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A REPORT OF THE BIOLOGICAL FIELD STATIONS OF TENNESSEE

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INTRODUCTION

Information for this report has been provided by Dr. Robert E. Martin, Director, Tech Aqua Biological Station, Tennessee Technological University, Dr. Neil A. Miller, Director, Edward J. Meeman Biological Field Station, Memphis State University, and Dr. Robert A. Carlton, Director, A. D. Oxley Biological Field Station, Lambuth College. Specific inquiries regarding future use of these facilities should be addressed to the appropriate Director.

TECH AQUA BIOLOGICAL STATION
DR. ROBERT E. MARTIN, DIRECTOR
Tennessee Technological University
Cookeville, Tennessee 38501

During the summer of 1980, 65 students from 21 different colleges and universities enrolled in courses at Tech Aqua during the summer session. The first summer term, 1981, will be held from June 7 to July 11, with the following courses to be offered:

Fish and Game Parasites	Ichthyology
Local Flora	Field Investigations
Ecosystem Analysis	Field Biology Seminar
Freshwater Invertebrates	

The second summer term, 1981, will be held from July 12 to August 15 with the following courses to be offered:

Entomology	Limnology
Fresh Water Algae	Field Investigations
Aquatic Vascular Plants	Field Biology Seminar
Biology of the Chironomids	

The Tech Aqua Biological Station continues to serve as a research base for graduate students from TTU and is used by field trip groups from several consortium institutions and by some non-consortium institutions. Inquiries on registration, fees, etc., should be addressed to the Director.

E. J. MEEMAN BIOLOGICAL FIELD STATION
DR. NEIL A. MILLER, DIRECTOR
Memphis State University
Memphis, TN. 38152

No courses are presently scheduled to be offered at the E. J. Meeman Biological Station during the summer of 1981. No further information is available at this time.

A. D. OXLEY BIOLOGICAL FIELD STATION
DR. ROBERT A. CARLTON, DIRECTOR
Lambuth College
Jackson, TN 38301

No courses are presently scheduled to be offered at the A. D. Oxley Biological Field Station during the summer of 1981. No further accouncements are possible at this time.

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ATMOSPHERE, ENERGY AND THE 1980's

GENERAL SESSION
TENNESSEE ACADEMY OF SCIENCES
89TH GENERAL MEETING

ACID RAIN: AN INTERNATIONAL PROBLEM, A NATIONAL RESPONSIBILITY

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Perhaps one of the more significant challenges of the coming decades relative to energy and the environment will be dealing with issues of long-range transport of pollution across socio-political boundaries. Acid rain is one example of such an issue which has attained an unprecedented level of international concern because nations being impacted are frequently minor contributors to the problem. Long-range transport and transformation of sulfur and nitrogen oxides from fossil fuel combustion have resulted in the deposition of

acidic precipitation over increasingly large geographic areas during recent decades. Not only are urban areas impacted, but also rural areas long distances down wind from pollution sources.

Although considerable concern has been voiced over the potential environmental effects of acid rain, demonstrated effects are primarily limited to aquatic ecosystems. Potential effects on terrestrial ecosystems have been identified, but not yet observed in the field. Much research remains to be done before it can be determined whether the problem of acid rain can be reconciled with the solutions to energy needs proposed by national energy policy.

ATMOSPHERIC CARBON DIOXIDE: IMPLICATIONS FOR WORLD COAL CONSUMPTION

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One unequivocal understanding that we do have about atmospheric carbon dioxide is that its concentration is consistently increasing. Since monitoring began at Mauna Loa Observatory, Hawaii, in 1958, the annual average atmospheric CO_2 level has risen from 313.53 ppm (by volume) to 336.48 ppm in 1979. Shorter records from other stations throughout the world show the same phenomenon. Although we cannot know exactly how this will affect the global climate, we do know that carbon dioxide has strong absorption bands in the infrared wavelengths at which the earth radiates energy to space, and most climatologists agree that this will ultimately lead to an increase in the average earth surface temperature. In fact, the best mathematical models of climate now predict that a doubling of atmospheric CO_2 concentration would lead to an increase of about 2°C in the mean temperature of the earth's surface, with dramatic regional variations in the temperature change and the precipitation/evaporation relationship.

The rise in atmospheric CO_2 concentration was actually predicted before it was observed and over the period of observations the annual increments have grown at the same rate as fossil fuel burning. Carbon release to the atmosphere via fossil burning now exceeds 5.2×10^9 metric tons per year and the atmospheric increase amounts to about half of that. Although all fossil fuels, of necessity, release CO_2 on burning, fuels vary in their carbon-hydrogen ratio and hence some release more CO_2 per unit of energy than do others.

Looking to the future, it appears that the bulk of fossil carbon exists in coal. If the remainder of global recoverable oil resources were fully oxidized, the accompanying increase in atmospheric carbon dioxide (assuming half remains in the atmosphere) would be less than 60 ppm, but if significant portions of the recoverable coal are oxidized, the atmospheric level could reach several times the current concentration. Aside from the possibility that major deposits of low-grade oil shale can be developed or that optimistic appraisals of unconventional oil and gas resources are borne out, it appears that high levels of atmospheric carbon dioxide will depend primarily on the quantity of world coal which is exploited and the rate at which exploitation occurs. With this insight, the global problem and how it is to be dealt with must be viewed with current estimates that almost 90% of world coal exists in 3 countries: the U.S., U.S.S.R., and China.

Our latest scenario for the future growth of atmospheric CO_2 envisions world energy consumption in 2025 at 3.3 times the 1975 level and with CO_2 releases at 13.6×10^9 tons per year. According to this scenario the CO_2 concentration would be close to 435 ppm and the global mean surface temperature (given time to reach equilibrium) up some 0.8°C by 2025. In this scenario, a major portion of growth in fuel use is related to the possibilities and aspirations for economic growth in the now less developed countries.

Well before this time (2025) we must hope to be able to judge if our understanding of the carbon cycle and of climate are sufficient to confront the tough decisions between expanding fossil fuel use, energy alternatives, and the many other social, economic, and technological priorities confronting the global community.

POWER-PLANT-INDUCED RAINFALL MODIFICATION: FACT OR FICTION

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Spatial correlations of monthly precipitation around the Bowen Electric Generating Plant (Plant Bowen) in Northwest Georgia have been developed from 28 years of National Weather Service data. Plant Bowen of the Georgia Power Company is a 3,160-MWe coal-fired power plant utilizing four natural-draft cooling towers. This study is a part of the Department of Energy (DOE) sponsored program called METER (Mteorological Effects of Thermal Energy Releases). This program is the result of the growing concern regarding the potential inadvertent weather modification caused by the significant amounts of heat and moisture discharged by the cooling towers and cooling ponds of large generating facilities. Current generation power plants dissipate about 5,000 MWt in the form of sensible and latent heat, while the next generation is expetced to double that amount. An additional dimension of this program is the consideration presently being given to the concept of power parks, especially for nuclear plants, to insure among other things the safeguards and nonproliferation. Such power parks are expected to dissipate about 30,000 MWt.

Among the various atmospheric effects linked to coooling tower emissions, is that of precipitation modification. Despite the fact that the amounts of heat and moisture involved with the towers of a large plant are negligible compared with those released by even a moderately sized thunderstorm, there is some speculation that the cooling tower plumes could function as a triggering mechanism serving to upset latent instabilities