

Observations of Red-headed Woodpeckers Including New Life History Behaviors

Red-headed Woodpecker Nest Camera Revelations

A Journey into New Discoveries Using Nest Cameras at Red-headed Woodpecker Nests



Text and Photography by Siah L St. Clair



The Red-headed Woodpecker Recovery project (RhWR) was organized in 2007 and is a 501(c)(3) tax-exempt non-profit organization.

Investigation and research activities about Red-headed Woodpeckers (RHWOs) at Cedar Creek Ecosystem Science Reserve began in 2008 when Cedar Creek ESR gave a permit to the RhWR to initiate those activities on site. The RhWR has continued investigation and research activities since 2008 both at Cedar Creek ESR and at other locations.

Field observation efforts for included information occurred between 2012 and 2025 in all 12 months of the year, with a combined 2,563 days and 15,438 hours by Siah St. Clair and work partner Jim Howitz. All observations were made during a succession of RHWO study and research projects. Many activities required extensive experience and expertise as well as special permits and permissions.

By conducting these observation activities new natural history behaviors of RHWOs have been documented and will be used to help reduce the decline of this species and other species impacted by the presence of RHWOs.

Unless otherwise noted, the information and photographs provided herein are based solely on observations by Siah L St. Clair, a volunteer of the Red-headed Woodpecker Recovery project.

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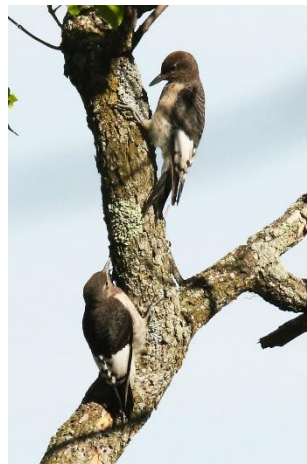
Photography and Text by Siah L St. Clair

In 2007, the newly formed Red-headed Woodpecker Recovery project (RhWR) discovered a large nesting cluster of Red-headed Woodpeckers (RHWOs) (30-50 nesting pairs) at Cedar Creek Ecosystem Science Reserve (CCESR) in East Bethel, Mn.

We learned that almost no serious research existed (in 2008) about RHWOs, which are listed in Minnesota as a species of greatest conservation need. In 2008 the RhWR project started survey actions at CCESR (with a permit to do so from CCESR) to learn more about the RHWOs nesting there.



Brood Reduction
4-7 eggs result in
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As we learned more about RHWOs from these early years of work the answers to one question were very elusive. The question centered around the fact that we had observed that almost every RHWO nest experienced brood reduction. Four to seven eggs would generally result in 2-3 fledglings. Our question was what was causing this brood reduction?

Seeking an answer to the brood reduction question opened an unexpected and an enormous wealth of information, discoveries, and observations into the lives of RHWOs and other animals that interact with Red-headed Woodpecker nest and roost cavities.

But, first, a little more background. In 2016 the RhWR Project decided that answering this question about brood reduction required a more focused effort. In 2017 and 2018 the issue of brood reduction was approached by having a few dedicated members observing and recording all activities at active RHWO nests. While assisting with this observation work, I learned much about specific foods brought to the nests, frequency of feeding, and nest maintenance. But no new information about brood reduction was being revealed by these nest observations.

In early summer of 2019, I was given permission to mount a trail camera onto a branch near an active RHWO nest cavity to see how the woodpeckers would respond to the camera and to see if the camera could collect valuable information that might help with the brood reduction question. On July 16, I attached a Cuddyback trail camera I already owned onto a branch about 5 feet from an active RHWO nest hole. This nest (#182) was high in a dead Northern Pin Oak tree with many dead branches. I knew any resulting images would be somewhat out of focus, since the focal length on most trail cameras is usually 10-20 feet.



These two pictures were taken during the trial by the Cuddyback camera on 7-18-19. While slightly out of focus, the pictures show, on the left, the color bands on the adult at the nest, and on the right, slightly cropped, an adult removing an unhatched egg from the nest. The woodpeckers were unbothered by the presence of the camera.

The RHWO pair at this nest (#182) ignored the presence of the camera entirely, and the camera captured behaviors and activities that had not been observed before. The camera produced over 6,400 images in a short time from both day and night.

When this nest was no longer active, on August 10, 2019, I placed the camera on a new nest (#203), for the rest of the summer and fall. For this nest, as there were no branches, I designed and built a frame to attach the camera frame to the trunk of the tree with the camera about 3 feet away from, slightly above, and aimed slightly down at the nest hole. The first camera location had lost camera time at sunset as it was aimed at the horizon and lost about an hour of documentation time at sunset due to sun glare.



These pictures demonstrate how the Cuddyback camera was set up at the second nest (#203), three feet from the nest cavity, and, that color bands can be seen on the bird, although it is slightly out of focus. Birds were not bothered by the camera presence.

The adults at the second nest (#203) were busy raising young and completely ignored the camera and camera frame. And the camera again documented never before seen behaviors both day and night. The images were out of focus, but color bands on woodpecker legs could still be seen and identified as well as other actions at and around the nest.

In early September of 2019 I learned from a visiting researcher at Cedar Creek, (Louis Ramirez), that the Reconyx Trail Camera Company might be able to help with the focus and other issues with placing cameras at the nests. I learned that Reconyx cameras were used by many researchers, particularly with special situations. I contacted Reconyx and learned that they could re-focus their cameras to a 3 foot focal length on their assembly line. On October 8, 2019, I ordered and personally paid for 2 cameras focused to 3 feet. These cameras were Reconyx HP 2X Hyperfire 2 Gen 3 No-Glow Infrared models and I also purchased a universal mount bracket for each (\$974.87 for 2 in 2019).

I then designed a housing box and frame to attach these new cameras to nest trees so the camera would be positioned 3 feet away from and slightly above the nest hole. I then purchased materials and tools and built the frames and housing boxes in my home garage. I also purchased 2 highspeed 256 gig memory cards for each camera plus 12 ultimate lithium AA batteries for each camera. Research technician April Strelczyk Haverstock assisted by setting the cameras to take 3 pictures and a 10-30 second video when triggered by motion and heat. I retained ownership of the cameras while doing this camera research work.



Author with finished nest camera frame ready to install at a nest, on left, installing a camera frame in center, and changing batteries and memory card at an active nest camera on the right. Photos taken with my phone by Jim Howitz.

On November 9 and 18, 2019, I installed the cameras and frames onto two active RHWO roost trees with the help of fellow volunteer Jim Howitz. Jim had located trees that were actively being used as roosts by RHWOs and we chose tree #218 and #183 for these first “tests” with the Reconyx cameras. Jim and I carried ladder and tools plus cameras, frames, and batteries to each roost tree, often a trek through hundreds of yards of thick fallen trees and heavy brush after driving 4-wheel drive vehicles on narrow fire breaks into Cedar Creek.

When arriving at a nest tree Jim Howitz would be at the bottom of the ladder while I was at the top with a climbing harness carabinered to a safety strap on the tree. Jim would tie tools and camera frames to a rope, and I would pull them up to the nest, around 20-25 feet high. Attaching these new large frames (48" by 46") securely to the nest/roost trees at the correct distance and angle to the cavity was a learning process for two guys past 70 years.

After the frames were attached, I put cameras into the housing box. I had also designed and built an aiming device as the cameras needed to be carefully aimed to assure the nest hole was in the middle of the camera's picture frame. The cameras were then turned on and left for the winter. Cedar Creek is generally inaccessible during winter due to snow, so we had to wait for spring to see any results of these new cameras.



Example of the aiming device I created so the cameras could be aimed directly at the nest cavity entrance hole or slightly below, as that is where most action occurred. This is a demonstration picture I created in my back yard, using a real nest cavity (tree) that had fallen to the ground a previous year and a used nest camera frame.

The camera is seen as it protrudes from the nest camera box attached to the universal mount. Part of the frame is also seen as it extends from the nest tree.

On April 22, 2020, I changed batteries and memory cards in the cameras with Jim again at the bottom of the ladder. Together the two cameras had recorded 10,532 images and videos and revealed activities and behaviors never recorded before. The images were in focus and provided excellent images and videos. On one camera the batteries gave out in late February, and the second camera was still functioning on April 22.

I took the memory cards to my home and downloaded the files onto my computer into folders I had created. I then reviewed all 10,532 images and video files. Files with especially interesting and new behaviors I copied and sent with much excitement to others involved in the larger RHWO research work.

On April 16, 2020, I called Reconyx and ordered 6 additional cameras with the universal mount brackets. RhWR directly paid for these cameras with funds raised for this purpose (\$2,922.20). I also personally purchased 12 additional high speed 128 gig memory cards to go into the new cameras, along with 12 packages of 12 AA ultimate lithium batteries for the cameras (around \$1,000). I also purchased materials for and built 6 new camera frames with camera housing boxes and also purchased materials to install the cameras and frames onto the nest trees. (See separate article on construction and installation of the nest

On May 14, 2020, Jim Howitz and I began installing the camera frames and cameras onto active RHWO nest trees. To install a nest camera frame on a tree, the RHWO nests needed to be 30 feet or lower on the nest tree. The nest tree needed to not be too long dead to be able to lean a ladder on safely. On many of these dead trees we needed to place the ladder straight up and down on the tree, as many of the trees were quite dead and rotten at the base. The nest cavities also needed generally to be on the main trunk and not out on a side branch to be safely accessible by ladder.

As new nests were discovered by Jim and me, we would install nest cameras. All new nest cameras had been installed by June 3, 2020. I had discovered while viewing the downloaded images that individual pictures missed important action between pictures. Consequently, during July, all cameras were reprogrammed so they would only take 10-30 second videos. There were a number of times over the next years when I would have to reprogram the cameras after damage by nest trees falling, damage by other woodpeckers, severe hail and rainstorms, and prescribed prairie fire damage. And with that a whole new world of amazing discovery began.

By the fall of 2025, the 9 nest cameras (some years less than 9) had been nearly constantly operating 24 hrs/day all year round and had been placed on nest (or roost) cavities on 30 different nest/roost trees. No Red-headed Woodpeckers had abandoned any of the nests these cameras were mounted on. Indeed, some pairs returned to the same nest camera nest in following years to raise young. The cameras had accumulated 293,784 surveillance hours at nest or roost cavities and acquired 500,315 videos and pictures of actions at the cavities by late summer of 2025.

Table 1

Nest Camera Recording Totals All Years: July 2019 Through August 2025

Year	Full days surveillance	Number of hours of surveillance	Videos acquired. 10-30 seconds each	Pictures (JPG) acquired	Pictures and Videos Combined
2019	52	1,248	493	7,948	8,441
2020	1,702	40,848	83,086	118,596	201,682
2021	2,112	50,688	40,861	3,354	44,215
2022	2,646	63,504	111,263	3,213	114,476
2023	1,966	47,184	41,850	0	41,850
2024	2,504	60,096	62,729	0	62,729
2025	1,259	30,216	26,922	0	26,922
Totals	12,241	293,784	367,204	133,111	500,315

Within the hundreds of thousands of videos and pictures, there is amazing documentation of newly observed behaviors by adult, nestling, and fledgling RHWOs. In addition to documenting RHWo behaviors, the cameras recorded 36 other vertebrate species interacting at the nest cavities in at least 13 distinct ways. Many of these species interacted in multiple ways, and some species had only one type of interaction. The nest cameras function 24 hours a day 365 days a year. Because of this, winter (non-breeding season) interactions by 17 vertebrate species were documented, and nighttime periods documented 14 vertebrate species interacting during nighttime hours at the cavities.

Nest camera presence did not have a negative impact on Red-headed Woodpecker nest success. Fledging success at nests with a camera (29) was 82%, while fledging success at all nests (611) was 76%. The number of fledglings produced, on average, at nests with a camera was 2.6, and the number of fledglings produced, on average, from all nests was 2.1 (These numbers are compiled from the personal observations of Jim Howitz). Nest trees were chosen to have a camera placed on them by the tree's perceived ability to accept placement of a nest camera frame on the tree trunk, as well as the condition of the tree to allow the author to safely climb a ladder above the nest cavity (14 to 33 feet).

Through all of these efforts some answers to possible causes, and non-causes, of brood reduction were discovered in pictures and videos from the nest cameras and other observations as well. These answers are elaborated in a separate article, but generally there were very few outside causes (storm damage to nest trees, partial predation by Southern Flying Squirrel) and numerous actions involving the Red-headed Woodpeckers themselves (adults and nestlings) that led to brood reduction.

Jim and I had trekked to each of the nest camera trees and replaced camera batteries I had purchased and memory cards more than 360 times over these years (April Strzelczyk Haverstock assisted in 2021). I viewed all the image files on all the memory cards as they were collected and downloaded onto my now considerably expanded home computer system (25 terabytes). As I discovered exciting new behaviors and visitors to the nests, I would email copies of the files to others involved in the RHWO research project.

Below are a few pictures (still frames from nest cam videos) that illustrate a part of the diversity of activities the nest cameras captured throughout these six years. The following pages will expand this information in more depth with pictures and descriptions of Red-headed Woodpecker behaviors and with other species.



Above, a pair of Red-headed Woodpeckers during an incubation exchange, a nestling in the process of fledging, and an adult (only males do this) guarding its nest at night.



Above, a Red-headed Woodpecker at it's winter roost, an American Kestrel, one of many predators observed at nest cavities, and a Tree Swallow feeding its nestlings in an old RHWO nest cavity.



Red-headed Woodpecker chasing a Fox Squirrel away from its winter roost as the squirrel tries to steal cached acorns.

Samples of Information Learned from Red-headed Woodpecker Nest Cameras

All pictures from the nest cameras (unless noted)

1. Red-headed Woodpecker daytime behaviors at the nest cavity during nesting season.

- a. **Spring nest selection and conflict**, particularly in years when RHWOs return from migration, they frequently return to previously used cavities and the cavities may already be in use by another animal. RHWOs initiate nesting later than many permanent residents, and if another animal is already in the cavity, conflicts may occur. The conflicts are short lived, from a few hours to a few days. RHWOs will not draw out conflict, as injuries may occur and they need to start their own nesting activity. Other cavities may be nearby, or a new cavity may be excavated with a greater chance of nesting success than time spent in extended conflict.



In the top two pictures a RHW has returned from migration on May 10, to discover a Red Squirrel was using the cavity it used the previous year. After occasional fights for possession for a week the RHW pair began a nest in a different tree 50 yards away. The Red Squirrel left a few days later and was not seen again. In the bottom left picture, a RHW checks out the cavity it used the year before to find a Southern Flying Squirrel with babies in the nest. Mother squirrels with babies are very aggressive and it only took one encounter for this RHW to not return. In the lower right picture, a RHW that had nested in this cavity the previous year and just returned from migration, finds a European Starling already in the cavity on May 8. After a couple of days of fighting, both birds left this cavity. Spring conflict over cavities often ends with both animals moving elsewhere. Getting a nest started appears more urgent than spending time in conflict.

- b. **Pair bonding** in Red-headed Woodpeckers appears to be a few seconds near the nest with no ceremony at an established nest. When establishing a nest loud calls and drumming are common with the female inspecting the nest cavity that the male prepares, which might be a new or used cavity.



With Red-headed Woodpeckers, pair bonding appears to occur when the pair happen to be together, mostly at the nest. It is often only a couple of seconds and will include “soft talking” sounds that the nest cameras pick up but could not be heard 10 feet away from the nest, as in the two pictures on the left, where a nest has been decided upon and is active. In the picture on the right the pair are choosing this nest cavity and are making quite loud churr calls and the male is drumming as well. This may last for 10 seconds and then be repeated a short time later.

- c. **Incubation exchanges** happen during the daylight hours and occur generally every 20 to 30 minutes. A partner will arrive at the nest and soft call, or an incubating adult will come to the nest hole and make a soft call for its partner. Occasionally an adult will leave before the partner arrives.



From pole camera data during 2013 through 2015 we had learned that egg incubation in Red-headed Woodpeckers takes about 12 days. During daytime the pair share incubation while the nest cameras show that incubation at night is exclusively the responsibility of the male parent, who is also guarding the cavity at night against predators and intruders. Daytime incubation periods are fairly short, generally 20-30 minutes, although occasionally some might last 45-50 minutes. The exchange usually occurs over a few seconds with the non-incubating parent arriving at the nest and the parent inside looking out, making sure all is good, then exiting the cavity and flying away. Adults will continue to brood new hatchlings, particularly during cold, spring weather, bringing food to the nest as well.

- d. **Maintenance at active nests** in Red-headed Woodpeckers may be a critical component of nest success. Since the nestlings do not make fecal sacs for the parents to remove (this has not been observed) but instead scatter spray their fecal matter around the bottom of the nest, the nest can become a stinking mess if not maintained properly. And every pair seems to have a different level of commitment to nest maintenance/hygiene. At most nests the male appears to be primarily in charge of nest maintenance. Occasionally, a female will also participate.

Nest maintenance in active nests involves removing egg shells, rotten and unhatched eggs, and at times dead nestlings. Primarily, however, nest maintenance requires the removal of fecal matter-soaked woodchips from the nest bottom, and then replacing those chips with new chips chiseled from the inside walls of the nest cavity. If this is not done frequently, the nest will begin to smell, attract flies and other insects, and predators. At one nest the nest camera documented the adults removing soggy woodchips from the cavity 38 times in one day. At some nests adults might remove chips only a couple of times, if at all. When the adult returns, it can be heard on the camera video pecking on the inside walls of the cavity, making new woodchips.



Fresh woodchips in active Red-headed Woodpecker nests with nestlings are very important. (Picture not from a nest camera.) Red-headed Woodpecker roosts rarely have any woodchips in the bottom.



The pictures above are nest camera video frame shots. The picture on the left shows a male parent removing a left-over egg after the other eggs have hatched. The female parent is watching in the lower left. The center picture shows the male parent removing an egg-shell from a hatched nestling. Pictures of egg and egg-shell removal were rare on the nest cameras. The right picture shows an adult removing a beak-full of soggy fecal matter-soaked woodchips from the nest. The nest cameras frequently documented this behavior. Some nests had many flies around the nest hole, and some did not. There may be a correlation between the frequency of soggy woodchip removal and fly presence and also the presence of predator visits. Something to study in the future. Adults were rarely seen at night in a nest cavity where nestlings had recently fledged, possibly because of the potential for predators being attracted because of the smell.

- e. **Food fed to nestlings** is well documented by the nest cameras, both in identifying specific foods brought to the nest, and in the frequency of specific foods being used, and also how often nestlings are fed in general. The cameras show that feeding often begins by 6:00 AM and may continue until after 8:00 PM. The adults are generally at the nest with food 20 to 25 times per hour, with a few slower periods. But these numbers can change depending on the number and age of nestlings, food availability, special circumstances, and individual adult motivation to feed its nestlings. Size of food items (house fly or darner dragonfly) also changes frequency.

The vast majority (around 95%) of food given to nestlings is invertebrates, lots of different kinds of invertebrates. Beetles, butterflies, bees, wasps, walking sticks, spiders, dragonflies, grasshoppers, cicadas, and even snails. A smaller part of their diet is berries and nuts (acorns), and these only if and when they are in season and growing near the nest. Cherries and the first acorns don't ripen until after second broods have hatched and are near half grown. Blueberries and Juneberries ripen towards the end of the first brood's nest time.



The pictures above are from the same nest over a few days in August. On the left the adult has a Katydid, in the middle picture an Underwing Moth, and on the right a Walkingstick. Every two to three minutes something new arrives as food for the nestlings and disappears instantly into the nest.



The picture on the left shows an adult with a wild black cherry to feed its second brood nestlings in August. The pictures in the middle and right are slightly cropped to see the fruit better. Blueberries in the middle and a Juneberry on the right. This adult is in one of the special situations noted above. The male parent was taken by a predator (probably a hawk nesting nearby) a few days earlier, and she was now left to feed the nestlings on her own. She stepped up her game, and the camera documented that she doubled her nest visits within two days of the disappearance of the male.

But the odds were against her. She could not find many insects and brought fruit often to the nest, which the nestlings would frequently spit out. Primarily, there was no male to guard the nest at night, and the females do not know to do this if the male is absent. A flying squirrel killed and expelled the nestlings from the nest. But one nestling survived outside the nest, she found it, fed it during the daytime, and it survived.

- f. **Nestlings fledge** at about 30 days old. Personal observations of nestlings fledging are rare, but nest cameras have captured several of these brief experiences. Nestlings often bolt out of the nest to fledge, but sometimes they ease out, and the cameras have documented both methods. Nestlings from one nest do not fledge at the same time but individually over a period of hours or days. It does not appear that parents reduce feedings as an incentive for nestlings to fledge.



The pictures above show a very slow, tentative, fledging process on the part of this nestling. This sequence took eight seconds to complete.



The pictures on the left record the most common method of a Red-headed Woodpecker nestling fledging, simply bolting out of the nest. This process took less than one half of a second.

The new fledgling lands on a tree trunk or branch it can see from the nest hole and sits quietly still for the first few hours. This inaction is less likely to attract the attention of a predator. The next two weeks are the riskiest in the fledgling's life.

- g. **Daytime predators** at Red-headed Woodpecker cavities are a constant threat to adults, nestlings and eggs. Bull snakes (and other snakes) had been considered primarily terrestrial, but the nest cameras have recorded them at several nests. Birds of prey are patient with sharp eyesight and quiet flight from long distances. These birds of prey had their own hungry nestlings to feed. No Red Squirrels or European Starlings were recorded at active RHWO nests by the nest cameras.



The tree hides the fledgling bird that the Red-tailed Hawk had just captured in picture 1. The Bull snake in picture 2 was about to begin eating the 3 RHWO nestlings at this nest. The Eastern Garter snake was a surprise in picture 3. The American Kestrel had just chased an adult RHWO into the cavity in picture 4. The cavity opening was a little too small for the Kestrel to enter to eat the adult Red-headed Woodpecker.

- h. Fledglings use of natal nest** after they fledge. A fledgling will sometimes make use of its natal nest for different purposes. A fledgling may return to the nest to beg food from the male parent. The fledgling will beg for food from both inside and outside of the cavity. This may continue for a couple of weeks. The same fledgling may begin to use the natal nest as a roost at night. The female parent feeds the other fledglings 100 yards or more away from the natal nest.



In the above pictures, the nest camera recorded a former nestling returning to its natal nest to have its male parent feed it outside the nest (left), and while inside the nest (center), all in the midst of loud begging. In the right picture, a fledgling is using its recent natal nest as a night roost, a rare behavior when done within a week or two of having fledged from the same cavity.

- i. Female adult using first brood nest as a night roost during second brood nest period.** Adult Red-headed Woodpeckers are rarely seen using nest cavities from which nestlings have recently fledged, possibly because the cavity is a predator magnet due to odor. The nest cameras did record one nest cavity that had just fledged nestlings become the night roost for the adult female as she and her mate started a second brood nest in a nearby tree. She was so committed to this cavity that she and her mate successfully defended it from a Red Squirrel that tried to move in one day in July. The Red Squirrel was only able to defend the cavity from repeated attacks from the woodpeckers for a few hours and then left.



In the left picture above, the female RHWO is in her night roost, which happens to be the same cavity in which she and her mate had their first brood of the summer, and the nestlings had fledged a week before these pictures were captured by the nest camera. In the center picture, a Red Squirrel's head can be seen inside the cavity as it tries to usurp the cavity, now used as a night roost by the female woodpecker. In the picture on the right the male woodpecker is recorded about to attack the squirrel to convince it to leave the cavity, which the squirrel did. This whole event began just before 10:00 AM and ended with the squirrel leaving about 5:00 PM, never to return. Both the female and male woodpecker were engaged constantly in the fight to get the Red Squirrel to leave. I believe they took turns, while one parent was incubating the eggs in the new nest, the other parent worked at convincing the Red Squirrel to leave through confrontation.

- j. **Training of fledglings** is not apparent with most Red-headed Woodpecker pairs beyond passively not feeding fledglings as often, forcing them to find their own food. The nest cameras, however, recorded one male actively training his fledglings at a previous, but not current, nest cavity. He did this at the same cavity with two different sets of fledglings over two years. Training involved caching acorn pieces and whole insects in obvious and easy to find locations, often right in front of the fledgling. Fledglings would then “find” the cached food and either eat it or more commonly re-cache it in a new location, learning survival behavior in the process. This training occurred for more than two months after the young had fledged, with the family using this tree into January (6 months). There were three fledglings involved both years. Training also involved opportunities to learn social behavior and a place to roost at night and defend a cavity against intruders. Interactions with one’s fledglings for this long was not thought to occur. The training cavity tree was about 100 yards from the nest cavities both years and had been a nest cavity for this adult male a few years earlier. The female adult was not a part of these activities and not recorded by the cameras. The pictures below are frame shots from nest camera videos.



The parent Red-headed Woodpecker first attracts its fledglings to the training tree by giving them food on the tree a few times, as in the left picture above. Within a day or two the adult refuses to give the fledgling food directly, but caches food in obvious places while they watch. In the center picture a fledgling inside the cavity watches as an acorn piece is cached right in front of it by the adult. In the right picture the adult caches a live grasshopper while fledglings watch from outside of the camera frame.



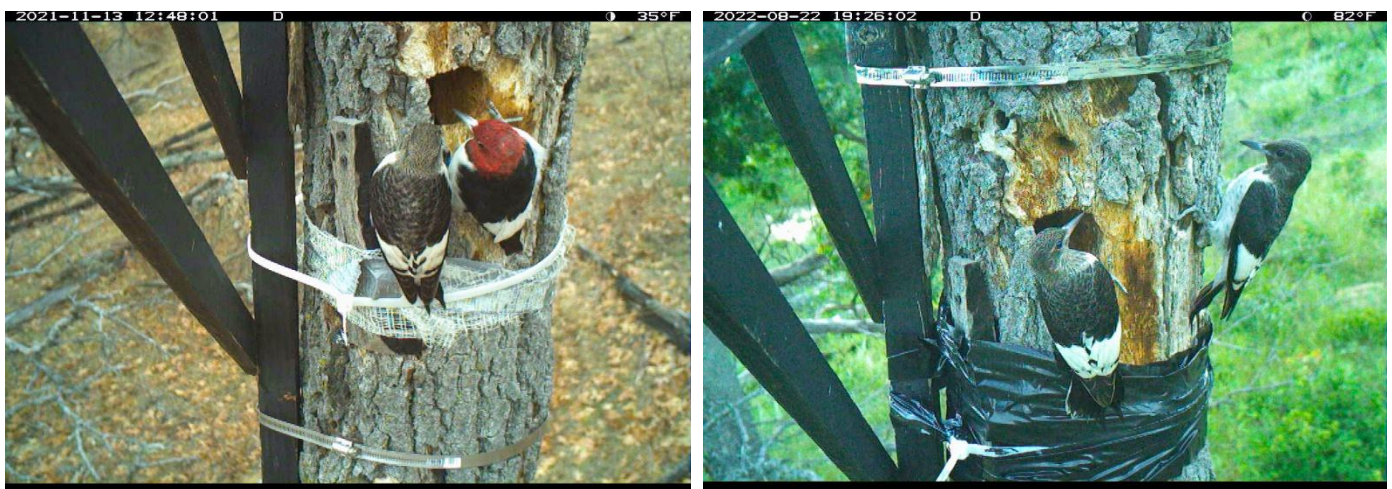
In the left picture above a fledgling has likely removed a grasshopper cached for it by the adult on this tree. In the center picture the fledgling attempts to cache an acorn piece with the adult looking on. In the right picture the fledgling is attempting to cache an acorn piece on its own. Caching food for the winter is a skill that takes time and practice by the fledglings, as can be seen in the next group of pictures.



In these video frame shots a fledgling Red-headed Woodpecker is practicing how to securely cache an acorn piece that it has retrieved from a demonstration cache by the adult. In the left picture it has the acorn piece, in the middle picture it attempts a cache placement, and in the right picture it notices that the cached piece is falling out of the location it had cached it in.



These pictures show, on the left, the fledgling rescuing the falling, poorly cached acorn piece, and then, on the right, attempting again to cache the piece in the same place, more securely. Practicing this skill means survival through the winter.



Another goal of the training tree is to learn social skills with other Red-headed Woodpeckers, adults and siblings.



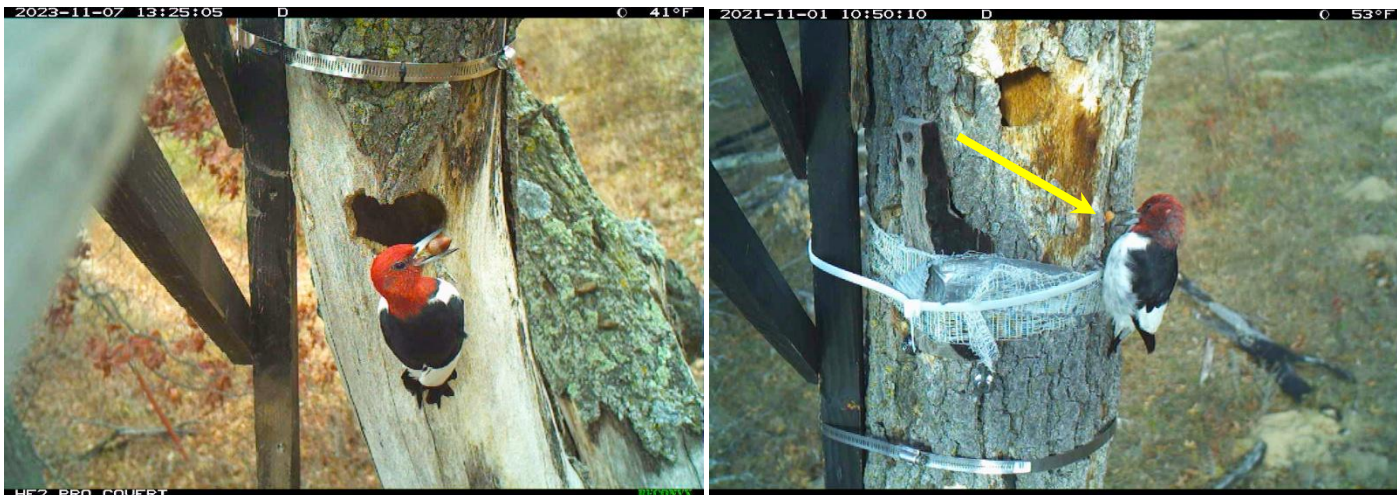
Nighttime requires another set of skills that fledgling Red-headed Woodpeckers need to learn. In these pictures one of the fledglings is roosting at night in the training tree cavity. A White-footed Mouse approaches the cavity entrance hole and the fledgling hears it. The fledgling is vigilant, protects the cavity by poking its beak at the mouse, and the mouse leaves in a hurry.



In a different year, a different fledgling is also being trained on this training tree, and it is also using the cavity as a night roost. In the picture on the left a Southern Flying Squirrel is right outside the nest hole, and the vigilant fledgling has its beak ready to poke the squirrel if it attempts to usurp the nest cavity. The squirrel was not successful. Three nights later, in the picture on the right, a sibling fledgling is also using the cavity as a night roost. This is the only time two fledglings were documented in the same cavity together. They have been out of their natal nest for three months here, so it is a surprise to see them roosting together in the same cavity. Both were vigilant and kept usurpers away through the night.

2. Day-time non-nest season activities at nest and roost cavities.

a. Caching acorns and insects for insects for food.



Red-headed Woodpeckers commonly cache acorns on the tree or close to the tree that they will roost in during the winter. By doing this they don't have to defend a large area and can get to food easily when the weather is extreme. In the right picture the woodpecker is caching a small acorn piece under the bark of the tree. Thousands of acorn pieces are cached by individual woodpeckers.



In the pictures above an adult Red-headed Woodpecker has brought an insect to this tree and then caches it into the bark in the picture on the right. This is rare. The cameras only captured this twice, and both times on this training tree in August, so not outside the nesting season while fledglings were being trained on this tree. I have observed this two times in other locations, but also only when the adults were actively training fledglings. Unless the insect was going to be eaten very soon it would not last long. Between ants, roaches, and other invertebrate scavengers, cached insects would be gone within 48 hours at this time of year.

At least in this area, I have not observed, nor have the nest cameras documented, Red-headed Woodpeckers ever caching insects in the fall months as a winter food source. If this is done, it might be done as a food source for later in the same day, but not as a food source for two or more months in the future.

b. During the non-nesting season defending self and food from day-time usurpers and predators.



In the non-nesting season Red-headed Woodpeckers have lots of new challenges to overcome to survive the changing seasons. The picture from mid-April on the left shows a Red-tailed Hawk that has just missed a meal as its wing covers up the Red-headed Woodpecker roost cavity in late April. The center picture shows a Red-headed Woodpecker chasing away a Fox Squirrel from both its roost and cached acorns in the middle of January. The picture on the right documents a solution to a daily issue, where to find water when temperatures are way below freezing. The woodpeckers eat ice and snow for their water needs in winter.

c. The safest place for Red-headed Woodpeckers to get water most of the year



Most animals need water frequently, including Red-headed Woodpeckers. But they are easily seen with their flashy colors, so flying down to a pond or stream is dangerous with many predators around. In one case a simple solution presented itself for adults and juvenile Red-headed Woodpeckers.

A dead nest tree from the previous year had leaned a little during the winter, and in the spring, rainwater ran directly into the cavity, filling it often. Adult and juvenile Red Heads found it and used it all summer and fall as a safe source of fresh water, hidden by branches and leaves of nearby trees. The biggest problem was competing with other animals for the water. (Picture of water taken with my phone)

3. Night-time activities at Red-headed Woodpecker nest and roost cavities.

a. Constant vigilance in the cavity opening against usurpers and predators.



Nighttime at Red-headed Woodpecker nest and roost cavities is often busier than during the day. The woodpecker inside protects the cavity (and eggs or nestlings) from predators and usurpers. Only the males guard the nests at night when there are eggs or nestlings present. The picture on the left shows the adult male in a vigilant, or guarding, pose at the nest entrance. Southern Flying Squirrels want the cavity for their own nest and try repeatedly to get into the cavity to kill nestlings so the adult woodpeckers will leave.

In both the center and right pictures above the adult woodpecker is poking the Flying Squirrel to make it leave. In the center picture the adult woodpecker was pulled out of the nest by the Flying Squirrel and the nestlings were killed. In the right picture the woodpecker was successful and chased the squirrel away. Flying Squirrels are a primary cause of nest failure for Red-headed Woodpeckers. These squirrels were documented at nearly every nest the nest cameras were placed at. Scarcity of cavities makes this happen.

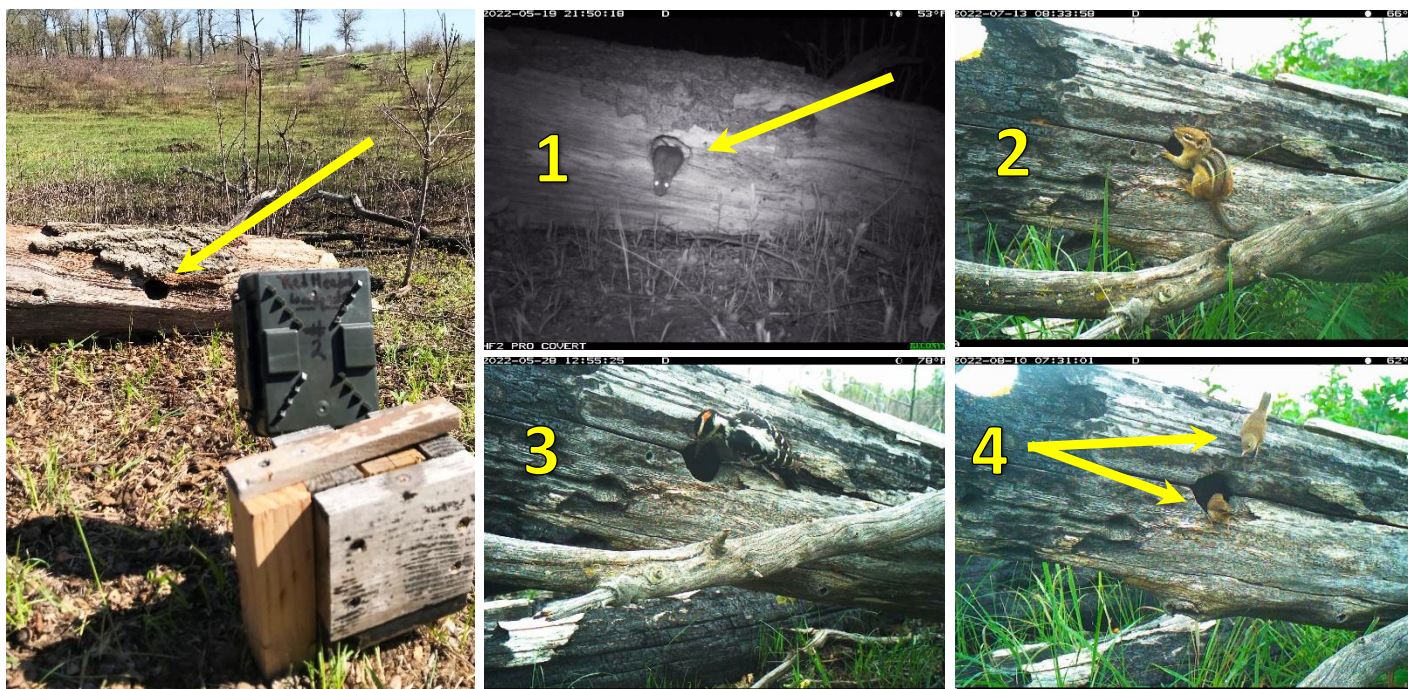


Flying Squirrels are not the only predator or usurper that regularly visits Red-headed Woodpecker nests. Raccoons like the one in the left picture visited nearly every nest over 6 years, sometimes more than once. White-footed Mice were common at all nests as seen with a vigilant adult woodpecker in the picture on the right. The Fisher seen in the middle picture was only documented by nest cameras once, although they were often seen while walking to and from nests. Larger predators like the Raccoon and Fisher were not documented by nest cameras ever being successful at cavities with Red-headed Woodpeckers in them. The woodpeckers and nestlings would huddle at the bottom of the nest cavity out of the predator's reach.

While not captured by the nest cameras, some Red-headed Woodpecker nests were in trees that were so rotten from decay that the predator was able to tear open the cavity and eat its contents. Predators doing this were most likely Raccoons and Fishers.

4. Activities at nest cavities after the tree falls to the ground.

During one six-month period I placed two nest cameras at two former Red-headed Woodpecker nest cavities after the tree had fallen to the ground. I was curious to document what use the cavities might receive while being on or near the ground. There are many, many cavities that have fallen to the ground. There were 23,000 videos acquired from these two cameras over this short time period. There are videos of deer and bison feet passing by, and numerous other animals that were not interacting with the old cavities, squirrels, raccoons, and birds. The cavities had only a few species (5) interact with the cavity. This project was a small sample for only 6 months. It would be interesting to extend this for more time and cavities.



The left picture above shows how the nest cameras were placed to record activities at the Red-headed Woodpecker nest cavities that had fallen to the ground. The yellow arrow shows the location of the nest cavity entrance hole. Picture 1 shows a White-footed Mouse, which was the most common visitor to the cavities, often many times per night, every night, but they did not nest in the cavities. Picture 2 shows an Eastern Chipmunk investigating the cavity, possibly as a temporary shelter or food storage location. Picture 3 shows a Hairy Woodpecker investigating the cavity. Red-bellied Woodpeckers did the same. Picture 4 shows a pair of House Wrens investigating a cavity, possibly looking for insect food or as a future nesting location.

5. What follows is an introduction to the thirty-six vertebrate species that have been documented by the nest cameras interacting with Red-headed Woodpecker nest cavities in some manner. These interactions demonstrate that Red-headed Woodpeckers are Ecosystem Engineers as illustrated by the tables showing extensive cavity use by these animals. A separate article has more detail.



The 36 Vertebrates include:

1. 10 Mammals
2. 23 Birds
3. 2 Reptiles
4. 1 Amphibian

Table 2

36 Vertebrates Documented Interacting with Red-headed Woodpecker Cavities by Nest Cameras

#	Species	#	Species
1.	White-footed Mouse <i>Peromyscus leucopus</i>	19.	Pileated Woodpecker <i>Dryocopus pileatus</i>
2.	Southern Flying Squirrel <i>Glaucomys volans</i>	20.	American Kestrel <i>Falco sparverius</i>
3.	Red Squirrel <i>Tamiasciurus hudsonicus</i>	21.	Great Crested Flycatcher <i>Myiarchus crinitus</i>
4.	Gray Squirrel <i>Sciurus carolinensis</i>	22.	Blue Jay <i>Cyanocitta cristata</i>
5.	Fox Squirrel <i>Sciurus niger</i>	23.	Common Raven <i>Corvus corax</i>
6.	Eastern Chipmunk <i>Tamias striatus</i>	24.	Black-capped Chickadee <i>Poecile atricapillus</i>
7.	Raccoon <i>Procyon lotor</i>	25.	Tree Swallow <i>Tachycineta bicolor</i>
8.	Fisher <i>Pekania pennanti</i>	26.	White-breasted Nuthatch <i>Sitta carolinensis</i>
9.	Mink <i>Neovison vison</i>	27.	Brown Creeper <i>Certhia americana</i>
10.	Bat (<i>Vespertilionidae</i>)	28.	Eastern Bluebird <i>Sialia sialis</i>
11.	Wood Duck <i>Aix sponsa</i>	29.	European Starling <i>Sturnus vulgaris</i>
12.	Red-tailed Hawk <i>Buteo jamaicensis</i>	30.	House Wren <i>Troglodytes aedon</i>
13.	Ruby-throated Hummingbird <i>Archilochus colubris</i>	31.	Baltimore Oriole <i>Icterus galbula</i>
14.	Red-bellied Woodpecker <i>Melanerpes carolinensis</i>	32.	Brow-headed Cowbird <i>Molothrus ater</i>
15.	Yellow-bellied Sapsucker <i>Sphyrapicus varius</i>	33.	Tufted Titmouse <i>Baeolophus bicolor</i>
16.	Downy Woodpecker <i>Dryobates pubescens</i>	34.	Bullsnake <i>Pituophis catenifer</i>
17.	Hairy Woodpecker <i>Dryobates villosus</i>	35.	Eastern Garter Snake <i>Thamnophis sirtalis</i>
18.	Northern Flicker <i>Colaptes auratus</i>	36.	Gray Treefrog <i>Hyla versicolor</i>

Table 3

Types of Interaction at Red-headed Woodpecker Cavities by 36 Vertebrates by Nest Cameras

	Interaction Type	# of Species		Interaction Type	# of Species
1.	Nests in Cavity	6	8.	Search for Food	19
2.	Inspects Cavity	22	9.	Find Nesting Material	1
3.	Roosts in Cavity	9	10.	Use as Watering Hole	11
4.	Temporary Shelter	17	11.	Alter for Access or Food	4
5-6	Predator-Infanticide	11-2	12.	Obligate Brood Parasite	1
7.	Usurpation of Cavity	12	13.	Resource Competition=Death	1

Table 4

**Vertebrate Species Interacting at Red-headed Woodpecker Cavities During Non-Nesting Season
Documented by Nest Cameras**

#	Species	#	Species	#	Species
1.	Hairy Woodpecker	7.	Brown Creeper	13.	Southern Flying Squirrel
2.	Red-bellied Woodpecker	8.	Blue Jay	14.	Red Squirrel
3.	Downy Woodpecker	9.	European Starling	15.	Gray Squirrel
4.	Pileated Woodpecker	10.	Black-capped Chickadee	16.	Fox Squirrel
5.	Northern Flicker	11.	Eastern Bluebird	17.	White-footed Mouse
6.	White-breasted Nuthatch	12.	Tufted Titmouse	18.	Mink

Table 5

**Vertebrate Species Interacting at Red-headed Woodpecker Cavities During Full-Dark Night
Documented by Nest Cameras**

#	Species	#	Species
1.	Raccoon	8.	White-footed Mouse
2.	Mink	9.	Bat—species
3.	Fisher	10.	Hairy Woodpecker
4.	Southern Flying Squirrel	11.	Downy Woodpecker
5.	Gray Squirrel	12.	Red-bellied Woodpecker
6.	Fox Squirrel	13.	Northern Flicker
7.	Red Squirrel	14.	Gray Tree Frog



Full dark night, in science, is called astronomical darkness, a time when the atmosphere no longer scatters sunlight. This occurs after or before astronomical twilight, when the sun is at least 18 degrees below the horizon. Since this time changes a bit each day as the seasons change, and since this time coincided frequently with the nest cameras having completely black backgrounds, I used the full black background of the images as being full dark night. The pictures above are all full dark night examples. The left picture has a Mink about to enter a Red-headed Woodpecker cavity at 12:45 AM on Christmas morning. In the center picture the Hairy Woodpecker is being thrown out of its roost by a Southern Flying Squirrel at 8:53 PM on October 2nd. And the bat in the right picture is grabbing insects off the bark at the cavity entrance area at 4:18 AM on October 10th. The nest cameras exposed full dark night activity well.

Table 6

Table of RHWO Non-nesting Season Nest Cavity Camera Activity (41% of the year—11-1 to 3-31)

#	Nest #	Winter Year	Begin date	End date	Days of Surveillance	# of Pictures and videos	RHWOs Migrate Y/N
1.	Nest 218	2019-2020	11-9-19	2-13-20	97	5,252	No 92% stay
2.	Nest 183	2019-2020	11-18-19	3-23-20	127	5,280	No
3.	Nest 203	2019-2020	11-1-19	1-10-20	71	3,964	No
4.	Nest 84	2020-2021	11-2-20	3-22-21	141	553	Yes 100 %
5.	Nest 94	2020-2021	11-2-20	3-31-21	150	1,043	Yes
6.	Nest 230	2020-2021	11-2-20	3-31-21	150	585	Yes
7.	Nest 227	2020-2021	11-2-20	3-31-21	150	1,598	Yes
8.	Nest 223	2020-2021	11-3-20	3-31-21	149	642	Yes
9.	Nest 219	2020-2021	11-3-20	3-31-21	149	404	Yes
10.	Nest 219	2021-2022	11-1-21	3-30-22	150	1,034	Some 40 %mig
11.	Nest 203	2021-2022	11-1-21	3-3-22	121	4,284	Some
12.	Nest 223	2021-2022	11-1-21	3-27-22	147	217	Some
13.	Nest 230	2021-2022	11-1-21	3-29-22	149	1,206	Some
14.	Nest 247	2021-2022	11-5-21	3-27-22	143	3,446	Some
15.	Nest 256	2021-2022	11-1-21	3-31-22	151	3,054	Some
16.	Nest 258	2021-2022	11-1-21	3-20-22	140	4,048	Some
17.	Nest 260	2021-2022	11-5-21	3-31-22	147	268	Some
18.	Nest 247	2022-2023	11-1-22	3-29-23	149	433	Yes 100 % go
19.	Nest 261	2022-2023	11-3-22	3-29-23	147	282	Yes
20.	Nest 276	2022-2023	11-1-22	3-29-23	149	266	Yes
21.	Nest 277	2022-2023	11-1-22	3-28-23	148	302	Yes
22.	Nest 279	2022-2023	11-1-22	3-24-23	144	80	Yes
23.	Nest 247	2023-2024	11-1-23	3-31-24	152	2,208	No-all stay
24.	Nest 261	2023-2024	11-1--23	3-31-24	152	1,442	No-all stay
25.	Nest 272	2023-2024	11-5-23	2-22-24	110	3,810	No- all stay
26.	Nest 277	2023-2024	11-1--23	2-20-24	119	4,826	No-all stay
27.	Nest 302	2023-2024	11-1--23	3-31-24	152	1,029	No-all stay
28.	Nest 318	2023-2024	11-1--23	3-31-24	152	1,471	No-all stay
29.	Nest 319	2023-2024	11-1--23	3-31-24	152	2,309	No-all stay
30.	R 339	2023-2024	11-5-23	3-31-24	148	507	No-all stay
31.	Nest 261	2024-2025	11-7-24	3-20-25	134	2,449	No-all stay
32.	Nest 302	2024-2025	11-1-24	3-31-25	151	987	No-all stay
33.	Nest 318	2024-2025	11-1-24	3-31-25	151	1,259	No-all stay
34.	Nest 319	2024-2025	11-1-24	12-10-24	34	2,554	No-all stay
35.	R 339	2024-2025	11-1-24	3-31-25	151	1,615	No-all stay
					4,688 days	64,845	
					112,512 hrs of Surveillance	22% of Total Years P and V	

The significance of this table is that it shows that in years when the Red-headed Woodpeckers migrate away, the nest cameras are triggered much less often (79% less). The average when they stay per nest is 2,661 triggers, and when they leave is 563. When they stay for the winter, the majority of the camera triggers are other animals trying to steal cached acorns. When the woodpeckers don't stay, what do those other animals do for food? Do their populations decline?

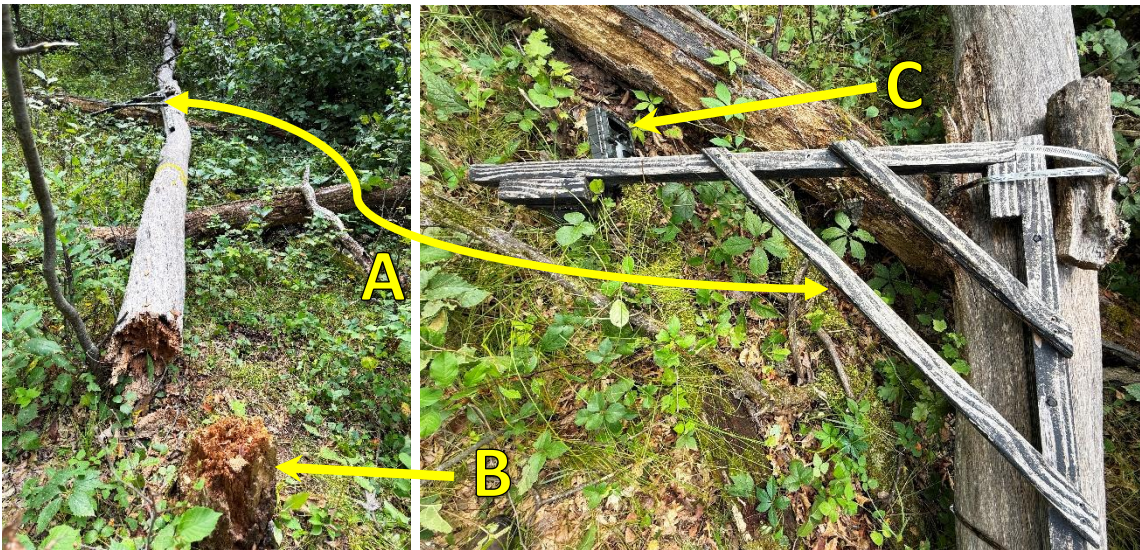
Table 7

Red-headed Woodpecker Nest Cameras at Cedar Creek Ecosystem Science Reserve 2019-2025

Nest camera placement by nest number and year first placed

#	Nest Number R=Roost G=Ground	Year Installed	# of RHWO Nests In Cavity and Year	Tree Fallen Yes/No Year	Fell With Camera Attached	Bird Name at Nest
1.	182	2019	1—2019	Yes—2022	No	MJ/Annie
2.	203	2019	1—2019	Yes—2023	No	No Name
3.	183R	2019	0	Yes—2022	No	
4.	218	2019	1—20 and 1--21	Yes—2021	Yes	Boo/Spooky
5.	84	2020	1—20 Second Brd	Yes—2021	Yes	Gloria/Eldon
6.	94	2020	2—2020	Yes—2022	Yes	No Name
7.	219	2020	1—2020	Yes—2022	Yes	Lucy/Croix
8.	223	2020	1—2020	Yes—2024	No	Bella/Bucko
9.	225	2020	1—2020	Yes—2020	Yes	Piper
10.	227	2020	1—2020	Yes—2020	Yes	Carmen/Brazil
11.	230	2020	1—2020	Yes—2024	No	Lucky/Clover
12.	231	2020	1—2020	No	-	Gloria/Eldon
13.	247R	2021	0	Yes—2024	Yes	Wolfe
14.	255	2021	1—2020	Yes—2021	Yes (2)	Tomek/Izza
15.	256	2021	1—2021	Yes—2023	No	MJ
16.	258	2021	1—2021	Yes—2025	No	Markie
17.	260R	2021	0	Yes—2022	Yes	
18.	261	2022	5—22, 24, 25	No	-	Roger/Jessie
19.	272	2022	1—2022	Yes—2024	Yes	Tiny
20.	276	2022	1—2022	Yes—2024	No	Tomek/Izza
21.	277	2022	1—2022	Yes—2024	No	Lucy/Croix
22.	279	2022	1—2022	Yes—2024	Yes	Tango
23.	94G	2022	0	-	-	-
24.	255G	2022	0	-	-	-
25.	302	2023	1—2023	No	-	No Name
26.	318	2023	1—2023	Yes—2025	Yes	Banjo
27.	319	2023	1—2023	No	-	Fallyn
28.	339R	2023	0	No	-	-
29.	387	2025	1—2025	No	-	No Name
30.	392	2025	1—2025	No	-	Holes
	30 Locations	6.15 Years	30 Nest Cycles Covered	21 Nest Trees Fallen of 28 (75%)	Cameras Fell 13 Times	21 Nesting Pairs Recorded

There were 9 nest cameras placed at 30 locations over 6 years on 28 different RHWO nest/roost trees. Four of the locations were roost trees and two of the locations were fallen nest cavities on or near the ground. There were 30 RHWO nest cycles recorded by the cameras of 21 nesting pairs of RHWOs. Twenty-one of the nest trees fell during the six years (75% of the total). The nest cameras and the frames they were attached to fell with the trees 13 times (62%) and survived mostly intact except two times when the camera frames burned up with the tree during prescribed burns.



Fallen Nest Camera tree.
 “A” shows the unbroken nest camera frame in both pictures. “B” shows the tree stump that the tree broke away from. “C” shows the undamaged nest camera after the fall.

Thirteen nest camera trees fell while the nest cameras were still attached like the one in this picture. All but one of the 13 broke off at the base like the one in the picture above. Heart rot within the tree caused this.

There were 24 different cavities that the cameras were at with active nests. Twenty-one of those cavities (87.5%) were only used once for nesting while the camera was present. One cavity was used by the same pair in two consecutive years. One cavity had two nest attempts by the same pair in the same year. And one nest cavity was used for two broods by the same pair (Roger and Jessie) in two non-consecutive years, and then one more time by the same male with a different mate in a succeeding year.

One pair (Gloria and Eldon) was documented by the nest cameras nesting successfully in two different trees in the same summer. One pair (Tomek and Izza) was documented by nest cameras nesting in two different trees over two successive years. One pair (Lucy and Croix) was documented by nest cameras nesting in two different trees in two non-consecutive years.

This article has illustrated some basic information about Red-headed Woodpeckers and some of the animals that interact with the cavities these woodpeckers create using nest cameras close to the nests. Much more can be gleaned from the 500,000 plus videos and pictures created at this site. While this was initiated to learn more about brood reduction, which resulted, so much more of the Red-headed Woodpecker’s world was revealed. Imagine what more could be discovered if the same process was implemented 50, 100, and 500 miles away on a different group of Red-headed Woodpeckers. Different predators, habitats, tree species, food items, and other species they interact with are all waiting to be discovered.