists plants ordered from spring blooming to fall and includes pollinator observation information.

More information on a variety of plants is available by visiting the Barnyards & Backyards website, www.barnyardsandbackyards.com, and clicking on “Landscaping.”

PLANT TOXICITY

Many plants have some level of toxicity to animals (including us). This includes plants from elsewhere in the world (introduced plants) and those native to the Rocky Mountain region. Many plants likely contain toxic compounds as a way to keep herbivores (rabbits, deer, insects, etc.) from eating them. Any threat they pose depends on several factors:

- Toxicity varies by plant species (and plant varieties within species) and the plant part eaten.
- The environment the plant is growing in and what growth stage the plant is at can affect the levels of toxic compounds.
- What animal species is consuming the plant. Not all animals are similarly susceptible to the toxic compounds in any particular plant species. Just because cattle or wildlife are eating a plant does not mean they are safe for humans to eat!
- How toxic they are to the animal species consuming them. Toxicity ranges from highly toxic in which a minute amount can kill an animal to minimally toxic when an animal must consume very large amounts to have any effect.
- How likely they are to be eaten. Many (but not all) of our poisonous native plants are not very palatable (animals do

not like to eat them), and they won't be consumed unless the animal has little choice (such as in overgrazed pastures).

A little information is provided here on some commonly known plants with toxic properties. This does not mean others listed are not toxic as well. If concerned with these issues, research the plant in question.

Never eat or allow others whom you supervise (such as children) to eat any plant you haven't positively identified or which you don't know (100 percent) to be safe to eat.

Additional plant toxicity resources

Burrows, George E., and Ronald J. Tyl.

Toxic Plants of North America. John Wiley & Sons, 2013.

University of California Agriculture and

Natural Resources. “Toxic Plants (by Scientific Name).” Safe and Poisonous

Garden Plants, ucanr.edu/sites/poisonous_safe_plants/Toxic_Plants_by_Scientific_Name_685/.

USDA-ARS. *Plants Poisonous to Livestock in the Western States*, United States Department of Agriculture - Agricultural Research Service, 2011, www.ars.usda.gov/ARSUserFiles/oc/np/PoisonousPlants/PoisonousPlants.pdf.



Spring meadow saffron

Bulbocodium vernum (also known as *Colchicum bulbocodium*)

Height: 3–4 inches

Width: 1–2+ inches

Small, raggedy looking but very early little bulb. Critter resistant. All parts toxic.

Photo: RukiMedia/shutterstock.com



Crocus

(Many varieties)

Height: 3–4 inches

Width: 2+ inches

Hardy, small, early flowering bulb. Wide variety of colors. Flowers and foliage might be eaten by rodents, rabbits, and deer.



Snow iris

Iris reticulata

Height: under 6 inches

Width: 3 inches

An early-blooming dwarf iris bulb. Clumps will increase by offsets in size over time if happy. Leaves grow taller after blooming until dormancy. 'Pixie' pictured.



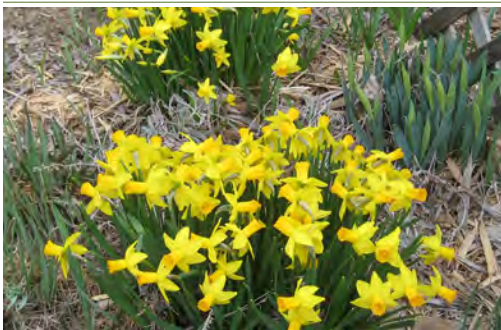
Pasqueflower

Pulsatilla vulgaris, *Pulsatilla patens* (pictured)

Height: 6–12 inches

Width: 12 inches

P. patens is native to Wyoming, *P. vulgaris* is not. Blooms very early followed by feathery seed heads. All parts are toxic.



Daffodils

Narcissus

'Jetfire', 'King Alfred'

Height: up to 16 inches

Width: clump size depends on number of bulbs planted

'Jetfire' (pictured) is a shorter, smaller type of daffodil. 'King Alfred' is a classic daffodil type. All parts toxic.



Glory-of-the-snow

Chionodoxa forbesii

Height: 4–6 inches

Width: 3–6 inches

A spring-blooming bulb. It will often spread via seed and bulb offsets.



Tulips

Tulipa

Species (botanical-type) tulips are general shorter and have smaller flowers than regular tulips. Clumps will expand over time if happy with their location. Tulip flowers and foliage are eaten by many wildlife.

‘Little Beauty’ pictured.



Grape Hyacinth

Muscari

Height: 6–8 inches

A cheerful spring-blooming bulb. Leaves also grow out in the fall.

Muscari armeniacum can reseed a lot. Plant another species or deadhead to avoid reseeding.



Thymes

Thymus

Height: generally under 10 inches

Width: varies

Many different types; some can be used as groundcover.

‘Elfin’ pictured.



Sugarbowl clematis

Clematis scottii

Height: 12 inches

Width: 18 inches

Native bush clematis. A bit floppy. It takes a little while to bulk up from small plants. Amusing seed heads. Bumble bees push themselves into the urn-shaped flowers.



Hall's penstemon

Penstemon hallii

Height: to 8 inches

Width: 12+ inches

Adaptable, early-blooming penstemon from higher elevations in Colorado. Relatively easy to start from seed; plants are not common in nurseries.



White-tufted evening primrose

Oenothera caespitosa

Height: approximately 12 inches

Width: 12–24 inches.

Native. Short-lived (a couple of years.) Reseeds; can reseed a lot depending on location. Some varieties spread underground. Fragrant flowers. Jackrabbits like to eat it. A larval and nectar food for hawkmoths.



'Kannah Creek' sulfur buckwheat

Eriogonum umbellatum

Height: 6–12 inches

Width: 8–12 inches.

Native. Long season of interest. Flowers turn rusty orange color.



Coral bells

Heuchera spp.

Height: up to 16 inches in bloom

Width: up to 15 inches

'Ruby Bells' (pictured) is a cultivar of the plant native to the Southwest. Coral bells tend to grow in places such as on canyon walls. Probably will do better in part shade in hot areas. Attractive to hummingbirds.



'Walker's Low' catmint

Nepeta

Height: 15–18 inches

Width: 2–3 feet

Long bloom time. Can rebloom if deadheaded. Purchase only sterile, vegetatively propagated types to minimize reseeding. Extremely attractive to a wide variety of pollinators.



Firecracker & Beardlip penstemon

Penstemon eatonii, *Penstemon barbatus*

Height: up to 3 feet

Width: 12–18 inches

Native to Utah and Colorado. *P. eatonii* (pictured) tends to bloom before *P. barbatus*. Attractive to hummingbirds. Can reseed.



'May Night' salvia

Salvia nemorosa

Height: 18–24 inches

Width: 12–18 inches

Longish bloom period. Reseeds. Cut back after blooming for fresh growth and to control reseeding. Visited by many bees.



Large beardtongue

Penstemon grandiflorus

Height: 2–3 feet

Width: 8–12 inches

Native. Large showy blooms. Reseeds moderately. Short bloom period of approximately 2 weeks. Can be short-lived (1–2 years).



Desert princesplume

Stanleya pinnata

Height: 3 feet

Width: 18–24 inches

Native. Can be short-lived. Concentrates selenium, can be toxic to livestock if they are without other forage sources. Can reseed.



Rocky Mountain penstemon

Penstemon strictus

Height: 18–24 inches

Width: 12–18 inches

Native. Easy to grow. Susceptible to powdery mildew, especially in shade. Prolific reseeder; deadhead to avoid reseeding.



Purple prairie clover

Petalostemon purpureus (also *Dalea purpurea*)

Height: 2–3 feet

Width: 1–2 feet

Native. Nitrogen-fixing plants. Slow growing from seedlings. Takes a couple of years to bulk up. Likes irrigation. Very attractive to bees.



Palmer's beardtongue

Penstemon palmeri (also known as pink wild snapdragon)

Height: 2–4 feet

Width: 18–24 inches

Native to Utah. Large, showy fragrant blooms. Short-lived but reseeds when happy.



Blanket flower

Gaillardia

Height: 12–18 inches

Width: 12–18 inches

Reseeds a fair amount and can be short-lived. Native *Gaillardia aristata* has rhizomatous tendencies and is susceptible to powdery mildew.



Prairie coneflower

Ratibida columnifera (also known as upright prairie coneflower)

Height: 18–24 inches

Width: 18–24 inches

Native. Long bloom period. Short-lived plant but reseeds moderately. Flowers can be yellow or burnt orange. Some native bees, such as digger bees, visit this plant.



Garrett's firechalice

Zauschneria garrettii

Height: 18 inches

Width: 18–24 inches

Native. Late summer color. Spreads underground and can cover a large area in time. Visited by hummingbirds.



Poppy mallow

Callirhoe involucrata

Height: 6–12 inches

Width: 2–3 feet

Does not transplant well due to taproot. Reseeds.



Hollyhock

Alcea

Height: 3–8 feet

Width: 2+ feet

Tall plants range from biennials to perennials. Visited by many bees. Leafcutters cut circles out of the petals to use in their nests.



Black-eyed Susan

Rudbeckia hirta

Height: approximately 24 inches

Width: approximately 24 inches

Variety *pulcherrima* is native. Various varieties available in cultivation. A short-lived perennial. Great late-summer color. Vigorous reseeder.



Agastache

Height: 2–3 feet

Width: 18+ inches

A. foeniculum is native. Other species and varieties also available. Some are cold-hardier than others. Visited by bees and hummingbirds.





Narrow-leaf coneflower

Echinacea angustifolia

Height: 18–24 inches

Width: 12–18 inches

Native. More drought-tolerant than *E. purpurea* (below) but not as large and showy. Reseeds. Takes a few years to bulk up. May need to grow from seed.



Purple coneflower

Echinacea purpurea

Height: 2–3 feet

Width: 18–24 inches

Late-summer blooms. Not a xeric plant in some areas of Wyoming. Performs better with supplemental water.



Beebalm

Monarda didyma

Height: up to 24 inches. Dwarf ‘Petite Delight’ is 12–15 inches.

Width: 18–24 inches

Susceptible to powdery mildew. Choose resistant cultivars.

‘Fireball’ pictured.



Spike speedwell

Veronica spicata

Height: 12+ inches

Width: up to 18 inches

Various varieties. Visited by bees.



Milkweed

Asclepias spp.

Height: 20–30 inches

Width: 6–8 inches at base; wider at top when in bloom.

Native. Attractive to butterflies and some bees. Larval host for butterflies. Some *Asclepias* toxic to livestock, see note “Butterfly milkweed” on page 72.



Oregano

Oreganum

Height: 18 inches

Width: 24+ inches over time

Many different types of bees, syrphids, and other pollinators cover the flowers of this herb for as long as it blooms in late summer.

Hardiness varies among cultivars.



Colorado four o'clock

Mirabilis multiflora (also known as wild four o' clock)

Height: 1–3 feet

Width: 2–4 feet

Long-lived. Do not transplant due to taproot. Reseeds.



Goldenrod

Solidago spp.

Height: 18–24 inches

Width: 16 inches

‘Golden Baby’ is a hybrid goldenrod highly attractive to bees. Good source of late summer and fall food for a variety of bees. It forms a clump. Many goldenrods are vigorous rhizomatous spreaders.



Gentians

Gentiana parryi, *G. septemfida* hybrids

Height: 6–8 inches

Width: 12 inches.

Native and non-native cross. Bumblebees like to squeeze inside these late-blooming flowers. Like moisture. Can be planted near downspouts. Some gentian species bloom in spring.



Scarlet gilia

Ipomopsis aggregata

Height: up to 3+ feet

Width: 24 inches

Native. Biennial or short-lived perennial. Favorite of hummingbirds. Takes up little room in the garden until it bursts into bloom in late summer. Can reseed.



Dotted blazing star

Liatris punctata (also know as Gayfeather)

Height: 12–18 inches

Width: 6–12 inches

Native. More drought-tolerant than some liatris. Takes a few years to bulk up from a seedling. Long-lasting flower heads attractive to butterflies and bees.



'Autumn Joy' sedum

Sedum

Height: 18–24 inches

Width: 12–18 inches

Long, late-summer bloom time. Bee favorite.



Colchicum

Height: up to 8 inches

Width: 5+ inches

One of the latest flowers to bloom in the fall. Huge flowers on many varieties. Animal resistant. Taller leaves come up in spring before going dormant. All parts toxic.

Shrubs



Serviceberry

Amelanchier alnifolia

Height: 6–10 feet

Width: 5–8 feet

A spring-blooming shrub. Blooms followed by edible blue-black berries. Can experience winter dieback in some locations.

Photo: HES Photography/shutterstock.com



Sand cherry

Prunus besseyi

Height: 4–6 feet

Width: 4–6 feet

A native shrub that provides food for wildlife. Susceptible to powdery mildew on the leaves. Blooms smell sweet. Some suckers. Fruit can be very nice tasting or very astringent.



Golden currant

Ribes aureum

Height: 4–6 feet

Width: 4–6 feet

Native plant. Sweet smelling yellow blooms. Spreads by suckers or reseeding.



Three-leaf sumac

Rhus trilobata

Height: 3–12 feet

Width: 4–10 feet

Native shrub. Glossy leaves. Inconspicuous flowers and red berries. Fall foliage colors can be nice. Can sucker.



Lewis mock orange

Philadelphus lewisii

Height: 4–9 feet

Width: 4–9 feet

Covered with sweet-smelling white flowers in early summer. Native to Montana and the Northwest.



Silver buffaloberry

Shepherdia argentea

Height: up to 12 feet

Width: 12+ feet

Native, spring-blooming shrub. Very attractive to bees. Male and female flowers are on separate plants. Can form thickets.

Photo: Andrey Kozyntsev/shutterstock.com



Wood's rose

Rosa woodsii

Height: 3–6 feet

Width: 3–6 feet

Native with fragrant flowers. Can quickly spread to form thickets.

Photo: cjchiker/shutterstock.com



Raspberry

Rubus

Height: up to 6 feet

Width: 4+ feet

Delicious fruit. Bees love the flowers. Old stalks are used by some native bees that create their nests in the pithy middles.



Potentilla

Potentilla fruticosa

Height: 2–4 feet

Width: 2–4 feet

Tough shrub. Long summer bloom period.



Fernbush

Chamaebatiaria millefolium

Height: up to 6 feet

Width: 6 feet

Native in Idaho and Utah. Aromatic with rounded form. Visited by bees, syrphids, etc. Brittle stems; avoid planting where it will get crushed by snow falling off roofs.



Blue mist spirea

Caryopteris x clandonensis

Height: 2–3 feet

Width: 3 feet

Late summer bloomer. Can cut back in early spring. Bees visit it heavily.

BUTTERFLY MILKWEED

A note on the *Asclepias* species (butterfly milkweed). Milkweeds have received a lot of press in recent years due to concerns with monarch butterfly populations. *Asclepias* species serve as food sources for the caterpillars of these butterflies. The caterpillars consume leaves and concentrate toxic substances within the plants apparently as a means of defense (birds who eat the caterpillars throw up). *Asclepias* are toxic to some livestock.

The species most often reported to be of concern to livestock are *Asclepias labriformis*, *A. subverticillata*, *A. eriocarpa*, and *A. fascicularis* (You can find out which species are native to the state on the Plants USDA website <https://plants.usda.gov>). In part, this is reported to be due to their presence in harvested hay. Their thin leaves are hard for animals to discern in dried hay and avoid eating them. They are also a

concern where animals are trailed or where they have no other forage. *Asclepias speciosa* is native to Wyoming and has been declared noxious in some counties in the state. This plant is not recommended for landscape beds as it is also a highly vigorous spreader. Some of the other *Asclepias* can also spread vigorously.

There is some debate amongst the scientific community on the importance of planting milkweeds as a caterpillar food source for monarchs. Drought in places such as Texas that reduces nectar sources along their migration routes, has been implicated by some studies as playing a large role in the health of monarch populations. Further studies may clarify the situation.

For more detailed information on toxicity see *Toxic Plants of North America*, George E. Burrows and Ronald J. Tyrl.

APPENDIX 2

MORE BEES, BUTTERFLIES, AND HUMMINGBIRDS

You can visit bugguide.net to help you with the challenge of identifying bees. *Bumble Bees of the Western United States* is also a helpful guide, <https://www.fs.fed.us/wildflowers/pollinators/documents/BumbleBeeGuideWestern2012.pdf>. UW researchers are developing a Wyoming bee identification guide.¹

BEES

Family Andrenidae (mining bees)



Andrena

Andrena female with pollen load on a veronica plant.

Photo: Jennifer Thompson



Andrena

Andrena visiting a fernbush plant.

Photo: J. Thompson

Family Apidae (carpenter, digger, bumble, honey bees, and other)



Anthophora

Anthophora move extremely quick, making them hard to see clearly. They often appear as fuzzy blurs visiting penstemon flowers.

Photo: J. Thompson

¹ Thanks to Christine Bell for her assistance with bees and identification. Butterfly text by Scott Schell. Thanks to UW Biodiversity Institute for the use of butterfly photos from their collection.



Anthophora

Anthophora visiting a daffodil in spring.

Photo: J. Thompson



Honey bees

Honey bees can vary a bit in their coloring. Golden-toned, left; darker, below. Honey bees have hair on their eyes.

Photos: Bobbie Holder, top. J. Thompson, lower



Long-horned bee

Female *Melissodes* with a pollen load.

Photo: B. Holder



Long-horned bee

Male *Melissodes* on sunflower.

Photo: J. Thompson



Mountain bumble bee

Bombus appositus visiting a *Penstemon strictus* (Rocky Mountain penstemon) flower. This species has white-colored hair on its face and shoulders.

Photo: J. Thompson



Mountain bumble bee

Bombus appositus feeding on a delphinium.

Photo: J. Thompson



Two-form bumble bee

Bombus bifarius collecting nectar from a fernbush (*Chamaebatiaria millifolium*) flower.

Photo: J. Thompson



California bumble bee

Bombus californicus makes its appearance early. Pictured on golden currant flowers.

Photo: J. Thompson



Central bumble bee

Bombus centralis on veronica.

Photo: J. Thompson



Brown-belted bumble bee

Bombus griseocollis on purple coneflower (*Echinacea purpurea*).

Photo: B. Holder



Hunt bumble bee

Bombus huntii visiting a penstemon flower.

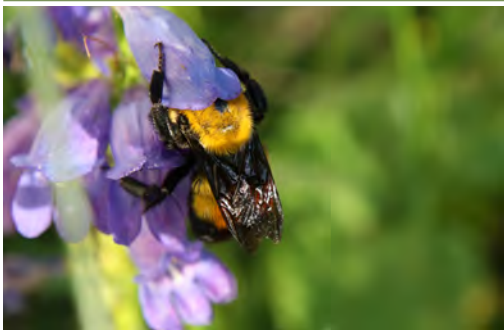
Photo: J. Thompson



Hunt bumble bee

Two *Bombus huntii* visiting bladderpod (*Physaria*) flowers early in the year.

Photo: J. Thompson



Nevada bumble bee

Bombus nevadensis visiting a penstemon flower.

Photo: B. Holder

Family Colletidae (plasterer, polyester, and masked)



Masked bee

Hylaeus on a veronica plant. You won't see pollen-covered legs on a *Hylaeus* as they carry pollen inside their crop.

Photo: J. Thompson

Family Halictidae (sweat bees)

This is one of the most common families of bees found in Wyoming. It contains a very large and diverse number of species.



Metallic green bee

Agapostemon

Photo: B. Holder



Agapostemon femoratus

On rabbitbrush.

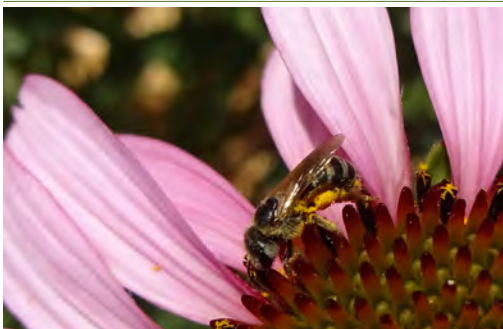
Photo: B. Holder



Lasioglossum

Tiny *Lasioglossum* subgenus *Dialictus* caught in a spider web.

Photo: J. Thompson



Halictus ligatus

On purple coneflower.

Photo: J. Thompson

Family Megachilidae (leafcutter, mason, carder bees, and others)

Female bees in this family can often be identified by the scopa (hairs) they use to collect pollen. These are located under the abdomens; many other bees use hairs on their back legs.



Carder bee

Male *Anthidium* rests between flights to patrol his territory.

Photo: J. Thompson



Dianthidium

Photo: B. Holder



Mason bee

Hoplitis visiting a veronica flower.

Photo: J. Thompson



Leafcutter bee

Male *Megachile*. Note the wide portion on the front legs. This helps distinguish males from females.

Photos: J. Thompson





Leafcutter bee

Female *Megachile*. Note the hairs (scopa) under the abdomen which are used to carry pollen.

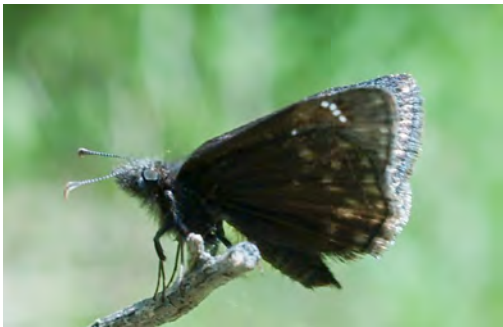
Photos: J. Thompson



BUTTERFLIES

Family Hesperiidae (Skippers)

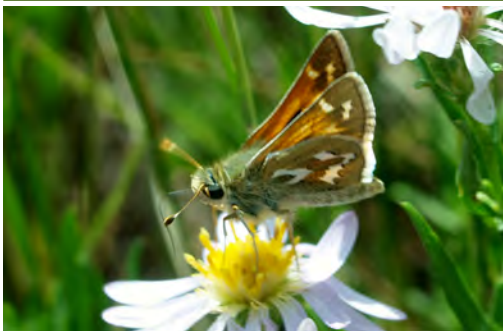
This family gets its common name “skippers” from the members’ darting flight patterns. The small-sized skippers are a very diverse butterfly family. Many species require close examination of facial markings to distinguish. However, all skippers have a thin extension, called an apiculus, on the end of their antennae clubs/knobs, other butterfly families don’t have. The subfamily called the grass-skippers use grasses for their caterpillar’s host plant so they can be very abundant on Wyoming grasslands.



Persius duskywing

Erynnis persius

Photo: John Nordin



Western branded skipper

Hesperia colorado

Photo: J. Nordin



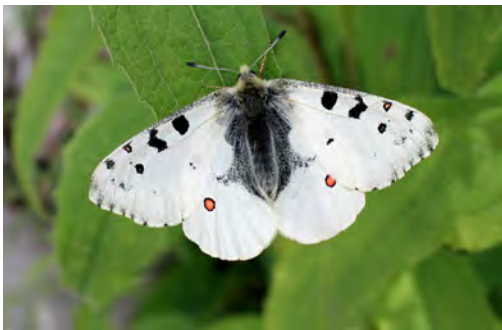
Woodland skipper

Ochlodes sylvanoides

Photo: J. Nordin

Family Papilionidae (Parnassians and Swallowtails)

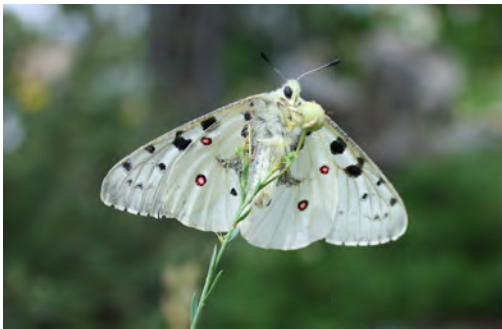
This family contains Wyoming's largest butterfly species. Most of the swallowtails members have "tails" or projections on the back edge of the hind wings. The five beautiful tiger swallowtail species found in Wyoming can be difficult to tell apart due to color variations and even hybridization, which is known to occur between species. The large size, white wings, lack of "tails" on the hind wings, and the presence of bright spots on the wings distinguish the Parnassians butterflies from their relatives in the family.



Rocky Mountain parnassian

Parnassius smintheus

Photos: B. Holder, top and center; J. Nordin, bottom





Anise swallowtail

Papilio zelicaon

Photos: Helen Coates, top; B. Holder, bottom



Western tiger swallowtail

(*Papilio rutulus*)

Photo: J. Nordin.



Western tiger swallowtail chrysalis

Papilio rutulus

Chrysalis

Photo: B. Holder



Western tiger swallowtail

Papilio rutulus

Larva

Photo: B. Holder



Two-tailed swallowtail

Papilio multicaudata

Photos: B. Holder



Family Pieridae (Whites and Sulphurs)

Most members of this family are small to medium in size and have wing tops predominantly white or yellow colored. The presence or absence of orange or black markings on the wings can help identify the species observed. Some species can be quite abundant in Wyoming's farm land including the non-native cabbage white butterfly. It is one of the few species of butterfly whose caterpillars can be a crop and garden pest.



Stella orangetip

Anthocharis stella

Photo: J. Nordin



Orange sulphur

Colias eurytheme

Photo: H. Coates



Clouded sulphur

Colias philodice

Photo: J. Nordin



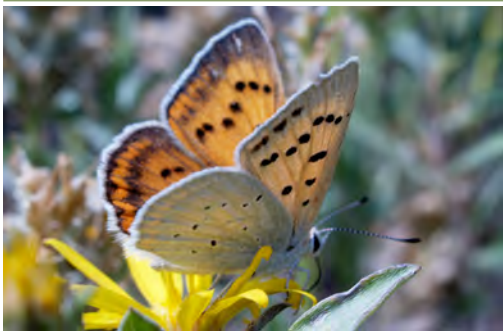
Western white

Pontia occidentalis

Photo: H. Coates

Family Lycaenidae (Gossamer-wing Butterfly)

The common names of the three subfamilies of Lycaenidae are coppers, blues, and hairstreaks and are accurately descriptive. The lycaenids are typically very small but often beautiful butterflies. They usually perch with wings upright. Luckily, the spots and markings on the underwing can be useful to identify them. The hairstreak species frequently have short tails that look like antennae and eyespots on the hind wing that can make some of them appear to have two heads.



Ruddy copper

Lycaena rubidus

Photo: J. Nordin



Melissa blue

Plebejus melissa

Photos: J. Nordin, top; B. Holder, bottom



Sheridan's green hairstreak

Callphrys sheridanii

Photo: J. Nordin

Family Nymphalidae (Brush-footed Butterfly)

The front pair of legs of members of this family are shortened, hairy, and held tightly to the face unless they are in use to “taste test” flowers. The remaining four legs function typically. Many of Wyoming's prettiest and most commonly seen butterflies belong to this diverse family.



Viceroy

Limenitis archippus

Photo: H. Coates



Weidemeyer's admiral

Limenitis weidemeyerii

Photos: B. Holder, top; J. Thompson, bottom



Weidemeyer's admiral

Limenitis weidemeyerii

Larva

Photo: B. Holder.



Green Comma

Polygonia faunus

Photo: H. Coates



Mourning Cloak

Nymphalis antiopa

Photo: J. Thompson



Milbert's tortoiseshell

Aglais milberti

Photo: B. Holden



Common wood-nymph

Cercyonis pegala

Photo: H. Coates



Painted Lady

Vanessa cardui

Note the front pair of legs (butterflies have 6 legs, 3 pairs) on this butterfly that are “brush-footed.”

Photos: H. Coates



Painted Lady

Vanessa cardui

Chrysalis

Photos: B. Holder





Common alpine

Erebia epipsodea

Photo: H. Coates



Common ringlet

Coenonympha tullia

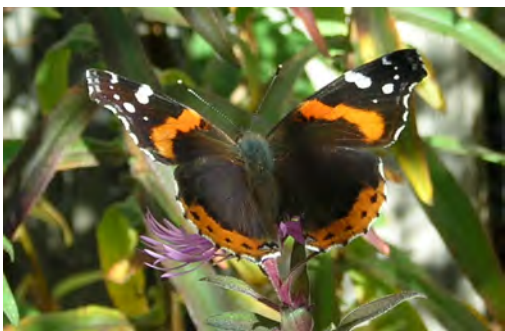
Photo: H. Coates



Mormon fritillary

Speyeria mormonia

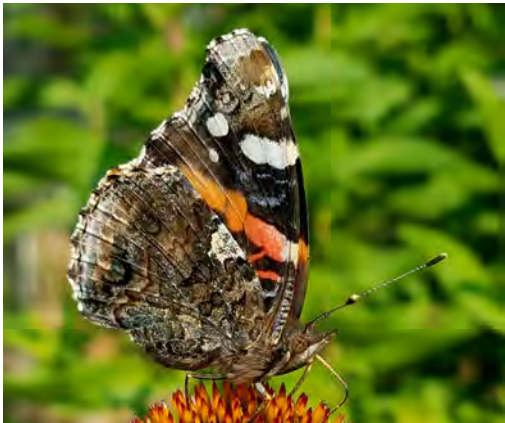
Photo: J. Thompson



Red admiral

Vanessa atalanta

Photos: B. Holder



HUMMINGBIRDS

Male hummingbirds are usually easier to identify than females due to the more prominent differences in their plumage color. Pictures of males can be found in the guide, beginning page 30.



Selasphorus rufus

Female Rufous hummingbird in flight.

Photo: Pete Arnold

APPENDIX 3

EXAMPLE SEED MIX FOR POLLINATOR PLANTINGS

The decision process for creating a pollinator seed mix can be somewhat complex. The following are some factors to consider:

- Most guidelines suggest choosing three species of flowers to bloom in each bloom period for a total of nine species. (Note: the example mix is short one late-blooming species.) There are several USDA-NRCS publications that can help you look at choices. Visit <http://www.uwyo.edu/barnbackyard/resources/pollinators.html> for links.
- No more than 30 percent of seed should be grasses (bunch grasses are preferred to rhizomatous since they are less likely to out-compete the flowers)
- Do you want just native plants? How “native”? Native to the U.S.? Native to the region? Native to Wyoming? Native to your county? Visit <https://plants.usda.gov/> to see maps (zoom in to see your county) on each plant’s page that shows whether the NRCS considers the plant to be native to the area. (These designations are not always cut-and-dried.)
- Is seed available for this plant from a seed company? (Some sources listed on <http://wyomingnativegardens.org/index.php/resources/seed-sources/>)
- How much will the seed cost?

This example seed mixture is calculated on a very heavy seeding rate used for broadcast application by hand. It is four times the amount of seed recommended by USDA-NRCS for use with seed drills. Calculations are based on seeding half an acre.

Plant common name	Plant scientific name	Seeds/lb	% mix	Pounds PLS needed ¹	Seeds/ft ²	Example cost per pound (\$) ²	Cost of seed (\$)	Seedling depth (inches)	Bloom period
Indian ricegrass	<i>Achnatherum hymenoides</i>	162,000	10%	1.6	11.90	12.00	19.20	½–3	
Bottlebrush squirreltail (grass)	<i>Elymus elymoides</i>	220,000	10%	1.2	12.12	14.00	16.80	¼–½	
Sandberg’s Bluegrass	<i>Poa secunda</i>	1,000,000	10%	0.4	18.37	5.00	2.00	0–¼	
Beeflower, Rocky Mountain	<i>Cleome serrulata</i>	64,000	10%	3.4	9.99	64.00	217.60	0–⅛	early–mid
Utah Sweetvetch	<i>Hedysarum boreale</i>	46,000	5%	2.4	5.07	150.00	360.00	¼–½	early
Penstemon, Rocky Mountain	<i>Penstemon strictus</i>	286,000	10%	0.8	10.51	70.00	56.00	0–⅛	early
Blanketflower	<i>Gaillardia aristata</i>	200,000	10%	1.0	9.18	52.00	52.00	¼–½	early
Prairie clover, white	<i>Dalea candida</i>	448,000	10%	0.4	8.23	70.00	28.00	¼–½	mid-late
Sunflower, annual	<i>Helianthus annuus</i>	45,000	10%	4.8	9.92	14.00	67.20	¼–½	mid-late
Coneflower, prairie or Mexican hat	<i>Ratibida columnifera</i>	740,000	15%	0.9	30.58	36.00	32.40	¼–½	mid
Totals			100%	22.9	161.00		\$851.20		

1 PLS stands for pure live seed. Read this article to gain a better understanding of what that means. http://www.uwyo.edu/barnbackyard/_files/documents/magazine/2013/fall/092013bbseedlabel.pdf

2 These are just example prices to demonstrate some of the variability (though some of the more expensive ones, \$500 per pound, were not included). Seed prices can vary widely year-to-year based on supply and demand.



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