



Luminant



REforestation...

RESTORING THE WOODLAND RESOURCES



Benefits of reforestation include long-term watershed protection, reduced soil erosion and improved water quality.

FORESTS have played a vital role in the history and development of our nation. By restoring millions of trees over thousands of acres of mined land, Luminant is doing its part to sustain forest benefits for future generations.

ABOUT LUMINANT

Luminant, a subsidiary of Energy Future Holdings Corp., is a competitive power generation business, including mining, wholesale marketing and trading, and development operations. Luminant has over 15,400 megawatts of generation in Texas, including 2,300 MW fueled by nuclear power and 8,000 MW fueled by coal. Luminant is also the largest purchaser of wind-generated electricity in Texas and the fifth largest in the United States. Visit www.luminant.com for more information.

BACKGROUND OF THE MINING OPERATIONS

Luminant began mining at the Big Brown Mine near Fairfield, Texas, in 1971. Since then, operations have been opened at additional mines across East and Central Texas. All Luminant mines are mine-mouth operations, delivering lignite to nearby Luminant power plants, which generate electricity for a large part of the population of Texas. Lignite production, which totaled 27.5 million tons in 2010, is expected to grow to 33 million tons with full operation of three new coal-fueled generating units.

Prior to mining, post-mine land uses are planned for each mine site. The land-use plan is based on pre- and post-mine factors, including vegetational region, resulting topography and soil type, and local economic trends.

Until 1973, little was known about mined land reclamation in East Texas. Studies completed that year demonstrated the potential for reforestation success on post-mine soils. Research findings indicated that East Texas overburden material had the ability to support various vegetation types. Since then, 12 studies related to reforestation on East Texas overburden material have been completed under the [Luminant Environmental Research Program](#). The results of these studies helped shape a reforestation process that has become an important part of the company's reclamation program.

Today, about 60 percent of the acres reclaimed each year are being reforested. With the development of reliable seedling sources, tree-planting techniques and forestry maintenance practices, quality reforestation has increased significantly on Luminant mined lands. Nearly 68,000 acres have been reclaimed after mining, half of which have been reforested. In May 1996, the Texas Forest Service and the Texas Forestry Association recognized Luminant's reforested reclamation areas as a certified Tree Farm. The American Tree Farm System is a nationwide program of the American Forest Council to encourage private forest owners to manage forests for continuous tree production, with planned benefits to wildlife habitat, watershed protection and outdoor recreation.

Luminant continually seeks new ways to improve the quality of its reforestation efforts through research, field trials and application of improved techniques in the reclamation process. This has led to a reforestation

program widely recognized as a model for success. Practices and procedures developed from Luminant's research, field trials and tree-planting operations are readily available and often directly applicable to benefit other mine reforestation efforts across the nation.

RECLAMATION PRACTICE

More than 30 million trees have been planted on Luminant reclaimed sites since 1975. During this time, reclamation personnel have resolved many of the problems that can inhibit successful reforestation. Luminant uses selective overburden handling as the mining and reclamation method at its mines. This approach is possible because of the value of East Texas overburden material as a topsoil substitute. The identification of suitable topsoil



About one-half of Luminant's reforested area is developed as wildlife habitat.

‘All across the planet, trees
— in a wonderful profusion of form
and function — literally hold the world
together.’

DAVID SUZUKI | *TREE: A LIFE STORY*



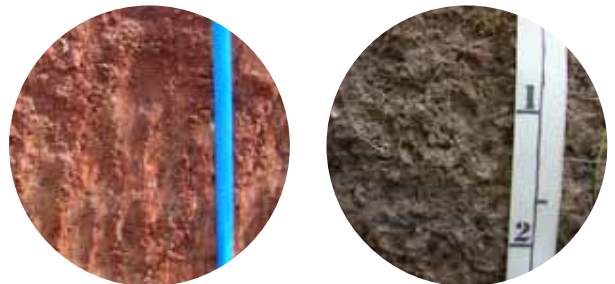
Forested wetlands are an important part of Luminant's reforestation program.

replacement material is refined through geologic and soils studies during the mine-permitting process. By selectively placing suitable overburden material in the top four feet of the final reclamation, post-mine soils can exhibit superior chemical and physical properties compared to native soils. The native soils of East Texas are mostly either deep sands (40 inches or more of sand or very fine sand) or have a claypan at shallow depths (less than 20 inches). Both tend to be very droughty soils, either because of the high sand content throughout or because of the abrupt textural break at shallow depths, causing a boundary across which water, air and roots have difficulty passing.

On the other hand, post-mine soils are typically loamy textured throughout the entire rooting depth with significantly improved water and nutrient holding capacity. The lower layers of reclaimed soils also allow freer movement of roots, water and air. Additionally, Luminant uses low ground pressure track equipment for soil reconstruction and regrading activities, preventing the development of dense, compacted soils similar to those that existed prior to mining. As a result of select overburden handling and leveling practices, post-mine soils often meet prime farmland criteria, as described by the Natural Resources Conservation Service.

Quality post-mine soils provide the growth medium needed to establish the proper ground cover prior to planting trees. This is a key factor in reforestation success. Luminant uses wheat, a cool-season annual cover crop, to prevent soil erosion and provide protection for the first-year seedlings. An ideal ground cover provides enough height to protect seedlings from wind and sun desiccation, without shading the young trees. This type of ground cover also keeps soil temperatures down by shading the soil surface but does not compete with seedlings for moisture and nutrients during the warmer, dryer months. Native grasses and legumes are interseeded where needed to provide perennial cover. When a more aggressive ground cover is needed for erosion control, perennial herbaceous cover is established before tree planting. Band spraying with herbicides can then be used to reduce competition from the herbaceous vegetation, leaving ground cover intact.

Each mine has on-site or nearby cold-storage facilities for holding large quantities of seedlings shipped from nurseries. Cold storage allows for a longer planting period by maintaining dormancy of trees. Proper handling after trees are lifted from the nursery beds is essential for good tree survival. Experienced reclamation specialists at each site oversee the planting operations from start to finish, ensuring proper handling and protection of seedlings.



The pre-mine soil (left) is poor quality claypan that limits plant root and water penetration, while the post-mine soil has extensive plant root development and is loose and more friable.

WILDLIFE HABITAT

All wildlife species require the fundamental habitat elements of food, water and cover. Trees that produce acorns, nuts, berries or fruit (mast) on forested lands provide important food sources for wildlife. Various types of oak trees make up the majority of nut-bearing tree species in East Texas, with fleshy, fruit-bearing species also contributing significantly as an important wildlife food source. This type of regional vegetation information is incorporated into Luminant's reforestation planning program, resulting in approximately one-half of the reforested areas established as quality wildlife habitat.

By partnering with local and regional nurseries, the availability of tree species needed in the reclamation of wildlife habitat in East Texas has been dramatically increased. Where availability was once limited to only a half-dozen species, Luminant now plants 32 species of trees, including 16 hard-mast producers.

Careful selection of the species of trees planted and the incorporation of native grasses and forbs have resulted in the establishment of thousands of acres of quality habitat benefiting a variety of native fauna.

In Texas, habitat destruction, fragmentation and degradation as well as the introduction and spread of invasive or non-native species are the leading threats



Wildlife abounds on Luminant's post-mine land.

TREE SPECIES PLANTED DURING 2009 PLANTING SEASON

<u>Hard-Mast Producers</u>	<u>Soft-Mast Producers</u>
Black gum	Cedar elm
Black oak	Hackberry
Black walnut	Mulberry
Bur oak	Persimmon
Cherrybark oak	Red maple
Laurel oak	Red mulberry
Live oak	Sugarberry
Mockernut hickory	Water tupelo
Nuttall oak	<u>Other</u>
Overcup oak	American beautyberry
Pecan	Baldcypress
Post oak	Black cherry
Shumard oak	Buttonbush
Southern red oak	Chickasaw plum
Swamp chestnut oak	Cottonwood
Water hickory	Dogwood (roughleaf)
Water oak	Green ash
White oak	Loblolly pine
Willow oak	Longleaf pine
	Mayhaw
	Redbud
	River birch
	Southern crabapple
	Sweet gum
	Wax myrtle

to species habitat and biodiversity. Luminant strives to offset this trend through the development of wildlife habitat as a post-mine land use. Establishing diverse stands of tree species native to East Texas that provide high-quality food and cover is an important part of Luminant's reforestation program.



Loblolly pine is the primary species used for establishment of commercial timber stands.

COMMERCIAL FORESTRY

The other half of Luminant’s reforestation effort is focused on establishing commercial stands of pine timber. Luminant views mine reclamation as an opportunity to renew an important natural resource that will contribute to the local economy for many years.

Although loblolly pine is the primary species used for commercial timber stands, Luminant takes pride in its efforts to reestablish the longleaf pine ecosystem. Vast amounts of logging in the early 1900s removed virtually all virgin longleaf pine from East Texas. Longleaf pine forests can be economically profitable and provide excellent wildlife habitat, biodiversity and a host of recreational opportunities. Loblolly and longleaf pines are planted at rates recommended by the Texas Forest Service for commercial forestry areas. Planting rates and forest-management techniques are employed in reclamation areas to ensure the production of high-quality commercial timber.

Luminant works with local and regional nurseries to plan seedling orders at least two years in advance. This ensures that cultural practices in the nurseries

TREES PLANTED IN 2010 PLANTING SEASON

Big Brown	33,875
Martin Lake	845,500
Monticello	260,150
Three Oaks	45,000
Total	1,184,525

will produce seedlings that meet the specifications for height, root collar diameter and root-to-crown ratio needed for enhanced survival and growth under post-mine conditions. Although direct seeding has been studied, the use of bare-root and container grown seedlings has proven to be more successful for forest reestablishment. Additionally, genetically improved seedlings are planted to maximize growth rates and increase the potential for economic return.

ON-SITE EFFECTIVENESS

The vast majority of trees planted on Luminant’s reclaimed land are planted with commercially built tree planters. Machine planting provides excellent quality control for obtaining proper spacing and planting depth, while hand planting is used when access by equipment is limited. One tractor and planter with two operators can plant up to 8,000 trees per day in reclaimed areas. With favorable ground conditions during the planting season, Luminant may

INCREASING PERMITTED PERCENTAGES OF POST-MINE REFORESTATION LAND USES

	First Year	Percent First Year	Percent 2010
Big Brown Mine	1989	23	59
Monticello Mine	1992	23	51
Thermo Mine	1992	12	23
Martin Lake Mine	1993	56	69
Oak Hill Mine	1992	45	87

have up to 10 planters in operation on a given day. In 2010, Luminant mines planted almost 1.2 million trees and have, on average, planted 1.4 million trees every year since 1995.

Luminant has sought to increase post-mine reforestation to a level that is consistent with the local and regional economic and environmental needs. With its added benefits of improving wildlife habitat, watershed protection, air quality, carbon sequestration, recreation and aesthetics, reforestation has become a cornerstone of the Luminant mine reclamation program.

TRANSFERABILITY TO OTHER MINING OPERATIONS

Keys to reforestation success at Luminant mines include: (1) soil quality, (2) proper ground-cover establishment, (3) seedling quality control that begins at the seed source, (4) advance planning and ordering of seedlings, (5) cold-storage facilities at or near the mine site and (6) proper handling, planting and maintenance techniques. Other mining companies can take advantage of a similar approach by developing program goals and working to eliminate any deterrents to success.

LONG-TERM BENEFITS

Luminant began reclaiming mined land and planting trees even before mining regulations were promulgated in the mid-1970s. The 68,000 acres reclaimed to date are providing a valuable resource base for current and future users of the land. As a significant part of that reclamation effort, reforestation brings many benefits. The demand for wood and wood products in the United States and the world increases as the population grows. Reforesting mined lands can help meet that need. Reforestation enhances wildlife habitat and provides long-term watershed protection by reducing soil erosion and improving water quality. Trees also sequester carbon by capturing carbon dioxide, which has been identified as a contributor to global climate change. Surface mine reclamation provides an opportunity to take advantage of these benefits. Where suitable overburden materials are present and proper mining, reclamation and reforestation techniques are used, the results are certainly worth the effort.



A variety of post-mine land uses are established during reclamation.