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The Role of Biology in Conservation Education*

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The theme which seems to unite most discussions of the conservation of renewable natural resources is that of biology.[1] The basis of forest conservation is biology. Our most effective methods of retaining soil and water involve biological beings, the plants. The fisheries are biological problems. Man himself is a biological entity. The relationship between populations, including man, and their food supplies is fundamentally biological in nature. Almost without exception, it is biology to which we turn for answers to our conservation questions.

I would have no one misunderstand me in regard to primary education. The problem of learning to read and to interpret is basic and should be advanced by every means available. People must be literate before they can be led to a reasonable understanding of their place in the universe. The general education of our citizens is in reality a problem in biology since man is a biological being, and this basic education presents other biological questions. For instance, cultural and moral improvement in a nation is dependent upon the economic and nutritional well-being of the individuals in the population. These are biological problems in the fields of education and sociology.

One of the deficiencies frequently found in formal education is the failure to include sufficient biology. In most countries it is possible to finish not only the elementary and the secondary years but also college or university training *without any science.* The time has come when biology must be included in all college curricula. I say this not for personal reasons, but because I am convinced that the survival of our civilization, and perhaps of man himself, is absolutely dependent upon our under-

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1 Biology, i.e., both botany and zoology.

standing of our relationship to all living things. The hour is too late for personal feelings or whims to be the deciding factor in regard to this phase of our college curricula.

I would also insist that our high school students must have some understanding of the biological world in which they live. This is all the more imperative since few of our young people receive college training. I would go even further and introduce certain phases of biology *beyond* human physiology into elementary education. According to Blose (1), there are many people, some very intelligent, who never receive the equivalent of high school training.[2] It is probably true that at this elementary level (and perhaps at all levels) new methods and new materials will have to be devised, but this can and must be done.

At this point, it should be emphasized that biology can serve as well as any science in teaching the relation between cause and effect, a most important item in education. As yet, too many decisions, even involving conservation, are made by our citizens and officials on the basis of prejudice and emotion. A child cannot learn too early that the individual is responsible for his actions, and that these invariably lead to good or bad reactions or effects.

Again, biology can serve better than any other subject, not only in orienting man in the universe, but also in teaching the fundamental unity and balance in that universe. Too often, actually in the majority of cases, each subject (including biology) is taught as an independent unit. Biology, properly taught, makes use of chemistry, physics, mathematics, geography, and other disciplines.

[2] It should be noted that of the children starting the first grade in the United States, approximately 85% finish the 8th grade, 45% receive high school diplomas and less than 5% receive a college degree.

One of the common failures in education is represented by the fact that few students ever visualize the universe as an integrated whole, and we must not forget that this concept is very important to an understanding of conservation.

There is still another phase of education in which there must be introduced material for facilitating an understanding of the biological resources of the local community and even of the world. I refer to adult education. The decisions regarding conservation are in the hands of adults, and, by whatever means they can be reached: By radio, by press, by classes and conferences, by demonstrations, it must be urgently impressed upon them that their economy and culture and the future of their children are closely interrelated with the biological well-being of their community.

It may sound as if I can only find fault with education in general for its failure to include enough biology to insure that our citizens understand and appreciate their environment. The fault lies in part, perhaps equally, with biologists. Like all people, biologists have their prejudices and short-comings. All too few of them appreciate the fundamental relationships between their science and our civilization; often then cannot even bridge the gap between their specialty and some other phase of biology. Some biology teachers who do have this appreciation lack the feeling of responsibility for inculcating a sound understanding of the cosmic relationship in their students. Again, the biologist frequently fails to use proper methods and materials for his particular audience. And traditionally, *much* beginning biology is taught as a laboratory science without reference to the field. And there are still colleges in America where biology is taught dogmatically,

without laboratory equipment and materials or even a single field trip!

It is also imperative that our biologists, if they become specialists, have in addition a deep understanding of the relationship of their field to biology in general and even to the world at large. They must relate their subject to the other disciplines and help the students visualize their environment as a unified whole consisting of many interrelated facets.

I have already pointed out that biology can make as large a contribution as any discipline toward the conservation of our natural resources. Before it can perform its maximum service, however, some of the difficulties currently present in the field of biology must be overcome. On a highly competitive market there must be found zealous teachers not only with sound biological training but also with a broad understanding of ecological relationships. The word "zealous" is used purposely, for we need teachers so thoroughly imbued with the importance of their work that not only will they make the almost inevitable financial sacrifice to do their job but also instil in their students a philosophy of service as well as gain. The teacher must be able to impress the students that salvation in regard to dwindling resources cannot be bought and to convince them that the long-time point of view is the only sound and practicable one.

It is particularly important that the laboratory worker and field biologist each understand the other's point of view and appreciate the contributions in each field. Too often there seems to be a lack of understanding and perhaps a little jealously in this matter, but each would fail without the other. At the same time it must be admitted that it is difficult to provide the students with a full understanding of the contributions of biology to conservation by laboratory and lecture without any field experience. Agassiz's statement: "If you study nature in books when you go out of doors you cannot find her!" must not be forgotten. Our urban students frequently lack any considerable outdoor background, and often the student from the farm misinterprets his observations.

Moreover, the subject must be presented logically. Biology is particularly valuable in training students to experiment, observe, note and verify the facts and synthesize them into an answer which the student himself can defend. To teach it dogmatically and teleologically may give the students bad habits of thinking which are equally obnoxious in all fields, including the solution of conservation problems. On the other hand properly presented, biology can provide both facts, and methods of problem-solving useful in conservation.

It must be emphasized that the same methods cannot be used in presenting biology at all levels. All too frequently the high school teacher apes the college instructor and so on down the line. Each pedagogue must analyze his audience and choose and present his materials accordingly. A third year student in elementary school presents an entirely different problem from a college student and to use exactly the same methods and materials on each, as has been attempted, is idiotic.

The teacher in applying biology to conservation must be courageous. It is his duty to present biological facts regardless of the pressures which may be applied on him from various angles. Vested interests will resent his instruction where it may impinge on their profits, e.g., lumber interests often fight sound programs in national parks or forests because they interfere with immediate gains. The relation between

population and food supplies and birth control are in large part biological problems, but to present accurate facts on these subjects may bring down onto the instructor's head the wrath of the clergy and others.

Again, by way of emphasis, I insist that the biologist must, wherever possible, relate his instruction to conservation and to general living. No other discipline can so readily challenge the idea so widely held that we have unlimited natural resources in the form of forests, soil, water, fish, etc. It is high time that all realize that there is not an unlimited amount of anything, not even the materials from which atomic energy is derived.

The public and public officials have a right to ask all of the above from our biologists, and the latter are obligated to do their best. On the other hand the biologists have a right to request a certain consideration from these same individuals. When decisions are to be made involving problems with biological implications, specialists should be consulted and use made of their advice. All too frequently their council is not sought on pertinent questions and their suggestions ignored even when requested. Thus we see dams being built without adequate consideration of watershed control or fish production; The Tennessee Valley Authority in some ways illustrates one of the few exceptions in this respect. Industries are encouraged without much thought being given to the replenishment of the biological resources on which they depend. Politicians foster a high birth rate without regard to the food potentials of their areas. Economically unsound loans are made by public and banking officials because they fail to assay the biological potentials of the land on which they are made. International conferences are held and important decisions made without reference to the opinions of biologists or conservationists; witness the formation of the United Nations at San Francisco without the presence of conservationists. The importance of conservation in planning for peace has been discussed by Vogt (2).

Moreover, the biologist can help give us some idea of the amount of energy we will have available from that daily stored by the process of photosynthesis. It is still doubtful that coal and oil reserves, water power and atoms can indefinitely furnish all the energy needed in our civilization. A more efficient means of capturing and making available the solar energy falling on the earth would do much toward minimizing international rivalries and the causes for war. No greater service could be performed by biology than contributing to the solution of this grave problem. That would be conservation in its highest form.

The answers may not be palatable but the biologist can provide information, and within limits, predictions concerning most problems of conservation. He can guide the lawmaker in matters of legislation concerning forests, ranges, watersheds and fisheries. He can point out to the engineers the ecological significance of his dams, roads and other devices. He can help evaluate the biological resources of an area for the economist. He can inform the sociologist as to the biological implications of many of his suggestions. He can assist the agriculturalist in the selection of efficient crops. He can legitimately propagandize the public regarding the danger of unwise exploitation of our natural resources. He can train the public to recognize the fallacy in such statements as the following: "The forest resources of the world are adequate for present

day and future needs''; ''Our usuable energy resources are limitless''; ''Alcohol will replace petroleum''.

By way of emphasis, may I repeat that biology serving as a basis for conservation must become an integral part of the formal education of all school and college students and adults. In no other way will our citizens and officials so fully understand their environment and the need for conservation. The biologist in order to meet this responsibility, must teach with soundness, with inspiration and with breadth. He must command his subject and realize its cosmic implications. He must understand other biologists and above all his students.

With a public which fails to understand biology and ecology, our public officials, specialists and technicians will lack the support and understanding to initiate a sound attack upon the problems of conservation.

REFERENCES

(1) BLOSE, D. T.: *Statistical Summary of Education,* 1943–44., pp. 30, 31., U. S. Govt. Printing Office, 1947.

(2) VOGT, W.: *Saturday Evening Post,* 217 (46) : 17, 109, 110., 1945.

Preserving Animals in Plastic

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Every biology teacher has at some time or another become impatient with the use of formaldehyde as a preservative for plant and animal specimens. When introducing a unit in animal classification it is very inconvenient, as well as disagreeable, to present the students with jars of ''pickled'' animals. Too often, the top does not fit tightly and the fluid drips out over notebooks and texts. The unpleasant odor is also a disadvantage. The students often receive their first impressions via the olfactory organ, and remember their biology periods as the ''smelly'' class.

Since the introduction of liquid plastic as an embedding medium this has been largely overcome. In our laboratory we have prepared specimens of the various animal phyla as permanent mounts by using plastic. This is an account of some of the work we have done. Most of the biological supply houses list plastic embedded specimens in their catalogues. These are excellent and easily obtained, but one misses the fun of doing it oneself by the purchase of them.

We used *Castolite* for our work. We selected a small animal representative of each of the phyla, with the exception of the Protozoa, for embedding. The reason for this omission is obvious.

Some of the specimens were dried, such as the starfish and cicada. Most of the others had been preserved in formaldehyde. As an example of Chordata we used a small male guppy, and in this case began our work with a living animal. The preliminary treatment of the three types was different.

The dried specimens were the easiest to work with. After selecting a suitable sized mold the embedding could be done directly. For all of our work we used small glass stender dishes. We greased these with a thin layer of vaseline and then poured each about half