

WHY AN INTERNATIONAL BIOLOGICAL PROGRAM?

For all animals and for man, today's material resources are tomorrow's garbage, and vice versa. Waste, therefore, does not exist. Living systems move matter around, into and out of many sources and sinks, but they do not create matter, or destroy it. Eventually, plants remake what we call resources out of what we call garbage. The energy they need to do this is captured from sunlight.

Most resources used by man are chemically reduced. Food, iron, and gasoline are examples. When they are used, oxygen is added to their molecules, and they gain weight. Therefore, the more resources are used, the faster the total weight of garbage increases. Fortunately, in turning oxidized compounds that were garbage into reduced compounds that are resources, plants restore the oxygen to the atmosphere.

Human societies are now so large, so complex, and use resources so rapidly, that they are in danger of drowning in their garbage. The problem is inescapable; there is no rug under which it can be swept. All sinks are temporary; like cesspools, they have a way of becoming septic when overloaded. "Waste resources" have seriously polluted the Great Lakes, and even the ocean cannot process all the garbage it now receives.

Most men understand these matters in principle, to detail, nobody understands them well enough. Partly, this is because living systems are amazingly complex, and are turning out to be interlocked in unexpected ways. In addition, the pace of technological progress has intensified the need for understanding. Human ingenuity creates so many "new" resources, and they become garbage so quickly, that old ways of handling garbage can no longer be counted on. Meanwhile, the old familiar pollutants—silt in our reservoirs, manure on our farms, carbon and sulfur compounds in our air—pile up on an unprecedented scale, and overflow the sinks that used to contain them.

When garbage is smoothly converted to resources, we speak of a system's "output" as "production". When interruptions occur in the same systems, we call the pileups "pollution", and notice that "production" is declining. Pollution, then, is deflected production. It can be channelled or controlled, but as every material pollutant is a potential resource, none can be eliminated entirely. Pollution is the internal friction of productive systems, part of the cost of maintaining output.

The International Biological Program is devoted to understanding the biological basis of human welfare. Because it is an international research program operated in more than 60 countries, it emphasizes those kinds of biology that demand information from a global "field." These include human genetics and nutrition, human responses to stressful environments, transport of airborne spores and pathogens, colonization of islands and of disturbed environments, and other not yet fully formulated. None is more important than the one the US-IBP Committee has chosen as central: Analysis of Ecosystems. It is central because it focuses on man's central problem, as a dweller in environments: the relations, in depth and detail, between pollution and production.

Analysis of Ecosystems is not less international than other components of IBP. In the United States, however, it differs both in scope and in emphasis from its counterparts in other countries. In much of the world, where more food is man's paramount need, the emphasis logically falls on production. In the United States, as in other developed countries, production has been reasonably adequate, at least up to now, and the emphasis falls instead on pollution. In the ecological view, however, these problems are inseparable. Today's productive systems are always polluted in some sense; it is *intensified* pollution that short-circuits production, behaving exactly as a cancer in the system. The objective of Analysis of Ecosystems is to understand living systems well enough to recognize such cancers before they start.

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ADDITIONAL VIEWS SUBMITTED BY DR. JOHN E. CANTLON

I should like to take as a point of departure a recent remark made in a body of scientific consultants. This group was examining a series of possible avenues that might yield useful approaches for meeting our burgeoning environmental problems. One scientist's remark brought the discussions to a climax.

"I keep hearing strong pleas for encouraging the investigation of natural purification phenomena, and of the need for more and better ways to halt increasing pollution. Why aren't we concentrating our scientific efforts on increasing tolerance to pollution?"