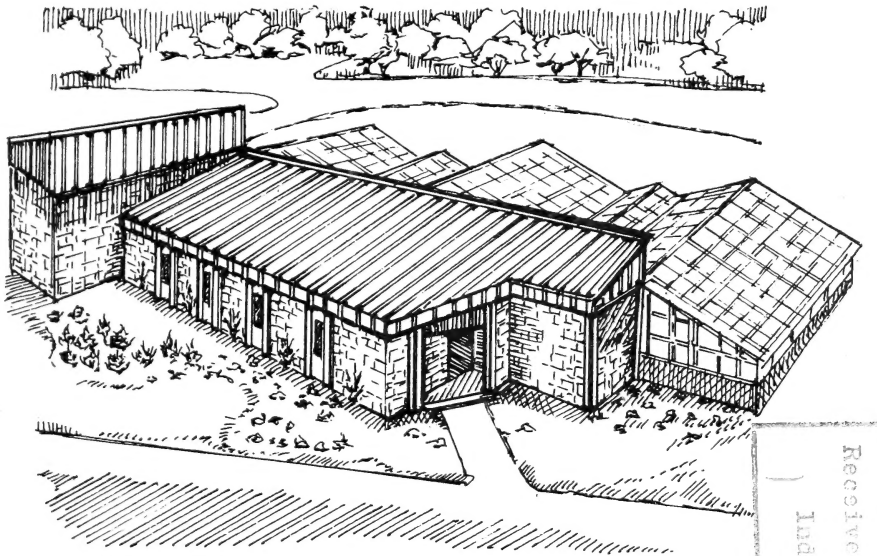
CENTER FOR FOREST ENVIRONMENTAL STUDIES



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What changes do we face in environmental conditions and what are their effects on our forests' growth and vigor? Efforts to measure the impact of these conditions will be major goals of a new Forest Service facility.

Trees' health and growth varies with a forest's changing environment. For example, trees will react to high levels of ozone, acid rain, ultraviolet light, and carbon dioxide. Other environmental factors are also thought to be changing at this time. It is vitally important to understand how forests are affected by these environmental factors.

To address this complex subject, the Center for Forest Environmental Studies has been built at Macon, GA. The Center is a state-of-the-art facility equipped to produce information needed to evaluate and respond to changing environmental stresses, particularly air pollution.

The Greenhouses and Headhouse

The 7,000-square-foot greenhouse is designed to closely control as many environmental factors as possible. All air continuously passes through a series of filters to remove particles and chemical pollutants. An air conditioner maintains specified temperatures. The unusual glass in the roof transmits more light than does conventional glass, particularly in the infrared spectrum. The glass softens shadows, and helps prevent burning of

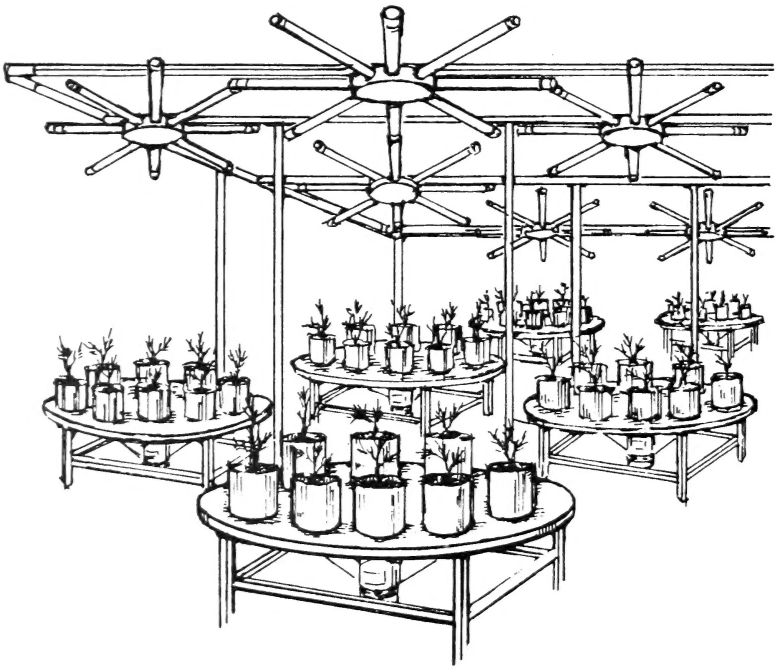
the foliage below. A large backup generator starts automatically in the event of an electrical failure.

The 2,000-square-foot headhouse contains equipment to support studies being conducted in the greenhouse. This includes a pot-filling machine, a water purification system and a complex system of computers and monitors that control the exposure equipment. The Center also uses additional laboratory and office space in the nearby Southern Forest Fire Laboratory.

The Exposure Equipment

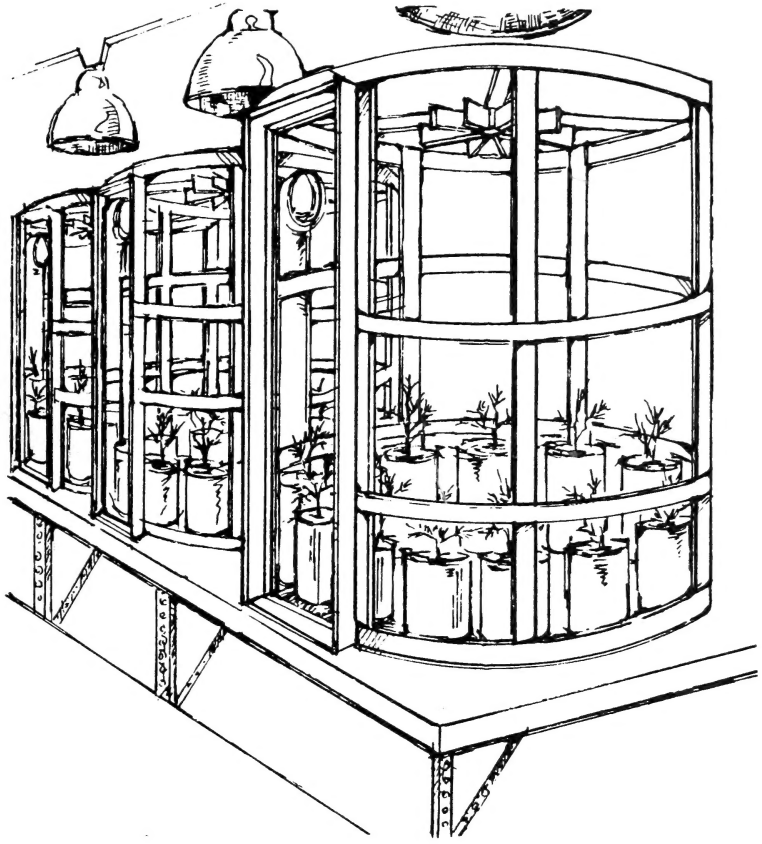
The Center has two major types of equipment: 12 rain tables that expose plants to simulated rainfall and 20 continuously stirred tank reactors (CSTR's) that expose plants to gaseous pollutants.

Each raintable includes about 180 needles set in an eight-armed hub. Simulated rain falls from the needles, which are supplied with water by a pulsating pump. This system applies extremely uniform drops, which fall on a round, rotating table on which seedlings are placed. A variety of equipment in the headhouse purifies tap water. Then chemicals are added to simulate those found in rain. A series of tanks at the pumping-and-mixing station allows several different solutions of simulated rain to be tested at the same time.



Rain tables.

The CSTR's are chambers in which seedlings are placed and exposed to controlled levels of gaseous pollutants. They are being used to test the effects of ozone at this time, but can be easily adapted to test the effects of a wide variety of other gases, including carbon dioxide and sulfur dioxide. The CSTR's at this facility are among the most sophisticated in the world because their computer controls allow for variable concentrations of gases.



Continuously stirred tank reactors (CSTR's)

Current and Future Projects

Three projects are underway to evaluate the effects of acid rain on forests and forest resources. The first study will compare the growth and physiology of loblolly pines exposed to three levels of rain acidity. In addition, this test will compare the responses of five typical southern forest soils to various levels of rain acidity. This study will last two years and will make daily use of the rain tables. The second study will evaluate the effects of simulated acid rain on the most destructive disease of southern pines. It will compare the effects of three levels of rain acidity on the ability of fusiform rust to attack various seedlots of loblolly pine.The third study will look at the effects of simulated acid rain on dogwood anthracnose, another fungus disease that is rapidly spreading in the East. It will evaluate the ability of the anthracnose fungus to attack dogwood seedlings grown under four different levels of rain acidity. Additional projects to evaluate the effects of acid rain are being planned.

Several studies are planned for the CSTR's. The objective of one study will be to develop a screening method to identify seedlots from commercially important trees that can tolerate ozone. If foresters could identify air pollution resistant trees and plant them now, they may be able to minimize the impact of this stress in the future. A second study will evaluate the interactions between ozone and fusiform rust or other disease agents.

Another study will evaluate the sensitivity of other plants present in the ecosystem. This information

would help managers of wilderness areas determine concentrations of air pollutants that affect sensitive species. It may also help identify plants that could serve as an early warning of the presence of pollutants.

The effects of fluctuations in ozone concentrations over time are important, but have been difficult to study with manually controlled exposure systems. The computer controls on these CSTR's should make them ideal for future studies of this type.

The Center is large enough and its equipment versatile enough to conduct several evaluations at the same time. Only minimal alteration of the facilities would be required to examine the effects of changes in carbon dioxide, temperature, ultraviolet light, and other environmental factors. The interactions between different factors such as ozone and acid rain can also be studied. The Center will be able to provide information needed to maintain healthy and productive forests in our constantly changing environment.

The Center for Forest Environmental Studies was built by the USDA Forest Service with funds from the Southern Commercial Forest Research Cooperative of the National Acid Precipitation Assessment Program. The Center operates through the cooperative efforts of the Forest Service's Southern Region, Southeastern Forest Experiment Station, and the Georgia Forestry Commission.
