Restoration of Hydrologically Dis-functional Rangeland Watersheds, Wildlife Habitats, and Improved Pastures in Western Texas

Geographic Area of the Project: southern Rolling Plains, northern Edwards Plateau, eastern Trans Pecos land resource areas

Name of Principal Investigators:

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Texas Agricultural Experiment Station
Texas Cooperative Extension
Texas A&M University Agricultural Research & Extension Center-San Angelo
Entomology Department - Texas A&M University
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Project Need, Description and Expected Outcomes

A high percentage, perhaps as much as 75%, of the rangeland watersheds, wildlife habitats, and improved pastures in the western half of Texas are "at risk" due to the impacts of drought and concomitant attacks by desert termites or grasshoppers. The combined effects of prolonged drought, termites and/or grasshoppers and, in some cases, previous management have created hydrologically dis-functional ecosystems that will be unable to absorb and hold rainfall and recover naturally when rain returns. Vast landscapes are now dominated by annual grasses and forbs and may be beyond the threshold for natural recovery because: 1) the mortality of perennial, warm-season grasses has been extremely high; and 2) little or no mulch, standing dead vegetation, or deep-rooted grasses remain to facilitate rainfall infiltration. Without intervention, this conversion of vast landscapes from warm-season, perennial grass dominance to cool-season, annual forb/grass dominance will have long-term negative impacts on water availability/quality, wildlife habitat, livestock production, and sediment yield into the State's streams, rivers, and reservoirs. Repairing the hydrological processes on these vast landscapes will restore the land for watersheds, wildlife habitat, livestock production, recreation, aesthetics, and real estate, while encouraging the economic viability of rural communities.

The scientists involved in this project, as well as many observant ranchers in central and western Texas, firmly hold that desert termites (*Gnathamitermes tubiformans*) have played a key role in the current, severe desertification cycle via their removal of mulch, litter, standing dead plants, live plants, and the feces of livestock and wildlife from the soil surface. Our hypothesis is substantiated by research reported in the scientific literature. Removal of the vegetative cover leaves the soil surface unprotected from the energy of raindrop impact, resulting in excessive intertill erosion, the destruction of surface soil aggregates, soil puddling, inadequate rainfall infiltration, excessive loss of water to overland flow, and excessive silt loads in runoff water. Strategies for control of desert termites on rangelands or pastures have not been developed, but

some highly effective termiticides are currently available for field evaluation. The manufacturers of two of these termiticides are keenly interested in developing their products for use on wildland areas and pastures.

It has been known for decades that water conservation practices which modify the soil micro-relief and fracture impervious soil layers, such as ripping (sub-soiling) and contour furrowing, can be highly effective, when integrated with appropriate grazing management strategies, in restoring healthy hydrological cycles and productivity of degraded wildlands and pasture lands. However, the lack of guidelines on optimum spacing of these treatments for specific precipitation, slope, and soil surface conditions has resulted in very low levels of adoption and use of this technology. Research on rangeland ripping at the San Angelo Center during the current drought has shown that rangeland can be ripped 15 - 18 in. deep, on the contour on 20- to 30-ft. spacings, for <$4/acre; that rainfall infiltrated >4 ft. deep along rips compared to only 4 - 5 in. on unripped areas; that herbage production was almost 1800 lb/acre on ripped landscapes compared to only 370 lb/acre on untreated rangeland; and that ripping increased the livestock carrying capacity to 32 animal units/section compared to 6 animal units/section on unripped rangeland. This work has stimulated significant interest in water conservation treatments among ranchers, rangeland resource managers, wildlife biologists, and the U.S.D.A. Natural Resources Conservation Service.

Much of the ground work for this project is already underway. Drs. Allan McGinty and Darrell Ueckert installed rangeland ripping research/demonstration plots in 5 counties during 2001. Dr. Steve Whisenant is currently installing several pitting, furrowing, and aeration treatments on a 1,000-acre block of land managed by University Lands - The University of Texas System in Reagan County. Continuous soil water monitoring equipment at this site will enable us to relate infiltration/runoff ratios to different rainfall intensities for a range of slopes and soils. Dr. Dale Rollins currently has research underway on the benefits of spreader dams on quail habitat in the Trans Pecos region, and he plays a leadership role in the new TAMUS quail habitat restoration initiative. Drs. Chris Sansone and Darrell Ueckert have arranged for the delivery of samples of termiticides and baits from Aventis and Dow AgroSciences. The mechanisms and expertise necessary for rapid and effective transfer of the technology and knowledge that will be developed in this project are incorporated via the active participation in this project by Drs. Sansone, McGinty, and Rollins (TCE) and Wayne Hamilton (CGRM). The funding requested by this proposal would: 1) facilitate the expansion and completion of several rangeland restoration/water conservation studies that are underway; 2) allow us to make significant progress toward developing integrated pest management strategies for desert termites; 3) examine the interactions between water conservation treatments and termite control practices on rangeland restoration; and 4) initiate the development of an effective technology transfer program to enhance and expedite the adoption of water conservation/termite management technologies by land owners, resource managers, and resource management agencies.

An initial step in the proposed research will be to determine the colony size of desert termites. This will be accomplished using widely spaced termiticide bait stations and a release/recapture method using termites fed dye-stained grass in areas not receiving baits. This information is critical for designing strategies for maximizing the spacings between termiticide bait stations and minimizing the absolute amount of termiticide applied per acre. A second phase of the termite related work will be to select a substrate for the termiticide bait that will be readily eaten by desert termites (e.g., wheat straw vs. wood shavings). Replicated field experiments will then be designed to examine the effects of water conservation treatments, termite control, and interactions of these factors on recovery of degraded rangelands, wildlife habitats, and improved pastures. Treatments will include untreated rangeland, ripping only, termiticide only, and ripping + termiticide. Termite control treatments will be superimposed upon water conservation treatments that are already established to the largest extent possible. Small-plot studies will also be superimposed over water conservation treatments to determine the success of re-seeding with selected native and introduced species of grasses and forbs. Post treatment variables that will be estimated by appropriate sampling methods will include plant densities, basal or foliar cover, annual yield, plant species composition, and termite abundance (or surface foraging activity). All data will be subjected to appropriate statistical analyses.

This project will: 1) greatly expand our knowledge base on the biology and ecology of desert termites and the values of water conservation treatments for reversing the desertification cycle on rangeland

watersheds; 2) develop a cost-effective integrated pest management program for desert termites; and 3) develop an effective marketing program to expedite the transfer of valuable water conservation/desert termite management technology to ranchers, rangeland resource managers, and natural resource management agencies.

Specific Issues Addressed:

- water management and conservation
- soil management, quality/health
- mulching (natural mulching via plant growth)
- land management related to soil and water conservation

Progress

Eleven experiments and/or demonstrations on mechanical water conservation treatments which range in size from 5 to several hundred acres have been installed in the following counties in western Texas: Tom Green, Crockett, Val Verde, Pecos, Upton, Ector, Edwards, Howard, Reagan, and Runnels. Water conservation treatments have included ripping, ripping + contour furrowing, contour furrowing, and aeration with a Lawson aerator. The rip + furrow treatment has been accomplished by attaching shop-made "wings" or a modified lister bottom to the shank of single-shank rippers. Contour furrowing was accomplished with a road grader at one location. Mixtures of grasses have been planted on the upslope margins of rips and rip/furrows, where water will stand following rainfall events, to determine the feasibility of seeding for establishing permanent vegetative cover. Seeding was accomplished either with a shop-made, revolving drum seeder attached to an all-terrain vehicle or with a specially built Truax 1-row seeder mounted on the single-shank ripper implement. Grasses were planted with a drill between contour furrows or by broadcasting behind the aeration or ripping operation at one location. Soil moisture monitoring equipment has been installed at the Reagan County study site. The continuing drought at most study sites has precluded the germination and establishment of perennial grasses. Herbicide treatments have been installed in bands along rips or rip + furrows in some experiments where annual weeds were dense to conserve soil water for the establishment of perennial, warm-season grasses. Field work to determine the colony size of desert termites, the acceptability of insecticide baits to these insects, and the impact of various insecticide treatments on establishment of vegetative cover along rip and rip + furrow treatments has been planned and will be conducted by Ann Thornton, a graduate student in the Entomology Department at Texas A&M University.