A Track Tube Survey of Augusta High School Old Field Habitats

The Search for Small Mammal Winter Activity Zones

By: The 2002-2003 Augusta High School Ecology Class
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Introduction

Small mammal activity can be a good indicator of how productive an ecosystem can be. A good small mammal population is evidence that there is a base for a strong food web, which is very important to the ecosystem. The goal of this study was to discover the amount of activity by small mammals in an old field. The old field was chosen because of its convenience in location to our school, which is located in Augusta, Wisconsin, in Eau Claire County. Latitude 44 degrees 41' 7.94" N, Longitude 091 degrees 8' 23.38" W. The field was surrounded on three sides by a strip of 30 year old red pine trees and was mainly composed of matted down reed canary grass, timothy grass, goldenrod, and other opportunistic old field plants. Mowing of this field stopped four seasons ago. This study lasted approximately two weeks, which was 1-7-03 through 1-21-03. These were the small mammals we were expecting to find:

Materials:

Track Tube Sizes

<table>
<thead>
<tr>
<th>Track Tube Sizes</th>
<th>Size</th>
<th>Made Of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big</td>
<td>12 ½&quot; x 4 ½&quot; x 3 ¾”</td>
<td>Big is made out of plastic rain gutter.</td>
</tr>
<tr>
<td>Small</td>
<td>12 ¼” x 2 ½” x 2 ½”</td>
<td>Small is made out of plastic down spout.</td>
</tr>
</tbody>
</table>
Materials to make Track Tubes:
- Plexiglas
- White contact paper
- CPVC Pipe
- Peanut Butter
- Velcro
- Hot glue gun, and glue
- Newspaper
- Non-Reflective Sight Black
- Double-sided sticky tape
- Heavy duty tape

Area Designation
- Study area to set track tubes
- Measurement of Area
- Figure out how many track tube rows are going to be used in one area.
- How many track tubes to set out in each row, and when to pick them up.
- Measuring wheel or tape measure or known paces
- GPS
- Fieldbook and pen

Analysis
- Tweezers
- Overhead Acetate Sheets
- Scanner
- Computer Graphic Program Ex.) Adobe photo shop, Paint shop pro
- Scion Image  [www.scion.com](http://www.scion.com)

Far right picture is of the GPS. (Global Positioning System)
Picture to the Right of GPS is the Measure Wheel.
Picture on bottom Left is the Adobe Scanning screen.
Bottom right is Scion Image, where the analyzing takes place.
Planning

To successfully enact this experiment, there is a bit of planning involved before you can begin. You need to make many decisions as to how you are going to go about it. First of all, you should decide where to place your experiment. Choose an area where you believe you will find some small mammal activity. You have to decide how large of an effort you wish to put forth. Divide your area into a grid depending on the amount of track tubes you wish to make, nights you want to leave them out, and how far apart you wish to space them. Plan how many nights you wish to leave them out, and if you’re going to take note of temperature, weather and vegetation differences. “The change in animals' response is significant only over several weeks - for example, over 4 weeks, animals increase in their likelihood to enter tracking tubes by about 50%, whereas over one day, animals increase in their likelihood to enter tracking tubes by about 5%” (Nams and Gillis, 2002). You need a basic overview of what you are going to do before you start.

Building the Track Tubes

When building these unique track tubes, you can be as creative as you want or make them as simple as can be. You first need to gather your materials (you can find the material list in the section materials) then you are going to want to either form an assembly line with a few people, or just do it all at once.
Directions for the big track tubes;
1.) You will need to have your plastic rain gutter, then cut it in half. 12 ½” x 4 ½”
2.) Take your heavy duty clear tape and wrap it around your rain gutter so they are firmly attached.
3.) Once you are done with that, you will need to cut your plexi glass, cut them into 12 ¼” x 4 ¼” pieces. Or to your standards.
4.) Cut your CVCP pipe in half and about 2 inches long. Or to fit your standards.
5.) Glue the CVCP pipe in the middle of the plexi glass, it doesn’t have to be exact.
6.) Now take your Velcro, and cut it to small pieces, about the size of a quarter. You will need 4 for each track tube.
7.) Glue your Velcro to the ends of the plexi glass with the fuzzy side down, so it will attach to the other piece. Then take the track tube and glue the sticky side up, in line of the other Velcro so that they attach one each other.

Directions for the small track tubes.
This is pretty much as the same the big tube;
1.) Take your down-spout, and cut it to 12 ¼” x 2 ½” You should only have to worry about the length, it should already be at height.
2.) Then repeat all steps as above, except that you will need to cut the plexi glass to 12” x 2 ¼”

Cutting the contact paper:
- You will need to cut the big track tube contact paper to, 4”x 3” or to fit on the track tube so that there is about a 2 inch space between the contact paper and the edge, where the non-reflective spray will go.
- For the little tubes you will need to cut it to 4”x 2 ½” so there is about a 2 inch space for the black spray.
Setting the Track Tubes

After you have your tubes built, and you have a plan of where you are going to place them, you can prep them for placement. Remove the tray from the tube. Use the double-sided tape to stick a sheet of contact paper, sticky-side up, to each end of the tray, between the food trough and the sprayed ends. Try not to get fingerprints or other marks on the paper. Fill the food trough with peanut butter, or whatever it is you are using for bait. Reattach the tray inside the tube via the velcro. Repeat this process with all the track tubes you intend to put out.

Positioning the track tubes in the study area

When putting out the track tubes, you will need to already have a plan on what and where you are going to be putting them. You will need to take out a measuring wheel, and your GPS. Choose how far apart you are going to place them. (10-15 meters should be considered) Before placing the tubes clear the area of any grasses sticks etc. Your tube should be placed on ground level, so easy access of the small mammals is prime. This will help your results. Every so many meters (Depending on what you have chosen) repeat that process for every track tube.
Retrieving the Track Tubes

When your required time is up, go outside and gather your track tubes, you may need to use the GPS with the recorded way-points. After you have brought in the tubes, carefully take the plexi glass out of the tubes. (Using a tweezers maybe your best option) With a twisting motion, the plexi glass should come out easy. Once you have the plexi glass dissembled, carefully peel the contact paper off of the plexi glass. You NEED to be careful it will rip or stretch, and alter your results. After you have gotten the contact paper off of the plexi glass you will need to stick it to clear transparent sheets. You will place the “track” side down, resulting in it sticking to the transparent sheets.

Track Tube Image Analysis

Materials

PC
Scanner

Software:
Paint Shop Pro (or other high quality image/paint program, Adobe Photoshop, etc..)
Scion Image (image analysis program, freeware) http://www.scioncorp.com/
*You will need to download Scion Image and install it on your computer*

Contact Paper Track Tube Results
Clear Overhead Acetate Sheets

Basic Procedure for Track Analysis and Counting

Prep of the contact paper

1. Carefully remove contact paper track results from the plastic backing.
2. Press the contact paper results onto the clear overhead acetate as smoothly as possible. Be careful to remove or avoid wrinkles, bubbles, and scratches so the images of the track marks are as clear as possible.
3. Cut the individual results (from each tube) out of the overhead paper and apply them to a clear sheet of printer paper, label the results with date, location, time, habitat, and any other information needed.

**Scanning**

4. Scan the image into the paint program. *If you are using Paint Shop Pro and the Augusta Science Scanning Station follow these directions. Other scanners will require different methods. However use at least 1200dpi for your scans.*
   a. Open Paint Shop Pro
   b. File - Import - TWAIN – Acquire
   c. The HP Scanning window will pop up.
   d. Choose Picture
   e. Preview Scan
   f. Use the outline tool to select the area of the image you want to scan
   g. Click the little compass button to increase the quality of the scan
   h. Click Options, choose “Black and White Photograph”
   i. Click on Printer Icon on the options window and choose 1200 dpi
   j. Click OK
   k. You are now back to the scan window, click Accept
   l. It will scan the image into Paint Shop Pro
   m. Save the image in Paint Shop Pro as a TIFF file image.
   n. Choose “Save As” and pick the tif image file type.
   o. Name the image with a name that corresponds to your data labels.
   p. Make sure you check the file save options and choose “uncompressed tif” otherwise the scion image program won’t open it.
   q. After you have saved the image you will want to cut the tracks and the writing out of the image.
   r. Make sure you are keeping file names in a data table in your notebook so you know what file is what tube on what day, etc…

**Cleaning the Image**

s. Choose the freehand tool from the tool bar in Paint Shop Pro and outline the area of the image with the tracks on it.
   t. Edit – Copy
   u. Edit – Paste – As New Image
   v. File – Save As – Save this new image as you did before, change the file name by adding an “a” to it so you know it is the cut version for analysis.
   w. Close Paint Shop Pro

**Analyzing the Image for Track Counts**

x. Open Scion Image
   y. Open the cut file for analysis
   z. Options --- Threshold (this picks out the tracks and makes it a black and white image.)
   aa. Process -- Rank Filters – have the Median Button Clicked – put the number 5 in the Iterations box, click OK. (this will remove all the small marks that are not tracks.
   bb. Analyze --- Analyze particles – choose the minimum particle size as 50, check the label particles and reset measurement counter boxes, click OK.
cc. Analyze – Show Results --- This will give you a count of all the marks on the track paper that are larger than 50 pixels. (tracks have been analyzed and 50 pixels is a good cut off for small mammal tracks in this method)
dd. If you want to visualize the tracks better do the following and play around with the image analysis and manipulation tools.
e. File – Revert To Saved
ff. Process – Shadow -- play around with the directions for shadowing. NW or NE seem to work fairly well.
gg. Process – Rank Filters, reset the box to 1 and filter the image as many times as you need to get the tracks to stand out better and the noise to disappear.
hh. Now use the “hand” from the tool bar to move around the image and look for anatomical features in the tracks.

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</tr>
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</table>

Table 1: Row describes which transect of the field it is. The letter in tube number column describes whether the tube is big or small and the number in this column is to keep track of the different big or small tubes. Waypoint is a number generated by the GPS in the order that the tubes went out. Percentage is the percentage of the paper in the tube covered with the animal’s prints. Date out is the day that the tubes were set out.
Track Tube Locations and Small Mammal Activity

After retrieving the tube from the field and determining which tubes had tracks, track records were scanned and the program Scion Image was used to calculate the percentage of the track record covered with small mammal tracks. After doing this the results were entered into ArcView GIS creating Figure 1. Upon examining the map three major activity zones became apparent in our initial research. Further examination of these three zones may be a topic of future research, to determine what factors caused these areas within the field to be preferred. We believe the vegetation depth, nest habitat availability, food availability and territoriality may play a role in the distribution of the small mammals in the old field. These of course will require more investigation.
Appendix 1.

Small Mammals Expected During Our Survey

**Prairie Deer Mouse**
*Peromyscus maniculatus*

**Habitat:** Open places.
**Diet:** Seeds, grains, and fruits.
**Range:** Southern two-thirds of Wisconsin.
**Physical Description:** Cinnamon colored with dark band down back. The underparts are cream colored.
**Breeding Info:** Three or four litters a year. Two to nine young to a litter.
**Predators:** Owls, skunks, weasels, raccoons, foxes, and coyotes.
**Population Info:** Ten mice per acre.
**Tracks:**

![Prairie Deer Mouse Tracks](image1)

**Northern White-footed Mouse**
*Peromyscus leucopus*

**Habitat:** Woodlands, forests, and densely brushy areas.
**Diet:** Seeds of grasses, fruits, and weeds. Nuts are also eaten.
**Range:** Southern three-fourths of Wisconsin.
**Physical Description:** Cinnamon colored with dusky brown down the back.

**Breeding Info:** One to seven young in a litter.

**Predators:** Owls, weasels, skunks, and foxes.

**Population Info:** Three to four adults per acre.

**Tracks:**

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**Woodland Deer Mouse**
Peromyscus maniculatus

**Habitat:** Forests, old cabins, and abandoned lumber mills.

**Diet:** Seeds, nuts, and insects.

**Range:** Northern part of Wisconsin.

**Physical Description:** Cinnamon colored, underparts are white.

**Breeding Info:** Four or five litters a year. Four or five young to a litter.

**Predators:** Hawks and owls.

**Population Info:** Five to six individuals per acre.

**Tracks:**
Meadow Jumping Mouse
Zapus hudsonius

**Habitat:** Moist grassland  
**Diet:** Seeds, berries, fruit and insects.  
**Range:** All of Wisconsin.  
**Physical Description:** Brown band on back with sides of yellowish brown and white underparts.  
**Breeding Info:** Two to three litters a year with two to nine young.  
**Predators:** Weasels, foxes, the mink, owls, and the domestic cat.  
**Population Info:** Up to 10 per acre.

Tracks:

Woodland Jumping Mouse
Napeozapus insignis

**Habitat:** Wooded areas.  
**Diet:** Insects, seeds, fungi, nuts and fruits.  
**Range:** Northern part of the state.  
**Physical Description:** Brown to black on back, orange on sides, white on belly.  
**Breeding Info:** One to two litters a year with 2-7 young.  
**Predators:** Weasels, foxes, skunks, owls, domestic cats, and hawks.  
**Population Info:** One per acre.  
**Tracks:**
Long Tailed Weasel
Mustela frenata

**Habitat:** Forested, brushy and open areas.
**Diet:** Mice, rats, shrews, voles and poultry.
**Range:** All of Wisconsin.
**Physical Description:** Brown coat on top, with white to yellow on the bottom.
**Breeding Info:** One litter of four to nine young is born a year.
**Predators:** Owls and hawks.
**Population Info:** One individual every 30-40 acres.

Tracks:
Short Tailed Weasel
Mustela erminea

**Habitat:** Open woodlands, brushy areas, grasslands, and wetlands.
**Diet:** Mice, shrews, baby rabbits, birds and frogs.
**Range:** Throughout the state.
**Physical Description:** Brown above, white below. Tail is brown with a black tip.
**Breeding Info:** One litter per year with 4 to 9 young.
**Predators:** Owls, hawks and humans.
**Population Info:** One adult every 30-40 acres.

Tracks:

Cinereous Shrew
Sorex cinereous

**Habitat:** Moist woodlands with abundant plant life.
**Diet:** Invertebrates, caterpillars, beetles and grubs.
**Range:** Statewide.
**Physical Description:** Mostly brown and gray.
**Breeding Info:** Litters of 2-10 young.
**Predators:** Fox, coyote, weasel, snakes, owls and other shrews.
**Population Info:** Three to four to an acre.
Tracks:

Arctic Shrew
Sorex arcticus

**Habitat:** Moist areas.
**Diet:** Sawfly larvae, and grasshoppers, will also eat dead shrews.
**Range:** All of Wisconsin except driftless area.
**Physical Description:** Black or dark brown on head, light brown on sides, and a grayish brown belly.
**Breeding Info:** Litters of 5-9 young.
**Predators:** Owls.
**Population Info:** 8-10 to an acre in favorable habitat.
**Tracks:**
Red-Backed Vole
Clethrionomys gapperi

**Habitat:** Woodland and forests, including both conifer and deciduous. Most prefer moist ground, with mossy logs and matted grass.

**Diet:** Mostly vegetable matter. They eat hazel nuts and beechnuts; hemlock, spruce and maple seeds; the fruit or seeds of pin cherry, shadbush, black alder, silky dogwood, mountain ash, blueberry, partridge berry and clintbush.

**Range:** Northern, Central and Eastern parts of Wisconsin.

**Physical Description:** It has a large head, ears long enough to appear above the fur, small eyes and a skinny tail which is typically 32 to 42 mm in length. Adults body length is usually 134to 150mm(4.5-6in), and they usually weigh 22 to 36 grams. They have a stripe of chestnut from the upper parts of their forehead to the base of their tail. The nose and side of the body is grayish, and the underside is usually whiter.

**Breeding Info:** They may mate as early as March in WI, but most is done in April. They may raise three or four litters between then and October. Litters are composed of 3 to 8 babies, but field observations indicate that it is most common to have 5 or 6 young.

**Predators:** hawks, owls, weasels, foxes, skunk and house cats.

**Population info:** the ranges of 15 adult males in 600 to 1000 square yards, and adult females in 500 to 600 square yards.

**Tracks:**
Meadow Vole
Microtus pennsylvanicus

**Habitat:** Mostly lowland fields and meadows, along grassy marshes, rivers and lakes. They will occupy orchards and wooded areas if the ground is grassy enough.

**Diet:** It eats fresh grass, sedges and other herbage. It also eats a variety of grains and seeds. From May to August most of its diet is green and succulent vegetation. In autumn it will frequently enters shocks of corn or other grains standing in fields and eats both the foliage and the grain seeds.

**Range:** All of WI in suitable habitat.

**Physical Description:** Moderately large mouse with small ears concealed in heavy fur. Medium tail, 42-56mm long. Upper parts dull chestnut brown to yellow chestnut, underparts dusky gray with tinges of cinnamon, tail dusky brown. Adults are 160-188mm (6.3-7.4in) and weigh 36-56 grams.

**Breeding Info:** Breed throughout the year with main breeding done March to November. 2-9 babies in litter, with most common being 6 or 7. First mating can occur when the female is only 25 days old, or half grown and the male is 45 days.

**Predators:** Hawks, Owls, shrikes, gulls, herons, weasels, minks, striped skunk, badger, red and gray foxes, coyote, mole shrews, house cat and dogs, and snakes.
**Population Info:** A rough estimation of 75 million meadow voles in the state.

**Track:**

Hindprint 5/8" (16 mm) long,
Foreprint 1/2" (13 mm) long.

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**Prairie Vole**  
*Microtus ochrogaster*

**Habitat:** Dry and growing grassy areas along fence lines and in open fields; sandy prairies and slopes, especially if weeds or grass is growing there. They also like abandoned farm fields or poorly cultivated fields.  
**Diet:** It primarily eats stems of grass and herbaceous rootlets. It also eats some tubers, small fruits, and sometimes bark of trees and shrubs.  
**Range:** Southern and Southwestern parts of WI.  
**Physical Description:** They are brownish on top and cinnamon underneath. Adults are typically 136-160mm (5.3-6.3 in) and weigh 32-50 grams.  
**Breeding Info:** Most of the breeding done in July, August and September. 2-6 young in each litter, most commonly 3-4. They are sexually mature by the age of about 30 days.
Predators: Hawks, owls, rarely by weasel, coyote, red and gray foxes, striped skunk and house cats.
Population Info: Less abundant than the meadow vole.
Track: N/A

House Mouse:
*Mus musculus*

Habitat: Common in buildings and areas with good ground cover. They stay away from a common natural environment. They can also commonly be found in cultivated fields.
Diet: The house mouse mostly feeds on grain, fruit and vegetables and stored food.
Range: Throughout Wisconsin.
Breeding Info: The house mouse matures fast in about 35 days after birth and have several 21 gestation periods per year, producing 4-7 offspring each time.
Predators: Owls, hawks, snakes, cats, foxes and weasels.
Population Info: N/A
Physical Description: Hairless tail that is about half the body length which is about 5 1/8 to 7 3/4 inches. Grayish brown above, nearly as dark below. Like most small mammals prefers the night.
Track:
**Norway Rat**  
*Rattus norvigicus*

**Habitat:** Farms, cities, and a lot of human dwellings, in summer cultivated fields.  
**Diet:** Considered an omnivore eating anything a human would eat, also, garbage, green plants and fruit and vegetables.  
**Range:** Throughout Wisconsin  
**Physical Description:** Scaly tail less than half of the length, 12 3/8 to 18 1/8 inches, Brownish Grey above. Also known as common rat, sewer rat, house rat, and brown rat.  
**Breeding Info:** Breeds year round sometimes mates within hours of giving birth, gestation 21-26 days, could bear up to 12 litters per year containing 2-22 per litter. Young born hairless and blind opening eyes in two weeks.  
**Predators:** Snakes, hawks owls, mink, weasels, cats and fox.  
**Population Info:** N/A

**Giant Mole Shrew (Short Tailed Shrew)**  
*Blarina brevicauda*

**Habitat:** Populations are most dense in damp brushy woodlands, bushy bogs and marshes, and weedy and bushy borders of fields.  
**Diet:** Consists mainly of invertebrates and plant material. It sometimes preys upon animals much larger than itself, including salamanders, frogs, snakes, mice, birds, and other shrews.  
**Range:** All of Wisconsin  
**Physical Description:** Head and body length is 75-105 mm, tail length is 17-30 mm. Their color is almost uniformly slate gray, with the underparts being only slightly paler.  
**Breeding Info:** Females may have up to 3 litters per year, although 2 is more common. Litter size can be 3-10, with 5-7 young being the average.  
**Predators:** Foxes, hawks, snakes and weasels.  
**Population Info:** N/A
**Tracks:** Small, usually less than 1/2" (12 mm) long. Complete tracks seldom encountered

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**Least Shrew**  
*Cryptotis parva*

**Habitat:** Prefers grassy, weedy or brushy fields.  
**Diet:** Insects and other invertebrates.  
**Range:** Southwestern part of Wisconsin.  
**Physical Description:** The total length is 67-103 mm. The upper fur is brown to black and the underside is white.  
**Breeding Info:** Breeding season is from March to November. Litter size is 3-6 young.  
**Predators:** Hawks, foxes, snakes.  
**Population Info:** N/A  
**Track:**  
Small, usually less than 1/2" (12 mm) long. Complete tracks seldom encountered
**Pygmy Shrew**  
*Sorex hoyi*

**Habitat:** Coniferous and deciduous forests, swamps, grassy clearings, bogs and floodplains.  
**Diet:** eat insects and other invertebrates including ants, flies, spiders, earthworms, beetles, grubs, and caterpillars.  
**Range:** Northern half of Wisconsin.  
**Physical Description:** Approximately 80-91mm in total length. They have a narrow head, pointed nose, and obvious whiskers. The eyes are hidden, being covered by short, soft fur. Fur is gray with underparts being lighter.  
**Breeding Info:** The mating season is from June through August. They have 3-8 young per litter.  
**Predators:** Weasels, hawks, foxes, snakes, other shrews.  
**Population Info:** .21 shrews per acre.  
**Tracks:** N/A

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**References:**


Jackson, Hartley H. T., Mammals of Wisconsin, Univ of Wisconsin Pr; (December 1961)
