USDA Agricultural Research Service
PASTURE SYSTEMS AND WATERSHED MANAGEMENT RESEARCH UNIT
FACT SHEET

MANAGING INTENSIVELY GRAZED PASTURES

Improving Drought Tolerance

The Forage and Grazing Lands Biodiversity Project is one of three major projects in the Pasture Systems and Watershed Management Research Unit at University Park, Pennsylvania. The mission of this unit is to conduct research leading to the development of land, water, plant, and animal management systems, which ensure the profitability and sustainability of northeastern farms while maintaining water quality.

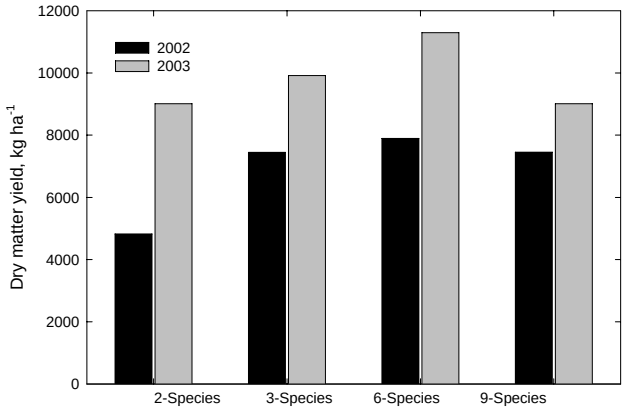
Background

Reduced forage production on pastures during periods of summer drought presents a significant risk to producers who are constantly searching for ways to reduce that risk. Considerable research suggests that increasing the number of species in pasture mixtures can increase and stabilize productivity under stressful conditions. Benefits from increased species diversity are often greatest under harsh environmental conditions and have been associated with several factors including:

- Improved utilization of scarce resources;
- Facilitation of the growth and survival of one or more species by a companion species;
- An increased probability of including the most productive species for a given environment

Important Findings

- Including more than two species in pasture mixtures increased yield under drought conditions but not when rainfall was adequate.
- Photosynthesis increased with increasing species number during the summer and fall when moisture was limited but not in the spring when drought stress was not present.
- Roots were distributed deeper in the soil profile with increasing species richness, thus improving access to deep soil moisture.
- Including species in pasture mixtures that exhibited specific desired attributes was more important in determining forage yield than was the actural number of species. All mixtures tended to lose species over time.

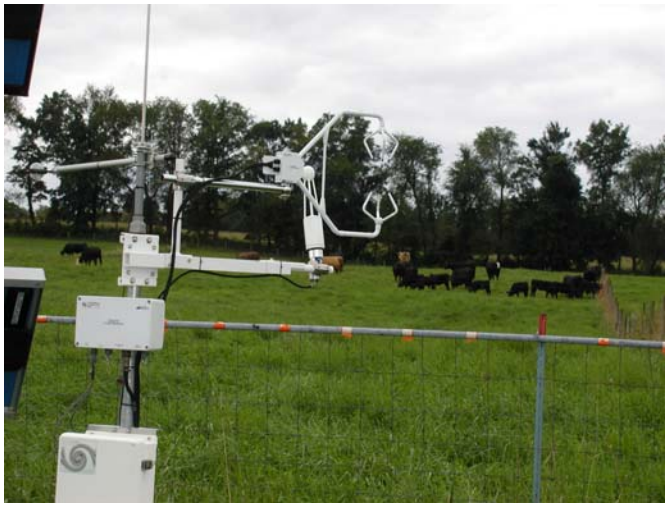


Practical Application of Results

Forage production during periods of summer drought can be increased by including additional species in the pasture mixture, especially if those species have desirable attributes such as improved water use efficiency or deep root systems. However, many relatively drought-tolerant species such as chicory or red clover are relatively short lived and will probably require periodic reestablishment for long-term realization of the benefits they can provide to pastures.

Prepared by the ARS Pasture Systems and Watershed Management Research Unit. For additional information contact Dr. Howard Skinner(814-863-8758); howard.skinner@ars.usda.gov; http://www.ars.usda.gov/naa/pswmru)

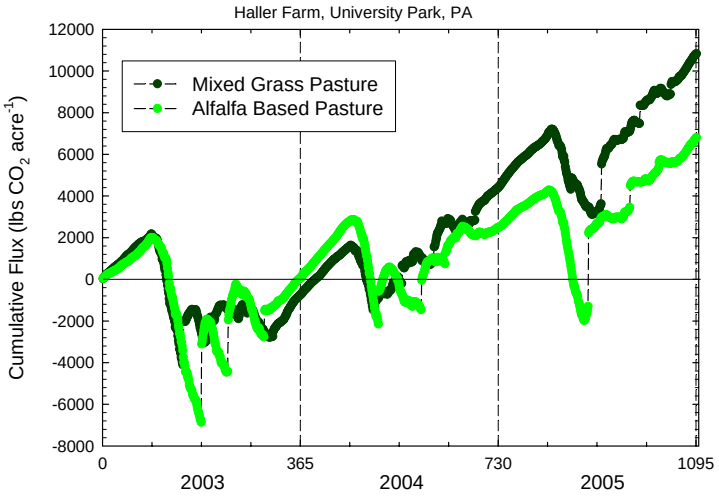
Carbon Sequestration in Mature Humid-Temperate Pastures



Background. Decades of plowing have depleted organic carbon stocks in many agricultural soils. Conversion of plowed fields to pasture has the potential to reverse this process, recapturing organic matter that was lost under more intensive cropping systems. Systems are being put into place to provide payments for practices that increase soil carbon. Pastures in the northeastern USA are highly productive and could act as significant sinks for carbon dioxide. However, such pastures have relatively high shoot relative to root growth, the majority of which is removed as hay or consumed by grazing animals. In addition, the ability of pastures to sequester carbon dioxide decreases over time as previously depleted stocks are replenished and the soil returns to equilibrium conditions.

Important Findings. We have monitored carbon dioxide (CO_2) gains and losses from two fields in Central Pennsylvania that have been managed as pastures for at least 40 years. Results are shown in the figure to the right.

- When biomass removal as hay or by grazing was taken into account, the pastures experienced a net loss to the atmosphere of about 1.4 ton CO_2 $acre^{-1}$ $year^{-1}$ (positive values represent loss to the atmosphere while negative values represent uptake by the pastures).
- Returning manure from the hay that was consumed off site would have partially replenished the lost carbon, but the pastures would have still experienced a net loss of CO_2.
- Heavy utilization of the biomass produced on these mature pastures prevented them from acting as carbon sinks.



Application of Results. Although good management practices following conversion to pastures can increase soil carbon sequestration, land managers must realize that limits exist to the amount of carbon that can be stored. Mature pastures and those that are heavily utilized, either by haying or grazing, can not be counted on to continuously accumulate soil carbon.