Seth Zesiger
Statistics
Project

Deer Use of Habitat

Introduction:

The whitetail deer is the most abundant big game animal in North America and management of the population is therefore a major focus of wildlife management efforts. In fact many people, especially in Wisconsin, come into contact with the whitetail on a regular basis, from vehicle-deer collisions to crop damage. Due to the whitetail deer's abundance, frequent contact with the human population, and role as a major source of sporting goods revenue (through the sale of licenses and hunting apparel), it is useful to have a basic knowledge of the species.

A part of this knowledge would include being aware the habitats that a deer uses and what types of habitat that a whitetail prefers (this information would be especially useful if you are an avid hunter, whitetail enthusiast, or game biologist). With this in mind, I have decided to research this aspect of whitetail deer behavior, particularly seeking to answer the question "Do deer use the habitats (the variable) on land that can be rifle hunted by the Zesiger hunting group in proportion to their availability (in this case, an individual would be a deer observed on land that can be hunted by the Zesiger hunting group and the population would be all deer on land that can be rifle hunted by the Zesiger hunting group)?"

The habitats that deer could use were assigned to four levels: open timber (OpT; mature hardwoods), thickets (Thic; poplar slashings, tag alders), open timber adjacent to cropland (OpTC), and thickets adjacent to croplands (ThicC). In order to calculate the proportion of each level of habitat that was available for the deer, it was necessary to find the total acres of land hunted by the group during the 2007 season. This was done by first using a plat book to research and sum the total acres of land owned by the Zesigers, land that the group had permission to hunt, timber company land/public land, and Managed Forest Land (only land that was hunted during the 2007 season was included). Next, land that did not fit into the levels (or was not hunted on), such as actual cropland or areas with buildings, was excluded and the remaining land was then assigned as one of the four categories, this done using the group's extensive knowledge of the pertinent regions from activities such as past hunting, scouting and trapping excursions, logging operations, tree tapping, etc. These calculations resulted in 1,240 acres of open timber, 400 acres of thicket, 300 acres of open timber adjacent to cropland, and 160 acres of thicket adjacent to cropland. These figures were then converted to proportions for use in an 11-step

hypothesis test, which resulted in 0.59 (59%) open timber, 0.19 (19%) thicket, 0.14 (14%) open timber adjacent to cropland, and 0.08 (8%) thicket adjacent to cropland.

With this data in mind, I expected that we would find that deer would favor thickets adjacent to cropland over any of the others, due to the abundance of cover (the importance of which would increase as awareness of hunting pressure increased) and close proximity to food sources. I then speculated that the deer would use open timber adjacent to cropland and thickets in nearly equal proportions, with use of the open timber adjacent to cropland perhaps slightly greater (my line of reasoning being that deer can take advantage of the terrain and wind within the open timber adjacent to cropland to ensure relative security and still be located close to a food source, while the thicket would provide maximum security but sacrifice proximity to a favored food source). This left open timber, which I expected would be lowest in deer use due to the disadvantages it had in security, cover, and distance from favored food sources (cropland).

As an avid hunter and outdoorsman myself, I naturally found this topic to be interesting, and as our hunting group practices Quality Deer Management (QDM), I also believed that this information could be of some value in helping us hone our management practices. These results could also be of importance to the public at large because it could aid other hunters in choosing more successful hunting grounds, inform vehicle drivers as to where to be especially on guard in order to avoid a collision with a deer, and could also aid in the formation of more productive and successful wildlife management techniques for other hunters or the government (Department of Natural Resources).

Methods:

In order to conduct this study, I took advantage of the November 2007 9-day rifle season in Sawyer County, Deer Management Units 13 and 18, and used a common hunting technique known as a "deer drive" to collect data. A deer drive is initiated by designating some members of the hunting group as "drivers" and others as "standers." Prior to the drive, the drivers evenly space themselves along the edge of the parcel of forest about to be driven. Next, they proceed into the woods simultaneously upon receiving a prearranged signal, and by traveling their assigned routes at approximately the same speed, attempt to flush deer out and ahead of them in order to run them past previously positioned standers. After a drive has ended, it is typical for the group to discuss how many deer where "jumped" and where they were seen

at. I recorded this information from the drivers, writing down how many deer each driver observed and in what type of habitat they initially "jumped" them in (type of habitat was a relative observation based upon the judgment of the driver; deer that were assumed to have been observed by more than one driver during a drive were only recorded once; however, observing the same deer on different days or on different drives was not an object of concern (as long as it was just by one driver), due to the fact that I was only attempting to observe habitat use and not a feature for which it would have been undesirable to have recorded the same individual more than once). This information was recorded from the drivers and not the standers due to the fact that the drivers were the ones getting the deer up from the habitat that they were naturally in, whereas the standers would be observing the deer in habitat that they would not have been in at that particular moment had they not been getting flushed out by human presence.

It should be observed that as the deer noticed the onset of the hunting season, it is highly likely that their patterns and habitat uses changed from what it naturally would have been. Therefore, the results may not reflect deer habitat use in a natural, undisturbed state, but rather deer habitat use during a time of increased pressure and human "predation." Note should also be taken of the fact that no randomization was used in the selection of which drives to do and when to do them. Instead, this selection was a rather calculated process intended to maximize the likelihood of killing a "shooter" buck and was based upon wind direction and time of day (this was so because the main focus of the group was hunting and not the construction or performance of my study).

Results:

Part of the process of gaining insight into the results of this study involved performing a categorical univariate exploratory data analysis. According to the frequency table (**Table 1**), proportions table (**Table 2**), percentage table (**Table 3**), and supporting graphic (**Figure 1**), it appears that the majority of the deer observed were in open timber adjacent to cropland and open timber (the number observed in each was nearly equal).

Table 1. Frequency table of the number of deer observed in open timber, thickets, open timber adjacent to cropland, and thickets adjacent to cropland, Sawyer County, Deer Management Units 13 and 18, November 2007.

OpT	Thic	OpTC	ThicC
148	62	156	129

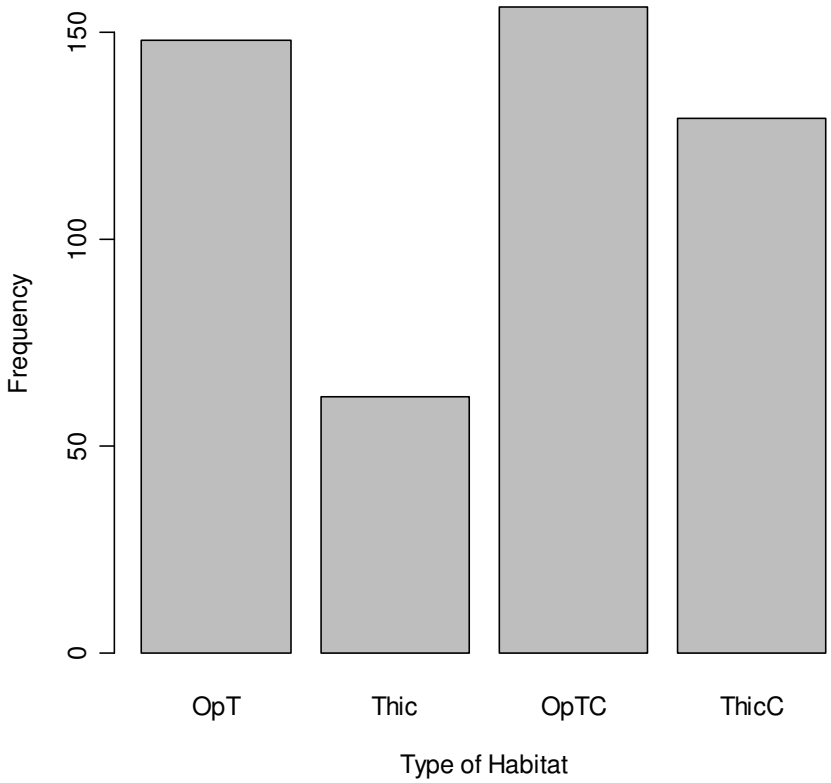

Figure 1. Bar chart of the frequency of deer observed in open timber, thickets, open timber adjacent to cropland, and thickets adjacent to cropland, Sawyer County, Deer Management Units 13 and 18, November, 2007.

Table 2. Proportions table of the number of deer observed in open timber, thickets, open timber adjacent to cropland, and thickets adjacent to cropland, Sawyer County, Deer Management Units 13 and 18, November 2007.

OpT	Thic	OpTC	ThicC
0.2989899	0.1252525	0.3151515	0.2606061

Table 3. Percentage table of the number of deer observed in open timber, thickets, open timber adjacent to cropland, and thickets adjacent to cropland, Sawyer County, Deer Management Units 13 and 18, November 2007.

OpT	Thic	OpTC	ThicC
29.89899	12.52525	31.51515	26.06061

The second stage of analyzing the study data was the completion of an 11-step hypothesis test:

1. A categorical variable with four levels from a single population was recorded. Thus, a goodness-of-fit test is required.
2. The null hypothesis is H_O: "Deer use the habitat in proportion to its availability" and the alternative hypothesis is H_A: "Deer do not use the habitat in proportion to its availability."
3. The rejection criterion is $\alpha = 0.05$.
4. The study is observational with no randomization.
5. The value in each cell of the expected frequency table is greater than 5. Thus, the test statistic computed should reasonably follow a χ^2-distribution.

	OpT	Thic	OpTC	ThicC	Total
Deer	292.05	94.05	69.3	39.6	495

6. The appropriate statistic is shown as the table of observed frequencies:

	OpT	Thic	OpTC	ThicC	Total
Deer	148	62	156	129	495

7. The appropriate test statistic is $\chi 2 = 392.2688$ with 3 degrees of freedom (**Table 4**)
8. The p-value is p-value < 2.2e-16 (**Table 4**).
9. Reject the null hypothesis because the p-value is less than α.
10. It appears that whitetail deer do not use the habitat in proportion to its availability.

Discussion:

To reiterate, it appears from step 10 of the goodness-of-fit test that whitetail deer on land that can be rifle hunted by the Zesiger hunting group do not use the habitat in proportion to its availability. Specifically, it appears that the deer used thickets adjacent to cropland and open timber adjacent to cropland much more than was expected with respect to their availability (**Table 5**). It also appears that the open timber was used significantly less than expected while thickets were used only slightly less than expected (comparatively), again with respect to their availability (**Table 5**). This data appears to support my pre-experimental reasoning that the

thickets adjacent to cropland would be the most heavily used. However, whereas I had thought that deer use of open timber adjacent to cropland and thickets would be nearly equal (perhaps slightly higher for open timber adjacent to cropland), it appears that the urge to feed outweighed the need for a greater degree of security by a larger margin than expected. As hypothesized, deer use of open timber was the lowest in proportion to its availability.

This information could be used in a variety of ways. For example, in a hunting situation, areas that appear to hold the most deer (thickets adjacent to cropland) could be designated as sanctuaries and allowed to fill up with deer for hunting later in the season or in order to allow a greater number of immature deer to survive the season. In terms of success, the results of this study would allow hunters to avoid areas that are less likely to produce (open timber) and focus their efforts on tracts of land where they will probably experience success.

To improve upon this study, future research should take place over a longer period of time (as well as during a period or in a location where hunting pressure is nonexistent and using less aggressive observation techniques if it is desirable to record this information when deer are in a natural, undisturbed state). An important improvement that could also be made would be to randomly select the location (in this case drive) and time at which to conduct observation. This could be done by assigning each parcel of land a number, writing these numbers on paper and placing them in a hat, mixing the paper up, and then drawing the paper (once a location had been drawn, it would be left out of the hat for the remainder of the day). Likewise, the times at which to conduct the drives could be written on paper and then a method similar to choosing what drive to do could be used in selecting a time. A third and final adjustment that could be made would be to divide the habitat into more levels, such as conifer stands, mixed timber, herbaceous plots, and perhaps even the cropland itself. Additions such as these would bring more description, precision, accuracy, and depth to the study, which would in turn boost its credibility.

Table 4. Output from a goodness-of-fit test in R that contains information for the answers cited in steps 7 and 8.

```
Chi-squared test for given probabilities

data:  deer.obs
X-squared = 392.2688, df = 3, p-value < 2.2e-16
```

Table 5. A residual table demonstrating how much and in what "direction" the values within each level differed from expectation.

```
    OpT      Thic      OpTC     ThicC
-8.429167 -3.304826 10.414837 14.206593
```

Sources:

Rockford Map Publishers. *1997 Sawyer County Plat Book*. Rockford, Illinois. Rockford Map Publishers, Inc. 1997.