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The two meanings of "ecology"

“Ecology” refers to two very different things that are often confused: an attitude towards the environment and an emerging scientific field. This distinction has important implications for agriculture and for KVL. In the future, agriculture, whether “conventional” or “ecological,” will be seen as a form of ecological engineering, and this perspective should be reflected in our curriculum.

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Any scientist who has studied ecology knows there are two very different meanings of the word “ecology” as it is used today. Although those of us who have studied ecology in post-graduate school were taught that ecology is the area of biology that deals with the abundance and distribution of organisms, the word “ecology” in everyday language is more associated with a series of environmentally-oriented values than it is with an area of scientific inquiry. To most people, the word “ecology” or “ecological” refers to an attitude towards environmental issues, and only secondarily, if at all, to a scientific field. There are probably few sciences that are so closely identified with a specific ideology as is the science of ecology. If I am asked in a non-academic situation what my profession is, I hesitate to say that I am an ecologist, because people will assume I work for an environmental organization. If I say that I am a botanist, which is equally true, there is no such presumption of a particular value system.

This is not to say that there is no relationship between the science of ecology and the environmentalist philosophy, but simply that this relationship is one between two essentially different things. For example, “agroecology,” the name of a group in the Department of Agricultural Sciences at KVL, is the area of ecology that concerns itself with agricultural ecosystems. But “ecological agriculture” refers to agricultural practices that are considered to be more sustainable and environmentally-friendly than conventional farming practices. But from a scientific point of view, an agricultural field sprayed with pesticides has ecology, just as a tropical rainforest has ecology. This is similar to saying that a rat or a cockroach is as much of an animal as is a whale or a tiger. One can study the ecology of a conventional farm, such as the inputs and outputs of nutrients and energy,

just as one can study the ecology of an “ecological” farm. Indeed, many of the criticisms that have been raised against conventional farming have been based on ecological studies of conventional farming systems. But all types farms, traditional, conventional and “ecological”, are ecological systems that can be studied scientifically. Even a toxic waste dump will have a community of organisms living on it. Therefore it has ecology. The question for society is not the presence or absence of “ecology,” but what type of ecological systems we want to inhabit and use to produce food and other human needs.

What does this distinction between the science of ecology and “ecological” values mean for KVL? KVL’s mission is research and education in agriculture. Agriculture is changing very rapidly, especially in Europe. The science of ecology will be central to agriculture in the coming years. The ecological context in which agriculture exists, the environmental effects of agriculture, and the interactions among organisms, both “production” species and other species, are becoming important areas of study. In the future, agricultural issues such as plant nutrition, pests and diseases, and even production itself, will be seen as ecological issues. For example, plant nutrition occurs in the field, in the context of organic matter decomposition, mineralization, inputs from the atmosphere and from the farmer, and outputs to the atmosphere, ground water and surface runoff. These are ecological factors. Pest and disease problems will be seen as interactions among organisms, rather than simply as individual problem species to be studied in isolation and controlled with chemicals. Agriculture will increasingly be seen as a form of ecological engineering: the manipulation of an ecosystem for human ends.

Traditionally, agricultural research and education have not emphasized ecology. At many universities, including the KVL, the different areas of ecology are found in different institutes and in different courses. These areas are seen primarily as subfields of other disciplines, rather than as part of ecological science. For example, plant ecology is considered to be an area of botany, even though we know that plants can be influenced as much by animals and microorganisms as they can by soils and other plants. Since ecology concerns itself with the interactions among organisms, and organisms do not limit their interactions to other organisms within the same taxonomic group, a taxonomic division of ecology into “insect ecology”, “plant ecology”, etc. does not ultimately make scientific sense. Most animals eat plants, not other animals. This interaction, called herbivory, will influence the abundance and distribution of both groups. Forest ecology is the area of

ecology that deals with forest ecosystems, not just the part of forestry that deals with ecological interactions in forests. Ecological systems share certain principles that cannot be understood if one studies only one type of ecosystem. The modern way to subdivide ecological science is by the level of organization: (1) population ecology - a focus on one or a few species, (2) community ecology - the assemblage of species that live in one place, and (3) ecosystem ecology - the study of whole ecological systems, including organisms and non-biological factors. The subdivision of ecology into different taxonomic groups and different ecosystem types is still necessary, if not desirable, because no one can be truly knowledgeable about all types of organisms and all types of ecosystems.

There has been significant interest in “ecological agriculture” at the KVL, both among the students and among some teachers. Many of us would like to see KVL become a more “green” university. But the movement for “ecological agriculture” needs the science of ecology, because ecology is the area of basic science that underlies the applied science of agriculture. Increased sustainability will require a better scientific understanding of the ecology of agricultural systems than we currently have. Ecology will become as central to agriculture as chemistry or economics are now.

We need both meanings of ecology at KVL. We need more research and education in “ecological” agriculture, but we also need to develop the scientific understanding on which agricultural sustainability must be based. To meet this need, KVL needs a unified curriculum in ecology. There is no course in general ecology at KVL, and proposals for such a course have been contentious, in part because such a course would inevitably overlap with courses taught within the traditional disciplines. But we don’t teach chemistry only through courses such as plant chemistry, animal chemistry, and soil chemistry. Rather, these are seen as specialized areas to be studied after a student has mastered the principles of general chemistry. Doesn’t KVL need a basic curriculum in ecology as well? Just as general chemistry is a prerequisite for biochemistry, one could argue that general ecology should be a prerequisite for animal ecology or agroecology. An ecology curriculum should be an option for students, however, not another requirement.

Both science and agriculture are changing very rapidly. KVL must also change, or, to use a metaphor from ecological science, KVL itself will become like a species that is adapted to a niche that no longer exists.

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What is the science of ecology? One common definition is “the study of the relationships between organisms to each other and to their environments.” A more precise and less grandiose definition is “the study of the interactions that determine the abundance and distribution of organisms.” Ecologists ask questions such as: what determines the population size of a species, how do nutrients and energy move through ecosystems, what determines the biological diversity of a community of organisms? Modern ecology is very closely related to evolutionary biology. Populations evolve in their ecological context, in response to ecological forces such as competition, predation, and to environmental factors such as climate and geology. Ecology is a young discipline, with many different branches that originated from disparate sciences such as botany, zoology, forestry, mathematics, engineering, and geography.