Literacy: What Level for Food, Land, Natural Resources, and Environment?

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ABSTRACT

Many forms of literacy exist. Each literacy is an integration of ways of thinking, acting, interacting, and valuing. To understand the impact of agriculture (i.e., farming, ranching, forestry, and fisheries) and the contributions and interactions to the environment (e.g., losses of biological diversity, soil degradation, air and water pollution, the effects of human activity on the land, the landscape and natural resources, and the overall impact on nutrition and other biologically based consumer consumption choices) requires literacy about food, land, natural resources, and the environment. To define citizen levels of literacy we need to understand the competency levels of literacy—nominal, functional, cultural, and multidimensional. Nominal literacy identifies the minimal recognition of concepts. Functional literacy provides the content and understanding of *what*. Cultural literacy provides context to concepts and ability to articulate *why*. All three are conditions for multidimensional literacy, which gives meaning to concepts and *how* to achieve purposeful actions. Multidimensional literacy implies all levels of literacy about food, land, natural resources, and the environment are needed, if the populace is to "ask the right questions" for public and personal decision making.

Literacy refers to minimum skills and knowledge to function in a role or setting. Literacy is a moving target reflective of changing societies and a changing world. Traditionally, literacy meant reading, writing, and arithmetic. The U.S. Congress, in the National Literacy Act of 1991(U.S. Congress, 1991), defined literacy as

> an individual's ability to read, write, and speak in English and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and to develop one's knowledge and potential.

More recently there has been national and international focus on science literacy. Each new wave of concern about workforce competency, international competitiveness, environmental degradation, and public understanding of science and technology has fueled the cry for more emphasis on mathematics, chemistry, physics, geography, biology, and environmental literacy.

One might question whether our attention to literacy has been focused on the right target as we experience the explosion of knowledge and perceptions that all must learn more and more about narrower and narrower disciplines while continuing to add new fields of knowledge (e.g., genomics and nano-technology). Connecting science and technology to our daily lives has become a major challenge for educators and for many in society.

It is my view that we have failed to develop a systems perspective around which we can frame our relationships and our understandings about our physical and biological world of which all humans are a part. We have failed to build the connections and understanding of the dependence and interdependence among life systems. How we use and protect the earth's capacity to provide for humankind through informed personal, social, and political action will determine the future of all.

The food, fiber, environment, and natural resources systems are ideal media for linking scientific and technical—physical, life, earth, and space technology—with empirical, personal, and social dimensions, while addressing the stated outcomes of an inquiry-based and relevant science education program as outlined in the National Science Education Standards (NRC-NAS, 1996). Many persons associated with food and fiber systems reflect their endeavors as art (culinary, landscaping), science (animal science, crop science, forestry, soil science), or business (agri-business, forest products.) All learners depend on the biological and physical resources of our food, fiber, environment, and natural resources systems and exist within an environment affected by the systems. The largest sector of the world's population (45.0%) derives their livelihood directly from food, fiber, natural resources, and environment (FAO, 1999), but less than 2.0% of the U.S. population is engaged in production and management of these resources. Thus, all the more reason to make food, fiber, natural resources, and environmental systems the context on which we build our education efforts to create social and personal relevance of science and technology in the community and create multidimensional food, fiber, environment, and natural resources systems literacy.

A Minnesota survey of environmental literacy of 1000 adults, conducted from July to September 2001, reported 36% of the state's adults had above-average general knowledge and 65% believed they were knowledgeable about environmental issues and problems. However, almost 46% exhibited below average knowledge about the environment in response to specific questions (Murphy, 2002). A California Academy of Science/Harris Poll (2001) found only 23% of Americans surveyed feel very knowledgeable about environmental issues.

A 1999 survey of more than 3000 4th, 8th, and 12th grade students from large and small, rural and urban Minnesota schools gave ranges of only 14 to 20% scoring above average, whereas 40 to 58% failed in their responses to food, fiber, environment, and natural resources based questions, which were scaled by grade level and judged as subject appropriate by a panel of teachers for each grade (Cardwell, 2000). These and other studies indicate a lack of literacy about food, land, natural resources, and environment.

LITERACY DEFINED

Michaels and O'Connor (1990) describe literacy as follows:

> Literacy…is an inherently plural notion. We all have, and indeed fail to have, many different literacies. Each of these literacy's is an integration of ways of thinking, talking, interacting, and valuing, in addition to reading and writing…Literacy then is less about reading and writing per se, and is rather about ways of being in the world and ways of making meaning with and around text.

The terms *agricultural literacy* and *environmental literacy* have been used for several years in relation to agricultural and environmental education without much disciplined reference to debates

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about literacy. Both terms have working definitions, but these have not been derived from systematic engagement with literacy debates within agricultural, food, land, natural resources, and environmental or contemporary literacy debates in literature and language. As part of the work on "education standards," Roth (1992) provides a framework for environmental literacy. Wenzel (2003, p. 794–798) through Project Food, Land and People, and Leising et al. (1998) have provided similar frameworks or descriptions for agriculture, food, and fiber systems literacy with relation to knowledge, affect, skills, and behaviors at three levels of competence (nominal, functional, and operational). Although each of these frameworks might have their practical uses, neither is overtly grounded in the primary academic debate about the nature of literacy.

Roth (1992) defines environmental literacy as the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems. Roth further specifies that:

> Persons at the operational level routinely evaluate the impacts and consequences of actions, gathering and synthesizing pertinent information, choosing among alternatives, advocating action positions, and taking actions that work to sustain or enhance a healthy environment. Such people demonstrate a strong, ongoing sense of investment in and responsibility for preventing or mediating environmental degradation both personally and collectively, and are likely to be acting at several levels from local to global in so doing.

Frick et al. (1991) defined *agricultural literacy* as "possessing knowledge and understanding of the food and fiber system. An individual with such knowledge can synthesize, analyze, and communicate basic information about agriculture." Leising et al. (1998) applied this definition in developing their frameworks and descriptors of literacy. The characteristics of most food and fiber systems literacy statements focus on production, processing, and distribution but lack connection to health, nutrition, environmental qualities, and the well being of the individual and society at large. Leising et al. (1998) does note that food and fiber systems literacy "will allow 21st century consumers to make informed decisions from the supermarket to the voting booth," and… "the knowledge needed to care for their environment."

Biological Sciences Curriculum Studies (BSCS, 1993) postulates that a biologically literate individual should understand the unifying principles and major concepts of biology, the impact of humans on the biosphere, the processes of scientific inquiry, and the historical development of biological concepts. These knowledge, skills, and values are necessary to become effective citizens in society.

STAGES OR LEVELS OF LITERACY

As previously stated, many kinds of literacy have been identified. In relation to language development, it is common to distinguish between functional, cultural, and critical literacy (Williams and Snipper, 1990). Roth (1992) identifies nominal, functional, and operational levels of competency for environmental literacy. BSCS (1993) identified four levels of literacy: nominal, functional, structural, and multidimensional.

Nominal literacy represents the most rudimentary level of literacy. Nominal literacy is the ability to read and write. The learner can recognize terms but cannot define terms and expresses misconceptions. The learner typically has minimal mathematical computational skills. See Table 1 for examples of nominal literacy skills for current issues in food, land, natural resources, and the environment. An issue may involve one or more concepts needed for clarity and understanding.

Functional literacy "is the ability to decode what is encoded within the black marks on the white paper into intelligible words, phrases, and clauses, and to understand their literal meaning on a superficial level" (Williams and Snipper, 1990). The learner, at this level, cannot explain concepts. For example, you can read a story but cannot draw any implications, conclusions, or meaning from it. Statistics concerning rates of literacy and illiteracy generally relate to functional literacy (i.e., read, write, and perform simple mathematical computational operations) and obscures the fact that the requirements for functionally literacy varies considerably from time to time and place to place. Consider, for example, the level of print literacy needed to "function" as a farm worker in the 19th century vs. a computer operator in the 20th century (Williams and Snipper, 1990). BSCS (1993) defines functional literacy as the ability to describe a concept but with limited understanding. Roth (1992) defines *nominal environmental literacy* as the ability to recognize many of the basic terms used in communicating about the environment and the ability to provide rough but unsophisticated working definitions of their meaning. This definition approximates the terminology of BSCS and Williams and Snipper.

Functional literacy reflects rough understanding of concepts. Functional print literacy can be measured by objective tests, which can be purely summative, or may be diagnostic if subjected to miscue analysis, which analyzes reader's errors. Functional literacy is not just a matter of knowing what words mean, but of being able to find out what they mean in the context of whole sentences by the use of phonic and contextual cues. Functional literacy also involves being able to read words referring to commonplace abstractions (beauty, goodness, fear, safety, etc.). It involves literal comprehension.

Functional food, land, natural resources, and environmental literacy must, therefore, refer not only to the ability to remember wheat, milk cow, yellow pine, or tall grass prairie, but to recognize each; not only to recognize several crops within a given geographic area, but to know whether they are typical of an agrarian landscape. Functional literacy about food, land, natural resources, and environment must involve the ability to ascertain meaningful information from contextual cues. For example, to make an informed guess based on observation, to distinguish between weeds in a crop and a planned mix of intercropped plants; whether a soil is a well-drained sand or a poorly drained clay; whether the animals are beef or dairy; or whether a stand of trees are cultivated or natural, or to distinguish between native and invasive species.

Stables et al. (1999) noted that functional literacy is not a mere prerequisite to more advanced forms of literacy, but involves a series of complex skills and an accumulation of knowledge that has unlimited capacity for continued learning. Arguably, much science education in schools focuses chiefly on what is defined here as functional literacy. The topics of agriculture, food, land, natural resources, and environment should not be underestimated as the basis of topics and themes to achieve broad learner outcomes and functional literacy in education. However, functional literacy about food, land, natural resources, and environment is not enough because it does not engage either with the crucial notion of what the systems of agriculture, food, land, natural resources, and the environment mean to persons within these systems, or to the general public and learners in general. Education about agriculture, food, land, natural resources, and the environment must not abandon its scientific knowledge base, but must move beyond it so that scientific knowledge is used to inform what are essentially human value judgments. In terms of food, land, natural resources, and environmental literacy, we must acknowledge the importance of the functional literacy as this provides the content, but it must be juxtaposed alongside cultural or operational literacy, which provides context.

Functional literacy about agriculture, food, natural resources, and environment develop knowledge of *what*. What is natural, what is anthropogenic, and what are the basic concepts of relevance to the public and to the learner in a modern society.

Cultural, *operational*, and *structural* literacy are somewhat analogous terms. Marum (1996) notes *cultural literacy*, like functional literacy, is in a sense passive: it is the ability to know the

Table 1. Examples of issues in food, land, natural resources, and environment reflecting literacy levels and ability to make informed personal and public decisions.

Literacy level	Food, land, natural resources, and environment issues					
	Genetic engineering	Hypoxia	Global warming	Biofuels	Obesity	Food quality
Nominal Recognizes terms/concepts without valid explanation.	Genetically modified (engineered) organism, i.e., GMO	Low oxygen	Rise of the earth's surface temperature	Fuels made from plant material	Fat	Taste
Functional–Content Can provide a memorized definition of terms/concepts with limited application and some content. Understands "what" factors.	GMO: this is a plant or animal that has been developed by gene splicing.	Lack of oxygen (below normal levels) to the tissues and organs; affects higher plants and animals	A rise in the temperature of the earth's atmosphere caused by an increase in atmospheric carbon dioxide.	The product of biomass conversion; can be used directly to provide heat or electricity, i.e., wood burning	Excess fat due to eating more calories than used	Anything which, when taken into the body, serves to nourish or build up the tissues or to supply body heat and energy
Cultural–Context Can provide a definition of terms/concepts and explanation in own language using appropriate context. Understands "why" factors.	GMO: generally refers to living organisms, at all levels, where portions of the DNA from one organism is introduced into and made part of the DNA of another organism	Seasonally depleted dissolved oxygen concentrations (<2 mg/L) in a water body. Winterkill of fish. Dead zone in Gulf of Mexico.	An increase in the near surface temperature of the earth. Global warming occurred in the past as the result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases associated with use of fossil fuels.	Fuels made from biological or chemical conversion or extraction of biomass resources, usually of plant origin. Biofuels, renewable resources include ethanol, biodiesel, and methanol.	The condition in which excess fat has accumulated in the body; usually considered to be 20% above the recommended weight for height and age.	Essential body nutrients, such as proteins, carbohydrates, fats, vitamins, or minerals. An example of poor food quality is food-borne illnesses.
Multi-dimensional Can provide definition/concept, explanation, apply content, context, and other information; solve problems. Understands "how" factors required to make needed changes.	Any organism that has been altered through use of DNA manipulation. For example, GMO seeds exists today that produce plants that require less insecticide spraying because the plant produces toxins to common pests.	Depletion of dissolved oxygen in water, a condition resulting from an overabundance of nutrients of human or natural origin that stimulates the growth of algae, which in turn die and require large amounts of oxygen as the algae decompose. It is one of the most frequently cited direct causes of fish-kills in the USA.	Global warming refers to an average increase in the earth's temperature, which in turn causes changes in climate. A warmer earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans. Greenhouse gases make the earth warmer by trapping energy inside the atmosphere. Greenhouse gases are any gas that absorbs infrared radiation in the atmosphere and include: water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and hydro fluorocarbons (HFCs).	Biofuels include wood, wood waste, agricultural crop residues, dedicated energy crops, and food waste, as well as gaseous and liquid fuels produced from these feedstocks. Most biofuel technologies are considered capable of producing carbon offsets. Renewable energy.	A condition of marked overweight in animals and humans produced by a large variety of factors including genetic predisposition ("thrifty" genes), metabolic factors (over-secretion of insulin), and behavioral conditions (overeating, insufficient exercise).	Meeting the standards of manufacturing, particularly to know what ingredients are present to meet dietary requirements and food labeling standards, coupled with "best if used before dates."

Table 1 (continued).

Literacy level	Food, land, natural resource, and environment issues					
	Drought	Zoonotic disease	Organic	Fertilizer	Free range	Invasive
Nominal Recognizes terms/concepts without valid explanation	Long period of dry weather	Diseases and infections that are naturally transmitted between vertebrate animals and humans	Molecules containing carbon	Materials that provide nutrients for plants	Allowed to range over a large area of open land	Nonnative species
Functional–Content Can provide a memorized definition of terms/concepts with limited application and some content. Understands "what" factors.	A period of abnormally dry weather sufficiently prolonged for the lack of water to cause serious shortages of water	Viruses and bacteria to which man may be exposed. Transmitted from infected vertebrate host to a susceptible vertebrate host.	From a living thing or organism. Originating in nature. Molecules contain carbon, hydrogen, and oxygen.	Organic or inorganic plant foods that may be either liquid or granular used to amend the soil to improve the quality or quantity of plant growth	A practice whereby livestock are released into public or open lands to graze	Nonnative species disrupting and replacing native species
Cultural–Context Can provide a definition of terms/concepts and explanation in own language using appropriate context. Understands "why" factors.	Less rainfall than is expected over an extended period of time, usually several months or longer; it is a deficiency of rainfall over a period of time, resulting in water shortage for domestic use; agriculture or environmental sector.	A "zoonotic disease" is defined as a disease of animals shared by humans. Several of these diseases cause more problems in immune-suppressed people, such as in the very young and very old, in pregnant women, for people with AIDS, or those receiving chemotherapy.	Carbon-based compounds produced by living plants, animals, or by synthetic processes. Referring to substances that are or have been alive, and therefore contain carbon molecules in their chemical structure.	A substance that provides nutrients to plants. Some, such as manure and mined products are natural (organic); others are manufactured (synthetic). A substance that improves the plant-producing quality of the soil, such as manure or a mixture of chemicals.	A method of husbandry where the animals are permitted to roam freely instead of being contained in corrals or barns	Alien (nonnative) species of plants, animals, and pests whose introduction causes or is likely to cause economic, environmental or human health harm, e.g., zebra mussel, Africanized bee, Formosan termite, Eurasian milfoil
Multi-dimensional Can provide definition/concept, explanation, apply content, context, and other information; solve problems. Understands "how" factors required and making needed changes.	A normal, reoccurring feature of climate that originates from a lack of precipitation over an extended period of time, usually a season or more. Droughts can occur in virtually all climates. The precise definition depends on the region, but the definition is often determined by comparing recent precipitation to a 30-year average.	A disease that normally exists in animals, but can infect humans. Evidence suggests measles, smallpox, influenza, and diphtheria started out as zoonotic diseases surviving in nonhuman reservoirs. Plague was a zoonotic, as are salmonella, tetanus, brucellosis, Lyme disease, and West Nile virus. Interactions most likely between a carrier hosting pet or domestic animal and owners. Pasteurization of foodstuff and limiting exposure to carriers reduce risk.	Refers to volatile, combustible, and sometimes biodegradable chemical compounds containing carbon atoms bonded together with other elements, i.e., fossil fuels. The principal groups of organic substances found in plants and animals are proteins, carbohydrates, fats, and oils. A chemical or fertilizer, obtained from a source that is or has been alive. Also the general term used for a type of gardening or food production using no chemical or synthetic fertilizers or pesticides.	Any combination of organic or commercially produced soil amendments that carry essential plant nutrients. Fertilizers are required by law to state the percentage of N, P, and K contained in the blend, i.e., 13–13–13 is 13% nitrogen, 13% phosphorus, and 13% potassium. A substance used to increase growth of a plant or improve the quality of a crop. When used inappropriately, can contribute to water pollution.	This term refers to animals, including poultry, that are not confined, meaning these animals are able to go outdoors to engage in natural behaviors. It does not necessarily mean that the products are cruelty-free or antibiotic-free, or the animals spend the majority of their time outdoors.	Invasive organisms, which spread into our nations' fields, pastures, forests, wetlands, waterways, natural areas, and right-of-ways. Variously referred to as exotic, nonnative, alien, noxious, or nonindigenous. Plants and animals that displace native species. May be harmful to humans and animals. Strategies to limit introduction and early detection and eradication scenarios are very important.

received wisdom in a cultural or social context, such as the meaning of Thanksgiving or Fourth of July, or institutions such as church or school without making meaning for yourself. With *structural literacy* (BSCS, 1993) the learner can provide an appropriate explanation of concepts in their own language. Roth (1992) defines functional environmental literacy as the ability to recognize many of the basic terms used in communicating about the environment and the ability to provide rough, but unsophisticated, working definitions of their meaning based on "a broader knowledge and understanding of the nature and interactions between human social systems and other natural systems." In this same way, persons raised on a farm have an *operational literacy* of crop or tree farming or livestock production (i.e., a general understanding of other crop or livestock systems not common to the individual's farm experience). The learner can explain concepts in their own terms and can relate them to personal experiences. For the purpose of this article, cultural literacy will be used to denote literacy illustrated by an understanding of concepts in a context of the human activities associated with food, land, natural resources, and the environment. Cultural literacy refers to the ability to understand the significance that society attaches to cultural icons. Such icons include living natural objects (e.g., national parks, Californian redwoods [*Sequoia sempervirens* (Lamb. ex D. Don) Endl.], Boundary Water Area of Minnesota, Great Lakes) and values (e.g., the land ethic, stewardship, clean water, safe food, and private property). Increased cultural literacy about food, land, natural resources, and environment would be gained by a reading of Schama's *Landscape and Memory* (1995), in which the author discusses a series of landscapes of rich significance to contemporary societies (including part of the Eastern European forest, the English Greenwood, and the California redwoods) in terms of cultural history and with respect to the ways in which these landscapes have been viewed, used, and reshaped over a millennium. One of the abiding impressions gained from a reading of *Landscape and Memory* is that the landscapes in question have often been strongly shaped by cultural and social forces throughout the period in question. Schama effectively dispels the still partly held misconception, for example, that much of England was covered with virgin forest until the last couple of hundred years. Another excellent reading is Cather's *My Antonia* (1918), which captures the spiritual attachment to the land and associated importance of stewardship and private property in American culture.

Cultural literacy enables us to explain *why*. Cultural literacy about food, land, natural resources, and environment merely enables one to recognize the significance of natural images in human culture, along with some recognition of why and to whom they are significant (e.g., the American bald eagle [*Haliaeetus leucocephalus*], the sun, the landscape, the plow, domestic and wild plants and animals, or the white dove of peace are examples). However, it also allows for an understanding of why the landscape itself is as it is, shaped not merely by climate, glaciations, topography and time, but by arguments about enclosure, the need for timber and food, and patterns of land ownership and use, dating back centuries in some cases.

Cultural literacy depends on a degree of acceptance of cultural influences; it links the learner with a dominant value system. U.S. cultural history reflects a broad cross-section of European traditions, which have clashed with Native American traditions and beliefs. Local cultural literacy may identify a grass as "June grass" because it flowers in June. This has little scientific basis, as there are at least five species with the common local name June grass. "Corn" is another culturally based term. In the USA it is *Zea mays* L., in England it is *Hordeum vulgare* (barley), and in parts of Africa it is *Sorghum bicolor* (sorghum). Corn literally refers to the principle cereal grain of a country or region, not to a specific species. Cultural literacy refers primarily to cultural heritage. Insofar as cultural literacy is empowering, it empowers by giving the learner access to socially powerful perspectives and local parlance; cultural literacy alone does not enable the learner to act on that knowledge, once acquired. Effective action requires multidimensional literacy. Differences between functional literacy and cultural literacy are presented in Table 1 for some current food, land, natural resources, and environmental issues.

Critical, *operational*, and *multidimensional* are the terms used by Stables et al. (1999), Roth (1992), and BSCS (1993), respectively, to describe literacy as the ability to make sense in your own terms. To take effective action. It includes the ability to "get behind" the text or situation to interpret it in terms of its ideological or scientific underpinnings; to distinguish, for example, between factual account and propaganda, between scientifically valid data and unfounded opinion. Multidimensional means multiple senses. For example in literary criticism in which the "critical appreciation" of texts demands an extended personal response and evaluation of the text as work of art: an exploration of the reader's initial affective response. On the other hand, the responds to the text or situation may require more than a naive interpretation, but a reflection of an understanding of the cultural, social, political and scientific forces that shape the text or situation and can therefore guard against being taken in by it (Stables et al., 1999). Roth (1992) notes that persons at this

> level routinely evaluate the impacts and consequences of actions, gathering and synthesizing pertinent information, choosing among alternatives, advocating action positions, and taking actions that work to sustain or enhance a healthy environment.

BSCS identifies three qualities of multidimensional literacy as the ability to: (i) recognize personal deficiencies in knowledge or skills, (ii) obtain additional knowledge or skills, and (iii) apply knowledge of a concept to related subjects and solve a problem or answer a question.

Multidimensional literacy will be the term used in this paper that describes this level of literacy, which reflects the capacity for active exploration of significance, meaning, and decision-making. Multidimensional literacy is the ability to understand the text of a paper on a deeper and more creative level; the ability to discuss the use of genre in context, to question the motives and ideology of proponents, and to explore and develop personal and broader social responses to an issue. Multidimensional literacy about food, land, natural resources, and environment must then imply the power to understand the *how* factors that contribute to physical and biological changes affecting all life systems and to have a view on how to further mediate change in a way that can be translated into action. Examples of current food, land, natural resource, and environmental issues requiring multidimensional literacy can be found in Table 1. Multidimensional literacy about food, land, natural resources, and environment involves the ability to explore questions such as:

- What does a [food, plant, animal, place, or issue] mean to me?
- What does it mean to us, or to others?
- What are the consequences of carrying on in this way in relation to this [food, plant, animal, place, or issue]?
- Should we act differently, and if so how?
- How do we translate our values into effective action?
- Are our values themselves ready for change as a result of what we now know or feel?

As has been stressed above, multidimensional literacy cannot be effectively developed without good levels of both functional and cultural literacy. Food, land, natural resources, and environmental literacy rely on functional literacy because both debate and action rely on information (content) and require cultural literacy not simply because the debate and action need to be grounded in an awareness of the norms and values of our respective cultures. Informed decision making (multidimensional literacy) about food, land, natural resources, and environmental change demands an understanding of the norms and values (context) of the dominant culture and the perspective of minority cultures as well as clear understanding of the concepts and content.

CONCLUSION

Literacy in any subject is more than memorizing definitions of a set of terms. Literacy is the continued acquisition of knowledge, understanding, and skills that allow individuals to participate in discussions of contemporary issues, gather valid information when needed, and make informed personal and public decisions. Food, land, natural resources, and environmental literacy by its very nature implies science literacy, but mediated by cultural, social, and ethical values.

Agriculture, food, land, natural resource, and environmental literacy for all learners is thought to be important based on the following four basic attributes: (i) the interrelationships between natural and social systems in the "harvest of products" from the land and water for the benefit of humans; (ii) humankind's dependence on and intrinsic links to nature; (iii) the interface of technology and the making of personal and public decisions; and (iv) the appropriateness of topics to provide content, context, and concepts for "active learning" across the disciplines for learners of all ages.

Science and technology have provided us the means to understand agriculture, food, land, natural resources, and environmental challenges. By demystifying the terminology and concepts of our sciences we can build functional literacy with a new respect for and understanding of the natural world. From the arts and the humanities, geography, economics, and history we can achieve understanding of the cultural literacy of the relationship humans have to food, land, natural resources, and the environment.

Multidimensional literacy about food, land, natural resources, and environment will be achieved when the informed person understands the underlying scientific and technological principles, societal and institutional value systems, and the spiritual, aesthetic, ethical, and emotional responses and is able to ask the right questions. Such a person can follow in the footsteps of Aldo Leopold (1947), who noted:

> I'm trying to teach you that this alphabet of natural objects—soil, rivers, birds and beasts—spells out a story, which he who runs may read, if he knows how. Once you learn to read the land, I have no fear what you will do with it. And I know the many pleasant things it will do to you.

We, as a populace, with the shift from agrarian to urban life styles and fewer than 2% of the U.S. population currently engaged in producing food and fiber, have lost multidimensional literacy–the ability to 'read the land' and the relationship of food, natural resources, and environment. Without multidimensional literacy, which gives meaning to concepts and the capacity to take informed and effective personal and public actions, the future of our food, land, natural resources, and the environment and indeed all of life is insecure.

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About the Author…

Vernon Cardwell

Vernon Cardwell is primarily involved in undergraduate teaching and advising at the University of Minnesota. He has spent most of his 38 years at the University of Minnesota focusing on agronomic education and curriculum, and agricultural literacy. He is the Minnesota Coordinator for Food, Land and People Project (FLP), a K–12 agricultural literacy project, and active in Ag In The Classroom programs, both locally and nationally. Working with the latter two programs has raised concerns about the definition of ag literacy or environmental literacy. What does the learner know and what can the learner do? He is a former CCSA and ASA President and a career-long member of Division A-1, Resident Education.