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Pasture Management for Sequestering Carbon

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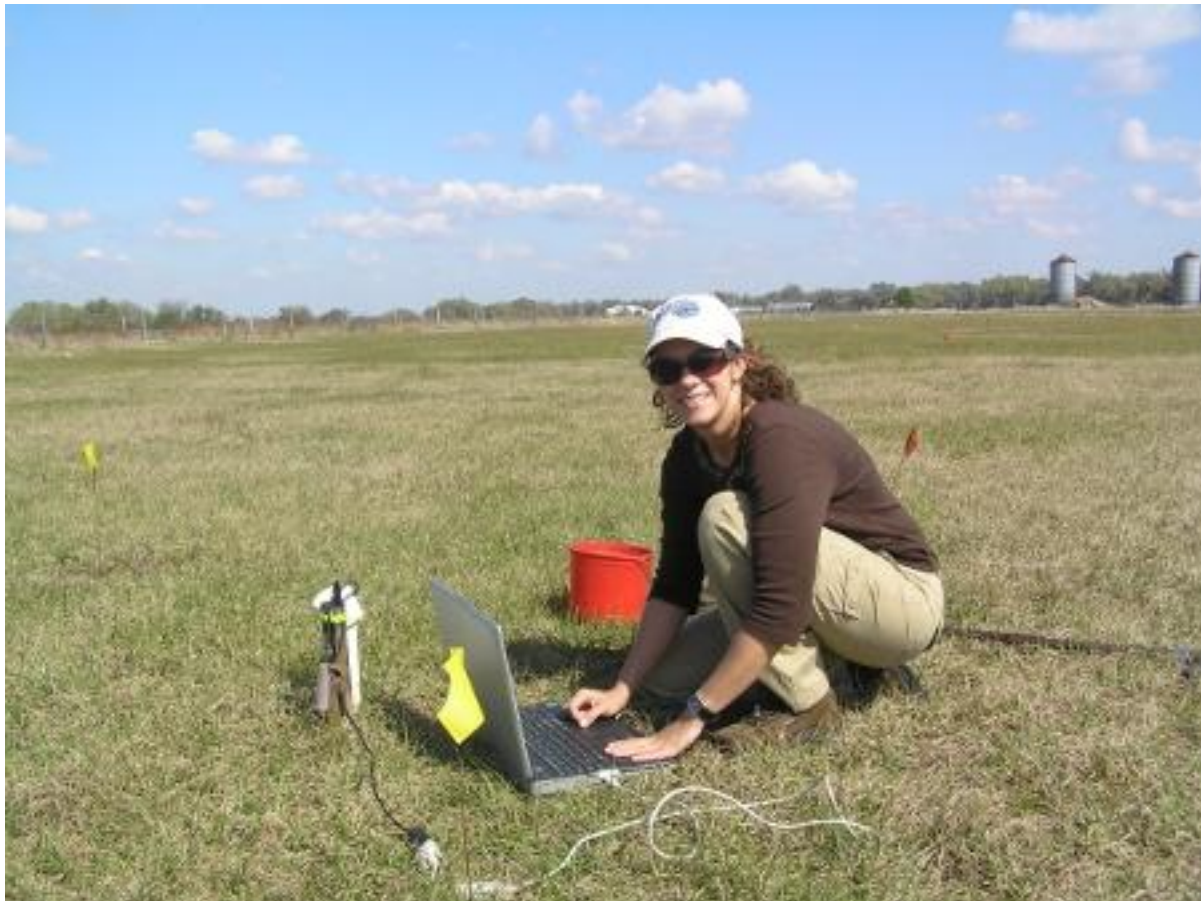
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Carbon sequestration refers to the process of transferring carbon dioxide (CO₂) from the atmosphere into the soil. A significant fraction of carbon stored in the soil is stable and, consequently, can remain in the soil for decades or longer. This process of transferring or “sequestering” carbon from the atmosphere helps off-set emissions from combustion of fossil fuel and other human-related activities. Over the past decade, U.S. agricultural soils overall have acted as a net sink of atmospheric CO₂, sequestering approximately 12 million metric tons of carbon per year. Although agricultural soils can also emit CO₂ to the atmosphere, adoption of best soil and cropping management practices improved the ability of agricultural soils to remove more carbon from the atmosphere than they release to it.

Pasturelands can be important sinks of atmospheric CO₂ and play a major role in the overall carbon cycle fluxes. Unlike tropical forests, where the majority of the carbon is the vegetation, as much as 90% of the carbon pools in pastures are located in the soil. Hay and pastureland tend to have high carbon inputs because perennial grasses allocate a large portion of the carbon in the root system. Researchers have estimated that from 29.5 to 110 million metric tons of carbon can be annually sequestered in grazing lands in the USA. Because the extensive area that native and improved pasturelands encompass in the U.S., very small changes in the amount of carbon sequestered in pastureland soils have significant consequences in the global carbon cycle. Reports have shown that an increase (or loss) of only 1% of the soil carbon in the top 4 inches of grazing land soils is equivalent to the total carbon emissions from all U.S. cropland agriculture. This trend underscores the importance of pasturelands to potentially help mitigate global atmospheric CO₂ emissions.

Current pasture management strategies such as fertilization strategy and grazing management are generally aimed at increasing forage production. However, pasture management can also promote carbon storage in the soil. In fact, most techniques used to improve forage production can also promote carbon inputs to the soil and, consequently, increase soil carbon sequestration. For instance, fertilization, irrigation, grazing management, fire regimen, introduction of legumes, and use of improved grass species can boost plant productivity while promoting soil carbon sequestration. Numerous studies have shown that when low-fertility soils receive fertilizer or lime, forage productivity and soil carbon levels generally increase.

Carbon sequestration rates vary by climate, topography, soil type, management history, and current practices. Pastureland in the eastern U.S. receives more precipitation and, consequently, has a greater potential to respond to management inputs as compared to arid and semi-arid rangelands. Because of the warm climate and ability to grow crops year round, pastures in Florida offers a unique opportunity to sequester large amounts of carbon. On the other hand, global estimates showed that a significant portion of pastureland area is being replaced by more intensive agriculture and urban development. This is particularly true in Florida, where urban development is increasingly competing with natural resources for land. Thus, continuation of this trend is expected to have major impacts on regional climate, potential future carbon sequestration, and greenhouse gas emissions.



Studies are currently being conducted at the Range Cattle REC to evaluate the potential of pastures in Florida to sequester carbon. Our preliminary results showed that N fertilization can promote soil carbon sequestration in intensively managed bahiagrass pastures. Our data also showed that grazing intensity can have major impacts on soil carbon accumulation. Although intensive grazing is often associated with reductions in soil carbon concentrations, proper grazing management can result in greater soil carbon concentrations than non-grazed systems. In addition, because of the increasing global demand for alternative energy sources, pasturelands may also become an important source of biomass fuel. This trend can further enhance the importance of pastures in terms of global carbon sequestration potentials. We are currently evaluating the potential of different perennial bioenergy crops to sequester soil carbon. We hope that in the near future research will help identifying pasture management strategies that promote long-term carbon sequestration and also enhance the economic feasibility of carbon sequestration in pasturelands in Florida.