

Secondary and Higher Education for Development of in Indonesia

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Indonesia's Protection and Management of the Environment Act stresses the importance of environmental education in protecting and managing the environment. Environmental education is defined as efforts to change behaviors and attitudes of individuals to improve their knowledge, skills, and awareness of environmental values, issues, and problems and to motivate people to participate in efforts to preserve the environment for the present and future generations. Environmental education can be carried out through monolithic and integrative approaches, including the infusion and block methods, which incorporate the study of conservation, the environment, and natural disaster mitigation. Secondary and higher environmental education can be formally conducted as separate courses or as parts of other subjects. No explicit environmental education for sustainable agriculture is depicted in the curricula of secondary schools in Indonesia. Environmental education is delivered by either curricular or extracurricular activities. In universities with agricultural faculties, environmental education is generally integrated into several supporting competency courses (e.g., plant ecology). An exception is Bogor Agricultural University, where specific primary courses on agriculture and the environment are offered. Many sustainable-agriculture field schools have been run by government agencies, non-governmental organizations, and foreign organizations to specifically deal with agricultural problems. Examples include field schools on integrated pest management, soil and water conservation, and watershed management.

Key words: curricular, block method, field school, infusion method, sustainable agriculture education

Introduction

Environmental deterioration is an ongoing problem throughout the world. Climate change; a reduction in the ozone layer; increased risk of skin cancer and other health hazards; pollution; a decline in biodiversity; water scarcity; severe floods and droughts; and soil erosion are just some of the problems associated with the deterioration. The situation will worsen unless people become more aware of how to protect and manage the environment.

Ecology has been applied as a scientific paradigm to develop a philosophical basis for environmental ethics (e.g., biocentric ethics, land ethics, deep ecol-

ogy ethics, and ecofeminism) and to improve pluralism, democracy, and civil society. It has also been used as an ideological foundation of the Green political parties and for the development of ecological and of developmental economics. Ecology has also served as the basis for developing environmentally friendly ("green") businesses and implementing sound management practices. In addition, it has provided the foundation for developing sustainable development policies and eco-friendly technologies in agriculture, mining, and manufacturing, and has provided a basis for community development and education (Adiwibowo, 2009).

Section 70, Article (3) of Act No. 32/2009 concerning the protection and management of the envi-

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ronment in Indonesia emphasizes the importance of the role of the community in protecting and managing the environment, as well as the importance of capacity building, innovation, and environmental education for living sustainably. Each individual has the right to take part as a stakeholder in the sustainable development of the Republic of Indonesia (Soerjani, 2009).

The Joint Agreement between the Minister of the Environment and the Minister of National Education (No. Kep 07/MENLH/06/2005 and No. 05/VI/KE/2005, 3 June 2005) stipulated that environmental education should be developed by using basic environmental concepts and should be implemented in all types and levels of science education, from elementary school to institutions of higher education (Soerjani, 2009). Informal efforts by governmental institutions or by other organizations or individuals are also discussed in the agreement. The goal of environmental education is to enhance the current and future welfare of the ecosystems in which we live.

In this paper, we focus on the current state of environmental education for sustainable agricultural development in Indonesia.

Environmental Education Programs in Primary and Secondary Schools

Environmental education is defined as efforts to change the behaviors and attitudes of various individuals or community elements. The aim is to improve people's knowledge, skills, and awareness of environmental values, issues, and problems and to

motivate people to participate in efforts to preserve the environment for the present and future generations.

Environmental education in Indonesia developed as follows:

- (1) 1975: A UNESCO workshop resulted in the development of The Belgrade Charter—A Global Framework for Environmental Education.
- (2) 1975: IKIP Jakarta pioneered the development of environmental education in Indonesia by creating the Broad Outline of a Teaching Program (BOTP) for Environmental Education, which was tested in 15 elementary schools in Jakarta in 1977 and 1978.
- (3) 1979: Centers for Environmental Study (CESs) were formed in some Indonesian universities and a CES Coordination Body was organized in the year 2007=97 CESs.
- (4) 1996–1997: Some non-governmental organizations (NGOs) formed a network of environment perpetuation (in the year 2007=213 NGOs).
- (5) 2000–2005: According to the ASEAN Environmental Education Action Plan, each ASEAN country must create a framework for the development and implementation of environmental education.

Instructional materials are needed for students to gain the knowledge, skills, and attitudes that must be mastered. The materials hold an important position in all curricula and should be prepared so that learning can be achieved as depicted in Figure 1 (Dikmenum, 2010; Hamzah, 2009).

Materials must be adjusted according to the stu-

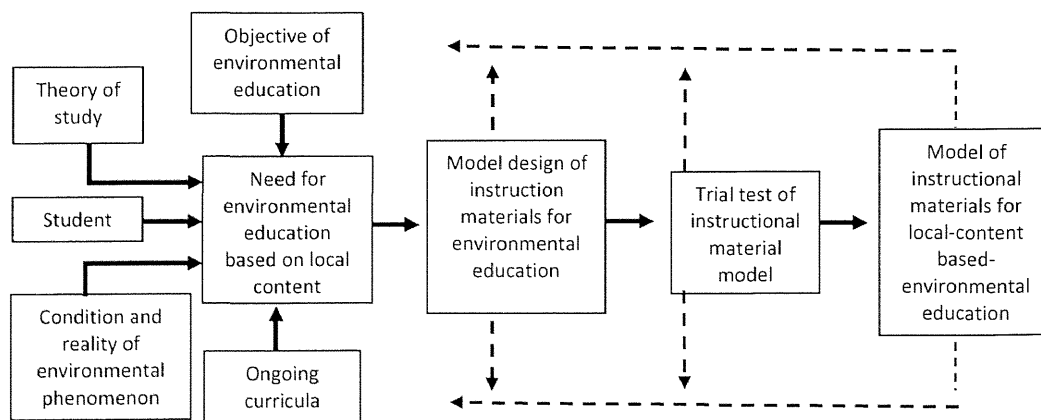


Fig. 1. Model of the development of instructional materials for environmental education (Dikmenum, 2010; Hamzah, 2009).

dents' capabilities, interests, and needs. In line with this, the development of instructional materials and strategies for environmental education must refer to local landscape conditions, natural resources, socioeconomic conditions, and culture. Solutions to problems related to resources should always be illustrated through harmonious ecological practices. It is important to understand that students come from communities that have diverse cultural and socioeconomic conditions, all of which will affect the learning process and the targeted results.

Environmental instructional materials can be developed on the basis of the concept of Education for Sustainable Development, which was created by UNESCO. The instructional materials should emphasize knowledge (science), skills (competence), issues (events/environmental policies), values (attitudes), and perspectives (assumptions).

Indrawati (1999) in Leksono (2008) stated that an instructional model is a teaching plan that has an instructional pattern. In teacher-student activities, the learning sources used to realize the learning conditions or an environmental system that causes learning to occur can be observed.

The approaches for environmental education can be monolithic and integrative. Judi and Wood (1993) in Leksono (2009) stated that there are two principal types of techniques for incorporating the subject matters of conservation, environment, and mitigation of natural disasters into curricula: the infusion method, which is integrative, and the block method, which is monolithic.

Infusion Method

The infusion method is also called the insertion method—it integrates the contents and processes of the conservation of nature and mitigation of natural disasters into existing curricula. These subjects have traditionally been inserted into the natural sciences, social sciences, and history, but they can also be inserted into other subjects by using an educational unit level curriculum.

The integrative approach develops certain subjects into an educational package by integrating subjects into the following: (1) the curriculum (BOTP), (2) a subject unit based on an integrated BOTP, (3) the learning-teaching process, and (4) both the formative and summative assessments.

This approach is suitable for formal education

from the elementary level up to the senior high school level, because it does not require extra learning time at school; thus, implementation is more efficient because it does not add any extra burden to existing curricula. Many teachers, however, will have to improve their knowledge of the materials to be taught. The greater the teachers' involvement in the integration of the materials, the faster knowledge about the environment will be spread to students.

To implement the integrative approach, teachers are required to study a matrix of the environmental management educational materials that have been integrated into the particular area of study. The materials used must consistently refer back to competency standards and learning principles. Cahyana (2009) presented a method for planning an integrated environmental instructional unit (lesson plan) (Fig. 2).

Various resources must be taken into consideration when formulating a study plan. Teachers must analyze and collect appropriate materials to be developed as instructional materials, including materials related to the natural, human, and social environments. Materials related to environmental management include *information on environmental policies*, conservation, spatial and pollution management, Environmental Impact Assessment (EIA) function, regulations, and institutions. The modes of study include books, research reports, journals, the Internet, multimedia sources, and the environment (natural, social, cultural, economic, etc.).

Block Method

In the block method, the environment, conservation, and natural disaster mitigation are studied in a single subject area or course. This method uses a monolithic approach that is based on the idea that every subject is a single component with its own objective. The monolithic approach can be applied in two ways: (1) develop a discipline (e.g., environmental mitigation education) that has the same level as other subjects in curricula, and (2) develop an educational package that is a single subject such as chemistry and physics.

Environmental materials are usually integrated into school curricula in a "local content" format. Environmentally based education can be developed through the *Adiwiyata* program, which is described

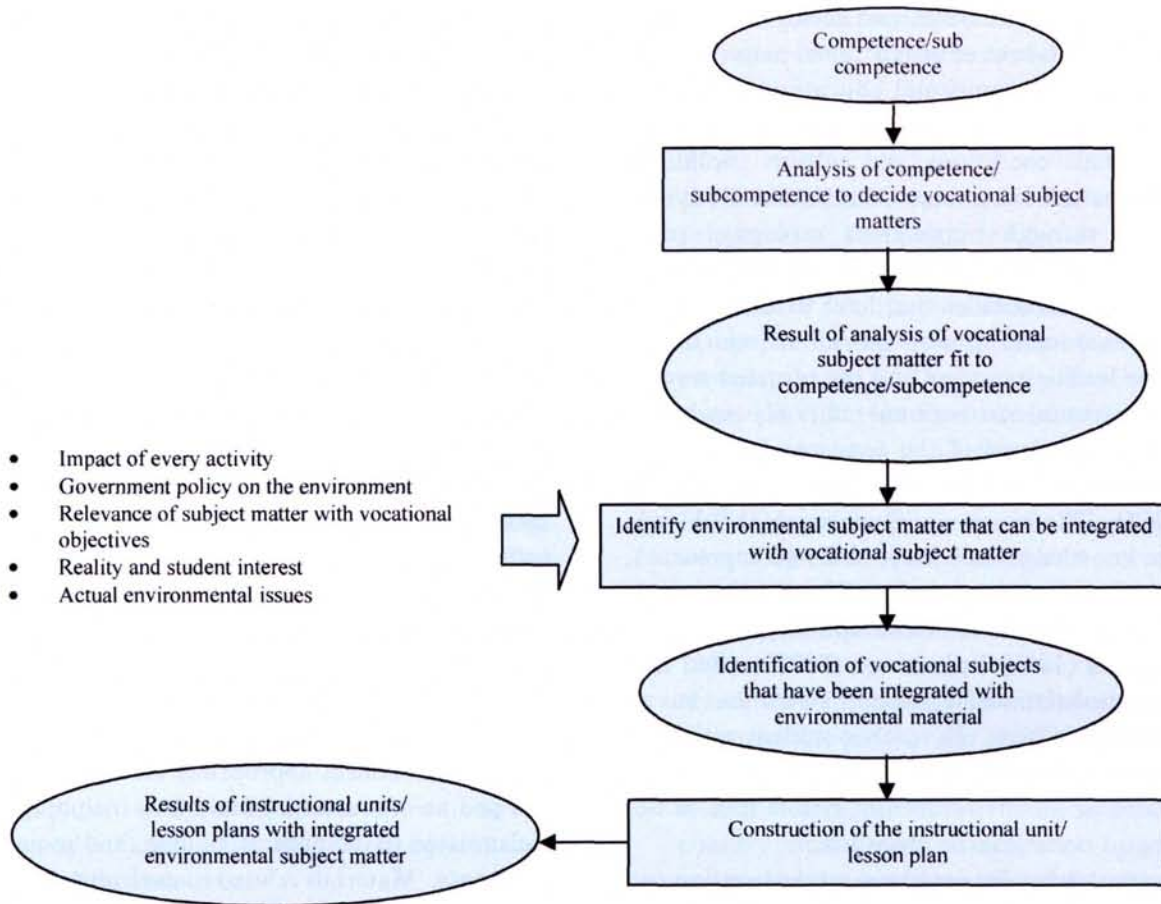


Fig. 2. Flowchart of the arrangement of subject matter in integrated environmental studies (Cahyana, 2009).

in greater detail later, and environmental education is generally integrated into curricular and extra-curricular activities in most schools (Muchrodji and Cahyana, 2009).

Curricular Activities

Students are expected to obtain direct and applied knowledge of environmental concepts to improve their general knowledge, their skill in the application and sensitivity of statistical analysis, and their ability to solve problems. The design of the study experience substantially affects the outcomes for the students.

Schools are expected to use participatory activities in their environmental education curricula. These activities should be conducted according to plans to enhance the realization of environmental knowledge and awareness of the students. Among the practical examples are detailed instructions on how to conserve resources (e.g., water, electricity, and paper) at each school. Physical proof of the

activities is often required in the form of a School Principal Decree.

Extracurricular Activities

Extracurricular activities should be used to help students form caring environmental attitudes. These activities should be innovative, productive, and creative and are expected to build positive environmental attitudes as well as useful practical skills. Participation-based extracurricular activities can be implemented similar to those implemented for curricular activities in support of environmental education. Examples of extracurricular activities include environmental lectures, environmental exploration, and competitions. Schools are expected to be active in the initiation of environmental protection and in facilitating collaboration between schools and outside parties. Cahyana (2009) stated that strategies for extracurricular activities can be implemented as shown in Figure 3.

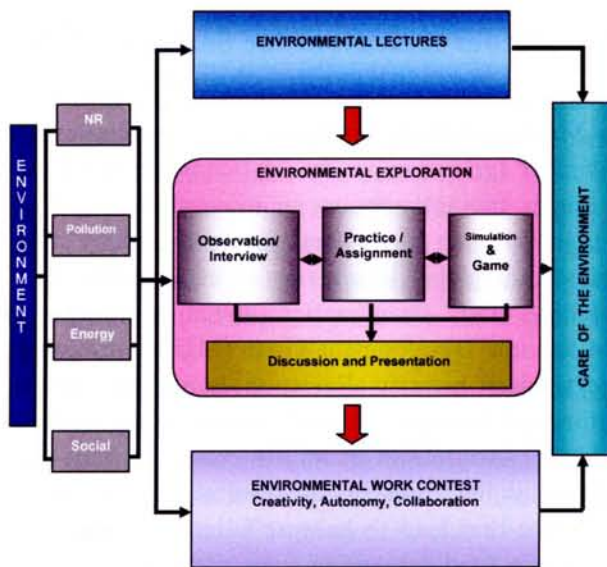


Fig. 3. Flowchart of the strategic implementation of extracurricular activities for environmental education (Cahyana, 2009).

Environmental Lectures

An environmental lecture is an extracurricular activity intended to provide students with knowledge and insight on the environment. The scope of the material can cover a range of current “hot” issues, such as garbage, floods, energy shortages, and illegal logging. The lecturers can come from both inside and outside the school, and the topics and timing can be chosen to coincide with specific events, such as Earth Day.

Environmental Exploration

Exploration materials are selected from environmental components potentially causing environmental problems or from current environmental cases, for example, explorations of garbage, rivers, forests, volcanoes, valleys, cultural sites, water pollution, and air pollution. The scope of the exploration covers the description of object studied, the environmental problems associated with it, prevention and mitigation activities, forms of empowerment, and methods to anticipate them.

Explorations are generally implemented outdoors and utilize “natural laboratories” in a group setting. Locations vary depending on the level of funding and the readiness of students and teachers. Safety is always also a concern. The activities can be done in conjunction with structured assignments in other subject areas, including biology, physics, chemistry,

Indonesian language, social science, and religious education. At the end of the activity, groups should discuss the results of their observations, interviews, practices, and simulations, and they should communicate with other groups about these results.

Environmental Work Competitions

Environmental work competitions are extracurricular activities intended to guide student achievement in environmental areas. They can take many forms, including scientific research with environmental themes, environmental management programs, essays, and posters. Competition materials can be adjusted to suit the level of expertise at the particular school, the environmental issue chosen, and local environmental problems. Competitions can be conducted for individuals or groups, and appropriate types of competitions, such as cleanliness around the school, can be held on certain holidays.

Management of the School Environment

Environmentally conscious behavior is the result of continuous learning and habits developed at an early age. In addition to curricular and extracurricular environmental education programs, applied practical approaches can be used to link environmental concepts to the daily lives of students.

An eco-school or a “green” school is designed so that all aspects of the school’s programs are directed to learning and creating environmentally aware habits. The environmental components of physical and social management practices are as follows:

- (1) Physical management includes the management of hygiene, recycling, waste, water, land, and energy use.
 - (a) The school yard is arranged holistically; it is clean and green and can act as a natural laboratory.
 - (b) Water and energy are utilized efficiently.
 - (c) Waste and garbage are managed according to the 4 Rs (reduce, reuse, recycle, and recovery); the goal is to approach zero waste.
- (2) Social life at the school is managed to create positive social attitudes about discipline, collaboration, environmental awareness, courage, appreciation of others, and fairness.

The Adiwiyata Program

Cultural and environmental awareness is being

created at schools by using the *adhiyaya* program developed by the Ministry of the Environment. *Adhiyaya* means a good and ideal place wherein sciences, norms, and ethics can be obtained; all of these subjects become the foundation for the realization of social welfare and sustainable development. The objective is to create favorable learning conditions and raise the environmental awareness of students so that they can act responsibly to create a safe environment and sustainable development.

The goal of the *Adhiyaya* program is to develop elementary and secondary schools that nature cultural and environmental attentiveness, as well as to develop basic norms such as togetherness, equity, honesty, justice, and sustainability. A basic principle is that communities should be involved all aspects of school management, including planning, implementation, and evaluation.

Adhiyaya schools share some of the following traits:

1. Development of the following environmental policies:
 - School philosophy, vision, and mission for the environment and culture
 - Material development of environmental study
 - Capacity building
 - Efficient use of natural resources
 - Allocation of funds for environmental activities
 - Support for the realization of environmentally and culturally aware schools
2. Environmentally based curricula, including development of the following:
 - An environmental study model (integrated or monolithic)
 - Materials on local and global environmental issues
 - Curricular activities with environmental themes
 - Study methods
3. Participatory activities (both inside and outside school):
 - Creation of extracurricular and curricular activities supporting the development of environmental education
 - Active participation in environmental activities conducted by school outsiders
 - Development of partnership activities (government, private, and NGO) for development of environmental education

Higher Education for Sustainable Agriculture Development

Many important developments have significantly affected agriculture in the 21st century, and Indonesia is presently facing many complicated challenges to meet its demand for food. Many other important global issues also affect agriculture, including trade liberalization; global warming; and Millennium Development Goal (MDG) programs, particularly poverty alleviation, hunger mitigation, universal education, and environmental sustainability. Additional issues are energy scarcity and rising global food prices resulting from climate changes that lead to harvest failures, a drastic increase in food demand in some countries (whether for consumption or food security), and use of grain for bio-fuel production (FKPT-PI, 2008).

To face both the internal and external challenges, the Directorate General of Higher Education (DGHE) in the Ministry of National Education created the Higher Education Long Term Strategy (HELTS). In HELTS IV (2003–2010), a paradigm for higher education development in Indonesia was directed towards three main issues: national competitiveness, autonomy, and management of education and upgrades to the organizational health of institutions of higher education. In the context of the paradigm change, all agricultural higher education institutions in Indonesia joined in the Forum for Communication of Indonesian Higher Education of Agriculture (FCIHEA). The forum has instituted several efforts, beginning with changing the arrangement of undergraduate and graduate programs, developing leading agricultural research to achieve a knowledge-based economy (K economy), and stating collective goals towards the creation of world-class universities.

After long discussions concerning the restructuring of undergraduate study programs, FCIHEA released a decree (DGHE No. 163 Year 2007) on undergraduate studies. In response to the decree, several FCIHEA ad hoc meetings were held with academic directors and DGHE to determine (1) the profiles of new graduates of agrotechnology/ agroecotechnology and agribusiness study programs, (2) minimum competence levels, and (3) study materials (FKPT-PI, 2008).

A graduate of a faculty of agriculture majoring

in agrotechnology should be capable of applying scientific concepts and principles in soils, plants, pests and diseases, and the environment, as well as designing and developing sustainable agricultural production technologies. The decree by the Minister of National Education (No. 045/U/2002 dated 2 April 2002) concerning the core curricula of higher education states that the target competencies in an agrotechnology study program are the capability to:

1. Effectively and productively plan and design systems and apply science and technology to cultivation before and during the production process in line with sustainable agriculture principles, using both modern and local traditional wisdom.
2. Appropriately plan a production process system in line with environmentally sound agricultural norms.
3. Evaluate and assess pre- to post-production processes of crops.
4. Develop and conduct innovative methods for environmentally friendly crop production.
5. Apply innovative theories of crop science to business practices.
6. Creatively identify, formulate, and solve problems (using analytical and synthetic thinking) in environmentally friendly plant production processes having a global scope and in the context of society.
7. Design and conduct research, and analyze and interpret data professionally.
8. Mobilize self potential and be able to collaborate in a multidisciplinary team
9. Communicate and negotiate effectively.

University courses that explicitly address the environmental aspects of agriculture include Plant Ecology (including carbon stock), Biodiversity, Agroclimatology, Analysis of Landscape and Regional Development Planning, Landscaping, Soil and Water Quality, Esthetics, Plant Protection Principles, and Weed Science.

In the case of Bogor Agricultural University (Institut Pertanian Bogor, IPB) academic courses were taken on a full-credit system until 2005. Since 2005, however, IPB has implemented a major-minor system in which students must take major courses to exhibit competence in their major fields of study, as well as minor courses to demonstrate

competence in a complementary field. A total of 49 undergraduate courses related to sustainable agriculture are offered, and 54 additional postgraduate courses are also offered.

An examination of the undergraduate and graduate academic handbooks revealed that IPB's academic curricula are fully consistent with the National Education Ministry's Core Scientific Model. Some undergraduate and graduate courses explicitly describe sustainable agriculture (e.g., Soil and Water Conservation, Agricultural Ecology, Resource Economics, Sustainable Development and Growth, System of Sustainable Agriculture, and System of Integrated Pest Management). Other courses are more closely related to ecology and consider achieving environmental balance as an important factor in utilizing natural resources (e.g., Principles of Ecology, Human Ecology, Plant Ecology, Tropical Marine Ecology, Ecology and Management of Animal Resources, and Ecology of Tropical Forests). The terms "environment" and "sustainable" appear in many other course titles as well.

Some new graduate-level courses consider sustainable agricultural development more comprehensively than previous ones, and some courses examine the ethical and moral implications of utilizing natural resources for agricultural development (e.g., Ethics of Forestry, Ethics and Morals of the Environment, and Environment and Theory of Human Ecology). Other courses investigate the politics that affect sustainability and environmental issues, including Theory of Political Ecology and Ecological Action and Political Ecology of Natural Resources (Murti Laksono and Hidayat, 2009).

Practical Environmental Education for Sustainable Agricultural Development

Environmental education for sustainable agriculture development can be formally conducted in or outside a traditional school. The success of an educational program conducted in the field can be affected by many factors, such as the farmers, agroecosystem conditions, the commodities cultivated, and infrastructure.

The Field School of Integrated Pest Management (FSIPM) created by the Ministry of Agriculture was created by the National Program of Integrated Pest Management in 1990. In the beginning, the

idea of field schools was unfamiliar, but after only four years, FSIPMs were being conducted by farmer groups in Indonesia, and they had also been implemented as Integrated Pest Management Farmer Field Schools in villages in Vietnam, China, Philippines, Bangladesh, India, South Korea, Thailand, and Ceylon. Presently Indonesia has developed FSIPMs for several commodities, including fruits and vegetables (but not paddy rice), and millions of farmers have graduated from FSIPM programs.

The FSIPM concept is an extension method of implementing integrated pest management (IPM) practices. Field schools share several characteristics: (1) they have participants and field guides; (2) they are taught in the field and participants directly practice/implement what they have learned; (3) they have curricula and evaluations and issue certificates for passing the course; and (4) they construct programs including study tours and field meetings.

The field school extension method was established on the basis of two core challenges: maintaining ecological biodiversity and enhancing the role of farmers as managers on their own plots. IPM can be difficult to achieve with common extension models (posters, lectures, etc.) because of the biodiversity of local tropical ecosystems in Indonesia. Therefore, IPM must adapt to local conditions—the concept is to work with nature, not against it.

FSIPMs have the following characteristics: (1) farmers and teachers respect each other; (2) farmer groups conduct joint planning; (3) farmer group members engage in collective decision making; (4) learning by doing/adult education is practiced; (5) action, experience, and self-discovery are emphasized; (6) training materials and field work are integrated; (7) operational farm fields are used as study sites; (8) the training period varies, but can be as long as a plant growth cycle; (9) a detailed and integrated curriculum is followed; (10) facilities and materials are practical, multipurpose, and easily obtained in the field; and (11) the process is democratic, collaborative, harmonious, and participatory.

The Society for Indonesian Farmers began conducting a field school of sustainable agriculture at the Center for Training and Education for Sustainable Agriculture at Cibeureum Village, Bogor in the year 2010. The field school aimed to produce

farmers who have a comprehensive understanding of the technical skills required to engage in sustainable agriculture. The goal was for all attendees to be able to implement the learned sustainable practices and apply the theoretical knowledge at their own farms. Teachers and other professionals also attended the field school (Serikat Petani Indonesia, 2010).

In fiscal year 2010, the Directorate General of Land and Water Management of the Ministry of Agriculture began conducting the Field School of Conservation (FSC), which aimed to support upper watershed conservation (UWC) activities and develop integrated farm land conservation (IFLC) and zero-burning land management (ZBLM) by improving knowledge, raising awareness, and empowering groups. The objectives of the field school activities are to: (1) raise farmers' general knowledge and skills; (2) improve their capabilities to use marginal land while also considering environmental norms; (3) mobilize and empower farmers and farmer groups; (4) develop an environmental conservation mind set; (5) establish farmers' autonomy in the management of sustainable land resources; and (6) increase participation in environmental protection and conservation activities. A total of 48 FSC activities are being conducted in 9 provinces and 26 districts for UWC implementation, 76 activities in 21 provinces and 70 districts for IFLC, and 9 activities in 3 provinces and 7 districts for ZBLM (Ditjen PLA, 2010).

The U.S. Agency for International Development (USAID) Environmental Support Program (ESP) has developed a Field School (FSESP) that utilizes an educational approach based on the scientific method by inventorying the capacities of communities to express problems related to their lives. The FSESP approach uses a participatory approach in which the community directly studies local ecology and socioeconomic conditions. Participants collect data on the main problems faced by people; analyze the social and economic factors, natural resources, infrastructure, and human resources; and construct a realistic action plan to address the identified problems. The action plan can cover a variety of topics, for example, watershed management, access to clean water, and sanitation.

FSESP is a "no wall" school. Meetings are conducted in a village's public facilities, such as a

village hall or mosque or an open field. Through the self-discovery study method, participants are encouraged to directly observe the unique conditions of a community. Generally about 15–25 community members attend an FSESP, and a learning cycle encompasses about 14–16 weekly meetings, each lasting about half a day (Environmental Service Program, 2010).

Concluding Remarks

Secondary and higher education for development of sustainable agriculture is important in Indonesia as stated in the Act of Protection and Management of the Environment. It must be maintained and improved.

Environmental education can be carried out through monolithic and integrative approaches, including the infusion and block methods. Secondary environmental education can be formally conducted as separate courses or as parts of other subjects and it can be incorporated in the curricular or extra-curricular such as Adiwiyata program.

Higher education for development of sustainable agriculture is generally integrated into several supporting competency courses. Sustainable agriculture and environmental subjects are specifically offered by Bogor Agricultural University.

Many sustainable agriculture field schools have been run by government agencies, NGOs, and foreign organizations (e.g., USAID) such as field schools on integrated pest management and soil and water conservation.

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