Catalog of the College of Agriculture and Sustainable Development

Cuttington University
Suakoko
Bong County
2012

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President's Message

The value of an institution of higher learning is measured by the quality of its academic programs as reflected in the contributions made by its faculty and students to society. Cuttington University has articulated its mission and its vision in order to address the current and emerging needs of Liberia. Cuttington University aspires to meet the educational, health, socio-economic and technological challenges to nation building by responding to the man-power development needs through academic excellence, effective administration and efficient utilization of resources at its disposal and to significantly impact Liberia's educational goals.

Therefore, the primary mission of Cuttington University is to fulfill the paramount goal of higher education by offering each student an intensive educational experience and by serving the human person and society. The vision and mission of the College of Agriculture and Sustainable Development, (CASD) encapsulates these views by providing innovations in agricultural research and education to support the socioeconomic development of Liberia; promoting the development of human capacity; developing skills required to solve critical agricultural and natural resources challenges of Liberia; undertaking interdisciplinary academic demand-driven research and outreach programs in agriculture and effectively managing natural resources for sustainable development.

The three departments; Animal Science and Health, Natural Resource Management and Plant and Soil Sciences are essential for agricultural development in Liberia. These departments will address many of the important components of education, health and nutrition and natural resource management and utilization.
It is my fervent hope that students of CASD will take advantage of this new curriculum to fully develop their potentials for future endeavors. As Walt Disney said, "All our dreams can come true, if we have courage to pursue them." Have courage to pursue your dreams through the use of the new catalog and you will achieve your dream.

Finally, Cuttington University remains grateful to all our partners and especially to USAID through the Center for Excellence in Higher Education for Liberian Development (EHELD) for undertaking the arduous task of assisting the faculty in revising the catalog.

Henrique F. Tokpa, MSc, M.P., PhD., L.H.D.

President

CU and Agriculture

Cuttington University, then Cuttington College and Divinity School, was established on February 22, 1889 for "the establishment of a manual labor farm, which should afford opportunity for practical instruction of the boys in the mission school and at the same time serve as a pattern for others." The curriculum included "Agriculture and Industry; Theology; Preparatory; and Collegiate." The College was closed in 1929 due to financial hardship.

In 1949, Cuttington re-opened in central Liberia on 1,500 acres of rich agricultural land at Suakoko, Bong County. The farm was established to supply the college with produce, furnish income through cash crops and train agriculturists. Degrees were offered in Education, Humanities, Natural Sciences Social Sciences, Nursing, Theology and Agriculture.

The university continued its Agriculture program until 1969. Ten years later in 1979, Cuttington and the United States Agency for International Development (USAID) collaborated and established the Rural Development Institute which offered Associate of Arts degree in Agriculture with the goal of producing graduates trained to assist smallholder farmers to improve their production of food crops and cash income through technology adaptations. These sub-professional agricultural workers were employed by the Extension Service of the Ministry of Agriculture and its agricultural development projects and private sector agricultural entities. During the lifespan of the program which ended in 1986, 374 individuals benefited.
Cuttington University operated in exile during the civil crisis in Liberia and therefore conducted no agriculture activity.

Upon the reopening of Cuttington University at Suakoko in 2000, the agricultural program was upgraded to a degree granting college known as the College of Agriculture and Integrated Development Studies (CAIDS) that offered bachelor's degrees in Agriculture and Integrated Development Studies. CAIDS assisted in the rehabilitation and training of two hundred ex-combatants under the UNDP/DDRR PROGRAM with agricultural skills in poultry production, rice cultivation, vegetable production and fishery.

In 2011, Cuttington University became a recipient of a USAID project with the title "Excellence in Higher Education for Liberian Development (EHELD)" to make CAIDS into a center of excellence in agriculture education in Liberia. Under this program, the name of the college was changed to "College of Agriculture and Sustainable Development (CASD) in 2012 to reflect its new mandate. CASD consists of three departments; Animal Science and Health, Natural Resource Management and Plant and Soil Sciences. The Dean, who is the academic and administrative head of the college, is assisted by heads of each of the departments in the college.

College of Agriculture and Sustainable Development

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Excellence in Higher Education for Liberian Development

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Cuttington University
Suakoko, Bong County
Liberia
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Justification

In the annual message to the 53rd National Legislature on March 23rd 2012, President Mrs. Ellen Johnson Sirleaf stated the necessity of investing, educating and providing equal opportunity to young people. Liberia has one of the youngest populations in the world with 60% of citizens under the age of 35. In such a young country Liberian youth will be the driving force behind the nation's development and socioeconomic growth [1].

The Ministry of Agriculture has proposed the "Back-to-the-County" initiative, where several constraints to agricultural programs have been identified including, land and land rights, land use for farming and irrigation, and low incomes and inadequate consumption levels. The Ministry of Agriculture has also decided to provide offices of the ministry in each county to provide greater outreach to rural communities. For the government of Liberia, agriculture is a high priority with a special focus on small farmers who represent the potential to ensure Liberian food security, particularly since 90% of the population is categorized as food insecure [2].

Traditional agricultural education in the post-civil war period has focused on 'catching up' and providing a basic training in the science and selected skills of crop and animal production but has been limited in the ability to introduce current agricultural science along with wide array of practical applications due to limited facilities, labs and resources. There has been little emphasis on orienting students to the current development challenges of Liberia and in upgrading the curricula. Cuttington University College of Agriculture and Sustainable Development (CASD), as a Center of Excellence in Agriculture, is critical to promote agriculture research, training, and technology transfer through service learning and outreach to promote sustainable agroforestry development, community enrichment and human development.

Agriculture is key to raise incomes and improve food security through proactive economic growth policies that create employment and opportunities to participate in remunerative and sustainable livelihoods. The Back-to-the-County initiative and poverty reduction strategies seek to attract agricultural entrepreneurs to the rural

counties to fully participate in agricultural production to create new economic opportunities and thus improved food security [2].

The FAO document "Climate-Smart Agriculture" has stated that agriculture in developing countries must undergo a significant transformation in order to meet the challenges of food security and climate change [3]. The Commission on Sustainable Agriculture and Climate Change has proposed several priority actions to address these issues including [4]: (a) the integration of food security and sustainable agriculture into national policies, (b) increased investment in sustainable agriculture and food systems, (c) sustainable and intensified food production while reducing environmental impacts, (d) Reshaping food access and consumption to ensure basic nutritional needs and to foster healthy nutrition, and (e) reducing food loss and waste across supply chains.

The Liberian government is promoting the transformation of agriculture to include a broad-based participation of farmers (particularly small-land holders) using an integrated, sustainable and productivity-driven, cash/food crops systems approach [5]. As Liberia still holds approximately 50% of the Guinea forest, the management and conservation of these rich and diverse natural (renewable) resources are key activities for the social and economic prosperity of Liberia.

Vision Statement

The College of Agriculture and Sustainable Development, CASD, as a Center of Excellence in Agriculture, provides innovation in agricultural research and education to support the socioeconomic development of Liberia. The college develops technically and professionally skilled graduates that are highly qualified to meet current and future workforce demands (public, private, and NGO sectors) to meet Liberia's future sustainable development priorities of food security and access, economic development, poverty reduction, gender issues and the conservation and use of natural resources and services.

Mission Statement

CASD promotes the development of human capacity, resources, and skills required to solve critical agricultural and natural resources challenges of Liberia and undertake interdisciplinary academic demand-driven research and outreach programs in agriculture and natural resources for sustainable development

Strategic Goals:

Develop technically and professionally skilled Liberians in key development areas of plant, soil, and animal sciences and natural resource management.

Promote entrepreneurship and enterprise development skills.

Provide students with demand-driven education, research, service learning and community outreach approaches that meet Liberia's sustainable development priorities and provide practical hands-on training and skills development.

Foster gender equity in agriculture, recognizing the central role of women in production and food systems.

Develop human capital that is able to transform rural and agricultural systems in sustainable and equitable manner that results in poverty reduction.

Foster leadership, critical thinking skills, and information literacy, while facilitating students' personal and professional development for lifelong learning.

Prioritize education in agricultural extension and outreach to address local and global challenges of economic, health, social, and environmental sustainability for agricultural and rural development.

Title of Program:

Bachelor of Science in Agriculture (B.Sc. Agriculture), with Major areas of study in Animal Science and Health, and Plant and Soil Sciences.
Bachelor of Science in Natural Resource Management (B.Sc. NRM)

Students have the opportunity to focus on a Major area of study as well as to specialize in a secondary Minor area of study. CASD offers seven minor areas of study with options for specialization in the following areas (15 credits each). Students may also minor in another department within Cuttington University such as peace studies, education, and more.

Minors Available

AgriBusiness
Agricultural Extension and Education
Agricultural Mechanization
Animal Science and Health
Gender, Culture, and Agriculture
Natural Resources Management
Plant and Soil Sciences

Duration of Program: 4-year undergraduate programs

Entry Requirements for Long Term Degree Program

Students desiring to be admitted into the 'Freshman' year for the four (4)-year degree programs must satisfy the Cuttington University Admissions and Enrollment

requirements as contained in the '2010-2013 Revised Catalog' and as would, from time to time, be determined by the Office of Admissions, Records and Registration. However, for direct entry based on recommendations from CASD, candidates must officially submit applications with the following attached documents:

(I) Evidence of satisfactory pass and/or Certificate in at least one of the following:

a) Special Entry Examinations conducted by the Cuttington University for students who have completed High School with 15 Units of High School Work and a Grade Point Average (GPA) of 2.50.
b) Candidates with the West African Senior Secondary School Certificate must in addition to passes in the three core subjects (English Language, Mathematics and Integrated Science), obtain passes in Chemistry, plus either Physics or Mathematics and Biology or General Agriculture.
c) GCE candidates must have five passes at the Ordinary Level examination or equivalent including English Language, Mathematics and either (i) Physics, Chemistry and Biology or Agricultural Science or (ii) General Science, Additional General Science, and any other subject. In addition, candidates should obtain three passes at the GCE Advanced Level or equivalent in Chemistry, Physics or Mathematics, and Biology or Agricultural Science.
d) An Associate (AA) Degree Certificate in Agriculture from the Junior College in Kakata or other recognized College or University such as Booker Washington Agricultural & Industrial Institute of Liberia (BWI).
e) CASD will accept students from other accredited Universities and Colleges whose academic records are assessed and certified to be satisfactory; and only courses with a minimum GPA of 2.0 or 'C' grade and above would be allowed for transfer. The student bears the responsibility to present evidence of attendance of a recognized College or University and such evidence must be accompanied by an Official Transcript and a Testimony sent directly from the Institution to CU.
f) CASD will accept transfer students from within Cuttington University but in doing so, those students may be required to spend additional time to fulfil all CASD requirements.

(II) Bank Receipt for a non-refundable application fee paid into the CU account as would be determined from time to time by the Financial Comptroller of Cuttington University.

(III) A signed 'Declaration Support' statement from the parent/sponsor of the applicant.

Assessment Requirements

There shall be formal University Examinations in all programs of study at the end of each semester. The examination (40% of total marks) in each course shall not be less than two hours in duration. In addition, there shall be a system of continuous assessment (60% of total Marks) based on any or a combination of the following: mid-semester examination, class tests, essays, tutorials, class assignments, practicums, projects, etc. The proportion of total marks may be shifted by instructor and Professor depending upon the course, with students being made aware of the grade distribution at the beginning of the semester. (Note: *the proportion of time allocated to la*bs*/field activities should be indicated in the catalog*).

Graduation Requirements for Degree Program

To qualify for a B.Sc. degree in Agriculture or Natural Resources Management, a candidate must have completed course work totaling not less than 138 credit hours of which thirty-nine (39) credit hours should be in the student's major area of study and should have passed all required courses (70% pass mark) with a GPA of not less than 2.00. Furthermore, graduating students will be required to complete six (6) credit hours of individual Project Study as well as an additional three (3) credit hours for the Internship Experience Learning **'On-the-Job-Training' (OJT)**. The candidate should have also satisfied all other departmental requirements. The one hundred and thirty-eight (138) credit hours required for graduation are distributed as follows:

Course distribution	**Credit hours**	
	ASH/PS	**NRM**
a. Common courses to be completed for the four (4)-year programs CASD (includes Independent Project Study and Writing with Presentations and Experience Learning On-the-Job-Training)	50	41
b. Courses in Major area of Discipline	36	45
c. University required courses	40	40
d. Minor area of study(optional) plus elective(s)*	12	12
Total Credit Hours Required for Graduation	**138**	**138**

*To have a minor area of study, students must complete a series of courses that meet or exceed 15 credits within that specialized area of focus. With the required cross cutting courses that are required, students will find that they will have already taken two classes (for 6 credits) that can be used toward the completion of a minor.

University requirements (all majors)

Course designation	Course title	Credit hrs
BIO 101	Principles of Biology (Lab)	4
CHEM 101	Principles of Chemistry (Lab)	4
COM 101	Introduction to Computer Science	3
CU 101	Introduction to University Studies	2
ENG 101	Fundamentals of Communication I	3
ENG 102	Fundamentals of Communication II	3
ENG 210	Advanced Composition	3
FREN 101/KPEL 101	Fundamentals of French I or Fundamentals of Kpelle	3
HIST 101	African History	3
MATH 111	Principles of Mathematics I	3
MATH 112	Principles of Mathematics II	3
PSY 101	Introduction to Psychology	3
REDU 321 or REDU 491	Christian Ethics or Comparative Religion	3
Total hours		**40**

Common and cross cutting courses

CASD common courses cut across many disciplines design to meet Liberia's developing challenges. These cross cutting themes include the components of sustainable development (social and rural development, economic development and environmental sustainability), and a focus on gender issues, food security, human nutrition and health and extension. These common courses are designed to provide exposure and training in developing a holistic approach to agriculture, agroforestry and natural resources management including the critical human components, the social and community factors and to improve student's skills in critical thinking, analyses, leadership, management of people and communication skills all requisite skills in one's professional and personal development. The CASD common and cross cutting courses are also purposefully designed to demonstrate the interplay of the many actors and players along the commodity chain while strengthening the foundational and applied sciences to provide the level of expertise needed for success.

CASD courses that cross departments including independent project study and experience learning*		
Course designation	**Course title**	**Credit hrs**
CASD 101	Introduction to Agriculture and Natural Resource Management	3
CASD 103	Rural Development, Gender, and Society	3
CASD 102	Rural Sociology, Gender, and Culture	2
CASD 104	Introduction to Geology, Soil and Environmental Sciences	3
CASD 201	Population, Food Security, and Sustainable Development	3
CASD 202	Human Nutrition	3
CASD 204	Agricultural Economics	3
CASD 206	Agricultural Physics and Meteorology	3
CASD 301	Entrepreneurship and Microenterprise	3
CASD 303	Environmental and Social Impact Assessment	3
CASD 305	Experimental Design and Statistics	3
CASD 307	Farm Mechanization and Technology	3
CASD 302	Gender Relations in Extension	3
CASD 304	Information Use and Technology	3
CASD 306*	Internship and Field Experience	3
CASD 401*	Research Methods and Proposal Development	3
CADS 402*	Senior Project and Presentation	3
Total hours		**50**

Extension and educational outreach courses though considered cross-department are listed in the respective majors (**Animal Science and Health:** Gender Relations in Extension, Extension and Food Safety. **Soil and Plant Sciences and Natural Resource Management:** Crop and Soil Management Extension, Natural Resources Management Extension and Gender Relations in Extension).

Consequently, students who qualify for graduation are required to spend 81 credits in the fundamental sciences, basic agriculture, natural resources, gender studies and sustainable development and in fulfilling general university requirements; leaving an additional 60 credits from which 45 credits are required to complete their Major Discipline. Candidates have the option of selecting one of the following minors (15 credits): *Plant and Soil Sciences, Animal Science and Health, Natural Resources Management, Gender, Culture, and Agriculture, Agribusiness, Agriculture Extension and Education, and Agriculture Mechanization*. If the student wishes to pursue a minor, the minor area of study should be selected by the end of Year Two. These courses will be combined with the cross cutting courses in the CASD general course listing that all CASD students are required and contribute toward the completion of the 15 credit hour requirement. The selection of a minor area of study is optional and has been developed to encourage students seeking in depth study in a secondary area of interest to be pursued.

In the final semester of their Senior Year of Study, all students are also required to conduct a Supervised Independent Project Study leading to the writing and defense of a Thesis Paper and spend at least FOUR (4) MONTHS of exposure to INTERNSHIP EXPERIENCE LEARNING 'ON-THE-JOB-TRAINING' (OJT) with an approved organization commencing in May and ending in September such that two (2) months would be during the first semester break. We strongly encourage and welcome students to spend additional OJT in industry and the private and public sector while recognizing that could result in needing additional time beyond the traditional four years of full-time study to complete their degree requirements. Students are encouraged to meet with your undergraduate advisors and the Dean of CASD to discuss such OJT placement.

Course Structure

Students registering for the four (4)-year Degree Programs in the College of Agriculture and Sustainable Development (CASD) will have options to major in one of three (3) Departments – two (2) Departments in Agriculture and one (1) Department in Natural Resources Management.

Each of these degree programs incorporates key issues to develop agriculture and natural resources management that are economically, environmentally and socially sustainable. This program utilizes a business approach to agriculture as economic growth is important for poverty reduction. Other dimensions of poverty reduction are equally important including health and nutrition, illiteracy, and gender inequalities. Courses have been included to cover all aspects of sustainable development, food nutrition systems, food security and occupational health.

The lack of an agribusiness approach coupled with a weak extension and outreach system has resulted in the slow pace of transforming agriculture from subsistent to commercial production. Agriculture is a business, whether it is farm production, processing and marketing agricultural products, or supplying agricultural inputs. For this reason, programs in each of the three majors include strong components of extension and outreach (3 courses) to give graduates the abilities to transfer technical knowledge to farmers and communities and to ensure student exposure to applied and practical experiences. Students majoring in the three Departments will be required to take courses in agribusiness and outreach. Students learn to apply the concepts, principles and terminologies of economics and business (management, finance, marketing and others) to real world issues and opportunities in areas related to agriculture, natural resource management, and related industries.

In Liberia and elsewhere in Africa, women play a major role in farming activities, though their roles remain largely unrecognized. Gender inequalities are significant and they limit agricultural productivity and undermine development agendas. This program seeks to highlight the role of women in agricultural production and to move from subsistence levels into higher-value, market-oriented production. This program also recognizes that for agricultural growth and rural development for the

Liberia, it is imperative to involve both women and men as drivers of economic expansion, poverty reduction and leadership. In this program, courses related to gender issues are required and this important area has been also embedded throughout the curriculum.

Each Departmental curriculum is built on three areas of **'Theoretical Instructions'** in classrooms and laboratories. For each curriculum, lab field and practices (6-credits) has been incorporated to include **'Supervised Practical Outreach'** in the major discipline and related work based on active and experiential learning activities and opportunities for **'On-the-Job-Training'** in approved organizations and institutions promoting agricultural development and natural resources management in Liberia. An outline of the programs and semester-by-semester layout of courses are provided. The CASD curriculum builds heavily upon 'experiential learning' which combines theory and classroom learning with hands-on practicums in the labs and fields. Each student will be required to participate in service learning experiences to strengthen their ability to both communicate and understand the relevance and impact that agricultural science and technology can have to improve the livelihoods of Liberians. While the curriculum brings in a strong scientific foundation and technical competencies, and the experiential approach in teaching and outreach ensures all students have many opportunities for hands-on practice in the research labs, student farm, animal facilities and more, the curriculum also purposefully focuses on the students personnel and professional development, highlighting communication skills, critical analytical thinking skills, leadership development, and an understanding of group dynamics, work ethics, and the importance of initiative and individual responsibility.

Department of Animal Science and Health

Vision

The Department of Animal Science and Health will deliver foundational information for students pursuing careers in production agriculture, non-governmental organizations, private industry and agriculture-related support industries for vigorous and sustainable agricultural production systems.

Mission

The Animal Science and Health curriculum offered in CASD addresses essential subjects including animal physiology, nutrition, reproduction, genetics, behavior, health, diseases, environmental impact, and end-product processing as well as integrated and sustainable systems for animal production and management. Formal instruction within CASD is augmented through experiential learning using the student experimental farm program, laboratories, senior research project, and internship opportunities.

Description of the Department (minors, lab and field practices)

Productive animal agricultural systems are dependent on the successful management of animal growth, development and reproduction in the context of their interaction with the environment. Sustainable animal agriculture systems must function to promote the health and well-being of the animal to maximize its productivity while also maintaining environmentally sound production practices.

Animal Science is the study of the biology and management of domestic animal species. Animal health is a growing field that serves not only the agricultural community but also our human society. Animal Science serves as a starting point of entry into various animal and human health-related careers that benefit Liberian society through the efficient and environmentally responsible use of animals for food, companionship and recreation.

Graduates of the Department of Animal Science and Health will become knowledgeable of livestock production as a business enterprise leading to an increase in national agricultural productivity and alleviating poverty at the grassroots level.

The courses offered by the Department are structured to produce work-oriented professionals trained as service providers in the Animal Industry or ready for self-employment opportunities. Courses in this curriculum provide broad-based knowledge essential aspects of agriculture, with emphasis on environmentally sound and sustainable methods of animal production, a knowledge of animal health issues associated with economically important animal production systems, and human-animal interactions.

List of courses

Year 1, Semester 1

Course Code	Course Title	Credit Hours
BIO 101	Principles of Biology (Lab)	4
CASD 101	Introduction to Agriculture and Natural Resource Management	3
CASD 103	Rural Development, Gender, and Society	3
CU 101	Introduction to University Studies	2
ENG 101	Fundamentals of Communication I	3
FREN 101 or KPEL 101	Fundamentals of French I or Fundamentals of Kpelle	3
	Total	**18**

Year 1, Semester 2

Course Code	Course Title	Credit Hours
CASD 102	Rural Sociology, Gender, and Culture	2
CASD 104	Introduction to Geology, Soil and Environmental Sciences	3
CHEM 101	Principles of Chemistry (Lab)	4
ENG 102	Fundamentals of Communication II	3
HIST 101	African History	3
MATH 111	Principles of Mathematics I	3
	Total	**18**

Year 2, Semester 1

Course Code	Course Title	Credit Hours
ASH 201	Introduction to Animal Production and Health	3
CASD 201	Population, Food Security, and Sustainable Development	3
COM 101	Computer Science	3
ENG 210	Advanced Composition	3
MATH 112	Principles of Mathematics II	3
PSY 101	Introduction to Psychology	3
	Total	**18**

Year 2, Semester 2

Course Code	Course Title	Credit Hours
ASH 202	Animal Anatomy and Physiology	3
ASH 204	Animal Nutrition and Growth	3
CASD 202	Human Nutrition	3
CASD 204	Agricultural Economics	3
CASD 206	Agriculture Physics and Meteorology	3
REDU 321 or REDU 491	Christian Ethics or Comparative Religion	3
	Total	**18**

Year 3, Semester 1

Course Code	Course Title	Credit Hours
ASH 301	Animal Genetics and Breeding	3
ASH 303	Animal Reproduction and Lactation	3
CASD 301	Entrepreneurship and Microenterprise	3
CASD 303	Environmental and Social Impact Assessment	3
CASD 305	Experimental Design and Statistics	3
CASD 307	Farm Mechanization and Technology	3
	Total	**18**

Year 3, Semester 2

Course Code	Course Title	Credit Hours
ASH 302	Ruminant Production	3
ASH 304	Swine and Poultry Production	3
ASH 306	Aquaculture and Fisheries	3
CASD 302	Gender Relations in Extension	3
CASD 304	Information Use and Technology	3
CASD 306	Internship and Field Experience	3
	Total	**18**

Year 4, Semester 1

Course Code	Course Title	Credit Hours
ASH 401	Animal Health and Disease	3
ASH 403	Animal Products and Technology	3
CASD 401	Research Methods and Proposal Development	3
	MINOR 1 or ELECTIVE	3
	MINOR 2 or ELECTIVE	3
	Total	**15**

Year 4, Semester 2

Course Code	Course Title	Credit Hours
ASH 402	Extension and Food Safety	3
ASH 404	Non Traditional Animal Production	3
CASD 402	Senior Project and Presentation	3
	MINOR 3 or ELECTIVE	3
	MINOR 4 or ELECTIVE	3
	Total	**15**

Course Description - Animal Science and Health courses

CASD 101 Introduction to Agriculture and Natural Resource Management 3 credits

The objective of this course is to introduce students to the significance of Agriculture and Natural Resources (Forests) to the total national economy. The content will include: Employment creation and contribution to GDP; Linkages between industry, agriculture and natural resources; Current agricultural and natural resource management methods and practices in most developing countries in West Africa; Input distribution systems; Production systems; Marketing systems; Agricultural and natural resource-based consumer products; How to improve the agricultural and natural resources value-chain through agricultural and natural resource business enterprises; Micro-credit/finance in agriculture and natural resource; Small-scale processing; Storage and distribution enterprises; Input acquisition and distribution enterprises; Value creation and addition enterprises.

CASD 102 Rural Sociology, Gender, and Culture 2 credits

The course will introduce students to the roles of communities, social life and organization in areas outside the major urban environment and thus in rural areas. Given the population dispersion in Liberia and the importance of stability and economic development in Liberian rural areas, this course will involve the examination of social life, theory, observation in historical and current contexts. Using both qualitative and quantitative data to better understand demographics, resources, and gender, this class will focus on ways to use sociological inquiry to first understand community life and Liberian rural society, and then to apply sociological theory and applied approaches toward the improvement of the quality of rural life. This course will also identify resources for rural development. Students will be introduced to the participatory roles of animators and other stockholders in rural development. The course focuses on rural institutions and rural community development.

CASD 103 Rural Development, Gender, and Society 3 credits

This course will introduce students to the basic fundamental principles, concepts and factors that either promote or hinder Rural Development and also the effects, issues, and problems of cultural practices in rural development theory of rural development system of approach to the transformation of rural society/community. This includes evaluation through case studies of various rural development strategies and policies. Topics will include: 1) experimental design and statistics. Gender, cultural relations and democracy, 2) relationships of gender equity, human development with social and economic development, 3) importance of appreciation of cultural diversity as the first step in the promotion of equal opportunities for men and women in agriculture and 4) gender equity and sustainable livelihoods.

CASD 104 Introduction to Geology, Soil and Environmental Sciences 3 credits

The objective of this course is to introduce student to the geology and the origin and formation of soils. Introduction to the mineral, energy and water resources of Liberia and impacts of geological engineering in sustainable development will be discussed. Concepts will include chemical and physical properties of soils, fundamentals of soil survey and classification, and interactions of soil colloids and other soil constituents to mineral nutrition. Fundamentals of soil biology, organic matter development and dynamics of nitrogen, phosphorous and sulfur nutrition will be discussed. Soil conservation and improvement, erosion prevention strategies, drainage, tillage and irrigation will be addressed.

CASD 201 Population, Food Security, and Sustainable Development 3 credits

This course examines the link of the components of sustainable development (social, economic and environment sustainability) with food security. The components of food security, supply, availability and access and utilization of food and the role of gender equity and agricultural productivity will be discussed. Linkage between health, hygiene, education and nutrition in Liberian society will be important topics in the course. The role of economic development and food production systems in sustainable development will be discussed in the context of climate change and the broader scope of international assistance and regional development.

CASD 202 Human Nutrition 3 credits

This course studies the importance of food choices for a healthy and adequate diet to human growth and development. Risks and benefits of foods will be a major component of the course. Nutrients in foods and the body, the science of nutrition, dietary intake and nutritional assessments will be emphasized. An essential focus is the link between diet and health. Details on digestion, absorption and transport will be discussed in detail. The composition of foods, particularly the foods now consumed in Liberia will be featured along with their nutritional value components (carbohydrates, proteins, amino acids, vitamins, minerals, fats, water). Food safety issues will also be reviewed. Strategies to improve diet and human nutrition at the household and community level will be discussed.

CASD 204 Agricultural Economics 3 credits

This course is an introduction to the economics of agricultural and food markets. The goal is to provide the student with an understanding of the basic theoretical tools employed by economists in the analysis of agricultural price determination and discovery. The basics of supply and demand will be reviewed and expanded upon. Types of markets and their structure will be examined as well as the implications they have for participants. Emphasis will be placed on agricultural marketing system in the developing world. The traditional topics of price seasonality, marketing margins, derived demand, and trade will be covered. The role of pricing and risk management institutions, such as commodity futures markets, will be covered. Finally, this course will examine the roll of strategy used in price

setting, how market power gets exploited, and what drives the consumer and how to learn more about them.

CASD 206 Agricultural Physics and Meteorology 3 credits
The course introduces students to concepts of applied physics in agriculture and the discipline of meteorology, atmospheric phenomena, weather and climate. Specific topics and concepts will include use of basic meteorological instrumentation, global climatic change and its impact to agriculture. Remote sensing and geographical information system applications in agriculture and natural resource management, and applications of renewable source of energy (e.g. solar radiation) in agriculture will be covered.

CASD 301 Entrepreneurship and Microenterprise 3 credits
Theories and principles of administration and management; personnel and office management; entrepreneurship will be discussed in this course. Characteristics of successful entrepreneurship, business ownership structure, legal issues of entrepreneurship, and risk management will be featured. Development of business plans, establishing microenterprises, implementation of a well-developed plan; and monitoring and evaluation of business will be essential components of the course.

CASD 303 Environmental and Social Impact Assessment 3 credits
This course studies the effects of agricultural productivity (animal and crop production systems), agro-forestry and the industrial commercialization of Liberian natural resources on the environment. The course will provide a primer as to how environmental and social factors need to be monitored, measured and assessed to understand the impact of such activities and then for the development of measures to reduce their impact or footprint. Impacts of these systems on environmental degradation will be discussed.

CASD 305 Experimental Design and Statistics 3 credits
Developing a testable hypothesis and implementing procedures to test hypothesis are essential components of the scientific process. Students in CASD will be exposed to the scientific process and will understand basic process of research including establishing experiments with appropriate controls and replication, recording appropriate data, analyzing data, and making appropriate conclusions from the research project. Students will also be exposed to the importance of written and oral communication of the results from research. This course will serve as a foundation for the student project. Students will have the opportunity to participate in the design of field studies, in the input of data and in statistical analyses. The importance of proper experimental design and statistical analysis in research and the ability to properly interpret the results of any study will be focused.

CASD 307 Farm Mechanization and Technology 3 credits
This course will include characterization and adoption of mechanization and technology used in plant and animal production systems. Economic performance of the total machine systems including machine performance, power performance and

operation performance will be discussed. Economic viability of mechanized systems in relation to management decisions for farm machinery and maintenance will be included. Application of new approaches to tillage, seed bed preparation, cultivation, seeding, chemical application, grain harvesting, forage harvesting, farm processing, and materials handling.

CASD 302 Gender Relations in Extension 3 credits

The objective of this course is to introduce gender concepts in agricultural extension and to stress the importance of developing gender sensitive extension and outreach services for sustainable agricultural development for Liberia and in Africa. Gender focused extension and outreach options at urban, peri-urban and rural settings are treated in the course. The course highlights the benefits of increased agricultural extension and outreach for women farmers in agriculture as ways of improving agricultural decision-making and output, marketing competencies, post-harvest technologies, communications at the community level, and household based food and nutrition security. The course will introduce concepts of diversity and justice including gender perspective with regards to balancing attention to production for markets and production for household and community food and nutrition security.

CASD 304 Information Use and Technology 3 credits

This course focuses on up to date technologies used for information access and dissemination. Advanced used of information resources available on the Internet and their effective use is also stressed in helping students to have extensive literature reviews as part of their senior project in their final semester of study. Information resources include full-text journals and indexing and abstracting tools available on AGORA from FAO as well as other resources to unique materials, including data, available on the Internet. New technologies, particularly those involving mobile devices will be emphasized for having information on hand to take into the field, to transmit information to cell phones and other mobile devices, other communications channels including multimedia, radio, and voice over the Internet, and effective techniques for providing information as part of extension. A major focus of the course will be on the development of using resources for both workplace literacy and ongoing lifelong learning. This course may be taught through the use of webinars and distance learning and involves a hands-on approach to accessing information in today's world.

CASD 306 Internship and Field Experience 3 credits

Students will have the choice of working with NGO, government agencies, or business associated with animal or plant systems or natural resource development. This course will expose students to practical applications of their academic program and will provide initial linkages with employment opportunities. Students will also be exposed to professionalism and intangible elements required for successful business and/or support of the agricultural sector of the Liberian economy. This course builds upon the concept and critical importance of service learning for the students' personal and professional development and fosters the connections not

only of the student but of the CADS faculty to working toward the improvement of Liberian society.

CASD 401 Research Methods and Proposal Development 3 credits
With assistance from an appropriate advisor/mentor, students will develop a research hypothesis and prepare a plan of action to test the hypothesis. Each student will prepare a proposal based on appropriate justification and experimental procedures. Students will implement the project during this time. The goal of this course is to help students develop critical thinking skills and to provide experience in having a student work through developing a concept to a full proposal. This course provides opportunities in the agricultural sector that foster sustainable development in Liberia. The student farm will be an essential component of this course and the companion course CASD 403.

CASD 402 Senior Project and Presentation 3 credits
This course involves the completion of research outlined in CASD 401 and will require analyses of data and preparation of a written documentation of results and application of those results to end users. The student will also present the research findings to their peers and academic advisor and other faculty members. The information will also be presented to agribusiness, NGO and government when appropriate.

ASH 201 Introduction to Animal Production and Health 3 credits
This is an Animal Science foundational course providing an introduction to diversity of livestock and fish and their uses, animal behavior, basic animal production systems, introductory concepts in animal health and disease, and an introduction to animal products and processing.

ASH 202 Animal Anatomy and Physiology 3 credits
This course provides fundamental concepts of anatomy and physiology of livestock, poultry and fish. This course is necessary for understanding the organization and functions of the animal body systems and their impact on animal productivity, health and well-being to maximize its productivity while also maintaining environmentally sound production practices.

ASH 204 Animal Nutrition and Growth 3 credits
Basic concepts in nutrition of livestock, poultry and fish will be discussed in this course. Topics will include anatomy and physiology of the digestive tract, nutrients and their metabolism, digestion, absorption, animal growth and development, introduction to foodstuffs, feeds and feeding, ration formulation and nutrient requirements.

ASH 301 Animal Genetics and Breeding 3 credits
Basic principles of inheritance in animals of agricultural and aquaculture significance, transmission genetics and its effects on the usefulness of animals, and

basic principles of animal improvement through the application of genetic selection will be discussed in this course.

ASH 303 Animal Reproduction and Lactation 3 credits
This course outlines the basic concepts in reproduction of livestock, poultry and fish including endocrine control of reproduction, anatomy and physiology of the male and female reproductive tract, mammary anatomy and physiology, milk and egg production, breeding cycles, seasonality, reproductive management and application of reproductive technologies in the effort to increase animal productivity and ensure food security.

ASH 302 Ruminant Production 3 credits
This course will discuss the management principles associated with meat (beef, sheep and goat) and dairy (cattle and goat) production. The content includes integration of technical information on nutrition, genetics, reproduction and health with production systems, operations management, record keeping systems, product marketing, business practices, and decision-making processes as applied to beef cattle, dairy cattle, sheep, meat goat and dairy goat operations in developed and developing countries.

ASH 304 Swine and Poultry Production 3 credits
The course is aimed at helping students to understand the management principles associated with swine and poultry production. Emphasis will be placed on interactions of physiology, health, equipment, nutrition, reproduction and genetics applied to the nursery (starting), growing, finishing, farrowing and breeding phases of swine production and to the broiler and egg layer segments of poultry production. Incorporation of waste management practices and alternatives, development of marketing strategies and economic evaluation of management practices as applied to swine and poultry operations in developed and developing countries.

ASH 306 Aquaculture and Fisheries 3 credits
The course introduces students to the management principles associated with aquaculture and fishery production. Biological and general principles of aquaculture and fisheries management, species involved, techniques employed, and problems encountered will be discussed.

ASH 401 Animal Health and Diseases 3 credits
The objective of this course is to provide basic health concepts and disease processes. This course focuses on external and internal parasites of livestock and fishes, as well as key diseases affecting livestock production and aquaculture, public health and zoonotic diseases.

ASH 403 Animal Products and Technology 3 credits

This course focuses on Livestock and carcass evaluation, meat and dairy products processing, egg products, aquaculture products, animal and fish by-products, and value-added product technologies.

ASH 402 Extension and Food Safety 3 credits

The objective of this course is to teach extension principles to transfer expertise to farmers in food safety and quality of animal products. This course will include topics related to appropriate sanitation and handling to obtain safe livestock-based products entering the food chain to generate a safe and secure food supply for consumers.

ASH 404 Non-Traditional Animal Production 3 credits

While traditional livestock and aquaculture production systems form the majority of animal systems, productions systems that include animals such as rabbits and other game or bush animals will be included in this course. Integrated systems that include interactions of multiple animals will also be a component of this course.

Department of Plant and Soil Sciences

Vision

The Department of Plant and Soil Sciences provides foundational information for students pursuing careers in farming, extension and education and interactions with private or public industry sectors to improve agriculture in Liberia.

Mission

The Plant and Soil Sciences curriculum is designed to educate students in sustainable crop production systems. Students learn to understand the relationships between crops, the environment and soils as a key strategy to increase productivity. The department places a specific focus in maintaining and increasing long-term fertility of soils.

Description of the Department (minors, lab and field practices)

Agronomy has an important role to play in the economic recovery and sustainable development of Liberia. Low agronomic productivity has been linked to rural poverty, thus the enhanced production (increasing yields and reducing postharvest losses) and marketing of crops and their products will create economic opportunities for farmers as well as contribute to alleviation of poverty and increased food security.

Marketing and trade of agricultural crops, products and commodities is key to ensure their commercialization. This program puts a strong emphasis on agricultural marketing. The Department also provides students with background on agricultural extension and outreach, with a focus on gender equality.

Students study methods of providing high-yielding and disease-resistant crop varieties, improving efficiency and profitability in the sustainable use of the environment to enhance increased production of food and raw materials, and ways to add value to agricultural products through processing and product development. The Department provides active and experiential learning activities, hands-on experience at the student experimental farm program, a senior research project, and internship opportunities.

List of courses

Year 1, Semester 1

Course Code	Course Title	Credit Hours
BIO 101	Principles of Biology (Lab)	4
CASD 101	Introduction to Agriculture and Natural Resource Management	3
CASD 103	Rural Development, Gender, and Society	3
CU 101	Introduction to University Studies	2
ENG 101	Fundamentals of Communication I	3
FREN 101 or KPEL 101	Introduction to French I or Introduction to Kpelle	3
	Total	**18**

Year 1, Semester 2

Course Code	Course Title	Credit Hours
CASD 102	Rural Sociology, Gender, and Culture	2
CASD 104	Introduction to Geology, Soil and Environmental Sciences	3
CHEM 101	Principles of Chemistry (Lab)	4
ENG 102	Fundamentals of Communication II	3
HIST 101	African History	3
MATH 111	Principles of Mathematics I	3
	Total	**18**

Year 2, Semester 1

Course Code	Course Title	Credit Hours
CASD 201	Population, Food Security, and Sustainable Development	3
COM 101	Computer Science	3
ENG 210	Advanced Composition	3
MATH 112	Principles of Mathematics II	3
PSY 101	Introduction to Psychology	3
	Total	**15**

Year 2, Semester 2

Course Code	Course Title	Credit Hours
CASD 202	Human Nutrition	3
CASD 204	Agricultural Economics	3
CASD 206	Agricultural Physics and Meteorology	3
PSS 202	Principles of Crop Production I	3
PSS 204	Crop & Soil Management Extension	3
REDU 321 or REDU 491	Christian Ethics or Comparative Religions	3
	Total	**18**

Year 3, Semester 1

Course Code	Course Title	Credit Hours
CASD 301	Entrepreneurship and Microenterprise	3
CASD 303	Environmental and Social Impact Assessment	3
CASD 305	Experimental Design and Statistics	3
CASD 307	Farm Mechanization and Technology	3
PSS 301	Principles of Crop Production II	3
	MINOR 1 or ELECTIVE	3
	Total	**18**

Year 3, Semester 2

Course Code	Course Title	Credit Hours
CASD 302	Gender Relations and Extension	3
CASD 304	Information Use and Technology	3
CASD 306	Internship and Field Experience	3
PSS 302	Horticultural Crop Production and Management	3
PSS 304	Fertility Management and Plant Nutrition	3
PSS 306	Soil-Crop Management Systems	3
	Total	**18**

Year 4, Semester 1

Course Code	Course Title	Credit Hours
CASD 401	Research Methods and Proposal Development	3
PSS 401	Principles of Pest Management I: Diseases and Weeds	3
PSS 403	Plantation Crop Production and Management	3
PSS 405	Plant Genetics and Breeding	3
PSS 407	Post-Harvest Handling and Processing	3
	MINOR 2 or ELECTIVE	3
	Total	**18**

Year 4, Semester 2

Course Code	Course Title	Credit Hours
CASD 402	Senior Project and Presentation	3
PSS 402	Principles of Pest Management II: Insects and Vertebrate Pests	3
PSS 404	Staple Crop Production and Management	3
	MINOR 3 or ELECTIVE	3
	MINOR 4 or ELECTIVE	3
	Total	**15**

Course Description – Plant and Soil Sciences courses

CASD 101 Introduction to Agriculture and Natural Resource Management 3 credits

The objective of this course is to introduce students to the significance of Agriculture and Natural Resources (Forests) to the total national economy. The content will include: Employment creation and contribution to GDP; Linkages between industry, agriculture and natural resources; Current agricultural and natural resource management methods and practices in most developing countries in West Africa; Input distribution systems; Production systems; Marketing systems; Agricultural and natural resource-based consumer products; How to improve the agricultural and natural resources value-chain through agricultural and natural resource business enterprises; Micro-credit/finance in agriculture and natural resource; Small-scale processing; Storage and distribution enterprises; Input acquisition and distribution enterprises; Value creation and addition enterprises.

CASD 102 Rural Sociology, Gender, and Culture 2 credits

The course will introduce students to the roles of communities, social life and organization in areas outside the major urban environment and thus in rural areas. Given the population dispersion in Liberia and the importance of stability and economic development in Liberian rural areas, this course will involve the examination of social life, theory, observation in historical and current contexts. Using both qualitative and quantitative data to better understand demographics, resources, and gender, this class will focus on ways to use sociological inquiry to first understand community life and Liberian rural society, and then to apply sociological theory and applied approaches toward the improvement of the quality of rural life. This course will also identify resources for rural development. Students will be introduced to the participatory roles of animators and other stockholders in rural development. The course focuses on rural institutions and rural community development.

CASD 103 Rural Development, Gender, and Society 3 credits

This course will introduce students to the basic fundamental principles, concepts and factors that either promote or hinder Rural Development and also the effects, issues, and problems of cultural practices in rural development theory of rural development system of approach to the transformation of rural society/community. This includes evaluation through case studies of various rural development strategies and policies. Topics will include: 1) experimental design and statistics. Gender, cultural relations and democracy, 2) relationships of gender equity, human development with social and economic development, 3) importance of appreciation of cultural diversity as the first step in the promotion of equal opportunities for men and women in agriculture and 4) gender equity and sustainable livelihoods.

CASD 104 Introduction to Geology, Soil and Environmental Sciences 3 credits

The objective of this course is to introduce student to the geology and the origin and formation of soils. Introduction to the mineral, energy and water resources of Liberia and impacts of geological engineering in sustainable development will be discussed. Concepts will include chemical and physical properties of soils, fundamentals of soil survey and classification, and interactions of soil colloids and other soil constituents to mineral nutrition. Fundamentals of soil biology, organic matter development and dynamics of nitrogen, phosphorous and sulfur nutrition will be discussed. Soil conservation and improvement, erosion prevention strategies, drainage, tillage and irrigation will be addressed.

CASD 201 Population, Food Security, and Sustainable Development 3 credits

This course examines the link of the components of sustainable development (social, economic and environment sustainability) with food security. The components of food security, supply, availability and access and utilization of food and the role of gender equity and agricultural productivity will be discussed. Linkage between health, hygiene, education and nutrition in Liberian society will be important topics in the course. The role of economic development and food production systems in sustainable development will be discussed in the context of climate change and the broader scope of international assistance and regional development.

CASD 202 Human Nutrition 3 credits

This course studies the importance of food choices for a healthy and adequate diet to human growth and development. Risks and benefits of foods will be a major component of the course. Nutrients in foods and the body, the science of nutrition, dietary intake and nutritional assessments will be emphasized. An essential focus is the link between diet and health. Details on digestion, absorption and transport will be discussed in detail. The composition of foods, particularly the foods now consumed in Liberia will be featured along with their nutritional value components (carbohydrates, proteins, amino acids, vitamins, minerals, fats, water). Food safety issues will also be reviewed. Strategies to improve diet and human nutrition at the household and community level will be discussed.

CASD 204 Agricultural Economics 3 credits

This course is an introduction to the economics of agricultural and food markets. The goal is to provide the student with an understanding of the basic theoretical tools employed by economists in the analysis of agricultural price determination and discovery. The basics of supply and demand will be reviewed and expanded upon. Types of markets and their structure will be examined as well as the implications they have for participants. Emphasis will be placed on agricultural marketing system in the developing world. The traditional topics of price seasonality, marketing margins, derived demand, and trade will be covered. The role

of pricing and risk management institutions, such as commodity futures markets, will be covered. Finally, this course will examine the roll of strategy used in price setting, how market power gets exploited, and what drives the consumer and how to learn more about them.

CASD 206 Agricultural Physics and Meteorology 3 credits

The course introduces students to concepts of applied physics in agriculture and the discipline of meteorology, atmospheric phenomena, weather and climate. Specific topics and concepts will include use of basic meteorological instrumentation, global climatic change and its impact to agriculture. Remote sensing and geographical information system applications in agriculture and natural resource management, and applications of renewable source of energy (e.g. solar radiation) in agriculture will be covered.

CASD 301 Entrepreneurship and Microenterprise 3 credits

Theories and principles of administration and management; personnel and office management; entrepreneurship will be discussed in this course. Characteristics of successful entrepreneurship, business ownership structure, legal issues of entrepreneurship, and risk management will be featured. Development of business plans, establishing microenterprises, implementation of a well-developed plan; and monitoring and evaluation of business will be essential components of the course.

CASD 303 Environmental and Social Impact Assessment 3 credits

This course studies the effects of agricultural productivity (animal and crop production systems), agro-forestry and the industrial commercialization of Liberian natural resources on the environment. The course will provide a primer as to how environmental and social factors need to be monitored, measured and assessed to understand the impact of such activities and then for the development of measures to reduce their impact or footprint. Impacts of these systems on environmental degradation will be discussed.

CASD 305 Experimental Design and Statistics 3 credits

Developing a testable hypothesis and implementing procedures to test hypothesis are essential components of the scientific process. Students in CASD will be exposed to the scientific process and will understand basic process of research including establishing experiments with appropriate controls and replication, recording appropriate data, analyzing data, and making appropriate conclusions from the research project. Students will also be exposed to the importance of written and oral communication of the results from research. This course will serve as a foundation for the student project. Students will have the opportunity to participate in the design of field studies, in the input of data and in statistical analyses. The importance of proper experimental design and statistical analysis in research and the ability to properly interpret the results of any study will be focused.

CASD 307 Farm Mechanization and Technology 3 credits

This course will include characterization and adoption of mechanization and technology used in plant and animal production systems. Economic performance of the total machine systems including machine performance, power performance and operation performance will be discussed. Economic viability of mechanized systems in relation to management decisions for farm machinery and maintenance will be included. Application of new approaches to tillage, seed bed preparation, cultivation, seeding, chemical application, grain harvesting, forage harvesting, farm processing, and materials handling.

CASD 302 Gender Relations in Extension 3 credits

The objective of this course is to introduce gender concepts in agricultural extension and to stress the importance of developing gender sensitive extension and outreach services for sustainable agricultural development for Liberia and in Africa. Gender focused extension and outreach options at urban, peri-urban and rural settings are treated in the course. The course highlights the benefits of increased agricultural extension and outreach for women farmers in agriculture as ways of improving agricultural decision-making and output, marketing competencies, post-harvest technologies, communications at the community level, and household based food and nutrition security. The course will introduce concepts of diversity and justice including gender perspective with regards to balancing attention to production for markets and production for household and community food and nutrition security.

CASD 304 Information Use and Technology 3 credits

This course focuses on up to date technologies used for information access and dissemination. Advanced used of information resources available on the Internet and their effective use is also stressed in helping students to have extensive literature reviews as part of their senior project in their final semester of study. Information resources include full-text journals and indexing and abstracting tools available on AGORA from FAO as well as other resources to unique materials, including data, available on the Internet. New technologies, particularly those involving mobile devices will be emphasized for having information on hand to take into the field, to transmit information to cellphones and other mobile devices, other communications channels including multimedia, radio, and voice over the Internet, and effective techniques for providing information as part of extension. A major focus of the course will be on the development of using resources for both workplace literacy and ongoing lifelong learning. This course may be taught through the use of webinars and distance learning and involves a hands-on approach to accessing information in today's world.

CASD 306 Internship and Field Experience 3 credits

Students will have the choice of working with NGO, government agencies, or business associated with animal or plant systems or natural resource development. This course will expose students to practical applications of their academic program and will provide initial linkages with employment opportunities. Students will also be exposed to professionalism and intangible elements required for successful business and/or support of the agricultural sector of the Liberian economy. This

course builds upon the concept and critical importance of service learning for the students' personal and professional development and fosters the connections not only of the student but of the CADS faculty to working toward the improvement of Liberian society.

CASD 401 Research Methods and Proposal Development 3 credits
With assistance from an appropriate advisor/mentor, students will develop a research hypothesis and prepare a plan of action to test the hypothesis. Each student will prepare a proposal based on appropriate justification and experimental procedures. Students will implement the project during this time. The goal of this course is to help students develop critical thinking skills and to provide experience in having a student work through developing a concept to a full proposal. This course provides opportunities in the agricultural sector that foster sustainable development in Liberia. The student farm will be an essential component of this course and the companion course CASD 403.

CASD 402 Senior Project and Presentation 3 credits
This course involves the completion of research outlined in CASD 401 and will require analyses of data and preparation of a written documentation of results and application of those results to end users. The student will also present the research findings to their peers and academic advisor and other faculty members. The information will also be presented to agribusiness, NGO and government when appropriate.

PSS 202 Principles of Crop Production I 3 credits
Students will learn basic anatomical and physiological processes associated with plant growth, development, and reproduction. This course will be foundational in understanding more complicated topics associated with crop production systems. In addition to classification of crops, topics will also include discussions of the role of climate and weather on crop growth and development and approaches to minimizing and avoiding crop stress.

PSS 204 Crop & Soil Management Extension 3 credits
Providing essential information on managing crop and soil systems is important in developing new enterprises and increasing efficiency and economy of scale of traditional agricultural production systems. This course will include key concepts associated with managing production systems and extending information to end users including farmers and allied industry, NGO, and government agencies.

PSS 301 Principles of Crop Production II 3 credits
Students will learn basic practices associated with establishment, protection, maintenance, and harvest of major crops grown in Liberia including rice, rubber, maize, cassava, and other staple and cash crops vital to the Liberian economy. General principles of harvesting, post-harvest handling, marketing and storage of crop plants will be discussed.

PSS 302 Horticultural Crop Production and Management 3 credits
Improved diets are a function of diversity of food available, especially vegetable and fruits. Students will learn about the major horticultural crops, their associated production and pest management systems that protect yield and quality.

PSS 304 Fertility Management and Plant Nutrition 3 credits
Improving soil fertility and understanding the relationship of soil fertility with crop growth and development are essential in optimizing crop yield and protecting soil resources. Students will learn essential elements and interactions of these elements and how they influence yield. Students will also learn how to calculate rates for soil amendments and the potential impact of fertility practices on the environment. This course will expose students to deficiency symptoms observed in key crops grown in Liberian and methods to correct nutrient deficiencies observed in these crops.

PSS 306 Soil-Crop Management Systems 3 credits
Understanding interactions of production and pest management practices in the context of a farming enterprise will be essential for sustainable crop production in Liberia. Students will learn how to develop and successfully implement a farm plan that includes protection of soil resources, incorporation of improved genetics, developing effective rotation systems, implementing irrigation systems, and understanding the economic impact of overall crop production and managerial expertise.

PSS 401 Principles of Pest Management I: Diseases and Weeds 3 credits
Disease and weeds can reduce yield and quality dramatically in all crop production systems. Managing these pests requires an understanding of interactions of pests with crop production systems. Students will learn key elements in pest management including identification of weeds and diseases, recognizing relationships between pest damage, pest populations, and yield and quality loss assessments; fundamental concepts associated with the biology and development of pests; and development and implementation of approaches and techniques designed to avoid or suppress pests and their impact on crop production.

PSS 403 Plantation Crop Production and Management 3 credits
Rubber and other crops that generate income but are not considered staple crops can generate significant economic income for communities. Students will learn production and pest management practices associated with these large-scale crops including infrastructure, transportation and marketing.

PSS 405 Plant Genetics and Breeding 3 credits
Incorporation of improved genetics is essential in increasing crop yield and efficiency of production either through the inherent ability of crops or through ability to resist biotic and abiotic stress. Students will learn the role of crop improvement through cultivar and hybrid development and methodologies designed to determine performance of promising plant material of major crops in Liberia. Students will be exposed to the techniques and issues associated with

genetically modified (GM) crops in the context of agriculture in Liberia. Students will also be introduced to the importance of germplasm collection, maintenance and evaluation and the ways in which varieties and advanced genetic lines are comparatively evaluated for possible introduction and commercialization.

PSS 407 Post-Harvest Handling and Processing 3 credits

Ability to deliver quality products to the market will influence economic value. Students will learn factors that affect loss of yield and quality after harvest during the handling, storage, and transportation steps in the agricultural production and delivery system and practices that can minimize loss in these areas. Handling of fresh products for processing (control of enzymatic and non- enzymatic changes), grading, sorting, cleaning, peeling, sampling and size reduction will be discussed. Appropriate processing of fruits and vegetables including canning, dehydration processes including freeze-drying, spray-drying and sun-drying will be included in the course as well as chemical, physical and physiological changes in cereals and tubers during storage and handling and methods of preservation. Low-cost systems of affordable cooling and storage of fresh produce will be reviewed. Principles of packaging, characteristics of packaging materials, packaging requirements for fresh and processed foods for local, regional, and international markets will be component of the course.

PSS 402 Principles of Pest Management II: Insects and Vertebrate Pests 3 credits

Insects and vertebrate pests such as rodents and birds can reduce yield and quality dramatically in all crop production systems. Managing these pests requires an understanding of interactions of pests with crop production systems. Students will learn key elements in pest management including identification of insects and nematodes, recognizing relationships between pest damage, pest populations, and yield and quality loss assessments; fundamental concepts associated with the biology and development of pests; and development and implementation of approaches and techniques designed to avoid or suppress pests and their impact on crop production.

PSS 404 Staple Crop Production and Management 3 credits

This course will cover production methods, harvesting and postharvest handling to increase production of staple crops such as rice, cassava, and legumes, essential in daily caloric and nutrient input for Liberians. The course is focused on increasing yields and quality through improved genetic materials and high quality germplasm, improved production technologies, proper harvest and postharvest handling.

Department of Natural Resources Management

Vision

The Department of Natural Resources Management is a leader in training students with the capacity to provide important contributions to the management, utilization, and preservation of Liberia's vast natural resources in support of the country's long-term and sustainable economic growth.

Mission

Develop capacity of students to comprehend the dynamics of natural resource management and its relationships to the environment. This includes the social, cultural and environmental factors, socioeconomic development and the importance of natural capital, resources and services, in sustaining economic growth in Liberia.

Description of the Department

The role of natural resources in the economics and environmental stability of countries is expanding. Today, resource use covers a wide range of recognized products and services from various ecosystems that exist in Liberia and the rest of Africa. Natural resource management is faced with wider stakeholder interests and more demands especially at a time when resource deposits and ecosystems are experiencing pressure and the potential declines in both cover and quality at rates higher than any other period in history. The work of the natural resources manager needs to also apply a wide range of skills to respond to a diversity of interests and expectations of stakeholders, conflict management, global and local influence on policy issues that result in competing demands on the environment and its resources.

The Department of Natural Resources Management thus aims to develop competencies for students in the economic, social and cultural issues related to natural resources management while ensuring strong training in the basic environmental sciences. In addition, students will be equipped to handle the complex multifaceted and multidisciplinary challenges in the sustainable management of natural resources while having a strong appreciation of the countries indigenous plants, timber and non-forest timber species.

List of courses

Year 1, Semester 1

Course Code	Course Title	Credit Hours
BIO 101	Principles of Biology (Lab)	4
CASD 101	Introduction to Agriculture and Natural Resource Management	3
CASD 103	Rural Development, Gender, and Society	3
CU 101	Introduction to University Studies	2
ENG 101	Fundamentals of Communication I	3
FRE or KPEL 101	Introduction to French I or Introduction to Kpelle	3
	Total	**18**

Year 1, Semester 2

Course Code	Course Title	Credit Hours
CASD 102	Rural Sociology, Gender, and Culture	2
CASD 104	Introduction to Geology, Soil and Environmental Sciences	3
CHEM 101	Principles of Chemistry (Lab)	4
ENG 102	Fundamentals of Communication II	3
HIST 101	African History	3
MATH 111	Principles of Mathematics I	3
	Total	**19**

Year 2, Semester 1

Course Code	Course Title	Credit Hours
CASD 201	Population, Food Security, and Sustainable Development	3
COM 101	Computer Science	3
ENG 210	Advanced Composition	3
MATH 112	Principles of Mathematics II	3
NRM 201	Introduction to Agro-Forestry	3
PSY 101	Introduction to Psychology	3
	Total	**18**

Year 2, Semester 2

Course Code	Course Title	Credit Hours
CASD 202	Human Nutrition	3
NRM 202	Natural Resource Economics	3
NRM 204	Natural Resources Management Extension	3
NRM 206	Ecosystems and Biodiversity	3
NRM 208	Water Resource Management and Hydrology	3
REDU 321 or REDU 491	Christian Ethics or Comparative Religion	3
	Total	**18**

Year 3, Semester 1

Course Code	Course Title	Credit Hours
CASD 301	Entrepreneurship and Microenterprise	3
CASD 303	Environmental and Social Impact Assessment	3
CASD 305	Experimental Design and Statistics	3
NRM 301	Principles of Community Development	3
	MINOR 1 or ELECTIVE	3
	MINOR 2 or ELECTIVE	3
	Total	**18**

Year 3, Semester 2

Course Code	Course Title	Credit Hours
CASD 302	Gender Relations in Extension	3
CASD 304	Information Use and Technology	3
CASD 306	Internship and Field Experience	3
NRM 302	Ecology, Land Use, and Environmental Quality	3
NRM 304	Climate Change Impact on Natural Resources	3
NRM 306	Forest Ecology and Management	3
	Total	**18**

Year 4, Semester 1

Course Code	Course Title	Credit Hours
CASD 401	Research Methods and Proposal Development	3
NRM 401	Urbanization and Sustainable Development	3
NRM 403	Regional Development	3
NRM 405	Land Rights, Natural Resources, and Benefit Distribution	3
NRM 407	Non-Timber Forest Products	3
NRM 409	Project Development and Implementation	3
	Total	**18**

Year 4, Semester 2

Course Code	Course Title	Credit Hours
CASD 402	Senior Project and Presentation	3
NRM 402	Natural Resource Use and Public Policy	3
	MINOR 3 or ELECTIVE	3
	MINOR 4 or ELECTIVE	3
	Total	**12**

Course Description – Natural Resource Management courses

CASD 101 Introduction to Agriculture and Natural Resource Management 3 credits

The objective of this course is to introduce students to the significance of Agriculture and Natural Resources (Forests) to the total national economy. The content will include: Employment creation and contribution to GDP; Linkages between industry, agriculture and natural resources; Current agricultural and natural resource management methods and practices in most developing countries in West Africa; Input distribution systems; Production systems; Marketing systems; Agricultural and natural resource-based consumer products; How to improve the agricultural and natural resources value-chain through agricultural and natural resource business enterprises; Micro-credit/finance in agriculture and natural resource; Small-scale processing; Storage and distribution enterprises; Input acquisition and distribution enterprises; Value creation and addition enterprises.

CASD 102 Rural Sociology, Gender, and Culture 2 credits

The course will introduce students to the roles of communities, social life and organization in areas outside the major urban environment and thus in rural areas. Given the population dispersion in Liberia and the importance of stability and economic development in Liberian rural areas, this course will involve the examination of social life, theory, observation in historical and current contexts. Using both qualitative and quantitative data to better understand demographics, resources, and gender, this class will focus on ways to use sociological inquiry to first understand community life and Liberian rural society, and then to apply sociological theory and applied approaches toward the improvement of the quality of rural life. This course will also identify resources for rural development. Students will be introduced to the participatory roles of animators and other stockholders in rural development. The course focuses on rural institutions and rural community development.

CASD 103 Rural Development, Gender, and Society 3 credits

This course will introduce students to the basic fundamental principles, concepts and factors that either promote or hinder Rural Development and also the effects, issues, and problems of cultural practices in rural development theory of rural development system of approach to the transformation of rural society/community. This includes evaluation through case studies of various rural development strategies and policies. Topics will include: 1) experimental design and statistics. Gender, cultural relations and democracy, 2) relationships of gender equity, human development with social and economic development, 3) importance of appreciation of cultural diversity as the first step in the promotion of equal opportunities for men and women in agriculture and 4) gender equity and sustainable livelihoods.

CASD 104 Introduction to Geology, Soil and Environmental Sciences 3 credits

The objective of this course is to introduce student to the geology and the origin and formation of soils. Introduction to the mineral, energy and water resources of Liberia and impacts of geological engineering in sustainable development will be discussed. Concepts will include chemical and physical properties of soils, fundamentals of soil survey and classification, and interactions of soil colloids and other soil constituents to mineral nutrition. Fundamentals of soil biology, organic matter development and dynamics of nitrogen, phosphorous and sulfur nutrition will be discussed. Soil conservation and improvement, erosion prevention strategies, drainage, tillage and irrigation will be addressed.

CASD 201 Population, Food Security, and Sustainable Development 3 credits

This course examines the link of the components of sustainable development (social, economic and environment sustainability) with food security. The components of food security, supply, availability and access and utilization of food and the role of gender equity and agricultural productivity will be discussed. Linkage between health, hygiene, education and nutrition in Liberian society will be important topics in the course. The role of economic development and food production systems in sustainable development will be discussed in the context of climate change and the broader scope of international assistance and regional development.

CASD 202 Human Nutrition 3 credits

This course studies the importance of food choices for a healthy and adequate diet to human growth and development. Risks and benefits of foods will be a major component of the course. Nutrients in foods and the body, the science of nutrition, dietary intake and nutritional assessments will be emphasized. An essential focus is the link between diet and health. Details on digestion, absorption and transport will be discussed in detail. The composition of foods, particularly the foods now consumed in Liberia will be featured along with their nutritional value components (carbohydrates, proteins, amino acids, vitamins, minerals, fats, water). Food safety issues will also be reviewed. Strategies to improve diet and human nutrition at the household and community level will be discussed.

CASD 301 Entrepreneurship and Microenterprise 3 credits

Theories and principles of administration and management; personnel and office management; entrepreneurship will be discussed in this course. Characteristics of successful entrepreneurship, business ownership structure, legal issues of entrepreneurship, and risk management will be featured. Development of business plans, establishing microenterprises, implementation of a well-developed plan; and monitoring and evaluation of business will be essential components of the course.

CASD 303 Environmental and Social Impact Assessment 3 credits

This course studies the effects of agricultural productivity (animal and crop production systems), agro-forestry and the industrial commercialization of Liberian natural resources on the environment. The course will provide a primer as to how environmental and social factors need to be monitored, measured and assessed to understand the impact of such activities and then for the development of measures to reduce their impact or footprint. Impacts of these systems on environmental degradation will be discussed.

CASD 305 Experimental Design and Statistics 3 credits

Developing a testable hypothesis and implementing procedures to test hypothesis are essential components of the scientific process. Students in CASD will be exposed to the scientific process and will understand basic process of research including establishing experiments with appropriate controls and replication, recording appropriate data, analyzing data, and making appropriate conclusions from the research project. Students will also be exposed to the importance of written and oral communication of the results from research. This course will serve as a foundation for the student project. Students will have the opportunity to participate in the design of field studies, in the input of data and in statistical analyses. The importance of proper experimental design and statistical analysis in research and the ability to properly interpret the results of any study will be focused.

CASD 302 Gender Relations in Extension 3 credits

The objective of this course is to introduce gender concepts in agricultural extension and to stress the importance of developing gender sensitive extension and outreach services for sustainable agricultural development for Liberia and in Africa. Gender focused extension and outreach options at urban, peri-urban and rural settings are treated in the course. The course highlights the benefits of increased agricultural extension and outreach for women farmers in agriculture as ways of improving agricultural decision-making and output, marketing competencies, post-harvest technologies, communications at the community level, and household based food and nutrition security. The course will introduce concepts of diversity and justice including gender perspective with regards to balancing attention to production for markets and production for household and community food and nutrition security.

CASD 304 Information Use and Technology 3 credits

This course focuses on up to date technologies used for information access and dissemination. Advanced used of information resources available on the Internet and their effective use is also stressed in helping students to have extensive literature reviews as part of their senior project in their final semester of study. Information resources include full-text journals and indexing and abstracting tools available on AGORA from FAO as well as other resources to unique materials, including data, available on the Internet. New technologies, particularly those involving mobile devices will be emphasized for having information on hand to take into the field, to transmit information to cell phones and other mobile devices, other communications channels including multimedia, radio, and voice over the Internet, and effective techniques for providing information as part of extension. A major

focus of the course will be on the development of using resources for both workplace literacy and ongoing lifelong learning. This course may be taught through the use of webinars and distance learning and involves a hands-on approach to accessing information in today's world.

CASD 306 Internship and Field Experience 3 credits
Students will have the choice of working with NGO, government agencies, or business associated with animal or plant systems or natural resource development. This course will expose students to practical applications of their academic program and will provide initial linkages with employment opportunities. Students will also be exposed to professionalism and intangible elements required for successful business and/or support of the agricultural sector of the Liberian economy. This course builds upon the concept and critical importance of service learning for the students' personal and professional development and fosters the connections not only of the student but of the CADS faculty to working toward the improvement of Liberian society.

CASD 401 Research Methods and Proposal Development 3 credits
With assistance from an appropriate advisor/mentor, students will develop a research hypothesis and prepare a plan of action to test the hypothesis. Each student will prepare a proposal based on appropriate justification and experimental procedures. Students will implement the project during this time. The goal of this course is to help students develop critical thinking skills and to provide experience in having a student work through developing a concept to a full proposal. This course provides opportunities in the agricultural sector that foster sustainable development in Liberia. The student farm will be an essential component of this course and the companion course CASD 403.

CASD 402 Senior Project and Presentation 3 credits
This course involves the completion of research outlined in CASD 401 and will require analyses of data and preparation of a written documentation of results and application of those results to end users. The student will also present the research findings to their peers and academic advisor and other faculty members. The information will also be presented to agribusiness, NGO and government when appropriate.

NRM 201 Introduction to Agro-Forestry 3 credits
This course will cover concepts of the systems, practices, and technologies of agroforestry, including its origin and evolution, structure and function, and its dynamics and manipulation. Students will gain insight into the ecology of agroforestry systems and in the possibilities and limitations of application of agroforestry systems. Specific topics covered will include an overview and the identification of multipurpose trees and shrubs and products and services available and their interactions; pests, diseases and weed management in these systems; socio-economic issues in agroforestry; diagnosis and design of agroforestry systems; and the utilization and enhancement of local knowledge in agroforestry.

Students will develop an ecological understanding of the basis for sound agroforestry as well as plantation management.

NRM 202 Natural Resource Economics 3 credits

This course introduces students to economic issues specific to the use and management of natural resources. It explores the economic principles for the efficient allocation of resources over time. Topics covered include the economic classification of natural resources; scarcity, growth and sustainability; ownership, access systems and rent dissipation; and principles of optimal depletion and use. Policies and mechanisms to foster greater economic efficiency in economic systems dependent on natural resources will be examined. Key social and demographic factors will be evaluated in the context of the demand for environmental assets and amenities. Course objective includes familiarizing students with the applications of economic principles to public and private management of natural resources and the environment; to understand the economic justification for collective action in allocating, managing, and protecting the environment; and to develop the analytical skills and concepts that will enable the student to critically evaluate private actions and public policy influencing environmental and natural resource management.

NRM 204 Natural Resources Management Extension 3 credits

Providing essential information on managing natural resource systems is important in developing new enterprises and increasing efficiency and economy of scale of traditional agricultural production systems. This course will include key concepts associated with managing production systems and extending information to end users including farmers and allied industry, GMO, and government agencies. Other extension will include strategies for natural resource management, conservation and restoration.

NRM 206 Ecosystems and Biodiversity 3 credits

This course will study the main ecosystems in the world with emphasis on the West African region and the relationship of ecosystems and biodiversity. This course also provides a basic foundation for understanding evolutionary and ecological processes. Natural selection, evolutionary theories, human evolution, population ecology, community ecology, biodiversity, biogeochemical cycling, global climate, and conservation biology will be explored. An ecosystem approach for sustaining biodiversity and their importance to sustainable development will also be presented. Effects of technology and population growth on species, ecosystems, and human communities will be included. The protection of habitats and ecosystem services as a way to protect biodiversity for sustained social development and economic growth will be highlighted. Causes and consequences of degradation of ecosystem and biodiversity loss, prevention of habitat loss will be discussed.

NRM 208 Water Resource Management and Hydrology 3 credits

Course will cover the principles and practices of watershed management and hydrology, including the management of forests, rangelands, and other areas, for the protection, maintenance, and improvement of water resource values. Course will

cover hydrological and biological methods used to manage watersheds and assess watershed health. Ecology, management, and basic aspects of wetland ecosystems including the issues surrounding the utilization of wetlands and problems of wetlands management and use will be examined.

NRM 301 Principles of Community Development 3 credits
This course discusses the processes involved in active and sustainable communities based on social justice, equality and mutual respect. Theories and practices of community development will be discussed. Social dynamics and human ecology will be linked with strategies of community and individual empowerment through skill development and capacity building to overcome poverty, generate economic opportunities and preserve the environment. Approaches to community development will be examined in the context of Liberian society.

NRM 302 Ecology, Land Use, and Environmental Quality 3 credits
This course studies the ecological processes involved in the evolution and re-creation of a natural community including the challenges of ecological sustainability of the land use and management. The importance of sustaining ecological systems to preserve and support ecosystem services, cultural and aesthetic values, recreation, and sustainable extractive uses of the land. Habitat characteristics, life histories, reproductive ecology, biological invasions and ecological transformations, mutualism, societal laws, attitudes toward restoration and approaches to ecological restoration will be explored.

NRM 304 Climate Change Impact on Natural Resources 3 credits
This course will cover the history and impact of climate change on natural resources. Other topics to be discussed include: Analysis of the major global climate changes based on principles of ecosystems ecology; carbon, nutrient, and pollution cycling mechanisms and budgets; the methods used to study these phenomena. Climate change will also be explored in relationship to agro-forestry, tropical diseases, food production, food security, environmental impact of agricultural and industrial systems and how such changes can impact the biological and social underpinnings of conservation.

NRM 306 Forest Ecology and Management 3 credits
This course will cover ecology as applied to the management of natural resource ecosystems including biological diversity and conservation biology in natural resource ecology. Study of plant life histories, populations, communities, and plant animal interactions (pollination, dispersal, herbivory) and evolutionary basis for plant ecological traits will be included. Basic principles of forest, fish, and wildlife management, which are components of the forest ecosystem, will also be covered including history, ecology, economics, and policy. Students will be introduced to the fundamentals of measuring and quantifying natural resources including cruising and scaling timber, quantifying wildlife and fisheries habitat, measuring and estimating forage production for wildlife and livestock, and sampling wildlife populations. The course will also introduce basic statistical concepts and their

applications in resource management. Nomenclature, identification, ranges, and habitats of important native and naturalized trees of Liberia will be examined. Shrubs, vines and Non-Timber Forest Species, important as wildlife food and cover will be discussed.

NRM 401 Urbanization and Sustainable Development 3 credits
This course explores the process of urbanization that is playing a dominant role in the modern world and the impact the changing landscape has on the environment and sustainable development. Other aspects of this course will include (i) advantages, challenges and opportunities of urbanization; (ii) the link between urbanization and economic prosperity, social development and environmental sustainability; (iii) Sustainable development, urbanization and the relationship with rural development; (iv) the relationship between society and nature; and (v) plant biology and the preservation and management of trees in urban environments.

NRM 402 Natural Resource Use and Public Policy 3 credits
This course provides an overview to the national rules and regulations governing the use, extraction and commercialization of natural resources of Liberia. The course will compare public policies from other African countries and international treaties.

NRM 403 Regional Development 3 credits
This course introduces students to regional development in several ways: 1) processes within the context of the development of Liberia and West Africa; 2) as a vehicle for constructive change; and 3) as a process with unintended consequences to the natural resources and communities living in the forests. The course will provide an opportunity to foster ideas and discussion about environmental and scientific impacts that are associated with regional development in the context of natural resources. Case studies examining specific regional development initiatives will be examined. Students will be introduced and exposed to the world of the nongovernmental agencies, international donors and others in research, advocacy relative to the protection, preservation and conservation of the natural resources; and to those invested in the commercialization of natural resources for regional development.

NRM 405 Land Rights, Natural Resources, and Benefit Distribution 3 credits
This course considers development, content and implementation of public land and natural resource policies emphasizing forest, range, wildlife, and wild land recreation. It will also review and examine Liberian law that focuses on land rights, inheritance, benefit distribution and natural resources.

NRM 407 Non-Timber Forest Products 3 credits
The forests occupy a massive land mass in Liberia and yet few have studied the non-timber species (flora and fauna) that provide and hold aesthetic, ecological, environmental and economic value. This course will provide an overview and

inventory of Non-Timber Forest Species (NTFS) in Liberia and West Africa. Quantitative analysis and understanding of the ecology, management, and conservation of game and non-game wildlife (terrestrial and aquatic) will be addressed. Population dynamics, harvesting, habitat requirements and fragmentation, conservation genetics, and managing of protected areas all will be explored as case studies focusing on botanicals, spices and medicinal plants from the forests. Using the World Health Organizational Guide to Good Agricultural and Collection Practices, students will be exposed to strategies to sustainably collect and extract high value plant products from the forests while ensuring the protection of the indigenous plant and associated ecosystem. The use of NTFS as a vehicle to provide income generating activities will be explored.

NRM 409 Project Development and Implementation 3 credits

This course will expose students to a series of case studies involving natural resources. Students will learn how to develop and hypothesis, design experiments to test the hypothesis and arrive to valid conclusions and write a report. Students will be introduced and trained in conducting quality and quantitative interviews. Students will be exposed to internal/external sources of funding, and grant writing and application process. Student will learn to a) generate inventory of Liberian plants, develop germplasm banks and vegetative propagate important Liberian plants, and development of mitigation plans.

Minor in Gender, Culture and Agriculture

Mission
CASD is a leader in developing countries that focuses on the important roles, challenges, and opportunities for male and female in agriculture and promotes individuals to actively prepare for degrees and careers in agricultural development in Liberia and elsewhere in Africa.

A minor in Gender, Culture and Agriculture highlights the importance of gender issues in agriculture and the roles of women in agricultural production and food systems.

Objectives:

a) To adequately address the system of gender relations as it pertains to the role, problems, and participation of women in agricultural development;
b) To enhance students' understanding of gender issues as part of the agricultural development process;
c) To teach skills and methodology needed to effectively approach gender problems in agricultural development;
d) To train more women professionals in the field of Agriculture.

To graduate with a minor in Gender, Culture and Agriculture, students are required to take at least 15 credits of approved gender courses. The *Rural Sociology, Gender and Culture*; and *Gender Relations in Extension* courses serve as introductory courses for this minor (and would fulfill 6 credits):
Additional courses can be taken from a selection of approved social science courses in addition to an internship, field experience or a research project specifically focused on women in the final semester.

Choose three (9 credits) of the following approved courses for this minor:

	Course Code	Gender, Culture, and Agriculture	Credit Hours
1	SOC 305	Gender and Society	3
2	SOC 403	Woman and Social Change	3
3	SOC 408	Environmental Justice	3
4	SOC 409	Agroforestry and Gender Politics	3

Minor Course Description - Gender, Culture and Agriculture

SOC 305 Gender and Society 3 credits

The purpose of this course is to prepare students to critically analyze social and cultural practices from a gender perspective and learn how to apply this theoretical framework in different contexts. The course is aimed at improving the professional development of students through the application of gender studies to social concerns in agriculture, nutrition and rural development, as well as, in the diverse fields of social sciences, education, psychology, law and economics.

SOC 403 Woman and Social Change 3 credits

Analysis of the implication of social change for the status of women and an evaluation of the women's movement a force for social change will be major part of this course. A primary focus will be on the Liberian society but within the broader context of the West African region.

SOC 408 Environmental Justice 3 credits

A study of the emergence and development of environmental justice perspectives, analysis and legal processes in land use decision making. This will include interactions between human and the natural environment as well as inequality among different human groups as defined by race, class, and gender. Environmental racism; the environmental justice movement, land tenure system, contemporary ecofeminism, and environmental attitudes, class and gender disparities in health and environmental well-being will be addressed.

SOC 409 Agroforestry and Gender Politics 3 credits

The purpose of this course is to highlight the significance of gender concern and gender imbalances in Agroforestry. In particular, the course will focus on women's involvement in Agroforestry, highlighting their motivations and challenges, relative to men. The aim is to provide students, both male and female with the tools and skills that will assist them in decision-making process, accessing resources equitably and holding positions in the political and economic arena of agroforestry. A critical perspective will be placed on, a) how forested open space is defined, b) who controls the spaces (large scale vs. small scale; international vs. domestic ownership), c) what kinds of crops (export vs. domestic consumption) and non-crop (e.g. watershed management) uses are engaged; d) what is the cultural political economy of land ownership; e) can women own and manage forestry space; and f) can women borrow money to buy land or make improvements, among other topics.

Minor in Plant and Soil Sciences

Mission
The minor in plant and soil sciences provides a background on the production of crops for students in other majors.

Objectives:
1. Introduce principles of plant biology geared towards crop production.
2. Provide an in-depth understanding of crop production including harvesting and post-harvest handling.
3. Present concepts of integrated management of pests.

This minor is introduced by cross cutting courses of *Introduction of Geology and Soil Science* and *Population, Food Security and Sustainable Development that count towards the minor (6 credits)*. To graduate with a minor in Plant and Soil Sciences students are required to choose 3 of the following approved courses (15 credits for the minor):

	Course Code	Plant and Soil Sciences Minor	Credit Hours
1	PSS 202	Principles of Crop Production I	3
2	PSS 301	Principles of Crop Production II	3
3	PSS 304	Fertility Management and Plant Nutrition	3
4	PSS 401	Principles of Pest Management I: Diseases and Weeds	3
5	PSS 402	Principles of Pest Management II: Insects and Vertebrate Pests	3
6	PSS 405	Plant Genetics and Breeding	3

Minor Course Description – Plant and Soil Science

PSS 202 Principles of Crop Production I 3 credits
Students will learn basic anatomical and physiological processes associated with plant growth, development, and reproduction. This course will be foundational in understanding more complicated topics associated with crop production systems. In addition to classification of crops, topics will also include discussions of the role of climate and weather on crop growth and development and approaches to minimizing and avoiding crop stress.

PSS 301 Principles of Crop Production II 3 credits

Students will learn basic practices associated with establishment, protection, maintenance, and harvest of major crops grown in Liberia including rice, rubber, maize, cassava, and other staple and cash crops vital to the Liberian economy. General principles of harvesting, post-harvest handling, marketing and storage of crop plants will be discussed.

PSS 304 Fertility Management and Plant Nutrition 3 credits

Improving soil fertility and understanding the relationship of soil fertility with crop growth and development are essential in optimizing crop yield and protecting soil resources. Students will learn essential elements and interactions of these elements and how they influence yield. Students will also learn how to calculate rates for soil amendments and the potential impact of fertility practices on the environment. This course will expose students to deficiency symptoms observed in key crops grown in Liberian and methods to correct nutrient deficiencies observed in these crops.

PSS 401 Principles of Pest Management I: Diseases and Weeds 3 credits

Disease and weeds can reduce yield and quality dramatically in all crop production systems. Managing these pests requires an understanding of interactions of pests with crop production systems. Students will learn key elements in pest management including identification of weeds and diseases, recognizing relationships between pest damage, pest populations, and yield and quality loss assessments; fundamental concepts associated with the biology and development of pests; and development and implementation of approaches and techniques designed to avoid or suppress pests and their impact on crop production.

PSS 405 Plant Genetics and Breeding 3 credits

Incorporation of improved genetics is essential in increasing crop yield and efficiency of production either through the inherent ability of crops or through ability to resist biotic and abiotic stress. Students will learn the role of crop improvement through cultivar and hybrid development and methodologies designed to determine performance of promising plant material of major crops in Liberia. Students will be exposed to the techniques and issues associated with genetically modified (GM) crops in the context of agriculture in Liberia. Students will also be introduced to the importance of germplasm collection, maintenance and evaluation and the ways in which varieties and advanced genetic lines are comparatively evaluated for possible introduction and commercialization.

PSS 402 Principles of Pest Management II: Insects and Vertebrate Pests 3 credits

Insects and vertebrate pests such as rodents and birds can reduce yield and quality dramatically in all crop production systems. Managing these pests requires an understanding of interactions of pests with crop production systems. Students will learn key elements in pest management including identification of insects and nematodes, recognizing relationships between pest damage, pest populations, and yield and quality loss assessments; fundamental concepts associated with the biology and development of pests; and development and implementation of

approaches and techniques designed to avoid or suppress pests and their impact on crop production.

Minor in Natural Resources Management

Mission
The minor in Natural Resource Management provides students with current knowledge of the challenges facing Liberia's natural resources and opportunities for sustainable development for students in other majors.

Objectives:
1. Introduce urbanization issues on the socioeconomic and environmental development of Liberia;
2. Provide students with knowledge of current issues of land rights;
3. Build students' capacity to comprehend the complexity of forest ecology and its application to environmental management.

This minor is introduced by *Introduction to Agriculture and Natural Resource Management* and *Population Food Security and Sustainable Development* in the CASD general course listing (6 credits used toward the minor).

To graduate with a minor in Natural Resource Management students are required to choose additional 3 courses (9 credits, 15 credits for the completion of the minor) of approved courses:

	Course Code	Natural Resources Management	Credit Hours
1	NRM 306	Forest Ecology and Management	3
2	NRM 401	Urbanization and Sustainable Development	3
3	NRM 405	Land Rights, Natural Resources and Benefit Distribution	3
4	NRM 407	Non-Timber Forest Products (NTFPs)	3

Minor Course Description – Natural Resources Management

NRM 306 Forest Ecology and Management 3 credits
This course will cover ecology as applied to the management of natural resource ecosystems including biological diversity and conservation biology in natural resource ecology. Study of plant life histories, populations, communities, and plant animal interactions (pollination, dispersal, herbivory) and evolutionary basis for plant ecological traits will be included. Basic principles of forest, fish, and wildlife management, which are components of the forest ecosystem, will also be covered

including history, ecology, economics, and policy. Students will be introduced to the fundamentals of measuring and quantifying natural resources including cruising and scaling timber, quantifying wildlife and fisheries habitat, measuring and estimating forage production for wildlife and livestock, and sampling wildlife populations. The course will also introduce basic statistical concepts and their applications in resource management. Nomenclature, identification, ranges, and habitats of important native and naturalized trees of Liberia will be examined. Shrubs, vines and Non-Timber Forest Species, important as wildlife food and cover will be discussed.

NRM 401 Urbanization and Sustainable Development 3 credits

This course explores the process of urbanization that is playing a dominant role in the modern world and the impact the changing landscape has on the environment and sustainable development. Other aspects of this course will include (i) advantages, challenges and opportunities of urbanization; (ii) the link between urbanization and economic prosperity, social development and environmental sustainability; (iii) Sustainable development, urbanization and the relationship with rural development; (iv) the relationship between society and nature; and (v) plant biology and the preservation and management of trees in urban environments.

NRM 405 Land Rights, Natural Resources, and Benefit Distribution 3 credits

This course considers development, content and implementation of public land and natural resource policies emphasizing forest, range, wildlife, and wild land recreation. It will also review and examine Liberian law that focuses on land rights, inheritance, benefit distribution and natural resources.

NRM 407 Non-Timber Forest Products 3 credits

The forests occupy a massive land mass in Liberia and yet few have studied the non-timber species (flora and fauna) that provide and hold aesthetic, ecological, environmental and economic value. This course will provide an overview and inventory of Non-Timber Forest Species (NTFS) in Liberia and West Africa. Quantitative analysis and understanding of the ecology, management, and conservation of game and non-game wildlife (terrestrial and aquatic) will be addressed. Population dynamics, harvesting, habitat requirements and fragmentation, conservation genetics, and managing of protected areas all will be explored as case studies focusing on botanicals, spices and medicinal plants from the forests. Using the World Health Organizational Guide to Good Agricultural and Collection Practices, students will be exposed to strategies to sustainably collect and extract high value plant products from the forests while ensuring the protection of the indigenous plant and associated ecosystem. The use of NTFS as a vehicle to provide income generating activities will be explored.

Minor in Animal Science and Health

Mission
The minor in Animal Science and Health provides a background for students in other majors at CASD to develop a background in animal production, reproduction, nutrition, and other subjects.

Objectives:
1. Introduce animal production systems and their end products and how they contribute to the development of a sound agricultural economy.
2. Define relationships between animal health and its impact on both animal productivity and human health.
3. Describe fundamental concepts of nutrition, growth and reproduction that support successful animal production operations.

This minor is introduced by the cross cutting courses: *Introduction to Agriculture and Natural Resource Management* and *Population Food Security and Sustainable Development.* (6 credits used toward the minor).
To graduate with a minor in Animal Science and Health students are required to choose additional 3 courses (9 credits, 15 credits for the completion of the minor) of approved courses:

	Course Code	Animal Science and Health	Credit Hours
1	ASH 201	Introduction to Animal Production and Health	3
2	ASH 202	Animal Anatomy and Physiology	3
3	ASH 204	Animal Nutrition and Growth	3
4	ASH 303	Animal Reproduction and Lactation	3
5	ASH 403	Animal Products and Technology	3

Minor Course Description – Animal Science and Health

ASH 201 Introduction to Animal Production and Health 3 credits
This is an Animal Science foundational course providing an introduction to diversity of livestock and fish and their uses, animal behavior, basic animal production systems, introductory concepts in animal health and disease, and an introduction to animal products and processing.

ASH 202 Animal Anatomy and Physiology 3 credits
This course provides fundamental concepts of anatomy and physiology of livestock, poultry and fish. This course is necessary for understanding the organization and

functions of the animal body systems and their impact on animal productivity, health and well-being to maximize its productivity while also maintaining environmentally sound production practices.

ASH 204 Animal Nutrition and Growth 3 credits

Basic concepts in nutrition of livestock, poultry and fish will be discussed in this course. Topics will include anatomy and physiology of the digestive tract, nutrients and their metabolism, digestion, absorption, animal growth and development, introduction to foodstuffs, feeds and feeding, ration formulation and nutrient requirements.

ASH 303 Animal Reproduction and Lactation 3 credits

This course outlines the basic concepts in reproduction of livestock, poultry and fish including endocrine control of reproduction, anatomy and physiology of the male and female reproductive tract, mammary anatomy and physiology, milk and egg production, breeding cycles, seasonality, reproductive management and application of reproductive technologies in the effort to increase animal productivity and ensure food security.

ASH 403 Animal Products and Technology 3 credits

This course focuses on Livestock and carcass evaluation, meat and dairy products processing, egg products, aquaculture products, animal and fish by-products, and value-added product technologies.

Minor in Agricultural Education and Extension

Mission
The Minor in Agricultural Education and Extension (AEE) at CASD in Cuttington University prepares the student for agricultural technology packaging, transfer and adoption in Liberia and elsewhere in Africa for sustainable agricultural development.

Objectives:
1. Impart sound academic instruction and practical skills in agricultural technology packaging and transfer in resource-focused disciplines, especially plant and soil sciences, animal science & health, and natural resource management.
2. Enable equip students to become more proficient in communicating key issues associated with agriculture and agroforestry.
3. Enable students to interact effectively with the community at all social strata and on gender and other sensitive matters.

This minor is introduced to some CASD majors by *Gender Relations in Extension, Extension and Food Safety and Agriculture and Resource Management Extension* courses (6 credits counting towards the minor). In addition, all CASD students are required to take Information Use and Technology.

To graduate with a minor in Agricultural Education and Extension, students are required to choose additional 3 or more courses (15 credits for the minor) of approved courses or other classes in service learning, communication, sociology and/or psychology offered in another college at CU, subject to pre-approval by the Dean of the CASD.

	Course Code	Agricultural Education and Extension	Credit Hours
1	AEE 301	Educational Psychology and Extension	3
2	AEE 303	Extension Methods	3
3	AEE 402	Public Policy and Agricultural Extension	3
4	AEE 404	Leadership Impact in Agricultural Extension	3

Minor Course description – Agricultural Education and Extension

AEE 301 Educational Psychology and Extension 3 credits
This course focuses on theories of learning, development and motivation applied to Agricultural Extension and Outreach. It examines theories that explain how the clientele in agriculture adopts new technologies, considering the social, moral, and emotional dimensions. It highlights case studies of socio-economic impact of

successes and failures in agricultural extension. The course also explores methods of identifying how the clientele in agriculture develops and learns; how one clientele is different from every other clientele; and how the theory and practice of extension and outreach come together to inform the delivery of sound agricultural extension and outreach programs. Key subjects: Concepts of psychology; personality development; concept of intelligence; concept of measurement in psychology; extension teaching & learning and motivation; classification and description of extension methods. Agricultural clientele psychology, extension agent-clientele relations, socio-economic barriers to agricultural technology transfer will be included.

AEE 303 Extension Methods 3 credits

This course examines the basic principles of cooperative extension. It defines diffusion and adoption; processes of diffusion and adoption; adopter categories and diffusion curves. It describes the organization of governmental and non-governmental extension services in Liberia; explains the roles and qualities of different categories of extension personnel; compares selected extension methods and techniques. It also deals with the meaning and elements of communication process; methods and strategies in extension; education and entertainment education in social change; extension learning & teaching situations and experiences; preparation and use of communication development models; news gathering techniques; mechanisms and techniques of writing agricultural news for the media; news evaluation and copy editing, organization of twilight, town hall and other community meetings. The course also covers the principles and practices of using audio-visual equipment such as projectors, digital and video cameras; tape recorders, public address system, cartoon and graphics; information and communication technologies. Key subject: Cooperative Extension: Principles and Practices.

AEE 402 Public Policy and Agricultural Extension 3 credits

This is senior level course which purpose is to clarify to the student the relationship between public policy and agricultural development and the role of agricultural extension. It discusses government policies that directly or indirectly impact agricultural development in Liberia. Public policy on urban, peri-urban and rural development in relation to agricultural practices will be discussed. The challenges of development in Liberia and how a good agricultural extension program may minimize such challenges are considered. Strategic options for implementing effective agricultural extension methods in a given public policy scenario are explored. Students also debate how to influence public policy for the advancement of effective agricultural extension services in Liberia. Key subjects: Public Policy, Agricultural Development, Cooperative Extension.

AEE 404 Leadership Impact in Agricultural Extension 3 credits

This is a senior level course which focuses on the impact of strong leadership in successful cooperative agricultural extension. It teaches the student the basic principles of effective leadership in cooperative extension, the relationship between

leadership qualities and success in agricultural development at individual, group and community levels. The student is taught how to identify, evaluate and train leaders for agricultural development at the community level; it distinguishes between professional/technical and local leaders, explains the patron-client relationships and value systems. It discusses the principles and procedures for community organizations and types of organizations that advance agricultural development at the community level. As tools for strong leadership, the course teaches the student elements of the planning process, principles and concepts of program planning; steps in planning; concept of monitoring and evaluation; and evaluation approaches. As additional tools for strong leadership qualities, the course also teaches the concept, theories, principles and guidelines of administration; organization and supervision of agricultural extension services in Liberia; staff recruitment, selection, placement and supervision; and assessment of extension work accomplishments. Key subjects: Leadership Qualities, Organizational Ability, Community Knowledge, Effective Planning, Administration.

Minor in Agribusiness

Mission
This minor empowers students to be effective in the use of economic and marketing principles to support the development of various agricultural enterprises and to provide avenues for new opportunities to enhance profitability.

Objectives:

1. Impart education to young men/women for taking up the responsibilities for managing any form of organization & other agro based income generating and development activities.
2. Create knowledge through research relevant to management discipline and to disseminate such knowledge through publications.
3. Contribute to the formulation of public policy.

This minor is introduced by the courses *Agricultural Economics,* and *Agricultural Entrepreneurship and Micro-Franchising* (6 credits counting towards the minor). To graduate with a minor in Agribusiness students are required to choose additional 3 courses (9 credits) (15 credits for the completion of the minor) of approved courses:

	Course Code	Agribusiness	Credit Hours
1	AGB 301	Farm Production and Management	3
2	AGB 303	Agricultural Finance	3
3	AGB 402	Value Chain Analysis in Commercial Agriculture	3
4	AGB 404	Economics of Agricultural Sustainability	3

Minor Course Description – Agribusiness

AGB 301 Farm Production and Management 3 credits
The purpose of this course is to develop an understanding of the various business management decisions involved in the organization and operation of a farm firm for continuous profit and production cost efficiency. Each farm, like any other agribusiness firm, is a complex business. Most farms are organized as sole proprietorships or as family businesses, like many other small businesses, but farmers must understand a broader array of management activities including, managing biological productive processes, evaluating and adopting new technology, devising and carrying out marketing strategies, arranging financing, dealing with personnel, and using communication technology to their advantage. The rapid pace of new institutional developments and of evolving government programs, of changing market environments brought about by more open and competitive

markets, and of new technology place, the modern producer is under constant pressure to adapt and change.

AGB 303 Agricultural Finance 3 credits

The objective of this course is to present principles and procedures in managing financial and credit resources. Financial analysis of agricultural businesses such as liquidity, capital structure, and growth of agricultural firms, risk and return, capital budgeting methods, analysis of land investments, leasing, and costs of credit, financial intermediation and major financial institutions for agriculture, credit scoring, loan pricing, and asset-liability management techniques by financial intermediaries will be covered. Specific learning outcomes for students taking this course include: be able to construct a set of integrated financial statements for an agricultural business, be able to analyze financial condition and performance using financial criteria and measures, be able to evaluate and analyze financial information for management and credit decisions, understand the interrelationship between business and financial risk and demonstrate how risk management tools can be used to manage risk.

AGB 402 Value Chain Analysis in Commercial Agriculture 3 credits

The objective of the course is to make the students understand value chain concepts and competitiveness and be able to assess risks and identify strategic opportunities to strengthen value chains, recognize how cohesive value chains can be used to reduce risks and facilitate access to finance and learn how to apply value chain financial products to meet the needs of various actors in the value chain. The students will learn about the mapping these commodity value chains to demystify and quantify the associated risks and costs. The result of this should facilitate the introduction of focused, viable and sustainable agriculture finance products within institutions that stretch beyond the bounds of production finance.

AGB 404 Economics of Agricultural Sustainability 3 credits

This course introduces students to theories and principles of the economics of sustainability. Primary course objectives are to provide students with basic understanding of the economic theory that can be used in decision making and to provide a good understanding of microeconomic agricultural sustainability issues. Several topics are covered including agricultural intensification, population growth, market efficiency, agricultural policy, trade, and consumer awareness.

Minor in Agricultural Mechanization

Mission
The Minor in Agricultural Mechanization (AM) at CASD in Cuttington University prepares the student for the application of appropriate technologies to production agriculture and postharvest handling to significantly enhance efficiency in small and medium scale agriculture under Liberian conditions.

Objectives:

1. Improve practical skills in the application of small and intermediate technologies to agricultural operations at all stages including postharvest handling.
2. Enhance competence needed to operate and maintain simple and intermediate agricultural machines, tools and implements under Liberian conditions.
3. Train students on the application of critical thinking to solve technical problems in production agriculture and postharvest handling under Liberian conditions.
4. Introduce students to sustainable energy development options (e.g. alternative fuels- solar, wind, methane generation).

This minor is introduced by the courses of *Agricultural Physics and Meteorology,* and *Farm Mechanization and Technology* (6 credits counting towards the minor)*. .*
To graduate with a minor in Agricultural Mechanization students are required to choose additional 3 courses (9 credits) (15 credits for the completion of the minor) of approved courses:

	Course Code	Agricultural Mechanization	Credit Hours
1	AGM 301	Farm Structures and Environmental Control	3
2	AGM 303	Farm Machinery and Power	3
3	AGM 401	Irrigation Technologies	3
4	PSS 407	Postharvest Handling and Processing	3

Minor Course Description – Agricultural Mechanization

AGM 301 Farm Structures and Environmental Control 3 credits
Students will be exposed to environmental and structural requirements of farm structures; planning of plant and livestock houses; water supply and waste disposal (biogas as a means of utilizing waste). Specifications and selection of farm building materials, environmental control for plants and livestock, farm planning and layout, and use of psychrometric charts will be dicussed.

AGM 303 Farm Machinery and Power 3 credits

The objective of this course is to introduce students to farm machinery and power in the animal and plant sciences. Successful implementation of farm mechanization; machinery in crop production, operation, repair and maintenance; and selection of machines and machine systems in conservation agriculture will be discussed. Additional topics will include use and maintenance of horticultural equipment, machinery in the animal sciences; and alternative sources of energy for the farms under Liberian conditions which may include solar, wind, hydroelectric, biomass (biogas) energy systems.

AGM 401 Irrigation Technologies 3 credits

The objective of this course is to highlight the interrelation of irrigation and conservation agriculture, hydrological cycle, soil/plant relationships, infiltration, evapotranspiration, and assessment of irrigation and drainage systems construction and management. A major emphasis of this course will be to preserve soil resources and the environment.

PSS 407 Postharvest Handling and Processing 3 credits

For this course description refer to the department courses.

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