Abstract

Many woody plant species rely on animals for seed dispersal, and in Maine forests, small mammals are the most important dispersers for several plant species. Small mammals act simultaneously as seed predators and dispersers, having both positive and negative effects on the regeneration of many tree species of important economic value for Maine. Therefore, understanding small mammal patterns of seed dispersal and consumption is crucial for predicting forest regeneration patterns and informing forest managers, with important economic ramifications. However, seed consumption and dispersal spatial patterns depend on small mammal distribution and space use. Accordingly, in order to understand the effects of small mammal populations on recruitment patterns of important tree species, we must understand their habitat use patterns.

The spatial distribution of prey animals is shaped by a 'landscape of fear' (1), or the spatial and temporal variation in predation risk that occurs across the home ranges of prey. A landscape of fear is determined by the predators that are present and the habitat features of the landscape. Habitat structure mediates the effectiveness of predators and can create areas of safety, making habitat an important determinant of risk. The abundance and diversity of the predator community also shape predation risk. Increasing predator presence alters prey foraging behavior, activity levels, and vigilance, but prey respond differently to different predators, making the composition of predator species important (2). Small mammals are under high predation pressure from a variety of terrestrial and avian predators and operate in heterogeneous landscapes with varying levels of refuge. Therefore, small mammals live in a landscape of fear determined by the predator community and microhabitat features of their home ranges. Mapping

this landscape of fear will give us insight into small mammal space use and therefore seed predation and dispersal and spatial regeneration patterns of many important tree species.

I will contribute to our understanding of small mammal habitat use by assessing microhabitat features and predator presence within six small mammal trapping grids to determine how these factors affect their distribution. Owls are a main predator of small mammals, and I will use acoustic devices recording from sunset to sunrise every night from March through October to monitor their presence. To analyze these recordings, I need to use Wildlife Acoustics' Kaleidoscope Pro software, which has the ability to comb through the recordings and cluster similar vocalizations. This software would allow me to identify vocalizations from each cluster to determine if it is an owl, count the number of vocalizations, and check when they occurred to assess owl presence. This data processing, and therefore owl monitoring, would be impossible without the software. Therefore, I am requesting a grant to cover the cost of this software and the micro SD cards needed for the acoustic devices. Additionally, I will use camera traps to monitor the terrestrial predator community and their distribution in my study area. I already have some cameras, but I need more than what is available. Therefore, I am requesting additional grant money to go toward the cost of two cameras

References:

1. Laundre, J. W., Hernandez, L. ;, & Altendorf, K. B. (2001). Wolves, elk, and bison: Reestablishing the "landscape of fear" in Yellowstone National Park, U.S.A. In *Canadian Journal of Zoology* (Vol. 79, Issue 8).

2. Eccard, J. A., Pusenius, J., Sundell, J., Halle, S., & Ylönen, H. (2008). Foraging patterns of voles at heterogeneous avian and uniform mustelid predation risk. *Oecologia, 157*(4). https://doi.org/10.1007/s00442-008-1100-4

Itemized Budget

Item #	Description of Item	Source (Company)	Quantity	Individual Cost	Total Cost (Quantity x Ind. Cost)	Amount Requested
1	Song Meter Micro Acoustic Devices	Wildlife Acoustics	6	$249	$1,494	$0
2	Kaleidoscope Pro Software*	Wildlife Acoustics	1	$399	$399	$399
3	128 GB Micro SD Card	SanDisk	3 (3 packs of 2 for a total of 6)	$15.25 (2-pack for $30.50)*	$93	$93
	128 GB Micro SD Card	Samsung	6	$24.99	$149.94	
	128 GB Micro SD Card	Gigastone	6	$18.98	$113.88	
4	Cameras*	Bushnell	96	$199.99	$19,199.04	$358
Total:					$21,185.04	$850.00

* Additional quotes for the software are not given because this is the exact software that is needed to run the analysis for my project. Also, no additional quotes for the cameras are given because I must keep all of the cameras I deploy consistent and therefore must buy the exact camera which my advisor already has some of. Lastly, no additional quotes are given for the Song Meter Micros because they have already been purchased with other grant money.

Budget Explanation

The Kaleidoscope Pro software will make owl monitoring possible. Owls are significant predators of small mammals, and without monitoring their presence, my project would be missing a vital piece of information. Kaleidoscope Pro would make it possible to analyze the acoustic data and determine when and where owls were present. These devices also require micro SD cards for storing data, and due to the amount of data collected every night, they need a

large capacity. Therefore, the 128GB micro SD cards are vital for this piece of the project and I have found the cheapest option on Amazon. Lastly, trail cameras are necessary for monitoring terrestrial predators of small mammals. My advisor currently has some Bushnell Trophy Cam HD cameras which I will be using. In order for my data collection quality and methods to remain consistent, I need to purchase the exact same model to use with the ones we already have. At $200 each, I will use $358 dollars of the grant money to go towards the purchase of two more cameras. The cameras, as well as the Kaleidoscope Pro software, will facilitate further research related to predator monitoring after my project. Additional funding sources are being explored, such as the Sigma Xi Grants in Aid of Research and the Wildlife Acoustics grant program.