

In Search of Wild Colonies of Honey Bees in the Cawdor Wood, Scotland

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Fig. 1 Entrance of the Cawdor Castle, Scotland

Following the arrival of *Varroa destructor* in the United States in the late 1980s, most beekeepers thought that all the wild colonies of honey bees living in cavities inside trees and buildings must have perished, for certainly nobody was treating them with miticides. In recent years, however, it has become clear that wild colonies are still present in some woodlands in the U.S., and that these bees have evolved various mechanisms to cope with *Varroa* (reviewed in Seeley 2019). Might there also be wild colonies still present in the forests in the United Kingdom (England, Scotland, Wales, and Northern Ireland)? To help address this question, in 2019 we conducted two rounds of hunting for wild colonies of honey bees living in the Cawdor Wood, part of the Cawdor Estate, which lies about 12 miles east of the city of Inverness, in the Scottish Highlands.

We focused our search on the Cawdor Wood partly because one of us (Ann) lives nearby it, in the hamlet of Piperhill, but also because it is a substantial (813 acre, 1.3 square mile) remnant of an ancient oakwood. The Cawdor Wood extends south from the village of Cawdor, famous for its 14th century Cawdor Castle (Figure 1). This fortress is the traditional home of the Thane (Earl) of Cawdor, a title that was immortalized by William Shakespeare in “Macbeth.” During the Napoleonic Wars (1803-1815), many of the great oaks (sessile oaks, *Quercus petraea*) in the Cawdor Wood were harvested for shipbuilding, and during both World Wars these oaks were again heavily harvested. Fortunately,

it still includes large areas of mature forest containing oak, birch, aspen, rowan, wych elm, holly and juniper trees, so we reckoned that this forest contains many excellent nest cavities for wild colonies of honey bees.

Our search for wild colonies in the Cawdor Wood started with a chance experience on a warm day in early February 2019. While walking along a one-lane road that runs beside a field on the eastern edge of the Cawdor Wood, Ann heard a worker bee flying and then landing somewhere beside the road. She stopped and searched for the bee and finally spotted her standing almost motionless on a wet blade of grass, collecting water. Eventually, the bee flew home, which probably was nearby, but where exactly? To find out, Ann returned to the same roadside spot a few days later, when the weather was again warm, and this time she spotted several water collectors on the grass. She captured one in a bee hunting box and introduced it to a small square of bee comb filled with sugar syrup. This baiting worked. A few minutes after the first bee was released and flew home, others began to arrive and poke around the syrup-filled comb, probably recruited to the spot by the first bee. By watching how these bees departed after they had tanked up on the sugar syrup, it became clear that they were heading home by flying northwest, thus toward the woods at the end of the field. Ann’s husband, Linton, went off to search these woods and soon discovered bees flying to and from a crack on the south side of a large larch tree (*Larix decidua*) about 100 yards away, just

behind the stone wall along the north edge of the field (Figure 2). Success!

This discovery showed us that there was at least one wild colony of honey bees living in the Cawdor Wood. It also inspired us to search for more wild colonies living in and around this ancient woodland. Five months later we did so by bee hunting around the Cawdor Wood over four days: 29 July through 1 August 2019. Our method was simple: Locate flowers in fields and gardens just outside the Cawdor Wood, find honey bees foraging on these flowers, capture some in a bee hunting box, give them a comb filled with sugar syrup, and determine the bee line(s) to their home(s). (For a detailed description of the tools and techniques of bee hunting, see Seeley 2016.) We hoped that most of our bee lines would point to homes of wild colonies living in or around the Cawdor Wood, but we expected that some would point to beekeepers’ hives. It was important, therefore, to know the locations of apiaries in the countryside around the Cawdor Wood. So, before we searched for more wild colonies, one of us (ABC) contacted members of the local beekeepers’ club and located most, probably all, of the apiaries within 2 miles of the Cawdor Wood.

Figure 3 shows the results of our search for wild colonies and of Ann’s reconnaissance for apiaries. Each red oval containing a number marks a site at which we captured bees and established a bee line. The red oval containing a “1”, for example, marks where Ann captured water collectors along a road and so started our project. Each yellow X marks the homesite of a wild

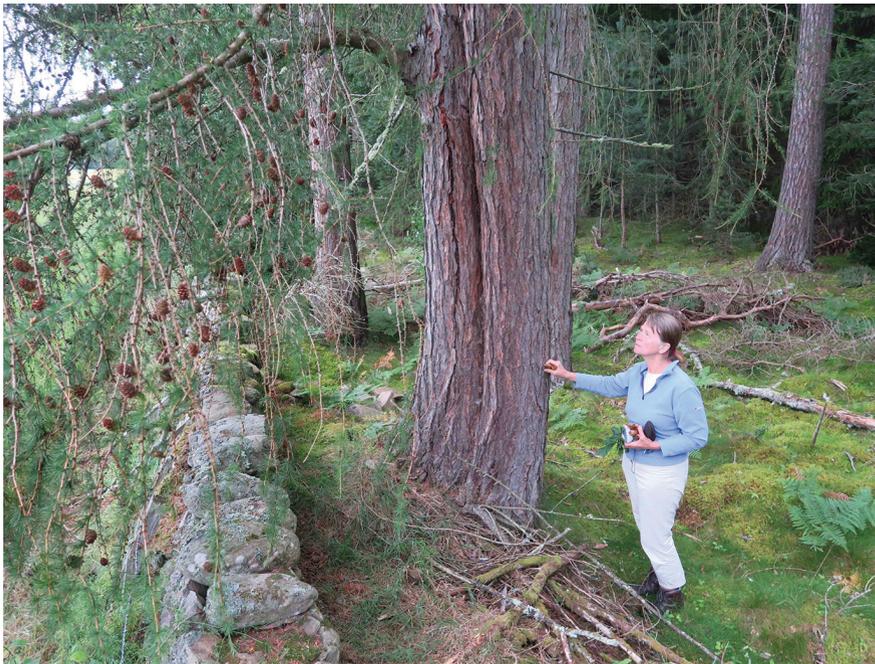


Fig. 2 Ann at the first bee tree found in the Cawdor Wood, in February 2019. Nest entrance is part of the crack in this larch tree's trunk.

colony, living in a tree or in a building. And each A:X symbol marks the location of an apiary; X indicates how many hives were in the apiary.

DAY 1: 29 JULY 2019

The day started cloudy and cool, but by midday the sun was shining and the air was warm. We began our bee hunting around 1 p.m. by stopping by a recently cut hayfield near the southwest corner of the Cawdor Wood. This is Site 2 in Figure

3. Most visitors to this corner of the Cawdor Wood come here to see the ruins of the Barevan Church, which was built in the 1300s but was superseded in 1619 by the Cawdor Parish Church, following the Scottish Reformation (the switch from Roman Catholic to Scottish Presbyterian as the state religion). The stone walls of this ancient church are beautiful (Figure 4), but we came here to examine a different form of beauty: a patch of fireweed (*Chamaenerion angustifolium*) in bloom

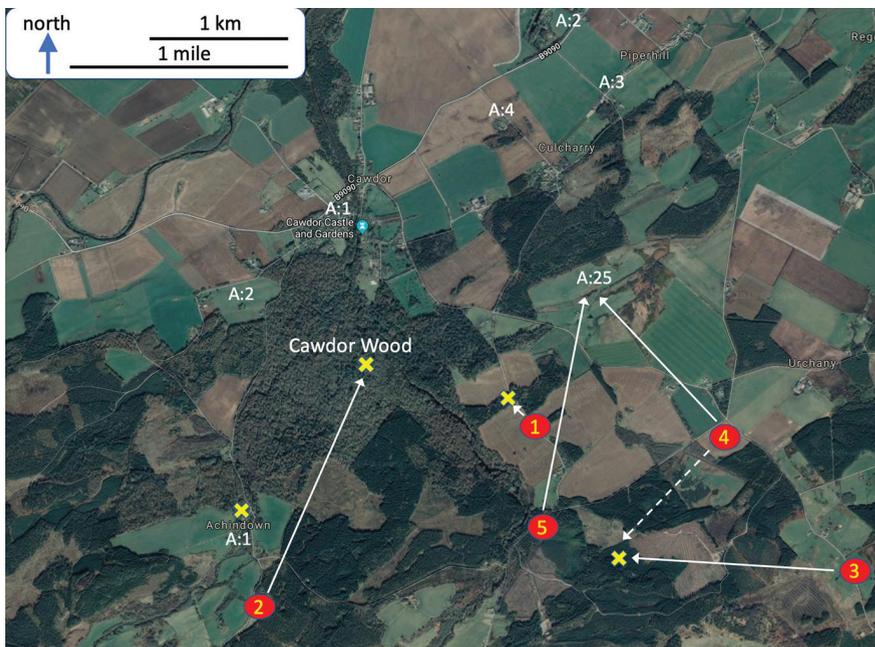


Fig. 3 Aerial photo of the study area. Red ovals show where we established bee lines (white arrows). Yellow X's show the nest-site locations of wild colonies. Each "A:X" shows the location of an apiary; the "X" indicates the colony count for the apiary.

on the edge of the field across the road. We found only a few honey bees on the fireweed's pink flowers, which shone brilliantly against the blue sky, but we managed to capture two of them in our bee box. We then introduced these bees to a comb filled with anise-scented sugar syrup. When let out of our box, they flew home and 18 minutes later one returned to our feeding station. (We knew she was a returnee because she flew directly to the syrup-filled comb and landed there without hesitation. Her behavior showed clearly that she knew all about this unusual food source.) She received a dot of green paint on her thorax. Over the next two hours, Green Thorax made four round trips between her home and our comb, and she always departed on a bearing of approximately 23°. Green Thorax was also consistent in how long it took her to fly home, offload her "nectar," and fly back to our feeder (= her "away time"): 10-12 minutes.

Given this bee's consistent departure bearings and away times, we were confident that her home was located along a bearing that led deep into the Cawdor Wood and was at most one mile away (see the arrow projecting from Site 2 in Figure 3). Unfortunately, Green Thorax did not recruit nestmates to our feeding station, probably because there was a honey flow on — from the fireweed and purple loosestrife plants (*Lythrum salicaria*) bordering the fields and streams in the area, the linden trees (*Tilia cordata*) blooming in Cawdor Village (see below), and the expanses of heather (*Calluna spp.*) glowing in the woods and moors nearby — so we could not perform moves down her bee line to zero in on her home. (Note: The process of "moving down the bee line" goes smoothly only if you have a sizable crowd, at least 10 bees, visiting your feeding station.) Nevertheless, Green Thorax revealed to us the existence, and general location, of a second wild colony living in the Cawdor Wood.

We should mention at this point that Ann's reconnaissance to find apiaries had already revealed that there were two colonies living at the Achindown (also spelled Achindoune) House, 0.4 miles north of the Barevan Church. One was a managed colony in a hive kept by the House's gardener, and the other was a wild colony in the roof of the Achindown House. Evidently, few, if any, foragers from these two colonies were working the patch of fireweed where we were working. That we did not engage foragers from these two colonies nearby showed that our survey of the wild colonies living in and around the Cawdor Wood would

not be comprehensive. But we figured that it was still worthwhile, for it was a start and it would yield a minimum estimate of the abundance of these unmanaged colonies.

At 3:30 p.m., we left the Barevan Church spot and drove to the home of a friend, Susan Jardine, who was living near the southeast corner of the Cawdor Wood, near the Ordbreck Farm. This is Site 3 in Figure 3, and it sits approximately 2.8 miles east of the Barevan Church. We knew that Susan had an herb garden, so we figured that we might find honey bees foraging there. Indeed, we did. We captured in our bee box three worker bees foraging on spearmint (*Mentha spicata*) and oregano (*Origanum vulgare*). We then put the comb filled with anise-scented sugar syrup inside the bee box and set it on the stone wall that runs beside a pasture there (Figure 5). This release point gave us a clear view in nearly all directions, which we knew would help us see the direction that any visitor to our feeder would take to fly home. About five minutes later, we released the bees.

You may be wondering why we do not mark the bees immediately upon catching them the first time. Collecting sugar syrup from a comb probably seems to a bee like she is robbing, so many bees are quite wary about doing so. If we were to put a paint mark on a bee when she is first caught, then we would risk making her even more wary and thus less likely to fly back to the bee box/food. But once a bee has returned to the food, we know that she is more or less comfortable doing so, and that we can safely add some paint to her without scaring her off.

Only one of the three bees that we released came back. She received a dot of red paint on her abdomen and soon flew off across the pasture to the west. Between 5:48 and 7:56 p.m., Red Abdomen made six trips to our feeder. Her departure bearings were 246°, 280°, 280°, 283°, 280°, and 277°. These told us that her home was somewhere in the woods beyond the far side of the pasture, in the direction of approximately 274° (nearly due West). Her away times were 34, 12, 9, 11, 12, and 18 minutes. That she could fly home, unload, and fly back to our feeder in just 9 minutes told us that her home was at most one mile away. (Figure 5.5 in Seeley 2016 shows the relationship between the time a bee spends away from your feeder and the distance to her home.) This location (ca. one mile west) is deep within



Fig. 4 Stone walls that formed the nave of the Barevan Church, built in the 1300s and then gradually abandoned following the Scottish Reformation in 1619

the forestlands of the Cawdor Estate, so we knew that this bee was traveling to and from a wild colony's nest. At 8:10 p.m., we headed back to Ann's home in Piperhill, leaving the feeder comb (filled with sugar syrup) on the stone wall, to stoke more interest by Red Abdomen. We hoped that tomorrow she would be so excited by our sugar-syrup bonanza that she would recruit nest mates to it.

DAY 2: 30 JULY 2019

This day, like the previous one, started cloudy and cool. But by late morning the sky was brightening, the

air was warming, and we were heading back to the stone wall beside the pasture at Ordbreck Farm. When we arrived at 12:03, patches of blue sky were starting to appear, but the feeder comb was empty and was deserted. We refilled the little square of comb and waited patiently, meanwhile sipping some tea, watching the cows, and straining to hear the hum of a returning bee. At 12:26, Red Abdomen zoomed in and resumed her work. Wonderful! Over the next 45 minutes, Red Abdomen made four trips to our feeder. In doing so, she demonstrated that she could fly home, unload her



Fig. 5 Stone wall along a pasture at Ordbreck Farm, where we established a bee line (see red oval #3 in Fig. 3). The bee box is covered with a black cloth to help the three worker bees inside to stay calm and find the comb that is filled with sugar syrup.



Fig. 6 Ancient sycamore in Cawdor Village that has housed wild colonies of honey bees

food, and come back in as little as 9.5 minutes. This confirmed our estimate of the distance to her home from the day before: about one mile. Also, her departure (bee line) directions matched what we had seen the day before. So we concluded that her home was indeed somewhere within the Cawdor Estate forestland to the west, as shown in Figure 3. We shut down the feeding station at 13:10 to move on. We did so because, here again, our bee did not recruit nest



Fig. 7 Tom capturing worker bees in a patch of fireweed where we established two bee lines (site 4 in Fig. 3). One line pointed to a large apiary to the northwest and the other pointed to a bee tree in the southwest.

mates so we could not easily make moves down her beeline.

We spent the rest of the sunny afternoon walking around Cawdor Village and the Cawdor Castle, searching for wild colonies in trees and buildings. The one beekeeper who lives in the village told us that a wild colony had lived for many years in the ancient sycamore by the old shop in Cawdor (Figure 6). When we inspected the trunk and limbs of this tree using binoculars, however, we did not spy bees flying to or from it. Likewise, when we spent two hours inspecting the stone walls and slate roofs of the Cawdor Castle in search of bees flying to and from cracks or other openings, we again found no traffic of bees. We did, however, hear and see countless honey bees outside the castle, on the blossoms of the ancient lime trees (basswood, *Tilia cordata*) lining the road to and the paths around the castle.

Seeing these trees brimming with bees helped us understand why we had failed to elicit recruitment to our syrup-filled feeder comb. For bees to be excited enough by a comb filled with sugar syrup to recruit nestmates to it, there must be a dearth of nectar sources. Only when nectar sources are sparse do worker bees judge that the rewards of collecting syrup from a bee hunter's comb — which must seem like robbing — outweigh the risks of this strange form of foraging. We, however, were working during a major honey flow. (Normally we would postpone the bee hunting until a time when there is a nectar dearth, but because Tom's time in Scotland was fixed by his travel schedule, and because he could not make a return trip, we had to press on and do the best we could.)

DAY 3: 31 JULY 2019

Rainy and cool. Alas, no bee hunting.

DAY 4: 1 AUGUST 2019

This was the last day of our study, and we hoped fervently for a full day of field work. Unfortunately, the day started cloudy and rainy, so we could not resume our hunting until late morning, when it became sunny. We established a new site, number 4, at a crossroad where we had spotted a remarkably tall stand of fireweed in full bloom (Figure 7). This site was one mile northwest of site 3 (see Figure 3). We chose to work here because it offered the possibility of getting

bees whose bee lines would point to the home of the wild colony that we had engaged already at site 3. If so, then this would help us pinpoint the location of this wild colony's home by seeing where the two beelines (those from sites 3 and 4) crossed.

And this is what happened, plus some other things. We captured four bees off fireweed flowers using our bee box; we let them fill themselves with sugar syrup from the comb in our bee box; and then we released them at 13:03. Three of our four bees flew straight home along a bearing of ca. 330°. This was precisely the direction to the largest apiary in the area, that of Mick Canham. He had some 25 hives near his house, 0.8 miles away (see Figure 3). The fourth bee, however, did much circling when she departed, so we did not get a clear vanishing bearing from her during her first trip home.

By 13:32, four bees had arrived back at our feeder, and we suspect these were the same four bees that we had captured, fed, and released. While each bee was again loading up at our feeder, we gave her a paint mark. This made the four bees individually identifiable as Pink Thorax, Yellow Thorax, Yellow Abdomen, or Green Thorax. The first three visited our feeder regularly and consistently headed home along a bearing of about 325°. They also trafficked back and forth with minimum away times of around 8 minutes, which told us that each one's home was about 0.75 miles away. These readings confirmed that these three bees were all coming from the large apiary down at Mick Canham's house.

The fourth bee, Green Thorax, flew off in another direction, along a bearing of approximately 230°. Unfortunately, she stopped visiting our feeder comb after making just two trips to it, so we could not collect good data on her departure and arrival times. The meant that we were unable to make a precise estimate of the distance to her home. But given how her homeward flights pointed to the estimated location of the wild colony that we had engaged at our previous site (site 3), it is likely that she came from this colony. The ca. 230° bearing of her homeward flights certainly boosted our confidence that (on the previous day) we had correctly estimated the site of this wild colony's home.

Around 15:00, we shifted our bee hunting from site 4 to site 5, located in a stand of mature Scotch Pine (*Pinus*



Fig. 8 Bell heather in a stand of Scotch Pine in the Cawdor Wood

sylvestris) within the Cawdor Wood (see Figure 3). This part of the forest had been thinned a few years before, so its canopy was fairly open and its floor was carpeted with large swatches of bell heather (*Erica cinerea*) in full, purple bloom (Figure 8). We easily found honey bees here, so soon we had captured 10 bees and presented them with a syrup-filled comb in the bee box. After being set free and then flying home, five returned for more of our sugar syrup. Soon, they carried paint marks. And when they took off to fly home, three gave us clear sightings of their vanishing bearings: 10°, 10°, and 10°. Eventually, we also got several good measurements of how long it took two of these bees to fly home, unload, and return to our feeder comb — 23 minutes — which told us that their home was not close by. We knew that the direction and distance from site 5 to Mick Canham's

apiary was 11° and 1.2 miles, so we concluded that these three bees were probably from his hives rather than a site in the Cawdor Wood. We ended our bee hunting a little after 5 p.m.

CONCLUSIONS

We feel that we made a good start at exploring whether or not there are wild (unmanaged) colonies of honey bees living in or around the Cawdor Forest in Scotland. We found that in August 2019 there were at least four wild colonies living in this place. Three were in trees and one was in the roof of a house. We also found that within the circle of land that lies within two miles of the center of the Cawdor Forest, there were seven apiaries containing 37 managed colonies, most of them (25) in just one apiary. The area of a circle with a 2-mile radius is approximately 12 square miles, so we learned that within our study

area the density of wild colonies is at least 0.33 colonies per square mile, while the density of managed colonies is about 3 colonies per square mile. The next stage of this study will consist of making periodic inspections of the two wild colonies whose locations we pinpointed — Bee Tree 1 and the Achindown House — to see how long these sites are continuously occupied. Will these two sites be occupied continuously for years and years? We shall see!

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