

mental surveillance. Detailed life histories are known for a relatively small proportion of the species of organisms even among those which are of direct importance to man. Several taxonomic specialists may be required for a single ecological study requiring identification of a large number of species.

Surveys

Comprehensive data are needed about the nature, frequency of occurrence and geographic distribution of living things and other environmental components comprising natural communities.

Broad scale studies.—Additional and more complete information is needed for national and regional inventories and descriptions of such things as soil, water, fish, wildlife, timber, range grasses and other vegetation. Several of these subjects for surveys are primarily found in natural areas or have their chief origins in them.

Localized benchmark studies.—Comprehensive documentation of the nature, abundance, distribution, diversity and condition of the components in a limited number of representative areas is needed to provide points of departure for measuring future changes in natural communities. Data from detailed benchmark studies provide a basis for further programs in research and monitoring and comprise an inventory of the related factors in a functioning natural system. From the standpoint of research they are points of departure for studies ranging from such basic aspects as measurement of energy flow within undisturbed natural systems, to providing a basis for assessing the long term effects of environmental manipulation e.g. existing weather modification programs. As an essential prerequisite for monitoring, benchmark information is the "ground truth" with which the impact of expected or unanticipated environmental changes can be compared.

Monitoring.—Monitoring of all relevant biological and environmental components of representative natural community areas is needed. Work should be conducted in both undisturbed and modified areas. Favorable and unfavorable changes should be noted over time and trends identified. Additional information is needed about the effects and duration of natural biologically—and environmentally—induced changes in plant and animal communities and man-induced changes resulting from management practices and other activities.

Information from monitoring has great utility in research to assess cause and effect relationships for changes in natural communities.

Education

As we recognize new and growing environmental problems associated with our rapidly advancing technological society, it is clear that there is a shortage of "ecologically oriented" scientists concerned with understanding natural ecological systems.

Ecology, more than most fields, depends on people trained in a wide variety of sciences, but trained to be conscious of interfaces.

Well-educated scientists are urgently needed in vegetation science, the dynamics of animal populations (from insects to whales), and ecosystem oriented ecology. Highly trained technicians are required to support research scientists. Much emphasis in the biological sciences in recent years has been placed on the molecular level, but the higher levels of biological integration have been seriously neglected. It is now recognized by the scientific community and society that one of the significant needs of our time is for scientific understanding at these higher levels, including the organization of human societies and their total environment. The understanding of natural plant and animal communities is a part of the knowledge required.

The need for an increased educational effort extends from kindergarten to the graduate level. An appreciation of nature is highly important to successful careers dealing with natural communities, and this element is acquired largely through early experience in the development of an individual. While the major need is for higher education, the elementary and secondary levels cannot be neglected.