Discipline: Agriculture	Sub-discipline: Sustainable Agriculture
General Course Title: **Introduction to Sustainable Agriculture**	Min. Units: **3 Semester**
	Proposed Suffix:

Course Description:
Introduction to the history, definitions, concepts, principles and practices of sustainable agricultural systems. Includes an examination of case studies to connect sustainable agriculture principles to actual farming practices.

Required Prerequisites or Co-Requisites[1]

Advisories/Recommended Preparation[2]

Course Objectives: *At the conclusion of this course, the student should be able to:*

- Define sustainable agriculture and related terms.
- Discuss the three "E's" of sustainable agriculture and the importance of each.
- Compare and contrast conventional and sustainable agricultural practices.
- Evaluate the role of soil fertility in an ecological production system.
- Discuss the principles and strategies of sustainable agriculture.
- Discuss historical milestones in the development of sustainable agriculture.
- Identify and describe local examples of enterprises using sustainable agricultural practices.
- Evaluate and implement methods to protect and enhance soil productivity.
- Describe the principles and practices used to enhance and maintain biological diversity in an agricultural environment.
- Describe strategies that combine management methods for integrated pest control.
- Discuss key principles and practices related to sustainable livestock production.
- Locate and apply regulations related to organic certification.
- Identify and describe local examples of enterprises engaged in sustainable agriculture production.

Course Content:

1. Introduction
    A. What is Sustainable Agriculture?
        1. Sustainable agriculture is both a philosophy and a system of farming. It has roots in a set of values and goals for the future of agriculture and it involves specific design and management procedures to pursue those goals.
        2. The word "sustain," from the Latin word *sustinere* (*sus*-, from below and *tenere*, to hold), to keep in existence or maintain, implies a long-term perspective.
        3. Sustainability rests upon the foundation that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, stewardship of both natural and *human* resources is of prime importance.
        4. Although the growth in sustainable practices is a recent phenomenon, sustainable farming approaches are certainly not new.

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    B. Other Terms Related to Sustainability
        1. Biodynamic Farming

[1] Prerequisite or co-requisite course need to be validated at the CCC level in accordance with Title 5 regulations; co-requisites for CCCs are the linked courses that must be taken at the same time as the primary or target course.

[2] Advisories or recommended preparation will not require validation but are recommendations to be considered by the student prior to enrolling.

2. Organic Farming
3. Bio-intensive/ French-intensive Farming
4. Permaculture
5. Agroecology
6. Alternative Agriculture
7. Low-till and No-till Farming
8. Regenerative Agriculture
9. Nature Farming
10. Low-input Sustainable Agriculture (LISA)
11. Integrated Pest Management (IPM)
12. Biointensive IPM
13. Holistic Resource Management (HRM)
14. Integrated Farming Systems (IFS)
15. Nonorganic Sustainable Farmers

C. "Sustainable Agriculture" was addressed by Congress in the 1990 Farm Bill as "an integrated system of plant and animal production practices having a site-specific application that will, over the long term:
1. Satisfy human food and fiber needs
2. Enhance environmental quality and the natural resource base upon which the agricultural economy depends
3. Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
4. Sustain economic viability of farm operations
5. Enhance the quality of life for farmers and society as a whole"

D. Common Themes of Sustainable Agriculture
1. Stewardship
2. A systems perspective
3. Interdisciplinary efforts in research & education
4. Making the transition to sustainable agriculture is a process
5. Reaching toward the goal of sustainable agriculture is the responsibility of all participants in the system

E. The Three "E's" of Sustainability
1. Economic viability
2. Environmental health
3. Social equity

F. Modern agriculture in crisis
1. Despite the success of modern agriculture, our system of global food production is in crisis
2. The techniques, innovations, practices, and policies that have allowed increases in productivity have also undermined the basis for that productivity

2. A Comparison of Sustainable and Conventional Agriculture Systems

Introduction to Sustainable Agriculture
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3. Practices of Conventional Agriculture
A. Intensive Tillage
B. Monoculture
C. Water Use
D. Application of Synthetic Fertilizer

E. Chemical Pest Control
F. Genetic Manipulation of Crop Plants
G. Confined Feeding Operations

4. Energy Use in Agriculture
    A. Intensive Tillage
        1. Role of tillage in agricultural systems
            a. Aerate soil
            b. Incorporate amendments
            c. Stimulate mineralization process
            d. Management of weeds
            e. Loosen compacted soils
        2. Soil quality impacts of intensive tillage
            a. Degrades soil physical properties of soils
            b. Reduces organic matter content and related water and nutrient holding capacities of soils
            c. May increase both compaction and rates of erosion
        3. Energy use in mechanical tillage

5. Monoculture
    A. Definition of monoculture production systems
    B. Production advantages of monoculture production systems
    C. Monocultures and susceptibility to pest pressure
    D. Monocultures and pesticide dependence

6. Water Use
    A. Water use in agriculture
    B. Impacts of water diversion
    C. Irrigation and soil salinity
    D. Irrigation efficiency and nutrient loss

7. Application of Synthetic Fertilizers
    A. Synthetic fertilizers and their role in production
    B. Production benefits of synthetic fertilizers
    C. Synthetic fertilizer use trends
    D. Synthetic fertilizers and effects on soil quality
    E. Environmental quality impacts and risks
    F. Human health risks

8. Chemical Pest Control
    A. Function and role of synthetic pesticides
    B. Advantages
    C. Trends / Trends in crop losses
    D. Environmental impacts of
    E. Human health risks of pesticide exposure
    F. Energy use in the production of synthetic pesticides

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9. Genetic Manipulation of Plants / Genetically Engineered Organisms in Agriculture
    A. Definitions of genetic engineering and transgenic organisms
        1. Genetic engineering is the manipulation or alteration of the genetic structure of a single cell or organism
        2. Genetic engineering is a general term referring to any alteration of an organism's genes for practical purposes
        3. Transgenic organisms are organisms into which a new gene has been

introduced or a gene has been disrupted by recombinant DNA methods = GMO "genetically modified organism"

4. Description of technology
5. Potential advantages of GE organisms in agriculture

B. Environmental quality risks
C. Human health risks

10. Confined Feeding Operations
    A. Definition and description of CFO
    B. Advantages of confined animal production systems
    C. Nutrient concentration and pollution
    D. Effects on animal health
    E. Energy and nutrient efficiency

11. Energy Use in Agriculture
    A. Energy use in formation of agricultural inputs
    B. Energy use in tillage and irrigation
    C. Energy use in food processing, packaging, transporting and refrigeration
    D. Environmental impacts of energy use in agriculture

12. Why Conventional Agriculture is Not Sustainable
    A. Soil Degradation
    B. Waste and Overuse of Water
    C. Energy Intensive
    D. Pollution of the Environment
    E. Dependence on External Inputs
    F. Loss of Genetic Diversity
    G. Dependence on External Inputs

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13. Sustainable Agriculture in Historical Perspective
    A. Historical Developments:1980-1990
        1. Many new forms of agriculture were named, defined and advocated
        2. Tumultuous debate occurred between proponents of organic and conventional agriculture
        3. Many resisted or were disenfranchised, and offended with the concept of sustainable agriculture
        4. Not enough "good science" behind it
        5. Fearful that productivity would be compromised
        6. Others dismissed it as a fringe movement
        7. Major conferences began to address why the current agricultural practices were not sustainable and discussed steps that were needed to achieve a more sustainable system
        8. Publications flourished:
            a. Explosion of academic journals signified a key change in the debate about sustainable agriculture, lending it scientific and public credibility
            b. A number of books also appeared during this time period which brought sustainable agriculture into the arena as a serious contender for guiding the future of agriculture, leading to "guides" for teaching sustainable agriculture

i. Sustainable Food Systems
ii. Alternative Agriculture
iii. New Directions for Agriculture
iv. Agroecology

9. The USDA and Congress established the Low Input Sustainable Agriculture Program (LISA)

B. 1990-2000

1. LISA was reauthorized under Congress and the program's name was changed to the Sustainable Agriculture Research and Education Program (SARE), established in 1990
2. Major "information centers" on Sustainable Agriculture were established.
   a. The Alternative Farming Information Center (AFSIC) located within the National Agricultural Library
   b. The Appropriate Technology Transfer for Rural Areas (ATTRA)
3. By the end of the 1990's, a number of state and private universities offered courses and programs in sustainable agriculture (offering bachelor's, master's and doctorate degrees)
4. Gradually, the movement coalesced, with various parties coming together under one "umbrella," sustainable agriculture.
5. The term sustainable agriculture has finally become accepted (nationwide and globally)

C. Evolution of national standards -- 2000 to present

1. NOP definition of "organic production
2. National Organic Standards Board (NOSB)
3. NOSB principles of organic production

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14. Elements of Sustainable Agriculture
    A. Soil health
    B. Biological diversity
    C. Integrated Pest Management (IPM)
    D. Efficient use of inputs
    E. Water conservation and protection
    F. Protection of natural systems
    G. Sustainable livestock production practices
    H. Quality of life for individuals and communities
    I. Economic Viability

15. The Road to Sustainability
    A. The concept of sustainability stands as an *ideal* or a goal, since achieving all of these dimensions can be challenging
    B. The *principles* of sustainable agriculture are put into practice through many specific strategies

16. Sustainable Agriculture Practices
    A. Soil Fertility & Nutrient Cycling
       1. "Healthy" soil is a key component of sustainability
       2. Soil is viewed as a "living" medium
       3. Methods to protect and enhance soil productivity:
          a. Regular soil testing and analysis
          b. Cover Crops
          c. Compost and/or manures

d. Reduced tillage
e. Avoid traffic on wet soils
f. Regular additions of organic matter

Soil Fertility & Nutrient Cycling (PPt units *Soil Sustainability; Cover Crops; Extended Crop Rotations for Organic Systems*)

B. Enhancing & Maintaining Biological Diversity
1. Diversified farms are more economically and ecologically resilient
2. Benefits of cover crops
a. Intercropping
b. Maintaining habitat strips and hedgerows
c. Enhancing soil microbiology
d. Optimum diversity can be obtained by integrating both crops and livestock in the same operation
e. Wildlife habitat conservation

Enhancing & Maintaining Biological Diversity (PPt units *Genetic Diversity in Agriculture; Hedgerows; Hedgerows for California Agriculture; Farmscaping with Native Plants*)

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C. Integrated Pest Management (IPM)
1. Pest problems are complex and ecological in nature
2. Develop broad-based strategies that combine management methods:
a. Preventive Measures
b. Cultural
c. Biological
d. Mechanical / Physical
e. Chemical

Integrated Pest Management (IPM) (PPt unit *Basic Integrated Pest Management Concepts*)

D. Efficient Use of Inputs (PPt unit, *Energy Inputs in Agriculture*)
E. Water Management
F. Conservation of Natural Resources
G. Sustainable Livestock Production
(PPt units *Fostering Organic Livestock Production; Organic Poultry Certification; Sustainable Practices in Animal Production; Pasture Ecology; Grazing Management Principles; Grazing Behavior and Species Integration in Grazing Systems; Understanding Plant Growth: Implications for Grazing/Harvesting Management*)

17. Organic Certification
A. CCOF
B. Organic market in California
C. Certifier's role
D. Certification process overview
E. Documentation tips
G. Benefits and resources
Organic Certification (PPt unit *CCOF Organic Certification*)

18. Case Studies: A National Perspective

A. Your county (fill in the blanks)
B. Sonoma County
    1. Fruits & Veggies:
        a. Canvas Ranch
        b. Carstensen Farms
        c. Dry Creek Peach & Produce
        d. Gabriel Farm
        e. Grossi Farms
        f. Imwalle Gardens
        g. Flying Frog Farm
        h. Quetzal Farm
        i. Laguna Farm
        j. McEvoy Ranch
        k. Middleton Farm
        l. OAEC
        m. Oak Hill Farm
        n. Oh! Tommy Boy's Organic Farm
        o. SRJC Shone Farm
        p. Tierra Vegetables

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    2. Flowers – Herbs – Nurseries
        a. Bloomfield Bees & Bouquets
        b. California Flora Nursery
        c. Devoto Gardens
        d. Oak Hill Farm
        e. Solum & Herbe
        f. Sonoma County Herb Exchange

    3. Livestock: Poultry – Meat – Dairy
        a. Bodega Goat Products
        b. Clover-Stornetta Dairy
        c. Just A few Chickens Ranch
        d. Indian Maiden Ranch
        e. Joe Matos Cheese
        f. Redwood Hill Farm
        g. Spring Hill Jersey Cheese
        h. Straus Family Creamery
        i. Willie Bird Turkey
    4. Animals
        a. Canvas Ranch
        b. Stone Horse
    5. Local Farmer's Markets:
        a. Cotati
        b. Healdsburg
        c. San Rafael (Marin County)
        d. Santa Rosa:
            i. Certified Farmer's Market
            ii. Downtown Market
        e. Sebastopol
        f. Sonoma Valley
        g. Windsor
    6. Local CSAs:

7. Local Sustainable Wineries:
    a. Benziger Family Winery
    b. Coturri Winery
    c. Everett Ridge
    d. Matanzas Creek Winery
    e. Porter Creek Vineyards
    f. Preston Vineyard
    g. Davis Bynum
    h. Topolos
    i. Fetzer
    j. Frog's Leap Winery
    k. Robert Sinskey Vineyard
8. Local Farm & Garden Suppliers:
    a. Bassignani Nursery
    b. Grab N' Grow Soil Products
    c. Harmony Farm Supply & Nursery
    d. Moonridge Worm Farm
    e. Sonoma Compost
    f. Sonoma Valley Worm Farm

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9. Local Non-Profits:
    a. CAFF: Community Alliance with Family Farmers. www.caff.org
    b. California Farm Link www.californifarmlink.org
    c. CCOF: California Certifies Organic Farmers www.ccof.org
    d. Farm Trails www.farmtrails.org
    e. Sonoma County Ag Preservation & Open Space District www.sonoma-county.org/opensp
    f. Sonoma County Farm Bureau www.sonomacountyfarmbureau.com
    g. SCGGA: Sonoma County Grape Grower's Association

19. Concluding Remarks
    A. People may still disagree on the specific words to define it, but there is a growing agreement that sustainable agriculture is a successful system capable of meeting the needs of the present while creating equal or better opportunity for the future.
    B. To work, the definition needs to encourage participation across the farming spectrum--with the organic farmer at one end and the conventional farmer who is adopting more sustainable methods of production at the other end of the spectrum
    C. Reaching the goal of agricultural sustainability is not an easy process, but each small step will bring our society further along the continuum. We have to remember that it is not just the farmer's responsibility, but everyone's.
    D. What part will you play?

Laboratory Activities: Individual Laboratory Activities are designed to support course objectives.

Methods of Evaluation: Lecture	Methods of Evaluation: Laboratory
Comprehensive Quizzes and Exams	Laboratory Skill Validation by Observation
Written Critical Thinking Scenarios	Laboratory Projects and Reports
Problem Analysis and Solution	Laboratory Research Projects and Reports
Research and Term Papers	Laboratory Skill Practicum Exams

Typical Textbooks, Manuals, or Other Support Materials

Ecological Principles in Agriculture. Powers, Laura E. and McSorely, Robert. Delmar, 2000.

Agroecology: Ecological Processes in Sustainable Agriculture.

	Gliessman, Stephen R. Sleeping Bear Press, 1998. Gaia's Garden: A Guide to Home-Scale Permaculture. Hemenway, Toby. Chelsea Green Publishing Co., 2000.
Statewide Articulation: Transfers as lower division elective	
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