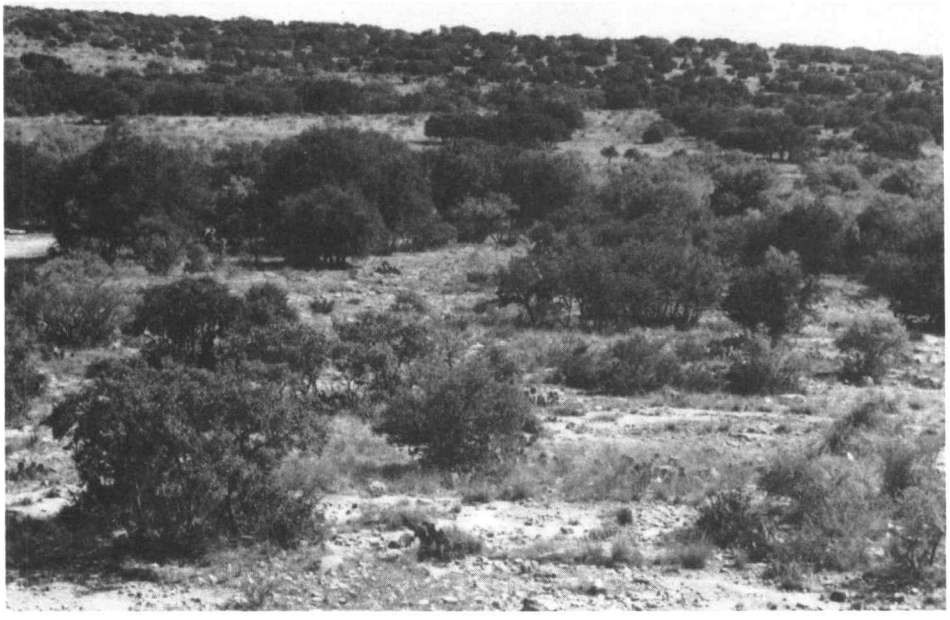

agement systems remained fairly constant. Midgrasses not only produce more grazeable forage than stoloneferous shortgrasses but they also help reduce surface runoff and erosion (Taylor et al. 1980, Thurow et al. 1987).

Research projects, on the Sonora Research Station, have closely examined the effects of livestock impacts under SDG on the soil hydrologic characteristics (McCalla et al. 1984, Warren et al. 1986a, Warren et al. 1986b, Thurow et al. 1986). These experiments were conducted on sites with bare soil (no vegetation cover) and on sites with a natural cover of vegetation.

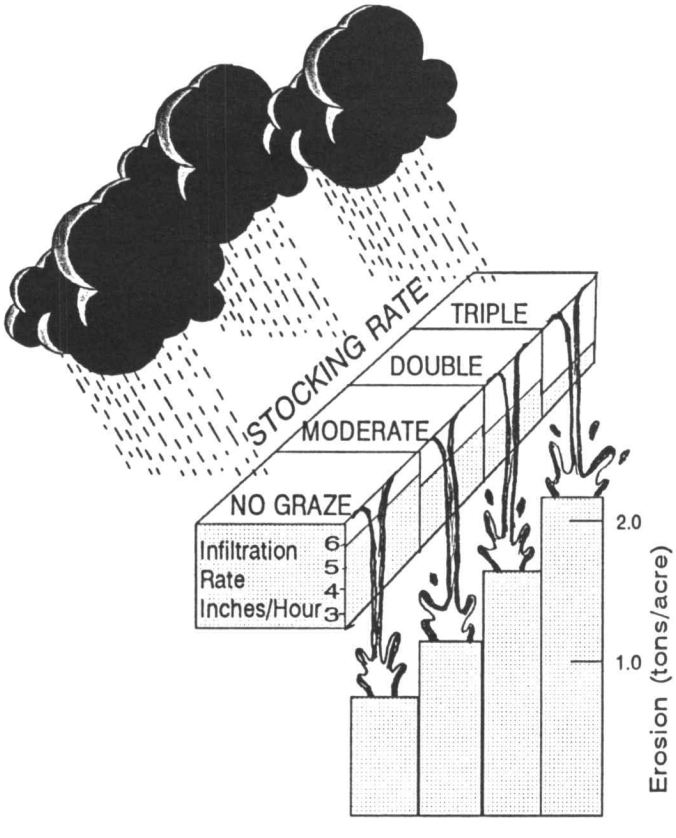

Fig. 3. *The Effects of Stocking Rate on Water Infiltration and Soil Erosion.*

In general, these studies indicated that infiltration rates were lower and sediment production (erosion) was higher for treatment pastures following short-term grazing periods in SDG compared to control pastures (no livestock) (Fig. 3). Thurow et al. (1988) attributed the majority of the treatment effect to the amount of plant cover. "The amount of cover was more important than the type, indicating that protection of soil structure from direct raindrop impact was the primary function of cover on infiltration." These results indicate that a minimum of about 300-500 lb/ac of total organic cover is necessary to reduce the harmful effects of raindrop impact and to provide enough obstacles to slow overland flow of water so that soil erosion is kept to a minimum.

The clayey soils on the Experiment Station, although subject to deterioration when abused, are resilient and if given proper management (i.e., moderate stocking rate, proper rest period) will recover. Livestock churning the soil with their hooves will further break down the remaining soil aggregates (Fig. 4). Therefore, in terms of SDG, three very important questions should be asked, "What is the optimum number of pastures needed, what is moderate stocking rate, and what is a proper rest period for soils of the Edwards Plateau?".

Our results indicate that in the Edwards Plateau, HILF grazing tactics should be employed during the major part of the growing season (May-September) to allow long rest perios for both the soil and vegetation to recover. For the dormant period of the year, SDG tactics can be employed to enhance livestock production, without damaging the warm-season midgrasses.

If breeding sheep and goats are part of the animal mixture, they should be removed from the grazing system during lambing and kidding season or they should be dispersed among all of the pastures and left until kids and lambs are large enough to travel with their dams without being separated. Annual forbs can represent a rather large portion of the vegetation complex during the late

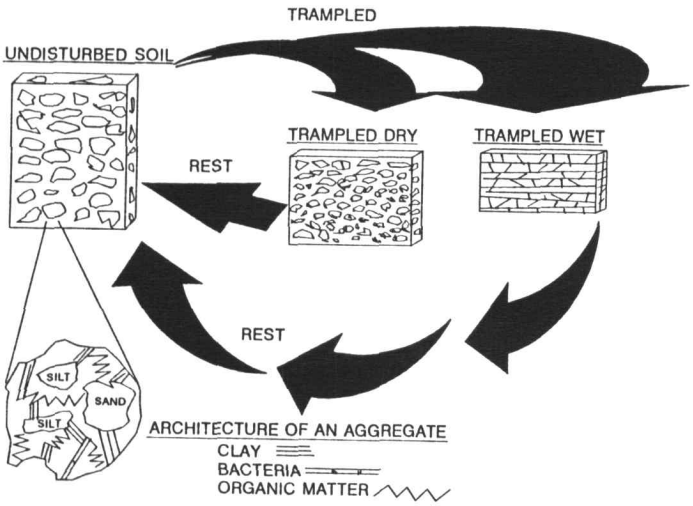

Fig. 4. *Conceptual Architecture of a Soil Aggregate and the Changes in Soil Aggregate Structure caused by Trampling under Wet and Dry Conditions.*

dormant and early spring period. We feel the most efficient way to harvest these plants is to disperse the sheep and goats over the entire grazing system and allow them to graze each pasture continuously. We believe that adopting this type of grazing system management in conjunction with moderate stocking rates will allow the resource manager to meet his goals of soil stability and vegetation improvement.

Based on our previous experience and research results we present the following conclusions relative to vegetation and soil response to intensive grazing systems:

* Rest, rather than intensive livestock activity, appears to be the key to soil hydrologic stability. Results indicate that a minimum of *90 days* of rest may be needed, under certain environmental conditions, for the soil to recover from intensive livestock grazing. Short rest periods of 50 days or less during this growing will favor the shortgrasses (Fig. 5).
* Expectations of rapidly improving deteriorated rangeland using SDG is a *false-positive* perception. Regeneration of preferred species will always be a slow process due to the presence of competing vegetation and influenced by precipitation, soil type, intensity and frequency of grazing, and length of deferment.
* SDG systems stocked at greater than moderate stocking rates significantly reduces the midgrass component of the vegetative complex.
* The protection of soil structure from direct raindrop impact is the primary function of cover on infiltration. A minimum of 300–500 lb/ac of total organic matter cover is necessary to reduce the harmful effects of raindrop impact. Midgrasses (i.e., sideoats grama, cane bluestem, Texas cupgrass) allow significantly greater amounts of water infiltration and significantly less amounts of soil erosion than short grasses (i.e., common curlymesquite, red grama, hairy tridens).

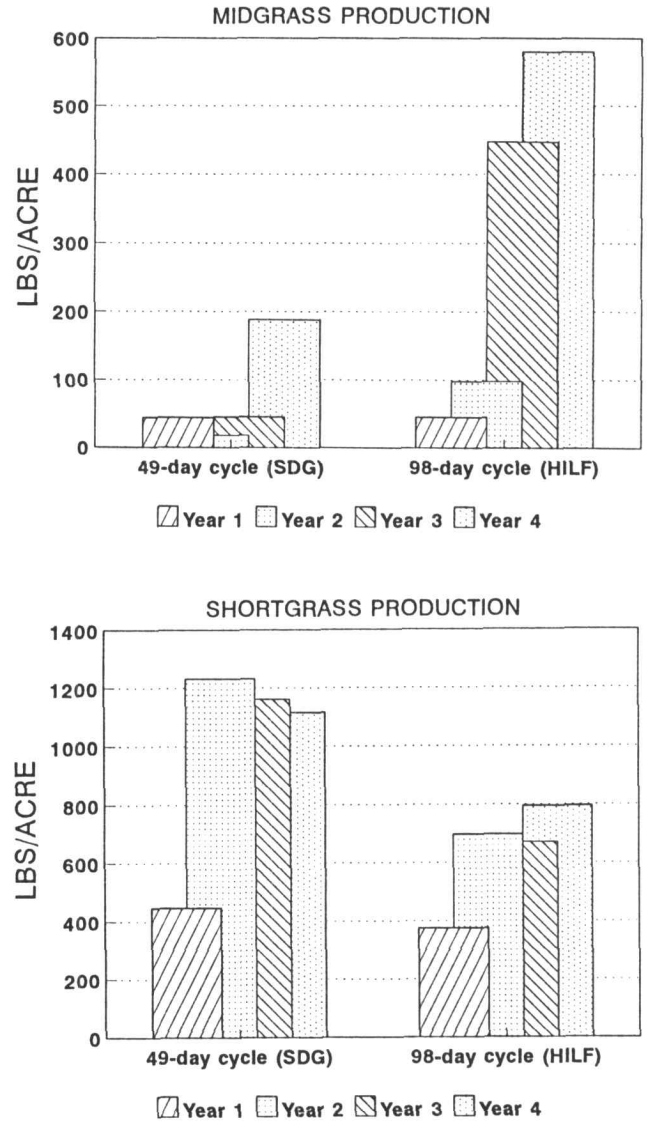

Fig. 5. *Midgrass and Shortgrass Production Measured from SDG and HILF Grazing Systems.*

* There is no evidence of any hydrologic benefit from livestock trampling or "hoof action". However, there is strong evidence that as intensity and frequency of trampling increases, soil hydrologic properties decrease.
* Infiltration rates are mostly reduced immediately after trampling. This would seem to accelerate drought conditions due to an immediate, mechanically induced decrease in infiltration rates due to trampling.

It must be remembered that the inherent low potential productivity of Edwards Plateau rangeland severely limits the alternatives available to ranchers to enhance productivity or correct management mistakes. Since recovery may be slow and expensive, grazing management on these ranges should be planned carefully to avoid mistakes that result in deterioration of the soils and vegetation.

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