



A Phenology Planner for Beekeepers

by Julia McGuire

DEDICATION

When it comes to nature, I always thank my grandmothers for nurturing my young self's curiosity and wonder through observing, hiking, and staring at field guides and pages of bird eggs in the encyclopedia. When it comes to beekeeping, I always thank my oldest child, the original beekeeper of the family.

Deep, deep gratitude goes to my contributors, reviewers, and letters of support across Iowa and surrounding counties: Ellen Bell, Cindy Blobaum, Mike Bredesky, Giselle Bruskewitz, Sharon Burman, Mark Campbell, Kate Cloudsparks, Rachel Conrad, Rachel Crane, Emily Enabnit, Arvin Foell, Diane Forristall, Gil Gillespie, Melissa Hanson, Kathy Hellstern, Ben Hokscho, John and Val Just, Susan Kelly, Courtney Keppler, Joe Klingelhutz, Jake Kundert, Tyler Lane, Ben Lehnen, Claire Dickey Licht, Paulette Lynn, Britta McCollum, Cole McGuire, Ella McGuire, Colleen McRoberts, Roger Ohmert, Mike Peverill, Ben Phillips, Jean Rhodes, Brent Scharf, Stacey Sieloff, Jenni Sykes, Diane Thoma, Don Weiss, Jennifer Welch, and Jan Yegge

Title: A Phenology Planner for Beekeepers

Author: Julia McGuire

Print Design and Botanical Illustration: Alex McGuire

Printer: Hyperion Creative Agency

Cover Image: Honey bee on Ageratum

Copyright 2021 by Julia McGuire

Inquiries about this book may be sent to julia@juliecache.com



United States Department of Agriculture
National Institute of Food and Agriculture

A Phenology Planner for Beekeepers

by Julia McGuire

2022

This book belongs to

KEY CONTACTS / PHONE A FRIEND

Local inspector _____

Mentor / local bee club leader _____

FROM THE AUTHOR

This planner was designed to assist Iowa beekeepers (and surrounding counties) make connections between their beekeeping work and the surrounding natural world. My goals for the planner match that of SARE Outreach -- profit over the long term, stewardship of our natural resources, and quality of life of the farmer. I hope these goals are attained through improved honey production, increased native foraging habitat, and a sustainable apiary, achieved through mindful colony management that works with the environment to maximize nectar and pollen flows and minimize swarming.

As a beekeeping instructor, I noticed a knowledge gap in my students when it came to identifying bee forage. While many “bee plant” lists and a few phenology databases exist, this planner/field guide hopefully adds value by going one step further by helping the user identify existing habitat (especially woody species) and connecting bee plants to beekeeping activities.

Because many of us are urban beekeepers, I have included garden and landscape plants that contributors have seen honey bees use as forage. I also note that the vertical space is prime real estate for maximum forage, so I've emphasized tree identification.

Honey bees are extreme generalists, so they collect pollen and nectar as the opportunity arises. Thus, they have been observed¹ to collect resources from non-native plants early in the season and native plants late in the season. This indicates the value of both types of plants to beekeepers. One study I found noted a delay in phenology events as the Midwest becomes warmer⁵, and two other papers suggest that native prairie plants could help buffer negative forage effects due to weather.^{2,4}

HOW TO USE THIS BOOK

This planner was created to supplement your hive inspection records. My vision is one where beekeepers write notes about the hyperlocal phenology and bee behavior at their bee yards. The left hand page is a field guide for identification and the right hand side is a notes page for observations that are tied to the phenology events of the month. Observations could be the date or location of a newly identified plant, bee activity, or weather event like an extremely low or high temperature. More field guide images can be found at juliecache.com.

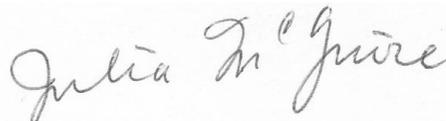
Although the dates on which the phenological events occur may differ from year to year, the order will be the same. Thus, linden trees may bloom earlier one year and later another year, but they will always happen after the black locust tree blooms. Notes that I make should give context and help with decision-making.

Decisions may include moving hives next year to be closer to certain trees or a field of forbs that were identified late in the season this year, or to plant more suitable forage to combat drought-stricken or flooded areas.

I envision myself using the right hand page of notes with a different color ink or making columns for different years. This book can help as you take advantage of and manage for the bees' natural tendencies to the extent that you can.

Because I had many data points submitted that would not fit on these pages, I encourage you to visit my website juliecache.com and find the Phenology section for more plants and phenology events to aid you on your beekeeping journey.

Peace,

A handwritten signature in cursive script that reads "Julia M. Givore". The signature is written in dark ink on a light-colored background.

During the winter, I'm identifying woody species to assess year-round forage and possible nectar flows. I do this through silhouettes of trees and their branch types. January is a perfect time to learn silhouettes (round, open, pyramidal, vase, etc.) from afar and leaf scars up close (opposite or alternate): maple (open and opposite), basswood (round and alternate in a zigzag). I find a maple's shape to be round and open; basswood's shape is oval and closer than a maple.

PHENOLOGY INFO:

Trees: Boxelder trees are maples. In winter, boxelders have greenish or purple twigs with white hairy buds while maple twigs tend to be reddish; bright red basswood buds are on zigzagged branches in winter.

Forbs: N/A

Garden/Ag: N/A

Other: Antler shed starts.



Maple, *Acer* spp.

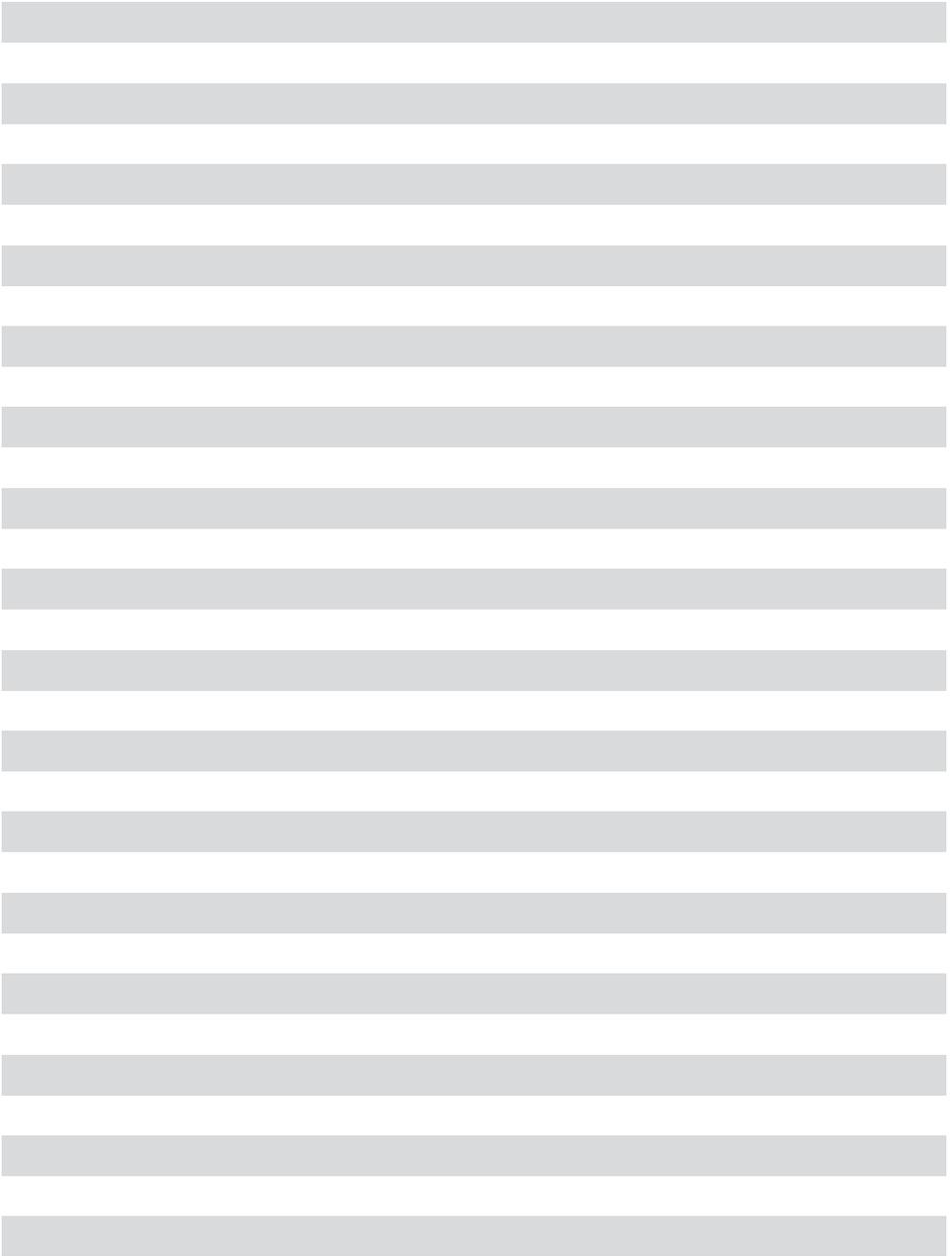


Basswood, *Tilia* spp.

BEE CHORE: Quick checks on food stores can and should happen during January thaws. Pop the lid quickly and replenish with enough food to last until the next time you can check.

Historical Temperatures
High: 73 Low: -47

JAN



Bees do not hibernate. They are active all winter long and will take cleansing flights in winter on warm days.

Woody species, such as willows and sumac, use vertical space, making them great additions to areas with restricted footprints. Willows vary widely in silhouette -- sticks in the ground, multi-trunked trees, and single trunked shrubs with all kinds of silhouettes. Looking for vibrant colored twigs can be a good way to identify these early bloomers. Sumac is easy to find now as it keeps its fruit through winter. The fruits can be used as smoker fuel and as the weather turns warm, their pale green flowers, which blend in with similarly colored pinnate leaves, offer nectar for the bees.

PHENOLOGY INFO:

Trees: Willow and maple flowers may begin to appear this month or next. Willows vary widely in shape and form and like maples, are special in that their flowers emerge before their leaves.

Forbs: Longer days and leaf tips are quite noticeable in Feb.

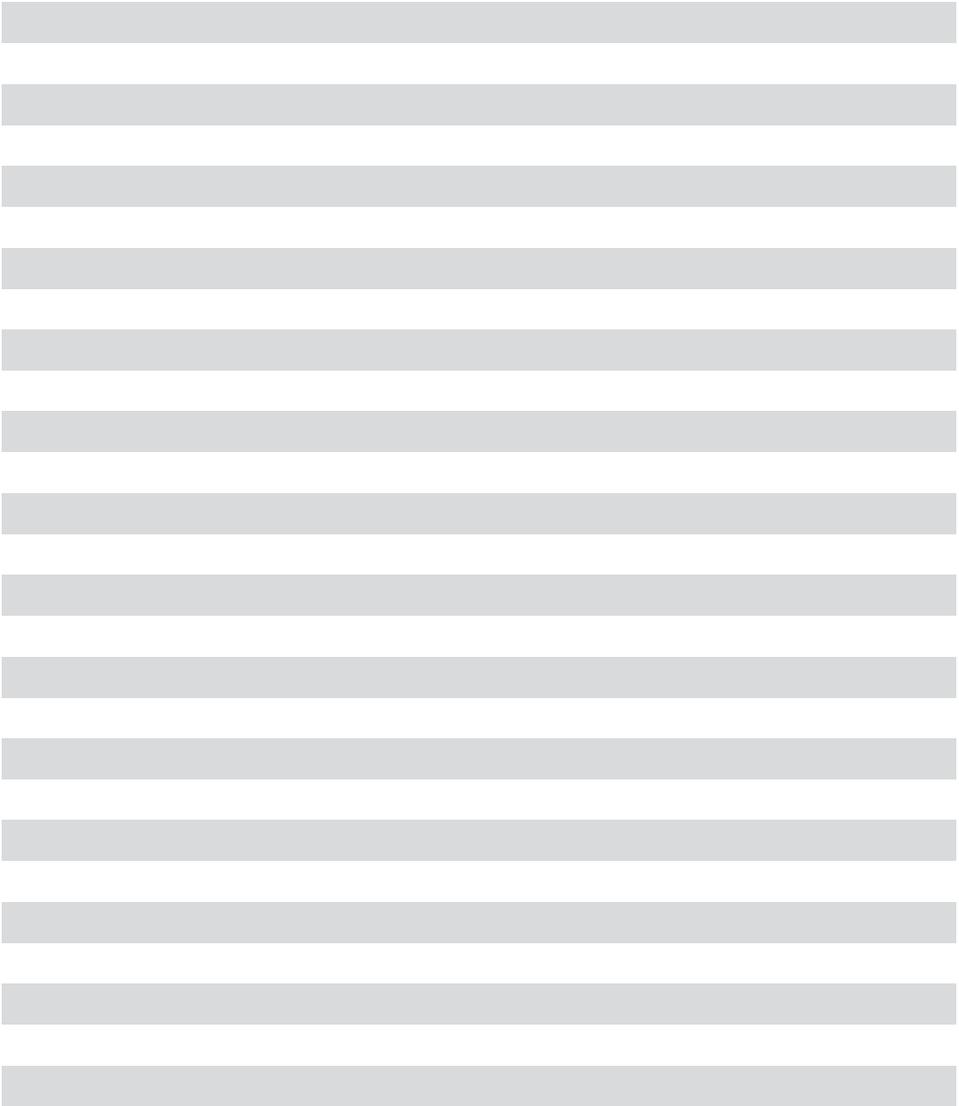
Garden/ag: Early bulbs start to pop up, providing early pollen for bees. We might see a few dandelions, too.

Other: When day time temperatures reach 40 F and above, maple sap starts to run.



Historical Temperatures
High: 82 Low: -47

FEB



BEE CHORE: With unpredictable weather, continue to check the bee's activity level and replenish food stores on warm days. Consider subscribing to a trade magazine.

Bees will check for forage as days lengthen and bring what food they can. The queen will lay more brood in response to available tree pollen.

Maple and willow flowers are signals that egg laying will increase. Dull coloration and height can make woody flowers difficult to spot, which is why winter identification and location are important. Vibrant colored twigs are good green flags. Maple flowers can be above the eye line, so I identify first the shape, then look for alternating twigs, then look for red at the tips. Willow catkins are typically fuzzy and less than 2" long.

PHENOLOGY INFO:

Overall: The landscape is greening up this month with spring ephemerals (perennial plants that emerge and die back quickly); many birds are migrating. Chorus frogs begin calling and serves as a cue for queen rearers to get their cell builders ready.

Trees: Flowers on maple and willow emerge. Red cedar (also called juniper, see November for image) and elm also flower. These are pollen sources that cue egg laying.

Garden/Ag: Dandelions can be a signal for raising our earliest queens.

Image by Mike Bredesky



BEE CHORE: The emergence of green grass is when some people reverse hive bodies. In a related activity, we can equalize overwintered hives once we get a long warm day, so be sure to locate all woodenware early in the month and have it repaired, clean, and ready. Along with longer days, bees are collecting pollen and nectar. We will want to watch the weather and look for signs of swarming and take action to prevent swarming.

Historical Temperatures
High: 92 Low: -35

MAR



Some beekeepers will assess their risks against the arrival of consistently warm weather and decide to switch from dry feed to 1:1 syrup to stimulate laying in anticipation of dandelion pop.

Forbs (flowering plants) are gearing up for full bloom and black mustard tends to be the earliest of these. Black mustard tends to be about 2' high. Its yellow flowers come at the end of a stalk in bunches and have four petals. Locust trees have an open silhouette and commonly found in parking lots. They have distinct bipinnate leaves. Some locusts have large thorns that are easy to see this time of year.

PHENOLOGY INFO:

Overall: Spring ephemerals continue to bloom this month. When there is a lack of native forage, bees will visit our cultivated bulbs and landscape plants. Typically last freeze comes the end of this month. Turkeys, snakes, tree frogs, morels appear.

Trees: Locusts usually bloom at the end of the month. Other woodies such as viburnum will also get attention from bees.

Forbs: Mustards

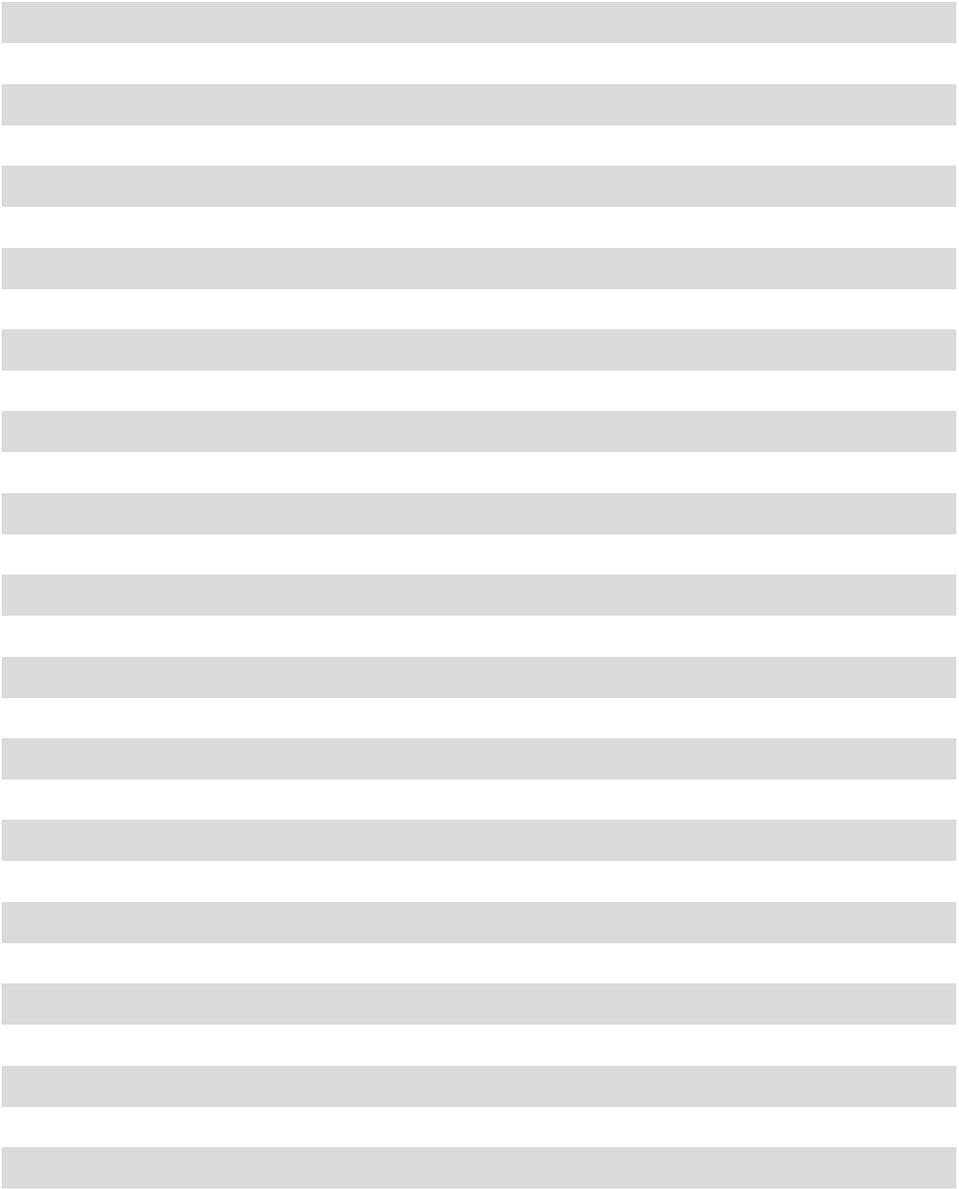
Garden/Ag: Bees are visiting fruit trees, strawberries, creeping charlie, and henbit.

BEE CHORE: Swarm calls start this month as the first naturally occurring swarm cells appear now that drones are flying. Dandelions in full bloom can signal the time to reverse hive bodies, make splits, and see the earliest lowa-raised queens emerge. Our days are long enough to clean deadouts and equalize hives out in the field. Some people also set out swarm traps before everything leaves out more.



Historical Temperatures
High: 100 Low: -9

APR



Some beekeepers try to prime a colony's population to coincide with basswood burst; others set up swarm traps.

Birdsfoot trefoil, white and yellow sweetclover, Dutch white clover and alsike clover all appear this month. Trefoil can get 12 - 30" high; the sweetclovers can be 2 - 8' high! Dutch clover has a faint "v" on its leaves and alsike does not; both tend to stay under 3' high.

PHENOLOGY INFO:

Overall: Spring ephemerals are petering out; our prairie forbs are emerging. We may want to avoid mowing areas where the above flowers are found. Lightning bugs, hummingbirds, and butterflies appear. Trees: Bees are visiting dogwoods and late flowering fruit trees. Forbs: Purple and white prairie clover emerge.

BEE CHORE: If clovers are abundant in your area, first budburst might be a good time to add a super on the hive to take advantage of its nectar flow.



Image by Don Weiss

Birdsfoot trefoil, *Lotus corniculatus*

Yellow sweet clover, *Mellilotus officinalis*

Image by Tyler Lane

Purple prairie clover, *Dalea purpurea*

Historical Temperatures
High: 111 Low: 10

MAY



The adage is, "A swarm in May is worth a load of hay, a swarm in June is worth a silver spoon, but a swarm in July is not worth a fly. " May is swarm season. A swarm is a natural reproductive act of the colony as a superorganism.

Basswood (also called linden) trees bloom first in sunny locations in town, followed by shady areas of town, then in edges and middles of woodlands. Basswood is tall; its lopsided heart-shaped leaves have serrated edges. Catalpa trees (not native) can also be a good nectar source. They're irregularly shaped with long, smooth heart-shaped leaves and keep long, flat seed pods through winter.

PHENOLOGY INFO:

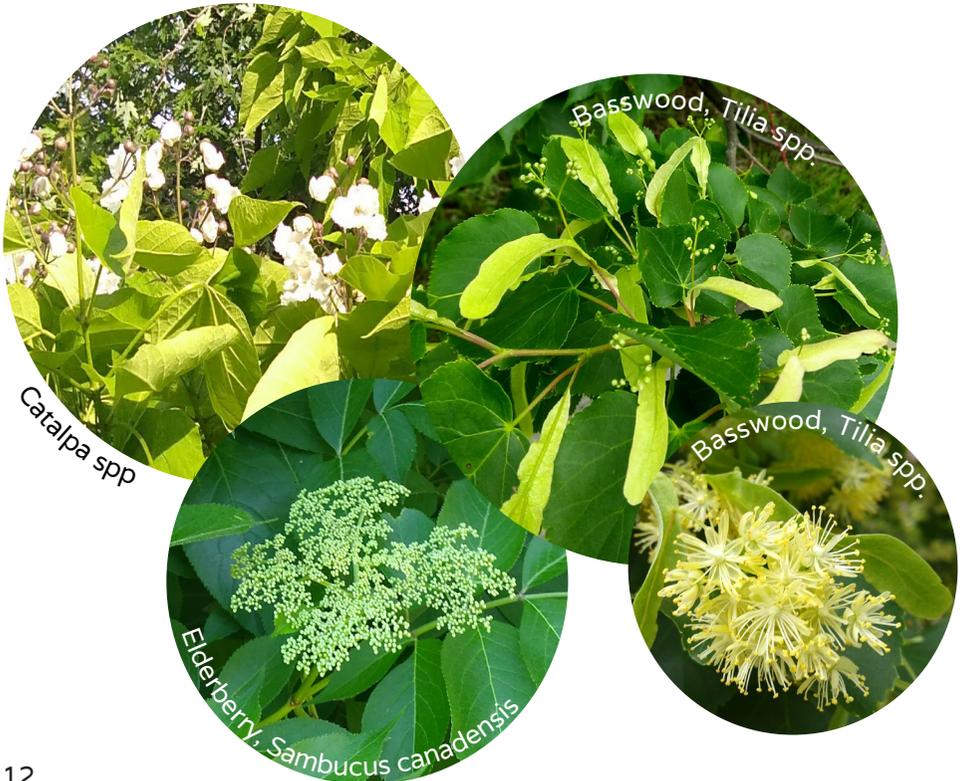
Overall: Bees can be found on purple prairie clover and elderberry flowers this month.

Trees: Elderberry has a distinct compound leaf and pale flowers that form a flat umbrel. The berries are very dark in contrast to the leaves, so elderberry bushes may be easier to find in August.

Forbs: Clovers, milkweeds, and blue flag iris bloom now.

Garden/Ag: Alfalfa and soybean blossoms are attractive to bees and can yield a nice crop early in the month. Bees also visit vetch and numerous flowers in the lawn and garden.

BEE CHORE: Identifying and locating trees and nearby places to set hives can increase yields. Basswood has a very light-colored honey with a distinct flavor and minty finish. In addition to regular inspections, monthly mite counts are an important practice in our operation.



*Historical Temperatures
High: 109 Low: 27*

JUN



Bearding is the bees' version of climate control - they create a 'fan' on the surface of the hive to move warm air (and bodies) out.

Prairie forbs such as partridge pea and mountain mint are abundant and bees frequently visit them. Partridge pea flowers have deep red stamens in the center of their yellow flowers and pinnately compound leaves, growing 1 - 3' high. Mountain mint has a bush-like form, round tops of very dense, small, white flowers and finely toothed leaves. Petals have a little pink spots and leaves smell like mint when crushed.

PHENOLOGY INFO:

Overall: This is commonly a drought month, meaning there is a dearth in forage. It is also when prairie forbs are abundant.

Trees: Sumac is flowering with its pale green petals.

Forbs: Bundle flower, coneflower, cup plant, wingstem

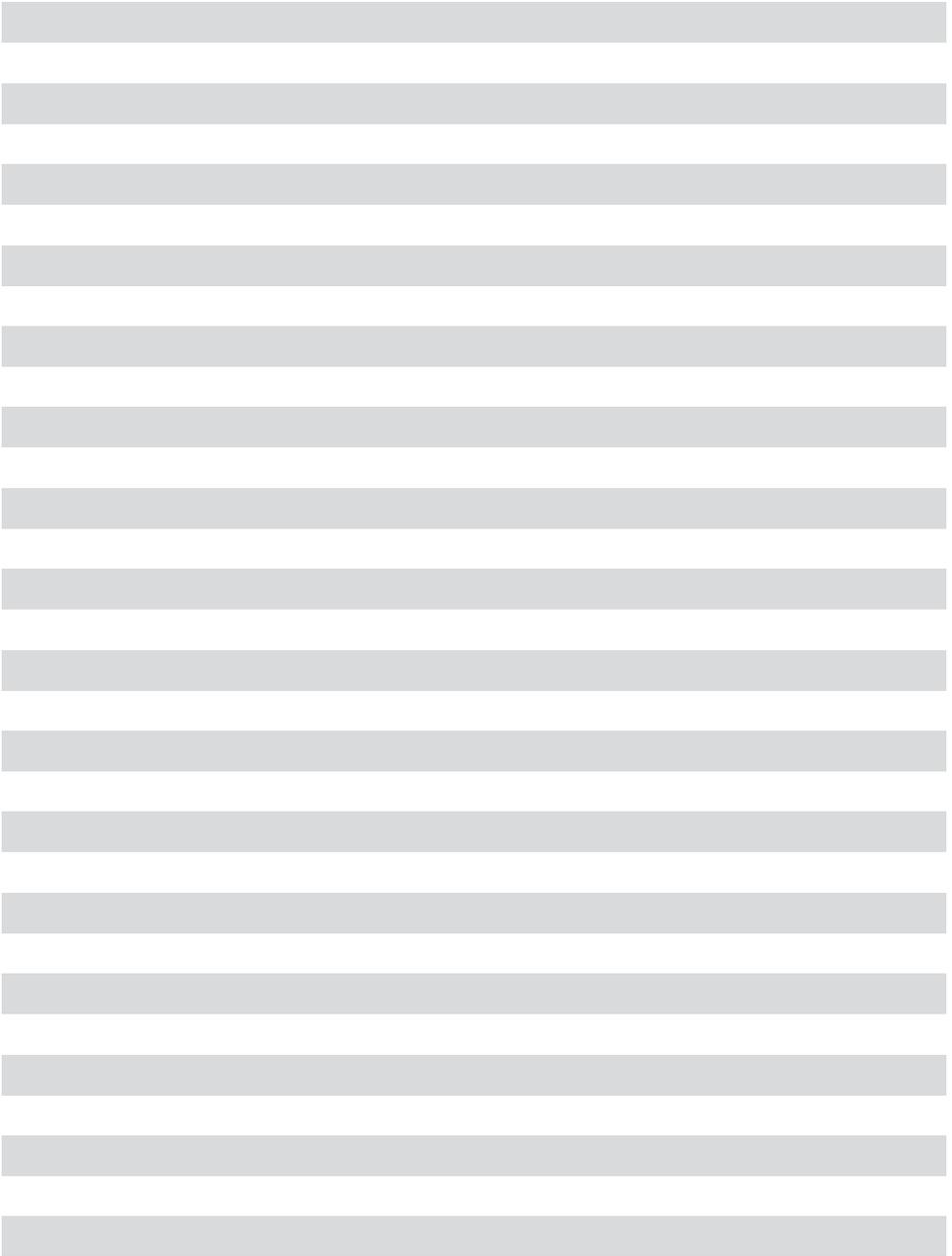
Garden/Ag: Bees will visit plantain, a common lawn weed, during dearth.

BEE CHORE: July is the peak of our nectar flows. The bee population spikes before varroa mite population spikes, so this is a good time to consider late season splits⁸. We continue our monthly mite counts.



Historical Temperatures
High: 117 Low: 35

JUL



Grandsisters of the winter bees are being laid this month.

Both goldenrod and aster are in the Aster family and very popular with bees. The common theme with these tiny flowers is the fine, rayed petals. Goldenrods are always yellow and range from 2-8' high. Aster leaves vary wildly in shape and size, so I tend to look for shorter stems with multiple non-yellow flowers.

PHENOLOGY INFO:

Overall: Goldenrod can be positive and negative for beekeepers. For some, goldenrod honey tastes terrible and signals the time to pull supers, leaving late honey for the bees. For others, this dark honey is a desirable fall specialty crop.

Trees: Elderberry fruits -- look for umbrels of small, dark berries -- are easy to identify if you weren't able to find this species earlier in the year. Trees are drying up and dying back for the year.

Forbs: Sunflowers and other Aster family flowers continue to bloom late in to fall for a late nectar source.

Garden/Ag: Herbs and other garden plants can fill wild forage gaps.

BEE CHORE: Harvest and treat for mites this month. This allows for weather conducive to a second treatment if the first treatment was ineffective.



*Historical Temperatures
High: 115 Low: 30*

AUG



Bees need at least a medium super of honey for the winter. Many bee keepers strive for #100 pounds of honey stores to last the winter.

While all milkweeds vary greatly in leaf shape, seed pod shape, and flower color, their seeds look almost the same. Being very drought tolerant makes them a nice addition to the available forage.

PHENOLOGY INFO:

Trees: Sumac seedheads can be harvested to use in smoker.

Forbs: Ragweed

Garden/Ag: Sedum and other landscape plants can fill native forage gaps when planted in masses.

Other: Birds begin to migrate and days get noticeably shorter.

BEE CHORE: If forage is in short supply, the bees will need 2:1 syrup to increase the weight and winter food supply. Make plans to lay seed, plant plugs, dig trees, etc. this month. Treat as soon as honey harvest is removed.



*Historical Temperatures
High: 107 Low: 15*

SEP



The bee population begins to shrink this month, just as mite population begins to peak.

Locust leaves are pinnate, with leaflets from 0.6" - 1" in length. When the leaves turn yellow and seed pods become dark brown, locusts are fairly easy to find. Sumac leaves and fruits turn red. As sumac leaves fall, the multi-trunk nature is easy to see.

PHENOLOGY INFO:

Overall: We still have plenty of flowers until first frost, which usually occurs this month.

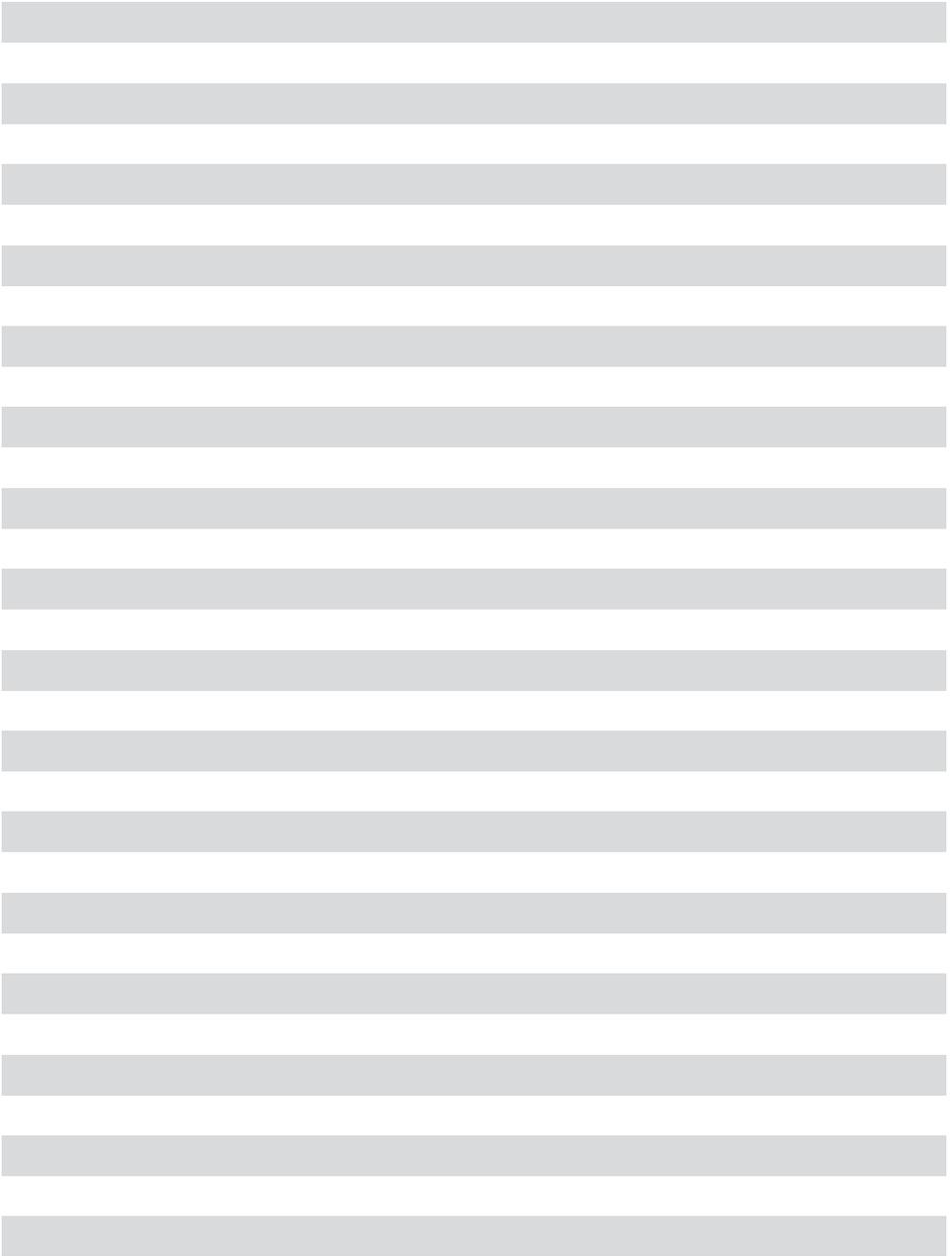
Trees: Mark the locations of trees you've identified and assess distance from existing hives, competing forage based on time of year, etc.

BEE CHORE: Forage is probably gone by the end of this month. Gather solid food and supplies to finish winterization. Make plans to attend conventions and club meetings over the winter.



*Historical Temperatures
High: 97 Low: -15*

OCT



Bees will form a cluster when outside temperatures reach the 50's.

Junipers are not typically used by bees, but with branches that are lower to the ground and evergreen, making them easy to identify. Red, immature berries and blue mature berries are good identifiers. Because of this, I like to note their locations because they produce pollen at the same time as maple and willow trees.

PHENOLOGY INFO:
Plants are dormant.

BEE CHORE: With fewer daylight hours, inspections tend to be quicker as weather allows. The queen has slowed or stopped laying eggs. Chores may include removing mite treatments or giving treatments that are recommended for broodless periods.



Red cedar/Juniper, *Juniperus virginiana*

*Historical Temperatures
High: 85 Low: -25*

NOV



While they have geared down their outdoor activities, bees do not enter torpor. They are active inside the hive during the entire winter.

Elm trees are easy to identify from a distance because they are very tall and have a vase shaped silhouette. Like junipers, they are not typically visited by honey bees when other sources are available. Elm pollen appears around the same time as maple and willow trees, so I like to note locations and use them to cue bee chores.

PHENOLOGY INFO:
Plants are dormant.

BEE CHORE: Be sure the hives are secure. Winter winds have more force without all the leafy cover present to break their speed. Find brood comb 3 years and older, then toss or scrape to keep residues to a minimum. Advantages of this practice include the fact that queens prefer to lay in 1-2 year old comb¹⁰.



Elm Ulmus spp.

Image by Ella McGuire



*Historical Temperatures
High: 74 Low: -40*

DEC



Bees take cleansing flights on warm sunny days. Yellow spots and streaks in the snow are evidence of these flights.

Thank you to...

Justin Glisan, State Climatologist, for supplying historic weather data.

Dr. Matt O'Neal, for sharing pre-publication drafts.

Thank you to Maggie Wachter for her extremely supportive words during the proposal stage of this project.

REFERENCES & SOURCES

- Ge Zhang, Ashley St. Clair, Adam Dolezal, Amy Toth, and Matthew O'Neal (2021) North American Prairie is a Source of Pollen for Managed Honey Bees (Hymenoptera: Apidae) *Journal of Insect Science* <https://academic.oup.com/jinsectscience/article/21/1/17/6147288?login=true>
- Ge Zhang, Ashley L St. Clair, Adam Dolezal, Amy L Toth, Matthew O'Neal (2021) Can native plants mitigate climate related forage dearth for honey bees (Hymenoptera: Apidae)? *Journal of Economic Entomology* Publication in Oct. 2021
- Ge Zhang, Ashley L St. Clair, Adam Dolezal, Amy L Toth, Matthew O'Neal (2020) Honey Bee (Hymenoptera: Apidae) Pollen Forage in a Highly Cultivated Agroecosystem: Limited Diet Diversity and Its Relationship to Virus Resistance, *Journal of Economic Entomology* <https://doi.org/10.1093/jee/toaa055>
- Adam G. Dolezal, Ashley L. St. Clair, Ge Zhang, Amy L. Toth, and Matthew E. O'Neal (2019) Native habitat mitigates feast–famine conditions faced by honey bees in an agricultural landscape. <https://www.pnas.org/content/116/50/25147>
- Ilka Beil, Jurgan Kreyling, Claudia Meyer, Nele Lemcke, Andrey V. Malyshev (2021) Late to bed, late to rise—Warmer autumn temperatures delay spring phenology by delaying dormancy. <https://doi.org/10.1111/gcb.15858>
- Medieval swarm adage. Oxford Reference <https://www.oxfordreference.com/view/10.1093/oi/authority.20110803100545424>
- Jake Kundert (2020) Identifying Nectar Resources on Farms. https://practicalfarmers.org/wp-content/uploads/2021/03/20.Ha_.Identifying-Nectar-Resources-on-Farms.pdf
- Meghan Milbrath (2017) Improving apiary sustainability by using an overwintered nuc system for colony replacement and expansion instead of purchased package bees. https://projects.sare.org/wp-content/uploads/Milbrath_SustainableFallNucs_Final.pdf
- Maggie Wachter and Rachel Coventry (2017) Pollination Guidelines for Small Farms <https://curtisorchard.com/wp-content/uploads/2018/01/Polination-Guidelines-for-web.pdf>
- Jennifer Albrecht and Dr. Judy Wu-Smart. Monitoring and Effects of Pesticide Residue Accumulation in Hives on Bee Health and Varroa Mite Susceptibility. (2019) IPM4Bees presentation, Ames, IA.

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under agreement number 2020-38640-31522 through the North Central Region SARE program under project number FNC21-1289. USDA is an equal opportunity employer and service provider. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.



Julia McGuire has a history of innovating the spaces she enters. Creator of BeeLaws.org, the first searchable website for bee laws, she believes in the importance of accessible and publicly-funded research. She believes beekeeping is more fun and sustainable when our bees are healthy and live through winter and will talk about beekeeping as long as someone will listen.

