The Influence of Prey Use and Habitat on Burrowing Owl (*Athene cunicularia*) Reproduction

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Introduction

Food, competition, and predation dictate habitat use (Schmutz et al. 1991) and ultimately reproduction. Avian reproduction is frequently food-limited (Wellicome 2000), and predation is the primary cause of nest failure (Martin 1993). Selection of prey and habitat features which minimize these effects should therefore enhance reproduction. We examined this issue using the Burrowing Owl, a declining species of the Great Plains.

Research Objectives:

Our primary objectives were to (1) describe the diet of the Burrowing Owl in northern Colorado and compare it to other regions, and (2) measure select diet and habitat variables and relate to reproductive output.

Figure 2. Black-tailed Prairie Dog colony.

Figure 3. Juvenile Burrowing Owl on satellite mound.

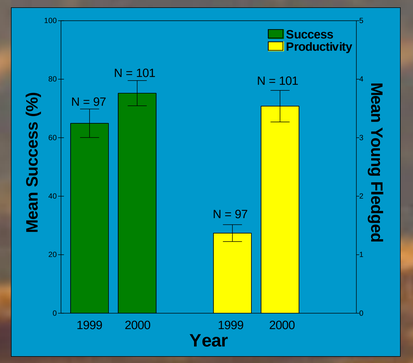

Figure 4. Comparison of Burrowing Owl success and fledging data. Bars represent ± 1 standard error. Numbers above bars indicate nest sample sizes. Productivity differed by year (*df* = 1, *F* = 19.59, *P* = 0.0003). Burrowing Owls fledged more young in 2000 than 1999 (2000: *x* = 3.54, *SD* = 2.71, *n* = 101; 1999: *x* = 1.37, *SD* = 1.43, *n* = 97). Nesting success was higher in 2000 than 1999, however differences were not significant (*P* > 0.05).

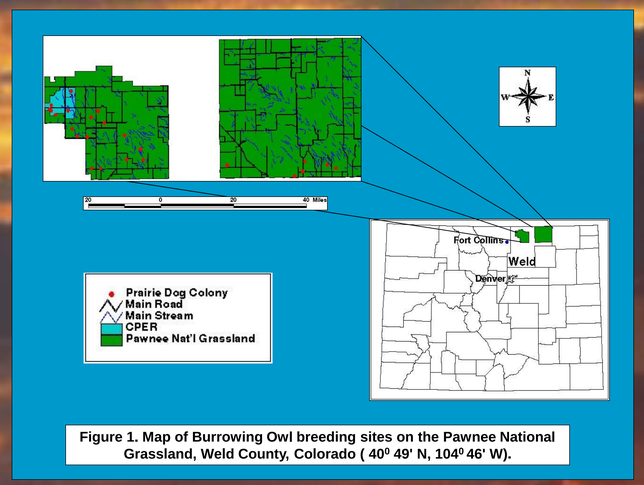

Figure 1. Map of Burrowing Owl breeding sites on the Pawnee National Grassland, Weld County, Colorado (40º 49' N, 104º 46' W).

Methods

- Locate and monitor Burrowing Owls breeding on active Black-tailed Prairie Dog (*Cynomys ludovicianus*) colonies on the Pawnee National Grassland (Fig. 1, 2).
- Estimate nesting success and minimum fledging rates, and record the density of satellite burrows within a 30-meter radius of occupied nest sites (Fig 3).
- Describe diet composition and quantify prey use based on analysis of regurgitated pellets.
- Map nest mounds and colony perimeters with a global positioning system (GPS) unit, and obtain distance to nearest nesting neighbor measures using geographic information systems (GIS).
- Assess variation in reproductive parameters and relate diet and habitat data to reproduction using mixed model analyses.

Results

Diet: Of the 83 species and 26 families identified, invertebrates were most frequently taken as prey items. Families Scarabaeidae, Carabidae, and Gryllacrididae accounted for more than 57% of the total individuals in the diet. Although several taxa were represented across studies, primary prey differed (Table 1). Our vertebrate use was among the lowest reported.

Reproduction: Reproduction differed by year (Fig. 4). Log likelihood analyses indicated significance of the random effects colony and year*colony; therefore both were retained in ensuing models. Reproductive performance was not significantly affected by either the distance to the nearest nesting owl neighbor (success: *df* = 1, *F* = 0.91, *P* = 0.3413; fledge: *df* = 1, *t* = -0.72, *P* = 0.4776) or the density of satellite burrows around the nest (success: *df* = 1, *t* = -0.58, *P* = 0.5690; fledge: *df* = 1, *F* = 0.11, *P* = 0.7447). Both diet breadth and the vertebrate content of the diet did not influence the number of young fledged by Burrowing Owls breeding in 2000 (Fig. 5).

TABLE 1. Invertebrate:vertebrate (I:V) composition and important prey in diet studies of the Burrowing Owl.

Study	Location	I:V	Top Prey Taxa[a]
This study (2000)	Colorado	93:3	Scarab Carab Grylla
Brown et. al. (1986)	Oregon	74:14	Acrid Scarab Stenop
Gleason & Craig (1979)	Idaho	91:9	Grylla Solpug Silph
Green et al. (1993)	Oregon	92:8[b]	Teneb Scarab Grylla
Green et al. (1993)	Washington	83:17[b]	Teneb Scarab Hetero
Grimm (1985)	Washington	81:19	Carab Teneb Acrid
MacCracken et al. (1985)	South Dakota	57:24[c]	Carab Teneb Hister
Marti (1974)	Colorado	92:8	Carab Grylli Scarab
Plumpton & Lutz (1993)	Colorado	56:33	Cricet Teneb Silph
Schlatter et al. (1980)	Chile	79:21	-
Thompson & Anderson (1988)	Wyoming	95:5	Acrid Carab Formic
Wiley (1998)	Dominican Republic	53:47	-

[a] Top prey families based on frequency of individuals in diet. Families include: Acrididae, Carabidae, Cricetidae, Formicidae, Gryllacrididae, Gryllidae, Heteromyidae, Histeridae, Scarabaeidae, Scorpionidae, Solpugidae, Stenopelmatidae, Tenebrionidae
[b] Data taken from same study.
[c] Results based on data pooled from May-August 1981.

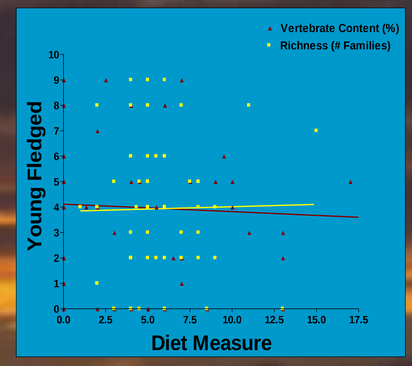

Figure 5. Plot of diet richness and vertebrate content against number of young fledged. Points represent diet and reproductive data collected for individual nests (*N* = 60). Neither vertebrate content nor diet breadth were significantly related to productivity (vert: *df* = 1, X^2 = 0.65, *P* = 0.4190; breadth: *df* = 1, X^2 = 0.06, *P* = 0.8055).

Conclusions

- Burrowing Owls foraged opportunistically. Although invertebrates were consistently taken at high frequencies, prey use varied at local and regional scales.
- Reproduction was not affected by nearest-neighbor distance or satellite burrow densities. Total burrow densities on the prairie dog colonies studied may have been sufficiently large that competitive and predatory effects were minimal.
- Neither vertebrate content nor diet richness affected fledging rates. Opportunistic foraging may have ameliorated nest-level conditions, however more studies are needed.

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