NOTES

EFFECTS OF CONSERVATION RESERVE PROGRAM SEEDING REGIME ON HARVESTER ANTS (*POGONOMYRMEX*), WITH IMPLICATIONS FOR THE THREATENED TEXAS HORNED LIZARD (*PHRYNOSOMA CORNUTUM*)

NANCY E. MCINTYRE*

Department of Biological Sciences, Texas Tech University, Lubbock, TX 79409-3131
**Correspondent: nancy.mcintyre@ttu.edu*

ABSTRACT—I compared the presence and abundance of nest-sites made by harvester ants (*Pogonomyrmex*), the primary prey for the endangered Texas horned lizard (*Phrynosoma cornutum*), among restored grassland plots planted in different grass species and indigenous prairie. The restored plots had been seeded as part of the Conservation Reserve Program (CRP) as exotic monocultures of either Old World bluestem (*Bothriochloa ischaemum*) or weeping lovegrass (*Eragrostis curvula*), or as mixtures of native grasses (both with and without buffalograss, *Buchloë dactyloides*). On average, the fewest ant mounds were found on Old World bluestem plots, whereas the indigenous grassland had the highest density of harvester ant mounds. However, there were no significant differences between native and exotic CRP plantings. Results obtained from a simultaneous visual survey for Texas horned lizards corroborate these findings. Thus, there is no evidence that CRP plots planted in exotic grasses are significantly poorer habitat for Texas horned lizards in terms of ant abundance than native grass plantings.

RESUMEN—Comparé la presencia y abundancia de nidos de hormigas *Pogonomyrmex*, la presa principal del camaleón texano (*Phrynosoma cornutum*), una lagartija en peligro de extinción, en parcelas restauradas de pastizales sembrados de especies diferentes y parcelas de pradera nativa. Dichos parcelas restauradas forman parte del Programa de Conservación de Reservas (CRP por sus siglas en inglés) y abarcan monocultivos de pastos introducidos (*Bothriochloa ischaemum* o *Eragrostis curvula*) o mezclas de pastos nativos (con y sin *Buchloë dactyloides*). En general, la menor densidad de nidos de hormigas *Pogonomyrmex* se encontró en las parcelas de *Bothriochloa ischaemum*, y la mayor densidad de los nidos se encontraron en los pastizales nativos. Sin embargo, no hubo diferencias significativas entre parcelas CRP de pastos exóticos y pastos nativos. Los resultados obtenidos de un muestreo visual simultáneo del camaleón texano corroboran estos resultados. Entonces, no hay ninguna evidencia de que los campos del Programa de Conservación de Reservas sembrados en pastos exóticos son un hábitat significativamente más pobre para *Phrynosoma cornutum* en términos de abundancia de hormigas que los sembrados en pastos nativos.

More than 99% of the Great Plains has been lost to anthropogenic habitat transformations, with resultant negative effects on many animal populations (Noss et al., 1995). Formed in 1985, the Conservation Reserve Program (CRP) of the United States Department of Agriculture leases private agricultural land for 10-year periods, whereby the landowner seeds the land and does not plow or graze it during that time (Young and Osborn, 1990; Olenbusch et al., 1995). Approximately 14 million ha are currently enrolled in the CRP (United States Department of Agriculture, 2000). This program has effectively been a form of prairie restoration in the Great Plains for many wildlife species (Berthelsen et al., 1989; Johnson and Schwartz, 1993; Reynolds et al., 1994; Johnson and Igl, 1995; King and Savidge, 1995).

Most of the earliest CRP leaseholders planted less costly exotic grasses, especially *Eragrostis*

curvula (weeping lovegrass) and *Bothriochloa ischaemum* (Old World bluestem). Leases initiated since 1997, however, require landowners to plant at least 90% of their fields in a mix of native grasses, such as *Bouteloua curtipendula* (sideoats grama), *B. gracilis* (blue grama), *Panicum virgatum* (switchgrass), and *Buchloë dactyloides* (buffalograss). Lease renewals since 1997 require reseeding at least 51% of existing CRP land in native plants. Because buffalograss is relatively expensive compared to the other species, however, many CRP fields do not include it despite its abundance and importance in native shortgrass prairie (Berthelsen et al., 1989; Lauenroth and Milchunas, 1991). Thus, CRP lands comprise a mosaic of exotic monocultures and mixed native plantings.

Harvester ants (*Pogonomyrmex*) are abundant and conspicuous components of grassland ecosystems (Cole, 1968). These ants clear vegetation around their nest-sites (mounds) to form a disk of bare ground 1 to 2 m in diameter (Crist and Wiens, 1994; McIntyre, 1999). These granivorous insects alter plant community composition through differential seed predation, affect soil chemistry through burrowing, and alter the behavior of other arthropods by providing areas of bare soil for thermoregulation and oviposition (McIntyre, 1999). They are also the primary prey for the Texas horned lizard (*Phrynosoma cornutum*).

The Texas horned lizard is listed as a threatened species in Texas and Oklahoma. Although the species once occurred in semi-arid grasslands from Kansas to the northern half of Mexico and from eastern Texas to extreme southeastern Arizona, its numbers have declined precipitously in recent decades, and it has virtually disappeared from the eastern portion of its historic range (Donaldson et al., 1994). The rapid and recent decline in the Texas horned lizard makes a habitat assessment for the species vital for future conservation efforts to halt this downward trend (Donaldson et al., 1994). One key element of such a habitat assessment must be an evaluation of the occurrence of its primary prey, harvester ants. Ants can comprise 69% of the prey individuals consumed by the Texas horned lizard (and 61.2% of stomach volume; Pianka and Parker, 1975; Donaldson et al., 1994). Few organisms other than horned lizards consume these ants, and the occurrence of horned lizards is tightly coupled to the occurrence of harvester ants (Whitford and Bryant, 1979; Donaldson et al., 1994).

The goals of this study were to assess the occurrence of harvester ants on CRP lands planted as exotic monocultures versus CRP planted in mixed native grasses, as compared to indigenous, unseeded grassland. Harvester ants were surveyed at 16 sites in the Texas Panhandle Plains: 4 plots were CRP weeping lovegrass; 3 were CRP Old World bluestem; 4 were CRP plots seeded with native species (with a dominance of sideoats grama, blue grama, and switchgrass) without buffalograss; 4 were CRP plots seeded with sideoats grama, blue grama, switchgrass, and buffalograss; and 1 was an unseeded, unplowed native grassland plot: Muleshoe National Wildlife Refuge (NWR). These plots were not associated with any particular soil types or textures, which consisted of various loams, clay and sandy loams, and fine sands (Newman, 1962; Sanders, 1962; Girdner, 1963; Blakley, 1974; Blackstock, 1979). Each of the CRP plots averaged 1 km^2 in size and was at least 3 years old. The Muleshoe NWR plot had never been plowed, and it had not been grazed by livestock for 3 years prior to study. Plots were separated by at least 1 km, with the maximum linear distance between sites being 97 km, indicating that the sites were largely independent and yet subject to a similar climate and agroeconomic history. The red imported fire ant (*Solenopsis invicta*), which might competitively eliminate harvester ants (Hook and Porter, 1990), was not found at any of these sites; the species has not become widely established in the Texas Panhandle, primarily because of its intolerance of xeric environments (Moody et al., 1981).

Because horned lizard predation pressure can cause harvester ants to curb foraging activity (Whitford and Bryant, 1979), the density of ant nest-sites might be a more constant and reliable indicator of habitat suitability than forager activity or abundance. I measured the density of harvester ant nest-sites at each of the 16 study locations. Ant colonies are relatively long-lived and sessile, and depredation by horned lizards does not significantly depress numbers of colonies (Whitford and Bryant, 1979), meaning that mounds can persist for many years in a given area. The density of ant nest-sites was surveyed along a 100-m north-

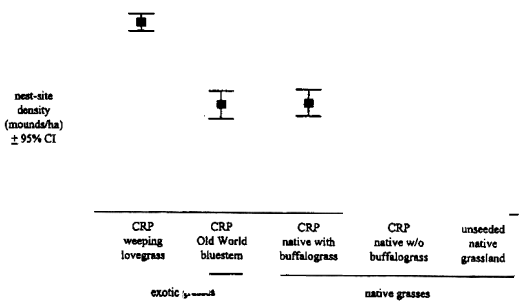

FIG. 1—Mean density (squares) with 95% confidence intervals (T-bars) of harvester ant mounds by site type in the Texas panhandle.

south belt transect (10 m in width) located at the center of each site. All sites were surveyed between 0700 and 1200 Central Daylight Time in July 2001 when the weather was sunny, clear, and dry, with temperatures of 22 to 35°C. Mean densities of nest-sites were compared among site types using 95% confidence intervals (CI) (Zar, 1999). Because there was only 1 unseeded, unplowed grassland plot, its density value is reported for comparison purposes and is not associated with 95% CI. A visual survey for Texas horned lizards was conducted simultaneously with the ant nest-site survey.

Harvester ant nest-site densities ranged from 0 to 20 mounds/ha. These values are consistent with previously reported densities from western Texas (0 to 25 mounds/ha; Donaldson et al., 1994). Significant differences were noted in mound density by site type (Fig. 1). On average, the fewest ant mounds were found on Old World bluestem plots (0 to 10.9 mounds/ha, with an average of 4.8); the unseeded native grassland had the highest density of harvester ant mounds (20 mounds/ha). No harvester ant mounds were found at 3 sites (1 Old World bluestem site, 1 weeping lovegrass site, and 1 native CRP plot planted without buffalograss). Even when these sites were excluded from analysis, however, the trends remained unchanged. The replicate sites within each site type differed from each other in terms of number of ant mounds present (evidenced by variable widths of the confidence intervals in Fig. 1). There was no evidence that CRP plots planted in exotic grasses were significantly poorer habitat in terms of ant abundance than native grass plantings.

Texas horned lizards were observed at 2 Old World bluestem sites (1 lizard at each site), 1 native CRP plot with buffalograss (2 lizards), and 1 native CRP plot planted without buffalograss (1 lizard). Horned lizards were observed only at sites where ant mounds were recorded. These results add corroborative evidence to the findings from the ant nest-site survey. The relatively high cost of buffalograss did not render CRP plots that incorporated it significantly better ant or horned lizard habitat compared to plots without buffalograss, meaning that CRP leaseholders who originally planted less expensive grasses still provided valuable wildlife habitat. New leases and lease renewals require that native grasses be used over a majority of the land.

Incidence of harvester ant nests is only 1 factor in the estimation of the value of an area as habitat for the Texas horned lizard (Burrow et al., 2001). The potential influence of other factors, such as the land-use history of a field, soil type and texture, and landscape context, warrant further investigation. However, the presence and abundance of the ants is a critical factor, nonetheless, in determining whether a parcel of land could support the Texas horned lizard. This is a promising avenue for future research concerning conservation of the Texas horned lizard and the value of CRP.

I thank the numerous CRP leaseholders who permitted access to their property for this study. I thank T. Thompson (Department of Range, Wildlife, and Fisheries Management, Texas Tech University), C. Boal (Texas Cooperative Fish and Wildlife Research Unit), the Natural Resources Conservation Service, and Muleshoe NWR for help in formulating this study. B. Bestelmeyer (Department of Biology, New Mexico State University), C. Boal, and 2 anonymous reviewers made helpful comments on manuscript drafts. H. Stevens (Department of Biological Sciences, Texas Tech University) provided the Spanish translation of the abstract.

LITERATURE CITED

BERTHELSEN, P. S., L. M. SMITH, AND C. L. COFFMAN. 1989. CRP land and game bird production in the Texas High Plains. Journal of Soil and Water Conservation 44:504–506.

BLACKSTOCK, D. A. 1979. Soil survey of Lubbock County, Texas. United States Department of Ag-

riculture, Soil Conservation Service, Washington, D. C.

BLAKLEY, E. R. 1974. Soil survey of Hale County, Texas. United States Department of Agriculture, Soil Conservation Service, Washington, D. C.

BURROW, A. L., R. T. KAZMAIER, E. C. HELLGREN, AND D. C. RUTHVEN. 2001. Microhabitat selection by Texas horned lizards in southern Texas. Journal of Wildlife Management 65:645–652.

COLE, A. C. 1968. *Pogonomyrmex* harvester ants. University of Tennessee Press, Knoxville.

CRIST, T. O., AND J. A. WIENS. 1994. Scale effects of vegetation on forager movement and seed harvesting by ants. Oikos 69:37–46.

DONALDSON, W., A. H. PRICE, AND J. MORSE. 1994. The current status and future prospects of the Texas horned lizard (*Phrynosoma cornutum*) in Texas. Texas Journal of Science 46:97–113.

GIRDNER, C. L. 1963. Soil survey of Bailey County, Texas. United States Department of Agriculture, Soil Conservation Service, Washington, D. C.

HOOK, A. W., AND S. D. PORTER. 1990. Destruction of harvester ant colonies by invading fire ants in south-central Texas (Hymenoptera: Formicidae). Southwestern Naturalist 35:477–478.

JOHNSON, D. H., AND L. D. IGL. 1995. Contributions of the Conservation Reserve Program to populations of breeding birds in North Dakota. Wilson Bulletin 107:709–718.

JOHNSON, D. H., AND M. D. SCHWARTZ. 1993. The Conservation Reserve Program and grassland birds. Conservation Biology 7:934–937.

KING, J. W., AND J. A. SAVIDGE. 1995. Effects of the Conservation Reserve Program on wildlife in southeast Nebraska. Wildlife Society Bulletin 23: 377–385.

LAUENROTH, W. K., AND D. G. MILCHUNAS. 1991. Short-grass steppe. In: Coupland, R. T., editor. Ecosystems of the world 8A: natural grasslands. Elsevier, Amsterdam, The Netherlands. Pp. 183–226.

MCINTYRE, N. E. 1999. Use of *Pogonomyrmex occidentalis* (Hymenoptera: Formicidae) nest-sites by tenebrionid beetles (Coleoptera: Tenebrionidae) for oviposition and thermoregulation in a temperate grassland. Southwestern Naturalist 44: 379–382.

MOODY, J. V., O. F. FRANKIE, AND F. W. MERICKEL. 1981. The distribution of fire ants, *Solenopsis* (*Solenopsis*) in western Texas (Hymenoptera, Formicidae). Journal of the Kansas Entomological Society 54:469–480.

NEWMAN, A. L. 1962. Soil survey of Lamb County, Texas. United States Department of Agriculture, Soil Conservation Service, Washington, D. C.

NOSS, R. F., E. T. LAROE, AND J. M. SCOTT. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. National Biological Service Report Number 0611-R-01 (MF). United States Department of the Interior, Washington, D. C.

OLENBUSCH, P. D., M. R. LANGEMEIER, AND S. L. WATSON. 1995. CRP: evaluating the options. Cooperative Extension Service Publication MF 2078, Kansas State University, Manhattan.

PIANKA, E. R., AND W. S. PARKER. 1975. Ecology of horned lizards: a review with special reference to *Phrynosoma platyrhinos*. Copeia 1975:141–162.

REYNOLDS, R. E., T. L. SHAFFER, J. R. SAUER, AND B. G. PETERJOHN. 1994. Conservation Reserve Program: benefit for grassland birds in the Northern Plains. Transactions of the North American Wildlife Natural Resources Conference 59:328–336.

SANDERS, D. 1962. Soil survey of Terry County, Texas. United States Department of Agriculture, Soil Conservation Service, Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE. 2000. The Conservation Reserve Program 20th Sign Up. United States Department of Agriculture, Farm Service Agency, Washington, D. C.

WHITFORD, W. G., AND M. BRYANT. 1979. Behavior of a predator and its prey: the horned lizard (*Phrynosoma cornutum*) and harvester ants (*Pogonomyrmex* spp.). Ecology 60:686–694.

YOUNG, E. C., AND C. T. OSBORN. 1990. Costs and benefits of the Conservation Reserve Program. Journal of Soil and Water Conservation 45:370–373.

ZAR, J. H. 1999. Biostatistical analysis, fourth edition. Prentice Hall, Upper Saddle River, New Jersey.

Submitted 14 December 2001. Accepted 18 March 2002. Associate Editor was Geoffrey C. Carpenter.