UF/IFAS Range Cattle REC Long-Term Agroecosystem Research (LTAR) Research Updates

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In 2011, the U.S. Department of Agriculture (USDA) established the Long-Term Agroecosystem Research (LTAR) network, with the mission of developing long-term, transdisciplinary research to address national and local agricultural priorities and advance the sustainable intensification of U.S. agriculture. The University of Florida, Range Cattle Research and Education Center, in partnership with Archbold Biological Station, is one of 18 sites nationwide in the LTAR network (https://ltar.ars.usda.gov) (**Figure 1**). The Archbold-UF interdisciplinary team with expertise in soil, agronomy, animal sciences, wildlife, and ecology addresses research questions related to management and sustainability of native and cultivated pastures in subtropical regions. Since joining LTAR, the Archbold-UF site has developed strong collaborations with other scientists across the network, making our research efforts more impactful and meaningful.

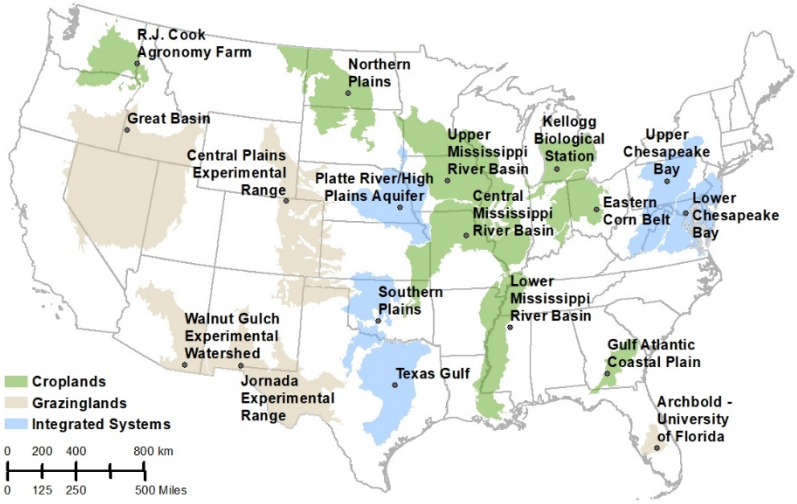

Figure 1. *The map above shows locations and main commodities (croplands, grazinglands, and integrated systems) associated with the current LTAR sites.*

The main research emphasis at the Range Cattle REC under the LTAR project involves management of native rangelands. This ecosystem is dominated by saw-palmetto, but it has more than 300 plant species that provide pollen for insects, habitat for wildlife and threatened species, among many other ecological and social benefits. Florida ranchers often use native rangelands as a source of forage for beef cows, thus making this ecosystem an important component of beef cattle production in the state. However, despite its ecological and economical importance, the area occupied by native rangelands has been severely threatened by conversion into urban and suburban areas. Most previous research on rangelands has been mainly focus on the nutritional value of rangelands to beef cattle. More recently, research efforts have also been focused on other important aspects of rangelands, such as carbon cycle, nutrient balances, and wildlife; however, research addressing these topics in Florida's native rangelands remains limited. Therefore, quantifying the agroecological benefits provided by rangelands is imperative to aid conservation.

Historically, natural fires were a normal occurrence in South Florida's rangelands; however, increased urbanization and development have interrupted this natural pattern. Prescribed fire (also known as controlled burning) along with mechanical control represent the most common management tool used by ranchers to control saw-palmetto and other shrubs species and increase biomass of desirable grasses for cattle. The LTAR team at the Range Cattle REC is currently evaluating how frequency of prescribed fire combined with mechanical chopping affect soil, vegetation, and greenhouse gas responses in southern Florida rangelands. Our experimental site, which consists of ~ 980 acres of native rangelands, represents one of the few long-term, large-scale studies dedicated to study multiple ecosystem responses to prescribed fire. Treatments were imposed in 2019 and will continue to be implemented as the study progresses (**Figure 2**).

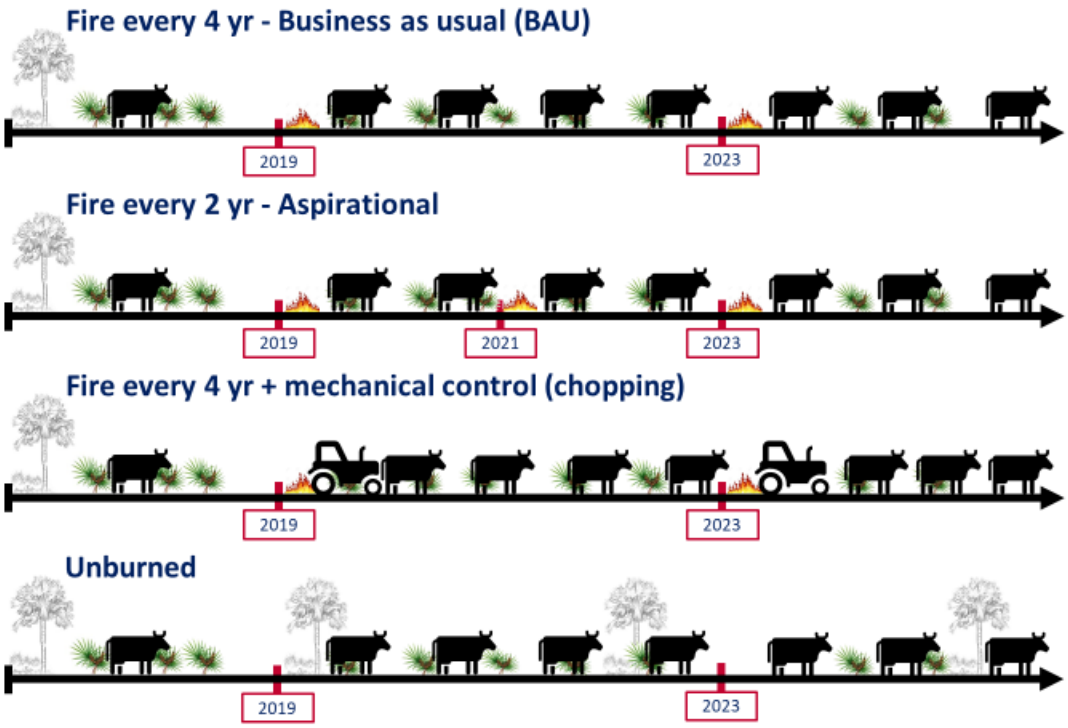

***Figure 2**. Treatments being evaluated at the Range Cattle REC LTAR site: (from top to bottom): fire every four years (also referred to as business as usual, since it represents typical*

management practice in region), fire every two years (also referred to as aspirational), fire every four years followed by chopping, and unburned.

Short-term responses to fire are currently being investigated. For instance, we are particularly interested in knowing how biomass and plant composition are affected by fire and chopping. Our data indicated that after just four to five months after fire was imposed in 2019, biomass of burned areas was similar to that of unburned (around 3820 lb/acre), indicating that vegetation recovers quickly after burning. When mechanical control was applied, biomass was reduced by approximately half (2250 lb/acre) of that from other treatments. Both fire and chopping decreased the proportion of saw-palmetto in total biomass at the time of biomass collection (~50% compared to 73% in unburned treatments). Burning also increased proportion of desirable grasses such as lopsided Indiangrass and chalky bluestem compared to unburned areas (11% compared to 2%, respectively), which would be advantageous for producers using native rangeland for cattle grazing. After chopping, however, there were proportionally more forbs and undesirable grasses than in any other treatment. Forbs represented 25% of total biomass after chopping compared to only ~7% in the burned and unburned areas, while undesirable grasses (such as wiregrass) were 21% after chopping and 8% in burned and unburned. These findings are illustrated in **Figure 3**.

Figure 3*. From left to right: vegetation in unburned, burned, and burned and chopped areas. Pictures were taken four to five months after treatments were imposed. In unburned areas, saw-palmetto is the predominant species (left). Although burned areas had similar biomass as unburned treatments, a greater proportion of desirable grasses (center) was associated with this treatment. Chopping after fire resulted in less biomass, and proportionally more forbs and undesirable grasses than in the other treatments (right).*

A number of responses of agroecological importance are currently being collected at the Range Cattle REC LTAR experiment. We are currently quantifying the effect of fire and chopping on plant productivity, composition, and nutritive value, soil nutrient dynamics, nutrient cycling and litter decomposition, animal performance, soil carbon storage, and greenhouse gas (carbon dioxide, nitrous oxide, and methane) emissions. The experimental area is also equipped with an Eddy Covariance Tower (**Figure 4**) that continuously quantifies ecosystem carbon and water flows. This sophisticated equipment also enables us to quantify net carbon dioxide (CO_2) exchange, which determines whether an ecosystem acts as a sink or source of carbon. Data

obtained from the last 4 years indicated that native rangelands are carbon sinks, which means the ecosystem retains more carbon than it releases as carbon dioxide to the atmosphere. Even in the years when prescribed fire was applied, native rangelands still acted as a carbon sink, although the amount of carbon dioxide removed from the atmosphere was lower than in other years. These data further support the important role of fire to maintain the ecological function and sustainability of native rangelands in Florida. Multi-site, long-term research is key to understand the complex relationships among land use, land management, agricultural production, and the important ecosystem services associated with native and cultivated pastures. Our team hopes to continue our long-term research efforts in this area and looks forward to expanding our collaborations with other institutions, stakeholders and commodity groups interested in sustainable intensification of agricultural production.

Figure 4*. Eddy Covariance Tower located at the Range Cattle REC LTAR experiment. This equipment was acquired in 2016 and has been continuously collecting data on ecosystem carbon and water flows, water table depth, temperature, soil radiation, rainfall, wind speed and direction every 30 minutes.*