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BROADENING THE ENVIRONMENTAL VISION OF AGRICULTURAL STUDENTS THROUGH TRAINING: A CASE STUDY OF SUSTAINABLE AGRICULTURAL TRAINING AT THE ELSENBURG COLLEGE OF AGRICULTURE, SOUTH AFRICA

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"This pre-occupation with teaching has...actually constrained the effectiveness of higher education and limited its abilities to meet society's demands.... We might say that we are now beginning to perceive that the purpose of education is learning. And we are beginning to realise that frequently teaching interferes with learning." - Graham Gibbs (1981)

ABSTRACT

Some perspectives on the tertiary educational process of the Elsenburg College of Agriculture are given. The challenges of promoting and ensuring sustainable farming practices are central to the training of future agriculturists. This training needs to acknowledge the fact that agriculture function within a broader system and that it cannot be isolated from its environment.

Sustainable agriculture is an approach or philosophy based on human aims, which incorporates land stewardship with agricultural activities. The problem is that it is too often seen merely as an outcome – rather than a process of change. Although agricultural education is but one of many factors shaping the professional role of farmers, this process does play a fundamental role in the process of re-orientation towards sustainable agricultural production. Education and training should help the farmer develop a deep awareness of his role in the ecology - understanding, insight, and the skills necessary to participate in the sustainable utilisation and management of his environment.

A course named Environmental Management *was developed. Through action research a* 'horizontal' *approach was used for this, with participants evaluating the current status of the agricultural environment and themselves making suggestions and/or finding appropriate solutions to certain agricultural issues. The researcher functioned as a facilitator in this stimulating process. To strengthen the attempt to influence value systems of students, additional actions were taken: themes were developed, workshops were organised, video material was utilised, a Wildlife Society was founded, hiking trips were undertaken, etc. The article briefly summarises the development of the course. It warns that no single course has the power to truly change values of students towards multidisciplinary or holistic thinking. To be able to really activate a positive change towards sustainable agricultural practice, the help of the full complement of subjects presented at colleges is needed.*

1. Introduction

For many years, and even at present, people have regarded the agricultural sector as being

alien to the broader nature conservation effort. Farmers and even the public seldom regard the agricultural sector as being an ecosystem on its own or as being part of a greater ecosystem. This perception is contra-productive to the realisation of true sustainable agricultural ecosystems. There is evidence that farmers and other rural residents express lower levels of awareness and concern over environmental issues than do their urban counterparts (Donahue, Undated).

This article provides some perspectives on the tertiary educational process of the Elsenburg College of Agriculture, situated about twelve kilometres outside the town of Stellenbosch, South Africa. Elsenburg, as it is commonly referred to, is the oldest agricultural college in South Africa, as it started with agricultural training as early as 1898. Agricultural education at college level was primarily aimed at preparing future commercial farmers for the task of managing commercial farms at micro-level. This focus has, however, shifted towards a more holistic agricultural training process as the local agricultural environment has changed.

Some structural changes have been noted. The national department of agriculture has emphasised the importance of incorporating the training of emerging small-scale farmers, with the aim of preparing them for the challenges of future commercial farming. This necessitated that Elsenburg develop training programmes to accommodate this new target group. In the same way, the changing environment led to the implementation of a more generally acceptable selection process for first year students. This had a definite impact on the female-male ratio, as well as the percentage of students that had an agricultural background.

There seems to be a special relationship between agriculture and the natural environment (Alblas *et al.*, Undated). The training of future agriculturists at college level needs acceptance of the fact that agriculture functions within a broader system and that it cannot be isolated from its environment. Therefore, agricultural systems should be regarded as ecosystems (Neher, 1992; Swart, 1995). By definition an agricultural ecosystem is *'a unit composed of associated communities or organisms and their physical/chemical environment'*. People are but one of the communities in agro-ecosystems. They are not external to ecosystem functions and play a governing role in regulating agro-ecosystem processes, some of which lead toward, and others that impede, sustainability in agricultural systems. Farmers, researchers and extension officers are responsible for the selection of crop varieties and livestock breeds, and they impart techniques, social organisations, values and knowledge to the function of agro-ecosystems. According to Neher (1992) and Ikerd (1993), ecosystem-level concepts require *'systems-level'* thinking and research. This will, naturally, also include the dissemination of knowledge through extensionists and educationists. It may thus be concluded that ecosystem-level concepts are the *core* of sustainable agriculture - in both definition and measurement.

2. Conceptualising sustainable agriculture as concept

The concept of sustainability has reached prominence, especially in the last decade, in agricultural production and agricultural development programmes. The emphasis on sustainability is the result of international concern about environmental degradation and processes such as soil erosion, loss of biodiversity, consumer concerns over chemical residues in food and farmer concerns over the quality of life their family and labour.

Sustainable agriculture is an approach or philosophy based on human aims, which

incorporates land stewardship with agricultural activities. It can thus be regarded as an abstract, ambiguous and highly subjective concept which has complex and practical problems for existing agricultural production systems (Francis, 1990; Flora, 1992; Dunlap *et al.*, 1992; Neher, 1992; Nowers, 1994a). Concepts such as organic farming, permaculture, low-input sustainable agriculture (LISA) and ecological farming are associated with this concept (Neher, 1992; Nowers, 1994b).

With the aid of all the various definitions available in relevant literature, it can be established that sustainable agriculture has three broad dimensions - an ecological, a socio-economical and an ethical dimension (Dunlap *et al.*, 1992; Flora, 1992; Neher, 1992; Norman, 1993; Nowers, 1994a). The ecological dimension focuses on the natural environment, its processes and resources (Neher, 1992), whereas the socio-economic dimension focuses on human welfare. The ethical dimension focuses on value systems and ethics and, by implication, on human behaviour patterns. This includes the supply of enough nutritious and affordable food to communities, the conservation of land for future generations and the improvement of the quality of the environment and natural habitats. Swart (1995), however, adds another dimension to this concept - social acceptability, which implies that surrounding communities should find a particular way of farming acceptable and justifiable.

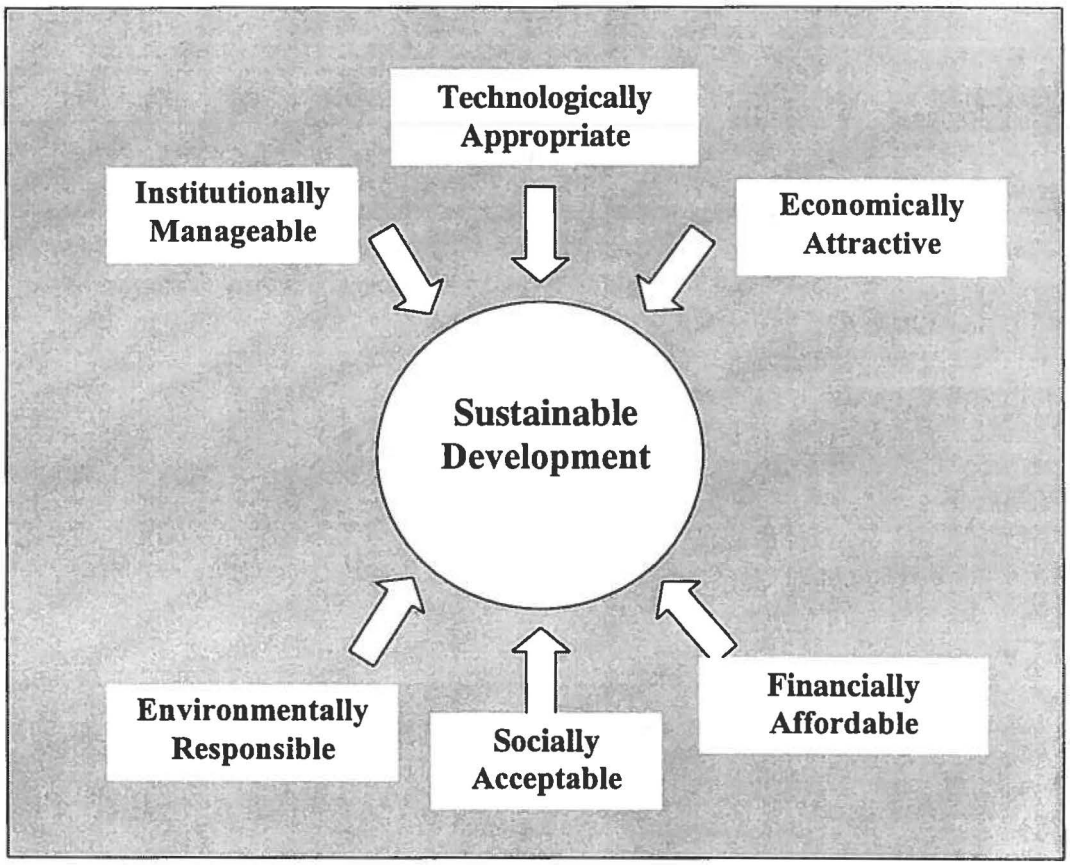

Figure 1: Factors influencing sustainable development (PROCON AFRICA, 1995)

The concept of sustainable development, which includes agriculture, is visually demonstrated in Figure 1, whilst the concept of sustainable agricultural practices may be summarised as follows (Hudson & Harsch cited in Dunlap *et al.*, 1992):

"...an integrated system of plant and animal production practices having a site-specific application that will over the long term: (1) satisfy human food and fibre needs; (2) enhance environmental quality and the natural resource base upon which the agricultural economy depends; (3) make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; (4) sustain the economic viability of farm operations; and (5) enhance the quality of life for farmers and society as a whole."

The IUCN, UNEP and WWF through the document *"Caring for the Earth"* attempted to avoid the debate over the meaning of sustainable development and coined the term, *"sustainable living"*, which proposed that governments, industries and families need to live by a new world ethic of sustainability. This ethic is supported by eight core values (Table 1) which, according to Fien (1993) define criteria for sustainable development and give direction for the development of environmental education policy and curricula.

Table 1: Criteria for sustainability: core values (Fien, 1993)

CORE VALUES FOR SUSTAINABILITY	
ECOLOGICAL SUSTAINABILITY	SOCIAL JUSTICE
Interdependence	Basic human needs
Biodiversity	Human rights
Living lightly on the Earth	Participation
Interspecies equity	Intergenerational equity

These core values may be criticised because of the lack of economic criteria. It can be argued that economic values such as strategic thinking/management, diversity in enterprises, optimal utilisation of inputs and entrepreneurship through value-added services should be included, but the question may be asked whether these criteria have not already been included by implication within the given ecological and social criteria.

The national Department of Agriculture of South Africa (1995) accepts the concept of sustainable agriculture as being integral in their mission statement. Its business policy identifies the principles for building a sustainable society as:

- Respect and care for the living world;
- The improvement of the human quality of life;
- The conservation of the earth's vitality and biodiversity;
- The minimisation of the depletion of non-renewable resources;
- Compliance with the earth's biological carrying capacity;
- Changing personal attitudes and practices;
- Enabling communities to care for their own environments;
- The provision of a national framework for integrating development and conservation; and
- The creation of a global alliance.

The concept of sustainability often misleads scientists and, for that matter, educators. Too often it is regarded as the concept which ultimately will 'save' the earth and its life, but the problem is that it is too often seen merely as an outcome – as something that exists, such as a sustainable farming system – rather than a process of change. Such processes should involve the building of sustainable relationships between people and people, and between people and their environment. To achieve this, a culture of learning is required (Ison, 1990) and this is where education has a role to play.

3 The changing environment of agricultural teaching

Although agricultural education is but one of many factors shaping the professional role of farmers, it does play a fundamental role in the process of re-orientation towards sustainable agricultural production (Alblas *et al.*, Undated). Lecturers and students in agricultural production should have a basic conceptual understanding of the structural changes required in agricultural production and their relationship with nature and the environment. Ison (1990), Alblas, Van den Bor and Wals (Undated) agrees that one of the main challenges in agricultural education is to organise learning processes which explore, develop and nurture the values that are necessary for an agricultural production system which is stable enough to ensure an ecologically and economically healthy future.

Table 2: The 'hard' (systematic) and 'soft' (systemic) traditions of thinking compared (Checkland in Ison, 1990)

THE 'HARD' SYSTEMS THINKING OF THE 1950s AND 1960s	THE 'SOFT' SYSTEMS THINKING FOR THE 1980s AND 1990s
PRINCIPLES	
Oriented to goal seeking Assumes the world contains systems which can be *'engineered'*	Oriented to learning Assumes the world is problematic but can be explored by using system models
Assumes system models to be models for the world (ontologies)	Assumes system models to be intellectual constructs (epistemologies)
Talks the language of *'problems'* and solutions	Talks the language of *'issues'* and *'accommodations'*
ADVANTAGES	
Allows the use of powerful techniques	Is available to both problem owners and professional practitioners
	Keeps in touch with the social realities of problem situations
DISADVANTAGES	
May need professional practitioners	Does not produce final answers
May lose touch with aspects beyond the logic of the problem situation	Accepts that enquiry is never-ending

In order to meet the needs of a dynamic, sustainable agriculture some radical rethinking about agricultural education is required. Most fundamental is the need to re-establish colleges as communities of learners. Academics must become involved in learning, learning about learning, learning with learners, and in exploring new ways of understanding others' realities (Ison, 1990; Salvador *et al.*, 1996). Table 2 summarises new paradigms which have impacted on the way in which agricultural research and development in western countries is viewed, with Table 3 making some distinctions between different traditions of knowledge and knowing which may aid curriculum development.

Ison (1990) argues *"...that universities and other agricultural education institutions reinforce the teaching paradigm by describing their purpose and function as 'custodian' and 'preservers' of knowledge. This creates the image of knowledge as a 'commodity' that can be 'stored' or 'warehoused' and then 'dispensed' or 'given (usually by a lecture) to a recipient (a student)."* Too often agricultural educators are found to be wedded to the belief that the building blocks of knowledge, taken from economics, botany, genetics, etc., must first be laid down in linear fashion before students can hope to grasp the complexities of an emerging science such as agriculture (Salvador, 1996). This reductionist approach seems to be in conflict with a view which regards knowledge as a social construct that cannot be isolated from the process through which it is generated. It is thus the process of knowledge construction which is, hopefully, an on-going, life-long process (Ison, 1990, Alblas *et al.*, Undated).

In rethinking agricultural education at college-level, attention should therefore be paid to three important areas. In the first place students must be given greater learning autonomy, so that their responsibility, leadership, innovation and creativity skills are developed and enhanced, rather than stifled. This requires the development of flexible, learner-centred curricula as opposed to teacher-centred curricula (Ison, 1990).

Secondly, more focus should be placed on the application of concepts or knowledge to real problem situations, and working with people to reach agreement about the existence and nature and possible roots of these problems. The use of guest speakers, who work with these problems, and towards solutions, can be used with great success. This is a problem and solution-determined learning system – the nature of it and the needs of the client(s), including the learner, should determine the content.

The last area touches on a somewhat sensitive area for educators – evaluation procedures should be adapted in order to assess more than the ability to reproduce facts. It should make provision for the assessment of other aspects of development, including giving greater responsibility and power to the students, and encouraging them to understand the real world better, rather than solely to pass examinations. These areas need much more attention within the agricultural education system at college-level.

The most fundamental reform, however, involves the development of curricula that appropriately reflect the principles of sustainable agriculture. Curricula have to focus more on 'praxis': practice informed by critical theories and achieved through the conscious commitment to methodological enquiry, to serve the needs of a sustainable agriculture. It should be remembered that no blueprint exists for making change. Each context will demand different approaches to manage the process of change.

Ison (1990) describe the weaknesses of many current curricula characterised by *"...overload, poor feedback, inappropriate teaching strategies, by offering tasks and material that can be learned by rote, and by assessment procedures"*. It is ironic to note that whilst most academics expect students to develop sound approaches to their learning, their curricula are based on lecturing and examinations that promote and reward rote learning. This way of teaching certainly promotes dependence and not creativity and initiative. Too little account is given to the process of learning (Ison, 1990). Criticism is the essence of the scientific method: education has to rediscover opportunities for students to be critical and to use criticism.

Table 3: Some distinctions between different traditions of knowledge and knowing that may aid curriculum development (Bawden and Macadam in Ison, 1990)

	SCIENTAE	TECHNE	PRAXIS
Focus	Learning for knowing	Learning for Doing	Learning for being
Knowledge produced	Propositional	Practical	Experiential
Structure	Subject disciplines	Crafts	Issues
Teacher's role	Expert	Master	Facilitator
Teaching strategies	Lectures on theory	Practical demonstrations	Real World projects
Research style	Basic (experimental)	Applied (developmental)	Action (Participative)
Role of researcher	Producer of knowledge	Producer of solutions	Co-creator of improvements
Research goal	Abstract knowledge	Workplace solutions	Local theory and Action for change
Basic philosophy	Positivism	Utilitarianism	Constructivism
Focus of reflection	What do I now KNOW?	What can I now DO?	Who am I BECOMING?

4. The rationale for the incorporation of the environmental dimension in tertiary agricultural training

In contrast with primary and secondary education, environmental education has received little, if any, attention in higher and vocational agricultural education (Alblas *et al.*, Undated). This is surprising and makes little sense, considering the major potential impact graduates have on their environments through the decisions they make and the actions they are likely to take.

It is widely agreed that environmental education and training (Sunter, 1992) is the single most important strategy towards deceleration of the over-exploitation of South Africa's natural resources. Agriculturists, including academics and practitioners in agricultural research, extension and training fields, may have for too long regarded environmental education and training as alien to agricultural training. It is necessary for agriculturists to view environmental education and training in a holistic manner and to accept that agriculture is but a single system within a broader ecosystem. With this as framework, the commercial farmer as well as the agricultural researcher, lecturer and extension officer should change his perceptions about himself as decisionmaker and his role in the broader world of nature and the global economy. This would enable him to fulfil his social responsibility as steward over scarce and expensive resources with success. Modise (National Parks Board, 1993) agrees with this issue and states that the primary aim of education and training should be to make people aware of these responsibilities and possible opportunities that may accrue from them. Agriculturists in training should be prepared through training and education for their role as present and future decision-makers.

According to Modise (National Parks Board, 1993) education and training should provide the student with a deep awareness of his role in the ecology - understanding, insight, and skills to

participate in the sustainable utilisation and management of his environment. Walters (1990) emphasises the lack of sound environmental education and training within farming communities and argues that a holistic attitude towards environmental education is crucial. The lack of effective environmental education in most schools is, however, restricted not only to agricultural schools (Clarke, 1991). Environmental training (Walters, 1990) is defined as *"... the education of an individual or group in those principles which underlie the development, regulation and maintenance of the natural environment, the factors that are detrimental for the maintenance of environments in their natural or even present state, and those factors that may contribute to the improvement of natural and disturbed environments, with the aim to satisfy the material, intellectual, recreational and aesthetic needs of communities".*

From this it follows that:

- There is a need for man to utilise natural resources;
- Genetic resources have both a present and a future value;
- It is important to eliminate negative influences on the production potential of natural resources, especially agricultural land;
- Agriculture has an important role to play in improving the aesthetic appearance and quality of landscapes;
- The integrated nature of agricultural and natural ecosystems with relation to their utilisation for tourism and recreational purposes is acknowledged; and
- It is accepted that the agricultural community is an integrated part of the total community.

Stevenson (1987) states that environmental education involves *"...the intellectual appraisal of environmental (and political) situations and the formulation of a moral code concerning such issues, as well as the development of a commitment to act on one's values by providing opportunities to participate actively in environmental improvement".* According to Fourie, Joubert and Loader (1990), environmental education has become an important branch of what is often called 'the ecological movement', 'ecological awareness', 'environmental awareness' or 'environmental conservation'. They explain environmental education and its chief objective as the *"guidance of people to:*

- *the insight that they belong to nature;*
- *the experience of wonder and joy in nature; and*
- *the acceptance of the responsibility to respect nature as the sustenance of life."*

The aim of environmental education is thus, on the one hand, to achieve a change of attitude and a resultant change in behaviour in as far as one or more of these aspects are lacking. On the other hand, it is to strengthen the attitude and develop these aspects in as far as they are already present in individuals or groups, whether these are children, students or practising farmers. This means that environmental education aims at fostering a permanent attitude towards nature and therefore towards oneself (Fourie, Joubert & Loader, 1990). It implies that environmental education aim at a philosophy of life, and a certain life-style. Alblas, Van den Bor and Wals (Undated), who argue that integrating environmental education into vocational training leads to more than just transferring new knowledge, support this statement. It also incorporates the development of students' notions and morality and care towards the environment. Therefore environmental education could, and should, play a major role in human development. Fien (1993), however, warns that the focus on personal development and nature experiences is characteristic of New Age thinking. According to him this philosophy tends to over-emphasise the importance of personal transformation at the expense of the interdependence of personal and broader structural transformation, which is

necessary for sustained social change.

One of the primary aims of tertiary education is to provide people with access to opportunities and the responsibility to participate in and manage their own environments. Undergraduate education also has the aim of preparing young people for their role as current and future decision-makers. In the light of the above, it seems imperative that educational institutions involved in the provision of agricultural education and training should follow a holistic approach to agricultural training. Although environmental issues receive some attention in some Southern African agricultural colleges, the course content is often fragmented. An integrated presentation of sustainable agricultural issues, with the aim of developing and strengthening the land stewardship of farmers in an ethical sense, is imperative in the curricula of agricultural colleges.

Although agricultural education is only one of a variety of factors, which influence the shaping of the professional role of farmers, it most definitely has a role to play in the process of re-orientation towards economic and environmental sustainability. Lecturers and students at college level should have a basic conceptual understanding of the dynamic environment of agricultural production and their relationship with this environment. According to Alblas, Van den Bor and Wals (Undated), one of the main challenges in developing the environmental dimension of agricultural education is to organise learning processes which explore, develop and nurture the values that are necessary for an agricultural production system which is stable enough to sustain an ecologically, economically and socially healthy future. Martin (1993) supports this by adding that environmental education encourages students to explore their own ideas and values as well as being aware of, and tolerant of, views of others.

5. The development of a course in environmental management

The fundamental role of the farmer in the sustainable management of ago-ecosystems has been emphasised earlier. What is lacking, however, is a credible philosophy, or ethic, which supports decisions regarding the management of agricultural resources. This ethical and moral dimension of agricultural management requires a view of conservation that is acceptable to all practitioners of sustainable practices over natural resources. The National Parks Board (1993) borrowed its definition of *'conservation'* from the IUCN (International Union for the Conservation of Nature and Natural Resources) which states that *"Conservation is ... the management of the human use of the biosphere so that it may yield the greatest sustained benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations"*. This definition is not only acceptable to all the major nature conservation organisations locally and globally, but is also accepted by the Department of Agriculture as the definition of conservation. The definition implies three important points that fit in perfectly with the three pillars of sustainable agriculture - ecology, economy and ethics:

- The human utilisation of the earth's resources;
- The realisation of the greatest sustainable benefits to present generations; and
- The needs and aspirations of future generations.

The *stewardship* principle states that man have *temporary* ownership over certain given resources. The word, 'temporary' is used, because although a specific individual may be the physical owner of a specified piece of land, he has no unlimited control over these resources as he will eventually die and pass the ownership on to another individual or generation. The

way he manages his resources will determine the condition in which the next owner/generation will receive his 'legacy'. It is a fact that man has the legal right to utilise a piece of the earth within certain specified limits for his own purposes. This right is an integral part of his stewardship over the land and its resources.

Huntley, Siegfried and Sunter's (1989) concept of human welfare is associated with the definition of conservation and also has three elements, economic development, environmental health and quality of life. They illustrated this as three overlapping circles with the common intersection named *"human welfare"*. It implies that human welfare is a function of the state of the environment, the accrued economic realisation, and the quality of life enjoyed as a result of it. It follows that a farmer wanting to improve his quality of life and that of his immediate community should not concentrate on an isolated aspect of his property or practice, as is popularly found on South African farms. He should rather operate in a holistic way by taking cognisance of all the elements of sustainable agriculture simultaneously.

It is thus imperative that a new, acceptable agricultural ethic be developed and implemented (Sunter, 1992). Hattingh (1993) contributed towards the realisation of this goal by adding a two-day module to the Agricultural Diploma Course of the Elsenburg College of Agriculture, called 'Environmental Ethics'. He specifically concentrated on the stewardship role agricultural managers need to play regarding the natural resources under their control. This module was, however, restricted to students who followed the Diploma course (three years training). The result was that first and second year students did not have any access to lectures concerning this important aspect.

Curricula at Elsenburg are based on a two-year course after which the successful student receives a Higher Certificate in Agriculture. The first year consists of eight compulsory subjects: Soil Science, Genetics, Agricultural Management, Animal Nutrition, Botany, Plant Protection, Agricultural Engineering and Environmental Management. After the successful completion of these courses, the student has the opportunity to select one of sixteen various options, therefore specialising in a more specific direction, which are what are found in practice within the Western Cape Province in South Africa. The various courses available for selection are:

- Viticulture-Physical Science-Large Stock
- Viticulture-Physical Science-Vegetables
- Viticulture-Physical Science- Small Stock
- Viticulture-Physical Science-Pomology
- Viticulture-Large Stock-Agronomy
- Viticulture-Agronomy-Small Stock
- Viticulture-Agronomy-Vegetables
- Viticulture-Agronomy-Pomology
- Viticulture-Large Stock-Small Stock
- Viticulture -Large Stock-Vegetables
- Viticulture-Pomology-Small Stock
- Viticulture-Pomology-Vegetables
- Agronomy-Pomology-Small Stock
- Agronomy-Large Stock-Vegetables
- Agronomy-Large Stock-Small Stock
- Agronomy-Pomology-Vegetables

Agricultural Management as well as Agricultural Engineering, are compulsory subjects, with Citrus, Ornamental Plants, Pig Production, Potatoes, Poultry, Tobacco and Controlled Environment Production being choice subjects. After studying the various curricula of each, it was found that each could potentially contribute towards understanding of the concept of sustainable agriculture, but that there is a need for an additional subject, which has to facilitate the integration of these various perspectives. The result was the subject called Environmental Management.

6. The course *'Environmental Management'*

Action research methods provided the needed qualitative information in developing this course. In contrast to traditional scientific empiricist approaches to research, it was not the intention to employ a pre-ordinate research design whose alleged objectivity accrues from its insulation from the substantive politics of the situation being studied. Rather, a need was recognised for the methodology to shape and be shaped by, and be responsive to, the changing substantive demands of the subject of study.

An earlier course ran into disrepute with students, because of a variety of factors. A guest lecturer who, according to the students, often was unable to give lectures because of other commitments, taught this course. The academic results were also comparatively high relative to other subjects, with the result that few, if any, students ever failed this course. Consequently few students took these classes seriously and this actually gave the course a 'bad' name.

This was realised by the management of the College, and in 1994 a survey was held amongst 106 students. The course as lectured up to 1994 was rejected as being complementary to the other agricultural courses by 74% of the students. The majority of the students, however, agreed that agriculturists need an environmental ethic to ensure a better quality of life. The results of the survey, as indicated by Table 4, led to a workshop held in the second half of 1994 at the Geelbek Gold Fields Environmental centre in the West Coast National Park.

Table 4: Evaluation of Environmental Management curriculum by first year students of 1994

COMMENT	PERCENTAGE
Present curriculum is relevant to qualification	26%
Curriculum should be able to change existing perceptions of agriculturists towards conservation of resources	97%
The agriculturist needs to be convinced of being part of the broader natural ecosystem	79%

Sixteen students took part in the workshop, held over a weekend, with the primary aim to identify elements which should be included in the curriculum of the 'Environmental Management' course. The researcher basically acted as a facilitator and allowed the students to show initiative in finding creative ideas to implement sustainable agriculture amongst the commercial farmers. Not only were some stimulating initiatives produced, but also participants found the whole workshop a highly enjoyable and worthwhile experience in shaping their own future as stewards of natural resources. Table 5 summarises the results of the discussions. These formal and informal discussions conducted in a group format and

around the campfires, also led to discussion of various themes relating to the quality of life and the symbiosis between the economy and ecology. Other themes such as the 'diversity of life', 'the big five concept in agriculture' and 'politics in agriculture' were thoroughly discussed.

The identified aspects in Table 5 were incorporated in an adapted curriculum and were implemented the following year. Through the research process the lecturer continued to act as a facilitator in order to stimulate discussions and even to entice arguments under certain circumstances. Educators wishing to stimulate reflective thinking widely use the act of controversy as a catalyst for discussion (Alblas *et al.*, Undated). This led to more students being willing to share their views and opinions and to actively participate in the classroom activities.

Table 5: List of the five most important aspects which should receive attention in the curriculum of 'Environmental Management' as identified by students of the Elsenburg College of Agriculture in a workshop held in 1994 in the West Coast National Park

THE FIVE MOST IMPORTANT ASPECTS IN *'ENVIRONMENTAL MANAGEMENT'*
Sound environmental ethic which relates to the inclusion of the agricultural manager in his broader agricultural and community ecosystem
Explanation of the concept of systems thinking and operations
Inclusion of labour in conservation thinking
Evaluation of biodiversity in its agricultural environment
Conservancies - the proclaiming and management of them.

The *quality of life, symbiosis between ecology and economy, politics in agriculture, diversity of life*, and the *'Big Five'*-concepts were introduced for the first time as central themes in the 'Environmental Management' course. These themes provided the necessary stimulation for active group participation in class, especially when they led to heated arguments. This encouraged students to take a stand and to think creatively about what is really happening in agriculture.

The evaluation of these 'innovations' in the curriculum took place in the lecture room itself. First year students, who passed the course in 1995, were asked during February 1996 to voice their opinion about these changes. The results were divided into students from a farming background and those who had no agricultural experience at all. A comparison between some types of farms was also made. Results are shown in Tables 6 and 7.

Table 6: A comparison between students with, and those without agricultural experience relating to curriculum changes in the Environmental Management course - conducted during 1995 at the Elsenburg College of Agriculture

COMMENT	FARMING EXPERIENCE (N=64)	NO FARMING EXPERIENCE (N=23)	TOTAL (N=87)
Course leads to sound environmental ethic	63%	87%	69%
Course positions the agricultural manager in an understandable way	69%	96%	76%
Course leads to systems thinking	59%	74%	63%
Course should be adapted to dynamic environment	95%	100%	95%

Table 7: A comparison between students from various agricultural backgrounds in the Western Cape Province, relating to curriculum changes in the Environmental Management course - conducted during 1995 at the Elsenburg College of Agriculture

COMMENT	WHEAT & SHEEP (N=14)	VITICULTURE (N=23)	DECIDUOUS FRUIT (N=27)
Course leads to sound environmental ethic	21%	70%	78%
Course positions the agricultural manager in an understandable way	64%	74%	67%
Course leads to systems thinking	21%	61%	78%
Course should be adapted to dynamic environment	100%	100%	89%

During the analysis of the data it became evident that the students without any farming experience actually rate the course higher than students with experience of farming. It became evident both in the survey and in the lecture hall itself that the students without a farming background are more able to think and argue holistically, and are more willing to change pre-conceptualised opinions about certain issues. This fact in itself led to definite challenges to the facilitator, and subsequently to his fellow educators.

A major distinction seems to exist between the more long-term (intensive) enterprises - viticulture and deciduous fruit - and annual (extensive) enterprises. Some of the students with experience in wheat and sheep farming failed to accept the environmental guidelines proposed by the *Environmental Management* course, as only 21% regarded it as successful in providing them with an acceptable ethic. In contrast, the students from farms which had viticulture and deciduous fruit enterprises, accepted the proposed philosophy more readily and were able to associate themselves with it. This may be the result of the fact that these farms are mostly geared towards export markets, which have strict measures and regulations regarding the use of chemicals on crops produced. Both agricultural managers and their marketing agents, for example, have come a long way in these businesses and, and recognising its relevance, have accepted integrated pest management.

The semester course in Environmental Management has five modules: Introduction to the earth and its major environmental problems, the biomes of South Africa and the factors influencing them, the status of natural resources, the philosophy of sustainable agriculture, and an introduction to basic ecology. In the first year of introducing this curriculum, it was soon realised that the students regarded the chapter on ecology as unnecessary, as they have already done this in detail at school level. The curriculum was, as a result of this reaction, reflected upon and changed to specifically accommodate practical agricultural case studies. For example, the issue of the importance of wetland conservation makes out an important component of demonstrating how ecosystems work and how they are related to each other. The definition of wetlands, energy flows, biodiversity with the emphasis on migrating birds, threats to them and their management are dealt with thoroughly.

In addition, various themes are discussed during the course. As an introduction to the course in Environmental Management, the theme "symbiosis between ecology and economy" illustrates the complementary relationship that exists between the ecology and the economy. It discusses the concept of farms as being open systems, thereby allowing continuous in and outflows between themselves and their environment. The theme on 'diversity' provides the framework to use videos to illustrate the importance of both intra- and inter-competition in nature as well as at farm level. Here the example of lions and hyenas is extrapolated to local examples of caracal and jackal, and birds of prey. Information on the ecological, economical and aesthetic (social) value of birds of prey, vultures and blue cranes is given, with the necessary information on the threats to and sound management of these groups within an agricultural context. South Africa is fortunate to have some excellent video material available to complement the lectures in this regard.

The "Big Five" theme is used to stimulate students to argue about the five most important resources within the agricultural environment - soil, water, human resources, capital and management. "Quality of life" is a theme which the lecturer actually uses throughout the whole course. This theme also receives attention in the farm business management course.

Finally, in the last semester of their two year studies during the end of the Agricultural Management course, the students view a video consisting of twelve ten minute modules on various environmental topics. Each module has a question, which the students have to discuss in small groups, after which feedback is given at a later stage to the whole class. The reason why the student is shown this towards the end of his studies is simply to give him the opportunity to be able to relate to all the various modules within the diversity of courses he has followed during the past two academic years. This enables him to answer the questions asked in the video in a multidisciplinary way. These questions are:

- Name and discuss the factors that result in the diversity of biomes and agricultural activities in SA (Theme: *Yesterday, today and tomorrow*).
- Discuss man's interaction with his environment. Emphasise the agricultural and related industries (Theme: *Listen to the land*).
- Discuss the influence of agriculture on the destabilisation of natural ecosystems. Emphasise the role of the farmer and the government in the prevention of this (Theme: *Soil: Capital of the nations*).
- Discuss the influence and consequences of management on the utilisation of grazing ecosystems (Theme: *Pasture management*).
- Discuss the nature, the source and the role of marshes in the ecology (Theme: *Water in the bank*).
- Discuss the ecological impact of invading plant species and the control thereof in the

struggle towards sustainable agriculture (Theme: *Aliens in agriculture*).

- Discuss the causes, consequences and control of floods (Theme: *Floods*).
- Discuss the role of agriculture in environmental pollution. Is some level of pollution necessary for sustainable production? (Theme: *Agriculture and pollution*).
- Discuss the conflict between the growing population and the sustainability of agriculture (Theme: *Sustainable agriculture*).
- Discuss how the water situation in South Africa can be improved through the application of sustainable agricultural practices (Theme: *Water 2000*).
- Discuss the needs and role of the communities in sustainable agriculture in South Africa (Theme: *Agriculture tomorrow*).
- Discuss the role of legislation and education in the pursuit and maintenance of sustainable agriculture (Theme: *Everyone's responsible*).

In addition to these formal educational practices, some other activities were launched to complement the course in *Environmental Management*. The most significant initiative was the founding of the Elsenburg Wildlife Society in 1994. This society enabled students to participate in hiking trips, to visit national parks and other places of environmental interest such as Table Mountain, and to invite guest speakers to give talks on certain topics. This club is highly successful, although its membership could be expanded - the major restriction being the fact that most of the students leave the college over weekends to visit their homes. A recycling project has been running since 1993. Paper for recycling purposes is collected and the income generated is used for the purchase of environmental videos. This activity, however, is more supported by the lecturers than the students themselves.

The most exciting project launched was the development of a *'bird identification'* course aimed at enhancing the knowledge of college students of local birds. This proved to be successful, for they not only learn to identify birds, but also to look at their own environments with other eyes. Some actually stated that it opened their eyes, for now they are able to identify items on their farms which they had never actually given attention to. It gave them an insight into why certain habitats house certain species of life, etc.

During the first semester of 1997, *concept mapping,* as a technique for illustrating concepts, was introduced. This was the first time that this technique had been used at the College. The lecturer used this tool to illustrate to the students how relationships between associated concepts could be demonstrated. This had the added value that the student could use the technique to improve his learning ability, which was proved when some of the students used these maps to illustrate their answers during exam papers. Concept mapping also provides the lecturer with the opportunity to break away from the normal lectures in that students have to organise themselves in groups of between two and five in order to do two assignments - the concept of conservation and the concept of biomes in South Africa. Instead of doing this in the classroom itself, he asked them to work outside the building, to encourage them to think laterally and not merely to include what the lecturer would like to see in the maps. It was encouraging to note that quite a few of the students started to use these maps to better perceive concepts related to other disciplines.

The conclusion was made that the *Environmental Management* course is successful in its present format in its endeavour to improve misunderstanding of the concept of sustainable agriculture among future commercial farmers - agricultural students at college-level - and that it has a positive effect on individual value systems. More attention should, however, be given to the more extensive farming businesses, as they tend to be slower to accept any new

changes within their individual value systems. It seems that this last category needs to see through more practical demonstrations the results and consequences of either changing or not changing their farming practices. In this regard it was found that the easiest and most practical way to achieve this, was to invite practising commercial farmers to whom they could relate, to convince them of the value of sustainable farming and systems thinking.

It should also be emphasised that no single course has the power to change values of students towards multidisciplinary or holistic thinking. It may influence them, but it seldom changes their set of values. To be able to really trigger a positive change towards sustainable agricultural thinking, the help of the full complement of subjects given at the College is needed. The easiest way to achieve this is to convince the individual lecturers to think holistically and to help them to assist the college student to think holistically and multilaterally. How? This is the challenge to agricultural educators who are serious about enhancing teaching in, and promoting, sustainable agriculture. One of the strengths of the Elsenburg College of Agriculture is its policy of sharing a room during tea/coffee breaks! This break creates the single most powerful opportunity for scientists (educators) to mix and to share problems, news and views amongst themselves, on a daily basis. At Elsenburg most of the educators do have a sound knowledge of, and sensitivity towards, environmental issues. This they have proved in the founding of a wildlife society for students, the establishment of a recycling project, the development of a bird identification course for students, and taking students on an annual practical agricultural tour which includes stops at farms that have successfully implemented sustainable agricultural practices.

The challenge, however, remains for educators to firstly, develop themselves in the field of sustainable agriculture, secondly, to develop social teaching techniques to transfer knowledge to students and, thirdly, to acknowledge that the environment is continuously changing, which results in the need for adapted curricula.

7. Conclusions

Striving towards sustainable agriculture cannot, and should not, be ignored by agriculturists, and this includes lecturers in agricultural science. The heads of agricultural training should acknowledge that a shift in the teaching environment has been taking place and that this places pressure on them to ensure that their institutions, with their members, adapt to this new learning culture which is expected by the dynamic environment. In some ways this may lead to radical changes which may place pressure on orthodox organisational structures and processes. It is possible to make some generalisations regarding the conditions necessary for the achievement of sustainable change (Ison, 1990):

- Academic leadership and those in power are both supportive of change and ensure the process of change is not undermined.
- At least a critical mass of people is dissatisfied with the existing situation.
- Information is available about alternative systems of management and learning.
- Relevant concepts are understood and shared, such as those relating to competence, curricula, learning/research, assessment etc. before engaging in debate on possible pathways for change.
- Necessary resources are available – often overestimated, with a frequent failure of those involved to differentiate between value and cost.
- Means to define personal goals in the changing organisation – for example an active programme of staff development.

- An organisational climate exists to facilitate development of group energy and enthusiasm by providing both challenge and support, thus providing a context in which it is safe to fail.

It is imperative to note that change and stability are inextricably linked in any open system. The challenge to practitioners and promoters of sustainable agriculture is to facilitate the emergence of new ways of knowing and behaving, so as to manage change creatively (Ison, 1990). This will go some way to offset growing concerns over the co-opting of the term 'sustainable' by those with short time horizons who may be promoting the status quo rather than change and evolution.

The development of the course in *Environmental Management* at the Elsenburg College of Agriculture positively indicates that some lecturers acknowledge this need to change existing teaching methods, as well as the fact that some agricultural colleges in South Africa attempt to keep in touch with their extremely dynamic environment.

Proving that our teaching is neutral and balanced is not an ethical professional obligation in the 1990's. Proving our commitments are morally and rationally defensible, is (Fien, 1993).

This case study will hopefully provide the agricultural educator with a useful case of curriculum reform through action research. Such cases are needed as examples for colleges elsewhere which also struggle with integrating environmental concepts into vocational education.

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