environmental sciences

Gathered last week in Boston at an American Meteorological Society seminar on the Study of Critical Environmental Problems

DATA COLLECTION

Difficulties are large

The group concerned with providing a data base for this summer's interdisciplinary Study of Critical Environmental Problems (SCEP) at Williams College, sponsored by the Massachusetts Institute of Technology, faced large difficulties, says Dr. Raymond F. Baddour, MIT chemical engineering chairman.

One approach was to measure amounts of raw materials used in the manufacture, for example, of various chemicals, and then apply a "loss factor" to calculate the amounts entering the environment. But there are thousands of industrial chemicals, says Dr. Baddour, "and no one has ever really faced up to the job of gathering this kind of data on all of them."

In some cases, he says, United States figures were available for production of various chemicals, but the SCEP study emphasis was on global problems and data were needed from other countries as well. Because the information was not available, estimates often were not reliable and were not reproduced in SCEP's final report.

CLIMATIC EFFECTS

Carbon dioxide and particulates

The climatic effects of increasing atmospheric carbon dioxide and particulates (SN: 11/15/69, p. 458) made up a major part of the SCEP study. According to Dr. William W. Kellogg of the National Center for Atmospheric Research, these effects are still an area of great uncertainty, and a SCEP recommendation was for far more thorough studies than any made to date.

About half the CO_2 released by man's burning of fossil fuels remains in the atmosphere, and it is estimated that there will be a 20 percent increase (from the current 320 parts per million, up from about 280 parts per million at the beginning of the industrial revolution) by the year 2000. The other half of the CO_2, says Dr. Kellogg, goes—in about equal amounts—into the biomass and into solution in the oceans.

It is important to study what happens to the biomass-sequestered CO_2, which may later be released; SCEP recommends further study.

This CO_2 had not been considered in earlier atmospheric models, says Dr. Kellogg. Everything else being the same, the CO_2 atmospheric increase would raise the earth's temperature by about one-half degree by 2000, says Dr. Kellogg.

However, everything else will not be the same; the effects of particulates are still little understood, and the SCEP recommends more study, especially of the optical qualities of particulate aerosols. One indication is that particles reflect solar radiation back into space; another is that they may also absorb heat. The net effect is unknown.

The group also studied possible effects from a projected 500 supersonic transports flying in the stratosphere by 1985. The major concerns are their engines' emissions of sulfur oxides and water vapor, which will have a two to three year residence time in the stratosphere.

ECOLOGY

The effects of man

Man's impacts on natural ecosystems are complex, but some generalizations are becoming possible, says Dr. Frederick E. Smith, Harvard ecologist.

The evolution of ecosystems is analogous, says Dr. Smith, to the evolution of single species. Mutations in species are largely deleterious; likewise changes in ecosystems are usually for the worse. Thus man's gross tampering usually has undesirable effects.

Man has managed, he says, to alter marine and terrestrial ecosystems in opposite ways, both of which are damaging to his interests and to the systems. In marine ecosystems the turnover of plants is low and animals is high, whereas in terrestrial ecosystems the situation is reversed. In both kinds of systems man's interference tends to damage predators most. In the sea, the result is a lower supply of predatory fish, the main commercial product of the seas. On land, the killing of predators causes increases in herbivores which destroy plants—and plants are the main commercial products from the land.

Also, by oversimplifying systems—as in single-crop use of land, for example—man has made ecosystems far more liable to breakdown, says Dr. Smith.

The SCEP study concentrated on four general ecological problems of global significance: DDT, toxic metals, petroleum and petroleum products in the oceans and nutrients in waterways and oceans.

"DDT is a crisis problem because it singles out the top of food chains," says Dr. Smith. SCEP recommends immediate curtailment of DDT use, including, if necessary, subsidies to underdeveloped nations so they can substitute nonpersistent pesticides—or biological controls—for DDT (SN: 9/5, p. 197).

Also recommended is substitution as soon as possible of a harmless substance for the phosphate builder in detergents, a major source of nutrient phosphorus in waterways.

MONITORING

An economic possibility

A global environmental monitoring system (SN: 10/10, p. 300) is well within the means of world governments, although its efficacy is doubtful in some areas such as long-term climatic changes, says Dr. George D. Robinson of the Center for Environment and Man, Inc.

About $25 million would set up such a monitoring system and operate it for the first year if existing systems and cheap expedients—such as using commercial aircraft for atmospheric CO_2 measurements—are used, he believes.

But there is some doubt that monitoring CO_2 changes, for example, would give an adequate warning of major climatic changes or that action could be taken quickly enough even with an adequate warning, says Dr. Robinson.

Two of the SCEP recommendations: a "short, sharp study" of the oceans and baseline stations at remote locations to establish ecological guidelines.