

Trade-Offs Among Ecosystem Services and Disservices on a Florida Ranch

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On the Ground

- We consider the trade-offs among “good” ecosystem services and “bad” ecosystem disservices attributable to past and current rangeland management and how such trade-offs depend on analysis at the scale of the ranch, the region, or the Earth.
- We focus on trade-offs in ecosystem services at one working ranch—Buck Island Ranch, location of the MacArthur Agro-ecology Research Center, lying in the headwaters of Florida’s Everglades—and managed for 25 years as a full-scale cow-calf operation by Archbold Biological Station, one of the world’s preeminent ecological research centers.
- The synthesis of how this ranch functions as an ecosystem (species, habitats, nutrient dynamics, hydrology, etc.) is set in the context of financial realities and economic viability.
- We develop a conceptual model to visualize trade-offs among ecosystem services and disservices, and provide insight into what it takes to be sustainable ecologically and economically.

Keywords: ecosystem services, ecosystem disservices, Florida ranchlands, Everglades.

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How can we sustain ecosystem services and productivity on rangelands while avoiding strong, adverse ecological impacts?¹ Defined as “the benefits people obtain from ecosystems,” ecosystem services are categorized as *provisioning* (e.g., food, fiber, game harvest), *regulating* (e.g., ameliorating flood and drought, maintaining natural fire regimes), *cultural* (e.g., supporting cultural practices of native peoples, distinctive cul-

tures), and a fourth category of *supporting services* (e.g., net primary productivity, carbon sequestration, soil formation).² Conversely, harmful ecological impacts such as excessive drainage, eutrophication, and introduction of invasive species are defined as ecosystem *disservices*.³ Interdisciplinary approaches are needed to evaluate trade-offs among ecosystem services and disservices and to consider trade-offs at spatial scales from local to regional to global.⁴ Further development of the ecosystem service concept in rangelands should consider the relative contributions of “goods” and “bads” and their influence on ecosystem and economic resiliency.

One remote fragment of rangeland that provides important ecosystem services is found in central Florida, the site of the 67th Society for Range Management Annual Meeting,¹ and isolated across a continent from western rangelands. Florida’s rangelands differ from western counterparts in that they are temperate to subtropical, humid grasslands, dominated by C₄ bunchgrasses, receiving more than 1,300 mm of rain a year, mostly during the hot summer months, and experiencing dry winters with occasional freezes. Beef cattle production on Florida rangelands and pastures is typically cow and calf enterprises with calves sold at weaning. Florida ranks 11th in beef cows nationally with approximately 926,000 head distributed mostly on the acid, nutrient-poor grasslands throughout central and south peninsular Florida (Fig. 1). Although more than 16,000 producers are registered in Florida, 67% have gross sales of less than \$5,000 per year and most cattle are managed in large commercial herds. Six of the top 20 beef cattle ranches in the United States are in Florida, accounting for 54% of the number of head in the nation’s top 20 ranches.

Florida’s grazing lands overlap extensively with the headwaters of the Everglades, a watershed of 1.062 million hectares draining south into Lake Okeechobee, which at 0.181 million hectares is the largest lake in Florida, and the 10th largest in the United States (Fig. 2). Downstream from Lake

¹The 67th SRM Annual Meeting, *From Dusty Trails to Waning Wetlands*, will be held in Orlando, Florida, 8–13 February 2014. Join us there to learn more about Florida rangelands. For more information on the 2014 SRM Annual Meeting, see <http://www.rangelands.org/events/>.

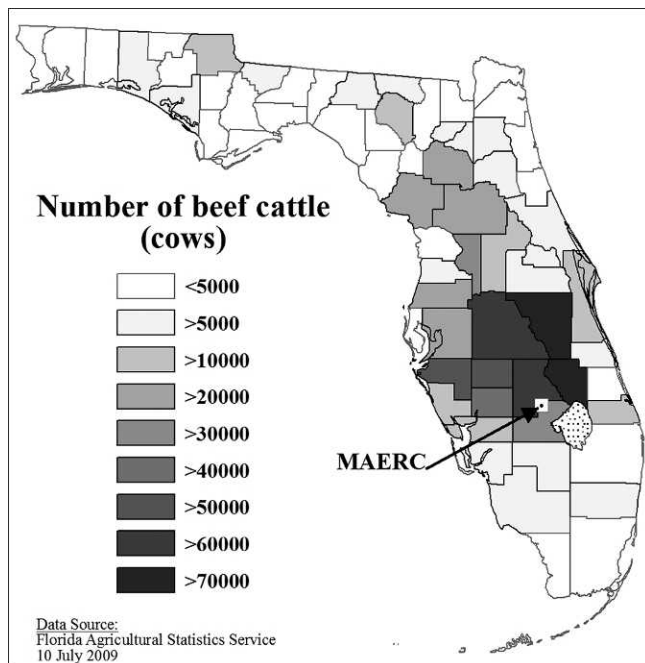


Figure 1. Distribution of beef cattle in Florida. The largest numbers occur in the counties that form the headwaters of the Everglades.

Okeechobee waters flow south into the Everglades, although much of the historic southerly flow is now diverted to the east and west coasts of Florida via large canals.⁵ The headwaters of the Everglades differ fundamentally from the quintessential Everglades marshes south of the lake. Lands north of the lake are largely privately owned, with only 22% under conservation management (public or private) compared with more than 50% south of the lake. In the southern portion of the headwaters watershed land use is 70% agricultural including dairies, row crops, citrus groves, and mostly extensive beef cow-calf operations.⁶ There has been extensive conversion from rangeland to pastures planted with warm-season, perennial forage grasses. The geographical location, climate, and low elevation of the land is unlike other rangelands or pastureland in North America and more like the grazing landscapes of ranches in South America.

To sustain ecosystem services from Florida rangelands it is imperative to understand the trade-offs among services and their counterpart disservices, and to examine these in relation to economic return.⁷ We address these issues by integrating multidisciplinary research from a cow-calf operation in the headwaters of the Everglades, Buck Island Ranch, which is the location of the MacArthur Agro-ecology Research Center (MAERC). In 1988, Archbold Biological Station established MAERC and assumed management of the ranch under a lease from the John D. and Catherine T. MacArthur Foundation. MAERC, at 4,249 ha and more than 3,000 head, is among Florida's top 20 beef cattle producers. The ranch is managed as a full-scale commercial beef cow-calf operation providing a real-world infrastructure for agro-ecology research on a working ranch.

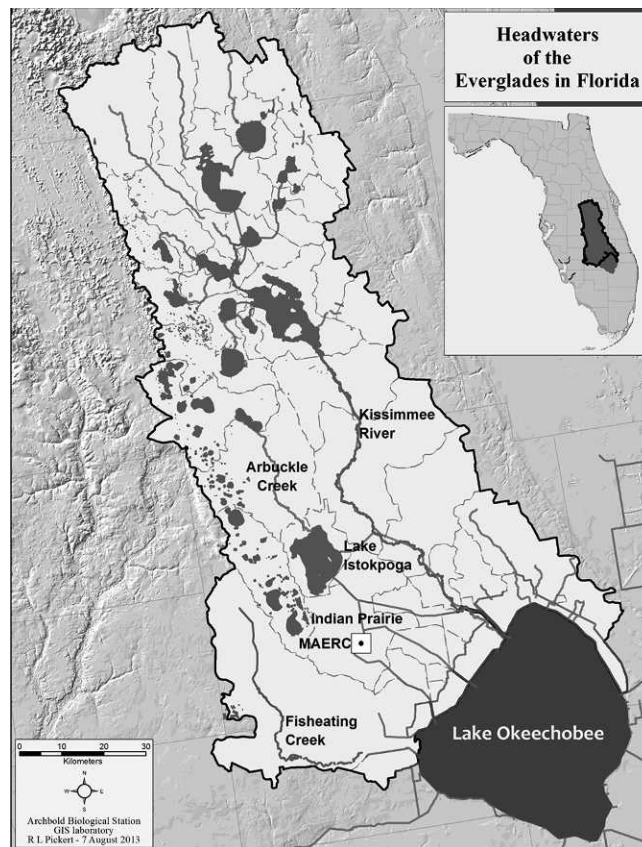


Figure 2. Ranches are the predominant land use in the headwaters of the Everglades, within the many watershed subbasins (dotted lines) that drain south into Lake Okeechobee. The headwaters are dominated by the Kissimmee River, Fisheating Creek, and the Arbuckle Creek–Lake Istokpoga–Indian Prairie watershed basins. MAERC is located in the Indian Prairie subbasin.

We start with a history of MAERC including land conversion, drainage, and fertilization. These activities transformed ecosystem processes and the spatial structure of the landscape, resulting in ecosystem disservices that continue to this day. We then describe the ecosystem services that continue to be derived from this land—provisioning, supporting, regulating, and cultural services—and the trade-offs among these services and converse disservices. Our comparison of trade-offs is conducted at three relevant spatial scales⁴—local (the ranch), regional (headwaters of the Everglades), and global. Ecosystem services are considered in terms of economic returns from provisioning services. Finally, we contrast the trade-offs under ranch management with trade-offs likely under alternate land use scenarios—intensive cropland, suburban development, or restoration to natural areas—allowing us to compare the ecosystem contributions of retaining ranching vs. alternative future land uses in this globally important watershed.

A History of Ecosystem Disservices

Buck Island, a name attributed to local Native Americans, was originally a 1,800-ha island of Florida dry prairie (Fig.

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