

### **Criteria for Deciding the Breadth and Depth of Topics in a Time-Constrained One-Semester Agroforestry Course**

**John K. Boateng**, 415 Agricultural Administration Building, The Pennsylvania State University, University Park, PA 16801. Phone: (814)-863- 7877. Fax: (814)-863- 4753. E-mail: [jkb183@psu.edu](mailto:jkb183@psu.edu)

**Ephraim M. Govere**, Department of Crop and Soil Sciences, The Pennsylvania State University

#### **Abstract**

*Many universities, especially in Sub-Sahara Africa, cannot afford to offer more than one agroforestry course due to limited funds, skilled personnel, and/or physical facilities. They have to make tough decisions on the breadth and depth of topics to be covered in a time-constrained one-semester agroforestry course. In this paper we present the theoretical base and an example of the application of an AGROforestry COurse DEcision Model (AGROCODEM) as an aide in deciding whether a time-constrained one-semester course has adequate breadth and depth. AGROCODEM consists of six factors: knowledge, attitudes, skills, aspirations, inspirations, and intentions with each factor having seven elements that serve as decision-making criteria. An agroforestry course has adequate breadth and depth if, and only if, it has potential to cause positive agroforestry knowledge, attitude, skill, aspiration, inspiration, and intention (PAKASAI) changes in the learner. The AGROCODEM decision model is intended to provide educators with new ideas and serve as a decision criterion for topics and details to be covered under each topic and hopefully it will help to improve syllabi for time-constrained one-semester agroforestry courses being offered in colleges and universities in Sub-Sahara Africa and other regions of the world.*

## **Introduction**

African universities are among the world's poorest and yet in their effort to catch up with new knowledge, they embrace emerging programs such as agroforestry, defined by Huxley and Houten, (1987) as a dynamic, ecologically based natural resources management system that, through the integration of trees in farmland and rangeland, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. Even though the universities' research, extension and training needs in agroforestry are high (Govere, 1997a), most of them only offer a time-constrained one-semester course on agroforestry due to limited financial, material, and human resources (Govere 1997b). Temu (2003) and Govere (1996) reported that agroforestry content in the courses differed very widely due to the nature and mandates given to institutions in different countries and because agroforestry is a multi-disciplinary field of study. The questions colleges and universities face, especially those in Sub-Sahara Africa, is, "Should a one-semester agroforestry course provide students with a general overall background of agroforestry by addressing multiple topics only briefly? Or should it concentrate on a few key topics in depth?"

## **Purpose and Objective**

The purpose of this paper is to present a decision model code named AGROCODEM (AGROforestry COurse DEcision Model) that can be used by institutions teaching agroforestry to decide the breadth and depth of topics that should be covered in a time-constrained one-semester course. The essence of the decision model is to guide the design of Agroforestry syllabi especially by African colleges and universities in such a way that would contribute to positive agroforestry knowledge, attitude, skill, aspiration, inspiration and intention (PAKASAI) changes. Our hypothesis is that an agroforestry course has adequate breadth and depth if, and only if, it has the potential to cause PAKASAI changes in the learner.

## **The AGROCODEM Process and Procedure**

The development of the AGROCODEM model is being pursued in four different phases. Phase 1 entailed the development of the theoretical base to demonstrate the application of the AGROCODEM model as a decision tool. Phase 2 will entail the construction of a time-constrained one-semester prototype agroforestry syllabus and the evaluation of agroforestry course outlines from universities in Sub-Sahara Africa for their potential to pass the PAKASAI test. In Phase 3, we want to work with Faculty from African Universities to develop course outlines for instruction at their respective universities that incorporates instructional objectives stipulated by the AGROCODEM model. In Phase 4 we will develop and administer a survey instrument that will be used to assess students at the universities where we collaborate with the Faculty to develop agroforestry course outlines. The intent will be to test if there have been PAKASAI changes resulting from a time-

constrained one-semester agroforestry instruction that was formulated using the AGROCODEM model. This paper presents only information and results from the Phase 1.

### **The AGROCODEM Concept and Principles**

The AGROCODEM is based on Bennett's hierarchy for targeting outcomes and evaluating achievement (Bennett, 1979). Bennett pointed out four factors: Knowledge, Attitude, Skill, and Aspiration (KASA) changes to evaluate the effectiveness of an education program. In recent literature, a new component "intention" has been added (Bennett and Rothwell, 1999). We have added a sixth component "inspiration" to come up with PAKASAIL, acronym for Positive Agroforestry Knowledge, Attitude Skill Aspiration, Inspiration, and Intension changes. AGROCODEM is based on the premise that a course has adequate breadth and depth if and only if, it has potential to cause PAKASAIL changes. A course that does not address all the six components in PAKASAIL fails the test. Thus AGROCODEM sets the criteria for deciding the breadth and depth of topics in a time-constrained one-semester agroforestry course.

### **The AGROCODEM Sub-Models**

The AGROCODEM has six sub-models: Positive Knowledge, Attitude, Skill, Aspiration, Inspiration, and Intention ((Figure 1). Each of the sub-models consists of seven key elements. The AGROCODEM is a fusion of 42 elements. A syllabus whose design is based on the 42 elements is said to have the adequate breath and depth and has the greatest potential to result in meaningful learning: learning that results in positive PAKASAIL, the learning that cause the greatest benefits to the student and the community at large. Details of the sub-models and their elements are presented below.

#### **Positive knowledge change sub-model**

Bloom (1956) viewed knowledge as comprising a continuum of the following attributes:

1. Facts: Concepts and principles relevant to student learning.
2. Understanding: Identifying common terms, labeling specific facts and describing principles, methods, and procedures.
3. Comprehension: Knowing what is being communicated and making use of what is being communicated without relating it to other material or seeing its fullest implications.
4. Application: Using abstractions in particular situations and including general ideas, rules of procedures, generalized methods, technical principles, and theories that must be remembered and applied.
5. Analysis: Disintegrating material into its constituent parts. Observing the relationships of the parts and the way they are organized.
6. Synthesis: Assembling the component parts to form a whole.

7. Evaluation: Judging the value, ideas, works, solutions, methods, and procedures using criteria to appraise the extent to which particular situation and circumstance is accurate, effective, economical and satisfying.

Knowledge gained from incomplete knowledge spectrum (facts -> understanding -> comprehension -> analyzing -> synthesizing -> evaluating -> actionable judging) is not positive knowledge and does not result in what Ausubel calls “meaningful learning” (learning that has potential to positively transform student behavior) - the most valuable and long lasting learning (Siann and Ugwuegbu, 1985).



Figure 1. *AGROforestry COurse DEcision Model (AGROCODEM) for Sub-Sahara Africa*

### Positive attitude change sub-model

Engel et al. (1986) defined attitude as a mental and neural state of readiness to respond that is organized through experience and exerts a directive and or dynamic influence on behavior. Krathwhol et al. (1964) viewed attitude as comprising a continuum of five attributes namely: receives, responds, values, organizes and characterization by value. Scholl (2002) proposed two additional attributes, cognition, and evaluation as defined below:

1. Cognition: Refers to beliefs, theories, expectancies, cause and effect beliefs, and perceptions relative to the focal object or situation.
2. Receives: Refers to feelings and shows the importance of learning and sensitivity to human needs and social problems.
3. Responds: Refers to behavioral intentions or goals, aspirations, and students' expected responses to the attitude object or situation.
4. Values: This component demonstrates belief in the democratic process with orientation in problem solving.
5. Organizes: Refers to student's ability to recognize the need for balance between freedom and responsibility and the role of systematic planning in solving problems.
6. Characterization by value: This component enables students to examine both sides of the problem before making a decision.
7. Evaluation: The central component of attitudes, they consist of the imputation of some degree of goodness or badness to an attitude object or situation.

Positive attitude change in agroforestry education can be defined as an acquired mental state that influences agroforestry choices for personal action through preferences, avoidance, or commitment (Petty et al., 1997; Ajzen, 2001). Curriculum and syllabi intending positive attitude change for agroforestry education should incorporate all seven components of attitudes.

### **Positive skills change sub-model**

Skills are technical or quantitative ability developed by some individuals as a result of exposure to some training or learning such as skills in critical and creative thinking, problem solving, application, and performance (Rochester Institute of Technology, 2000). Simpson (1972) conceptualized skills as comprising a continuum of seven attributes:

1. Perception: The ability to use sensory cues to guide motor activity.
2. Set: The mental, physical and emotional dispositions or mindsets that predetermine a student's response to different situations.
3. Guided response: Refers to the early stages of learning a complex skill. It entails imitation, practice and trial and error.
4. Mechanism: Refers to the intermediate stage for learning a complex skill. Learned responses can be performed with some confidence and proficiency.
5. Complex overt response: The skillful performance of motor acts that involve complex movement or response patterns. Proficiency is indicated by a quick, accurate and highly coordinated performance.
6. Adaptation: Skills are well developed and the student can modify movement and response patterns to fit special or specific requirements.
7. Origination: Create new response patterns to fit a particular situation or specific need or problem.

Positive skills change is the ability to use knowledge in a practical manner that has been acquired by training or experience. When learning occurs, skills change (Bennett, 1979). Students who complete agroforestry study should possess the psychomotor (mental and physical skills) required to solve agroforestry problems.

### **Positive aspiration change sub-model**

Quaglia and Cobb (1996) defined aspirations as a student's ability to identify and set goals for the future, while being inspired in the present to work toward those goals. The National Center for Student Aspirations (NCSA) came up with several conditions that foster aspiration (NCSA, 1995; Hyatt, 2002):

1. Belonging and Empowerment: Having a sense of self, connection, support and being a fully and richly involved, valuable community member who takes control and responsibility for his/her actions.
2. Mentoring and Heroes: Having an accessible, real-world role model to admire, respect and seek out for guidance.
3. Sense of Accomplishment: Achieving on personal, social and academic levels, and being recognized for doing one's best.
4. Excitement and Enjoyable: Exhibiting genuine enjoyment in activities, and being open to learning and growth.
5. Curiosity and Creativity: Inquisitiveness, an eagerness and strong desire to satisfy the mind with new discoveries and willing, and appreciating what it means, to take a risk, to be successful, to fail and to try again.
6. Leadership and Responsibility: Expressing ideas and accepting the consequences of one's actions.
7. Confidence to Take Action and Risk: Setting high goals and having positive attitudes about working to achieve them; taking deliberate and thoughtful activity involving choosing healthy and sensible options.

Positive agroforestry aspirations change is demonstrated by selection of future agroforestry course of action or decisions and commitment made for the future. An effective agroforestry syllabus should have the potential to leave in a student an ardent desire and strong hope to achieve agroforestry goals.

### **Positive inspiration change sub-model**

Inspiration is a word derived from the Latin "inspirare" meaning "to breathe into" (McKay, 1995). Councill (1988) noted that if we as a human species do not inspire, it would seem that we are destined to expire. In his book, *Year to Success*, Bennett (2003) stated that inspiration is one of the three addends that lead to success: education + inspiration + action = success. Quaglia and Cobb (1996), viewed inspiration as one of the two engines of aspirations; the other one being ambition. Inspiration reflects that an activity is exciting and enjoyable to the individual and the awareness of being fully and richly involved in life here and now. According to Fallows and Aahmet (1999), inspiring students is primarily a matter

of motivation and an individual's motivation to learn is determined by the following attributes:

1. Desire to Please: Use of positive and encouraging feedback to build the understanding that achievement is not merely a matter of luck or a preordained inevitability.
2. Perceived Need: Study topics that are seen to be relevant. Indicating the relevance of the topic and delivering material within a framework that utilizes examples appropriate to the students' needs.
3. Degree of Interest: Exploration of teaching methodologies that seek to involve the student in active learning.
4. Values and Beliefs: Recognition of the diverse nature of the student body can help to ensure that students are inspired to learn. Diversity of values and beliefs can include reference to ethnicity/race, religious beliefs, gender considerations and ethical matters.
5. Attitudes: Appreciating the differences in attitudes.
6. Aspirations: What students are seeking from the course.
7. Incentives and Rewards: Actions that generate students' interest and promote active participation and learning.

Positive inspiration goes beyond technicalized and intellectualized agroforestry body of knowledge, it requires that a syllabus instill into a student the feeling within the body of elevated energy and enthusiasm to perform agroforestry activities currently and in the future. It also brings in the real passions and pains that men and women in agroforestry feel. An inspirational syllabus, like an inspirational leader is one that helps students to expand their capacity to understand the complexities of agroforestry and to inspire or "breathe life into" future vision of agroforestry interventions. Without such inspiration, agroforestry as a profession remains status quo and reactive rather than proactive toward the future.

### **Positive intention change sub-model**

Intention is the design, resolve or determination to act in a certain way or to do a certain thing. Thus intention only refers to the state of the mind with which the act is done or omitted (Black, 1979). According to the theory of reasoned action, behavior is determined by people's intention to perform or not to perform the behavior (Bright et al., 1993). The behavioral intention in turn is determined by attitude toward performing the behavior and subjective norm. Ajzen (1988, 1991) and Fishbein and Ajzen. (1976) came up with several constructs or conditions that foster positive intention change:

1. Behavior: The transmission of intention or perceived behavioral control into action.
2. Behavioral Intention: An indication of how hard someone is willing to try and of how much an effort they are planning to exert, in order to perform the behavior. Influenced by three components: person's attitude toward performing the behavior, the perceived social pressure, called subjective norm and perceived behavioral control.
3. Attitude: The first determinant of behavioral intention. It is the degree to which the person has a favorable or unfavorable evaluation of the behavior in question.
4. Subjective Norm: Considered the second predictor of behavioral intention, this is the influence of social pressure that is perceived by the individual (normative beliefs) to

- perform or not perform a certain behavior. This weighted by the individual's motivation to comply with those perceived expectations (motivation to comply).
5. Perceived Behavioral Control: The third antecedent of behavioral intention. This construct is the individual's belief concerning how easy or difficult performing the behavior will be. It often reflects actual behavioral control.
  6. Control Beliefs: Beliefs about the level of control over behavior.
  7. Self-Efficacy: The individual's perception that she/he will be able to perform a certain behavior successfully.

Positive intention change can be defined as anticipated positive agroforestry outcome that is intended or that guides planned actions in a syllabus. Intentions are the key to the nature of conscious beings and to all of their activities. Intention is somewhat different from ambition in that ambition represents the perception that an activity is important as a means to future goals and it reflects individuals' perceptions that it is both possible and desirable to think in future terms and to plan for the future (Quaglia and Cobb, 1996)

### Application of The AGROCODEM Process

As stated earlier, the AGROCODEM is a fusion of 42 elements. In Table 1, we have presented 42 elements that can be used as criteria to test if a syllabus has the adequate breath and depth. Our preliminary results based on a few syllabi we have evaluated from Sub-Saharan Africa reveal that they failed the PAKASSI test. The syllabi had few of the 42 PAKASSI indicators. They focused mainly on knowledge and skills. We are currently implementing Phase 2 of AGROCODEM process that entails the construction of time-constrained one-semester prototype agroforestry syllabus and the collection and evaluation of all agroforestry course outlines from Sub-Saharan Africa.

**Table 1.** *Examples of indicators of potential PAKASSI (positive agroforestry knowledge, attitude, skill, aspiration, inspiration and intention) changes used to assess an agroforestry syllabus.*

<b>Indicators of Potential Positive Knowledge Change</b>
<b>Facts:</b> Syllabus defines, describes, labels, lists or outlines new facts, concepts and principles that are relevant for student learning.
<b>Understanding:</b> Syllabus helps students identify common terms by highlighting them, label specific facts and describe principles, methods and procedures. Offers opportunity for student practice
<b>Comprehension:</b> Syllabus explains facts and principles to enhance student comprehension; it justifies methods and procedures
<b>Application:</b> Syllabus enables students to apply concepts and principles to new situations; it enables students demonstrate correct usage of a method or procedure.
<b>Analysis:</b> Syllabus helps students recognize unstated assumptions and logical fallacies in reasoning and distinguish between facts and inferences.
<b>Synthesis:</b> Students are given opportunity to write a well-organized theme, they can give a well-organized speech in the subject area.



**Evaluation:** Students can judge logical consistency of written material; they can judge the adequacy with which conclusions are supported by data.

#### **Indicators of Potential Positive Attitude Change**

**Receives:** Syllabus shows importance of learning and sensitivity to human needs and social problems

**Responds:** Syllabus sets goals, gives opportunity to students and clarifies responses expected from students.

**Values:** Syllabus demonstrates belief in the democratic process with orientation in problem solving.

**Organizes:** Syllabus recognizes the need for balance between freedom and responsibility and the role of systematic planning in solving problems.

**Characterization by value:** Syllabus incorporates decision cases to enable students examine both sides of the problem before making a decision

**Cognition:** Syllabus incorporates theories, concepts, explains beliefs and expectations, cause and effect beliefs, and perceptions relative to agroforestry study.

**Evaluation:** Syllabus enables students to judge the adequacy with which conclusions are supported by data and specific examples.

#### **Indicators of Potential Positive Skills Change**

**Perception:** Syllabus uses higher order teaching and learning strategies that facilitate sensory stimulation through cue selection to translation. Makes the learning environment comfortable, safe and encouraging.

**Set:** Syllabus acts upon a sequence of steps in a teaching or learning process. Recognizes student abilities and limitations. Problems and examples offered are within students' ability to solve. Uses variety of teaching and learning strategies.

**Guided response:** The syllabus gives students opportunity to practice. Makes time for course and topic reviews, mock exams, practice quizzes, make up quizzes, stepwise instruction to build models and use mathematical equations. Ensures action and reflection and participants are involved in their own learning.

**Mechanism:** Syllabus incorporates laboratory sessions, and gives opportunity to practically handle and use equipment. Builds group and individual confidence by encouraging and rewarding.

**Complex overt response:** Syllabus is consistent. Shows accurate and highly coordinated performance. Learning activity meets student needs and relates to the problems of students. Builds on local experiences, and recognizes and rewards individuals and groups. Uses activities that involve, that are simulating, are participatory and are immediately applicable.

**Adaptation:** Syllabus adequately prepares students to respond to unexpected experiences. Uses active strategies and incorporates experiential learning strategies. Modifies instruction to meet and reflect needs of students.

**Origination:** Syllabus shows evidence of presenting new information, concepts or theory. Provides evidence of new and comprehensive teaching and learning programs. Learning outcomes emphasize creativity and high order skills. Allows time and space for reflection.

#### **Indicators of Potential Positive Aspiration Change**

**Belonging and Empowerment:** Syllabus gives students credit for membership and active participation in local agroforestry societies, government and non-government agencies, and community projects.

<b>Mentoring and Heroes:</b> Syllabus enables students to visit the national/regional, or international agroforestry gurus.
<b>Sense of Accomplishment:</b> Syllabus allows students to present in writing or orally class or individual project/work in writing through various media e.g. journals or magazines or newspapers, television, web pages. Gives prizes or other forms of recognition for outstanding work.
<b>Excitement and Enjoyable:</b> Syllabus allows for field trips to have agroforestry related experiences and fun. Writing agroforestry jokes or cartoons!!
<b>Curiosity and Creativity:</b> Syllabus makes students come up with novel agroforestry ideas and inventions and take leadership roles implementing them.
<b>Leadership and Responsibility:</b> Syllabus gives students opportunities to set their own agroforestry learning objectives and goals and to write implementable community projects under joint leadership with the community.
<b>Confidence to Take Action and Risk:</b> Syllabus gives students opportunity to be instruments of change in agroforestry related policies and activities at local, national and international levels.
<b>Indicators of Potential Positive Inspiration Change</b>
<b>Desire to Please:</b> The syllabus shows various feedback mechanisms including verbal and non-verbal, written and oral, formal and non-formal to instill into a student the feeling within the body of elevated energy and enthusiasm to attain the highest achievement levels.
<b>Perceived Needs, Wants and Desires:</b> The syllabus presents topics, case studies or examples, and learning settings that meet individual student's needs, wants and desires.
<b>Degree of Interest, Incentives and Rewards:</b> The syllabus incorporates teaching approaches and methodologies, incentives and rewards, to generate students' interest and promote active participation and learning.
<b>Values and Beliefs:</b> The syllabus is not stereotype but captures diversity of values and beliefs reflected (ethnicity/race, religious beliefs, gender) and create a stimulating environment that promotes cross-fertilization of ideas and collaboration.
<b>Scientific Investigation and Examining:</b> The syllabus includes scientific method and knowledge of human systems to explain the uniqueness and interdependence of those systems and their interactions influenced by the external environment. Scientific approaches minimize the appearance of bias or prejudice.
<b>Futuristic Approach:</b> The syllabus is more oriented by focusing on future courses of action and decisions or commitments made for the future.
<b>Cause/Effect and Cost/Benefit Approaches:</b> Syllabus shows content that seeks to identify cause and effect or cost and benefit for selected decision and events.
<b>Indicators of Potential Positive Intention Change</b>
<b>Behavior:</b> The syllabus transmits intention or perceived behavioral control into action.
<b>Behavioral Intention:</b> Indication of how hard a syllabus or instruction tries and of how much an effort it exerts, in order to affect student attitude and behavior.
<b>Attitude:</b> Is the degree to which the syllabus or instruction has a favorable or unfavorable evaluation of the student behavior in question.
<b>Subjective Norm:</b> Does the syllabus deal with social pressure that is perceived by the students (normative beliefs) to perform or not perform a certain behavior? To what extent are students motivated by syllabus to overcome social pressures?
<b>Perceived Behavioral Control:</b> Does the syllabus deal with student's belief concerning how

easy or difficult performing the behavior will be?
<b>Behavioral Beliefs:</b> Does the syllabus include vivid beliefs about the teaching/learning process?
<b>Self-Efficacy:</b> Does the student empower students to perceive they will be able to perform a certain behavior successfully?

## Implications

The AGROCODEM model has potential to be a powerful tool. It is intended to serve as a decision criterion for topics and details to be covered in a time-constrained one-semester agroforestry course. It is our belief that an AGROCODEM-based syllabus would (1) facilitate the learning environment by making it comfortable and encouraging, (2) ensure that the teaching and learning activity meets the needs of students and relates to the problems of the community at large, (3) ensure that the course activities are involving, participatory and simulating, as well as of immediate applicability, (4) allow time and space for reflection, and (5) build group and individual confidence by encouraging and rewarding students.

## Educational Importance

The socio-economic development in Sub-Sahara Africa is mostly sustained by agricultural and related enterprises. There is a growing realization that the development can collapse unless sustainable agricultural land use systems that harmonize land derived benefits with environmental components (soil, fauna, flora, water, and air) are introduced, refined and adopted. One such land use is agroforestry. To effectively introduce, refine and facilitate adoption of agroforestry in Sub-Sahara Africa, there is need for a comprehensive development of syllabi at college and university level. The AGROCODEM model with its 42 PAKASAI elements, has great potential to revolutionize course syllabi so that they contribute to the production of knowledgeable or intellectual students whose minds are not just storehouses of facts but are capable of processing facts and extracting their significance for human life and whose participation in the affairs of society is thoroughly imbued with the desire to bring their intellect to bear upon human problems so as to enrich life in Sub-Sahara Africa.

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