Anne M. Narayanan

Department of Entomology

Nature of the Problem

Rangelands that are experiencing desertification show a reduction in valuable standing vegetation and mulch. When standing vegetation and mulch are absent, rainwater is lost through an increase in runoff. Standing vegetation and mulch acts as a rainwater trap. This allows rainwater to absorb into the soil and not be lost as runoff. Standing vegetation and mulch must be conserved to promote rain utilization in rangelands. This water conservation will keep rangelands from further spiraling into the desertification process.

Research Objectives

To determine foraging distances of the desert termite Gnathamitermes tubiformans in natural habitats with varying amounts of standing vegetation and mulch.

To determine the mean population size of foragers of the desert termite Gnathamitermes tubiformans in natural habitats with differing amounts of standing vegetation and mulch.

Desert termites, specifically the species Gnathamitermes tubiformans, belong to the termite subfamily Termitinae in the family Termitidae. This is considered the highest or most recently evolved family of termites (Noirot, 2001). Differences from other termite families include gut structure and fauna, external morphology, and diet. Gnathamitermes tubiformans has a diet that deviates from other termite diets that use dead wood. Grasses, forbs, surfaces of dead wood, and certain types of mammal dung, especially that of cattle, are preferred food substrates of G. tubiformans (Bodine and Ueckert, 1975). Allen et al. (1980) found that 46% of G. tubiformans diet consisted of standing dead grass; 34% was grass litter; and 16% was live grass. Colonies of G. tubiformans are found in the soil and foraging occurs within tubes built from soil particles and feces glued together by the saliva of the worker termites (Nutting et al., 1987, Schaefer and Whitford, 1981). These tubes are straw-like structures that completely enclose the food substrates like grass culms and blades. When feeding occurs on a flat surface like that of dead wood, the area is covered in a sheet of soil particles cemented with saliva.

Gnathamitermes tubiformans has a distribution that stretches from northern Mexico to the southern areas of New Mexico, Texas, and Arizona (Bodine and Ueckert, 1975). Studies conducted in Arizona, New Mexico and Texas have evaluated the benefits and detriments caused by G. tubiformans. There is no clear answer to whether G. tubiformans is truly beneficial or truly detrimental to arid and semi-arid environments. Elkins et al. (1986) affirm that even with beneficial and detrimental effects, G. tubiformans is a "keystone" species in the northern Chihuahuan desert.

As a "keystone" species, the presence of Gnathamitermes tubiformans dictates the structure of the environment in which it inhabits. Too much reduction of standing

vegetation and mulch due to termite foraging lessens the condition of topsoil. Loss of water due to run-off occurs with the complete absence of plant litter on the soil surface. This litter keeps the soil temperature and evaporation of soil moisture lower (Bodine and Ueckert, 1975). Although desert termites remove standing vegetation and mulch, it is not clear if these insects solely dictate the consequences observed with desertification. The proposed project will focus on the relationship of desert termites with the amount of standing vegetation and mulch in the area that the termites inhabit. For all that is known about Gnathamitermes tubiformans, some basic and fundamental biology and ecology questions have not been answered. The project will focus on foraging distances and forager population sizes in areas of low, moderate, and high amounts of standing vegetation and mulch. The first set of experiments will test the null hypothesis that foraging distances do not vary with the amount of standing vegetation and mulch. The second set of experiments will test the null hypothesis that the apparent population sizes of desert termite foragers do not vary with the amount of standing vegetation and mulch. By understanding these insects, a way to override their detrimental effects can be found.

References

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Expected results of the two experiments will show significant differences between foraging distances and forager population sizes in areas of high amounts and low amounts of standing vegetation and mulch. If the results show greater distances and higher populations of desert termite foragers in areas of low amounts of standing vegetation and mulch, then this shows a negative impact on the conservation of these factors. This would be an indicator that desert termites are increasing desertification. These findings would then lead to more research on controlling the detrimental effects of

Gnathamitermes tubiformans by conserving standing vegetation and mulch that would lead to the conservation of rain water available to rangelands.

Intended Career Path Statement

Water is a scarce natural resource that is taken for granted by many people. My father, a wildlife biologist for a water district in west Texas, instilled in me the importance of conserving water. The amount of rainfall in a year rules the lives of many families in that area of Texas, especially farmers and ranchers. The water district, for which my father works, is fighting a constant battle to maintain area lakes and watersheds to provide water to thousands of west Texas residents. I realize conserving the watersheds of west Texas are vital to everyone who lives and works there. Not only do healthy watersheds replenish water sources like rivers and lakes, but they also allow farmers and ranchers to maintain their livelihoods. Through my research, I hope to learn more about the desertification process that is harming some important watershed areas in west Texas. After completing my degree, I plan to continue working in west Texas as an entomologist and biologist. I plan to pursue a career in areas of extension focused on natural resource conservation.