AGRI 0264 - FOREST HEALTH AND PROTECTION

Catalog Description

Advisory: Completion of AGRI 0260 with grade of "C" or better
Hours: 90 (36 lecture, 54 laboratory)
Description: Biotic and abiotic disturbance agents. Identification and ecology of important forest insects and diseases of North America. Predisposing factors that increase susceptibility of forests. Management strategies to reduce impacts. (CSU)

Course Student Learning Outcomes

- CSLO #1: Analyze the roles that stresses and disturbances play in shaping forest ecosystem dynamics and evaluate how disturbance regimes influence forest structure, composition, resilience, and successional trajectories across temporal and spatial scales.\\n
- CSLO #2: Construct differential diagnoses for forest health problems by systematically analyzing signs and symptoms, distinguishing between abiotic and biotic damage agents, evaluating diagnostic evidence quality, and creating investigation protocols to confirm or refute diagnostic hypotheses when faced with ambiguous situations.
- CSLO #3: Design and conduct systematic forest health assessments appropriate to different spatial scales (individual tree, stand, landscape) and management objectives, analyze collected data to identify patterns and relationships between causal factors and health problems, and evaluate the strengths and limitations of various assessment methodologies.
- CSLO #4: Evaluate diverse forest management strategies for reducing impacts of stresses and disturbances by analyzing their ecological effectiveness, economic feasibility, and social acceptability, and create integrated management plans that prioritize actions, incorporate adaptive management principles, and explicitly address uncertainty and competing objectives.\\n

Effective Term

Fall 2026

Course Type

Credit - Degree-applicable

Contact Hours

90

Outside of Class Hours

72

Total Student Learning Hours

162

Course Objectives

Lecture Objectives

1. Define and evaluate forest health from ecological, economic, and social perspectives.
2. Understand forests as dynamic ecosystems shaped by interactions among biotic and abiotic factors.
3. Recognize indicators of forest health and stress, including physical, physiological, and ecological signs.
4. Differentiate between biotic and abiotic stressors and explain their combined effects on forest ecosystems.
5. Apply critical thinking and diagnostic frameworks (e.g., disease triangle; predisposing, inciting, contributing factors) to assess forest conditions.
6. Explain the ecological roles and management implications of major disturbance agents, including:
    a. Wind – types of wind damage, predisposing factors, and ecological significance.
    b. Drought – physiological responses, symptoms, and interactions with other stressors.
    c. Air pollutants – effects on forest function and interactions with climate and drought.
7. Understand the biology and ecology of key forest pathogens and parasites, including:
    a. Root diseases (Armillaria, Heterobasidion, Phellinus): spread, symptoms, and management.
    b. Stem decay fungi: ecological roles, hazard assessment, and management considerations.
    c. Phytophthora species (e.g., *P. ramorum*): invasion biology, symptoms, and regulatory approaches.
    d. Mistletoes and rust fungi: life cycles, ecological functions, and control strategies.
8. Understand the biology and ecology of major forest insects, including:
    a. Bark beetles – life cycles, outbreak dynamics, and management strategies.
    b. Defoliators – outbreak cycles, natural controls, and ecological roles.
    c. Wood-boring insects and ambrosia beetles – symbioses, damage types, and invasive species risks.
9. Identify and interpret signs of canker diseases and animal damage, distinguishing them from similar abiotic injury.
10. Evaluate forest management strategies for pest, disease, and disturbance mitigation, considering ecological trade-offs.
11. Apply integrated forest health management principles that balance ecological understanding with practical outcomes.
12. Understand and use adaptive management frameworks to address forest health under uncertainty.
13. Incorporate climate change into forest health assessment and planning, anticipating future stressors and shifts.
14. Synthesize ecological knowledge across topics to interpret forest health patterns and processes holistically.
15. Apply critical thinking to novel forest health scenarios and emerging issues such as invasive species and altered fire regimes.
16. Reflect on the complexity of forest health management, recognizing uncertainty, interdependence, and the need for long-term thinking.

Laboratory Objectives

1. Conduct systematic forest health and crown condition assessments using standardized rating scales.

2. Distinguish between symptoms of abiotic stressors such as wind damage, drought, and air pollution.
3. Apply the disease triangle concept to diagnose both biotic and abiotic forest stress scenarios.
4. Document field observations accurately using proper terminology, photographic techniques, and mapping.
5. Evaluate site and stand factors that predispose trees to abiotic and biotic damage.
6. Create risk assessment matrices for wind vulnerability and other forest stressors.
7. Construct disease triangles and diagram disease cycles for specific pathogens, including infection, colonization, and dispersal phases.
8. Identify fungal structures (hyphae, spores, fruiting bodies) using microscopy and distinguish among pathogen types.
9. Recognize the difference between signs (pathogen presence) and symptoms (host response).
10. Evaluate how environmental factors influence disease development and severity.
11. Identify above-ground symptoms of root diseases and safely excavate and examine roots for diagnostic features.
12. Distinguish among root pathogens such as *Armillaria*, *Heterobasidion*, and *Phellinus*, and map disease centers and expansion patterns.
13. Evaluate disease severity, predict future spread, and design sampling strategies to confirm diagnoses.
14. Identify common wood decay fungi, assess extent of decay, evaluate structural integrity, and apply hazard tree risk rating protocols.
15. Distinguish between heart rot and sapwood decay and make management recommendations based on risk assessments.
16. Recognize symptoms of sudden oak death and other regulated pathogens, properly collect samples, and apply quarantine and regulatory concepts.
17. Identify common foliar diseases, distinguish among biotic, abiotic, and insect-caused damage, and prepare samples for microscopic examination and testing.
18. Identify major defoliating insects, distinguish complete vs. partial defoliation, assess severity, recognize natural enemies, and determine when intervention is warranted.
19. Apply integrated pest management principles to defoliator and other insect-related problems.
20. Conduct comprehensive forest health surveys documenting multiple concurrent health issues.
21. Analyze interactions among multiple stressors, pathogens, and ecological factors.
22. Prioritize forest health problems based on severity, impact, and manageability.
23. Develop integrated management recommendations and plans addressing multiple objectives.
24. Evaluate multiple management strategies and justify decisions using evidence-based reasoning.
25. Develop monitoring protocols for evaluating outcomes and adaptive management frameworks with decision triggers.
26. Communicate findings, trade-offs, and uncertainties effectively to technical and non-technical audiences.

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Natural Sciences
  - AA/AS - Natural Sciences Laboratory
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: Students analyze a forest experiencing decline using the disease triangle framework to identify host, environmental, and pathogen factors. They will evaluate which factors are predisposing, inciting, or contributing to the problem and determine what additional information is needed for a definitive diagnosis. Findings will be discussed collaboratively in class. Evaluation will be based on the accuracy and depth of analysis, application of the disease triangle concepts, clarity of reasoning, and engagement in class discussion. Objectives: 1, 2, 3, 5, 10, 11, 12, 15, 16
- Problem Solving Examinations
  - Example: Students will develop a 20-year forest health management plan for a 500-acre forest presented as case study that includes a concise assessment of conditions, prioritized actions, specific prescriptions by management unit, a phased timeline and budget, monitoring protocols, and adaptive-management triggers — plus a critical analysis of uncertainties and assumptions. Evaluation will be based on clear, evidence-based reasoning and feasible solutions with emphasis on thoughtful justification and transparency about trade-offs. Objectives: 1, 2, 5, 10, 15, 16
- Projects
  - Example: Students will create a presentation (with narration or speaker notes) that applies critical thinking frameworks to real-world challenges in forest health management. Using examples from the course, they will discuss how professionals navigate incomplete science, stakeholder conflicts, and ecological uncertainty, and reflect on how their understanding has evolved. Evaluation will be based on depth of content understanding, quality of critical thinking and examples, clarity of presentation, and insightfulness of reflection. Objectives: 1, 2, 11, 12, 14, 16
- Reports
  - Example: Using the disease triangle (host-pathogen-environment), students will analyze a forest showing signs of disease, identify potential pathogens, assess contributing environmental and host factors, and propose reasoned management or monitoring approaches. The exam emphasizes integrated reasoning, application of core concepts, and evaluation of uncertainty in real-world forest management scenarios. Evaluation will focus on the accuracy and depth of analysis, clarity of reasoning, correct application of the disease triangle, and the ability to synthesize ecological, social, and economic considerations into practical, well-justified recommendations. Objectives: 1, 2, 4, 5, 10, 11, 16

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. Instructor will demonstrate the use of a soil classification triangle to determine soil texture. Students will then prepare a soil sample and then demonstrate the use of a soil classification triangle. Performance will be evaluated based on the proper calculations of percentage of sand, silt and clay in their samples.

Lecture:

1. Instructor will present in lecture format various management techniques and their relation to soil conservation. Students will then work collaboratively, in small groups, analyzing case studies highlighting management practices and discuss options for agriculture producers featured in these case studies to increase the sustainability of soils by relating management practices to the lecture. Groups will report out summaries of their individual case studies and their recommendations.

Distance Learning

1. Instructor presents a lecture via the learning management system explaining structure and characteristics of the major classes of soil organisms essential maintaining soil quality and fertility. The lecture format includes transcript or closed captions, audio, and video information. Students complete an electronic version of a concept map or a summary table assessing the key components of the topic presented.

Typical Out of Class Assignments Reading Assignments

Students will read and annotate peer reviewed journal articles on forest health such as: Stephens, S.L., et al. (2018). "Drought, tree mortality, and wildfire in forests adapted to frequent fire." BioScience, 68(2), 77-88. Students will submit a reflection paper relating course materials and concepts to the research findings in the journal article. Objectives: 1, 2, 4, 5, 6, 13

Writing, Problem Solving or Performance

After reading and annotating peer reviewed papers on forest health students will write a concise reflection connecting the research findings from the assigned journal article to key course concepts in forest health. The paper should demonstrate critical engagement, discussing how the study reinforces, challenges, or expands their understanding of forest health, ecosystem dynamics, disturbance ecology, or management practices. Evaluation will emphasize insightful connections, depth of reasoning, and clarity of expression, rather than summary alone. Objectives: 1, 2, 5, 14, 15, 16

Other (Term projects, research papers, portfolios, etc.)

Students will select a forest they are familiar with and apply one conceptual framework from the course to analyze its conditions, management challenges, or ecological processes. The paper should include a description of the forest, a summary of the chosen framework, and an application of the framework to interpret patterns or relationships in the forest. Students will also reflect on the strengths and limitations of the framework and consider alternative perspectives. Evaluation will focus on the clarity of forest description, understanding and application of the framework, depth of reflection, and organization and professionalism of the writing. Objectives: 1, 2, 5, 14, 15

Required Materials

- Forest Microbiology
  - Author: Fred O. Asiegbu and Andriy Kovalchuk
  - Publisher: Academic Press
  - Publication Date: 2022
  - Text Edition: 3
  - Classic Textbook?: Yes
  - OER Link:
  - OER: https://www.sciencedirect.com/science/article/abs/pii/B9780443186943000079
- Plant Pathology and Plant Diseases
  - Author: Julie Urquhart, Mariella Marzano, and Clive Potter
  - Publisher: CABI Digital Library
  - Publication Date: 2020
  - Text Edition: 1
  - Classic Textbook?: Yes
  - OER Link:
  - OER:
- Forest Entomology and Pathology: Volume 1: Entomology
  - Author: Jeremy D. Allison (Editor), Timothy D. Paine (Editor), Bernard Slippers (Editor), Michael J. Wingfield (Editor)
  - Publisher: Springer
  - Publication Date: 2023
  - Text Edition: 1
  - Classic Textbook?: Yes
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.