Edge Effects on Microclimate, Nest Predation and Buckthorn Density at Clarkson University, St. Lawrence County NY

[author]

Introduction [topic defined, problem/question]

The change that one type of environment has on a bordering environment is called the edge effects of that area. Edge effects are of great interest to researchers because they can greatly influence the ecology in an area. Microclimate, vegetation, soil composition, and animal species found in that region are affected by the edge effects. However, often the exact impact that edge effects have on certain factors, such as temperature or predation, are unknown for different types of environments. The depth of the penetration of edge effects also differs based on areas. Some edge effects only influence the environment to about 10m, but others may go as far into the ecosystem as 1000m.

[scope, overview of method, hypotheses]

To study edge effects, an experiment was conducted in the forest bordering Clarkson University in St. Lawrence County, NY. The experiment focused on the influence of edge effects on microclimate (soil and air temperature, relative humidity, and wind speed), nest predation, and common Buckthorn plant density. Three transects were used, each penetrating 100m into the forest, to study the edge effects at different locations. Data for analysis was collected on two days in order to determine the effects of the edge on these factors and to determine just the severity of the effects. It was predicted that all of the factors would change, in some way, because of the edge effects. Soil and air temperature, as well as wind speed, would decrease the deeper into the forest the measurements were taken. It was also hypothesized that nest predation and Buckthorn density would be higher nearer the edge of the forest, compared to the data taken farther from the edge and deeper in the forest. Overall, it is predicted that edge effects have a significant impact on the surrounding environment.

Methods [Note the exact physical details and consistency of terms.]

Study Site

The experiment was set up in the forest bordering Clarkson University in Potsdam, New York. Three transects were created, 20m apart, extending from the edge to 100m into the forest. The site paralleled a road, with a trench between the road and the forest. The data were collected and observations were noted on September 9th, 2009 (Day 1) and September 23rd, 2009 (Day 2) at 8am. On September 9th, 2009, the weather was cloudy and cool. The weather on Day 2, September 23rd, 2009, was also overcast and cool.

Nest Predation

To study the nest predation, on Day 1, 15 clay eggs were constructed which were about the same size and shape as a quail egg. One clay egg and one real quail egg each were placed into each of 15 nests. The nests and the eggs were handled with gloves to minimize any transfer of human scent to them. The nests were placed at increments of -2m, 0m, 10m, 25m, and 50m on each of the transects. On Day 2 each nest was checked to determine whether it had been depredated: any

marks on the clay eggs, such as those from beaks or teeth. All marks were noted. All the eggs and nests were collected.

Invasive Species: Buckthorn Density
On Day 2, quadrants were laid out, 10m (parallel to the edge) x 5m (perpendicular to the edge) to measure the Buckthorn plant density. These quadrants were created on each transect at 0m, 10m, 25m, and 50m. All Buckthorn shrubs over 1m in height were counted in these areas. For the second set of data, the quadrant was marked out by 1 x 1m frame. At 0m, 10m, 25m, and 50m along each transect the number of Buckthorn saplings less than 1m in height found in the quadrant were counted and recorded.

Microclimate Observations – iButton

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Microclimate Observations - Kestrel

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Results

The recorded data and observations were graphed and charted. The following tables and figures present an overview of the results and analysis.

Nest Predation
Every egg recovered had animal markings on its surface. Most of the markings appeared to be scratches from claws or a beak digging at the egg's surface. Birds or small mammals were the most common predators disturbing the nests based on the markings.

Table 1 The percentage of nests that we depredated on each transect in relation to their distance from the edge (m)

Distance from the Edge (m)	Proportion Depredated
-2	100%
0	100%
10	66%
25	33%
50	33%

The data collected from the nests show a correlation between distance from the edge and the percentage of nests depredated. The nests closer to the edge, -2m and 0m, were always

depredated, whereas the nests deeper in the forest, 25m and 50m, were depredated on 33% of the time (Fig. 1).

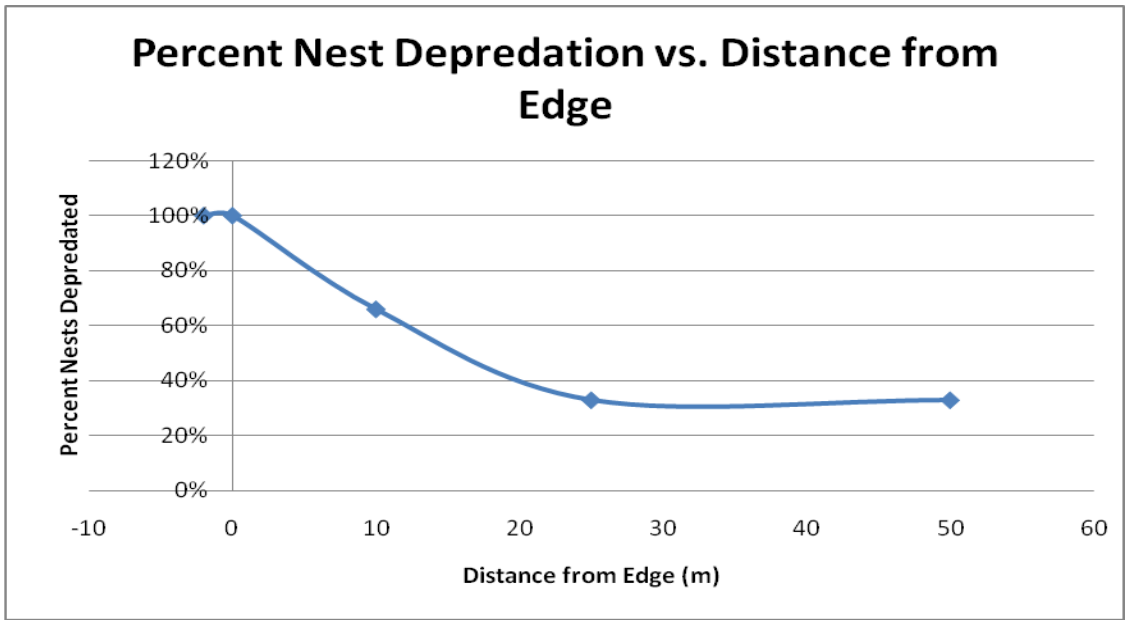

Fig. 1 The percentage of nests that were depredated in relation to the nest's distance from the edge (m).

Buckthorn Density

Table 2 gives the average number of shrubs and saplings observed in each of the quadrants.
Table 2 Mean number of Buckthorn plants observed and Standard deviation in relation to distance from the edge.

Distance from the Edge	Mean Number of shrubs (> 1 m)		Mean Number of saplings (< 1 m)	
	mean	SD	mean	SD
0	4.667	8.082	2.667	2.516
10	0.667	0.577	1	1
25	0	0	0	0
50	0	0	0	0

The data collected on Buckthorn density indicate edge effects related to the amount of Buckthorn present (Fig. 2). The effects penetrate about 10 meters. After 10 meters, no Buckthorn plants were observed, either saplings or bushes.

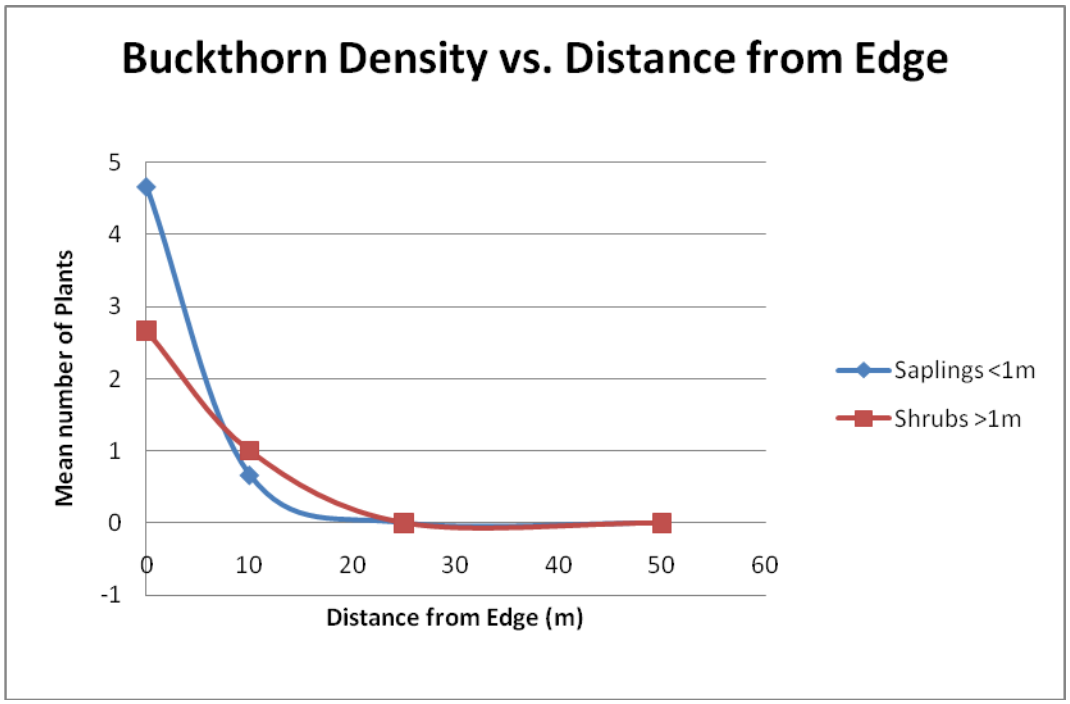

Fig. 2 Mean number of Buckthorn plants (both shrubs and saplings) observed in relation to the distance from the edge (m) on Day 2, 9/23/09

Discussion [Includes significant findings, sources of error]

The results show a direct correlation between the distance into the woods and temperature, both soil and air, Buckthorn plant density, and nest predation. The data support the prediction that these factors are influenced by edge effects. However, wind speed and relative humidity were not influenced by the distance from the edge. Therefore, it can be concluded that edge effects have no effect on either factor. From the data collected, it is clear that edge effects do manipulate some of the aspects of a patch.

Buckthorn density also shows a relation to the distance from the edge. The plants, both shrubs and saplings, were most common near the edge of the forest. All of the samples found were between 0 and 10m into the site; none were found beyond 10m (Fig. 5). In studies, Buckthorn has proved to be shade tolerant, but grows much faster when provided with adequate sunlight (Knight et al. 2007). More Buckthorn near the forest edge may result from its greater access to sunlight and thus faster growth than Buckthorn farther from the edge. Buckthorn saplings grow better in areas that are disturbed and in bare soil (Knight et al. 2007), but the forest in this study is undisturbed and has leaf litter on the ground, which may make it difficult for saplings to germinate.

Nest predation also showed a relationship with the distance the nest was placed in the forest and the percent of nests depredated. The nests that were closest to the edge of the forest, from -2 to 0m, were 100% depredated, whereas the nests farther in, about 25-50m, were only depredated 33% of the time (Fig. 6). This trend could be due to the fact that there are more people and

animals, such as dogs, present at the outer edge of the forest compared to the deeper sections. Also, the nests nearer to the edge were more exposed, while some of the deeper nests may have had better cover, such as being placed under a shrub or bush. Studies have shown that it is a possibility that shrubs and other forms of protection for nests may deter predators from trying to get at the nests (Schmidt et al. 1999). This could be a similar situation with the nests placed in the forest: those that were deeper in had more cover from objects such as bushes, fallen branches, or logs.

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There are also some possible sources of error within this experiment. For the nest predation data, the nests were placed in the woods adjacent to Clarkson University, where many people pass by daily. It is possible that some of the nests, particularly the ones at -2m and 0m from the edge, were disturbed by people, which could explain why some nests were not found and would affect the percent of nests depredated. . . . Also, during the observations for Buckthorn density, it is possible that Buckthorn plants were wrongly identified or overlooked, leading to unreliable data. Despite those sources of error, our data is consistent and reliable.

Conclusion **[Findings are recapped and future research. This author focuses only on future work.]**
Further research should be conducted on the impact of edge effects on a ecosystem. Since our data concluded that certain factors are influenced by the distance from an edge into the forest, such as soil and air temperature and nest predation, it is important to see just how they affect the ecosystem and organisms that live in these areas. Are there certain adaptations necessary for organisms to live in these areas? Buckthorn density was also affected by the plant's distance from the edge, so a question could be raised whether edge effects limit where certain species of plants can grow. Edge effects may also differ among types of habitats. For example, we studied a forest bordered by a road. Would a forest bordered by a field, or by a swamp? Overall, there is much more that can be looked at when studying the impacts that this occurrence has on the surrounding environments and ecosystems.

References

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