UF/IFAS Range Cattle Research and Education Center
Research Update 2024

The UF/IFAS Range Cattle Research and Education Center has a long history of service to the Florida Cattlemen. Since 1941, our research efforts have focused on relevant problems impacting beef production throughout Florida. We focus upon important issues spanning a broad scope of overlapping topics relevant to Florida's grazinglands such as forage and pest management, soil fertility and water quality, beef cattle management, wildlife, and beef cattle and forage economics.

Presently, the Center has 7 faculty programs with 24 support staff. In addition to research and extension projects, the Center's faculty mentor many MS and PhD graduate students and international exchange scholars and student interns. This article provides a highlight from each of the Center's faculty regarding work they are presently conducting in response to the research priorities of the Florida Cattlemen's Association.

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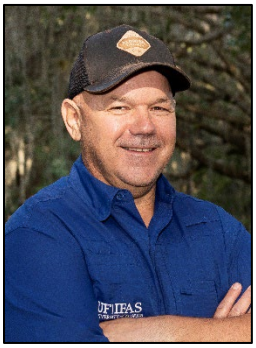
Brent Sellers, Professor and Center Director
Temnotfo "Tenzy" Mncube, Postdoctoral Associate/Visiting Scholar
Pasture and Rangeland Weed Management



It's probably suffice to say that cogongrass doesn't need an introduction since it is found on almost every ranch throughout the state. Cogongrass invades and persists in pastures through several survival strategies including an extensive rhizome system, adaptation to various soil conditions, drought tolerance, prolific seed production, and adaptation to fire. Additionally, it is typically unpalatable to livestock because it accumulates silicates along the leaf margin, making leaves hard and razor sharp as the plant matures. Unfortunately, many of us wait until an invading patch of cogongrass is well established before we recognize it as a problem in our pastures.

Control of cogongrass has been studied for many years by researchers world-wide. Nearly all available herbicides have been tested on cogongrass, but few have been effective. For example, almost all of the commonly used pasture herbicides have no activity on cogongrass. Only

glyphosate (Roundup, etc.) and imazapyr (Arsenal, Stalker, etc.) herbicides have been found to be effective, but long-term control is rarely achieved with a single application. Additionally, both are non-selective when applied at the recommended rates to control cogongrass.

In a recent literature search on cogongrass management, we came across some data from the mid-2000's. The research found that low rates of imazapyr resulted in significant above-ground cogongrass kill, but bahiagrass groundcover was relatively unchanged in a reclaimed phosphate mine ecosystem. The question became – can we see the same results in a managed bahiagrass pasture? A trial was initiated in November to get some preliminary data on cogongrass control and bahiagrass injury. Imazapyr (Arsenal 2 SL) was applied at 8, 16, and 32 oz/A in November on established cogongrass and relatively new patches of cogongrass. Since we do not expect cogongrass to be controlled with a single application of imazapyr at the lower application rates, a sequential application will be applied in November 2024 to monitor cogongrass growth and bahiagrass injury in 2025.

Cogongrass was slow to respond to the imazapyr as all rates provided less than 50% control 3 months after treatment; unfortunately, bahiagrass injury ranged from 60 to 85%. Thankfully, bahiagrass started to regrow and cogongrass control increased as daytime air temperatures increased coupled with timely rainfall. Cogongrass control averaged 55, 75, and 82% with imazapyr applied at 8, 16, and 32 oz/A, respectively, at 6 months after treatment. There was no bahiagrass injury with imazapyr at 8 and 16 oz/A, but injury ranged from 0 to 55% at 32 oz/A at 6 months after treatment.

Overall, we were excited to see the results 6 months after treatment. It will be interesting to continue to research this concept and incorporate soil fertility (pH and fertilization) and potentially grazing management. We could also potentially use artificial intelligence to identify and treat newly invading patches.

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Figure 1. Response of established cogongrass to imazapyr 6 months after treatment. Photographs represent individual treatments including the non-treated control (A), and Arsenal applied at 8 oz/A (B), 16 oz/A (C), and 32 oz/A (D). Note that there is little bahiagrass in these plots; however, bahiagrass regrowth is occurring in plots treated with 8 and 16 oz/A.

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Hance Ellington, Assistant Professor
Rangeland Wildlife Ecology

Historically, coyotes mainly occurred west of the Mississippi River. However, in response to land use changes and the loss of large carnivores in eastern North America, the coyote distribution has expanded eastward. Coyotes first arrived in Florida in the 1960s and 1970s and began rapidly expanding across the state, reaching the Florida Keys by the late 1990s.

Coyotes are medium sized carnivores (20 - 40 lbs.) that are highly adaptable. Because coyotes can live in most landscapes and can eat a wide variety of foods, it can be difficult to get a clear picture of how they use space or the consequences of their space-use choices. Coyotes are relatively common in Florida and, therefore, are more likely to be involved in human-wildlife conflict and can have a large impact on ecosystem dynamics. Coyotes can impact population abundance of important game species (e.g., wild turkey and white-tailed deer) and can be a predator of livestock.

If we can better understand the behavior of coyotes, such as how and why they use the areas they use, we can better understand what impact coyotes have on our important game species. Understanding the coyote ecology in Florida's unique landscape can also help us to better develop strategies that minimize negative interactions with coyotes, including reducing the risk of calf predation.

An exciting new project in the Rangeland Wildlife Ecology Lab, the DeLuca Coyote Project at the DeLuca Preserve, aims to provide this much-needed insight into coyote behavior and space use in Florida's rangelands.

The UF/IFAS DeLuca Preserve in Osceola County has rangelands, wetlands, oak hammocks, and pine flatwoods. It also supports around 1,000 cattle and large populations of white-tailed deer, wild turkey, and bobwhite quail.

Beginning in January 2024, in partnership with the USDA Wildlife Services, our team captured 15 adult coyotes at the DeLuca Preserve and deployed GPS telemetry collars with accelerometers on these animals before releasing them. These collars allow us to monitor coyote location every 15 minutes and coyote head movement every 5 seconds. We can then use advanced statistical models to understand coyote behavior. For example, the movement path and head position of a coyote traveling along its territory boundary looks very different from the movement path and head position of a coyote searching, chasing, and capturing a rabbit.

One of many potential outcomes of this research will be to determine when and how often coyotes display hunting and foraging behaviors in pastures with calves at DeLuca. Even if such coyote behaviors do not result in calf loss, they could induce stress and reduce calf growth rate. Ultimately, a more complete picture of how coyotes behave and move in Florida's rangelands is

an important first step in being able to understand the impact of coyotes on livestock production and to develop strategies that reduce the risk of human-wildlife conflict.

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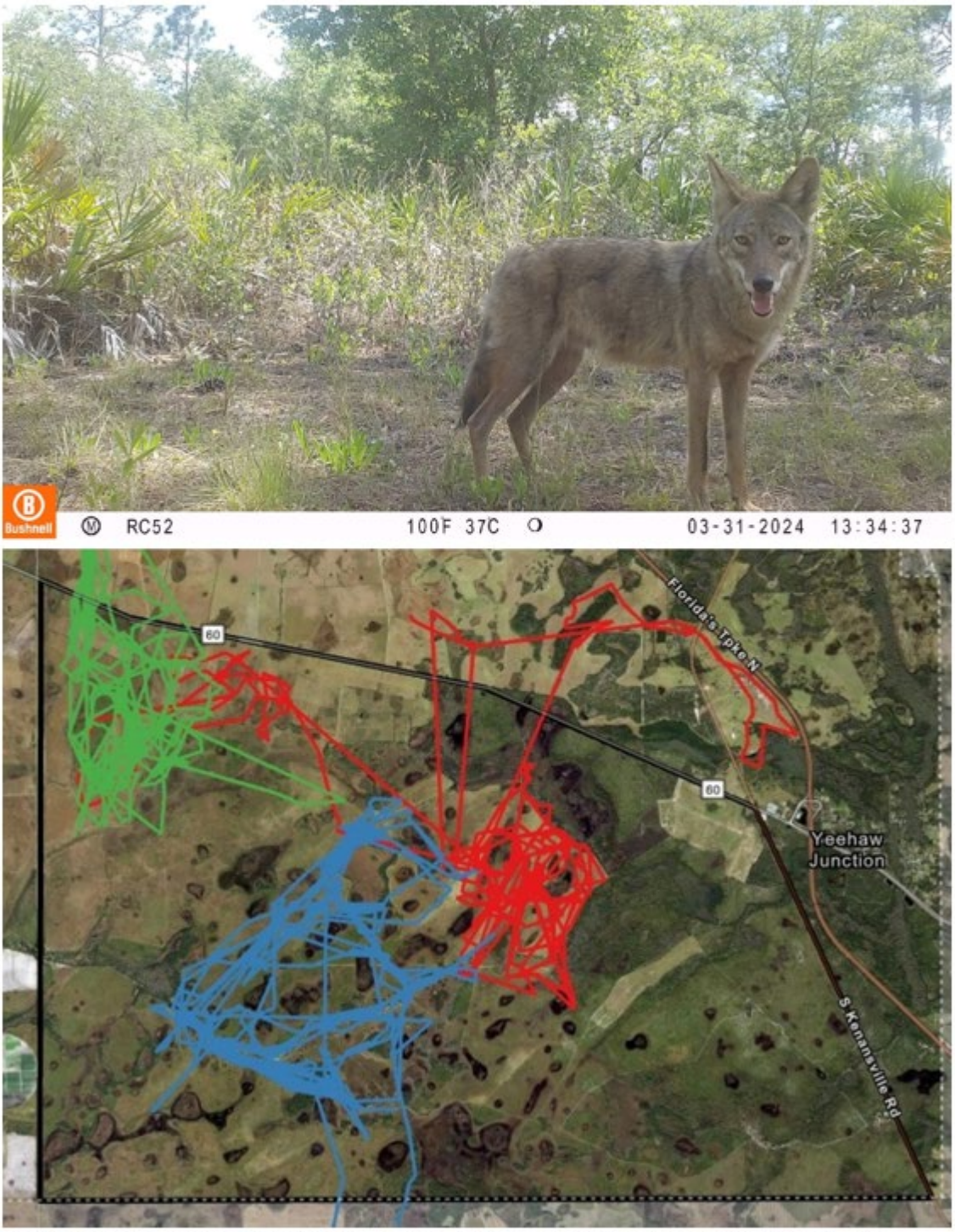

Figure 1. Coyote at the Range Cattle REC (top) and movement paths of three coyotes at the DeLuca Preserve in February 2024 (bottom).

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Golmar Golmohammadi, Assistant Professor
Watershed Hydrology and Water Quality

Artificial Intelligence (AI) for Water Resources Management Forecasting

The advent of artificial Intelligence, an emerging transformative technology, has permeated every aspect of our lives, from computer vision to healthcare and now the environment. Artificial intelligence (AI) technologies and machine learning (ML) algorithms are expected to revolutionize environmental health, improve efficiency, and reduce costs.

Recent advancements in AI techniques have shown promising potential in improving the accuracy of hydrological forecasting. With their ability to capture complex nonlinear relationships and temporal dependencies in data, these models are well-suited for predicting hydrological variables.

The climate drives the hydroclimatic characteristics of an area, affecting the availability of natural resources, soil health, the functioning and services of ecosystems, and human health. AI could help understand the complex relationships between the earth's climate, soil, and water processes. AI, with its ability to learn from databases, make predictions, and automate decision-making processes, presents a compelling solution to the multifaceted challenges of climate, soil, and water management. Therefore, AI can potentially improve forecasting environmental parameters at the field and regional levels, such as soil, water, and climate.

The main goal of our AI research in Florida is to introduce new AI techniques to predict all parameters of climate, soil, and water. With the available Florida hydrology database, we have started research that uses advanced AI methods to predict the most examined meteorological, hydrological, and hydrogeological fields (i. e., precipitation, temperature, stream flow, groundwater level, soil moisture, and soil temperature).

Forecasting Surface Water Discharge and Groundwater Levels using AI Methods
Accurately forecasting surface water discharge and groundwater levels is crucial for effective water resource management and planning, particularly in regions like Florida, where water resources are pivotal in supporting the local ecosystem and economy.

We investigated the applicability of AI and ML models in forecasting daily surface water discharge and groundwater levels across 45 stations in Florida. Our study introduced and validated a novel hybrid model for forecasting surface water discharges and groundwater levels

in Florida. The findings of this research have the potential to inform the development of more accurate and reliable hydrological forecasting models, which are crucial for sustainable water resource management in the face of changing environmental conditions and increasing water demands.

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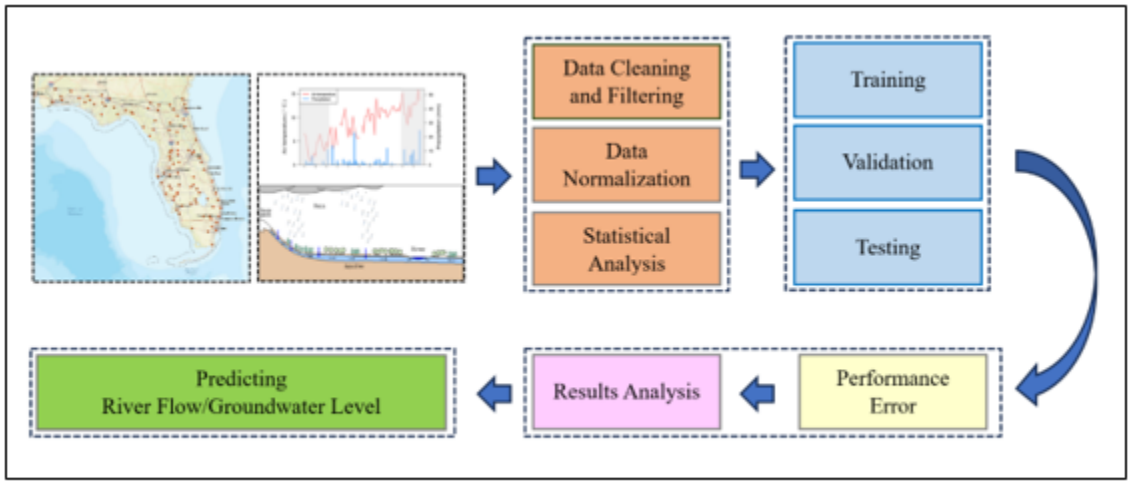

Figure 1. Schematic Diagram of AI Models to Forecast Hydrological Parameters

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Philipe Moriel, Associate Professor
Beef Cattle Nutrition and Management

Traditional guidelines typically suggest that beef heifers should achieve 60 to 65% of their mature body weight to optimize reproduction. Subsequent studies contradicted those guidelines and showed that overall reproductive performance of *Bos taurus* heifers did not differ when they achieved between 50 to 70% of their respective mature BW at the start of the breeding season. However, a previous study conducted at the Range Cattle Research and Education Center reported greater attainment of puberty at the start of the breeding season and greater overall pregnancy rates when *Bos indicus*-influenced beef heifers (Brangus crossbred) achieved 73% compared to 64% of mature BW at the beginning of the breeding season. Therefore, our group performed a retrospective analysis of 5 studies (2011 to 2022) and evaluated the effects of body weight and synchronization protocols before the start of breeding season on reproduction of *Bos indicus*-influenced beef heifers. Data was collected from 594 Brangus crossbred heifers weaned on average at 280 ± 26 days of age, allocated to bahiagrass pastures,

and supplemented with soybean hull-based concentrate (0.5 to 1.8% of BW; dry matter basis) from 2 weeks post-weaning until the end of the breeding season (189 ± 24 days of supplementation). Heifers were initially sorted into those that were or were not assigned to an estrous synchronization protocol (**SYNC** or **NOSYNC**) before the start of the breeding season. Within each synchronization group, heifers were sorted into those that were below (**BE**) or above (**AB**) 650 lb, which represents approximately 65% of mature body weight at the start of the breeding season (n = 130, 126, 146, and 192 for NOSYNC+BE, SYNC+BE, NOSYNC+AB, and SYNC+AB heifers, respectively). Heifers not assigned to an estrus synchronization protocol and weighing less than 65% of mature BW at the start of the breeding season (NOSYNC+BE) had the lowest puberty attainment, whereas heifers that were estrus synchronized and weighing more than 65% of mature BW (SYNC+AB) at the start of the breeding had the greatest puberty attainment (Figure 1). In this dataset, the use of estrus synchronization did not improve final pregnancy percentage of heifers but increased the percentage of heifers bred early and calving within the first 30 days of the calving season (Table 1). We also observed that, regardless of synchronization assignment, heifers weighing more than 65% of mature BW at the start of breeding had greater pregnancy and calving percentages compared to heifers weighing less than 65% of mature BW (Table 1). Our retrospective analysis indicates that heifers can be estrus synchronized to optimize their puberty attainment and calving distribution. These data also shows that *Bos indicus*-influenced beef heifers should still be developed to achieve over 65% of mature body weight at the start of the breeding season to improve their reproductive success.

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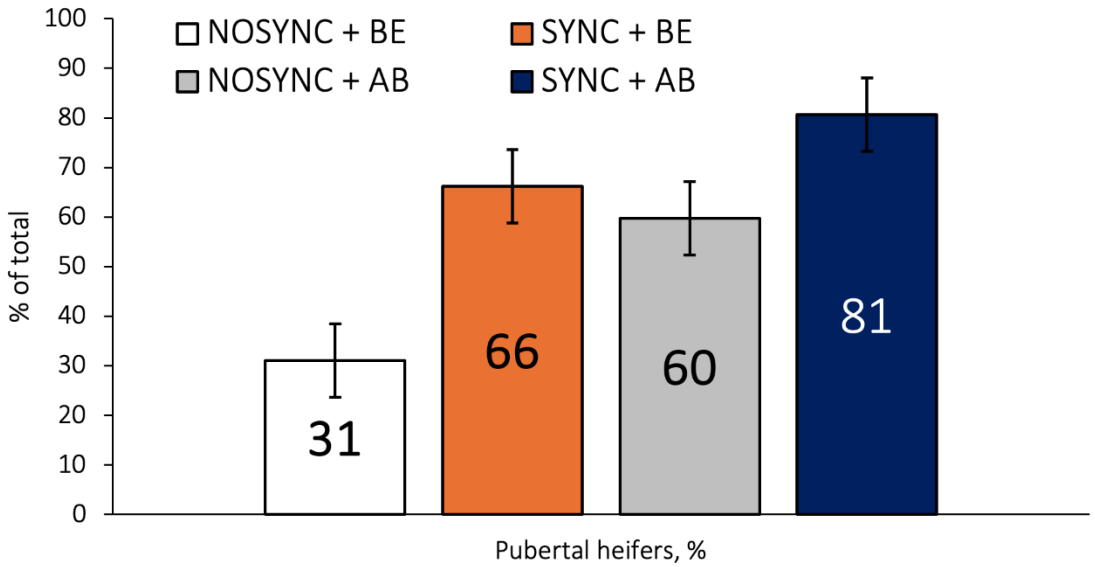

Item	Synchronization		P-value	% of mature body weight at breeding		P-value
	NOSYNC	SYNC		<65%	>65%	
Number of heifers	276	318		256	338	
Body weight, lb						
Start of breeding	655	655	0.97	601	709	<0.01
End of breeding	765	767	0.84	710	822	<0.01
Pregnant, % of total	75.0	74.1	0.87	67.8	81.4	<0.01
Calving, % of total	67.5	70.5	0.59	62.7	75.3	<0.01
Pregnancy loss, % of total	6.8	3.7	0.27	5.1	5.4	0.87
Calving distribution, % of total						
First 30 days	54.8	66.2	0.10	58.4	62.6	0.50
Second 30 days	27.8	27.3	0.94	28.0	27.2	0.89
Third 30 days	18.5	6.40	0.01	13.9	11.0	0.46

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Maria Silveira, Professor
Soil and Water Science

Evaluating the agronomic and environmental impacts of new FL-DEP biosolids rule

Biosolids are an effective source of crop nutrients and organic matter; however, public pressure has led to policies that further restrict biosolids applications in Florida. Based on the new FDEP Rule 62-640, Florida Administrative Code effective on June 21, 2021, biosolids must be applied at rates so that they do not exceed phosphorus (P) requirements for the particular crop. This policy significantly limits the amount of biosolids that can be recycled in pastures in Central and South Florida. Although limited information currently exists regarding forage production and nutritive value responses when biosolids are applied at reduced (P-based) rates, our data demonstrated that such low rates are unable to supply adequate amounts of N and other essential nutrients to sustain adequate forage production (Vieira et al., 2023). That implies that ranchers will have to supplement pasture fertilization with inorganic fertilizers, which typically cost more and have greater environmental risks than biosolids. Currently there is no scientific study demonstrating the link between land application of biosolids and water quality degradation in Florida. Our previous work (Silveira et al., 2019, Lu et al., 2019, 2020, 2021) demonstrated that prudent nutrient management is possible even on biosolids-amended Spodosols with high water tables. Pastures in Florida are typically low-input systems and have been historically under-fertilized and often overgrazed. Biosolids can be valuable resources to improve the sustainability of degraded pastures and to restore ecosystem functions. Data from a recent paper from our group demonstrated negligible amounts of

phosphorus were released from biosolids-amended soils (Vieira et al., 2024). This response was mainly to the appreciable amounts of aluminum (Al) and iron (Fe) added with biosolids that reduce soil phosphorus solubility. Phosphorus leaching from biosolids-amended soil were 45% less than unamended pastures. Our data also suggests nutrients in biosolids cannot be substituted for those in commercial fertilizer on a pound-for-pound basis, because not all biosolids-derived nutrients are readily available to a crop in the year of application. Field-scale trials are essential for accurate assessment of the risks and benefits of land application of biosolids to pastures in Florida. Current projects in this area includes rainfall simulation, greenhouse and field studies focused on evaluating the agronomic and environmental impacts of biosolids application. Our group also maintains the only long-term, fully instrumented field site in Florida addressing these important topics. We expect that this project will generate science-based information regarding the benefits of biosolids recycling programs to pastures in Florida, such as soil organic matter accumulation and carbon sequestration while also reducing dependence on commercial fertilizers.

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Joao Vendramini, Professor
Forage Management

Spodosols are the dominant soil type in South Florida and a large proportion of these soils are poorly drained during the growing season due to the relatively shallow water table and intense rainfall. Limpograss is the most cultivated forage in poorly drained soils in Florida and has several desirable characteristics, such as superior winter growth and digestibility. However, limpograss is propagated by vegetative plant material and there are several limitations of planting vegetative material, such as unpredictable climatic conditions to produce vegetative plant material, logistics of transporting vegetative material between locations, and machines and labor required for planting. In addition, limpograss is the only improved warm-season perennial grass adapted to poorly drained soils in Florida. If there is an unexpected occurrence of pests or diseases with significant reduction in limpograss production and persistence, beef cattle producers may face a severe shortage of forage due to the lack of genetic variability and different species adapted to poorly drained soils.

The Center for International Tropical Agriculture in Colombia released a series of new cultivars with perceived tolerance to poorly drained soils. It is indicated that these cultivars are tolerant to acidic soil pH and persistent under heavy grazing by livestock. However, there is limited scientific evidence of the production, nutritive value, and persistence of these new forage cultivars in Florida. A new research project was established at the Range Cattle REC – Ona to

test six new seed-propagated warm-season perennial grasses under different grazing intensities (5- or 10-inches stubble height). Plots were established in 2023 (Figure 1), the experimental period started in May 2024, and preliminary results will be presented at the 2025 Beef Cattle Short Course.

Sunn hemp is a warm-season legume that has been widely used as cover crop in the USA; however, there is interest to use sunn hemp as forage for beef cattle in Florida. A series of studies were conducted at the Range Cattle REC - Ona and we concluded that sunn hemp may result in reduced forage intake and animal performance due to the presence of alkaloids. Cattle consuming sunn hemp did not have increased levels of acute-phase proteins in the blood, indicating that the animals were not subject to metabolic disorders.

Sunn hemp can be overseeded with bahiagrass at establishment and will provide extra forage production and atmospheric N input to the newly established bahiagrass. The stand should be grazed at approximately 6 - 8 weeks after germination to avoid overgrow of sunn hemp and shading the bahiagrass seedlings.

Sunn hemp can be preserved as hay; however, thick stems require long drying periods after harvest (7 - 10 d), which may cause shedding of the leaves and reduced nutritive value. Silage or haylage may be viable alternatives but it is recommended to treat the silage with propionic acid (0.5% v/w) for adequate fermentation and preservation.

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Figure 1. Seed-propagated warm-season perennial grasses tested at the Range Catte REC – Ona.

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Hannah Baker, State Specialized Extension Agent II
Beef Cattle and Forage Economics

Gathering and shipping calves can make for an eventful and exciting day as this is the day every producer works towards all year. The end goal when shipping these calves is to have as many heavy and healthy calves as possible to maximize revenue. Achieving this goal involves purposeful management of the cow herd before shipping day. There are many factors that contribute to reproductive efficiency, but a solid nutrition plan is one of the most important. Research indicates that supplementing during the pre-calving season increases pregnancy rates and the chances of cows calving earlier in the calving season. Increased pregnancy rates improve weaning rates, resulting in more calves to sell. Older calves will be heavier at weaning, resulting in more pounds to sell. Increasing pregnancy rates and weaning weights helps in achieving the goal of maximizing revenue.

Managing a cow herd involves many variable expenses such as pasture management, hay, supplement, meds, breeding, labor, and minerals. So, it can be overwhelming when looking to alter a supplement plan that may increase costs. However, it is worth considering when looking at those increased costs a long-term investment. Figure 1 shows the return to variable expenses for different weaning rates and calving distributions. The nutrition plan in this analysis involves providing 2 lbs/head/day of supplement for 210 days, starting during the last trimester of pregnancy and lasting through calving. It should be noted that only variable costs are included in this analysis to provide a simple, general overview of returns to production expenses. Fixed costs (land, equipment depreciation, etc.) should be included when calculating returns for a specific operation.

The base calving distribution used in this analysis is 40-35-25, meaning 40% of calves are born in the first 30 days, 35% are born between day 30 and day 60, and 25% are born between day 60 and day 90. It is assumed that calves will gain 2 lbs/head/day, increasing the average weaning weight when more calves are born earlier. Understandably, having a defined breeding season is not always a feasible option, so influencing calving distributions may not be relevant for certain operations. However, improving weaning rates is of relevance to all cattle operations. So even without a defined breeding season, there is an opportunity for a positive return even if calves are not uniform in weight because having more calves is better than having fewer calves.

In conclusion, cattle prices are expected to remain favorable in the coming years due to current supply levels. Take advantage of the current market and plan for the future by investing in your cow herd and making changes that will allow you to sell as many calves and as many pounds as possible. Help your cows help you in achieving the goal of maximizing revenue.

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Figure 1. Return to Variable Expenses for a 50 Head Beef Cow Herd in Florida, 2024 (per cow)

	Weaning Rates		
Calving Distributions	**72%**	**80%**	**85%**
40-35-25	$209.06	$320.04	$431.01
45-35-20	$222.93	$333.91	$444.88
50-35-15	$236.80	$347.78	**$458.76**

[1]return to variable expenses: total revenues – variable expenses

[2]total variable expenses: $775.85/cow

[3]total revenues: combined average price of steers and heifers ranging from 405 lbs-525 lbs (April 2024) $2.89/lb; does not include cull cow revenue