Microhabitat Selection by Small Mammals

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Abstract: Habitat selection is the process by which individuals choose among available habitat patches. Habitat availability" as how accessible and procurable physical and biological components of a habitat are to animals. Research on small mammal habitat use helps to broaden their knowledge. Small mammals are often used as an indicator species group to reflect some aspects of "integrity. Small mammal abundances are affected by both macro- and micro- habitat structures. Studies on patterns of habitat use by mammals are important for understanding the mechanisms involved in their distribution and abundance. This paper provides a brief critical review on the microhabitat selection by Rodents. Reviewing literature, it is found that approximately most of researchers have been mentioned that microhabitat features such as food availability, predation risk, temperature, status of moonlight… are important in determining the variety and abundance of small mammals.

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Introduction

Measuring biological integrity is difficult. In order to do this, managers wish to gather as much information as possible about the habitat requirements of all wildlife species on the protected areas. Most Site research has been focused on birds and a few individual species (e.g., wolves). Research on small mammal habitat use helps to broaden their knowledge. Small mammals are often used as an indicator species group (Carey and Johnson, 1995) to reflect some aspects of "integrity." A biological indicator is "an organism whose characteristics, such as presence or absence, population density, dispersion, reproductive success, are used as an index of attributes too difficult, inconvenient, or expensive to measure" (Landres et al 1988). Small mammals are an appropriate indicator group in part because they have important ecosystem roles. They are primary consumers (Huntly, 1991). After a disturbance such as fire, pioneering small mammals may be important seed sources for plant regeneration (Sieg, 1987). Small mammals increase vegetation decomposition rates, and they are more efficient than both ungulates and insects at mineralizing organic matter (Hayward and Phillipson, 1979). They are also prey for many larger mammals, birds, and reptiles. More broadly, niche separation of different small mammal species on the forest floor may be an indicator of the number of available trophic pathways (Carey and Harrington, 2001). The distribution of species, particularly rodents, is heavily influenced by vegetation and substrate (Schmidty, 1977). Microhabitat includes the "physical/chemical variables that influence the allocation of time and energy by an individual within its home range" (Morris, 1987). Small mammal abundances are affected by both macro- and micro-habitat structures. Habitat selection is the process by which individuals choose among available habitat patches (Johnson, 1980). Studies on patterns of habitat use by mammals are important for understanding the mechanisms involved in their distribution and abundance. For small mammals, patterns of habitat selection reflect a variation in the availability of resources in space and time scales (Stapp, 1997). For small mammals, habitat selection is a hierarchical or scale-dependent process because individuals perceive and respond to environmental characteristics in a variety of spatial scales (Morris, 1987; Stapp, 1997; Jorgensen and Demarais, 1999; Moura et al 2005; Coppeto et al 2006). Studies of habitat selection need to compare two or more spatial scales to determine the scale of selection (Stapp,

1997) and to test the value of measures obtain e d at different scales to predict population abundance (Jorgensen and Demarais, 1999; Coppeto et al 2006). These animals use some microhabitats more frequently than others, suggesting that the animals perceive that these microhabitats differ somehow in quality (Simonetti, 1989). This paper provides a brief critical review to the mentioned concept.

Background

Several recent studies indicated that there are relationships between the abundance and or survival of small mammals and the presence of certain microhabitat characteristics (Carey and Johnson, 1995; Butts and McComb, 2000; Bowman et al 2000; Bellows et al 2001). Several methods have been used in the studies of microhabitat choice by small mammals. Most studies use 2 basic aspects of vegetation that can be distinguished: structure or physiognomy, and floristics (Morrison et al., 1992). Many authors have used structural aspects in their studies of microhabitat choice (Dueser and Shugart, 1978; Muruá and González, 1982; Ernest and Mares, 1986; Cerqueira et al., 1990), while others have used floristic aspects or both (Fa et al 1990).

Effect of predator density

Taraborelli (2001) had shown that the Desert rodents in Argentina concentrate their foraging activities under plant cover, probably due to increased predation risk in open microhabitats. High cover of shrubs can provide both protection from predators, and food (because seeds may be concentrated under shrub canopies; (Thompson, 1982)). Much is known about rodent habitat selection and there is considerable literature that suggests predation risk may play a role in selection and use of microhabitats by rodents (Kotler and Brown, 1988). For example, rodents may avoid foraging in unsheltered microhabitats and forest edges where they are more likely to be detected by avian (Kotler et al 1991) and other vertebrate predators (Morris et al 2000). The risk in a habitat may depend on several factors; two important ones being the probability of encounter between predator and prey and the conditions which may facilitate or hinder predation (e.g., moonlight and vegetation cover, respectively). While the second element is a property typical of the habitat or of the conditions at a given time, the presence of predators in the habitat and their density during that time, is an important issue that is not easily addressed. Predators are often assumed to have a fixed distribution e.g.,(Rahel and Stein, 1988), but the density of predators is likely to be affected by habitat choices and relative densities of prey and vice versa. All else being equal, prey animals should benefit from using habitats in which the probability of being caught is relatively low. Predators, in turn, should be influenced by the habitat selection of prey. Chupp (2002) examined the effects of potential predators in relation to habitat selection in *Peromyscus leucopus*. This species represented 76% of the captures among prey species and was the only species to demonstrate differences in relative abundance among habitat types. Although the relative abundance of the most abundant predator (*Procyon lotor*) and prey (*P. leucopus*) species were positively associated within certain habitat types, a negative association between predator and prey species abundance was evident within parks. Clarke (1983) concluded that predation risk have effective influence on rodents activity times.

Effect of moonlight

Rodents that live in sandy deserts reduce their activity and avoid open habitats on moonlit nights when predation risk is high (Lockard and Owings, 1974; Daly and Daly, 1975; Bowers and Duane Smith, 1979; Price and Kramer, 1984). Owls specialize on rodents and, as both visual and auditory hunters; their hunting efficacy is enhanced by increased illumination (Longland and Price, 1991). Many studies showed that the moon phase has effect on rodent foraging activity and some other animals (mainly because of predator facilitation) in sandy deserts too, and they have reported reduced foraging activity in the open habitats in full moon status e.g (Webster and Webster, 1971; Erkert, 1976; Greenberg, 1986; Reichmann, 1988; Bouskila, 1995; Zollner and Lima, 1999). The objective of my study was to test the hypothesis that the activity of small mammals outside from burrows is restricted mainly to special microhabitat variables.

Discussion

Reviewing literature, it is evident that approximately most of the researchers have been carried out in arid environments. Studies on sandy desert rodents have shown that foraging activity increases the exposure of prey species to predators (Daly and Daly, 1975) and, specifically, that owls usually attack only moving prey. “habitat use” as the way an animal uses (or consumes in a generic sense) a collection of physical and biological components (i.e., resources) in a habitat. Defined “habitat availability” as how accessible and procurable physical and biological components of a habitat are to animals. This is in contrast to the abundance of these resources, which refers only to their quantity in the habitat, irrespective of the organisms present. Bouskila (2001) developed a game theoretic model

for habitat selection of prey and a generalist predator. In the model, both prey and predator may choose between either a simple or a complex habitat. The model is applied to a system of rodents and their predators: snakes (the generalist predator) and owls. Under various conditions (moonlight, competition among rodents and dilution of their risk) the model predicts that snakes distribute themselves among habitats in a way that dampens rodent reactions to variation in owl predation risk and to effects of competition. He mentioned although a game between predators and prey may not be the cause for all their movements among habitats in the field, a game perspective may contribute explanations for what would otherwise be unintuitive habitat shifts. In order to inform managers about wildlife habitat requirements, Chupp (2002) studied habitat use of small mammals at which scale, macro- or micro habitat. Results of this study showed no significant differences were found between small mammal captures and site categories on either deciduous or coniferous plots even though differences in habitat structure among site categories existed. The variation in protection afforded by open and sheltered habitats appears to be greater than the differences in level of risk between moonless and moonlit nights. Owls are visual predators, so this risk is likely to be enhanced with higher illumination regimes. The trade-off between resource gain and predation risk is likely to be less profitable for the rodents during nights of the full moon. Most studies of the effect of moon phase on rodent foraging activity in sandy deserts have reported reduced foraging in the open habitat e.g. (Chupp, 2002; Price et al., 1984), or in both bush and open habitats (Bouskila, 2001), on nights of increased predation risk (presence of owls or added illumination), whereas others have not reported any response (Bouskila, 1995). A lack of response to moonlight has been explained as reflecting predator facilitation (Bouskila, 1995), as a result of seasonal changes or as being dependent on the extent to which rodents and their predators rely on vision and hearing (Longland and Price, 1991). Predator facilitation, between snakes in the boulder field and owls in the open (Jones et al., 2001). A community with high biological integrity is one that has existed under natural conditions for some considerable period. Unfortunately, preserving biological integrity is not a well-defined management goal. However, efforts can be made to restore ecosystem components that are possible to manage. The importance of microhabitat features in determining the variety and abundance of small mammals at a site has been examined by a number of investigators, who have reported that the number and diversity of small mammal captures depend on ecological factors such as food availability, temperature, predation risk, interspecific competition, nesting and roosting sites (Price, 1978; Wywialowski, 1987; Loeb, 1999).

Recommendation

Habitat selection results from multiple choices made by individuals during their activities including foraging, escape from predator s, mate searching, and refuge use (Garshelis, 2000). Ideally, estimates of all these activities should be included in the measures of habitat use to accurately determine patterns of habitat selection (Cox et al 2000).

Conclusion

- Many other wildlife species depend on the same habitat elements as small mammals and a management focus on these three habitat components during restoration will help to obtain overall biological integrity.
- That microhabitat features are important in predicting the distribution of small mammals.
- Differences in usage of ecological features are probably associated with the interaction of microhabitat variables such as food sources, nests or shelters, climate conditions and competition with other species.
- Variation in ecological factors such as resources, competition and predator abundance influence fine-scale spatial patterns of variation in small mammal populations
- Clear cutting results in environmental changes such as loss of food sources and roost sites, soil temperature increase, water loss and creation of large openings. These changes will cause small mammals to avoid affected portions of the forest. If management is to encourage or at least not diminish the diversity of small mammals at a site, it is essential to minimize habitat destruction and leave resources such as foods and nest sites in the forest.

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