

Upland Palmetto Prairies Reclamation

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About Mosaic Reclamation

> In carrying out its mission to help the world grow the food it needs, Mosaic couples recovery of phosphate resources with respect for the phosphate-rich land that ultimately fuels thriving communities, economies, and American and global food production. While mining is a temporary use of the land, reclamation offers benefits for generations to come. Land reclamation is the process of returning mined lands to other productive uses and has been required by Florida law since 1975. In respecting this moral and legal obligation, Mosaic continuously improves its reclamation practices to create sustainable, natural habitats blended with other land uses across the formerly mined reclaimed landscapes.

Mosaic's reclamation scientists, engineers and biologists develop detailed reclamation plans for the productive use of mined lands years before any phosphate is extracted. With Mosaic reclaiming every acre or more that it disturbs, its reclamation plans focus on connecting preserved and reclaimed habitats to create a diverse and sustainable habitat network integrated into the larger regional ecosystem.

Progress in Transition

Diversity is one of the most important aspects Mosaic incorporates when reclaiming the land. Whether it's the diversity of habitat types across the reclaimed landscape or the diversity of plant and animal species that inhabit

a particular reclaimed site, variety across all spectrums is needed for an ecosystem to survive and grow on its own. This is the essence of a sustainable environment. In addition to streams and their associated floodplains, reclaimed land includes connected and isolated wetland and upland natural habitats. <



Palmetto prairies thrive on reclaimed land, and the hydrology on the site is designed to drain well to support the variety of birds, reptiles and small mammals that use the habitat for nesting, protective cover and food.



Palmetto prairies are upland habitat and support a broad range of watershed functions.



Shaping the Future of Land Restoration

➤ Palmetto prairies are upland habitat. Their characteristics range from relatively high, well-drained, sandy soil that is seldom flooded to the edges of isolated and connected wetlands and streams. These upland communities support a broad range of watershed functions, as they are responsible for the intake, storage and delivery of water to surrounding wetlands and streams. These lands provide habitat for a variety of small mammals, reptiles and insects, which serve as food sources for wildlife such as snakes and birds, many of which are endangered species. The palmettos and native grasses also provide protective cover and food for other inhabitants like the gopher tortoise.



Gopher tortoises are one of the few tortoise species that actually dig and live below ground in burrows. They are herbivores, feeding on vegetation and fruit such as gopher apples.

Former palmetto prairies are in use today for row crops and pasture, such that many have been replaced by agriculture or housing developments. This often leaves isolated patches (e.g., less than 100 acres in size) too small to sustain viable populations of wildlife that occupy these unique habitats. Reclamation offers an opportunity to restore these critical uplands.

Mosaic's Little Manatee River No. 6/8 reclamation project (LMR 6/8), located at its Four Corners mine site in Hillsborough County, Florida, showcases how even in their early stages, palmetto prairies provide wildlife habitat and watershed functional values.

Prior to mining, LMR 6/8 provided only marginal wildlife habitat as improved pasture and sod farming land. Mining occurred on this site in 2002, and reclamation began in 2005. Currently, LMR 6/8 has been completed through initial vegetation. In place of agricultural uses, the site is planned for permanent, sustainable upland habitat as it is part of a future Mosaic land donation to Hillsborough County to ensure it stays that way. Moving forward, the focus for this site will be continued maintenance and supplemental planting until the design objectives have been met and it can be released by the state.

Water from LMR 6/8 helps feed other neighboring systems. It is connected to a downstream wetland system as well as nearby Howard Prairie Branch, a tributary to the Little Manatee River. ➤

Direct Design

> The design and mapping process for a reclaimed palmetto prairie begins with soil structure and drainage as well as shallow ground and surface water hydrology. The intricacies of designing this habitat type involve the use of a reference site, such as a nearby palmetto prairie that has not been impacted. Such reference sites help guide the basis for design and measure its success.

Mosaic utilizes two planting techniques – direct seeding and topsoil transfer – to reclaim wildlife habitats like palmetto prairies. Direct seeding is a process whereby seeds from native species are collected from natural, undisturbed areas and spread onto designated reclamation sites. Seeds can be collected from donor sites (nearby land not yet mined) using specialized farm equipment or simply by hand.

Key Design Aspects

In the design of LMR 6/8, the reference site provided information relevant to the reclamation design components, such as soil condition, hydrology and vegetation.

As an upland habitat, LMR 6/8 serves as a hydrological connection to downstream water resources. One of the most challenging aspects of the site's design is achieving the appropriate soil conditions.

Because optimal palmetto prairie wildlife habitat requires a spatial balance of palmettos and native grasses, proper vegetation establishment is critical to the site's sustainability. As bare soil is a component of the palmetto prairie habit, control of unwanted vegetation colonization, such as cogon grass, is a necessary part of the design plan. <



Some attributes of a successful palmetto prairie wildlife habitat include native grasses that provide protective cover and food for wildlife and appropriate soil conditions.

Seed to Soil

➤ Bringing a design for an upland palmetto prairie to life begins with sand tailings reclamation, a process whereby sand separated from the phosphate ore during mining is pumped back to the reclamation site to restore the land surface to a specific elevation. Palmetto prairie plant communities require sandy topsoils with less-permeable subsoils underneath to be sustainable. To meet this need, Mosaic generally pumps sand tailings after mining.

Topsoil transfer, as an alternative to seeding, is a more controllable – but less available – process involving directly transferring topsoil from a donor site to the reclamation/recipient site. In this case, the upper one foot of soil at the donor site was scraped using bulldozers, then loaded and hauled by heavy earth-moving equipment to the recipient site where the transferred topsoil was spread across the contoured land. These native soils contain diverse seed banks, which help establish proper native vegetation.

Direct seeding of upland habitats is also a practical construction technique, particularly when topsoil transfer is not an option. For example, topsoil transfer is not practical at long distances (greater than one mile) between the donor site and reclamation site or if timing needs can't be met (e.g., a recipient site is not available when the soil needs to be removed). Upland topsoil seedbanks, unlike the seedbanks in wetland muck,

do not survive when stockpiled. Therefore, for seed survival, these soils need to be immediately spread over a reclaimed site that is ready to receive them.

The topsoiling method also allows for some flexibility, as the transfer can be scheduled to occur throughout most of the year. On the other hand, direct seeding is limited to fall and early winter seasons, as seeds only ripen once a year. Regardless of method, hydration through either rainfall or irrigation is crucial to initial germination.

Key Execution Aspects

At LMR 6/8, Mosaic utilized both topsoiling and direct-seeding methods.

The native topsoil was spread on a portion of the site to the desired thickness specified in the site's design, generally six inches or less. For areas of the site where topsoil was not applied, Mosaic utilized direct seeding. Prior to seeding, Mosaic pretreated the site with approved herbicide to reduce the presence of unwanted vegetation, followed by tilling to create suitable, soft sandy topsoil, allowing for proper planting conditions. Seeds were then planted using a modified seed sprigger pulled by a farm tractor. <

Trends of Success

> When a reclamation site mimics that of a reference palmetto prairie upland habitat in terms of functions and sustainability, reclamation is deemed successful. At LMR 6/8, transects have been installed to track and measure the site's performance, specifically related to species diversity, vegetative cover, presence of key indicator species and the percent of both unwanted vegetation and bare ground.

Key Success Aspects

Even at its young age, LMR 6/8 is already providing a significant amount of support to surrounding habitats, including Howard's Prairie Preserve. <



Plant diversity is a key success indicator of a palmetto prairie habitat.



Progressive Contributions

> Palmetto prairies provide important wildlife habitats in both the watersheds they serve and Mosaic's reclaimed landscapes. In creating larger communities connected to preserved habitat, palmetto prairie reclamation helps create wildlife migration corridors that reverse the impacts of historical development across the region (e.g., isolation and fragmented patchwork of native upland habitat).

With the continuous evolution of land reclamation science, Mosaic is dedicated to advancing reclamation of all types, including upland palmetto prairies. At Mosaic, our reclamation engineers and scientists collaborate with leading researchers and proactively advance the state of the science. With this mindset, reclamation of sites like LMR 6/8 creates sustainable reclaimed habitats.

Reclamation efforts provide balance and benefits to broader land uses within the region by restoring habitats that are essential to Florida's unique ecosystem balance. Palmetto prairies significantly contribute to the post-reclamation balance of conservation, agriculture and sustainable development. Positioned in the landscape between the dry, xeric uplands and wetlands, palmetto prairies provide a critical linkage to the region's habitat structure and corridors. These efforts provide a balance not only in terms of acreage, but also spatially — just a part of Mosaic's commitment to creating sustainable habitat. <



Palmetto prairies provide a critical link between dry, xeric uplands and wetlands, and the vegetation present make them particularly hospitable to burrowing wildlife.