DESERT TERMITES

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Desert termites (*Gnathamitermes tubiformans*) are small, soft-bodied, social, subterranean insects that occur in TX, NM, AZ, OK and northern Mexico. They concern ranchers most years, but especially during drought. The nymphs look similar to the adults and their social castes include workers, soldiers, and reproductives. The reproductives, with 2 pair of wings of equal length, swarm during or following rainfall events usually in June, sometimes in such great numbers as to appear as a low-level, gray cloud. They mate, then each pair starts burrowing to establish a new colony. The small, wingless workers move aboveground and construct mud tubes or sheetings over all kinds of plant material, living and dead. They do not tunnel into wood, only shave off the outer layer. Their main surface feeding activity is at night and cooler parts of the day, and particularly following rains in March through October, but surface feeding may extend into early January in mild winters and may persist most of the year in southern Texas and northern Mexico. They retreat belowground when the soil surface temperature reaches about 95 F and they move below 1 foot in the soil when soil temperature at 6 inches is below 48 degrees F. They go below 4 feet when the soil temperature at that depth is 50 degrees F. Almost ¾ of their tunnels and chambers are in the upper 16 inches of the soil profile and a majority are in the upper 2.75 inches.

Desert termites are omnivorous herbivores, with insatiable appetites – meaning they will eat about any kind of plant material and often most all that's available! They always cover up their food items with mud casts and sheetings made from soil particles brought from below ground mixed with their saliva before dining. The workers eat their fill then take food belowground to feed the reproductives, soldiers and immature nymphs. On shortgrass prairie west of Post, TX, the diet of desert termites consisted of about 46% red threeawn, 26% buffalograss, and 24% blue grama, including the live and standing dead or dormant leaves and stems and the mulch of these plants. They also rapidly cover and consume the feces of livestock, wildlife, and other insects as well as the seeds of grasses and forbs, the sweet, outer layers of mesquite pods, as well as leaves and twigs that fall from the trees. Results from studying plant root biomass from soil cores in one growing season did not indicate desert termites are major consumers of plant roots. I've never seen roots in their tunnels or chambers. Competition between desert termites and livestock/wildlife is inevitable whenever growing conditions are suboptimal. We learned in a study near Post, TX that desert termites accounted for 55% of the disappearance of mulch left on the soil surface, with microbial decomposition removing the other 45%. In lab feeding studies, we documented that the food intake rates of worker desert termites ranged from 2.4% of live body weight per day on dry buffalograss leaves to 6.6% of live body weight per day on an equal mixture of dry blue grama leaves and cattle manure. Keep in mind that in these lab studies the termites were in containers and did not have tunnels through which they could transport food to reproductives and immatures in underground chambers. It is not known whether these termites have a protozoa in their gut or special digestive enzymes that enable them to digest cellulose and lignin.

Desert termites are a "keystone species" in the ecosystems they inhabit in that they have an important impact on ecological processes, structure, and function. Their numbers and live weight biomass rivals or exceeds that of most all other animal species anywhere in the world. On shortgrass rangeland west of Post, TX the numbers of desert termites in the upper 1 foot of the soil profile averaged 19.1, 10.7, and

6.0 million per acre during March through October of 1972, 1973 and 1974, respectively! Their estimated live weight biomass was 103, 57, and 32 pounds/acre for these 3 periods. For comparison, one 1,000 lb cow on 20 acres is a live biomass of 50 pounds/acre. The calculated amount of food the termites consumed in each of these 3 years was 592, 330, and 185 pounds/acre. On the same site, control of the termites with insecticide increased standing crop of grass 22% and increased mulch accumulation 50% after 2 growing seasons. Termite-free plots had almost 3 times more mulch than termite infested plots after 4 growing seasons. Rainfall infiltration was greater on termite-free soil after the first 15 min. of simulated rainfall events. Runoff and sediment load in the overland flow was greater on termite-infested rangeland than on termite-free rangeland. These differences were associated with improved soil health on the termite-free range, including more organic carbon in the upper 1 cm of soil, increased capillary porosity, increased large soil aggregates, and increased surface mulch. Some "experts" speculate that belowground termite tunnels and chambers enhance rainfall infiltration, but we found the surfaces of termite tunnels and chambers are water repellent. They required 9.3 seconds to absorb a drop of water, compared to 1.7 second for the surfaces of adjacent soil peds! Termites are smart – they don't want their tunnels channeling water downward to flood their nurseries and food storage chambers!

Desert termite activity usually seems greatest to most folks during drought. Our research data shows just the opposite – there are more termites in the upper 1 foot of soil during years with good growing conditions and especially late in the growing season when good rains come following an extended dry period. Makes sense that an insect that needs high humidity levels to avoid dessication would do better when soil moisture levels are fairly high and when plants are rapidly growing. We did not study the role of desert termites in nutrient cycling, but common sense says they are major players. Their role could be a negative influence if they practice cannibalism, recycle their own feces, or store their dead and large amounts of shredded or digested food too deep to be reached by plant roots. In my mind, excessive removal of mulch by desert termites is detrimental for soil health. I feel it is more advantageous to leave more mulch on the soil surface for bacterial and fungal decay because the by-products of bacterial and fungal decay cause soil particles to adhere and form water stable aggregates and increase the organic carbon content of the surface soil layer. Termites can be so abundant that it sounds like you're walking on crisp potato chips as you step on their mud tubes and sheets. I've witnessed grass plants that are drought dormant and grazed to ground level use the scarce carbohydrate reserves in their crowns and roots to send up new tillers after summer rains, only to have the tender shoots immediately and repeatedly covered by mud tubes and totally consumed by desert termites – resulting in death of the entire plant if this occurs a few times. To my knowledge, little is known about the fecundity rate and population dynamics of desert termites, but I would wager that they will be thriving on this planet long after man is extinct. Many of their activities seem to propel our productive rangeland into the downward spiral of "desertification".

So, how do we manage desert termites? In our research, we used insecticide chlordane to control desert termites, but this compound was banned because of it's strong residual activity. Later, we evaluated fipronil bait formulations, but they were not impressively effective, and the chemical company was not interested in registering the product for use on rangeland because of the very high costs of registration. The few insecticides registered for control of other rangeland insects would not be expected to be very effective on insects that spend most of their time underground or within mud tubes or below mud sheetings. The information presented in this paper strongly supports the current

philosophy of grazing management, i.e., that “proper use” of grass means to graze only to the extent that half of the grass produced this growing season will be present at the beginning to the next growing season, let the livestock graze 25%, and budget the other 25% for consumption by insects such as desert termites, or trampling by hooves, and contamination by feces, urine, etc. In years or seasons when desert termites are exceptionally abundant there very well may be less than 25% available for consumption by livestock, so the termite activity must be closely monitored and stocking rates modified accordingly. In many year it may not be possible to “leave half” because of desert termites. Ranchers should realize that serious or complete removal of surface mulch and standing vegetation by termites will have a negative impact on forage production and livestock carrying capacity in the next year(s) because of reduced rainfall infiltration (the desertification cycle). Mechanical treatments that create surface roughness, such as contour ripping, furrowing, or diking installed on 15 to 30-foot spacings, can be very effective for enhancing deep rainfall infiltration. The goal of these treatments, which fill in over time, is to establish dense bands of grasses that will slow down surface runoff and facilitate deep infiltration.