Certified Best Practices for Sustainably Sourcing and Managing Orchard Bees

Appendices

Appendix I

The following offers suggestions for creating partnerships for harvesting bees.

Permission and functionality are most likely to be successful if the process is developed by a combination of common interest groups and the governing entity. An example here in the west is the cooperation of various groups for managing sage grouse habitat. Some suggested guidelines are:

The governing entity charges an administrative fee. These are our best-guess estimates for comparable rental or lease agreements for extractive animal propagation on federal land - cows and honeybees.

Using grazing fees for cows as a basis –We start with the assumption that the grazing fee is $1.35 per AUM (Animal-Unit-Month), the cow is 9 months old at time of harvest, and weighs 800 lbs. If we figure $90/100 lb on the hoof (2003 prices) and all the weight was gained on forest rangeland, then the 9-month grazing fee would be $12.50 for a $720 cow, or 1.7% of gross value.

Using honey bee colony fees as a basis – We start with the assumption of 30 hives in a typical apiary, and presume that each colony produces 50 lbs surplus honey per hive, all from flowers on public land, yielding 1500 lbs of honey. Honey sold wholesale at $2/lb would yield $3000 gross gain per the standard BLM (Bureau of Land Management) $60 apiary site rental, or a 2% fee on gross returns.

Translated to solitary bees, 2% of $100 in BOB progeny from one site would be about a $2 fee for 20 acres, presuming a yield of 500 bees From our experience in trap-nesting BOBs over the years, collecting 500 bees per site would be a good average (one site = 1,000 holes for 20 acres). For example, one 2006 trap-nesting of BOBs at five new sites in S. California

yielded typical results: 1524 bees in one site, 584 at another, 49 at a third, 6 at a fourth and none at the fifth. So our average return was about 400 bees per site. Although this was the first year in California, we had the advantage of many years experience in the Intermountain area, suggestions from informed people and access to restricted areas. Inexperienced persons should expect to far lower bee returns, at least initially.

Assign individuals to specific areas. Anyone commercially trap-nesting bees will want more than 500 bees to support their considerable efforts, so we can expect commercial trap-nesters to want to lease multiple 20-acre sites. Leasing land for trap-nesting in 20 acre parcels would give users exclusive rights (and responsibilities) for specific areas, which could be very attractive.

Auction time-allotments at specific periods. We would recommend a 3-year lease agreement per site (so $6 per 20 acre site - $2/year for 3 years) especially in areas with known BOB populations, to encourage pollinator stewardship.

Designate interspersed conservation areas for re-colonization. Provide conservation areas within trapping areas from which native bees can recolonize to cover any contingencies.

Foster trapper-management collaboration with transparency and cooperation.
For novice trappers, work with knowledgeable people to **properly identify species**, including nest characteristics, use only hole sizes favored by the females of the target species (USDA, ARS Logan Bee Lab https://www.ars.usda.gov/pacific-west-area/logan-ut/pollinating-insect-biology-management-systematics-research/
is willing to do workshops for interested parties).
Record and report numbers collected to land management agency.
Repatriate cleaned bycatch (non-target species) to same areas collected.
Begin allowable take at low levels to assure sustainable levels and monitor over time

Tepedino, V.J. and Nielson, Dale. 2017. Bee-Rustling on the Range: Trap-nesting for Pollinators on Public Lands. Natural Areas Journal 37(2):265-269.

Appendix II

Further biological notes of nest pests
The adult checkered flower beetle ***(Trichodes ornatus)*** is very colorful. The adult females lay their eggs in bee nests. The beetle larvae prey on the developing bee brood and eat the pollen provisions.

Blister beetles ***(Tricrania stansburyi)*** lay their eggs in flowers, and when the eggs hatch, the new larvae wait for a bee to come and visit, then hitch a ride back to the bee's nest. In this way, the beetle larva finds its way into a sealed nest cell, where it kills the bee egg and then feeds on the pollen provision.

Flour beetles ***(Tribolium spp.)*** lay their eggs in the nests, and the larvae feed on the pollen provisions. They typically do not harm the bees directly, but they can become quite numerous if nest material is not kept clean. They also seem to deter active bees from using the nesting material.

Carpet beetles commonly scavenge in bee nests. Carpet beetles belong to the family ***Dermestidae***. These too can build up into great numbers if nest material is not kept clean.

Leucospis wasps insert their egg into the blue orchard bee cocoon to lay an egg on the bee larva (prepupa) within, which the wasp larva consumes. Nest material must be thick enough to deter this wasp, which can penetrate substrates –even wood-- less than 1/8 inch thick.

Assuring that the backs and cracks of the nest cavities are sealed tightly, using paper or reeds that are at least 0.040" thick (to prevent ovipositing through) and that any nesting straws fit snugly in their hole, will deter tiny ***Monodontomerus*** (Torymidae) wasps from entering through the back or side of a nest. Typically a female wasp enters the nest through cracks and crevices. She then locates a cocooned bee larva on which she lays her eggs. *Monodontomerus* is the primary pest concern for exposed cells with developing brood. Nests should not be left exposed during summer development as these wasps can parasitize loose cocoons easily. Paper tubes with at least a 1 mm wall thickness will help eliminate parasitism by these wasps. A pan with soapy water or vegetable oil directly under a black light will attract and drown the emerging wasps and other pests. They undergo several generations in one season, so be on the lookout throughout the summer. Just a few in a closed container with easy access to cocoons can dramatically reduce bee numbers by the end of summer if not controlled.

Black light system for trapping and killing parasites: Blue orchard bee nests are placed in a darkened room during pre-wintering. A tray of soapy water or mineral oil is placed between the nests and a black light. Emerging parasites drown as they move toward the light.

Cleptoparasitic wasps lay their eggs in blue orchard bee nests. The cleptoparasite larvae kill the immature blue orchard bees and eat all their food. The beautiful metallic green wasp ***Chrysura*** (Chrysididae) is one example.

Stelis is a cleptoparasitic bee that is closely related to the blue orchard bee. It is also called a cuckoo bee. It resembles a blue orchard bee, but is smaller and flies more erratically around the host nest. It overwinters as a larva, so emerges later than *O. lignaria.* A good control of both *Monodontomerus*, and Stelis is to remove and destroy any remaining cocoons shortly after the bees have emerged in the spring since they emerge later.

Hairy fingered mites (***Chaetodactylus krombeini), also known as pollen mites,*** can also be destructive in blue orchard bee nests. Under certain conditions, the mites can multiply fast enough to outcompete the developing larva in consuming the provision, causing the bee larva to starve. Heavy infestations can also burden emerging bees. The mites cannot move between the mud partitions in a nest, unless the partition is damaged.
A good spring control for this pest is to retrieve nests from the field soon after nesting is over, or a little before, and increase the temperature to 27 to 32°C (81 to 90°F). Reduce humidity to 30-40% as well for a few days. Then allow the nighttime temperatures cycle to ambient until the bees pupate.
If they are found in the fall, one technique for cleaning is to tumble cocoons with sand to eliminate mites. Place equal amounts of cocoons and silicate sand in a rock tumbler and let it rotate for 30 seconds. Wet sand can also be used. Sieve the cocoons from the sand and dispose of the sand after each use. The mites will have mostly attached themselves to the sand. The sand can be baked to kill the mites in order to reuse.

The biology of ***Ascosphaera,*** or chalkbrood, in the blue orchard bee is very similar to chalkbrood in the alfalfa leafcutting bee and honey bee. A typical infected larval cadaver becomes brittle and full of the powdery spores. In some, they do not manage to develop spores, or only develop in a few spots (black areas). cocoons potentially exposed to the loose spores could be immersed for 10-15 minutes in a 0.5% bleach/water mixture and then rinsed in cold water to clean them.

Cleaning cocoons
Cocoons do not have to be "clean," just pest-free.
Consider this process:

- Manually remove cocoons from nests in the fall. If chalkbrood is found, bleach surfaces.
- Remove pollen balls, pests and cocoons of other species.
- If mites are found, tumble the cocoons with sand.

- Place cocoons into a cold water bath to separate mud plugs and dry on screens (optional). Do NOT dry in direct sunlight.
- If internal parasites are suspected (mono, leucospis), lightbox (use bright, narrowly focused background light to look through the cocoon) cocoons to inspect and clean if you don't have access to x-ray equipment.
- Place cocoons into wintering trays/boxes in a layer that does not exceed 1" deep with air gaps between the other trays. Small cardboard boxes, 1.5" tall, make good wintering boxes. Do not place cocoons in airtight plastic containers.

For a more detailed description of pests and mechanism of control as well as more on management, see "How to Manage the Blue Orchard Bee as an Orchard Pollinator" by Jordi Bosch and William Kemp.

Also:

Krunic, M., Stanisavljevic, L., Pinzauti, M., Felicioli, A. 2005 The accompanying fauna of *Osmia cornuta* and *Osmia rufa* and effective measures of protection. Bull. Insect.58,141–152.

Houdini Fly - A new invasive pest threatens Mason Bees. https://www.youtube.com/watch?v=CEmqw1sCX_U. Available in internet. 03-02-2020.