

MINISTRY OF EDUCATION



TEACHING SYLLABUS FOR FORESTRY (SHS 1 - 3)

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TEACHING SYLLABUS FOR FORESTRY - SENIOR HIGH SCHOOL

RATIONALE FOR TEACHING FORESTRY

Forests play a major role in the maintenance of environmental quality through their productive functions which yield direct and indirect benefits. The direct benefits include timber, fuelwood, bamboo and rattan, canes, sponges, medicinal plants, wildlife, mushroom and snails. The indirect benefits, though very vital, are not fully appreciated. They include erosion control, moderation of climate, protection of water bodies, supply of oxygen and purification of air.

In addition to the above benefits, the forest estate of Ghana contributes immensely to the socio-economic development of the country. Timber is the fourth source of foreign exchange earner in Ghana, whilst fuelwood, bush meat, medicinal plants and other forest products contribute significantly to the livelihood of most Ghanaians.

In spite of these benefits, the rate of exploitation of the forest resources has out-paced conservation measures resulting in deforestation, destruction of wildlife and environmental degradation. There is therefore an urgent need to take appropriate measures to stop the depletion and degradation of forest resources in the country. The major interventions are to create awareness of the importance of forestry at the senior high school level and sensitise students on their role and civic responsibilities towards forest conservation. The forestry course is intended to help students acquire basic knowledge and skills in forestry that will form the basis for sound tertiary education. For those who would not embark on tertiary education, the course equips them with skills that will make them employable in the forestry industry and related disciplines.

GENERAL AIMS

This syllabus is designed to help students to:

1. appreciate the importance of forests to life
2. acquire knowledge in forestry practices
3. take measures to prevent the negative effects of population growth on the forests
4. adopt measures to deal with the causes and effects of forest degradation
5. apply the regulations governing the use of forest resources appropriately
6. appreciate the functions of forestry sector institutions
7. acquire basic skills in establishing forest plantations
8. contribute to the conservation and sustainable use of Ghana's forests.

SCOPE OF CONTENT

The content of this course has been designed in such a way that it will offer enough knowledge and skills to students for whom Senior High School education is terminal, as well as provide adequate foundation for those who want to pursue further education and training in forestry and natural resource management. The course covers the following:

- Introduction to forestry.
- Forest estate of Ghana and its functions.
- Forest policy and role of forest sector institutions.
- Current state of the forests.
- Causes of deforestation and associated environmental consequences.
- Forest conservation and sustainable resource use.

It also covers practical training in tree identification, nursery establishment and management, tree planting, plantation establishment and development, as well as providing basic skills in forest mensuration and land surveying. A section has been devoted to assist students with income generation ventures. Competencies in professional areas of Forestry also serve as guides in setting objectives, content selection and teaching/learning activities.

PROFESSIONAL AREAS IN FORESTRY

ARTIFICIAL FORESTS

- i. Provide Service in Plantations (Plantation Supervisors).
- ii. Provide Service in Forest Product Processing Industries.
- iii. Provide Services to Non Timber Forest Product (NTFP) Industries.
- iv. Manage Production SMEs in Forestry (Nurseries & Plantations).
- v. Manage SMEs on NTFPs (Mushroom, Honey Production, Shea Butter, Prekese, Dawadawa, etc).
- vi. Manage Small and Medium Agro-based Shops.

NATURAL FORESTS

- i. Provide Service in Natural Forest Management (Assistant Range Supervisors)

WILD LIFE MANGEMENT

- i. Provide Service in Zoos.
- ii. Provide Service in Wild Life Management (Field Assistants).

PRE-REQUISITE SKILLS AND ALLIED SUBJECTS

Students offering forestry must have sound foundation in Integrated Science and Mathematics at the Junior High School level. Students studying forestry should offer General Agriculture in addition to 1 or 2 other subjects from the options specified under the SHS Agriculture programme.

ORGANIZATION OF THE SYLLABUS

The syllabus has been structured to cover the three years of the Senior High School Programme. Each year's work consists of a number of sections with each section comprising a number of units. The syllabus is presented as follows:

STRUCTURE AND ORGANISATION OF THE SYLLABUS

YEAR 1	YEAR 2	YEAR 3
<p>SECTION 1: INTRODUCTION TO FORESTRY(p.1)</p> <p>UNIT 1 : Basic Concepts: Forest and Forestry UNIT 2 : Forest Products- Contribution to National Development</p>	<p>SECTION 1: PLANT PARTS AND TREE IDENTIFICATION (p.15)</p> <p>UNIT 1 : Plant parts and Functions. UNIT 2 : Tree Identification</p>	<p>SECTION 1: MARKETING OF FOREST PRODUCTS (p.30)</p> <p>UNIT 1 : Demand for Forest Products UNIT 2 : Marketing Agencies</p>
<p>SECTION 2: INTRODUCTION TO FOREST ECOLOGY (p.4)</p> <p>UNIT 1 : Concept of Forest Ecology UNIT 2 : Forest Ecosystem</p>	<p>SECTION 2: INTRODUCTION TO WILDLIFE (p.17)</p> <p>UNIT 1 : Concept of Wildlife UNIT 2 : Identification of Wildlife UNIT 3 : Importance of Wildlife UNIT 4 : Wildlife Reserves</p>	<p>SECTION 2 : DEFORESTATION (p.32)</p> <p>UNIT 1 : Forms and Causes UNIT 2 : Effects of deforestation UNIT 3 : Controlling deforestation UNIT 4 : Reforestation, afforestation, reafforestation UNIT 5 : Natural regeneration</p>
<p>SECTION 3: ECOLOGICAL ZONES OF GHANA (p.7)</p> <p>UNIT 1 : Vegetation Zones UNIT 2 : Forest Types</p>	<p>SECTION 3: FORESTRY SECTOR STRUCTURES (p.208)</p> <p>UNIT 1 : Policy-making, Implementation, Monitoring & Evaluation UNIT 2 : Training and Research</p>	<p>SECTION 3: PLANTATION ESTABLISHMENT I: NURSERY PLANNING (p.37)</p> <p>UNIT 1: Plantation Development UNIT 2: Nursery establishment UNIT 3: Costing Nursery establishment</p>
<p>SECTION 4: LAND TENURE SYSTEM (p.9)</p> <p>UNIT 1 : Types of Land tenure UNIT 2 : Impact of Land Tenure on Land Use</p>	<p>SECTION 4 : FOREST POLICY AND LAW (p.21)</p> <p>UNIT 1 : Introduction to Forest & Wildlife Policy</p>	<p>SECTION 4: PLANTATION ESTABLISHMENT II - PLANTING AND TENDING (p.40)</p> <p>UNIT 1 : Land Preparation UNIT 2 : Tending Operations UNIT 3 : Costing plantation development UNIT 4 : Other Intervention</p> <ul style="list-style-type: none"> • Agro forestry • Taungya forestry <p>UNIT 5 : Project Work</p>

YEAR 1	YEAR 2	YEAR 3
<p>SECTION 5: FOREST ESTATE (p.10)</p> <p>UNIT 1 : Forest Estate</p> <p>UNIT 2 : Forest area and Reserves Depletion</p> <p>UNIT 3 : Protective Measures</p>	<p>SECTION 5: FOREST MENSURATION AND WILDLIFE SAMPLING (p.22)</p> <p>UNIT 1 : Measurement and enumeration of trees</p> <p>UNIT 2 : Enumeration of growing stock and sampling methods</p>	<p>SECTION 5: INCOME GENERATION VENTURES (p.44)</p> <p>UNIT 1 : Importance of mushroom</p> <p>UNIT 2 : Biology of mushroom</p> <p>UNIT 3 : Methods of mushroom cultivation</p> <p>UNIT 4 : Mushroom – Harvest and Post harvest Handling</p> <p>UNIT 5 : Beekeeping</p>
<p>SECTION 6: RIGHTS TO FOREST RESOURCES (p.13)</p> <p>UNIT 1 : Types of Rights</p> <p>UNIT 2 : The Role of Stakeholders</p>	<p>SECTION 6: HARVESTING OF FOREST RESOURCES (p.24)</p> <p>UNIT 1 :Harvesting of Timber</p> <p>UNIT 2 : Harvesting of Non-Timber Forest Products (NTFP's)</p> <p>UNIT 3 : Uses of Harvested Forest Products</p> <p>UNIT 4 : Harvesting of Wildlife</p> <p>UNIT 5 : Harmful Wildlife Harvesting Practices</p>	<p>SECTION 6: ENTREPRENEURSHIP IN FORESTRY (p.49)</p> <p>Unit 1: Establishing Enterprises in Forestry</p>
	<p>SECTION 7 : FOREST INDUSTRIES (p.27)</p> <p>UNIT 1 : Timber Industries and Products</p> <p>UNIT 2 : Career and Training opportunities</p>	

TIME ALLOCATION

A minimum of six periods of teaching and practical work must be allocated for Forestry per week, with each period lasting for 40 minutes. Of the six periods, three should be devoted to practical work and three to theory. The practical aspect of the subject is essential and teachers should give adequate attention to it.

SUGGESTIONS FOR TEACHING THE SYLLABUS

Forestry is a subject in the Elective Agriculture programme for Senior High School. The syllabus has been revised and new issues integrated into it. It may therefore contain concepts new to the teacher and especially students. It is important to read this section very carefully to be able to follow the sequence of steps and processes suggested for effective teaching and learning.

Teachers should identify resource persons who will assist them to teach some of the topics which they may find difficult to teach. Classroom activities should be supplemented with practical work, field trips and attachment to Forestry nurseries, plantations, forest reserves and institutions.

Schools are encouraged to have nurseries, woodlot and plantations for practical activities in forestry. Some teaching-learning materials on forestry such as seeds, plant specimens and tools and equipment may be available to the nurseries and offices of forestry districts and regions, University Faculties of Renewable Natural Resources at KNUST and Forest Technology, Sunyani.

Teachers need to organise field trips to these facilities, undertake projects specified in the syllabus for students to have experiential learning in forestry. The projects must be supervised, evaluated and graded. Students are also encouraged to attach themselves to forestry institutions for experiential learning during holidays. Students should write and present reports on field trips and attachment. Teachers are entreated to evaluate and grade the reports as part of School-based assessment (SBA).

Some new concepts have been introduced in the new set of syllabuses to help improve instructional delivery and learning. Read this section very carefully and relate the information to your repertoire of teaching methods and skills.

Sections and Units: The syllabus has been planned on the basis of Sections and Units. Each year's work is divided into sections. A section consists of a fairly homogeneous body of knowledge within the subject. Within each section are units. A unit consists of a more related and homogeneous body of knowledge and skills.

The syllabus is structured in five columns: Units, Specific Objectives, Content, Teaching and Learning Activities and Evaluation. A description of the contents of each column is as follows:

Column 1 - Units: The units in Column 1 are divisions of the major topics of the section. You are expected to follow the unit topics according to the linear order in which they have been presented. However, if you find at some point that teaching and learning in your class will be more effective if you skipped- to another unit before coming back to the unit in the sequence, you are encouraged to do so.

Column 2 - Specific Objectives: Column 2 shows the Specific Objectives for each unit. The specific objectives begin with numbers such as 1.3.5 or 2.2.1. These numbers are referred to as "Syllabus Reference Numbers". The first digit in the syllabus reference number refers to the section; the second digit refers to the unit, while the third digit refers to the rank order of the specific objective. For instance, 1.3.5 means: Section 1, Unit 3 (of Section 1) and Specific Objective 5. In other words, 1.3.5 refers to Specific Objective 5 of Unit 3 of Section 1. Similarly, the syllabus reference number 2.2.1 simply means Specific Objective number 1 of Unit 2 of Section 2. Using syllabus reference numbers provides an easy way for communication among teachers and other educators. It further provides an easy way for selecting objectives for test construction. Let's say for instance, that Unit 2 of Section 2 has five specific objectives: 2.2.1 - 2.2.5. A teacher may want to base his/her test items/questions on objectives 2.2.3 and 2.2.4 and not use the other three objectives. In this way, a teacher would sample the objectives within units and within sections to be able to develop a test that accurately reflects the importance of the various skills taught in class.

You will note also that specific objectives have been stated in terms of the student i.e., *what the student will be able to do after instruction and learning in the unit*. Each specific objective hence starts with the following, “The student will be able to..” This in effect, means that you have to address the learning problems of each individual student. It means individualizing your instruction as much as possible such that the majority of students will be able to master the objectives of each unit of the syllabus.

Column 3 - Content: The “content” in the third column of the syllabus presents a selected body of information that you will need to use in teaching the particular unit. In some cases, the content presented is quite exhaustive. In some other cases, you could add more information to the content presented. In a few cases the content space has been left blank. You should, as much as possible, add to the information provided by reading from books and other sources.

Column 4 -Teaching and Learning Activities (T/L): T/L activities that will ensure maximum student participation in the lessons are presented in column 4. Try to avoid rote learning and drill-oriented methods and rather emphasize participatory teaching and learning, and also emphasize the cognitive, affective and psychomotor domains of knowledge in your instructional system wherever appropriate. You are encouraged to re-order the suggested teaching and learning activities and also add to them where necessary in order to achieve optimum student learning.

As we have implied already, the major purpose of teaching and learning is to make students able to apply their knowledge in dealing with issues both in and out of school. A suggestion that will help your students acquire the habit of analytical thinking and the capacity for applying their knowledge to problems is to begin each lesson with a practical problem. Select a practical problem for each lesson. The selection must be made such that students can use knowledge gained in the previous lesson and other types of information not specifically taught in class. At the beginning of a lesson, state the problem, or write the problem on the board. Let students analyse the problem, suggest solutions etc., criticize solutions offered, justify solutions and evaluate the worth of possible solutions. There may be a number of units where you need to re-order specific objectives to achieve such required effects. The emphasis is to assist your students to develop analytical thinking and practical problem solving techniques. You are encouraged to use teaching aids, visits and resource persons for effective delivery of lessons.

Column 5 - Evaluation: Suggestions and exercises for evaluating the lessons of each unit are indicated in Column 5. Evaluation exercises can be in the form of oral questions, quizzes, class assignments, essays, structured questions, project work etc. Try to ask questions and set tasks and assignments that will challenge your students to apply their knowledge to issues and problems in fisheries that will engage them in developing solutions, and developing positive attitudes as a result of having undergone instruction in this subject. The suggested evaluation tasks are not exhaustive. You are encouraged to develop other creative evaluation tasks to ensure that students have mastered the instruction and behaviours implied in the specific objectives of each unit. For evaluation during class lessons, determine the mastery level you want students to achieve in their answers and responses. If for instance, you take 80% as the mastery level, ensure that each student’s answer to questions asked in class achieves this level of mastery.

Profile Dimensions

A central aspect of this syllabus is the concept of profile dimensions that should be the basis for instruction and assessment. More than one dimension constitutes a profile of dimensions. A ‘dimension’ is a *psychological construct* for describing a particular learning behaviour. Profile dimensions describe the underlying behaviours or abilities students are expected to acquire as a result of having gone through a period of instruction.

Profile dimensions are derived from the cognitive, affective and psychomotor domains of educational objectives. From the cognitive domain, two profile dimensions are developed; namely Knowledge and Understanding (KU) and Application of Knowledge (AK). The affective domain covers beliefs, attitudes and values. The psychomotor domain covers physical and combined skills normally referred to as process skills or practical skills. Specific objectives used in developing syllabuses or training programmes describe behaviours to be exhibited by learners after going through a learning process. A specific objective represents attributes of learning from one or more of the domains of educational objectives.

For example, the statement of a specific objective is as follows: The student will be able to describe, ...etc. contains an action verb “describe” that indicates what the student will be able to do after teaching and learning have taken place. Being able to “describe” something after the instruction has been completed means that the student has acquired “knowledge” from the cognitive domain. Being able to explain, summarise, give examples etc. means that the student has understood the lesson taught. Similarly, being able to develop, plan, construct etc, means that the student has learnt to create, innovate or synthesize knowledge.

Each of the specific objectives in this syllabus contains an “action verb” that describes the behaviour the student will be able to demonstrate after the instruction. “Knowledge”, “Application” etc. are dimensions that should be the prime focus of teaching and learning in schools. Each action verb indicates the underlying profile dimension of each particular specific objective. Read each objective carefully to know the profile dimension toward which you have to teach.

DEFINITION OF PROFILE DIMENSIONS

As already stated, profile dimensions describe the underlying behaviours for teaching, learning and assessment. In Forestry, the three profile dimensions that have been specified for teaching, learning and testing are:

Knowledge and Understanding	20%
Application of Knowledge	40%
Attitudes and Practical Skills	40%

Each of the dimensions has been given a percentage weight that should be reflected in teaching, learning and testing. The weights, indicated on the right of the dimensions, show the relative emphasis that the teacher should give in the teaching, learning and testing processes. Combining the three dimensions in the teaching and learning process will ensure that Fisheries is taught and studied not only at the cognitive level, but will also lead to the acquisition of practical skills in the subject.

The explanation of the key words involved in each of the profile dimensions is as follows:

Knowledge and Understanding (KU)

knowledge	The ability to: remember, recall, identify, define, describe, list, name, match, state principles, facts and concepts. Knowledge is simply the ability to remember or recall material already learned and
understanding	The ability to explain, summarize, translate, rewrite, paraphrase, give examples, generalize, estimate or predict consequences based upon a trend. Understanding is generally the ability to grasp the meaning of some material that may be verbal, pictorial, or symbolic.

Application of Knowledge (AK)

The ability to use knowledge or apply knowledge, as implied in this syllabus, has a number of learning/behaviour levels. These levels include application, analysis, innovation or creativity, and evaluation. These may be considered and taught separately, paying attention to reflect each of them equally in your teaching. The dimension “Application of Knowledge” is a summary dimension for all four learning levels. Details of each of the four sub levels are as follows:

application	The ability to apply rules, methods, principles, theories, etc. to concrete situations that are new and unfamiliar. It also involves the ability to produce, solve, operate, plan, demonstrate, discover etc.
analysis	The ability to break down a piece of material into its component parts; to differentiate, compare, distinguish, outline, separate, identify significant points etc., recognize unstated assumptions and logical fallacies, recognize inferences from facts etc. Analytical ability underlies discriminant thinking.
Innovation/ Creativity -	The ability to synthesize or put parts together to form a new whole. It involves the ability to combine, compile, compose, devise, suggest a new idea or possible ways, plan, revise, design, organize, create, and generate new solutions. The ability to create or innovate is the highest form of learning. The world becomes more comfortable because some people, based on their learning, bring new ideas, design and create new things.
Evaluation	The ability to: appraise, compare features of different things and make comments or judgments, contrast, criticize, justify, support, discuss, conclude, make recommendations etc. Evaluation refers to the ability to judge the worth or value of some materials, ideas etc., based on some criteria. Evaluation is a constant decision making activity. We generally compare, appraise and select throughout the day. Every decision we make involves evaluation. Evaluation is a high level ability just as application, analysis and innovation or creativity since it goes beyond simple knowledge acquisition and understanding.

A number of examination questions at the Senior High School level begin with the word “Discuss”. Discuss belongs to the evaluation thinking skill and implies the ability to analyze, compare, contrast, make a judgement etc. The word “discuss” asks for a variety of thinking skills and is obviously a higher order thinking behaviour. Students consequently do poorly on examination questions that start with “Discuss”. For this reason, and also for the reason that discussion of issues, discussion of reports etc., are some of the major intellectual activities students will be engaged in, in work situations and at higher levels of learning after they have left secondary school, it will be very helpful if you would emphasize discussion questions etc. both in class and in the tests you set.

Competency Based Learning

Competency learning is a combination of knowledge, skills, and the ability to use tools and equipment for accomplishing work to acceptable standards in the industry. Competency includes cognitive and practical skills as well as attitudinal and other personality characteristics. These characteristics include principles of social orientation that is the core values of honesty, fairness, reliability, trustworthiness, cooperation and support as well as the ability to relate well with people. Competency Based Learning has been adopted for teaching and learning practical subjects.

Competency Based Learning require students to perform tasks by using relevant knowledge, skills, and tools to achieve specified targets within specified times. The case study approach in teaching and learning is particularly suitable in providing students with situations which they could emulate to reach high levels of professional practice.

Competence involves *application of knowledge* in a significant range of work activities, performed in a variety of contexts/activities which may be complex or not routine and there is some individual responsibility or autonomy. Collaboration with others perhaps through membership of a work group or team, may often be a requirement. Personal accountability for analysis, diagnosis, design, planning, execution and evaluation of task may also be required

Attitudes and Practical Skills (APS)

Attitudes and Practical skills form the third profile dimension in practical or vocational subjects. They are competencies or abilities required for performing satisfactorily in a job. Performance is a reflection of skills. Four types of skills are identified in job performance:

1. **Intellectual skills**
2. **Psychomotor skills**
3. **Social skills**
4. **Attitudes**

Intellectual skills

Intellectual skills in job performance are also referred to as perceptual skills. They enable a person to conceptualise performance. Conceptualisation is a mental skill which depends largely on one's cognitive abilities. One needs to conceptualise and visualise an action before it is performed. For example, one needs to know the names of all forest tree species in a given country, describe the characteristics of the trees before being able to identify an abnormality in a particular tree.

Psychomotor skills

Psychomotor skills refer to motor activities which are performed with an intention. It needs coordinated movement of hand, body and muscles, mental abilities and intention to guide movement. They involve demonstration of manipulative skills in using tools, machines and equipment to carry out practical operations and to solve practical problems. The element of thinking is much needed in movement in order to perform a given task better.

Examples of activities involving psychomotor skills include:

1. Equipment Handling
2. Observation
3. Manipulation
4. Measuring
5. Recording
6. Reporting
7. Creativity
8. Communication

Equipment Handling: Students should be able to handle and use equipment properly for practical work in **Crop Husbandry and Horticulture**. The teacher should ensure that students acquire a high level of proficiency in the use of tools and equipment relevant to the field of **Crop Husbandry and Horticulture**.

Observation: The student should be able to use his/her senses to make accurate observations. He/she should, for instance, be able to tell the colour, form, texture and the structure of specimens provided and be able to classify them.

Manipulation: Manipulation involves the skilful handling of scientific objects and tools for accomplishing specific tasks.

Measuring: Refers to the accurate use of measuring instruments and equipment. The teacher should guide students to make accurate measurements of specimens, chemicals etc.

Recording: Recordings must aim at a high degree of accuracy.

Reporting: Students should be able to present pertinent and precise reports on projects they undertake. Reports, oral or written, should be concise, clear and accurate.

Creativity: Students should be encouraged to be creative and be able to use new methods in carrying out projects. You can help your students to be creative by encouraging any little creative efforts, techniques and products they may develop.

Communication: Students should be guided to develop effective oral and written communication skills necessary for group work, reports etc. The teaching and assessment of psychomotor skills should involve practical experiences in work sites, field work, experiments, projects, case studies and field studies.

Social skills

Social skills refer to activities which are performed in a given social context. For example, interviewing people for information involve social skills. The effectiveness of interviewing people for information, does not only depend on the verbal fluency of an interviewer, but largely on how well the interviewer approaches the interviewee, how accurate the interviewer was in selecting an interviewee. It is not the content of the interview but how one conducts the interview. Examples of social skills include effective communication with farmers, good relation to the farmer when conducting an interview, understanding farmers indirect expressions, etc.

Attitudes

Attitudes are feelings one develops towards something. The feelings can be positive or negative. An individual who has positive attitude to work can derive happiness from his or her work, enjoys the job and is willing to do more, makes clients feel more attached, values the individual and services rendered.

A person with negative attitudes to work does a job only as a means of livelihood, achieves no job satisfaction, has poor results and has clients who are unhappy with him or her. Attitudes influence job performance, education and training in agriculture should be geared to cultivating of positive attitudes to agricultural work.

Assessment of Attitudes and Practical Skills

Process Assessment: The processes or steps (sub-skills) involved in performing a task are observed and rated with marks or letter grades. In awarding marks or grading, the performance of the learner is judged by comparing with the indicator of acceptable performance. In judging, depending on the type of sub-skill, if learner performance matches with the indicator of acceptable performance a grade A is given, grade B is awarded if performance is acceptable but below the indicator standard. Grade C is given if achieved performance is below the indicator and unacceptable. The three level grading system is adopted if the sub-skills are not crucial for successful performance of the whole task. If the sub-skills are crucial for achieving successful task performance, then a two level grading type is used. In such cases, an A is awarded for successful performance and a B is given for unsuccessful performance

Product Assessment: The quality of a finished product is assessed using the criteria describing the quality standards of the product. Marks are awarded depending on the level of match between the criteria for assessment of the product.

Proficiency Assessment: In this, the quality of a product or task and the speed used in performing the task are crucial. The two level grading system is normally used. For example, after students have learned and acquired the skills in castrating pigs, a number of piglets are given them to castrate within a specified time frame. Students who complete the assignment successfully within the time period obtain grade A, while those who fail to castrate the animals successfully or did not meet the time limits get grade B. In other words, students who obtain grade B are not proficient in performing the task

The action verbs provided under the profile dimensions should help you to structure your teaching such as to achieve the effects needed. Select from the action verbs provided for your teaching, in evaluating learning before, during and after the instruction. Use the action verbs also in writing your test questions. This will ensure that you give your students the chance to develop good thinking skills, and the capacity for excellent performance in examinations and in practical life situations. Check the weights of the profile dimensions to ensure that you have given the required emphasis to each of the dimensions in your teaching and assessment.

FORM OF ASSESSMENT

It must be emphasized again that it is important that both instruction and assessment be based on the profile dimensions of the subject. In developing assessment procedures, select specific objectives in such a way that you will be able to assess a representative sample of the syllabus objectives. Each specific objective in the syllabus is considered a criterion to be achieved by the student. When you develop a test that consists of items or questions that are based on a representative sample of the specific objectives taught, the test is referred to as a “Criterion-Referenced Test”. In many cases, a teacher cannot test all the objectives taught in a term, in a year etc. The assessment procedure you use i.e. class tests, home work, projects etc. must be developed in such a way that it will consist of a sample of the important objectives taught over a period.

The example on the next page shows an examination consisting of three papers, Paper 1, Paper 2, Paper 3 and Continuous assessment. Paper 1 will usually be an objective-type paper; Paper 2 will consist of structured questions or essay questions, essentially testing “Application of Knowledge”, but also consisting of some questions on “Knowledge and Understanding”. Paper 3 will be the practical test paper, and continuous assessment will be based on all three dimensions as indicated. The distribution of marks for the objective test items, essay type questions and the practical questions in the three papers and in the continuous assessment should be in line with the weights of the profile dimensions already indicated and as shown in the last column of the table below.

The West African Examinations Council (WAEC) generally sets about 60 objective test items at the SSSCE. Try to emulate this by developing an objective test paper (Paper 1) that consists of 60 items. Paper 2 could consist of some structured questions and essay questions. In general, let students answer five essay questions from a list of 7-10 questions. Paper 3 will consist of 5-7 practical questions.

In the examination structure presented below, Paper 1 is marked out of 60; Paper 2 is marked out of 90, Paper 3 marked out of 60, and school-based assessment (SBA) or continuous assessment is marked out of 110, giving a total of 320 marks. The last row shows the weight of the marks allocated to each of the four test components. The three papers are weighted differently. Paper 2 is a more intellectually demanding paper and is therefore weighted more than Papers 1 and 3.

Distribution Of Examination Paper Weights And Marks

Dimensions	Paper 1	Paper 2	Paper 3	Continuous Assessment	Total Marks	% Weight of Dimension
Knowledge and Understanding	40	20	-	20	80	20
Application of Knowledge	20	70	-	30	120	40
Attitudes & Practical Skills	-	-	60	60	120	40
Total Marks	60	90	60	110	320	
% Contribution of Papers	20	30	20	30		100

You will note that Paper 1 has a contribution of 20% to the total marks; Paper 2 has a contribution of 30% to the total marks; Paper 3 has a contribution of 20%, and School-based Assessment or Continuous Assessment has a contribution of 30% to the total marks. The numbers in the cells indicate the marks to be allocated to the items/questions that test each of the dimensions within the respective test papers.

The last but one column shows the total marks allocated to each of the dimensions. Note that the numbers in this column are additions of the numbers in the cells and they agree with the profile dimension weights indicated in the last column. Of the total marks of 320, 80 marks, equivalent to 20% of the total marks, are allocated to Knowledge and Understanding. 120 marks, equivalent to 40% of the total marks, are allocated to Application of Knowledge, and 120 marks, equivalent to 40% of the total marks, are allocated to Attitudes and Practical Skills. The weight of each of the three dimensions are indicated in the last column. The ratio of theory to practice in the Forestry is 60:40.

Item Bank: Obviously the structure of assessment recommended in this syllabus will need a lot of work on the part of the teacher. In preparation for setting examination papers, try to develop an item bank. The term "item bank" is a general term for a pool of objective items, a pool of essay questions or a pool of practical test questions. As you teach the subject, try to write objective test items, essay questions, structured essay questions and practical test questions to fit selected specific objectives which you consider important to be tested. If you proceed diligently, you will realize you have written more than 100 objective test items, and more than 30 essay questions in a space of one year. Randomly select from the item bank to compose the test papers. Select with replacement. This means, as items/questions are selected for testing, new ones have to be written to replace those items/questions already used in examinations. Items and questions that have been used in examinations may also be modified and stored in the item bank.

Test 'wiseness'

An important issue in the preparation for a major examination such as the SSSCE, is the issue of test 'wiseness'. To be test wise means that the student knows the mechanics for taking a test. These mechanics include writing your index number and other particulars accurately and quickly on the answer paper; reading all questions before selecting the best questions to answer; apportioning equal time to each question or spending more time on questions that carry more marks; making notes on each question attempted before writing the answer; leaving extra time to read over one's work; finally checking to see that the personal particulars

supplied on the answer sheet are accurate. Some good students sometimes fail to do well in major examinations because of weakness in the mechanics of test taking; because they are not test wise. Take your students through these necessary mechanics so that their performance on major examinations may not be flawed by the slightest weakness in test taking.

GUIDELINES FOR SCHOOL-BASED ASSESSMENT (SBA)

A new School Based Assessment system (SBA), formally referred to as Continuous Assessment, will be introduced into the school system from September 2009. SBA is a very effective system for teaching and learning if carried out properly. The new SBA system is designed to provide schools with an internal assessment system that will help schools to achieve the following purposes:

- Standardize the practice of internal school-based assessment in all schools in the country
- Provide reduced assessment tasks for subjects studied at each of the school levels
- Provide teachers with guidelines for constructing assessment items/questions and other assessment tasks
- Introduce standards of achievement in each subject and in each class of the school system
- Provide guidance in marking and grading of test items/questions and other assessment tasks
- Introduce a system of moderation that will ensure accuracy and reliability of teachers' marks
- Provide teachers with advice on how to conduct remedial instruction on difficult areas of the syllabus to improve class performance.

SBA may be conducted in schools using the following: Mid-term test, Group Exercise, End-of-Term Test and Project

1. Project: This will consist of a selected topic to be carried out by groups of students for a year. Segments of the project will be carried out each term toward the final project completion at the end of the year,

The projects may include the following:

- i) farm work
- ii) experiment
- iii) investigative study (including case study)

A report must be written for each project undertaken.

2. Mid-Term Test: The mid-term test following a prescribed format will form part of the SBA
3. Group Exercise: This will consist of written assignments or practical work on a topic(s) considered important or complicated in the term's syllabus
4. End-of-Term Test: The end –of-term test is a summative assessment system and should consist of the knowledge and skills students have acquired in the term. The end-of-term test for Term 3 for example, should be composed of items/questions based on the specific objectives studied over the three terms, using a different weighting system such as to reflect the importance of the work done in each term in appropriate proportions. For example, a teacher may build an End-of-Term 3 test in such a way that it would consist of the 20% of the objectives studied in Term 1, 20% of objectives studied in Term 2 and 60% of the objectives studied in Term 3.

GRADING PROCEDURE

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following WASSCE grade structure for assigning grades on students' test results. The WASSCE structure is as follows:

Grade A1:	80 - 100%	-	Excellent
Grade B2:	70 - 79%	-	Very Good
Grade B3:	60 - 69%	-	Good
Grade C4:	55 - 59%	-	Credit
Grade C5:	50 - 54%	-	Credit
Grade C6:	45 - 49%	-	Credit
Grade D7:	40 - 44%	-	Pass
Grade D8:	35 - 39%	-	Pass
Grade F9:	34% and below	-	Fail

In assigning grades to students' test results, you are encouraged to apply the above grade boundaries and the descriptors which indicate the meaning of each grade. The grade boundaries i.e., 60-69%, 50-54% etc., are the grade cut-off scores. For instance, the grade cut-off score for B2 grade is 70-79% in the example. When you adopt a fixed cut-off score grading system as in this example, you are using the criterion-referenced grading system. By this system a student must make a specified score to be awarded the requisite grade. This system of grading challenges students to study harder to earn better grades. It is hence a very useful system for grading achievement tests.

Always remember to develop and use a marking scheme for marking your class examination scripts. A marking scheme consists of the points for the best answer you expect for each question, and the marks allocated for each point raised by the student as well as the total marks for the question. For instance, if a question carries 20 marks and you expect 6 points in the best answer, you could allocate 3 marks or part of it (depending upon the quality of the points raised by the student) to each point, hence totalling 18 marks, and then give the remaining 2 marks or part of it for organisation of answer. For objective test papers you may develop an answer key to speed up the marking.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 1

INTRODUCTION TO FORESTRY

General Objectives: The student will:

1. understand the basic functions of forestry.
2. appreciate the socio-economic importance of forest products.
3. become aware of salient features of forestry.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 BASIC CONCEPTS: FOREST AND FORESTRY	The students will be able to: 1.1.1 explain forest and forestry. 1.1.2 describe the salient features of Forestry to differentiate it from Agriculture. 1.1.3 outline the functions of the forest and its role in national development.	Explanation of forest and forestry: Forest: community of trees or other woody vegetation occupying an extensive area of land. Forestry: forestry is the practice and management of forests and the use of their products. Differentiate between Forestry and Agriculture in terms of: Land occupancy, time frame, risk. Business aspects of forestry. Functions of the forest: - Conservation of climate , water, soil - Conservation of species of plants and animals - Ensure sustainable agricultural production - Provision of wood for industry - Export of wood and related products.	Students to brainstorm to bring out the meaning of Forest and Forestry. Assist students to compare agriculture and forestry to highlight essential features of long term activity, time frame, risk, etc. Students brainstorm the various roles forest play in socio-economic development of the country. - creation of employment avenues - setting up of industries - influence on climatic conditions favourable for growth of all types of crops - supply of wood products to the economy - provision of wood fuel i.e. energy source - establishment of forest related vocations - purification and supply of air - provision of habitat for wildlife - conservation of water bodies: (Lakes, underground water, streams, rivers)	Students to differentiate forest from forestry. What will happen to a soil that has no forest cover? Analyse what will happen to a land where the forest cover has been removed. How does forest help productive agriculture?

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION																																																
<p>UNIT 1 (CONT'D)</p> <p>BASIC CONCEPTS: FOREST AND FORESTRY</p>	<p>The students will be able to:</p> <p>1.1.4 name some of the plant types found in the forest.</p>	<p>Types of plants in the forest: Trees, shrubs, herbs, climbers, special plants (fungi – edible and non-edible).</p>	<p>Teacher to take students out to observe various types of plants, draw a plant type and identify ten timber trees by their names.</p> <table border="0"> <thead> <tr> <th><u>Local Name</u></th> <th><u>Botanical Name</u></th> </tr> </thead> <tbody> <tr> <td>Wawa</td> <td><i>Triplochiton scleroxylon</i></td> </tr> <tr> <td>Emire</td> <td><i>Terminalia ivorensis</i></td> </tr> <tr> <td>Odum</td> <td><i>Milicia excelsa</i></td> </tr> <tr> <td>Dahoma</td> <td><i>Piptadeniastrum africanum</i></td> </tr> <tr> <td>Dubene</td> <td><i>Khaya inverensis</i></td> </tr> <tr> <td>(Mahogany)</td> <td></td> </tr> <tr> <td>(Mahogany) Dubini</td> <td><i>Khaya anthotheca</i></td> </tr> <tr> <td>Sapele</td> <td><i>Entandrophragmac cylindricum</i></td> </tr> <tr> <td>Edinam</td> <td><i>Entandrophragma angolense</i></td> </tr> <tr> <td>Utile</td> <td><i>Entandrophragma utile</i></td> </tr> <tr> <td>Asanfena</td> <td><i>Aningeria robusta</i></td> </tr> <tr> <td>Papao</td> <td><i>Azalia africana</i></td> </tr> <tr> <td>Danta</td> <td><i>Nesogordonia papaverifera</i></td> </tr> <tr> <td>Chenchen</td> <td><i>Antiaris africanum</i></td> </tr> <tr> <td>Esa</td> <td><i>Celtis mildbraedii</i></td> </tr> <tr> <td>Onyina</td> <td><i>Ceiba pentandra</i></td> </tr> <tr> <td>Hyedua</td> <td><i>Guibourtia ehie</i></td> </tr> <tr> <td>Kokrodua</td> <td><i>Pericopsis elata</i></td> </tr> <tr> <td>Kusia</td> <td><i>Nauclea diderrichii</i></td> </tr> <tr> <td>Ofram</td> <td><i>Terminalia superba</i></td> </tr> <tr> <td>Cedrela</td> <td><i>Cedrela odorata</i></td> </tr> <tr> <td>Teak</td> <td><i>Tectona grandis</i></td> </tr> <tr> <td>Gmelina</td> <td><i>Gmelina arborea</i></td> </tr> </tbody> </table>	<u>Local Name</u>	<u>Botanical Name</u>	Wawa	<i>Triplochiton scleroxylon</i>	Emire	<i>Terminalia ivorensis</i>	Odum	<i>Milicia excelsa</i>	Dahoma	<i>Piptadeniastrum africanum</i>	Dubene	<i>Khaya inverensis</i>	(Mahogany)		(Mahogany) Dubini	<i>Khaya anthotheca</i>	Sapele	<i>Entandrophragmac cylindricum</i>	Edinam	<i>Entandrophragma angolense</i>	Utile	<i>Entandrophragma utile</i>	Asanfena	<i>Aningeria robusta</i>	Papao	<i>Azalia africana</i>	Danta	<i>Nesogordonia papaverifera</i>	Chenchen	<i>Antiaris africanum</i>	Esa	<i>Celtis mildbraedii</i>	Onyina	<i>Ceiba pentandra</i>	Hyedua	<i>Guibourtia ehie</i>	Kokrodua	<i>Pericopsis elata</i>	Kusia	<i>Nauclea diderrichii</i>	Ofram	<i>Terminalia superba</i>	Cedrela	<i>Cedrela odorata</i>	Teak	<i>Tectona grandis</i>	Gmelina	<i>Gmelina arborea</i>	<p>Students to write the local names and botanical names of ten timber trees.</p>
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UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 (CONT'D) BASIC CONCEPTS: FOREST AND FORESTRY	The students will be able to: 1.1.5 describe the habitats of different species of plants. 1.1.6 name some of the animals found in the forest and describe their habitats.	Description of plant habitat: - waterlog (aquatic) - dry land(terrestrial) - valley/slope/hill tops (terrestrial) - on plants (arboreal) Types of animals in the forest: Birds, insects, mammals, reptiles, amphibians, snails.	Assist students to describe the characteristics of the various habitats of plants. Students to name various types of animals found in the forest; birds, insects, mammals, reptiles, amphibians, snails, etc. Students to describe the habitats of animals named above.	List two types of plants found in the following habitats: i. dry land ii. on trees iii. water
UNIT 2 FOREST PRODUCTS - CONTRIBUTION TO NATIONAL DEVELOPMENT	1.2.1 list various forest products and classify them into direct and indirect benefits/uses. 1.2.2 outline the factors which can contribute to the demand of forest products in the national economy.	Classification of forest products into direct and indirect benefits: i. Timber and Non-timber forest products - NTFPs Direct benefits. ii. Non-tangible products – indirect benefits. Demand factors for forest products: - Demand spectrum of selected forest products. - Local and external markets for forest products. - Role of forest based Industries. - Current use.	Teacher to arrange a visit to forest based industries for students to identify and classify forest products according to whether they give direct or indirect benefits. Assist students to discuss forests products produced in the country and the factors which affect their demand. Students to describe their contribution to income generation and employment opportunities. Students to identify forest industries in the locality and visit them.	Students to classify forest products observed into direct or indirect benefits. Students to list forest products and show how they contribute to national development.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 2

INTRODUCTION TO FOREST ECOLOGY

General Objectives: The student will:

1. understand the forest ecosystem.
2. be aware of the relationship between plants and animals in the forest ecosystem.
3. appreciate the basic principles underlying the forest ecosystem.

<p>UNIT 1</p> <p>CONCEPT OF FOREST ECOLOGY</p>	<p>The students will be able to:</p> <p>2.1.1 describe forest environment.</p> <p>2.1.2 explain ecology and forest ecology;</p>	<p>Forest environment: physical surroundings – soil, air, water, climate and geology.</p> <p>Ecology and Forest ecology: community of plants and animals in a forest environment.</p> <p>Types: aquatic, terrestrial, arboreal.</p>	<p>Students to:</p> <p>Use digital content to explain ecology and discuss the components of the forest environment as stated in the content.</p> <p>Teacher to take students to the nearest forest. Let students observe types of trees, shrubs, herbs, animals, soil, etc. Let students in groups take samples of soil and examine the composition.</p> <p>Students to discuss the group report in class.</p> <p>Students to brainstorm and bring out the meaning of ecology and give examples in relation to various habitats (terrestrial, aquatic, arboreal).</p>	<p>Students to give the components of forest environment.</p> <p>Students to</p> <p>(i) determine whether the forest floor is open or closed; the middle layer is open or closed; the upper layer is open or closed.</p> <p>(ii) What animal and plant species are dominant at each layer – during observation?</p>
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UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 1 (Cont'd)</p> <p>CONCEPT OF FOREST ECOLOGY</p>	<p>The students will be able to:</p> <p>2.2.2 describe the producer – consumer relationship in the food-chain.</p> <p>2.2.3 give examples of producer-consumer relationship in different habitat.</p> <p>2.2.4 give examples of symbiotic associations in the various habitats</p> <p>2.2.5 differentiate between saprophytes and epiphytes</p>	<p>Producers: Plants Consumers: Animals.</p> <p><u>Types of Consumers:</u> Herbivores Carnivores Omnivores Decomposers</p> <p>Producer – Consumer relationship in the food-chain in a forest ecosystem.</p> <p>Types of producer-consumer relationships in: - terrestrial - arboreal - riverine habitats</p> <p>Types of symbiotic associations in terrestrial, arboreal, riverine habitats</p> <p>Differences between saprophytes and epiphytes</p>	<p>Assist students to discuss major components of the ecosystem and give examples of producers and consumers.</p> <p>Students to discuss types of consumers under herbivores, carnivores, omnivores, and decomposers.</p> <p>Students in groups to draw food-chain showing producer consumer relationship of a forest environment and give presentations on the food chain in each habitat.</p> <p>Students to discuss the food chain (producer-consumer relationship) in various habitats in the forest environment after the group presentations with each group working on a habitat.</p> <p>Teacher to display samples of symbiotic associations eg: rhizobium and root nodules, mistle on trees, algae and fungus forming lichens for students to examine and identify.</p> <p>Use digital content to identify saprophytes and epiphytes and describe their characteristics and differences.</p>	<p>What happens if the food web is disturbed at each of the habitats?</p> <p>Explain symbiotic association and give two examples each.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 FOREST ECOSYSTEM	<p>The students will be able to:</p> <p>2.2.1 explain ecosystem</p> <p>2.2.2 State the major components of ecosystem</p> <p>2.2.3 State ecosystem functions</p> <p>2.2.4 Trace the effects of a good ecosystem on human health</p> <p>2.2.5 Trace the impact of degraded ecosystems on health</p>	<p>Meaning of ecosystem: - a community of plants and animals interacting together and showing a functional relationship.</p> <p>Major components of the ecosystem: forest, dry land, polar, cultivated, urban, inland water, coastal, marine ecosystems</p> <p>Ecosystem functions. - Provisioning - Regulation - Supporting - Cultural</p> <p>Impact of a good ecosystem on health</p> <p>Impact of a degraded ecosystem on health</p>	<p>Brainstorm on the meaning of ecosystem and differentiate it from ecology.</p> <p>Discuss the characteristics of the major ecosystems listed in content</p> <p>Brainstorm to explain ecosystem functions to include: - Provisioning – food, fresh water, bio-chemical, etc., - Regulation- climatic, disease, water, etc. - Supporting- soil formation, nutrient cycling, etc. - Cultural- aesthetic, religious, recreational, etc.</p> <p>Discuss ecosystem functions /services.</p> <p>Use the Futures Wheel to trace the effects of a good ecosystem on health</p> <p>Use the Futures Wheel to trace the impacts of ecosystem degradation on human health</p>	<p>Differentiate between ecology and ecosystem.</p> <p>State the characteristics of the major ecosystems</p> <p>Explain ecosystem functions and give three examples.</p> <p>Write an essay on the impact of ecosystem on our health.</p> <p>Debate on the topic: Ecosystem degradation who suffers most: Urban or Rural dwellers?</p>

SENIOR HIGH SCHOOL - YEAR 1

SECTION 3

ECOLOGICAL ZONES OF GHANA

General Objectives: The student will:

1. be aware of the factors that influence the distribution of vegetation in the ecological zones.
2. be aware of the flora and fauna association in the ecological zones.
3. be aware of the vegetation in the ecological zones of Ghana.
4. be aware of the prevailing land use practices and problems.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 VEGETATION ZONES	<p>The students will be able to:</p> <p>3.1.1 describe the various vegetation types of West Africa with reference to Ghana.</p> <p>3.1.2 state the factors that account for the different vegetation zones in different parts of the country;</p> <p>3.1.3 compare the vegetation zones in terms of differences in plant species.</p> <p>3.1.4 describe with examples types of different plants in the zone in which his/her school is located.</p>	<p>Description of vegetation types: Wet-evergreen, moist-evergreen, Moist semi-deciduous, Dry semi-deciduous, mangroves and savannah.</p> <p>Factors affecting distribution of vegetation: - Climatic (rainfall and temperature) - Edaphic (soil factors) - Biotic</p> <p>Comparison of vegetation zones.</p> <p>Reasons for the occurrence of vegetation zones.</p> <p>Description of some typical plants and animals in the school zone.</p>	<p>Assist students to describe and to illustrate the vegetation zones and vegetation types with maps and other relevant charts.</p> <p><u>Notes to the Teacher:</u> Prevailing climatic, edaphic and biotic factors should be considered. (biotic factors; gap creation) Determine the plants and animals association in the vegetation types in Ghana.</p> <p>Students to compare vegetation zones in terms of differences in plant species.</p> <p>Students to give reasons for the differences in occurrence of vegetation types in the different zones.</p> <p>Students to describe with examples of plants and animals found in the vegetation zone in which the school is located.</p>	<p>Students draw maps of West Africa showing the vegetation types and zones with the location of Ghana on them.</p> <p>Why do different vegetation types occur at different areas of the country?</p> <p>What is the influence of biotic factors on the vegetation of an area?</p> <p>Draw a map showing vegetation zones of Ghana.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 (CONT'D) VEGETATION ZONES UNIT 2 FOREST TYPES	<p>The students will be able to:</p> <p>3.1.5 describe the characteristic of some typical plants and animals in the vegetation zones.</p> <p>3.1.6 describe land use in the vegetation zones.</p> <p>3.2.1 compare forest types in the vegetation zones.</p> <p>3.2.2 differentiate between natural and artificial forests.</p> <p>3.2.3 identify major forest types in relation to latitudes.</p>	<p>Description of: Characteristics of forest and savannah plants and animals.</p> <p>Land use practices in the different vegetation zones.</p> <p>Comparision of Forest types: Distribution, composition and structure of Tropical High Forest (Tropical rain forest, tropical moist semi-deciduous forest), savannah, coastal scrub and grassland.</p> <p>Characteristics of natural and artificial forests.</p> <p>Major forest types in relation to latitude: - Tropical - Temperate - Coniferous - Arctic</p>	<p>Students to:</p> <p>Teacher to organise a field trip for students to observe and compare forest and savannah. Plants and animals.</p> <p>Discuss land use practices in the different vegetation zones.</p> <p>Locate forest types on maps and discuss their characteristics.</p> <p>Discuss virgin or primeval forest, secondary forest.</p> <p>Discuss differences and similarities of natural forests and plantations.</p> <p>Discuss the relationship between temperature and latitudes which give four natural zones running North and South of the equator and compare the vegetation zones of each forest type.</p> <p>Students to discuss angiosperms and gymnosperms, differentiate between them and indicate the (main) forest type of vegetation zones they occur (Hardwood and softwood).</p>	<p>Discuss the differences between the vegetation zones .</p> <p>What are the characteristics of tropical rain forest, savannah, coastal scrub?</p> <p>What are the differences between natural and artificial forests?</p> <p>Give examples of natural and artificial forests.</p> <p>Differentiate between angiosperms and gymnosperms.</p>

SENIOR HIGH SCHOOL - YEAR 1

SECTION 4

LAND TENURE SYSTEM

General Objectives: The student will:

1. be aware of the prevailing land-tenure systems in Ghana.
2. understand the impact of land tenure on sustainable land use.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 TYPES OF LAND TENURE	The students will be able to: 4.1.1 outline the prevailing land tenures in Ghana. 4.1.2 explain the authority of government in land acquisition. 4.1.3 explain Land registration procedure.	Land ownership: i. Role of stools and skins, ii. Land tenure - communal, individual, leasehold etc. Role of Central Government. Importance of Land registration.	Assist students to discuss land tenure systems in Ghana. Students to interview parents on the type of land tenure systems prevailing in their communities. Students in groups to compare the communal and individual tenure systems. Students to discuss how government acquires lands for development projects. Teacher to invite Land administration officer to give a talk on Land administration. Group students to discuss the importance of land registration.	State the advantages and the disadvantages of any one land tenure system in Ghana. Show how government acquires lands for development. Why is land registration necessary?
UNIT 2 IMPACT OF LAND TENURE ON LAND USE	4.2.1 identify the effects of the various tenure systems on land use.	Effects of land tenure on land use, e.g. fragmentation, litigation and difficulty in land acquisition etc.	Students to discuss the effect of land tenure system on land use e.g. litigation, fragmentation.	Suggest ways for improving the land tenure system in Ghana.

SENIOR HIGH SCHOOL - YEAR 1

SECTION 5

FOREST ESTATE

General Objectives: The student will:

1. be aware of the management of forest estates
2. understand the changes in the supply of forest resources.
3. be aware of the effects of decreasing forest resources on the nation and human health.
4. be aware of the measures instituted by the government to promote sustainable forest management.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 FOREST ESTATES	<p>The students will be able to:</p> <p>5.1.1 explain forest estate.</p> <p>5.1.2 differentiate between protected and non-protected forests.</p> <p>5.1.3 outline the management system of a forest estate.</p> <p>5.1.4 outline forest estate management problems.</p>	<p>Concept of forest estate</p> <ul style="list-style-type: none"> - Reservation and constitution of a forest estate, - Admitted rights, - internal and external boundaries. <p>Protected forest: Reserve (protection and production forests).</p> <p>Non-protected forest: Off-reserve (farm lands, settlements, secondary forests).</p> <p>Traditional protected areas: sacred groves, burial grounds; shrines.</p> <p>Management of Forest Estate. Public and Private estate management and development</p> <p>Forest estate management problems: Bushfires, illegal farming, illegal felling, chain-sawing, illegal mining.</p> <p>Solutions to forest estate management problems.</p>	<p>Students to discuss reservation and constitution of a forest estate, the role of a Reserve Settlement Commissioner, Internal and External Pillaring and admitted rights.</p> <p>Students to discuss differences between protected and non-protected forests.</p> <p>Teacher to give examples of forest estates and assist students to discuss prevailing management strategies for each option in the content.</p> <p>Teacher to invite a resource person to assist students discuss management problems of forest estate and how to solve them.</p> <p>Students to discuss bush fires</p> <ul style="list-style-type: none"> - as a management tool - as a management problems 	<p>How is a forest estate constituted?</p> <p>What is the role of a Reserve Settlement Commissioner?</p> <p>What are admitted rights?</p> <p>Why is it necessary for some forests to be protected? Name some traditional protected areas in your locality.</p> <p>Indicate ways in which some forest management problems can be solved.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 2</p> <p>FOREST AREA AND RESOURCES DEPLETION</p>	<p>The students will be able to:</p> <p>5.2.1 trace the historic facts about changes in the supply of forest resources.</p> <p>5.2.2 analyse the effect of decreasing forest resources.</p> <p>5.2.3 outline the effects of decreasing forest resources on our health.</p>	<p>Historical facts of Ghana's forest: area, composition of forest resources, and population growth.</p> <p>Effects of decreasing forest resources:</p> <ul style="list-style-type: none"> i at beginning of the century – about 8.2 million hectares of closed forest. ii by independence – about 4 million hectares of closed forest. iii by late 80s, about 2.7 million hectares of closed forest. iv current estimate of intact forest cover – 1.6 million hectares. <p>Effects of decreasing forest resources on our health</p>	<p>Students to discuss the trend of forest depletion from past to present.</p> <p>Students to gather statistics on forest areas and population growth for the past ten (10) years.</p> <p>Lead a class discussion on the trend of forest resources depletion from the beginning of the century through independence to the current estimate of 1.6 million of closed forest cover.</p> <p>Use Futures Wheel to identify and discuss the effects of decreasing forest resources on our health, the environment, the economy, etc.</p> <p>Project: Students to be guided by teacher to design a study by collecting information on forest resources in their community in the past, and present. They should forecast the situation of forest resources in the future. Students to design a programme to address the forest depletion situation and present it to members of the community.</p>	<p>Students to determine the forest area per head in their</p> <ul style="list-style-type: none"> i. districts ii. regions iii. country. <p>Project presentation and discussion.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 3</p> <p>PROTECTIVE MEASURES</p>	<p>The students will be able to:</p> <p>5.3.1 outline measures introduced by the Forest Services Division to protect the forest resources.</p>	<p>Measures introduced to stop over-exploitation of forest resources:</p> <ul style="list-style-type: none"> - Ban on log exports, - Star rating of species, - Differential stumpage fees, - Felling restrictions, - Participatory forestry. - Yield selection and approval - Acquisition of permits and felling rights. 	<p>Students in groups discuss forest resources threatened by exploitation and measures introduced to minimize over-exploitation of forest resources.</p>	<p>State two (2) measures introduced to minimize over-exploitation.</p> <p>What measures can communities institute to protect their forests?</p>

SENIOR HIGH SCHOOL - YEAR 1

SECTION 6

RIGHTS TO FOREST RESOURCES

General Objectives: The student will:

1. appreciate the rights governing the utilization of forest resources.
2. understand the requirements for acquisition of these rights and associated problems.
3. understand the role of stakeholders in the utilisation of forest resources.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 TYPES OF RIGHTS	The students will be able to: 6.1.1 state the existing rights governing the use of forest resources in Ghana. 6.1.2 explain how the rights are acquired and violated.	Legal Rights for acquisition of timber resources: - Timber Utilization Contract (TUC), - Timber Utilization Permit (TUP) - Non-Timber Forest Products (NTFPs) - Permit; canoe. - Salvage Permit Procedure for acquisition of Rights: Activities violating right: - Illegal felling. - Poaching of Wildlife. - Encroachment: illegal farming, illegal mining.	Students to brainstorm to bring out some of the legal rights relating to the use of forest resources. Assist students to discuss why it is important to have these rights and why it is necessary to obtain permits for harvesting non-timber forest products (NTFPs). Students to determine the difference between TUC and TUP. Assist students to discuss procedure for acquiring TUC, TUP and other permits. Put students into groups to discuss some illegal activities: timber felling, harvesting of wildlife and farming.	How does timber right promote sustainable development of the forest? Explain why people living near forest reserves (fringe communities) require no permit to harvest NTFPs? In what ways are illegal activities detrimental to sustainable forest management?

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 2</p> <p>THE ROLE OF STAKEHOLDERS</p>	<p>The students will be able to:</p> <p>6.2.1 name the stakeholders of the forest resources.</p>	<p>Stakeholders of forest resources:</p> <ul style="list-style-type: none"> i. Government Sector Institutions – Forestry Commission (Wildlife Division, Forest Services Division, Timber Industry Development Division). ii. Traditional Authorities and Communities: Stool land owners, alienation holders, caretakers, fringe communities. iii. Non-Governmental Organisations. iv. Forest based industries. 	<p>Students to discuss stakeholders and the roles they can play in sustaining the forest.</p> <p>Students to discuss alienation rights and compare with stool ownership rights.</p>	<p>State the roles Traditional Authorities play in sustaining the forest.</p> <p>How can one be an alienation holder?</p> <p>What role (positive, negative) can we derive from forest based industries in the sustainable management of the forests?</p>

SENIOR HIGH SCHOOL - YEAR 2

SECTION 1

PLANT PARTS AND TREE IDENTIFICATION

General Objectives: The student will:

1. recognise plant parts and their functions.
2. be aware of the salient features.
3. identify trees by their salient features.

NIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 PLANT PARTS AND FUNCTIONS	The students will be able to: 1.1.1 describe the morphological features of plants and state their functions. 1.1.2 describe the anatomical features of plants and state their functions.	External features of plants – morphological features. Anatomical features of plants and their functions.	Teacher to bring plants to class for students to examine and discuss the external features of the plant parts and their functions. Teacher to bring to class, plants for students to examine and discuss the anatomy of the leaf, stem and roots to cover the following: xylem, phloem, cambium, epidermis, cortex and pith.	Draw a plant and name its parts. Students to describe the morphological features typical of individual plants. Students to discuss the anatomy of the leaf in relation to the various parts and functions. Students to discuss the anatomy of the root and stem, various parts and their functions.
UNIT 2 TREE IDENTIFICATION	1.2.1 identify observable features of trees.	Observable features and terminologies –	Take students out to observe tree and identify trees by their leaves, bark, buttress stem, them etc.	Students should write scientific and local names of five (5) trees.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION																																																
<p>UNIT 2 (CONTD)</p> <p>TREE IDENTIFICATION</p>	<p>The students will be able to:</p> <p>1.2.2 accurately tag the trees on the school compound with scientific and common names.</p>	<p>i. leaf ii. bark – colour, scent iii. crown iv. flowers v. fruits vi. stem</p> <p>Application of scientific names, rules and regulations – use of smaller letters for the specific names, etc.</p>	<p>Students to identify trees on the school campus and tag them with local and scientific names.</p> <p>Teacher to assist students in the use of digital content for the recognition and identification of tree species and prepare an album to enable students discuss characteristic features of various trees.</p> <table border="0"> <thead> <tr> <th data-bbox="1234 500 1373 524"><u>Local Name</u></th> <th data-bbox="1457 500 1640 524"><u>Botanical Name</u></th> </tr> </thead> <tbody> <tr> <td>Wawa</td> <td><i>Triplochiton scleroxylon</i></td> </tr> <tr> <td>Emire</td> <td><i>Terminalia ivoreris</i></td> </tr> <tr> <td>Odum</td> <td><i>Milicia excelsa</i></td> </tr> <tr> <td>Dahoma</td> <td><i>Piptadeniastrum africanum</i></td> </tr> <tr> <td>Dubene</td> <td><i>Khaya inverensis</i></td> </tr> <tr> <td>(Mahogany)</td> <td></td> </tr> <tr> <td>(Mahogany) Dubini</td> <td><i>Khaya anthotheca</i></td> </tr> <tr> <td>Sapele</td> <td><i>Entandrophragma cylindricum</i></td> </tr> <tr> <td>Edinam</td> <td><i>Entandrophragma angolense</i></td> </tr> <tr> <td>Utile</td> <td><i>Entandrophragma utile</i></td> </tr> <tr> <td>Asanfena</td> <td><i>Aningeria robusta</i></td> </tr> <tr> <td>Papao</td> <td><i>Azelia africana</i></td> </tr> <tr> <td>Danta</td> <td><i>Nesogordonia papaverifera</i></td> </tr> <tr> <td>Chenchen</td> <td><i>Antiaris africanum</i></td> </tr> <tr> <td>Esa</td> <td><i>Celtis mildbraedii</i></td> </tr> <tr> <td>Onyina</td> <td><i>Ceiba pentandra</i></td> </tr> <tr> <td>Hyedua</td> <td><i>Guibourtia ehie</i></td> </tr> <tr> <td>Kokrodua</td> <td><i>Pericopsis elata</i></td> </tr> <tr> <td>Kusia</td> <td><i>Nauclea diderrichii</i></td> </tr> <tr> <td>Ofram</td> <td><i>Terminalia superba</i></td> </tr> <tr> <td>Cedrela</td> <td><i>Cedrela odorata</i></td> </tr> <tr> <td>Teak</td> <td><i>Tectona grandis</i></td> </tr> <tr> <td>Gmelina</td> <td><i>Gmelina arborea</i></td> </tr> </tbody> </table> <p>Students to undertake field exercise aimed at enhancing skills in observation of plants. Students to discuss uses of scientific names.</p>	<u>Local Name</u>	<u>Botanical Name</u>	Wawa	<i>Triplochiton scleroxylon</i>	Emire	<i>Terminalia ivoreris</i>	Odum	<i>Milicia excelsa</i>	Dahoma	<i>Piptadeniastrum africanum</i>	Dubene	<i>Khaya inverensis</i>	(Mahogany)		(Mahogany) Dubini	<i>Khaya anthotheca</i>	Sapele	<i>Entandrophragma cylindricum</i>	Edinam	<i>Entandrophragma angolense</i>	Utile	<i>Entandrophragma utile</i>	Asanfena	<i>Aningeria robusta</i>	Papao	<i>Azelia africana</i>	Danta	<i>Nesogordonia papaverifera</i>	Chenchen	<i>Antiaris africanum</i>	Esa	<i>Celtis mildbraedii</i>	Onyina	<i>Ceiba pentandra</i>	Hyedua	<i>Guibourtia ehie</i>	Kokrodua	<i>Pericopsis elata</i>	Kusia	<i>Nauclea diderrichii</i>	Ofram	<i>Terminalia superba</i>	Cedrela	<i>Cedrela odorata</i>	Teak	<i>Tectona grandis</i>	Gmelina	<i>Gmelina arborea</i>	
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SENIOR HIGH SCHOOL - YEAR 2

SECTION 2

INTRODUCTION TO WILDLIFE

General Objectives: The student will:

1. understand the importance of wildlife.
2. recognize wildlife resources in Ghana.
3. recognize common wildlife species in Ghana.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION		
UNIT 1 CONCEPT OF WILDLIFE	The students will be able to: 2.1.1 explain what wildlife is.	Concept of Wildlife.	Students to explain wildlife and to discuss Wildlife resources in Ghana.	What is wildlife?		
UNIT 2 IDENTIFICATION OF WILDLIFE	2.1.1 name common wildlife species.	Common and Scientific names of wildlife.	Students to visit wildlife reserves and zoological gardens to identify common wildlife species by the common and scientific names: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <u>Common Name</u> <u>Primates</u> Chimpanzee Black and white colobus Diana monkey Mona monkey (Spot nose monkey) Bosmans potto Baboon <u>Carnivorous</u> Lion Leopard Golden cat African civet Wild cat Hunting dog </td> <td style="width: 50%; vertical-align: top;"> <u>Scientific Name</u> <u>Primata:</u> <i>Pan troglodytes</i> <i>Colobus polykomos</i> <i>Cercopithecus diana</i> <i>Cercopithecus mona</i> <i>Perodicticus potto</i> <i>Papio anubis</i> <u>Carnivora:</u> <i>Panthera Leo</i> <i>Panthera pandus</i> <i>Felis aurata</i> <i>Viverra civetta</i> <i>Felis silvestris</i> <i>Lycaon pietus</i> </td> </tr> </table>	<u>Common Name</u> <u>Primates</u> Chimpanzee Black and white colobus Diana monkey Mona monkey (Spot nose monkey) Bosmans potto Baboon <u>Carnivorous</u> Lion Leopard Golden cat African civet Wild cat Hunting dog	<u>Scientific Name</u> <u>Primata:</u> <i>Pan troglodytes</i> <i>Colobus polykomos</i> <i>Cercopithecus diana</i> <i>Cercopithecus mona</i> <i>Perodicticus potto</i> <i>Papio anubis</i> <u>Carnivora:</u> <i>Panthera Leo</i> <i>Panthera pandus</i> <i>Felis aurata</i> <i>Viverra civetta</i> <i>Felis silvestris</i> <i>Lycaon pietus</i>	Give examples of Wildlife and their scientific names.
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UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 3</p> <p>IMPORTANCE OF WILDLIFE</p> <p>UNIT 4</p> <p>WILDLIFE RESERVES</p>	<p>The students will be able to:</p> <p>2.3.1 discuss the importance of Wildlife.</p> <p>2.4.1 identify types of Wildlife Reserves in Ghana.</p> <p>2.4.2 describe the features of the various Wildlife Reserves.</p> <p>2.4.3 outline management practices associated with the various wildlife reserves and the zoos.</p>	<p>Importance of wildlife: Socio-economic Environment Forestry Tourism/Scientific Research</p> <p>Types of wildlife reserves: i. National Parks e.g. Mole, Kakum, Bui ii. Game Production Reserves e.g. Shail Hills iii. Wildlife sanctuary, e.g. Buabeng Fiema, Owabi iv. Strict Nature Reserve e.g. Digya.</p> <p>Features of Wildlife Reserves: - Large tracts of land - Presence of water and food - Population of wildlife</p> <p>Wildlife Management Practices - Protection of Game Reserves against poachers</p>	<p>Students in groups to discuss the importance of wildlife to the economy and society, environment, forestry, tourism and scientific research.</p> <p>Students to discuss the differences between Game and Strict Nature reserves and give examples in Ghana.</p> <p>Visit to Game and Wildlife Reserves to observe wildlife in their natural habitat.</p> <p>Discuss with students' the features of the various wildlife reserves with the aid of a map, let students give reasons for the location of wildlife reserves in the places indicated on the map.</p> <p>Teacher to discuss with students the features of various wildlife reserves.</p> <p>Teacher to invite a resource person from the Department of Games and Wildlife to deliver a talk on the management practices of wildlife reserves.</p> <p>Teacher to organise field trip for students to wildlife protection and production reserves to study the management strategies in the various reserves, and the roles of various grades of staffs involved.</p>	<p>Write an essay on the importance of wildlife to</p> <p>i the economy and society</p> <p>ii forestry and the environment?</p> <p>Mention 3 common wildlife species typical of each of the following reserves:</p> <p>1. Damongo 2. Bia South 3. Bui</p> <p>Describe the features of a named wildlife reserve.</p> <p>Outline three management practices in a monkey sanctuary.</p>

SENIOR HIGH SCHOOL - YEAR 2

SECTION 3

FORESTRY SECTOR STRUCTURES

General Objectives: The student will:

1. understand policies and structures within the forestry sector.
2. understand the functions of forestry related institutions.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 POLICY-MAKING, IMPLEMENTATION, MONITORING AND EVALUATION	The students will be able to: 3.1.1 outline the role of Forestry Commission. 3.1.2 list the forest policy implementing agencies and compare their functions.	Ministry of Lands, Forestry and Mines (MLFM). Structures and functions of the Forestry Commission (F.C), Functions of the implementing agencies: FSD - Forest Services Division WD - Wildlife Division TIDD - Timber Industry Development Division	Students to discuss structures of FC: FSD, WD, and TIDD. Students to discuss functions of Forestry Commission, Ministry of Lands, Forestry and Mines. Teacher to invite resource persons to discuss with students the functions of the various institutions (MLFM, FC, FSD, TIDD, WD). Students to visit TIDD check points, FSD and WD Offices.	State the functions of MLFM. Compare the work of the implementing agencies.
UNIT 2 TRAINING AND RESEARCH	3.2.1 outline the roles of Training and Research Institutions in improving the forest industry.	Functions of: FORIG, FRNR, FFRT, WITC.	Visit to research and training institutions to discuss training and research work.	Students in groups of 5 to write their reports on the visits to the institutions.

SENIOR HIGH SCHOOL - YEAR 2

SECTION 4

FOREST POLICY AND LAW

General Objectives: The student will:

1. be aware of the Ghana Forest and Wildlife Policy.
2. recognise the importance of Forestry and Wildlife laws.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 INTRODUCTION TO FOREST AND WILDLIFE POLICY	The students will be able to: 4.1.1 outline the importance of the Forest and Wildlife Policy. 4.1.2 mention the important laws pertaining to Forest and Wildlife resources.	Importance of forest and wildlife policy. - Management of forest estate - Production of forest industries - Awareness creation of forest conservation - Manpower training and research - Stakeholders interest Policy-makers: MLFM, Forestry Commission.	Teacher to invite a resource person to talk briefly about Forest and Wildlife policy and their importance. Students to discuss the salient points of Forest and Wildlife Laws.	Discuss the function of Ministry of Land, Forestry and Mines (MLFM), Forestry Commission and Wildlife Conservation. Discuss the need for Laws in Forestry.

SENIOR HIGH SCHOOL - YEAR 2

SECTION 5

FOREST MENSURATION AND WILDLIFE SAMPLING

General Objectives: The student will:

1. acquire skills in tree measurement.
2. acquire skills in the use of mensuration equipment (tapes, altimeter, compass etc.).
3. acquire skills in sampling methods, enumerations and survey techniques.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 MEASUREMENT AND ENUMERATION OF TREES	<p>The students will be able to:</p> <p>5.1.1 explain forest mensuration.</p> <p>5.1.2 explain the purpose of forest mensuration.</p> <p>5.1.3 identify and state the use of measuring instruments and equipment in forest mensuration and enumeration.</p>	<p>Explain forest mensuration as a specialised field responsible for the measurement of forest resources.</p> <p>Purpose of forest mensuration:</p> <ul style="list-style-type: none"> - for comparison - quantity determination - trade purposes/selection - application of standard unit - pricing - management. <p>Identify the instruments used in tree measurement.</p> <p>Equipment and instruments - Haga Altimeter, tape, clinometer, compass, measuring chain, ranging poles and arrows.</p>	<p>Discuss with students forest mensuration and its importance.</p> <p>Students to discuss the purpose of mensuration in forestry:</p> <ul style="list-style-type: none"> - comparison of current and future states of the forest. - quantity of tree determination - tree selection/trade and industry - cost and pricing - management <p>Teacher to display tools and equipment required for practical application in forest mensuration for students to examine.</p> <p>Students to carry out the practical use of instruments, tools and equipment in forest mensuration.</p>	<p>What are the benefits of forest mensuration?</p> <p>What is the purpose of Forest mensuration?</p> <p>When would you use the:</p> <ol style="list-style-type: none"> i. altimeter and ii. compass, in forest mensuration? <p>List tools and equipment used in forest mensuration.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 ENUMERATION OF GROWING STOCK AND SAMPLING METHODS	<p>The students will be able to:</p> <p>5.1.4 practise and measure trees accurately with the measuring equipment and tools.</p> <p>5.1.5 keep records of measurements using metric system.</p> <p>5.2.1 carry out the:</p> <ul style="list-style-type: none"> - enumeration of growing stock - sampling methods - surveys (stock survey, land survey, etc.) 	<p>Measuring parameters: heights, diameters, girth and volume determination.</p> <p>Measurement of trees, and recording of details in the metric system.</p> <p>Growing stock determination:</p> <ul style="list-style-type: none"> - Enumeration (100%, 5%, 2½%) - Sampling methods: selective sampling, systematic sampling, random sampling <p>Surveys:</p> <ul style="list-style-type: none"> stock survey strip survey land survey 	<p>Students practise the appropriate use of equipment and instruments in the determination of tree heights, diameter and volume.</p> <p>Students in groups measure selected trees, record data and submit report in class for discussion.</p> <p>Teacher to explain (100%, 5%, 2½%) enumeration of the growing stock to students.</p> <p>Students to discuss sampling and sampling methods adopted in forest mensuration (selective, systematic and random sampling)</p> <p>Teacher to demonstrate to students the use of the compass, ranging poles, arrows to undertake survey practicals of:</p> <ol style="list-style-type: none"> i. school compound ii. a portion of the forest area <p>Students to discuss stock survey and the use of conventional keys/symbols in recording botanical names of trees e.g. Tri = Wawa, Pip = Dahoma, etc.</p>	<p>What is 5% enumeration?</p> <p>Why is sampling needed in forest mensuration?</p> <p>Group students to present their findings after surveying their school compound.</p> <p>What is stock survey and its significance?</p>

SENIOR HIGH SCHOOL - YEAR 2

SECTION 6

HARVESTING FOREST RESOURCES

General Objectives: The student will:

1. understand harvesting methods.
2. be aware of processing methods.
3. recognise the importance of safety measures in harvesting and processing.
4. be aware of harmful wildlife harvesting practices.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 HARVESTING TIMBER	Students will be able to: 6.1.1 state the factors to consider before harvesting timber. 6.1.2 identify procedures/techniques for harvesting timber in the natural forest or plantation. 6.1.3 mention and interpret markings on a log. 6.1.4 describe the harvesting, extraction and transportation processes from the forest to the processing centre.	Factors to consider before harvesting – stock survey, reconnaissance and field inspections. - Prefelling Inspection - Selection of trees to fell Techniques for harvesting timber. Natural forests:- permit acquisition, yield approval, felling, extraction, measurement Plantations: permit acquisition, felling, extraction, measurement Log markings: property mark, locality mark, compartment number, stock survey number. Tree number, reserve code, log number. Harvesting, extraction and transportation processes: - Felling and cross-cutting. - Hauling, marking, - Loading and - Transportation.	Teacher to invite a resource person to discuss factors to consider before harvesting timber Students to visit an approved felling area in the natural forest to acquaint themselves with techniques and procedure of harvesting timber. Students to discuss how logs are marked before transportation, and acquaint themselves with the interpretation of markings on logs. Teacher to use audio-visual aids e.g. pictures, film, charts and discuss harvesting, extraction and transportation processes to the sawmill centre.	Students to state factors to consider before harvesting timber. Students to write a report on procedure to follow in harvesting trees or make oral presentation. Students' to interpret markings on a log and their significance.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 2</p> <p>HARVESTING OF NON-TIMBER FOREST PRODUCTS (NTFP'S)</p>	<p>Students will be able to:</p> <p>6.1.5 name equipment for harvesting timber.</p> <p>6.1.6 identify safety measures in timber harvesting.</p> <p>6.1.7 describe the various forms of timber processing.</p> <p>6.1.8 sawmilling equipment.</p> <p>6.2.1 mention the products considered as Non-Timber Forest Products (NTFP's).</p> <p>6.2.2 describe some methods of harvesting NTFP's.</p>	<p>Equipment for harvesting timber: Chain-saw, hand saw, axe, cutlass.</p> <p>Timber harvesting and safety measures e.g. Use of - Safety gear - Directional felling - Staff training.</p> <p>Types of processed products: - sawn boards: (2 x 4, 2 x 6, 1 x 8, 1 x 12), etc. - veneer - plywood</p> <p>Sawmilling equipment e.g. bandmill Slicer veneer equipment Rotary veneer equipment</p> <p>Non-Timber Forest Products: <u>Marantaceae</u> leaves, chew sticks, plant medicines, canes, rafters, bush meat, etc.</p> <p>Methods of harvesting NTFP's : Hunting - (bushmeat), Gathering (leaves, food, snails, medicine, mushroom). Trapping (birds, bushmeat).</p>	<p>Students to discuss timber harvesting equipment and bring out their advantages.</p> <p>Teacher to show audio-visual aids e.g. pictures, film and charts on safety measures in timber harvesting</p> <p>Students to discuss safety measures adopted in timber harvesting.</p> <p>Students to discuss the processes involved in timber processing and be familiar with the sawmilling, equipment – sawn boards, veneer and plywood.</p> <p>Teacher to arrange a visit to the sawmill with the students to enable them acquaint themselves with the processing of timber into: - Sawnboards – (various specifications – 2x4, 2x6, etc). - Veneer production - Plywood manufacture</p> <p>Students to discuss NTFPs and explain why they are classified as NTFPs.</p> <p>Students to discuss harvesting methods of NTFP's considering the safety of the method and their sustainability.</p> <p>Students to discuss forest products and their uses.</p>	<p>What safety measures are adopted before felling timber?</p> <p>Students to state the process involved in plywood production.</p> <p>List NTFPs in your district and indicate their uses and value.</p>
<p>UNIT 3</p> <p>USES OF HARVESTED FOREST PRODUCTS</p>	<p>6.3.1 state some common uses of forest products. i. Timber and related uses. ii. NTFPs and related uses.</p>	<p>Uses of forest products: Shelter, furniture, household utilities, (e.g. pestle, mortar), artefacts, food, medicine, weaving, curing, wrapping, production of dye; bamboo for the production of furniture and other household utilities.</p>	<p>Students to visit production and processing centres at sawmills, carpentry workshop, tie and dye industry, other NTFPs small scale processing centres – e.g. sheabutter, Dawadawas, prekese etc, chop bars and identify some forest products used at such places.</p>	<p>Mention two (2) NTFPs in your district and state how they are preserved?</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 4 HARVESTING WILDLIFE	Students will be able to: 6.4.1 describe techniques for harvesting wildlife. 6.4.2 name some endangered, rare, and common, wildlife species, 6.4.3 explain why some wildlife species are endangered, rare and common.	Wildlife harvesting techniques: Hunting, trapping, baiting and gathering. Endangered species: Elephants Rare species: Porcupines Common species: grasscutters Reasons why some wildlife are endangered, rare and common: Over-exploitation, encroachment on wildlife resources highly on demand, poaching, bushfires, farming, logging.	Teacher to invite a resource person to give a talk on wildlife harvesting techniques. Follow up with a discussion. Students to name some endangered wildlife species and measures to protect them. (primates, elephants, parrots, pythons, etc) common wildlife species (antelopes, grasscutter, etc) Discuss with students give reasons why some wildlife species are endangered, rare and common.	Write an essay on harvesting techniques. How sustainable are the harvesting techniques?
UNIT 5 HARMFUL WILDLIFE HARVESTING PRACTICES	6.5.1 describe harmful wildlife harvesting practices. 6.5.2 suggest ways for reducing wildlife harvesting.	Harmful wildlife harvesting: Use of chemicals, fire, gin-trap. Reducing harmful harvesting of wildlife: Training and education, sanctions and confiscation of harmful equipment. Close and open hunting seasons, Hunting permit, Ban on night hunting.	Teacher to invite a resource person to talk on harmful wildlife harvesting practices and measures to control them. Follow up with a discussion. Students to discuss harmful wildlife harvesting practices prevailing in the country and how to prevent them. Students to discuss the close season in Ghana as starting from 1 st August to 1 st December each year.	What are the effects of the use of fire, gin, trap and chemicals in harvesting wildlife? Discuss the rationale for close and open hunting seasons in Ghana.

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SECTION 7

FOREST INDUSTRIES

General Objectives: The student will:

1. understand the importance of forest industries in the economy of Ghana.
2. recognize the sources of raw materials and the range of products manufactured by the industries.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 TIMBER INDUSTRIES AND TIMBER PRODUCTS	The students will be able to: 7.1.1 identify types of forest industries in Ghana. 7.1.2 explain the contribution of forest industries to the national economy.	Types of Forest Industries: Sawmill; Plywood mills, Chip Board mills. Location and sources of raw materials of forest industries. Contribution of forest industries to economy - emphasis on timber processing, range of products and marketing and employment opportunities, export earnings.	Discuss the types of forest industries in Ghana. Students to discuss products of different industries mentioned in the content. Students to discuss the geographical location of the timber industries. Students in groups to discuss the contribution of the forest industries to the national economy. Teacher to arrange for students to visit forest industries in the area. Students to discuss various ways forest products contribute to national economy.	Name four (4) forest-based industries and their products.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 CAREER AND TRAINING OPPORTUNITIES	<p>The students will be able to:</p> <p>7.2.1 identify training opportunities in Forestry.</p> <p>7.2.2 identify job opportunities in forestry and forestry-related careers.</p> <p>7.2.3 plan, produce and supply seedlings on commercial basis to plantation developers.</p> <p>7.2.4 keep quality standards in tree seedling production.</p>	<p>Forestry Training Institutions in Ghana.</p> <p>Opportunities in Forestry-Related Careers:</p> <ul style="list-style-type: none"> - Carpentry and furniture - Wood carving - Wood marketing and export - Timber graders - Saw doctoring - Production Manager in Sawmill - Wood Technologist. - Silviculturalist - Forest economists - Forest managers - Entomologists - Related institutions and organisations <p>Nursery and cultural practices:</p> <ul style="list-style-type: none"> - seed procurement and transplanting - shading - fencing - watering - stumping and stripling <p>Quality standards in tree seedlings production:</p> <ul style="list-style-type: none"> - rouging 	<p>Teacher to discuss training opportunities in Forestry.</p> <p>Teacher to invite a resource person to talk on job opportunities in Forestry.</p> <p>Use digital content to identify and discuss international careers in forestry.</p> <p>Students to plan the seedling production project of 100m by 100m size, procure seeds selected and perform the nursery and cultural practices.</p> <p>Student to keep records of all seedling production activities and demonstrate procedures for keeping quality standards in tree seedling production e.g. removal of rogue seedlings, etc.</p>	<p>List five (5) forestry-related training institutions in Ghana.</p> <p>Compare and contrast the following:</p> <ol style="list-style-type: none"> 1. plans adopted 2. seed selection procedure.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D) CAREER AND TRAINING OPPORTUNITIES	The students will be able to: 7.2.5 harvest tree seedlings.	Harvesting and post harvest handling: - stumping - stripling - polypot	Put students into groups to discuss: - signs of seedling maturity and observe minimum size for survival in the new environment. - precautions to observe in harvesting/lifting of tree seedlings and give reasons for the choice of harvesting/lifting techniques of tree seedlings: - stumping - stripling - polypot lifting - methods of package and transport of tree seedlings to planting site. - stump seedling can be bagged - striplings-roots are protected - polypot – direct packaging.	Students to: Discuss the precaution to take in harvesting/lifting tree seedlings. explain each of the following: - striplings - polypots - stumped seedlings What factors influence packaging and transportation of seedlings to the planting site?

SENIOR HIGH SCHOOL - YEAR 3

SECTION 1

MARKETING FOREST PRODUCTS

General Objectives: The students will:

1. be aware of the avenues for marketing forest products.
2. be aware of domestic and foreign consumers.
3. understand the requirements for marketing forest products.
4. develop plans for increasing consumption of forest products.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 DEMAND FOR FOREST PRODUCTS	<p>The students will be able to:</p> <p>1.1.1 state types of forest products demanded by the local market.</p> <p>1.1.2 state the types of forest products demanded by the foreign market.</p> <p>1.1.3 suggest reasons for differences in product demand in the local and foreign markets.</p> <p>1.1.4 outline the socio-economic benefits of the demand for forest products.</p>	<p>Type of forest products on demand locally: Local: Bushmeat, pestle, wrappers, chewing stick, timber, mushroom, medicinal plants etc.</p> <p>Forest products on demand at the foreign markets: Foreign: Timber, medicinal plants, rattan, live animals, animal trophies etc.</p> <p>Reasons for differences in demand at local and foreign markets: - differences in taste - differences in lifestyle - differences in the level of economic development - quality of produce - availability of produce</p> <p>Socio-economic benefits: - increased revenue employment opportunities and depletion of resources.</p>	<p>Students to brainstorm on the types of forest products observed and the demand pattern in the country.</p> <p>Students to discuss forest products of commercial importance in the local and foreign markets.</p> <p>Assist students to discuss differences in demand of forest products in the local and foreign markets.</p> <p>Students to discuss the socio-economic effects/benefits of the demand for forest products.</p>	<p>Write an essay on the socio-economic significance of forest products.</p> <p>Students to investigate the export earnings of some forest products and write a report.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 MARKETING AGENCIES	<p>The students will be able to:</p> <p>1.2.1 name both governmental and non-governmental agencies involved in marketing forest products.</p> <p>1.2.2 describe the functions of each marketing agency.</p>	<p>Agencies involved in the marketing of forest products: Wood products - GEPC, TIDD, Other forest products medicinal plants, wood carvings, rattan products, etc – GEPC, private companies.</p> <p>Functions of marketing agencies.</p>	<p>Students to discuss the functions of marketing agencies and give examples.</p> <p>Teacher to use charts and maps to illustrate the flow of products and functions of various agencies in the marketing of various forest products.</p>	<p>Name a marketing agency and describe its function.</p>

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SECTION 2

DEFORESTATION

General Objectives: The student will:

1. understand the forms and causes of deforestation in Ghana.
2. understand the effects of deforestation.
3. be aware of the intervention strategies against deforestation.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 FORMS AND CAUSES	The students will be able to: 2.1.1 explain deforestation and its features. 2.1.2 give examples of factors leading to deforestation.	Explanation of deforestation. Indicators of deforestation. Factors leading to deforestation - Ghana's forest - past, present, future. – Man made; bushfires, farming activities, felling of trees for timber, wood fuel, settlement and urbanization, - Natural: volcanic eruptions, natural fires, landslides, etc).	Students to explain and identify any manifestation of deforestation in the immediate environment and discuss the causes. Students to discuss the causes of deforestation Students in groups discuss the effects of deforestation on: i. Soil fertility ii. Animal habitat/population iii. Economy iv. Environment	Identify the causes of deforestation. What are the major causes of bushfires? Write an essay on the effects of deforestation in the community.
UNIT 2 EFFECTS OF DEFORESTATION	2.2.1 explain the effects of deforestation.	Effect of deforestation: - Changes in forest structure and composition - Loss of forest functions. - Loss of soil fertility. - Loss of habitat. - Loss of income. - Desertification. - Flooding and drought - Drying of water bodies		

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 3 CONTROLLING DEFORESTATION	<p>The students will be able to:</p> <p>2.3.1 outline methods and intervention programmes for the control of deforestation.</p> <p>2.3.2 select suitable trees for specific purposes.</p>	<p>Control of deforestation:</p> <ul style="list-style-type: none"> - appropriate farm practices, - education, - control of indiscriminate tree felling (firewood and timber) - enforcement of forest laws and regulations - appropriate harvesting and milling equipment <p>Intervention programmes</p> <ul style="list-style-type: none"> - education - rehabilitation. - afforestation - reforestation <p>Selection of trees for:</p> <ul style="list-style-type: none"> - shade - windbreak - crown size - economic - aesthetic 	<p>Teacher to organise field trips for students to observe control and intervention methods.</p> <p>Students to discuss control and intervention measures and types of trees for the control and intervention.</p> <p>Students to discuss the following terminologies: reforestation, afforestation, reforestation.</p> <p>Students to discuss factors to be considered in the selection of trees. e.g. for shade purposes, the tree should be pollarded, for windbreak/greenbelt, the tree should be evergreen with good crown formation; for economic purposes, the tree should be suitable for timber, wood lot establishment for fuelwood etc.</p>	<p>Students to state intervention measures for controlling deforestation.</p> <p>What trees are suitable for amenity planting?</p>
UNIT 4 REFORESTATION, AFFORESTATION AND REAFFORESTATION	<p>2.4.1 explain reforestation, afforestation and reforestation.</p> <p>2.4.2 explain some silvicultural terminologies.</p>	<p>Explanation of reforestation, reforestation, and afforestation.</p> <p>Terminologies: Silvics, silviculture, soil seed bank, shade demanding plants, light demanding plants, plant succession, forest gaps.</p>	<p>Students to explain the meaning of reforestation, reforestation and afforestation.</p> <p>Teacher to explain silviculture, silvics, soil seed bank, light and shade demanders, plant succession and forest gaps to students.</p>	<p>Students to differentiate</p> <ol style="list-style-type: none"> i. reforestation and reforestation; ii. natural and artificial regeneration. <p>What is silvics?</p> <p>Write notes on forest gaps and plant succession.</p>
UNIT 5 NATURAL REGENERATION	<p>2.5.1 explain the concept of regeneration.</p>	<p>Natural regeneration concept – soil seed bank, gaps (natural).</p>	<p>Students to review and brainstorm to bring out understanding of natural reforestation.</p>	<p>What is soil seed-bank and its implication on natural reforestation</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 5 (CONTD)</p> <p>NATURAL REGENERATION</p>	<p>The students will be able to:</p> <p>2.5.2 outline biotic factors that influence the choice of natural regeneration.</p> <p>2.5.3 describe the stages of succession in natural regeneration.</p>	<p>Biotic factors that influence the choice of natural regeneration:</p> <ul style="list-style-type: none"> - topography and slope - type of forest - level and extent of deforestation - occurrence of seed bearing (mother) trees. <p>Stages of development:</p> <ul style="list-style-type: none"> - succession; primary, secondary, climatic climax - light and shade tolerant trees intervention : line, spot planting. <p>Advantages of natural regeneration over artificial regeneration.</p>	<p>Students to brainstorm on the factors that influence natural regeneration.</p> <p>Students to explain soil seed bank, concept, gaps (natural).</p> <p>Soil seed bank practicals</p> <ul style="list-style-type: none"> - Teacher to organise a visit to a forest environment for students to collect soil samples from the forest floor into bags (poly-pots). Under protected open environment at the school compound/nursery, each group will provide the conditions necessary for germination and water periodically. Each student group will identify the weeds, seedlings type, climbers that will germinate – a proof of the soil seed bank concept. <p>Students to discuss plant succession stages:- primary, secondary and climatic climax forest</p> <p>Students to determine when to undertake intervention measures such as line and spot planting to supplement the natural regeneration potential.</p>	<p>Write notes on the factors that influence the choice of natural reforestation.</p> <p>Students to name 5 shade tolerant and 5 light tolerant tree species.</p>

	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 5 (CONTD) NATURAL REGENERATION	<p>The students will be able to:</p> <p>2.5.4 explain concept of artificial regeneration.</p> <p>2.5.5 explain the terms Invasive Alien Species (IAS) and Exotic Species</p>	<p>Artificial regeneration concept Forest plantations. – Use of :</p> <ul style="list-style-type: none"> - Indigenous species - Exotic species <p>Advantages and disadvantages with the use of exotic species</p> <p>Meaning of Invasive Alien Species (IAS) and Exotic Species</p>	<p>Students to:</p> <p>Students to discuss pure and mixed stands. Students to discuss the use of indigenous and exotic species in plantation development, their perceived advantages and disadvantages.</p> <p>Teacher to emphasise on 10 exotic species which have become naturalized in Ghana and 5 exotic species which can be categorized as invasive</p> <p>Use digital content to explain Invasive Alien Species (IAS) and Exotic Species Download pictures of IAS AND Exotic Species in Ghana from the Internet Explain the differences between Invasive Alien Species (IAS) and Exotic Species</p> <p>Students to discuss three each of terrestrial and aquatic invasive exotic species in Ghana; West Africa and Africa.</p> <p>Aquatic: <u>Eichhornia crassipes</u> – (Water hyacinth), <u>Salvinia molesta</u> – (Kariba weed), <u>Pistia stratiotes</u> – (water lettuce). <u>Mimosa pigra</u> (large sensitive plant)</p> <p>Terrestrial: <u>Chromolaena odorata</u> – (Siam weed – Acheampon weed), <u>Broussonetia papyrifera</u> (Pulp mulberry – York), <u>Leucaena Leucocephala</u></p>	<p>Differentiate between pure and mixed plantation.</p> <p>What is an exotic species?</p> <p>Give three advantages and disadvantages each associated with the use of exotic species.</p> <p>Explain the differences between Invasive Alien Species (IAS) and Exotic Species giving examples.</p> <p>Identify two exotic species each of the aquatic and terrestrial areas that are invasive in Ghana.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 5 (CONTD)</p> <p>NATURAL REGENERATION</p>	<p>The students will be able to:</p> <p>2.5.6 list other intervention methods of reforestation.</p>	<p>Other intervention methods:</p> <ul style="list-style-type: none"> - taungya practices - agroforestry practices (agro-silviculture, silvo-pastoral, agro-silvo-pastoral) 	<p>Students to explain taungya and give the historical background of its adoption into forestry practices.</p> <p>Students to explain agro-forestry as another intervention towards reforestation.</p> <p>Students to discuss agro-forestry, the advantages and disadvantages.</p>	<p>Students differentiate between agro-forestry and traditional farming practices.</p> <p>What is taungya? Differentiate between taungya and agro-forestry practices.</p>

SENIOR HIGH SCHOOL - YEAR 3

SECTION 3

PLANTATION ESTABLISHMENT I - NURSERY PLANNING

General Objectives: The student will:

1. understand the basic procedures for plantation planning.
2. acquire practical skills in nursery planning and management.
3. develop costing and record keeping system.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 PLANTATION DEVELOPMENT	The students will be able to: 3.1.1 outline factors to be considered for plantation development. 3.1.2 design a plan for a plantation.	Factors influencing plantation development: i. Wood deficit for industrial and domestic uses, ii. The environment is highly degraded iii. Improve upon the stocking of the existing tree species iv. There is the need for specific tree type for industrial purposes. Plantation design and plan: i. Objectives ii. Site Selection iii. Species Selection iv. Site Preparation v. Cost Aspect	Teacher to discuss plantation as an example of artificial regeneration. Students to discuss the factors that influence the plantation development. Students to relate factors to plantation development in Ghana. Students to discuss and visit a nearby plantation to establish the differences between a plantation and a natural forest and discuss purposes of plantation establishment. Students to discuss plantation planning by considering its objectives, site selection and preparation, species selection, cost etc.	Distinguish between a plantation and a natural forest. Students to design a plan for establishing a plantation.
UNIT 2 NURSERY ESTABLISHMENT	3.2.1 describe nurseries and their functions	Types of nurseries: permanent and flying or temporary Functions of a nursery: - Production of planting stock - Supply of planting stock to Plantation developers	Students to discuss the types, functions and importance of nurseries	Students to write on when to choose a flying nursery instead of permanent.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONTD) NURSERY ESTABLISHMENT	<p>The students will be able to:</p> <p>3.2.3 describe the cultural practices in nursery establishment.</p> <p>3.2.4 identify the various nursery Equipment and tools.</p> <p>3.2.5 demonstrate competence in performing various nursery operations.</p> <p>3.2.6 detect pests and diseases that affect nursery stock.</p>	<p>Cultural practices: pricking-out, stumping, stripling, hardening-off, transplanting seed collection, storage and treatment, bed preparation, sowing.</p> <p>Nursery tools, types and uses: Pick-axe, shovel, rake, hoe, wheel barrow, cutlass, watering can.</p> <p>Nursery operations</p> <ul style="list-style-type: none"> - Seed handling - Pre-germination treatment - Pricking out - Transplanting - Watering - Weeding - Shading <p>Nursery Diseases and Pests:</p> <p>i. Pests: e.g.</p> <ul style="list-style-type: none"> - Slugs/Snails - Termites <p>ii. Diseases:- e.g.</p> <ul style="list-style-type: none"> - Damping-off - Rust 	<p>Students to visit the nearest Forest Services Division nursery or the school nursery where applicable to observe some of the practices.</p> <p>Students to discuss cultural practices in nursery establishment.</p> <p>Show real tools or pictures for students to identify. Students to discuss and undertake practical exercises in tool handling and maintenance.</p> <p>Teacher to take students to the school nursery to undertake nursery operations where applicable.</p> <p>Students to discuss various diseases, symptoms and pest infestation.</p> <p>Students to discuss the nature of damage by pests and their control.</p>	<p>What factors are to be considered before starting a nursery in the school/village?</p> <p>Discuss the importance of seed treatment before planting.</p> <p>Name three (3) nursery diseases and their symptoms.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 3</p> <p>COSTING NURSERY ESTABLISHMENT</p>	<p>The students will be able to:</p> <p>3.3.1 identify various sources of cost associated with nursery establishment.</p> <p>3.3.2 suggest ways of controlling nursery costs.</p>	<p>Direct Costs: Raw materials, Labour and expenses for tools etc.</p> <p>Indirect costs: cost of work related materials e.g. stationery and other consumables; maintenance cost; rent of nursery plot.</p> <p>Ways of controlling nursery costs: Record keeping of daily activities, etc.</p>	<p>Students to discuss sources of cost in establishing a nursery.</p> <p>Students in groups to suggest ways of controlling nursery costs using the school nursery as an example.</p> <p>Teacher to invite a resource person to illustrate to students how to record and manage costs.</p>	<p>Students to plan a budget for a new nursery.</p> <p>Suggest ways of controlling cost in nursery operations.</p>

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SECTION 4

PLANTATION ESTABLISHMENT II - PLANTING AND TENDING

General Objectives: The student will:

1. acquire practical skills on plantation establishment.
2. develop skills in pegging, planting and tending operations.
3. acquire knowledge on costing and keeping of records.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 LAND PREPARATION	The students will be able to: 4.1.1 clear and peg a site. 4.1.2 seedling planting.	Site clearing and pegging under required spacing. Techniques for planting.	Students to clear and peg a site identified for plantation establishment under various spacing options. Students to demonstrate appropriate methods of planting. Teacher to supervise students to plant in groups.	When is it most appropriate to do site preparation and pegging? Discuss the importance of each tending operation in plantation establishment.
UNIT 2 TENDING OPERATIONS	4.2.1 describe the various tending operations.	Description of tending operations – - Weeding – complete, spot and line - Beating -up, - Pruning, - Thinning,	Discuss tending operations and their importance.	

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 (CONT'D) TENDING OPERATIONS	The students will be able to: 4.2.2 explain the effects of improper tending operations.	Effects of improper tending: Poor height and diameter growth, early branching and poor wood quality:- (growth depression and defects.)	Students to discuss the effects of improper tending. Students to visit an untended stand where possible.	
UNIT 3 COSTING PLANTATION DEVELOPMENT	4.3.1 identify sources of operational cost, and classify them as direct or indirect cost. 4.3.2 keep records of plantation operation and attendant cost.	Sources of operational costs: - Land Preparation - Tending Operation - Labour Inputs - Materials Importance of Record Keeping and cost in plantation establishment.	Students to discuss sources of cost and their significance in management. Students to suggest ways of keeping records using the school plantation where applicable as an example.	Outline the costs related to plantation establishment.
UNIT 4 INTERVENTIONS: AGRO FORESTRY	4.4.1 carry out agro-forestry practices and skills as a reforestation intervention.	Agro-forestry practices. Agro-silviculture: - alley cropping methods - mulching, pruning Requirements of agro forestry: Plants – ability to establish easily - it should grow rapidly - it should have deep rooting system - ability to produce heavy forage - ability to regenerate after pruning - have good coppicing ability - provide useful by products	Students to discuss agro-silviculture – alley cropping as a maximum utilisation of land use: providing mulch (green manure), pruning material for fodder, companion food, firewood from the same piece of land area. Students to discuss plant nutrient recycling. Deep rooted plants tap leached nutrients into the leaves, leaves become green manure or fodder for animals and crop use. Students to carry out agro-forestry practices e.g. mulching, pruning etc.	What benefits do we derive from agro forestry practices under agro-silviculture? Discuss the tree-nutrient pump recycle.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 4 (CONTD)</p> <p>INTERVENTIONS: TAUNGYA</p>	<p>The students will be able to:</p> <p>4.4.2 carry out Taungya practices as intervention for reforestation.</p>	<p>- Silvo-pastoral; - combining animal with trees on the same piece of land. - Agro-silvo-pastoral, combining animals, trees and crops together on the same piece of land.</p> <p>Taungya practice as another intervention of reforestation.</p> <p>Taungya is a vernacular word in Burma meaning "Taung" = hill, and "ya" = cultivation, hence taungya literally means Hill cultivation.</p> <ul style="list-style-type: none"> • Conditions that influence taungya practice <p>- scarcity of land for farming purposes - food crop scarcity (not cash crop)</p> <p>The ultimate goal of Taungya practice.</p> <p>- to increase food supply for a definite period. - to increase upon the stocking of the desired timber at any particular time.</p>	<p>Teacher to take students to silvo-pastoral area to observe the relationship between the animals and the plants in that agro-forestry practices e.g. cattle, sheep, goat grazing under tree plantation with grass undergrowth.</p> <p>Teacher to take students to agro-silvo-pastoral area to observe how animals, crops and trees are managed under agro forestry practices. Agriculture and Forestry practices in Agro forestry is like Husband and wife.</p> <p>Teacher to explain Taungya concept as embracing agriculture and forestry practice where the two are compared as husband and wife. That is the tress and the crop components come together at the same time but for a specific period on the part of the crop components.</p> <p>Lead students to discuss the duration of the farm crop component which ranges between one and eight years depending upon the type of tree species used.</p> <p>Discuss with students the differences between taungya and agro-forestry practices.</p>	<p>Agriculture and Forestry practices in Agro forestry is like husband and wife, explain.</p> <p>What is Taungya? - Differentiate between Taungya and agro-forestry practices. - What are the factors that influence the choice of Taungya in a forest estate?</p> <p>Discuss the advantages and the disadvantages of Taungya practices.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 5</p> <p>PROJECT WORK</p>	<p>The students will be able to:</p> <p>4.5.1 undertake project work in forestry and wild life.</p>	<p>Project work and presentation.</p> <p>Students work on selected practical activity</p> <ul style="list-style-type: none"> - undertake field observation - findings - draw conclusions and recommendations and present as a project document. 	<p>Teacher encourages students to select a practical activity as their project work.</p> <p>e.g.</p> <ol style="list-style-type: none"> 1. Students to visit a sawmill, collect specimen of lumber materials obtained from the forest trees, label each specimen, write short notes on findings, observations and place the specimen in the school laboratory. 2. Students to prepare a model each to demonstrate the use of forest trees as <ul style="list-style-type: none"> (a) improving infiltration (b) serving as wind breaks (c) increasing precipitation <p>Students to write short notes explaining on how each use of the trees in (a) (b) (c) operates.</p> <ol style="list-style-type: none"> 3. Students to design a circular calendar for a tree nursery development: <p>October – site preparation November – germination and transplant bed preparation December – sowing, broadcasting seeds and transplanting January – transplanting/cultural practices February, /March-April – cultural practices May – cultural practices/lifting June/July – lifting stumping, striping and then hardening and transporting out August – transporting out September – compost and mulching build up</p> <p>Note: Other significant projects could be devised.</p>	<p>Oral presentation of project by students on</p> <ul style="list-style-type: none"> - observations and findings. <p>Students present project paper on findings, observations, conclusions and recommendations</p>

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SECTION 5

INCOME GENERATING VENTURES - CULTIVATION OF MUSHROOM

General Objectives: The student will:

1. recognise the various types of mushroom.
2. cultivate, harvest and process mushrooms for the market.
3. know the uses of mushrooms.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 IMPORTANCE OF MUSHROOMS	The students will be able to: 5.1.1 identify and undertake income generation ventures. 5.1.2 explain the importance of Mushroom. 5.1.3 state the agricultural uses of the by-products of mushroom cultivation.	Income generation ventures: - bee keeping - mushroom production - snail rearing Importance of mushroom - economic - nutritional - medicinal - by-products (e.g. animal feed, organic manure). Uses of by-product of mushroom cultivation.	Teacher to invite resource persons to discuss the rearing of the snail, grasscutter, bee keeping and mushroom production with the students. Students to discuss the benefits in undertaking income generating ventures. Teacher to organise students to visit areas listed under content Teacher to guide students in groups, to discuss the importance of mushrooms under the following: - economic: income, employment, etc. - nutritional: protein - medicinal e.g. increase lactation, healing of wounds, hypertension Students to discuss uses of by products (animal feed, soil conditioner) of mushroom cultivation.	Students to give a talk in groups, on each of the income generating ventures. Students to write an essay on the traditional uses of mushroom in the locality. Compare and analyse protein yield of mushroom per unit area with respect to other sources of protein such as soya bean, fish, livestock.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 2 BIOLOGY OF MUSHROOM	<p>The students will be able to:</p> <p>5.2.1 classify fungi accounting to characteristics.</p> <p>5.2.2 distinguish between poisonous and non-poisonous mushrooms/ commercial and non commercial mushrooms.</p> <p>5.2.3 name the commonly cultivated mushrooms in West Africa.</p> <p>5.2.4 explain how mushroom obtains its nutrients.</p> <p>5.2.5 outline the reproduction and production cycles in mushroom cultivation.</p>	<p>Classification of fungi Characteristics of mushroom (class: basidiomycetes).</p> <p>- Poisonous and Non-poisonous mushrooms, - Commercial and Non-commercial mushrooms.</p> <p>Common mushrooms in West Africa.</p> <p>Nutrition of mushroom.</p> <p>Life cycle of mushroom.</p>	<p>Assist students to discuss the classes of fungi with special emphasis on the characteristics of basidiomycetes.</p> <p>Discuss with students the features of poisonous and non-poisonous mushrooms.</p> <p>Guide students to use digital contact to identify and name common mushrooms in West Africa.</p> <p>Discuss how mushroom obtains its nutrients. Explain how mushrooms subsist on their substrate/media.</p> <p>Discuss with students the reproduction and production cycles in mushroom. Guide students to cultivate mushroom through inoculation, incubation and cropping.</p>	<p>Draw a table showing the local varieties of mushroom giving the common, scientific and local names and the features of the cap.</p> <p>Students to draw and label the parts of typical mushroom.</p> <p>List the commonly cultivated mushrooms.</p> <p>Students to make a diagram of the life cycle of mushroom.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 3</p> <p>METHODS OF MUSHROOM CULTIVATION</p>	<p>The students will be able to:</p> <p>5.3.1 list and describe the various methods of cultivating mushrooms.</p> <p>5.3.2 carry out the various practices involved in the production of mushroom.</p>	<p>Cultivation of Mushrooms</p> <p>Methods -</p> <ul style="list-style-type: none"> - local/pit method - high bed method - low bed method - indoor/commercial/plastic bag method <p>Practices involved, especially the bag method -</p> <ul style="list-style-type: none"> - composting the substrate - bagging the substrate - sterilising the bagged compost - inoculation - incubation - cropping 	<p>Students to discuss the methods used for cultivating mushroom indicating in particular the stages/steps that are followed in each method.</p> <p>Students to visit a nearby mushroom production centre to observe (and to practice where possible) the various activities involved in mushroom growing. Let students write a report on their list – how mushroom is produced.</p> <p>Students to produce mushroom using any of the methods suited to their locality.</p> <p>NOTE: Teacher to emphasis on the different materials used in the different methods.</p>	<p>Students to write on the precautionary measures to be taken in mushroom growing.</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 4</p> <p>MUSHROOM - HARVEST AND POST-HARVEST HANDLING</p>	<p>The students will be able to:</p> <p>5.4.1 recognise the maturity stages of the different types of mushrooms.</p> <p>5.4.2 harvest different types of mushroom using the appropriate techniques.</p> <p>5.4.3 process mushroom for consumption, home market and export.</p>	<p>Maturity stages of mushrooms:</p> <p>Harvesting:-</p> <ul style="list-style-type: none"> - signs of maturity - techniques and precautions - frequency and yield <p>Processing:-</p> <ul style="list-style-type: none"> - cleaning - packaging - preservation: roasting, freezing, canning 	<p>Students to discuss the signs of maturity of the different types of mushrooms.</p> <p>Teacher to demonstrate how to harvest mushrooms using the appropriate techniques for the different types of mushroom.</p> <p>Teacher to supervise students to harvest mushroom.</p> <p>Students should be guided to process and package harvested mushroom.</p>	<p>Students to write an essay on how to improve the quality of harvested mushroom for both local and export markets</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 5 BEE-KEEPING	<p>The students will be able to:</p> <p>5.5.1 state the importance of Bee-keeping.</p> <p>5.5.2 set up an Apiary .</p> <p>5.5.3 identify members of honey bee colony and their roles</p> <p>5.5.4 undertake routine management practices in beekeeping.</p> <p>5.5.5 describe processes of marketing honey.</p>	<p>Importance of beekeeping: For honey, wax, pollination.</p> <p>Apiary establishment: - Siting beehives - Baiting - Capturing</p> <p>Members of honey bee colony and their roles.</p> <p>Management of an apiary: - Routine practices - Precautions to avoid harm to farmers</p> <p>Marketing of honey and other products.</p>	<p>students to brainstorm to come up with the importance of Bee-keeping.</p> <p>NOTE: Teacher to invite a resource person to give a talk on prospects of beekeeping.</p> <p>Students to discuss the establishment of an Apiary.</p> <p>Students to identify suitable places for siting beehives.</p> <p>Use pictures and let students identify members of bee hive colony and discuss their roles.</p> <p>Students to visit an established apiary to observe routine management practices in beekeeping. Alternatively teacher to use charts/pictures and audio-visuals on Bee-keeping for the discussion.</p> <p>Students to mount and colonise a beehive. Teacher to discuss the various methods employed in harvesting and processing honey and wax, harvest and process honey, wax and other products, identify some pests and diseases of the honey bee, discuss pests and diseases of bees and their control.</p> <p>Students to brainstorm to outline strategies for marketing honey.</p> <p>NOTE: Teacher to guide student to set up an apiary at suitable sites. School to acquire bee keeping equipment and tools.</p>	<p>State four (4) important reasons for Bee-keeping.</p> <p>Describe the role of each of the following in the colony: i. Queen ii. Drones iii. Workers</p> <p>Write a report on the visit to an apiary highlighting on the following: - Number of beehives - Equipment used - Daily routine practices</p> <p>Maturity of colony and harvesting.</p>

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SECTION 6

ENTREPRENEURSHIP IN FORESTRY

General Objectives: The student will:

1. plan and establish an enterprise based on Forestry.

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
<p>UNIT 1</p> <p>ESTABLISHING ENTERPRISES IN FORESTRY.</p>	<p>The student will be able to:</p> <p>3.2.1 identify and describe the factors that should be considered when establishing enterprises in Forestry.</p>	<p>Factors for Establishing Enterprises:</p> <ul style="list-style-type: none"> - Identification of business opportunities in Forestry. - Identification of a forestry product or service needed in a locality - Availability of market for product or service - Demand for produce/products or service, etc. <p>Resources –</p> <ul style="list-style-type: none"> - land - capital - materials and structures - services - labour (personnel) - technical know-how - task analysis 	<ul style="list-style-type: none"> - brainstorm to identify a business idea in forestry - identify and discuss factors for establishing forestry-based enterprises 	<p>Discuss the importance of business plans</p> <p>Outline the content of a simple business plan</p>

UNIT	SPECIFIC OBJECTIVES	CONTENT	TEACHING AND LEARNING ACTIVITIES	EVALUATION
UNIT 1 (CON'D) ESTABLISHING ENTERPRISES IN FORESTRY.	The student will be able to: 3.2.2 describe procedures for establishing an enterprise in forestry.	Procedures for establishing enterprises in forestry <ul style="list-style-type: none"> - development of a business idea - development of a business plan - registration of business, etc. - Management of business, etc 	Lead a class discussion on the: <ul style="list-style-type: none"> - the procedures for establishing an enterprise in forestry - importance of business plans - format and contents of a business plan Put students in groups to: <ul style="list-style-type: none"> - prepare a simple business plan - present the plan for a class discussion NB: Teacher to invite a resource person to give a talk on how to develop a business plan and procedures for establishing an enterprise.	i. Write out the outline of a business plan. ii. Describe four procedures in establishing an enterprise in forestry.

FORESTRY FACILITIES, EQUIPMENT AND TEACHING/LEARNING MATERIALS

FACILITIES	EQUIPMENT	TEACHING/LEARNING MATERIALS
<ol style="list-style-type: none"> 1. Land 2. Nursery 3. Nursery Structures(buildings, boxes, etc.) 	<ol style="list-style-type: none"> 1. Cutlass 2. 3. Rake 3. Hand Fork 4. Water Hose 5. Fencing wire 6. Mattock 7. Top Soil 8. Compass 9. Timber Jack 10. Honey Harvesting Equipment 11. Haga Altrimeter 12. Theodolite 13. GPS – Geographic Position Systems 14. Measuring Chain 15. Shovels 16. Measuring Tape 17. Watering Can 18. Felling Axe 19. Garden Line 20. Arrows 21. Ranging Pole 22. Chain saw 23. Protective clothing (boots, etc.) 24. Diameter Tape 25. Clinometer 	<ol style="list-style-type: none"> 1. Textbooks 2. Forestry – 6 Different titles 3. Wildlife - 6 Different titles 4. Journals 5. Magazines 6. CD Roms on: Invasive Alien Species, Forest ecology, etc.
	<p align="center">Legislation / Policy Documents</p> <ol style="list-style-type: none"> 1. Forestry Commission Act, 1999 Act 571 2. Forest Plantation Development Fund Act 583 3. The Timber Resources Management Act, 1997 Act 547 4. Timber Resources Management Regulations, 1988, LT 1649 	

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Authors: Kotey, H.A., Francois, J. Owusu J.G.K. et al.

LIST OF ACRONYMS

FC	-	FORESTRY COMMISSION
FSD	-	FOREST SERVICES DIVISION
FORIG	-	FOREST RESEARCH INSTITUTE OF GHANA
FRNR	-	FACULTY OF RENEWABLE NATURAL RESOURCES
FFRT	-	FACULTY OF FOREST RESOURCES TECHNOLOGY
TIDD	-	TIMBER INDUSTRY DEVELOPMENT DIVISION
WITC	-	WOOD INDUSTRY TRAINING CENTRE
GEPC	-	GHANA EXPORT PROMOTION COUNCIL
TUC	-	TIMBER UTILIZATION CONTRACT
WD	-	WILDLIFE DIVISION
TUP	-	TIMBER UTILISATION PERMIT
NTFPs	-	NON-TIMBER FOREST PRODUCTS
MLFM	-	MINISTRY OF LANDS, FORESTRY AND MINES