U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BIOENERGY TECHNOLOGIES OFFICE

Bioenergy Innovations Developed at the Savannah River Site

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Savannah River Site

DOE's short-rotation woody biomass sustainability project

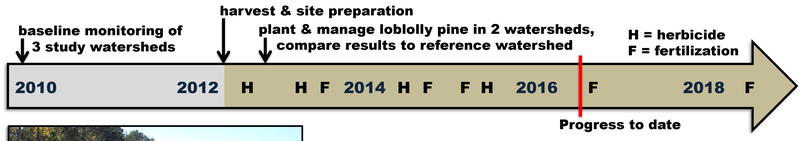
Objective: Use a watershed-scale experiment and watershed modeling approach to examine the effects of short-rotation pine management for bioenergy on water, soil, and productivity.

Watershed experiment: Baseline conditions were monitored for 2 years (2010-2012). Harvest, planting, and managing loblolly pine for bioenergy began in 2012 on 40% of the two treatment watersheds.

Forest harvest (spring 2012)

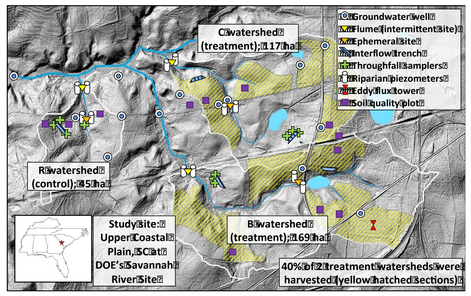
Fertilizing seedlings (spring 2013)

Loblolly pine (Oct 2015)



Silviculture practices followed South Carolina Best Management Practices for forestry to assess adequacy of current BMPs.

Field measurements:
- Water quality (N, P, C, herbicides, pesticides).
- Hydrology (stream flow, interflow, water table, evapotranspiration).
- Soil quality (N, C) and N cycling processes.
- Productivity and C fluxes.



Watershed modeling: Developing a watershed model specific to the southeastern US landscape. Model will evaluate the hydrologic effects of short-rotation pine over larger spatial and temporal scales than achievable in a field experiment. Model output will be compared to results from standard hydrologic models (MIKE SHE, SWAT).

Key findings to date:
- Field and modeling results suggest that the effect of growing short-rotation pine for bioenergy on water and soils is minimal thus far. Forestry BMPs are working.
- Soil and water responses are similar to other pine management systems.

Participants: ORNL, USDA-Forest Service, U of Georgia, U of Alabama, Oregon State U, U of Saskatchewan.

Water use by eucalyptus and loblolly pine project

USDA-funded project to compare water use of loblolly pine and eucalyptus as bioenergy feedstocks.

Objectives:
- Measure water use and water sources of loblolly pine and eucalyptus. Parameterize a process-based watershed model to examine effects at larger spatial scales.

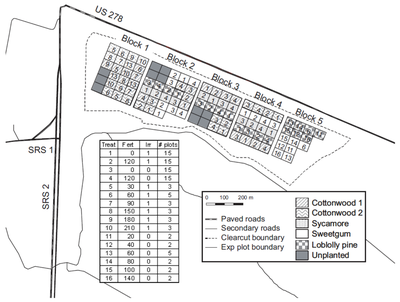
Field measurements:
- Construct annual hydrologic budgets and utilize water stable isotopes to determine water sources of pine and eucalyptus.
- 6 eucalyptus plots and 6 pine plots within two watersheds at SRS.

Participants: Savannah River Ecology Lab, U of Georgia, U of Saskatchewan, USDA-Forest Service.

Information courtesy of Rhett Jackson

Short-rotation woody crops project (Experiment A)

Objective:
- Examine aboveground and belowground resource allocation of 4 short-rotation woody crop species (cottonwood, sycamore, sweetgum, loblolly pine) in response to fertilizer and irrigation treatments.
- Seedlings planted in 2000, and measurements have occurred over time.



Treat	F wt	irr	# plots
1	0	1	15
2	120	1	15
3	0	0	15
4	120	0	15
5	30	1	3
6	60	1	6
7	90	1	3
8	150	1	3
9	180	1	3
10	210	1	3
11	20	0	2
12	40	0	2
13	80	0	5
14	80	0	2
15	100	0	2
16	140	0	2

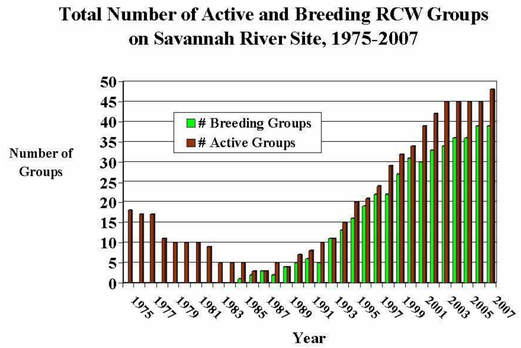
Figure 5—Treatments at the short-rotation woody crops study site. The 3 central analysis-of-variance blocks and the 2 peripheral regression blocks contain a total of 16 treatments of 5 tree genotypes. Treatments 1, 2, 3, and 4 were replicated in the central blocks for all genotypes. Block 1 includes irrigated treatments for cottonwood and sycamore, and block 5 includes nonirrigated treatments for pine and sycamore. A range of nonreplicated fertilizer levels was applied in both blocks 1 and 5.

Participants: University of Georgia, NC State U, Auburn U, USDA-Forest Service, ORNL, SRS, forest products industry.

Information courtesy of Mark Coleman

Management of SRS by the USFS-SR

Maintained and improved habitat to meet recovery population objectives for threatened, endangered, and sensitive species:
- USFS-SR improved conditions for the endangered red-cockaded woodpecker (RCW) by removing 132 acres of midstory vegetation and prescribed burning within 19,030 acres of habitat.
- Successful habitat manipulation increased the number of active groups from one in 1985 to 48 in 2007. USFS-SR also conducted surveys of threatened and endangered plants on 2,000 acres.



Evaluated the effects of management on the environment:
- USFS-SR teamed with a number of universities, as well as the Forest Service Southern Research Station, to develop and demonstrate effective management and to improve our knowledge and understanding of southern forest ecosystems.

Specific projects include:
- Forest biomass production for bioenergy: examining soil quality and productivity responses of loblolly pine for bioenergy to varying silviculture treatments.
- Impact of large woody debris on wildlife.
- Data for assessing impact of bridge and timber management.
- Management of wetlands.
- Restoration of the longleaf pine/savanna.
- Management of hazardous forest fuels.
- Monitoring of particulate matter related to prescribed fire.

Information courtesy of Virginia Dale

Biomass-cogeneration facility at SRS

- In 2009, Ameresco was awarded a DOE Energy Savings Performance Contract to build and run a 20 megawatt biomass-cogeneration facility at SRS. Operations began in 2012.
- Ameresco recently broke ground on a second plant at SRS; now the largest biomass-cogeneration facility in the US.
- The plant utilizes material from the surrounding counties which increases demand for wood products.

Photo from federal.ameresco.com