Environmental Literacy of Senior Students in the Agricultural Colleges of Ethiopia

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Abstract: The agriculture led development policy of the current Government of Ethiopia has raised new hopes and also new environmental concerns. Whether or not the implementation of programs aimed at boosting agricultural productivity to ensure food security is to be environment-friendly, depends a great deal on the level of environmental literacy of policy makers, agricultural resource managers and experts. In view of the fact that they will be the future policy makers, agricultural resource managers and experts, and that they form a convenience sample, a questionnaire survey was conducted on 335 senior students in four agricultural colleges of Ethiopia (Haromaya University, Debub University, Jimma University, and Mekele University) in the year 2002, to measure their level of environmental literacy. A questionnaire comprising of 105 questions was distributed. The three components of environmental literacy-knowledge, attitude and behavior-were measured by the students' response to the following groups of questions: ability to define key environmental concepts and identify key national and global environmental problems to measure knowledge; population-environment concerns, relationships between selected agricultural techniques/practices and the environment and the role of government in environmental protection to measure attitudes; and environment related habits/actions and willingness to bear the cost of environmental protection to measure behavior. The analysis of the results of the survey revealed reasonably higher levels in most of the items used to measure the components of environmental literacy. Overall, the students have shown fairly high level of environmental literacy, which can be considered instrumental in the shaping of a sustainable agricultural future for Ethiopia.

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Introduction

Agriculture is the mainstay of the Ethiopian economy. In Ethiopia about 85 percent of the economically active population is engaged in subsistence crop production and animal husbandry. Accelerated growth of population, accompanied by poverty and backward methods of agriculture has resulted in unsustainable practices of land and land-based resource utilization in this country. The ever-increasing demand for land in the upland farming systems has caused widespread clearing of natural vegetation and the conversion of wetlands, grazing lands and marginal lands into cultivated lands. Overstocking in the pastoral areas is causing serious problem of overgrazing. The consequences of such imprudent actions have been extensive soil degradation, the destruction of ecosystems, increased frequency and area coverage of devastating drought, and the threat of desertification. Impelled by the alarming increase in the problems of food insecurity, policies have been formulated and programs designed with the aim of boosting agricultural productivity.

Improving agricultural productivity necessitates the use of intensive methods of farming, including the application of agro-technologies and agro-chemicals. The agriculture led development policy of the Government of Ethiopia has raised new hopes and also new environmental concerns. Modern agriculture increasingly approaches industrial methods of production. It has a burdening effect on the environment. This means that it pollutes the air, soil, and water. The use of mechanization such as large energy inputs in the form of mineral and natural fertilizers, pesticides, and various land improvement mechanisms puts the environment at risk (Okoija, 1998). In recognition of this the Environmental Protection Authority (EPA) of Ethiopia has prepared a draft Environmental Impact Assessment (EIA) system. Unfortunately, as the existing EIA system is not legally binding, its implementation remains to be a matter of voluntary decisions (Yonas, 2003). This undoubtedly puts the future of Ethiopia's agricultural-environment under the mercy of agricultural policy makers and resource managers. Whether or not future agricultural policies and

actions are to be environment-friendly depends a great deal on the environmental literacy of future policy makers and resource managers.

Aklilu (1999) made a detailed assessment of the state of the environment in Ethiopia and stressed the need for the introduction and expansion of environmental education. There is a general agreement that environmental education has an important role to play in any poverty alleviation strategy as environmental degradation impacting upon agricultural productivity in Ethiopia is resulting in poverty (Bekalo and Bangay, 2001).

With environmental awareness on the rise in the late 1980's and early 1990's, higher education has been presented with a number of opportunities for environmental education (Bousquet, 1989). Tufts University (Massachusetts) became the first major university to establish environmental education and protection as an institutional priority (Creighton et al, 1992); and the University of Georgia became one of the first universities in the United States to require that every undergraduate student complete an Environmental Literacy Requirement (ELR) since 1993 (Moody et al., 2005).

Because of the fact that most of the future policy makers and resource managers go through higher institutions of learning, they have been targeted by a number of environmental literacy surveys: e.g. Schmidt and Buys (1974); Thompson and Gasteiger (1935); Ip and Miller (2003); Zakaria (1998); Paradise (1999); and Monosson (2000). Most of these contributions are case studies in the USA. Environmental literacy surveys for Africa and Ethiopia that have appeared as significant publications are non-existent. The available literature on environmental literacy is, by and large, at the stage of the elaboration of concepts.

Environmental Literacy: The Concept

Environmental literacy, as defined by Bogan and Kromrey (1996), involves: the possession of the cognitive and affective knowledge about the biological and physical surroundings, awareness of the potential magnitude of human impact on the biosphere, displaying willingness to engage in responsible environmental behavior, and participating in political action strategies that lead to the well being of the environment. Environmental literacy, therefore, comprises three components: knowledge, attitude and behavior related to environmental issues. Monosson (2000) described an 'environmentally-literate' individual as possessing high degree of environmental knowledge, a positive attitude towards the environment and behavior reflecting that level of knowledge and attitude.

Environmental literacy is also defined as an understanding of natural systems combined with how the systems interact with human social systems (Mancl et al., 1999). This, according to Lowe (2008), makes it to be broader than just environmental science. It incorporates the social, economic and political dimensions. In fact, environmental literacy is considered to be even larger than environmental education (Stables and Bishop, 2001).

According to Disinger and Roth (1992), environmental literacy draws upon six major areas: sensitivity, knowledge, skills, attitudes and values, personal investment and responsibility, and active involvement, These are collected into four strands: knowledge, skills, affect, and behavior. Roth (1992) identifies three major levels of environmental literacy: nominal, functional and operational; and Coppola (2008) characterizes functional environmental literacy as the capacity to use fundamental environmental knowledge, concepts, and thinking skills to formulate action positions on particular environmental issues and in daily behavior.

The definition of environmental literacy does not imply that the three components suggest one another. Increased knowledge does not directly result in the development of a more positive attitude; and a positive attitude is not necessarily expressed by favorable environmental behavior. Kibert (2000)

found out that knowledge and attitude had a weak correlation, while attitude and behavior components demonstrated a moderate correlation; and knowledge and behavior revealed no relationship. According to the conceptual model by Peyton (1987), attitude development involves a relatively more complex process of evaluating perceived phenomena within a 'frame of reference' comprising the existing relevant values, beliefs, priorities, and attitudes already formed from previous experiences. Pertaining to the inconsistency between attitude and behavior, the theory of cognitive dissonance asserts that there is often conflict in the individual's mind between the cognitive component (what one thinks or believes about something) and the behavioral component (how one acts towards it) (Wortman, 1992). The failure of positive environmental attitude to be expressed by appropriate environmental behavior could also be due to the 'hierarchies of attitudes' (Mitchell, 1989). Thus, attitude towards a particular environmental phenomenon may be put in a certain priority order in relation to its allocation and protection.

On the basis of the conceptual literature of environmental literacy elaborated above the survey was aimed to measure the levels of environmental knowledge, attitude and behavior of senior students of the agricultural colleges of Ethiopia. It also intends to draw conclusions about the kind of leadership and expertise the students are likely to provide for the agriculture-led economic future of the Country.

The Survey

Attitudes cannot be inferred from knowledge. It is also impossible to infer behavior from attitudes. Environmental literacy survey must, therefore, include measures for each of the three components separately. The questionnaire survey was conducted on 335 senior students in four agricultural colleges of Ethiopia (Haromaya University, Hawasa University, Jimma University, and Mekele University) in the year 2002. The purpose of the survey was to measure the students' level of environmental literacy (knowledge, attitude and

behavior). The environmental literacy survey used a structured questionnaire in which the students were required to ‘agree’ or ‘disagree’ to statements; answer ‘yes’ or ‘no’ in identifying key environmental problems; and ‘do’ and ‘do not’ in expressing environment related actions. They were also asked to express their ability to define key environmental concepts.

The response option for the ‘undecided’ or ‘neutral’ is deliberately avoided in order to reduce the number of “questionnaire item fatalities”. In most cases people will form opinions about issues that affect their lives directly or indirectly. The differences are only a matter of how articulated and substantiated the opinions are. In view of this, it would be difficult to expect a prospective graduate from an agricultural college not to have shaped an opinion about agriculture related environmental concerns. Moreover, experiences have shown that there is a tendency for many respondents to prefer the ‘undecided’ or ‘neutral’ option for reasons of ‘respondent-fatigue’ or fear of making personal opinions public. The latter is very much ingrained in the Ethiopian cultural value systems. Forcing opinions out, without leaving escape outlets for the respondent, is essential, though not justifiable, in the context of survey tradition.

The survey did not employ a rigorous sampling framework. It depended on those who were willing to fill in the questionnaires. A hard choice had to be made between conducting the survey on those who volunteered to do so or not conducting it at all. The students were busy working on their final projects. Class schedules were also tighted and varied that it was virtually impossible to use more representative sampling procedures. The fact that only volunteers have turned up for the questionnaire survey does not, to any significant degree cause bias. There was sufficient heterogeneity in their responses. The religious, ethnic and other background information of the students was not gathered. These are items that could lead to respondent suspicions and reluctance. The risk was not worth taking; given the undetermined importance such backgrounds have as predictors.

The questionnaire comprised 105 questions; but not all of them were used in the analysis. Some of the reasons are: “item fatality”, where the number of respondents was not enough for inclusion. Any and many of the questions were deemed redundant and thus only questions that had a higher response rate were selected. The initial list of the questionnaire items was as exhaustive as the knowledge of the author could go. No attempt was made to remove the redundancy before the survey was conducted. The advantage of asking more similar questions is much greater than asking a few refined ones. The items in the questionnaire that constituted the analysis are categorized as follows:

1. Knowledge measuring items
   - Ability to define 53 key environmental concepts; and
   - Identify key national and global environmental issues.
1. Attitude measuring items
   - Population-environment concerns;
   - Relationships between selected agricultural techniques/practices; and
   - The environment and the role of government in environmental protection.
2. Behavior measuring items
   - Environment related habits/actions; and
   - Willingness to bear the cost of environmental protection.

One of the questionnaire items employed to measure levels of environmental knowledge, which has relied on expressed ability to define key environmental concepts, and needs clarification. Expressed feeling of ability to define and actual ability to define are not highly correlated. The best way to measure the level of knowledge in this regard is to ask students to write definitions that would be compared with some standard definition of the concept. Unfortunately, this was a Herculean task-demanding the evaluation of over 15,000 definitions.

The target population of the survey has disciplinary focus. The certain level of environmental literacy needed for the sustainable development of the predominantly agrarian economy of Ethiopia is sought from students of

agriculture. Swanepoel et.al. (2002), in their study of teachers, observed a relationship between the level of environmental literacy and their field of academic training. It can, therefore, be hypothesized that students of the agricultural colleges of Ethiopia have attained a level of environmental literacy pertinent to what the sustainability of the agricultural future of Ethiopia demands.

Analysis of the Results of the Survey

The results of the survey were tabulated theme-wise and graphically represented with the help of MS-excel charts. The discussion of results is on the basis of the three components: environmental knowledge, attitude and behavior. Appropriate theme-wise charts are inserted in the discussions of each component.

Knowledge

Although there were several other questions in the survey questionnaire, which were intended to measure the level of environmental knowledge, two categories here that are thought to give a better picture of environmental knowledge are selected: defining 53 key environmental concepts; and distinguishing the relative significance of key environmental problems at national and global levels. About half of the students claimed to be able to define 30 to 40 of the terms given to them (Fig 1).

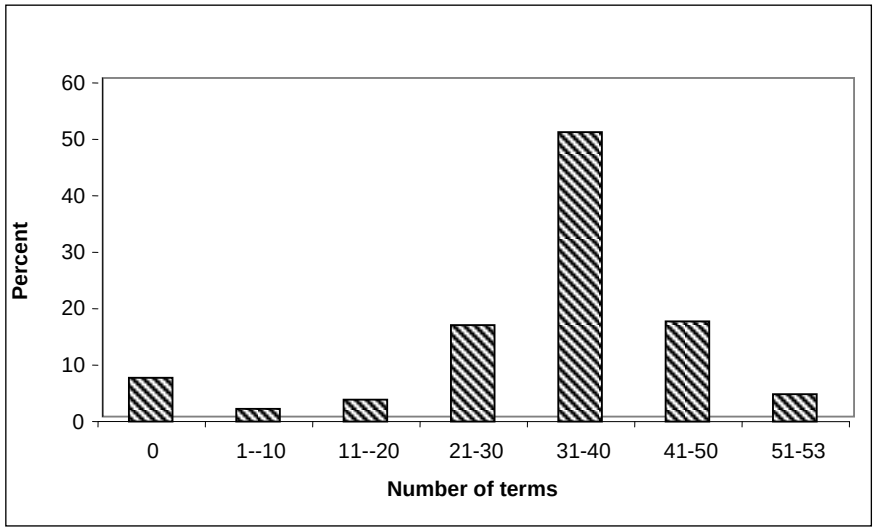

Figure 1: Percentage Distribution of Respondents by how many of the 53 Key Environmental Terms Given to them they Claimed to be able to define

The survey results indicated that drought, deforestation and soil degradation are ranked as the top three environmental problems in Ethiopia. The three most important global environmental problems (air pollution, ozone depletion, and global warming) were perceived to be the least concern in Ethiopia. (Fig 2).

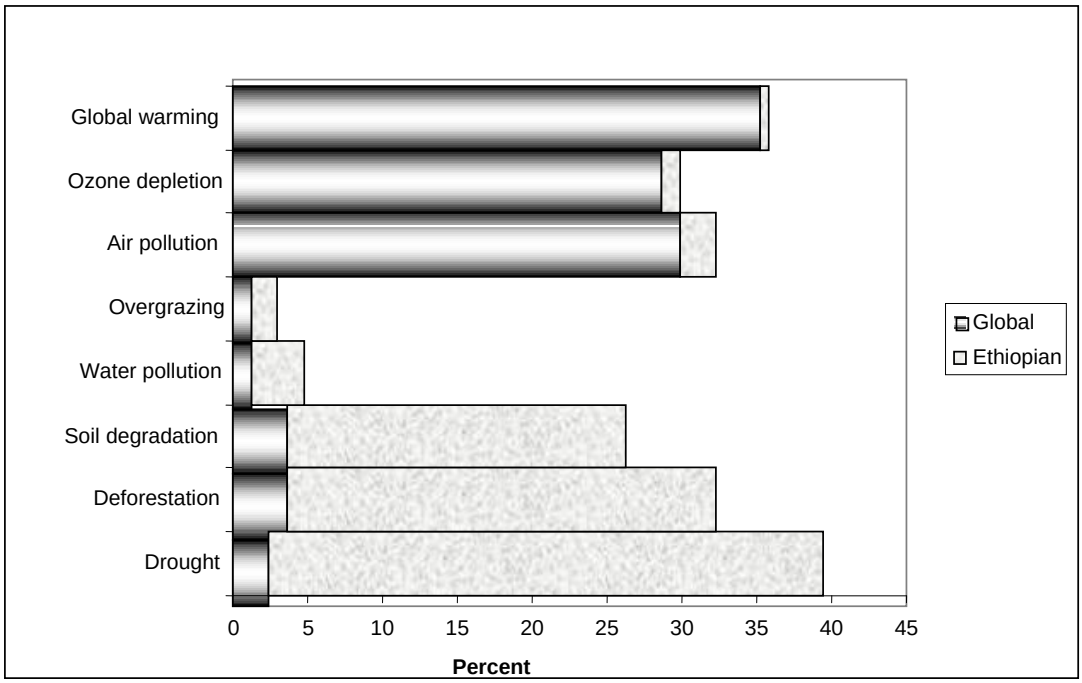

Figure 2: Perceptions of Relative Significance of Key Environmental Problems

Attitudes

The analysis of attitudes is based on the expressed feelings of the students about such matters as: population-environment concerns, relationships between selected agricultural techniques/practices and the environment, the role of government in environmental protection and the government's willingness to bear the costs of environmental protection.

Rapid population growth is often considered to be at the top of the listed of causes of environmental problems. Two-thirds of the respondents agree to the restriction of population growth for environmental protection (Fig 3:6); and the overwhelming majority of them expressed their readiness to limit the number of

children they like to have to contribute to the population growth control effort (Fig 3:8). About half of them even went to the extent of questioning the relevance, in the content of the present overpopulated world, of what are believed to be God's own words to Adam and Eve: "Multiply and Replenish the Earth" (Fig 3:9). A third of the surveyed students were in favor of the introduction in Ethiopia of China's "only one child/family" policy (Fig 3:1).

Regarding how the population environment problem can be solved, the students have somewhere to put the blame for the population crisis in the developing world. Close to two-thirds of them felt that the uneven distribution of wealth between the developed and developing world is the major cause of our population problem (Fig 3:7). This implies that fair distribution of wealth is vital to bring about solutions.

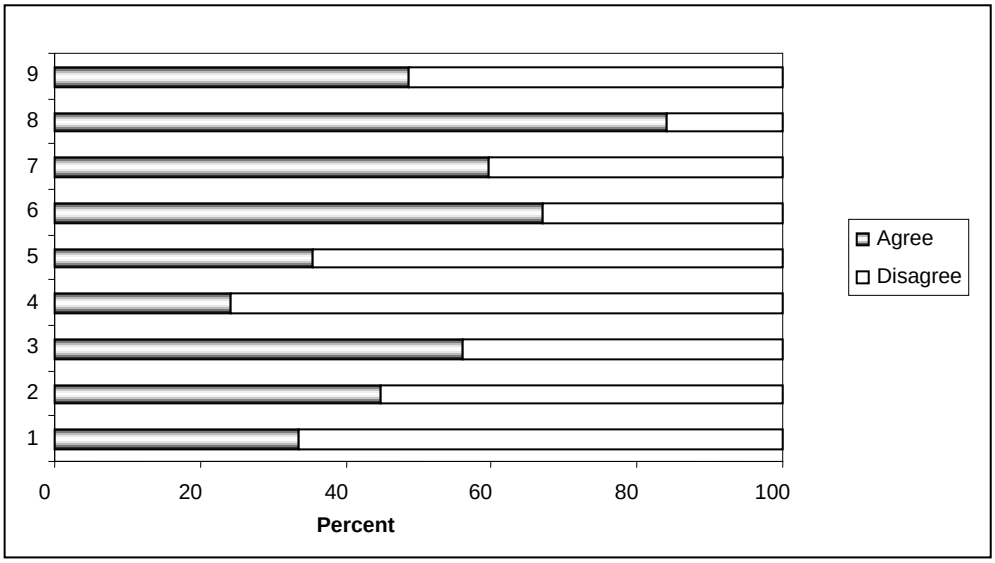

Figure 3: Expressed Attitudes on Population-environment Concerns

Key for Items in Fig. 3

1. One child policy for Ethiopia
2. Give priority to the control of rapid population growth rather than to the production of more food; because whatever you do, population will always grow much faster than food production
3. More people means more manpower than more hunger in Ethiopia
4. Resettlement is one of the best solutions for the problems of drought and degradation-induced famine
5. Settle nomads as a solution to environmental problems in the pastoral nomadic areas
6. Population growth should be restricted for the sake of environmental protection
7. Uneven distribution of wealth between the developed and developing world is the major cause of our population problem
8. Limit the number of the children you like to have to contribute to the population control effort
9. God's words "Multiply and Replenish the Earth" are still relevant

The students were not shown much enthusiasm in the resettlement of farmers and the settling of nomads as solutions to the current environmental problems of drought and land resource degradation (Fig 3:4, 5). Most students were not in favor of giving priority to population-growth control without an equal attention to be paid to food production (Fig 3:2). Moreover, the prevailing opinion is that more people do not mean more hunger in Ethiopia; it should mean more manpower (Fig 3:3).

The need to boast agricultural production in order to cope with the rising demand for food and raw materials for agro-industries has necessitated the use of agricultural techniques and practices, which may have positive or negative impacts on the various components of the environment.

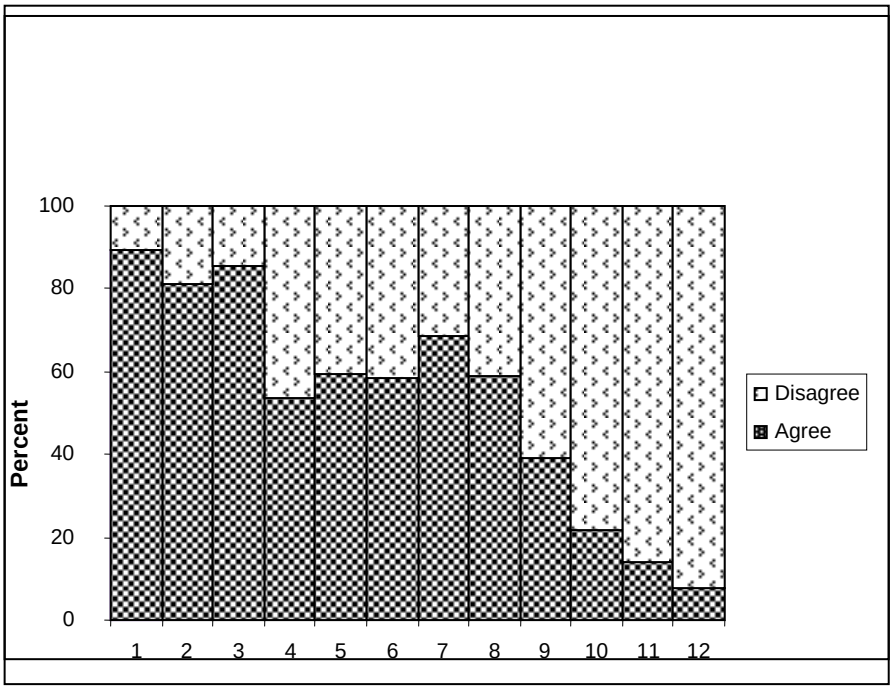

Figure: 4 Attitude towards the Relationship between Selected Agricultural Techniques/Practices and their Environmental Effects

Key for Items in Fig. 4

1. Agro/farm-forestry is the best approach to reforestation or afforestation because it solves the conflict between agricultural land use and forest cover
2. Mono cropping (specializing in a single crop) exposes crops to pest damage
3. As a crop researcher you would prefer to develop new crop varieties for organic farming
4. Small-scale irrigation is environmentally more sustainable than large-scale irrigation
5. Most of the chemical pesticides persist in the environment without being degraded
6. Genetically engineered crops could have adverse effect on the environment
7. Irrigation, pesticides and chemical fertilizers eventually destroy soil fertility
8. Alien species of plants or animals pose a threat to the native community
9. Trying to control pests with pesticides is like adding petrol into fire
10. As an official in charge of agricultural extension service you would like to see farmers engaged in high-input agriculture
11. No need to worry about the rate of the consumption of resources because technology will solve the problem
12. As an official in charge of agricultural extension service you would like to see farmers specializing in single crop

Most of the students did not tend to put all their trust in technology to solve the problem of resource depletion (Fig 4:11). The widespread feeling among the students was that technology does not only have limitations but it also has disastrous consequences on the environment: specializing in a single crop (Fig 4:2, 12) and high-input agriculture (Fig 4:10) i.e. the use of chemical pesticides (Fig 4:5, 7, 9), chemical fertilizers (Fig 4:7) irrigation (Fig 4:7) and the introduction of genetically engineered crops (Fig 4:6) and foreign species (Fig 4:8). Most the respondents agreed that the adoption of organic farming, agro-forestry and small-scale irrigation are beneficial in bringing about an environmentally sustainable agriculture (Fig 4:1, 3, 4).

The overwhelming majority of the surveyed students put the blame on the Government for the existing environmental problems. They felt that the Government was not doing enough to protect the environment (Fig 5:1): Existing laws are not enough to protect the environment (Fig 5:2); the mass media was not being adequately used to publicize issues of environmental concern (Fig 5:3) and the budget allocated for environmental protection was not adequate (Fig 5:4).

Key for Items in Fig. 5

1. Government is not doing enough to protect the environment
2. Existing laws are not enough to protect the environment
3. The mass media is not adequately used for environmental concerns
4. More budget should be allocated for environmental protection
5. State ownership of land ensures environmental protection

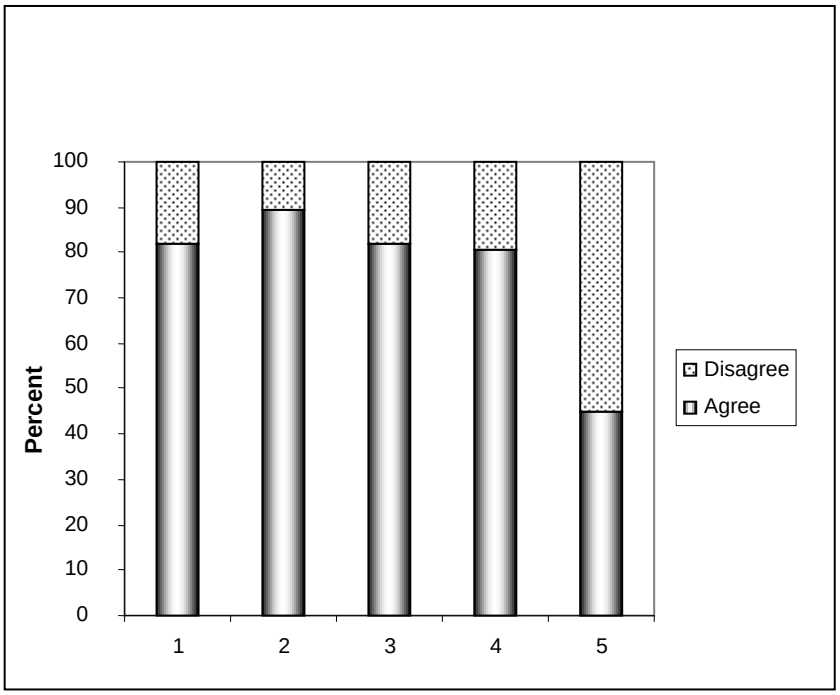

Figure 5: Expressed Feelings about the Role of Government in Environmental Protection

The students blamed the government for not doing enough; however, they had no consensus about whether or not key resources (land) should be under state ownership to ensure environmental protection (Fig 7:5).

Behavior

It is not enough to have the right attitudes to environmental matters. Environmental protection requires concomitant environmental behavior. The majority of the surveyed students said they had the habit of doing the right things like: watching TV or radio programs about the environment (Fig 6:1), talking with friends about the environment (Fig 6:6), setting good examples for

others on environmental matters (Fig 6:5); trying to stop people who harm the environment (Fig 6:4) and turning off lights when not using them (Fig 6:2).

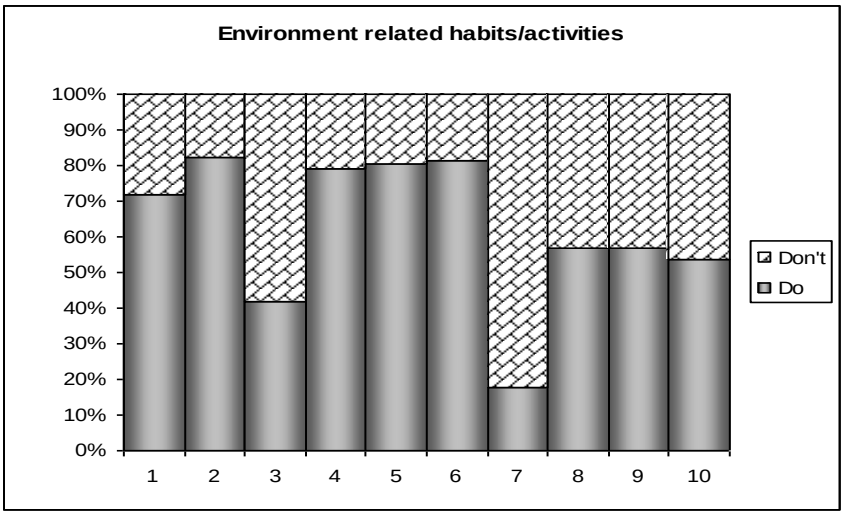

Figure. 6: Environment Related Habits/Activities

Key for Items in Fig. 6

1. Enjoy TV or radio programs about the environment
2. Turn off lights when not using them
3. Turn off water tap when not using it
4. Try to stop people who harm the environment
5. Set a good example to others on environmental matters
6. Talk with friends about the environment
7. Use the mass media to communicate environmental concerns
8. Participate in annual tree planting campaigns
9. Refrain from cutting a branch of Juniperus tree (*Tid*) for Christmas
10. Refrain from throwing plastic bags everywhere

Turning off water tap when not in use (Fig 6:3) and using the mass media to communicate environmental concerns, however, are not common practices. Moreover, it is only slightly more than half of the surveyed students who reported to have ever participated in annual tree planting campaigns. Fig. 6.10

shows the number of students who refrained from throwing plastic bags every where. Fig 6.9 shows the number of students who refrained from cutting branches of Juniperus for Christmas.

How genuinely positive their environmental attitude can better be discerned from behavior that requires some tangible personal sacrifices. Most students expressed their willingness to pay taxes for environmental protection (Fig 6:4). However, there was not much unanimity on measures like: increasing the prices of some necessities to provide for environmental protection (Fig 6:1), banning the use of fuel wood and charcoal (Fig 6:2) and restrictions on personal freedom for the sake of environmental protection (Fig 6:3).

Key for Items in Fig, 7

1. Prices of some necessities increase to provide for environmental protection
2. Banning the use of fuel wood and charcoal
3. Restrictions on freedom for the sake of providing for environmental protection
4. Paying taxes for environmental protection

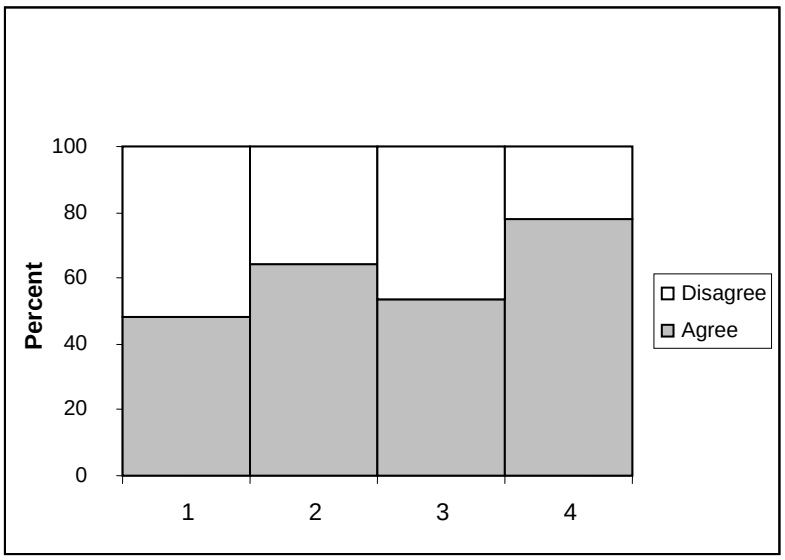

Figure 7: Expressed Willingness to Bear the Costs of Environmental Protection

Synthesis and Conclusion

Close to 10 percent of the respondents could not define any of the environments related terms. One could be satisfied with the simple majority who claimed to be able to define 30 to 40 of the terms. However, when it comes to the environment which needs to be understood in its entirety and complexity a statistical significance in knowledge levels may not be satisfactory. The ability of the students to adequately distinguish the National from the International environmental concerns and the manner by which they ranked them is very much in line with what is conventional.

The fact that students have adequately identified and ranked the key environmental concerns does not seem to have implied a consensus on what should be done about the causes of the concern. Attitudes to what should be done with rapid population growth have a touch of traditional value systems. It should not be surprising if so many students fearful about challenging what are believed to be the words of God about child birth. The same goes for the Chine-style legal restriction. Ethiopians educated or otherwise, have intimate attachment to their places of birth and the places where they are brought up. Resettlement is often considered to be one of the devil's alternatives to drought-induced famine and death. In spite of this, a significant majority of them are of the conviction that something has to be done with the population for the sake of the environment and that they take it upon themselves by limiting the number of children that they would like to have in the future.

The attitudes that the students bear towards the conventional agricultural techniques and practices as well as their alternatives are deemed most important for a sustainable agricultural future of Ethiopia. The role that agricultural education played in shaping the students' attitudes in this regard is clearly demonstrated in the responses. Disenchantment of the college students about the conventional agricultural technologies and practices and their tendency toward the more environmentally-friendly ones is unmistakable.

When it comes to who should shoulder the responsibility and take the blame for failures in environmental protection, most students have the government to blame. This should not be taken negatively, as most of these students are expected to join the government bureaucracy after graduation.

It may be assumed that the students will mechanically perform what is expected of them when they join agriculture and environment related careers. It may be argued that what they are fond of doing and what sacrifices and pains they are ready to endure make up more potent motivators to positive environmental actions than just job descriptions. The survey has noted with environment-friendly habits and hobbies of students practiced by majority of the respondents. Moreover, significant proportions have gone to the extent of showing their readiness to pay more and endure inconvenience of the environment.

Overall, the analysis of the results reveals that the prospective graduates in the agricultural colleges, covered by this survey, have shown high level of knowledge and positive attitudes to the environment. The expressed behavior patterns pertaining to environmental protection are also promising. Although it is hard to be conclusive based just on this survey of limited coverage, the observed fairly high level of environmental literacy of the prospective graduates can be instrumental in the shaping of a sustainable agricultural future for Ethiopia. However, this could be realized only if it is supported by appropriate and more potent policies and actions.

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