

Habitat Hole Study

By Kellen Radulski and Caleb Miller

Purpose: To determine what burrowing species of animals are present in the Cathance Preserve, and to determine the hole's surroundings (rocks, trees, etc), and material the hole is made of (stump, tree, earth, rock, etc).

Procedure:

1. Find a hole and mark a waypoint with a GPS.
2. Mark the hole with flagging tape.
3. Determine what the hole is made of and its surroundings.
4. Take pictures with a digital camera of the hole exterior and surroundings.
5. View the holes interior with hole camera.
6. For the motion-sensitive remote game camera:
 - a. Choose hole large enough to set up the game camera in.
 - b. Bait hole with foods to attract desired species (Corn, Sunflower Seeds, Sardines).
 - c. Check camera about every week, upload pictures to a computer, and clear the camera memory.

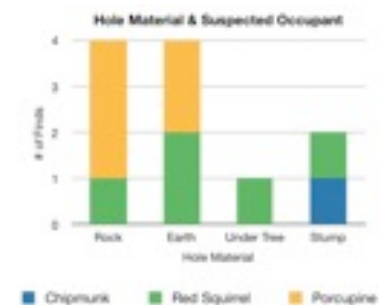
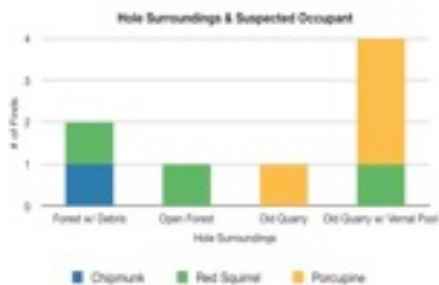
Hypothesis: What occupies a hole will depend on the surroundings (rocks, trees, etc), and what material the hole is made in (stump, tree, earth, rock, etc).

Conclusion: Red Squirrels dwelled in almost every kind of surroundings (forest with debris, open forest, old quarry with vernal pool). Porcupines dwelled in old quarries and Chipmunks dwelled in forest areas with debris. For hole materials, Red Squirrels used rock, earth, tree roots, and stumps. Porcupines used rock and earth. Chipmunks used stumps. Over a period of 29 days, 2621 pictures were taken with the game camera, averaging 93.6 pictures per day. Some pictures displayed animals, others did not. Animals observed with the game camera were: Snowshoe Hare, Raccoon, Red Squirrel, Porcupine, Blue Jay, Deer Mouse, and other unidentified birds. The hypothesis was supported for Porcupines and Chipmunks but not for Red Squirrels.



Map of Area

Graphs:



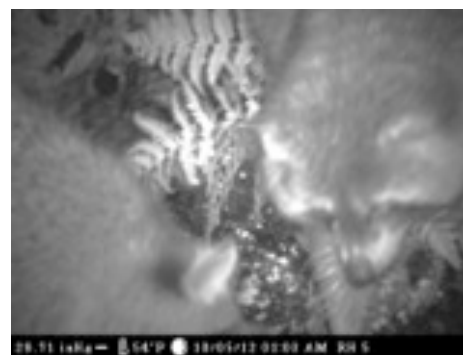
Larger hole where the game camera was located.



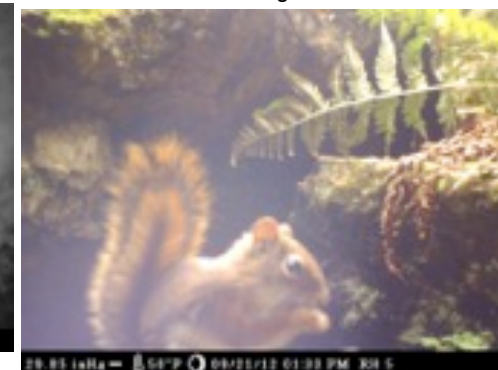
Snowshoe Hare at larger hole.



Caleb and Kellen looking for holes in a dead tree.



Raccoons at larger hole.



Red Squirrel at larger hole.

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Caleb Miller
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12/13/12
1-2 Red

Title: Habitat Hole

Theory:

Purpose: To determine what burrowing species of animals are present in the Cathance Preserver and to determine if the factors of the surroundings (rocks, trees, etc), and material the hole is made in (stump, tree, earth, rock, etc) determines what kind of animal occupies these holes.

Hypothesis: What occupies a hole will depend on the surroundings (rocks, trees, etc), and what material the hole is made in (stump, tree, earth, rock, etc).

Background Information:

Habitats are places where organisms live which consist of a variety of abiotic and biotic factors that affect the organisms in the area. Organisms vary greatly in different habitats. For example, while a fish might prefer a river or other source of water, a squirrel might prefer a tree. Depending on what resources and factors are in a habitat, they would define the organisms that live there.

An abiotic factor that would define what organisms dwell in a habitat, would be the materials that the habitat is made of. Animals use many different materials to construct their homes, some of which include, stone, dirt, sticks, and sometimes their own special materials, like in the case of most bees, wasps, and hornet species, where they use paper made from their own bodies. The materials depend on what type of organism, and what type of resources are available. A shelter is critical for the survival of most organisms, it helps to keep organisms safe from abiotic, and sometimes, biotic factors, such as predators.

Another crucial factor that plays the part in organisms shelter, is the availability of sources of energy. Water, sunlight, and food, do not necessarily come easily as they do to

humans. Depending on the organism, shelters have to be built close to these resources. Some resources are more necessary than others though, depending on the organism. For example, a plant usually needs quite a bit more sunlight than a bat would, and a fish would need more water than a bird would. Plants can gain energy through the sun, unlike animals. Because of this fact, plants and animals are spaced differently. Animals require food and water, but not every animal requires the same food. Herbivores need to be closer to plants, carnivores need to be closer to prey, and omnivores need a mix between the two.

The last important factor that influences an organisms shelter, is temperature. Organisms need certain temperatures to survive. Reptiles, being cold blooded have to live in a place where the temperature is high so their blood does not get too cold. Even mammals need certain temperatures to survive. Some mammals carry thicker skin and more fur than others. For example, snow leopards have fur as long as 12cm to keep them warm in their Himalayan climate. On the other hand, the regular leopard that dwells in Africa has a shorter lighter coat, made for tropical climates.

Within habitats there are shelters called burrows, in which we are studying. Burrows are a form of shelter usually defined as a hole dug, carved, or created in various ways that is used as shelter for many different animals. Some are occupied for long periods of time, while others are merely temporary safe places. Burrows protect from a variety of dangers/factors including, temperature extremes, predators, and weather. Prey are not entirely protected by burrows though, burrowing predators such as weasels, badgers, snakes, and even red foxes can dig into burrows and capture prey.

The common mammalian burrow consists of only an entrance, tunnel, and possibly, a nest. Most mammals use very simple burrows with usually around one to two entrances, but more is possible. Complexity of burrows depends on the animal, and material. For example, one of the most simple burrows is excavated by the Namib golden mole. This mole digs in very sandy soil which collapses behind it as it digs, effectively closing in the mole from outside harm. Larger mammals such as armadillos dig straight tunnels up to 1.25 meters long, and dwell in those.

The most complex of burrows belong to rodents, which include several entrances, nests, and interconnecting tunnels. Burrows start out relatively simple at first, but over time they begin to connect and grow larger. Prairie dog burrows are a good example, containing several entrances and many tunnels. In a study of 18 Prairie dog burrows, they ranged from 1 meter, to around 28 meters. These burrows started as straight vertical holes, then began to level off. In another study of 4 unrelated rodents, there were very distinct similarities between the burrows of the group, including, long burrows with multiple chambers. Rodents tend to spend their entire lives in one burrow.

Burrowing is not exactly exclusive to mammals, bird species such as puffins also burrow. In Maine we have the Atlantic Puffin. The atlantic puffin burrows on rocky islands, usually isolated from the mainland. A puffin burrow usually consists of a short tunnel, and a nest area. The nest area usually contains one egg, and is coated in feathers, seaweed, and other insulating material to keep the egg warm. Burrows are not dug, but rather, they are found in crevices between rocks that are big enough to have a burrow. Other organisms that burrow include crustaceans, insects, reptiles, amphibians, and many kinds of spider.

One of the more common burrowing animals in Maine, is the Eastern Chipmunk. Burrows are usually about 12-30 feet long, 18-36 inches deep, and about 2 inches in diameter. The beginning of the tunnel entrance is usually left unobstructed but all other entrances lead to some sort of covering, such as a pile of leaves, or a bush. Chipmunks do not usually create the main tunnel itself, but instead, use previous organism tunnels and root tunnels. Although they don't create the tunnels, they can alter them with their front paws, and carry dirt with their pouch-like mouth. In the middle of it all, there is a chamber used as the main chamber, coated in leaves, it also leads to the other food chambers.

Another burrowing organism that is not necessarily a common burrowing animal, but around the area is quite common, is the red fox. Burrows are not used for quite a while, not until the weather becomes wet, or a female needs a place for her kits. Red foxes do not, most of the time, build their own burrows. Usually they take over an abandoned skunk, or woodchuck burrow. Red fox burrows are more commonly called dens. A den can reach up to 25-27 feet in length, 3-4 feet in depth, and have entrances of about 8-15 inches in diameter. At the foot of the entrance, there is usually a mound of dirt, feces, and urine, which would be a way to tell that a red fox was occupying that den. During times when a burrow is not needed, Red Foxes sleep in hollow logs, or rocky crevices.

One of the larger common burrowing animals in Maine, is the Porcupine. The porcupine usually occupies burrows around rocky, or areas with lots of roots. Like other burrowing animals, the porcupine does not always build its own. If the rock formation is right, they will use it. When it does build its own, it usually means that the porcupine that dug the burrow lives with a family. Porcupines are not very partial to what habitats they dwell in. The

only environment in which they will not dwell in include moist forests, and excessively hot deserts. They most commonly occupy areas where there are lots of rocks, or hilly areas.

Yet another burrowing animal found commonly in Maine, is the North American Red Squirrel. The Red Squirrel is a small ground and tree dwelling squirrel that has red, or ruddy colored fur. It usually dwells in coniferous, deciduous, or mixed forests. Its diet consists mostly of nuts, seeds, barks, mushrooms, and small fruits. Some Red Squirrels have even been known to eat insects, small birds, or even young rabbits. Red Squirrels usually burrow in the hollows of trees, holes in the ground, and the crotches of trees. The Red Squirrel also digs lots of little burrows, or caches, for their stores of nuts and seeds. These are usually underneath trees, or logs. They do not always remember or go back to these caches, so this makes them an important spreader of trees.

Procedure:

1. Find hole along any trail at Cathance Preserve (A portion of the trail map showing the locations of the holes studied is included at the end of this paper).
2. Mark on GPS and determine longitude/latitude.
3. Mark hole with flagging tape (If Necessary).
4. Determine material the hole is made in such as earth, stump, rock, etc.
5. Determine hole's surroundings (rocks, trees, etc).
6. Take pictures of hole and hole surroundings with digital camera.
7. View as much of the interior of the hole as possible with hole camera.
8. Chose at least one hole to set up Game Camera - the hole chosen for this study was in a small rock pile left over from old quarrying operations in the area.
 - a. Bait hole with foods to attract desired species such as corn, sunflower seeds, sardines.
 - b. Set game camera in hole.
 - c. After a week has passed remove camera from hole.
 - d. Check the hole's pictures and clear it's memory.
 - e. Repeat a - d for as long as deemed necessary.

Safety Considerations:

One must be careful to avoid hitting one's head on rocks if one is in a hole for some reason. One must be careful to avoid hitting branches when walking through the woods, especially off the trail. One must walk carefully when on the uneven, loose, rocks of the old quarries. One must avoid contact with animals that might be in the holes being studied, though the chance of meeting one is unlikely. One must wash their hands after entering holes to avoid contracting diseases from old feces in the holes. If one gets a scratch or other wound which punctures the skin from an object such as a rock or a stick, they must take care to wash it later to avoid an infection.

Materials:

- Hole Camera (Tree Top Color Cavity Camera - Sandpiper Technologies)
- GPS
- Flagging Tape
- Sharpie
- Paper
- Pencils
- Flashlight
- Digital Camera
- Duct Tape
- Moultrie Game Spy Game Camera
- Corn Kernels
- Sunflower Seeds
- Sardines

Observations:

Hole 1 appears to be active although there is no scat or food clippings on top, later it was found to have been dug at by some animal, possibly a fox. Hole 2 has old porcupine scat and old chew clippings, later some new chew clippings appeared, and some nearby plants were flattened. Hole 3 has cone clippings, and there are many holes in the area, there was some Red Squirrel scat nearby. Hole 4 connects directly to a vernal pool, a small part of the vernal pool is inside the hole. Hole 5 and 6 are within 20 meters from each other, hole 5 is about 10 meters from the trail, and they are both about 100 meters from the housing development. The holes found in quarries

were usually in quarries that appear to be more overgrown. The camera in hole 2 was triggered the most right after it was re-baited.

Calculations:

The number of pictures taken per day were averaged by adding them all up and dividing by how many days the camera took pictures

Data Tables:

Information on Holes in the Cathance Preserve

Hole (#)	Coordinates	Surroundings	Hole Material	Suspected Animal	Confirmed Animal
1	N 43° 57' 22.6" W 69° 56' 53.4"	Woody debris Hemlock pocket Regen. hard wood	Old Stump	Red Squirrel Chipmunk	

Hole (#)	Coordinates	Surroundings	Hole Material	Suspected Animal	Confirmed Animal
2	N 43° 57' 24.1" W 69° 56' 53.6"	Rocks Regen. pine & balsam fir Mixed w/ regen. hard wood (birch, red oak, maple)	Rocky boulders	Porcupine	
3	N 43° 57' 24.9" W 69° 56' 53.4"	Small 2nd growth hemlock stand Downed logs	Under hemlock roots Earth	Red Squirrel	
4	N 43° 57' 24.9" W 69° 56' 56.1"	Vernal pool Beech dominated	Rock & earth	Porcupine	
5	N 43° 57' 23.9" W 69° 57' 08.5"	Rock (old quarry) Near small vernal pool Pine/oak stand w/scattered white birch	Rock and earth Under large boulder	Porcupine	
6	N 43° 57' 23.5" W 69° 57' 09.5"	Old quarry Near small vernal pool Pine/oak w/ scattered white birch, balsam fir & red pine	Rock & earth	Porcupine/ Red Squirrel	

Hole Material & Suspected Occupant

	Chipmunk	Red Squirrel	Porcupine
Rock	0	1	3
Earth	0	2	2
Under Tree	0	1	0

	Chipmunk	Red Squirrel	Porcupine
Stump	1	1	0

Hole Surroundings & Suspected Occupant

	Chipmunk	Red Squirrel	Porcupine
Forest w/ Debris	1	1	0
Open Forest	0	1	0
Old Quarry	0	0	1
Old Quarry w/ Vernal Pool	0	1	3

Number of Pictures Taken at Hole 2 on Different Days with Game Camera

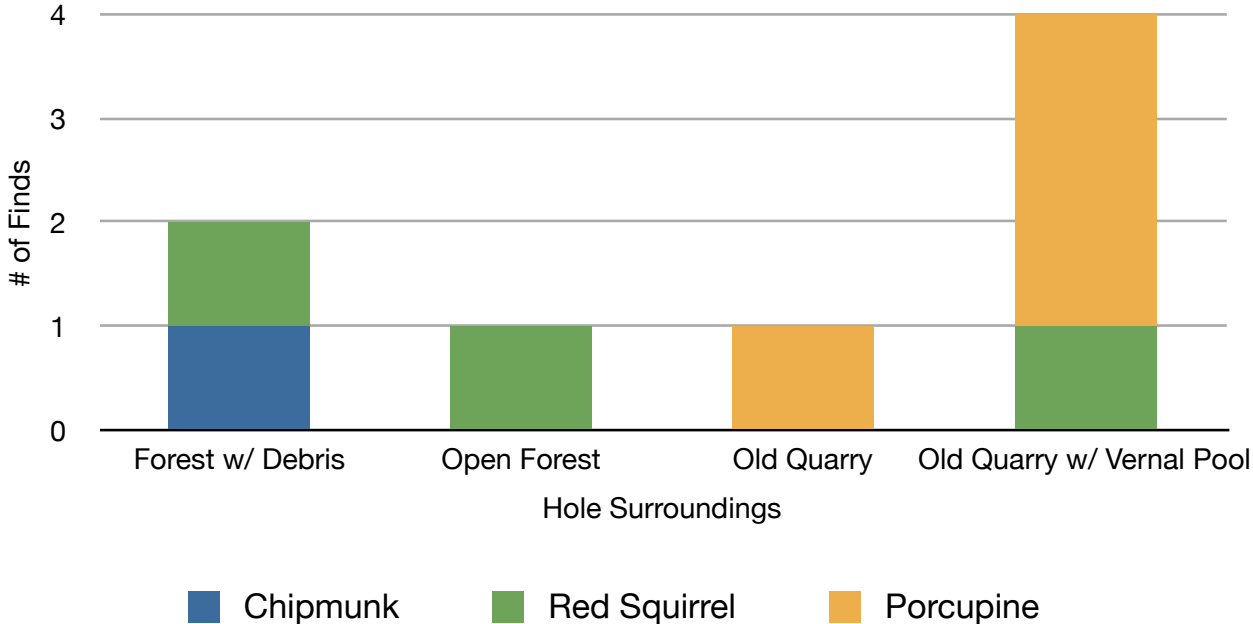
Date	# of Pictures Taken	Bait Added
Sep 21, 2012	480	Yes
Sep 22, 2012	603	
Sep 23, 2012	39	
Sep 24, 2012	6	
Sep 25, 2012	48	
Sep 26, 2012	0	
Sep 28, 2012	175	Yes
Sep 29, 2012	288	
Sep 30, 2012	105	
Oct 1, 2012	60	
Oct 2, 2012	32	
Oct 3, 2012	8	
Oct 4, 2012	195	Yes
Oct 5, 2012	174	

Date	# of Pictures Taken	Bait Added
Oct 6, 2012	48	
Oct 7, 2012	15	
Oct 8, 2012	3	
Oct 9, 2012	3	
Oct 10, 2012	0	
Oct 11, 2012	9	
Oct 12, 2012	45	Yes
Oct 13, 2012	87	
Oct 14, 2012	39	
Oct 15, 2012	9	
Oct 16, 2012	21	Yes
Oct 17, 2012	36	
Oct 18, 2012	60	
Oct 19, 2012	33	

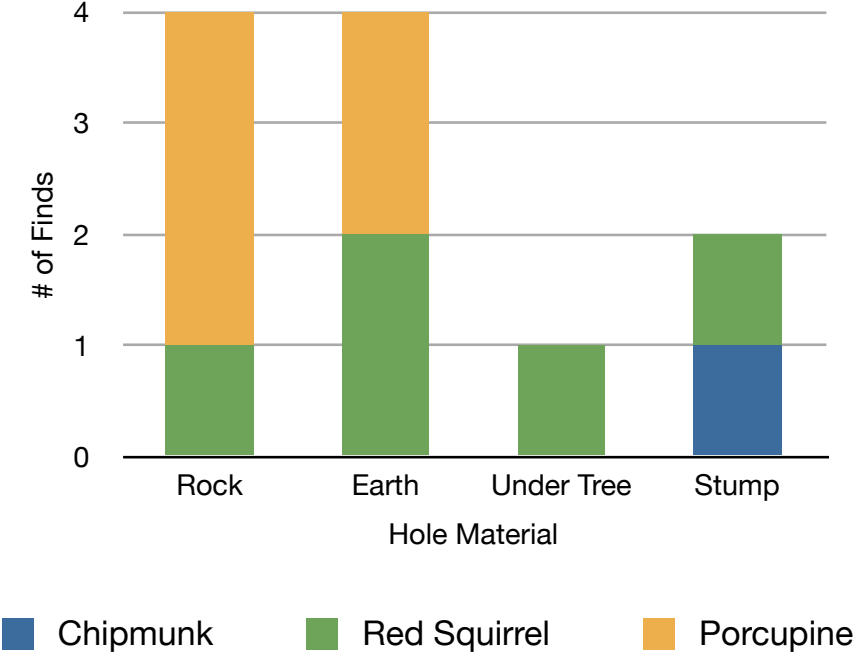
The average number of pictures per day is 94.

Graphs:

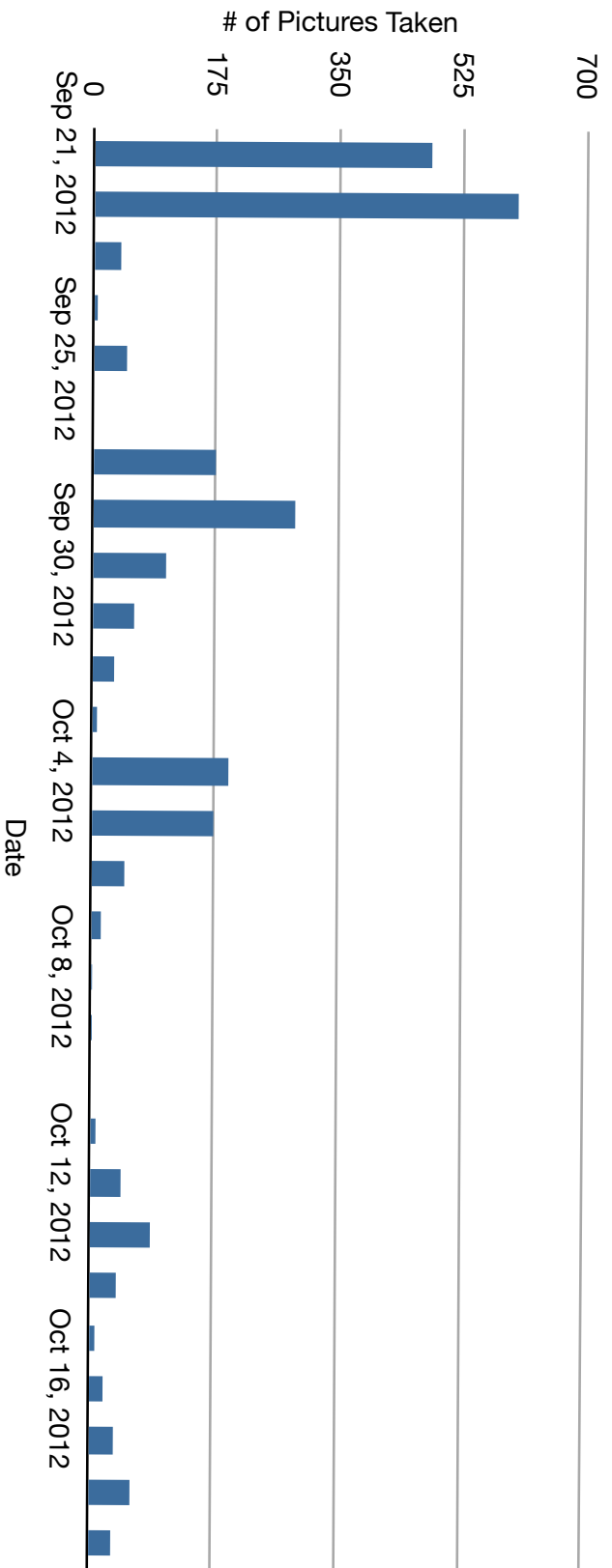
Hole Surroundings & Suspected Occupant



Hole Material & Suspected Occupant



Number of Pictures Taken at Hole 2 on Different Days



Analysis of Data: There were three collections of Data that were collected during this project. The first was “Hole Surroundings and Suspected Occupants”. This collection showed the physical surroundings of the hole, and what might live there. There were four types of surroundings where results were obtained, Forest with Debris, Open Forest, Old Quarry, and Old Quarry with a vernal pool. In the Forest with debris, there were two finds, one, a chipmunk burrow, the other, a red squirrel burrow. In the Open Forest location, there was only one find, a Red Squirrel burrow. The Old Quarry location contained only one occupant, that being a porcupine. The Old Quarry with vernal pool yielded greater results than the Old Quarry, it contained two occupants, a Porcupine, and a Red Squirrel. Red Squirrels seem to be quite flexible on where they dwell, living in 3 of the 4 locations. The Second collection was entitled, “Hole Material and Suspected Occupant”. There were four selections of materials, Rock, Earth, Under Tree, and Stump. Of these selections, Red Squirrels occupied all of them, Porcupine two, and Chipmunk one. Red Squirrels again prove their versatility, adapting to all materials. The last collection was the Number of Pictures Taken At Hole 2 per Day. Hole 2 was made in rocks and earth, its surroundings were regenerating pine and balsam fir mixed with regenerating hard wood (birch, red oak, maple), and rocks. Hole 2 was an area off of Beaver Loop Trail, it was surrounded by an old, smaller quarry. At this hole, a game camera was placed to record what animals visited the hole. Over the period of time in which this hole was observed, several animals were caught on camera. These animals included, red squirrel, gray squirrel, field mouse, blue jay, raccoon, and White Throated Sparrow. Hole 2 was baited, and also originally had the most activity. This collection occurred from September 21st, to October 19th. The number of

pictures taken per day range from 0 on September 26th and October 10th, to 603 on September 22nd. The average number of pictures taken per day, was 93.6.

The animals observed in hole 2 with game camera:

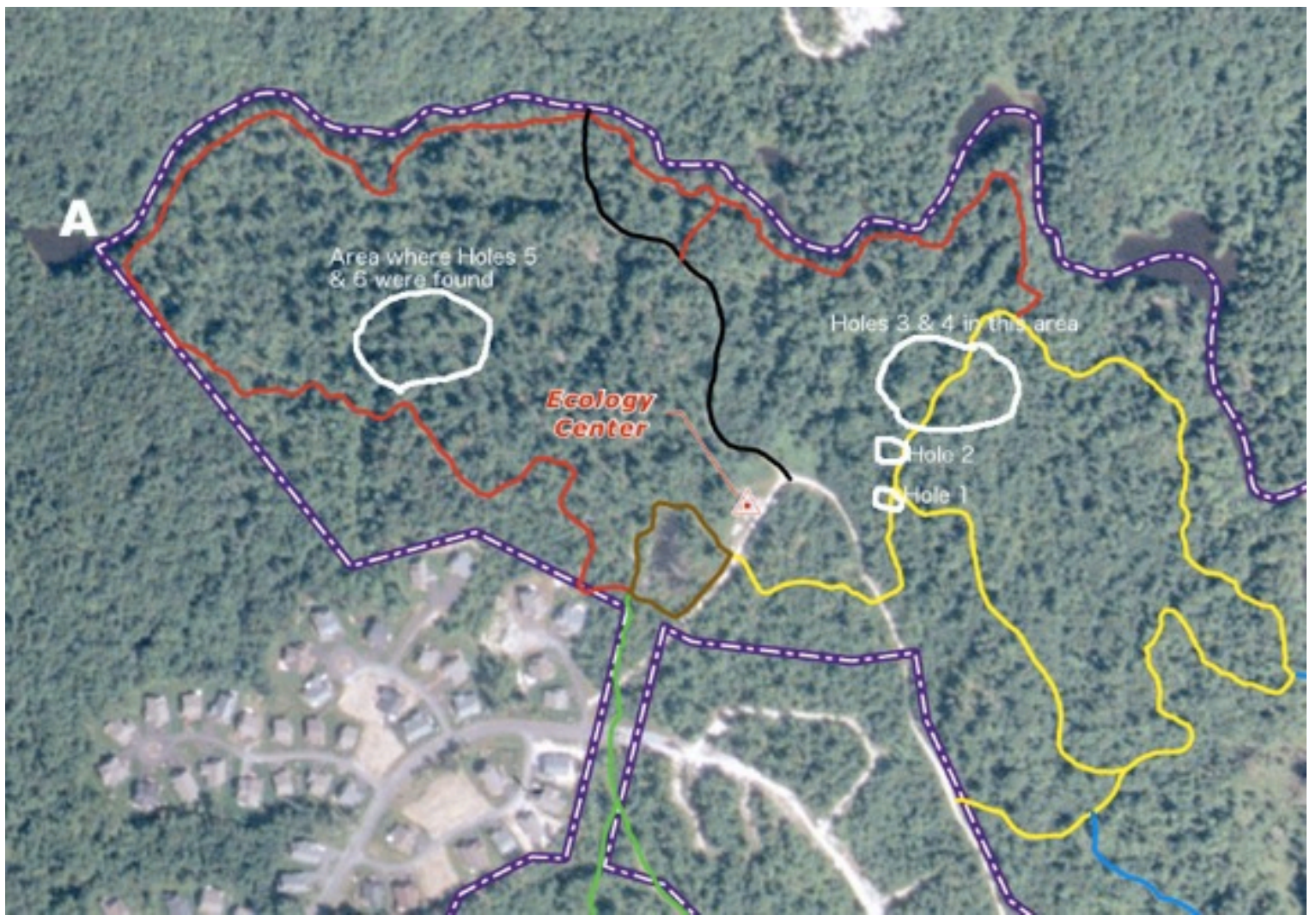
- Red Squirrel
- Porcupine
- Raccoon
- Rabbit (Probably a Snowshoe Hare)
- Blue Jay
- Deer Mouse
- Other unknown birds

Conclusion: Over the period of time that this project took place, data was collected for 3 different experiments. The first being “Hole Surroundings and Suspected Occupants”, this study gave information on where the hole was placed, and what lived there. Surroundings included, Forest with Debris, Open Forest, Old Quarry, and Old Quarry with Vernal Pool. Red Squirrels appeared frequently in this table being found in Open Forest, Forest with Debris, and Old Quarry with Vernal Pool. Chipmunks and porcupines were less common. Chipmunks were found only in Forest with Debris, and Porcupines were found in Old Quarries, and those with vernal pools. The second collection, “Hole Material and Suspected Occupant”, looked at the material of the burrow and what might live there. Categories for this included, Rock, Earth, Under Tree, and Stump. Again, Red Squirrels used every environment, meaning that they are quite versatile. Chipmunks were seen under stumps, and porcupines in rock and earth. The last collection looked at the “Number of Pictures Taken at Hole 2 per Day”. This yielded varying results from, 603 pictures a day, to 0. Animals seen in this study included, red squirrel, gray squirrel, field mouse, blue jay, raccoon, and White Throated Sparrow. Pictures were taken on various days after baiting, from the first day after, to the next baiting. The hypothesis of the project was supported, due to the fact

that porcupines were only found in quarries, made with rock, or earth. Also, chipmunks shared one common material and location, those being stump, and forest with debris. However Red Squirrels, did not support the hypothesis, being found in Open Forest, Forest with Debris, and Old Quarry with Vernal Pool habitats, also using Rock, Earth, Under Tree, and Stump materials.

Throughout the extent of this Project, there were places where error was quite possible. Not one animal was found within its burrow during the daytime. This was not uncommon though, given as it was the wrong time of year, and wrong time of day. So without this knowledge, most of the data on what animal was in the burrow, was based on secondary evidence. Also, the amount of pictures is affected by the fact that not every single picture taken was caused by an organism. A rock, or even a leaf could have fallen in front of the camera, and set it off. One last error was probably how hole surroundings could be defined. Every person has a different definition for surroundings, seeing as every person has a different perspective.

Although this Project was a valuable learning experience, there could have been improvements to it. To gain better results, it could have taken place at a different time of year, possibly in the springtime, when life is abundant. Also, to gain more results in general, there could have been more game cameras, to obtain more, diverse pictures. In general, there could also be more time added to the project, so that there could be more time to do thorough work. Some additions that could be added onto the project could include, animal tagging (if possible). This could be helpful to see which burrows are active, and gain more precise data on where animals burrow.



Works Consulted

- "Atlantic Puffin(*Fratercula Arctica*)." *Maine Department of Inland Fisheries and Wildlife*. N.p., n.d. Web. 28 Nov. 2012.
<http://www.maine.gov/ifw/wildlife/species/endangered_species/atlantic_puffin/index.htm>.
- "Eastern Chipmunk - *Tamias Striatus*." *Eastern Chipmunk*. N.p., n.d. Web. 28 Nov. 2012.
<<http://www.nhptv.org/natureworks/chipmunk.htm>>.
- "North American Porcupine - *Erethizon Dorsatum*." *North American Porcupine*. N.p., n.d. Web. 28 Nov. 2012. <<http://www.nhptv.org/natureworks/porcupine.htm>>.
- "Physical Features." *Snow Leopard Trust Physical Features Comments*. N.p., n.d. Web. 28 Nov. 2012. <<http://www.snowleopard.org/learn/cat-facts/physical-features>>.
- "Red Fox (*Vulpes Vulpes Desmarest*)." *Red Fox*. N.p., n.d. Web. 28 Nov. 2012.
<http://www.esf.edu/aec/adks/mammals/red_fox.htm>.
- "Red Squirrel - *Tamiasciurus Hudsonicus*." *Red Squirrel*. N.p., n.d. Web. 28 Nov. 2012.
<<http://www.nhptv.org/natureworks/redsquirrel.htm>>.
- Reichman, O. J., and Stan C. Smith. "Burrows and Burrowing Behavior by Animals." *Burrows and Burrowing Behavior by Animals*. N.p., n.d. Web.
<<http://www.lter.umn.edu/biblio/fulltext/t1473.pdf>>.