Ona Long-Term Agroecosystem Research (LTAR) Highlight

Maria Silveira, Marta Kohmann, Rosvel Bracho, Abmael Cardoso

November 1, 2022

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USDA, Long-Term Agroecosystem Research Network (LTAR)

https://ltar.ars.usda.gov/

Research network focused on finding solutions that **maintain or increase** agricultural productivity, environmental quality, and people well-being

Main Priorities:
1. Increasing agricultural production
2. Protecting the environment
3. Advancing rural prosperity

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Coordinated, large-scale, cross-disciplinary research

- 21 Working groups focused on specific research questions
- Working groups carry out coordinated, large-scale data collection and provide the infrastructure required to analyze and to disseminate research data

Working
- Soils
- Resilience
- Grazing lands
- Livestock
- Manureshed
- Sustainable intensification indicators
- Modeling
- Non-CO_2
- Eddy Covariance
- …

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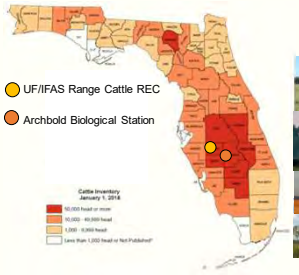
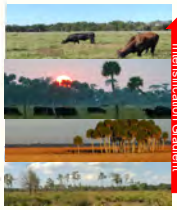
Archbold Biological Station & University of Florida LTAR Site



How does innovative management affect cow-calf production and multiple ecosystem services across a land use intensity gradient?



1. Cultivated pastures – 16 x 20 acres (UF RCREC)
2. Cultivated pastures – 8 x 40 acres (Archbold BIR)
3. Semi-native pastures – 8 x 40 acres (Archbold BIR)
4. Native rangeland – 16 x 40-70 acres (UF RCREC)

https://ltar.ars.usda.gov/sites/abs-uf/

Source: Florida Department of Agriculture, 2018.

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UF/RCREC LTAR team

- Maria Silveira
- Marta Kohmann
- Abmael Cardoso
- Rosvel Bracho
- João Vendramini
- Philipe Moriel
- Brent Sellers

Former students/ research assistants:

- Ester Ricken
- João Sanchez
- Carolina Braga Brandani
- Dipti Rai
- Kacey Aukema
- Lucas Zanini
- Igor Machado

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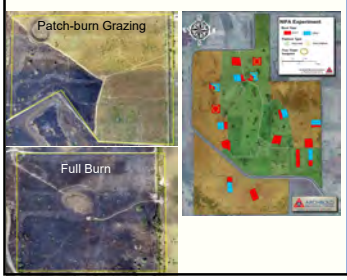
Common Experiment ABS-UF Sites

Archbold Biological Station



UF/Range Cattle REC

Unburned

Burned (2 or 4 yr)

Burned + chopped (4 yr)

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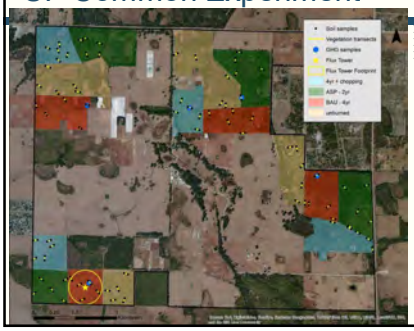
UF Common Experiment



- 16 experimental units (~40-70 acres each)
- 5 transects (150 ft) in each experimental unit
- Winter grazing (90 d; Nov. to Jan; ~ 13 acres/animal)

March 26, 2021

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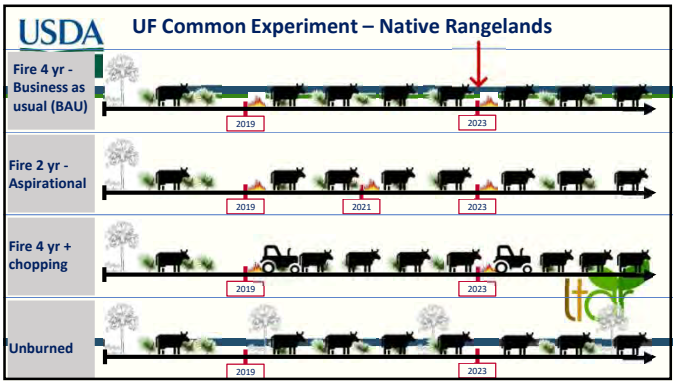
UF Common Experiment – Native Rangelands



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Vegetation manipulation with prescribed fire

Saw-palmetto (*Serenoa repens*) – C_3

Chalky bluestem, Indiangrass – C_4

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Measurements in the Common Experiment

- **Fire characteristics**: peak temperature, heating duration, % combusted biomass, ash deposition
- **Vegetation**: composition, herbage mass, nutritive value, tissue mineral composition
- **Soils**: soil chemical, physical and biological properties, nutrient cycling, soil carbon (quantity and quality, spatial distribution of nutrients/soil properties
- **Environmental**: greenhouse gas measurements (2 eddy covariance towers (CO_2/CH_4) and chamber-based)
- **Animals**: body condition score, body weight, blood metabolites (cortisol, plasma urea N, glucose, IGF1), animal behavior, calf birth and weaning wt.

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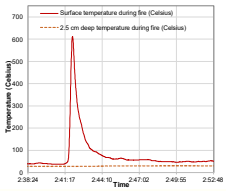
Fire Characteristics

Unit	Vegetation	Transect	Thermocouple	Surface	2.5 cm depth	Seconds with tem ≥ 60°Celsius (surface thermocouples)
				Peak temperature (Celsius)		
W3U3	Grass	1	E	395	38	210
			F	211	32	153
W3U3	Grass	2	A	218	34	122
			B	142	27	126
W3U3	Palmetto	1	G	519	37	255
			H	615	31	326
W3U3	Palmetto	2	C	173	26	159
			D	513	29	195



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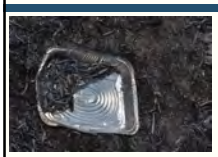
Nutrient additions via ash



Ashes: 14 lb N/A, 3 lb P/A, 4 lb K/A, 520 lb C/A

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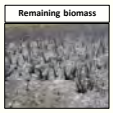
Short-term impacts of prescribed fire on C, N, and P dynamics

Pre-fire **Post-fire**



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Short-term impacts of prescribed fire on C, N, and P dynamics

	Saw-palmetto	Grass	*P*-value
Pre-fire	(g C m^{-2})		
Green biomass	283 ± 58	64 ± 17	0.04
Senescent biomass	129 ± 41	155 ± 40	0.43
Plant biomass	412 ± 86	219 ± 57	0.02
Litter	60 ± 12	65 ± 8	0.78
Total stock	473 ± 82	284 ± 65	0.01
Post-fire			
Plant biomass	159 ± 52	8 ± 3	0.09
Ash	20 ± 5	19 ± 5	0.86
Total stock	179 ± 52	± 8	0.08
Net loss	-293 ± 76	± 59	0.36

62% 90%

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Pre-fire	(g N m^{-2})		
Green biomass	5.1 ± 1.1	0.9 ± 0.2	0.05
Senescent biomass	1.6 ± 0.5	1.3 ± 0.3	0.60
Plant biomass	6.6 ± 1.5	2.2 ± 0.6	0.04
Litter	1.0 ± 0.3	1.1 ± 0.1	0.86
Total stock	7.6 ± 1.4	3.3 ± 0.7	0.03
Post-fire			
Plant biomass	1.2 ± 0.5	0.1 ± 0.1	0.13
Ash	0.4 ± 0.1	0.5 ± 0.1	0.73
Total stock	1.6 ± 0.5	± 0.1	0.10
Net loss	-6.0 ± 1.1	± 0.6	0.02

62% 90%

79% 82%

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Short-term impacts of prescribed fire on C, N, and P dynamics

	Saw-palmetto		Grass		*P*-value
	(g P m^{-2})				
Pre-fire					
Green biomass	0.50	± 0.09	0.12	± 0.01	0.04
Senescent biomass	0.10	± 0.03	0.09	± 0.01	0.77
Plant biomass	0.57	± 0.10	0.20	± 0.03	0.04
Litter	0.06	± 0.02	0.08	± 0.01	0.39
Total stock	0.63	± 0.10	0.28	± 0.03	0.04
Post-fire					
Plant biomass	0.19	± 0.06	0.01	± 0.01	0.09
Ash	0.06	± 0.01	0.06	± 0.01	1.00
Total stock	0.25	± 0.07	0.02	± 0.08	
Net loss	-0.39	± 0.11	0.03	0.18	

62%

75%

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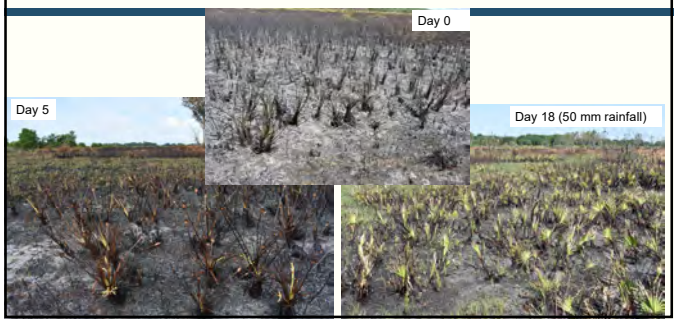
Fire-induced vegetation responses



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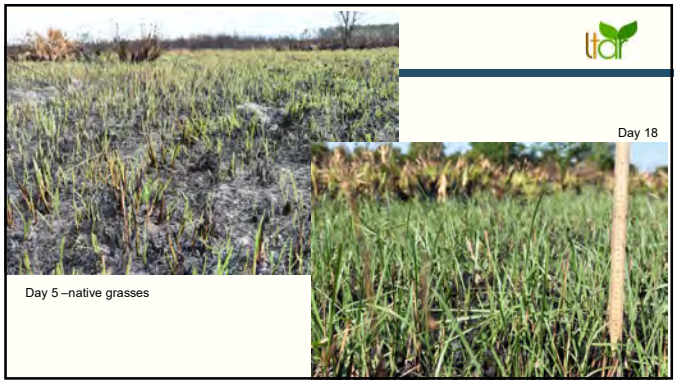

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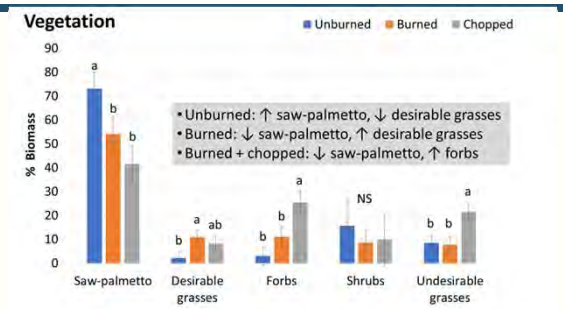
Fire-induced vegetation responses



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Fire-induced vegetation responses

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Desirable grasses

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Undesirable grasses

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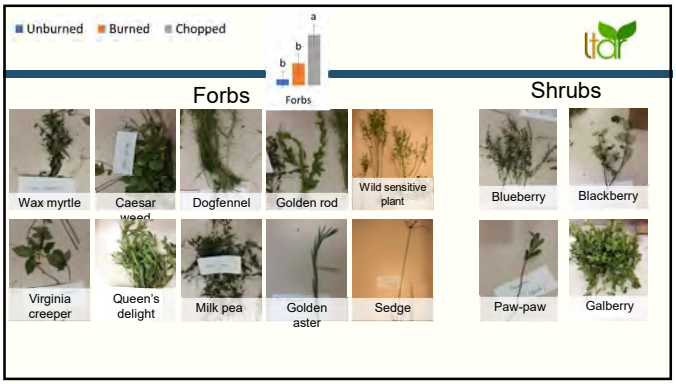

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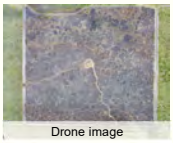
Fire impacts on ecosystem C fluxes


Drone image

Eddy covariance is a micrometeorological method that continuously measure the concentration of carbon and non-carbon gases in the atmosphere

Net Ecosystem Exchange (NEE) - the difference between the total amount of carbon fixed by plants in the process of photosynthesis (gross primary production) and carbon released by heterotrophic (soil/litter) and autotrophic respiration (plants and roots)

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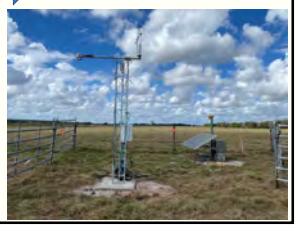
Fire impacts on ecosystem C and GHG fluxes

CO_2 and CH_4 sensors



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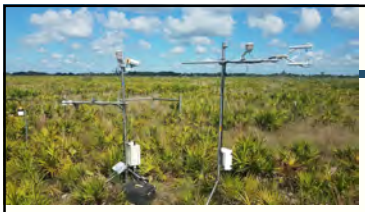

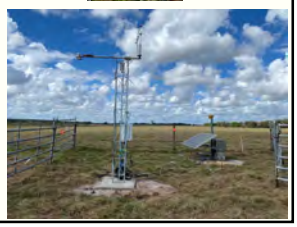

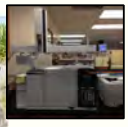

CO_2, N_2O, and CH_4

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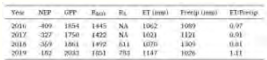
Results

Agricultural and Forest Meteorology

Carbon dynamics and soil greenhouse fluxes in a Florida's native rangeland before and after fire

- Fire effect was short-lived: 60 d after fire vegetation photosynthetic capacity
- Native rangeland acted as a C sink sequestering ~ -1148 g C m^{-2} during the 4-yr study (2.9 Mt C ha^{-1} yr^{-1})
- Florida's rangeland a very resilient ecosystem and a viable option for C mitigation under forecasted climate scenarios and management



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UF IFAS Extension
Pasture's Role in Climate Change Mitigation
Maria Silveira, Rosvel Bracho, Curtis Dell, and Abmael Cardoso
Background
https://edis.ifas.ufl.edu/publication/SS708
Carbon Sequestration in Grazing Land Ecosystems
Maria Silveira, Ed Hanlon, Mariana Azenha, and Hiean M. da Silva
https://edis.ifas.ufl.edu/publication/SS708
ONA REPORT
UF IFAS
https://rcrec-ona.ifas.ufl.edu/media/rcrec-onaifasufledu/pdf/2022----October----Ona-Report----climate----Silveira.pdf

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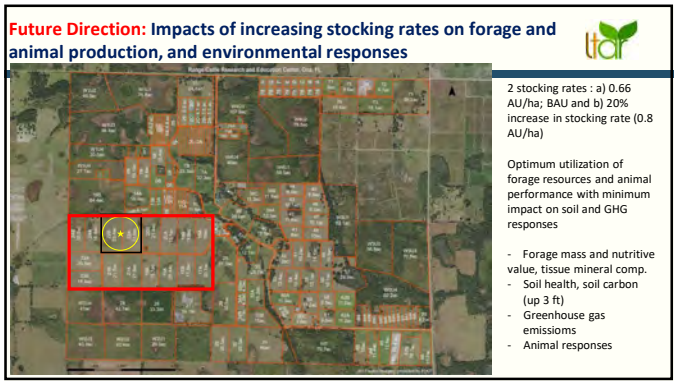
Future Direction: Impacts of increasing stocking rates on forage and animal production, and environmental responses
2 stocking rates : a) 0.66 AU/ha; BAU and b) 20% increase in stocking rate (0.8 AU/ha)
Optimum utilization of forage resources and animal performance with minimum impact on soil and GHG responses
- Forage mass and nutritive value, tissue mineral comp.
- Soil health, soil carbon (up 3 ft)
- Greenhouse gas emissioms
- Animal responses

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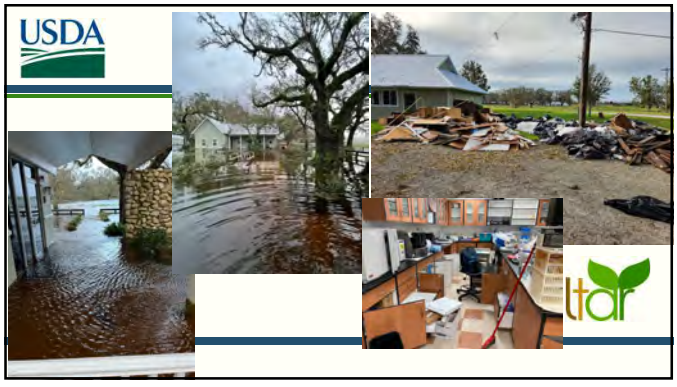
USDA

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