Annotated Bibliography of Sustainable and Organic Agriculture Curriculum Materials

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Agbaje, K.A.A., R.A. Martin, and D.L. Williams. 2001. Impact of sustainable agriculture on secondary school agricultural education teachers and programs in the north central region. *Journal of Agricultural Education*. 42(2): 38-45.

This study considers the extent to which sustainable agriculture is taught by educators in the North Central region of the United States. The authors state that educational theorists believe that problem-solving approaches concerning real world problems are very valuable to learning, and that this has created an increased interest in using agricultural education as a vehicle. Also, the National Council for Agriculture developed instructional materials to help integrate sustainable agriculture into secondary school curricula. The study found that sustainable agriculture was being taught "to a moderate degree" by the educators, but that educators felt a personal lack of knowledge about sustainable agriculture. When sustainable agriculture was taught, it was often from a systems perspective, and made use of problem-solving and decision cases. The study "revealed a need for professional development of teachers and curriculum development related to sustainable agriculture in the north central region."

Altieri, M.A., and C.A. Francis. Incorporating agroecology into the conventional agricultural curriculum. *American Journal of Alternative Agriculture.* 7(1-2):89-93.

This paper discusses how to incorporate agroecology as a supplement to existing college curricula. It outlines two courses, one on the biology of agroecosystems and one on agroecology and sustainable development. The authors conclude that "the degradation of soils and depletion of other natural resources impose high economic, ecological, and social costs on society in the long term," and so it is "important to incorporate agroecology and sustainability into the educational process of agriculture.

Avery, D.T. 1997. Saving nature's legacy through better farming. *Issues in Science and Technology.* 14(1): 59-64.

Avery argues that our interest in organic and sustainable agriculture must be set aside until ultrahigh yield can be achieved with these methods. He states that in order to feed our population, trade barriers and subsidies must be abolished, and that high yield agriculture should be practiced. Avery also says that low yield agriculture, which he equates with organic agriculture, will lead to an overall loss of land and of biodiversity.

Bezdicek, D.F. and C. DePhelps. 1994. Innovative approaches for integrated research and educational programs. *American Journal of Alternative Agriculture*. 9(1): 3-8.

Although the need for agricultural products continues to rise, the number of farmers continues to fall. Therefore, more food must come from less land, and this has increased farmer's use of purchased inputs such as pesticides. At the same time, "the average consumer has little knowledge or appreciation of our food system and little awareness of the connection between food and farming." To improve the curriculum of land grant colleges, the authors suggest the formation of interdisciplinary educational teams, and of partnerships between the university and the community. They also stress that agricultural research and education must be viewed using a systems approach, and that socioeconomic concerns must be addressed along with the biological sciences. The authors suggest many models for studying these partnerships, communities, and farms These include on-farm research, paired farm comparisons, and focus groups. Finally, the authors conclude that education must evolve along with the evolution in agriculture.

Bhavsar, V.M. 2002. Certified organic farming principles and practices: a course linking farmers and university students. *The Journal of Natural Resources and Life Sciences Education*. 31: 20-24.

This article describes the process and outcomes of a university-level class linking land grant students to organic farmers. The class was developed in response to the growing importance of organic agriculture. The goal of the course was to "foster agronomic disciplinary knowledge, encourage ability to consider a farm as an ecosystem, encourage respect for practitioners of organic and conventional farming, and foster creativity." The class involved a field trips, and a farm visit/case study. Students were required to formulate an answer to a problem being experienced by their farm. A small percentage of the course grade was determined by peer grading, due to the communal nature of the class.

Borsari, B. 2001. Sustainable agriculture: its time has come. *Journal of College Science Teaching*. 30(5): 336- 338.

Borsari addresses the need for introducing sustainable agriculture into the traditional undergraduate agricultural curricula; he also states that an interest in sustainable agriculture has already been generated at the secondary school level. This need has come about because "agriculture has been drifting away from its pragmatic origins, and standing still amidst a changing environment." The remodeling of the curricula should be to achieve "at least a partial homeostatic balance in the environment." "We can refocus teaching and learning on the ecological interactions in agroecosystems for the long-term prosperity of farming communities." Borsari believes a key element in the new curriculum should be to exposed students to "farming practices and technologies that are used in different environments," which will lead to an increased appreciation of diversity. Also, curriculum should make clear that change can happen in your lifetime,

and that "individual prosperity is linked to the welfare of the entire system," and that technological literacy is an important skill.

Borsari, B., and M.F. Vidrine. 2000. An evaluation tool for improving undergraduate curricula in agriculture. *The Journal of College Science Teaching*. February: 235-240.

The authors state that "the incorporation of sustainable agriculture principles into modern agricultural sciences curricula reflects a growing recognition of the field's importance during the last decade," but that the curricula of most colleges and universities has not evolved to reflect this change. They also state that "by incorporating the concepts of sustainability in the curriculum, the students' educational experience will be broadened, and they will become better managers of natural resources and good stewards of the land." The article itself reports on an evaluation instrument for comparing and evaluating ag courses and programs. The instrument is based on a list of peer-identified key terms in sustainable agriculture and is included in the article.

Borsari, B., M.F. Vidrine, and S. Doherty. 2002. Assessing students' preparedness towards sustainability in US and European undergraduate agricultural curricula. *American Journal of Alternative Agriculture*. 14(4): 188-194.

The authors studied the understanding and retention of certain organic and sustainable agriculture terms and principles by graduating students enrolled in agricultural sciences at universities in the United States, France, and Italy to understand strengths and weaknesses in the curricula. Smaller colleges and non-land grant universities seem to be more adaptable to a changing curriculum, in part because they are not funded by agrochemical and biotechnological companies. The authors feel that including sustainable agriculture in the curriculum is "a real necessity" and that traditional agricultural curricula has been too focused on the farm as business model. This article is also a good source of important terms and concepts in organic/sustainable agriculture, as identified by "experts" in the field.

Cardwell, V.B. 1995. Environment, food, agriculture, and renewable resources: the missing links in science education. *The Agricultural Education Magazine*. 68: 5-8.

Cardwell begins by reviewing the importance of agricultural education as a means for meeting the National Science Education Standards of "science for all students, science that is inquiry-based, and science that is relevant." He then provides a thorough overview of the history of agriculture, education, and science. He breaks the history of environment, food, agriculture, and renewable resources (EFAR) into four main eras:

- the pioneering and subsistence era
- the mechanical era
- the biologically enhanced era
- the sustainable era, which he claims is marked by "a loss of public support for EFAR research, loss of farmers, loss of rural communities, loss of agricultural

education programs, and 'right-sizing' of colleges of agriculture" that produced a "negative picture of EFAR."

Cardwell concludes, based on several statistics, that "less than a fifth of the population in the United States has an understanding of the food and renewable resources systems that permit the life styles we currently enjoy." This is directly related to a lack of teacher knowledge about agricultural systems. To address this problem, Cardwell proposes the foundation of the Coalition for Education about Environment, Food, Agriculture, and Renewable Resources (CEEFAR).

Charles, C., ed. 1989. *Project WILD Elementary Activity Guide.*

Project WILD is a widely-adopted resource for teaching environmental science and conservation to school students in the United States. The elementary guide contains lesson plans divided among seven sections: Awareness and Appreciation; Diversity of Wildlife Values; Ecological Principles; Management and Conservation; People, Culture, and Wildife; Trends, Issues and Consequences; and Responsible Human Actions. The book is a strong resource for any conservation or environmental studies program, and also includes several activities to support the study of organic and sustainable agriculture. These include "Eco-enrichers," a look at soil formation; "Classroom Carrying Capacity," which could be useful in discussing world hunger and population; "Who lives here?" an introduction to native and introduced species; "Lobster in your lunch box," a study of food sources and costs; "Deadly links," an examination of pesticides in the food chain; and "What did your lunch cost wildlife?" a study on the environmental impacts of traditional farming and of food choices. Project WILD books not for sale, and are available only to educators who complete Project WILD workshops. For more information, see http://www.projectwild.org/materials/materials.htm.

Chiappe, M., and N. Goodyear. 2001. North-south partnerships: a case study of curriculum development for sustainable agriculture in Norte de Santander, Colombia. *Journal of Sustainable Agriculture*. 19(1): 31- 45.

This paper reports on the joint effort between the Universidad Francisco de Paula Santander (UFPS) in Cucuta, Colombia, the Universidad de la Republica in Uruguay, and the Nova Scotia Agricultural college in Canada, to write curriculum in sustainable agriculture suitable for UFPS. It is necessary for the course to consider the needs of rural farmers and to address problems cause by the adoption of high-input, high-yield agricultural systems. The course was divided into three main segments: scientific, socio-humanistic, and professional; and included long term projects such as: writing a report on the classroom experience, writing a proposal relating to sustainable agriculture, training others in the course content, and presenting seminars to others.

Clapp, K., and M. Hoff, eds. 1995. *Cycling Back to Nature: Food Production and Pesticides*. Chevy Chase, Maryland: The National 4-H Council.

This 4-H publication is divided into six sections: Ecosystem Basics, Living and Nonliving, Basics of Agriculture and Food Production, Pesticides and the Environment, Minimizing Exposure to Pesticides, and World Population and Food Production. The format is reading followed by one to three activities, which can be completed under the supervision of a leader or teen leader, in small groups, or sometimes alone. The first two sections are very basic, and may be beneath many students. Sections 3-5 are very applicable to the study of organic and sustainable agriculture, although they tend to downplay the impact of pesticides on the environment and on public health. Some of the best activities included in these three sections are Field of (Potato) Dreams—a look at alternative farm management practices; The Great Potato Famine—the basics of IPM; and The Brown Pelicans of Louisiana—a game to examine bioaccumulation. The final section is an in-depth look at population in both the world and in the United States.

Cooper, N. and J. Gamon. 1991. Sustainable ariculture—what does it mean? ***The Agricultural Education Magazine.*** **63(8): 12-13, 22.**

According to Cooper and Gamon, sustainable agriculture is farming that is "resource-conscious, environmentally compatible, and commercially competitive," and that recognizes farming as a system comprised of diverse methods and inputs that prevents the environmental injury that often accompanies an extended monoculture. It includes such practices as crop rotation, seeding steep hillsides as grass, crop rotation, and computer technologies. It may use conventional methods, as long as they are used "correctly," to develop a long-term productivity of the land. Because sustainable agriculture must be profitable to the farmer, they can reduce the cost of their input and increase returns. Sustainable agriculture depends on a "society [that] is able and willing to pay for the production of the goods." "It employs a knowledge of soil, crop production, botany, pathology, chemistry, ecology, entomology, engineering, and economics."

Crews, T.E., C.L. Mohler, and A.G. Power. 1991. Energetics and ecosystem integrity: the defining principles of sustainable agriculture. ***American Journal of Alternative Agriculture.*** **6(3): 146-149.**

This paper examines the definition of sustainable agriculture and the role that economics plays in conventional definitions. The authors conclude that sustainable agriculture should consider ecosystem constraints first and foremost, before economics enter the picture.

Culen, G.R. and T.L. Volk. 2000. Effects of an extended case study on environmental behavior and associated variables in seventh- and eighth-grade students. ***The Journal of Environmental Education.*** **31(2): 9-15.**

The authors state that in forming "responsible environmental behavior," it is important to produce curricula providing information on environmental issues, techniques to review the issues, and citizenship skills. They tested a case study on wetland issues using a pre- and post-test analysis and found that "training in investigation-evaluation-

action skills" positively increased environmentally-conscious behavior. Furthermore, action is correlated to perceiving both group and individual loci of control.

Donahue, T.P. 1994. Community-supported agriculture: opportunities for environmental education. *Journal of Environmental Education*. 25(2): 4-8.

This article describes the pressures that small farms near growing cities face in terms of land development and socioeconomic realities. It is based on a case study of the Community Farm of Ann Arbor, Michigan. Donahue speaks of the importance of sharing and valuing differing social norms and expectations. The article details the workings of a community farm, and delves into "biodynamics," the principles that guide the Community Farm of Ann Arbor. According to Donahue, many educational topics can be addressed in the context of a community farm, including nature study, science education, composting and solid waste, the environmental impact of agriculture, farmland preservation, alternative agriculture movements, health and nutrition, ag economics and policy, and rural development, should environmental educators use community farms as a resource.

Doyle, R. and M. Krasny. 2003. Participatory rural appraisal as an approach to environmental education in urban community gardens. *Environmental Education Research*. 9(1): 91-115.

This article describes the planning, realization, and outcome of a project in which urban youth document gardening practices of ethnic minorities using the participatory rural appraisal approach. This approach emphasizes active, hands-on learning to engage the student in the subject matter. It stressed the involvement of youth in determining objectives for environmental action.

Durney, M., ed. 1996. *Project WET: K-12 Curriculum and Activity Guide*. Bozeman, Montana: The Watercourse and the Council for Environmental Education.

The Project WET (Water Education for Teachers) guide is widely distributed and commonly used in schools throughout Pennsylvania. The focus is clearly on water education, but some of the activities certainly overlap with a study of organic and sustainable agriculture. These activities include "Get the Groundwater Picture," which has students model groundwater flow by creating their own earth section; "Wetland Soils in Living Color," which helps student study soil using a color key made with crayons and could easily be adapted to other soils; "A-maze-ing Water," which helps students learn how certain activities impact water quality; "Color Me a Watershed," which shows students how development can affect a watershed; "Irrigation Interpretation," in which students explore irrigation systems; "Sum of the Parts," in which students demonstrate how everyone contributes to the pollution of a river; "The CEO," in which students look at the relationship between economic benefits and environmental quality; and "Dust Bowls and Failed Levees," in which students learn about the effects of drought, flood, and other water-related events on people.

Eagles, P.F.J. and D. Demare. 1999. Factors influencing children's environmental attitudes. *The Journal of Environmental Education*. 30(4): 33-37.

This study reports that "ecologistic and moralistic" attitudes concerning the environment correlated to discussing nature at home, watching nature films, and reading about nature. Perceptions about the environment are derived from a number of sources including family, media, and school-based environmental programs.

Federico, C.M., J.P. Cloud, J. Byrne, and K. Wheeler. 2003. Kindergarten through Twelfth-Grade Education for Sustainability. *The Environmental Law Reporter*. 33(2): 10117-10131.

This article condenses current pedagogical theories and resources available to educators interested in sustainability. The authors pay particular attention to k-12 resources, because they feel that "primary through secondary education is a major shaper of the truths, attitudes, ethics, concepts, and behaviors of American society. By reshaping K-12 education in the United States so that it systematically and effectively fosters sustainability, we will be able to make great progress toward the achievement of a sustainable world." The authors state that "there exist independent efforts to teach students the ecological literacy, systems thinking, multiple perspectives, connection to place, sustainable economics, citizenship, and the creativity and visioning they will need to fashion a more sustainable world," but national governing bodies are lacking and only one state (Vermont) has educational standards that "explicitly address" sustainability. More often, educational systems focus on lower-level thinking and fact recall. To change this paradigm, schools must connect students to real-world sustainability efforts. The 1992 Earth Summit stated that "education is critical for promoting sustainable development and improving the capacity of people to address environment and development issues." The authors identify several characteristics of effective sustainability curricula, including: ecological literacy, systems thinking, multiple perspectives, place, sustainable economics, citizenship, creativity and visioning. The authors suggest that student-centered problem solving techniques that emphasize critical thinking skills and cooperative learning are the best ways to teach sustainability, and that food systems education may be a valuable teaching tool for sustainability.

Feldman, R.S. 1999. Using a small-scale demonstration farm as a teaching arena in biology and environmental science. *Journal of College Science Teaching*. January: 186-191.

"Each generation of Americans is becoming more detached from farming and agriculture and fewer students come directly from families involved with farming," therefore, the author states, there are numerous teaching opportunities in agriculture. His students "are confronted with the opportunity to integrate ecological principles into the practical concern of growing food." This article provides a case study on how to use field experience to learn and apply these principles. A valuable experience will provide: application of academic work, tangible accomplishment, cooperative effort, long-term effort, relationship building, and mentorship. The author also states that he finds it

remarkable that a student's first (and perhaps only) farm interaction occurs during college, when in previous years it was a common part of life from early on.

Francis, C. and J. King. 1994. Will there be people in sustainable ecosystems? Designing an educational mosaic for the 22nd century. *American Journal of Alternative Agriculture.* 9(1): 16-22.

The authors state that "current conventional educational systems teach about an agriculture based on high inputs and generous fossil fuel use." But conventional systems may not be sustainable environmentally or economically. To change the agricultural paradigm, educators must change the way in which agriculture is taught. The authors suggest beginning with the "basic principles" of crop growth, plant-environment interactions, and animal nutrition, and then looking at these principles in the context of the larger agricultural system using participatory learning methods that motivate student curiosity, including case studies and on-farm practice. Also, that authors argue that students should be given a long-term view of the impacts of various agricultural inputs and practices. Finally, they suggest that these issues should be confronted "early in the educational process."

Gupta, G. 1997. A curriculum in sustainable agriculture. *Journal of Natural Resources and Life Sciences Education*. 26(2): 177- 179.

Gupta develops an undergraduate degree outline in sustainable agriculture. He defines sustainable agriculture as "a system of food and fiber production that improves the productivity of natural resources to meet the increasing demands of population and economic growth, produces food that is safe and nutritious, ensures adequate farm income, improves soil productivity and water resources and meets social and national expectations." In addition to a two-year study of general education, Gupta suggests courses in environmental science, resource economics, sustainable agriculture and the environment, water pollution, air pollution, natural resources management, and geographic information systems. Gupta also lists 6 ecological and economical concepts integral to the study of sustainable agriculture:

1. role of animals: animal and plant complementarity, enterprise diversification, animal-forage integration, forage farming, multiple animal cropping and manuring, and agroforestry
2. role of economics: enterprise or component analyses, whole farm analyses, profitability of adoption of IPM, cost and social impact of additional machinery requirements, renewable vs. nonrenewable resource management costs, sociological adaptation costs.
3. role of ecology: ecosystems and holistic management, water, air, and soil pollution, carrying capacity of the earth, limits to food production, resource pollution and depletion, chemical toxicity, and health effects.
4. soil biology, fertility, and erosion: soil biota as a component of sustainable agriculture, fertilizer and irrigation management, soil tillage, nutrient withdrawal and yield response, nutrient replacement vs. supplementation, nutrient balance, inputs, and removal

5. crop and pest management: soil testing and plant analyses, rotation management, cover crop management, minimizing nutrient losses, cultural weed control, chemical and biological control (IPM and ecologically based pesticide management—EBPM), environmental responses.
6. sustainable agriculture and water quality: supplementing precipitation, infiltration, soil water evaporation, modification of transpiration, soil storage increases, and percolation reducers.

Gupta also identifies other sustainable agriculture resources.

Hancock, J.M. 1991. *Biology is Outdoors: A Comprehensive Resource for Studying School Environments.* Portland, Maine: J. Weston Walch.

Biology is Outdoors! is a good resource for teachers wishing to undertake studies of their school environments. It includes guided studies on the physical setting of the school, on plant life and plant health on school grounds, on soil analyses and organisms, on opportunistic species, on microenvironments, on impact of the school building and the its people on the environment, and on natural areas. Many of the soil and impact activities could support local studies in sustainable and organic agriculture.

Harmon, A., R. Harmon, and A. Maretzki. 1999. *The Food System: Building Youth Awareness through Involvement.* University Park, Pennsylvania: College of Agricultural Sciences.

This curriculum book provides background information and activities on a number of topics relating to organic and sustainable agriculture, including the food system and its inputs, food production and transformation, food distribution and access, food consumption and outputs, and sustaining the local food supply.

Hawkins, M., ed. 1977. *Project Learning Tree*. Washington, D.C.: The American Forest Institute.

The American Forest Institute has produced two guides under the title Project Learning Tree—one is a resource for K-6 teachers, and one is a resource for teachers in grades 7-12. Although both are wonderful guides that have been widely adopted, neither have any lesson plans specifically related to the study of organic or sustainable agriculture. However, there are many topics that could support such a study.

Hubert, D., A. Frank, and C. Igo. 2000. Environmental and agricultural literacy education. *Water, Air, and Soil Pollution*. 123: 525- 532.

The authors suggest that environmental and agricultural ideas can be introduced into the normal, basic curriculum for students in K-12. Also, increasing urbanization has led to an increasing lack of agricultural knowledge in many students. This article provides a rationale for introducing ag studies into the classroom, based on the National Research Council's finds that all students should "receive at least some systematic

instruction about agriculture" throughout their K-12 years. Finally, it reports on the construction and implementation of a curriculum guide in the agricultural sciences.

Hurst, T. and L. Sperry. 2000. A vision for K-12 education in and about agriculture and natural resources. *The Agricultural Education Magazine.* July/August: 18-19.

This article addresses timing in agricultural education. According to the authors, by the time a child enters high school his or her ideas about agriculture are already set: "the elementary level is the ideal time to expose students to agriculture and natural resources through the use of literature and hands-on science and historical examples.

Jaus, H.H. 1984. The development and retention of environmental attitudes in elementary school children. *Journal of Environmental Education*. 15(3): 33-36.

This paper also states that the peoples' attitudes are fixed by the time they reach high school. From the study, the author concludes that minimal instruction in environmental education can have a large impact on attitudes which are retained over time, and that elementary school students tend to have a "slightly" positive attitude toward the environment even without instruction. This makes them receptive candidates to sustainability education.

Karsten, H.D., and R.E. O'Connor. 2002. Lessons learned from teaching an interdisciplinary undergraduate course on sustainable agriculture science and policy. *Journal of Natural Resources and Life Science Education*. 31: 111-116.

This describes a PSU course, cross-listed course in agronomy and political science. A main goal of the course was to "stimulate learning about science and policy through the food production systems, a topic that is personally relevant and interesting to many students." The article provides an overview of the course, including topics covered, course materials, evaluations, the team-teaching approach, and student reactions to the course. The professors used a case study approach to make the science both more interesting and less intimidating to the students. They also gave an attitudes and opinions survey before and after the course, and compared the responses using a difference of means *t*-test, to gauge the influence of the course on students' attitudes and opinions.

Kesselheim, A.S., B.E. Slattery, S.H. Higgins, and M.R. Schilling. 1995. *WOW! The Wonder of Wetlands*. Bozeman, Montana: The Watercourse and the Council for Environmental Education.

This book is full of curriculum for K-12 educators. It also includes extensive teacher background information, and suggested units for various grade levels. Several of the activities could support a study of organic and sustainable agriculture. These include "Marsh Mystery," a lesson on bioaccumulation; "Treatment Plants," a lesson on plant uptake of pollutants; "Nutrients: Nutrition or Nuisance?" a lesson on nutrient flow in a marsh; "Recipe for Trouble," a lesson on the effects of pollutants on water environments;

"Water Under Foot," a study of the ground water cycle; "Runoff Race," a study of water quality definitions; "Over Hill and Dale," a lesson on human impacts on watersheds; and "Do You Dig Wetland Soil?" an innovative lesson that uses a soil chart made with common crayon colors to explore wetland soil. "Do You Dig Wetland Soil?" could also be adapted to agricultural soils.

Knight, J. and J. Elliot. 1999. Don't throw the baby out with the bath water. *The Agricultural Education Magazine.* November/December: 14-15.

This article highlights the history and uses of supervised agricultural experience (SAE) programs.

Lippert, R.M., B.J. Speziale, J.H. Palmer, and G.C. Delicio. 1998. Evaluating an internet distance learning course on sustainable agriculture. *Journal of Natural Resources and Life Science Education*. 27: 75-79.

This article describes an internet distance education course on sustainable agriculture for middle and high school teachers. It was offered for graduate credit at Clemson University and with the intent that teachers could use the knowledge to enhance their curricula. Topics covered were: water quality, biodiversity, conserving soil resources, economics, and energy. The authors argue that agricultural is a good source of curriculum because it related science to "the real world," and provide learning opportunities in biology, chemistry, physics, earth science, and ecology. Field trips were also included in the class, and focused on erosion as a result of conventional versus sustainable agriculture, and impact of agriculture on insect populations.

Lohr, V.I. 1992. Research on human issues in horticulture motivates students to learn science. *HortTechnology*. 2(2): 257- 259.

Lohr relates that motivation is a "major factor that promotes learning" and that teachers can motivate students by be enthusiastic themselves. She also states that independent projects help students understand aspects of science that might otherwise be difficult (repetition, experimental design, etc.). Investigating human issues and real-world problems also motivate students to learn.

Lord, T.R. 1999. A comparison between traditional and constructivist teaching in environmental science. *The Journal of Environmental Education*. 30(3): 22-28.

This article compares the effects of teacher-centric and student-centric instructional methods on student learning at the undergraduate level. In both cases, identical examinations were used. It was found that students enrolled in the student-centric classes, which used small group discussions on "thought-provoking scenarios," performed better. Students in the class also had higher involvement in environmental activities offered on campus than their counterparts enrolled in a traditional class.

Maretzki, A., A.H. Harmon, and C.C. Giesecke. 1997. *Food Systems: Youth Making a Difference*. University Park, Pennsylvania: Northeast Network: Food Agriculture and Health Policy Education Program.

This guide includes eleven lesson for "teaching food policy to today's teens." It teaches systems thinking, where food comes from, and how policies affect the production of food. It closes with a lesson entitled "Act Locally," in which students "participate in framing a food policy issues and bringing about change in their local food system."

Marshall, T.A. and D.R. Herring. 1991. Sustainable agriculture: an essential part of the in-agriculture curriculum. *The Agricultural Education Magazine.* 64(1): 10-12.

Marshall and Herring argue that the educator's job is to teach students about "critical issues" facing agriculture. They label sustainable agriculture as the main issue with which to be concerned. They provide many definitions of sustainable agriculture and discuss research into sustainable agriculture at the national level. Finally, they delineate the main issues in sustainable agriculture:

- energy use and conservation
- water quality and conservation
- soil quality and conservation
- pest control and chemical use
- animal production issues
- sustainability and profitability

They conclude by saying that the "inclusion of sustainable agriculture in the curriculum is essential" but that it is not likely to be taught as a separate course at the secondary level, so the unit should be well-integrated into the existing curricula.

National Council for Science and the Environment (NCSE). 2003. *Recommendations for Education for a Sustainable and Secure Future.* David E. Blockstein and Julie Greene, Eds. Washington, D.C.

Available online: http://www.ncseonline.org/EFS

This document is a copy of the proceedings of the Third National Conference on Science, Polic, and the Environment, held from January 30-31, 2003 in Washington, D.C. It is divided into three main sections: Background on Education for Sustainability; Recommendations for Education for a Sustainable and Secure Future; and Conference Speeches, Awards, and Activities. It also includes several appendices that identify key documents to the history of sustainable education and available activities in environmental education, as well as lists of conference participants and sponsors. Of particular interest are summaries from breakout sessions that present recommendations on education for sustainability at various levels—including K-12 education. In the area of K-12 content, five main topics are identified: stewardship, the future, global issues, communities, and economics.

Natural Resources Conservation Service, USDA. ***America's Private Land: A Geography of Hope.***

Available online: http://www.nrcs.usda.gov/news/pub/GHopeHit.html
Or for purchase through the Government Printing Office.

"*America's Private Land, A Geography of Hope* tells the story of America's private, nonurban land. Private land is America's working land. It produces food and fiber, and much, much more: It also produces clean water, clean air, wildlife habitat, healthy and productive soil, and scenic landscapes. But this story is more than a national report card on the state of our Nation's natural resources; it will help the reader learn to think about land (soil, water, air, plants, and animals) in a different way. *A Geography of Hope* is a call to action, a call to renew our national commitment to America's private land and private landowners. The Nation will never achieve its goals for conservation and environmental quality if farmers and ranchers and all other private landowners are not engaged in a cooperative effort to use the land according to its capabilities. You'll get the facts and figures on natural resources from *A Geography of Hope*, all woven into a framework of land stewardship and a vision for natural resource management in the 21st century."

Needham, J. 2000. Agricultural education in the elementary classroom. ***The Agricultural Education Magazine.*** **May/June: 8-9, 23.**

The author discusses how agriculture relates to all school disciplines using her own 1st and 2nd grade classroom as a case study.

Pennsylvania Department of Education, Office of Environment and Ecology. No date. ***Agriculture K-12 Curriculum Supplement: Act 26.***

This publication introduces teachers to available resources useful for meeting the Pennsylvania education and environment standards. It includes topics such as pest control plan development; soil and nutrient management; food, fiber and distribution; ecological functions of wetlands; food safety; recycling; animal health; farmland preservation; barn design; and right to farm. It lists some resources with lesson plan excerpts, but all are covered in this document.

Pennsylvania Department of Environmental Protection. 1999. ***Learning About Land: A Guide for Educators.*** **[online:]**
http://www.dep.state.pa.us/earthdaycentral/99/ed_guide.htm

A hard copy of this guide was made available free of charge and contained information for educators as well as lesson plans culled from other sources, however there are no more hard copies available. Most of the guide is accessible at the above internet address; however the online version does not contain the lesson plans. Sections in the guide include "Linking Learning About Land to State/National Standards,"

"Teaching About Issues," "Seeking Information About Your Municipality and County," and "What to Know/What to Include When Teaching About the Land." There are also several references included for further information.

Peterson, R.L. and R.M. Joerger. 1999. Using problem-solving approaches in teaching agricultural education for the 21st century. *The Agricultural Education Magazine*. November/December: 22-24.

This article provides a rationale and framework for using problem-solving as a tool of agricultural education. The authors claim that for problem-solving to be an effective and innovative teaching strategy it must "involve real problems, engage students in identifying real problems, and provide a set of techniques to solve the problem." They suggest a six step plan involving identifying a problem, clearly defining the problem, devising and executing a solution, evaluating the solution, and making recommendations.

Petrzelka, P., P.F. Korsching, and J.E. Malia. 1996. Farmers' attitudes and behavior toward sustainable agriculture. *The Journal of Environmental Education*. 28: 38- 44.

The authors begin by defining sustainable agriculture as being "protective of soil and water resources and promotes the health of people and rural communities." Sustainable farmers are perceived to be more eco-friendly than conventional farmers, who are perceived to be more interested in the business model of agriculture. They explore the relationship between values and practice in a group of farmers who are Practical Farmers of Iowa members. They find that attitudes of sustainable agriculture have little relation to amount of chemical usage in practice. Age, gross farm income, and information sources are the best predictors of chemical use. They suggest that farmer education is a necessity to further adoption of sustainable ag practices.

Santone, S. 2003/2004. Education for sustainability. *Educational Leadership*. 61(4): 60- 3.

This article discusses the interdisciplinary approach of sustainability education, as well as the values and objectives that guide it. Santone argues that sustainability education can be interdisciplinary that can connect standards from many different areas. She says that it "emphasizes higher-order thinking, decision making, collaboration, problem solving, and interpersonal communication." Sustainability education lends itself to authentic problem solving and inquiry-based applications. She then provides several case studies of schools with sustainable curricula in place. Santone also provides a list of helpful resources, many accessible on the internet.

Santone, S. 2004. Teaching for a healthier earth: sustainability education has young students seeing the world in a new way- and teachers! *Instructor*. 113(6): 19-20, 22.

"Teaching education for sustainability means teaching students to think about how individuals and groups (such as families, towns, and nations) can have a good quality of life without exceeding ecological limits." The article provides many case studies of sustainability education at work. Santone reports on the importance of tying large concepts to experiences in the student's realm of reference and on providing the students with an opportunity to give back to the community. Santone alleges that because sustainability curriculums engage students in real problems, the students "learn to think and act in authentic roles as citizens, scientists, and policymakers." Santone also provides sustainability education resources across the country.

Simmons, B. 2000. Towards excellence in environmental education: a view from the United States. *Water, Air, and Soil Pollution*. 123: 517-524.

The author of this article feels that new educational standards are endangering the future of environmental education because they focus on subject disciplines. However, the author finds that environmental education can actually meet these standards because it is interdisciplinary. The author argues that "environmental education is essential education," and that "environmental literacy must be a goal of our society." The author identifies six "underpinnings" that should be at the root of all environmental education. These are systems understandings, interdependence of humans and the environment, bioregionalism, integration and infusion of other disciplines, roots in the real world, and lifelong learning.

Solter, L.F. 1997. Is entomological research child's play? Teaching children scientific methods. *American Entomologist*. 43: 198-200.

Solter gives a case study of her time spent teaching 3rd and 4th graders the scientific method using "real" entomological research. Students learned to test hypotheses, perform controlled experiments, and work through data analysis. Links to existing curricula were very important and also included much multidisciplinary work (math, writing, art, public speaking). It was found that real-world issues were a significant motivator for the children.

The Tahoe Center for a Sustainable Future. 1999. *Sustainability education: teaching sustainability in* every *classroom.* Harriet Goldman, Ed. [online:] http://ceres.ca.gov/tcsf/seg/

This document provides a solid introduction to the concepts of sustainability and sustainability education. It discusses such topics as problem-based learning, the development of community-based sustainability programs, how to develop empowered citizens, technology, and systems thinking. The document is still in draft form, and includes a feedback form for educators.

Trexler, C.J. 1994. Building capacity for an innovative elementary agriscience curriculum. *The Agricultural Education Magazine*. 67(1): 16-19.

Trexler presents a case study of integrating agriscience into the science curriculum of Sanilac County, MI. To be adopted, curriculum must relate to standards. "In elementary school, the most realistic way to infuse science and agriculture [into the curriculum] is to introduce hands-on modules, or units of instruction, that supplement and eventually replace existing curriculum and text books. Each module would focus on a particular science topic and provide teachers with the instructional materials and apparatus to investigate the topic in the classroom." (Understanding Agriculture: New Directions for Education.) Teacher involvement in design leads to adoption of curriculum. Provides a thorough overview of the development of hands-on agriscience curriculum.

Vehoviak, G.R., P.F. Adams, and T.H. Bruening. 1994. A sustainable farm plan activity. *The Agricultural Education Magazine.* 67(1): 8-10, 13.

This article presents a discrete lesson plan for high school and low-level college use. In it, students study sustainable agriculture by planning an organic, sustainable farm. Concepts covered include carbon and nitrogen cycles, hydrologic cycles, and biological diversity.

Guidelines for achieving sustainability

- The rate of use of renewable resources must be less than or equal to their rate of natural regeneration
- Replacement rates of non-renewable energy sources (fossil fuels) with renewable sources (solar, geothermal, wind, etc.) must equal or exceed current use of non-renewable sources
- Emission of pollutants and waste must be less than or equal to the rates at which these can be recycled, absorbed, or rendered harmless naturally within the environment

Students begin by studying the philosophic foundation of sustainability, then visit a farm, and study soils and geology. Finally, they develop a farm plan based on several guidelines. It is designed to focus on local conditions, which provides students with a sense of place and impact.

Weber, E.C. 1996. *Earthworm Empire: The Living Soil.* Dubuque, Iowa: Kendall Hunt Publishing.

This book contain 41 activities plus extensions for teaching school students about soil science. Most of the activities are hands-on or are completed through problem solving. The lessons are focused on soils in Iowa, but would be easily adaptable to soils throughout the U.S. The book is somewhat hard to read due to text formatting choices.

Whittington, M.S., J. Cano, J. Connors, and N. Knobloch. 2002. The latest trend: aligning with standards. *The Agricultural Education Magazine*. November/December: 10-11.

This article looks at ideas and events impacting teacher preparation programs in agricultural education, and discussing plans for preparing teachers to align with state and national standards.

Williams, D. 2001. Integrating sustainable agriculture into the classroom. *The Agricultural Education Magazine.* March/April: 26-27.

This article gives a summary of the dimensions of sustainable agriculture, and provides many thought-provoking questions to help an educator form their curriculum. It also provides many resource ideas to get an educator started.

Williams, D.L. 1997. Teaching tomorrow's agriculture today. *The Agricultural Education Magazine.* 69: 10-11, 27.

Williams begins by discussing the rise of sustainable agriculture and trying to define sustainable agriculture. He then discusses sustainable research and practices and identifies five top priorities in research:

- protecting and enhancing water resources
- compatibility of agriculture, natural resources, and environment
- ensuring food safety
- pest management
- biology and management of plant systems

He also defines a need for unit-based curricula in sustainable agriculture at the secondary level. Williams provides a list of educational materials in sustainable agriculture; however the website he lists is no long active and only a few of the items can be found. He summarizes objectives accomplished in the units.

- Design a sustainable farming program that includes a plan for crop rotation, etc.
- Groundwater flow modeling to illustrate groundwater pollution
- Crossword puzzle to learn terms
- Building an earthworm display case for use in illustrating how earthworms improve the soil
- Field activity for planning and implementing a buffer strip
- Develop a conservation plan to reduce pollution
- IPM plan for a garden
- Lab to illustrated effects of conservation tillage on the soil
- Field trip to monitor insect population in a growing crop

Finally, Williams briefly discusses curriculum adaptation potential for the FFA.

Williams, D.L. 2000. Students' knowledge of and expected impact from sustainable agriculture. *Journal of Agricultural Education*. 41(2): 19-24.

This study reports that Iowa high school students rated themselves low in knowledge about sustainable agriculture, but still expected high impacts from it. The author concludes that curriculum development in sustainable agriculture could increase

student knowledge and help them to realize the high impact they expect it to have on society.

Williams, D.L. and A. D. Dollisso. 1998. Rationale for research on including sustainable agriculture in the high school agricultural education curriculum. ***The Journal of Agricultural Education.*** **39(3): 51-56.**

The authors report that early education can change the environmental attitudes of youth, and that sustainable agriculture is a good candidate for increasing environmental awareness because it can be integrated with the existing curricula, and because it provides a multidisciplinary, systems-oriented approach that will help students succeed. Also, they state that curriculum materials are needed in sustainable agriculture.