TN Department of Education | College, Career and Technical Education

Conservation Strategies

Primary Career Cluster:	Energy and Sustainable Resources
Course Contact:	CTE.Standards@tn.gov
Course Code:	C33H16
Recommended Prerequisite:	Introduction to Ecology and Conservation
Credit:	1
Grade Level:	10
Elective Focus-Graduation Requirement:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Ecological Research and Conservation courses.
Program Of Study (POS) Concentrator:	This course satisfies one out of two required courses to meet the Perkins V concentrator definition when taken in sequence in an approved program of study.
Program of Study Sequence:	This is the second course in the *Ecological Research and Conservation* program of study.
Aligned Student Organization:	Skills USA: http://www.skillsusatn.org/
Coordinating Work-Based Learning (WBL):	Teachers who hold an active WBL certificate may offer placement for credit when the requirements of the state board's WBL Framework and the Department's WBL Policy Guide are met. For information, visit https://www.tn.gov/education/educators/career-and-technical-education/work-based-learning.html.
Tennessee Promoted Student Industry Credentials:	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit https://www.tn.gov/education/educators/career-and-technical-education/student-industry-certification.html.
Teacher Endorsement(s):	014, 015, 016, 017, 048, 081, 126, 127, 128, 129, 150, 210, 211, 212, 414, 415, 416, 417, 418, 448, 926, 927, 928, 929, 950
Required Teacher Certifications:	None
Required Teacher Training:	None
Teacher Resources:	Best for All Central: https://bestforall.tnedu.gov/

Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st-century skills necessary to be successful in careers and life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards that feed into intentionally designed programs of study.

Students engage in industry-relevant content through general education integration and experiences such as career & technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry-standard content and technology, solve industry-based problems, meaningfully interact with industry professionals, and use/produce industry-specific, informational texts.

Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course; note this is not an exhaustive list.

- Participate in the CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry-specific skills that involve teamwork and project management.
- Participate in contests highlighting job demonstration, interviewing skills, community service activities, extemporaneous speaking, and job interviews.
- Participate in leadership activities such as the National Leadership and Skills Conference, National Week of Service, and 21st Century Skills.

Using Work-Based Learning (WBL) in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1-2.7**| Invite a guest speaker to discuss conservation biology and human impacts on ecosystems and the environment.
- **Standards 3.1-4.3** | Invite an industry partner to discuss the roles of habitat conservation, restoration, and protected areas and management.
- **Standards 5.1-6.5**| Take an in-person or virtual field trip to observe conservation practices.

Course Description

Conservation Strategies is the second course in the Ecological Research and Conservation program of study. This course delves into various conservation strategies and practices, emphasizing practical applications in local ecosystems.

Course Standards

1. Conservation Biology

1.1 Principles of Conservation Biology: Critically analyze the **evolution of conservation biology**, integrating key theoretical frameworks and models that emphasize the protection of biodiversity, ecosystem function, and ecological resilience, specifically in Tennessee's unique landscapes. Evaluate the **role of conservation biology** in preventing species extinction and fostering ecosystem services in the face of anthropogenic pressures such as deforestation and invasive species.

1.2 Principles of Population Ecology: Synthesize **advanced population ecology concepts**, such as metapopulation dynamics, density-dependent regulations, and the impacts of genetic drift on conservation efforts. Analyze the **role of these principles in managing vulnerable species**. Construct an explanation of the **principles of population ecology** and its relevance to conservation.

1.3 Leaders of Conservation: Research the **leaders of conservation**, such as John Muir, Theodore Roosevelt, Gifford Pinchot, and Aldo Leopold, and how they impacted conservation efforts.

1.4 Modern Conservationists: Examine the multifaceted roles of **modern conservationists** in Tennessee, encompassing ecological research, policy advocacy, species monitoring, management, and habitat protection. Evaluate and outline the integration of scientific research with community engagement and policy frameworks, such as Tennessee's biodiversity action plans, to achieve effective conservation outcomes.

2. Human and Environmental Impacts

2.1 Human Impacts: Examine how local and regional impacts of **human activities affect ecosystems and biodiversity**, including how activities disrupt ecosystems and biodiversity.

a. Land Use Changes
b. Overfishing and Overhunting
c. Urbanization and Climate Patterns
d. Management
e. Protection and Preservation
f. Recreation

2.2 Ecological Theory: **Apply ecological theory**, including concepts such as ecosystem services, niche theory, and trophic cascades, to address pressing local and global environmental challenges. Evaluate **how ecological theory informs policy, conservation, and management solutions**.

2.3 Threats to Biodiversity: Discuss the **causes and consequences of threats to biodiversity**, such as pollution (primary and secondary), habitat fragmentation, loss of biodiversity in relation to biogeography theory, destruction, invasive species, and environmental change (natural and anthropogenic). Explain the immediate and long-term effects.

2.4 Mitigation and Management Strategies: Develop and explain evidence-based **strategies** to mitigate the adverse effects of human activities on ecosystems. **Propose integrated conservation solutions** that address habitat degradation, invasive species, and water pollution, while emphasizing sustainable practices.

2.5 Ecosystem Health Assessment: Design and implement an **ecological health assessment of a Tennessee ecosystem** to determine if the ecosystem is threatened by insects, diseases, etc. Analyze the ecological integrity of these ecosystems through field surveys, considering factors such as invasive species, diseases, and anthropogenic impacts, and propose targeted management interventions.

2.6 Non-native Species Management: Research **non-native species and analyze the effects of non-native species on the environment and native species**. Develop a comprehensive management plan that utilizes both biological control and habitat restoration techniques to mitigate their effects.

2.7 Environmental Change and Its Impact: Critically analyze the **impacts of environmental change on ecosystems**, with a focus on how shifts in climate, carbon cycles, and greenhouse gas emissions affect species distribution and ecosystem function. Debate the relative contributions of local versus global environmental changes and propose strategies for mitigation.

3. Habitat Conservation and Restoration

3.1 Habitat Conservation, Preservation, and Restoration: Distinguish between the principles and goals of **conservation, preservation, and ecological restoration**. Explore the role of habitat conservation in preventing ecosystem degradation and the use of restoration and preservation techniques to rebuild degraded ecosystems.

3.2 Restoration Techniques: Analyze **local restoration techniques** and explain how restoring native species, plant communities, and habitat structures can re-establish ecosystem functions and **improve resilience** to stressors such as environmental changes and invasive species.

4. Protected Areas and Management

4.1 Role of Protected Areas: Identify the **various types of protected areas** (e.g., park systems, forests, wilderness; and explain the role of protected areas in conservation. Assess the ecological, social, and economic importance of protected areas in Tennessee, such as the Great Smoky Mountains National Park, and evaluate their role in conserving biodiversity, supporting a sustainable environment, etc. Discuss challenges in balancing conservation with economic development.

4.2 Establishing and Managing Protected Areas: Research and explain the legal, political, and scientific **processes involved in establishing protected areas,** from initial site selection and planning to long-term management.

4.3 Categories of Protected Areas: Explain the **different categories of protected areas** (e.g., national parks, wildlife reserves, marine protected areas) and discuss their specific conservation objectives, management goals, and challenges.

4.4 Designing Protected Areas: Identify **key criteria and principles for designing protected areas**, incorporating ecological principles (e.g., habitat connectivity), socio-economic considerations (e.g., local community involvement), and sustainability goals. Formulate an explanation outlining the key principles.

4.5 Management Strategies: Explain the **different management strategies for protected areas** and the **global importance of protected areas** in mitigating habitat loss, management and control of invasive species, and environmental change. Examine the role of adaptive management in responding to emerging threats, such as climate change or disease outbreaks.

4.6 Adaptive Management: Analyze the **role of adaptive management in protected area management**, focusing on how monitoring, data collection, and iterative decision-making improve long-term conservation outcomes.

4.7 Challenges of Protected Areas: Examine the unique **challenges of managing protected areas**, including invasive species control, poaching, resource extraction, and human-wildlife contact.

a. Investigate local, state, and federal legislation that restore, conserve, manage, and enhance wildlife including the Pittman-Robertson Wildlife Restoration Act.
b. Analyze the economic impact of managing protected areas and public use and access.
c. Propose evidence-based solutions to these challenges using integrated management approaches.

4.8 Technology in Forest Management: Identify and describe how the **use of modern technologies** like drones, GIS (Geographic Information Systems), and remote sensing **monitor forest health**, including monitoring of tree health, assessing the impact of pests and

diseases, and evaluating the overall condition of forest ecosystems to inform conservation strategies and ensure the resilience of Tennessee's forests.

5. Conserving Wildlife and Forests

5.1 Roles of Wildlife in Ecosystem Functioning: Investigate the critical **ecological roles that wildlife species play** in maintaining the stability and function of ecosystems (e.g., pollination, seed dispersal, pest control).

5.2 Threats to Wildlife and Habitats: Identify and describe **major threats to wildlife and habitats**, including habitat loss, environmental changes, pollution, poaching, and invasive species. Explain the ecological consequences of these threats, such as habitat degradation and species extinction.

5.3 Conservation Programs: Compare and contrast **in-situ (on-site) and ex-situ (off-site) conservation methods**. Explore examples of successful wildlife conservation programs that use both in-situ and ex-situ conservation.

5.4 Wildlife Management Plan: Develop a comprehensive **management plan** for an endangered or at-risk species in Tennessee based on the species or habitat's conservation status (e.g., threatened, endangered, or healthy population). Describe the steps in **developing a wildlife management plan** that may include habitat restoration, population control, invasive species control, and human-wildlife conflict mitigation.

5.5 Role and Conservation of Forests: Examine the **role of forests within ecosystem functioning**. Highlight the various threats forests face, such as wildfires, insects, diseases, changing environmental patterns, invasive species, natural disasters, and human activities, including land development (e.g., construction of homes) and recreational activities that impact forest health. Explain the consequences of forest degradation.

5.6 Forest Management Plans: Investigate and communicate the **different types of forest management plans** (e.g., Tennessee and Natural Resource Conservation Service) and the key components that make up each plan. Develop management goals from a landowner's perspective and objectives. Describe the steps in developing a forest management plan.

6. Water and Management Conservation

6.1 Water Ecosystems: Explore the **structures, functions, and biodiversity of water ecosystems,** including aquaculture and the diverse species and habitats that comprise water ecosystems. Analyze the interdependence of aquatic biodiversity and water quality in sustaining ecosystem stability.

a. Freshwater: lakes and rivers
b. Estuaries: brackish water
c. Saltwater: oceans

6.2 Water Use and Management: Identify **water use and management** in agricultural settings and aquaculture, including the following:

a. distribution and properties of water in the hydrologic cycle;
b. agricultural uses of water and impacts on water resources;
c. agricultural uses that may impact water resources;
d. point and non-point source pollution;
e. impacts of water availability; and
f. sustainable practices.

6.3 Aquatic Ecosystem Structure and Function: Research and outline the complex **structures and ecological functions of aquatic ecosystems**. Focus on the role of keystone species, nutrient cycling, and the importance of wetland restoration in maintaining water quality and biodiversity in rivers, such as the Tennessee and Cumberland Rivers. Create a model to describe the importance of biodiversity within these symptoms for ecosystem stability.

6.4 Threats to Aquatic Environments: Analyze the **human-induced and natural threats that impact aquatic environments and species**. Research and present findings on a specific threat to aquatic environments, detailing its causes, impacts on marine biodiversity, and potential solutions for mitigation or restoration. Propose restoration strategies to address these threats.

6.5 Aquatic Conservation, Resource Management, and Sustainable Practices: Explore various **strategies and tools used in aquatic conservation** to protect aquatic biodiversity and ecosystems. Investigate and convey **sustainable practices for managing aquatic resources**, focusing on fisheries, coastal development, and tourism. Evaluate the effectiveness of **resource management strategies** aimed at balancing human needs with the preservation of aquatic ecosystems.

7. Conservation Strategies

7.1 Species Conservation: Evaluate and explain the **critical role of species conservation** in maintaining ecosystem health and resilience of endangered species, reintroduction programs, and genetic diversity. Investigate the importance of genetic diversity, habitat restoration, and species reintroductions, using case studies such as the restoration of the elk population in the Cumberland Plateau.

7.2 Conservation Strategies: Investigate the **effectiveness of various conservation strategies**, such as the preservation of Duck River in Tennessee, including protected areas, wildlife corridors, and restoration. Evaluate the success of long-term conservation efforts to safeguard biodiversity.

7.3 Conservation Plan: Design a **conservation plan for a local environmental issue** and present it to local government officials such as city council members, county commissioners, park district managers, planning commission members, environmental organizations, or local conservation agencies. Integrate scientific data, community input, and government policies to

design a feasible plan. Analyze data to determine the success of this plan, design a monitoring plan, and make recommendations for continuous improvement.

7.4 Case Studies of Successful Species Conservation Efforts: Analyze **case studies where conservation biology principles have been applied to address ecosystem degradation**, such as the restoration of wetlands, forest conservation programs, and coral reef preservation. Evaluate and present the successes and challenges of these case studies, focusing on the ecological, economic, and social outcomes.

8. Principles of Ecosystem Restoration

8.1 Ecosystem Restoration: Explicate **ecosystem restoration** and distinguish between rehabilitation, reclamation, and full restoration. Investigate the restoration of wetlands and forests, emphasizing the use of native species and ecological processes to restore function and biodiversity.

8.2 Ecological Principles: Describe and apply the **ecological principles guiding restoration projects**, such as succession, resilience, and biodiversity enhancement. Discuss how these principles guide successful long-term ecosystem recovery.

8.3 Historical Restoration Projects: Investigate and evaluate past **historical restoration projects** and analyze their success, challenges, and lessons learned.

8.4 Active versus Passive Restoration Techniques: Construct an explanation of **passive versus active restoration techniques**. Examine projects such as invasive plant removal in state parks and passive management of forest regeneration.

8.5 Specific Restoration Techniques: Evaluate **specific restoration techniques** for forests, wetlands, grasslands, and aquatic ecosystems (e.g., planting native species, soil remediation, hydrological restoration, and reintroducing keystone species).

8.6 Adaptive Management: Evaluate and explain **the use of adaptive management in the restoration process**, including monitoring and adjusting interventions.

8.7 Ethical Considerations: Discuss the **ethical considerations in ecosystem restoration**, such as prioritizing ecosystems, human livelihoods, and the potential for unintended consequences. Develop a personal ethical framework for restoration and conservation.

8.8 Case Studies: Examine and explain the critical components of **case studies of restoration projects** that involve multiple stakeholders (e.g., government agencies, non-governmental organizations (NGOs), local communities, and businesses). Evaluate the economic requirements for the implementation of such projects (e.g., Pittman-Robertson, donations, industry funding, certification).

8.9 Restoration Project: Apply **ecological principles and restoration strategies to plan a comprehensive ecological restoration project**. Analyze the degraded ecosystem, identify

key restoration goals, and design a practical, sustainable restoration plan that includes community engagement, monitoring, and long-term maintenance.

9. Evaluating Restoration Projects

9.1 Success of Restoration Projects: Research and verify **key ecological indicators, such as biodiversity, water quality, and soil health, to measure the success of restoration projects**. Design monitoring protocols to assess progress and adapt strategies over time.

9.2 Monitoring Ecosystem Recovery: Apply **techniques for monitoring ecosystem recovery** (e.g., field surveys, remote sensing, data collection).

9.3 Restoration Data: Analyze and interpret **restoration data** to evaluate project effectiveness and identify areas of improvement. Propose recommendations for improving restoration outcomes based on data analysis.

10. Sustainable Practices

10.1 Principles of Ecological Sustainability: Examine and articulate the **principles of ecological sustainability** and the importance of balancing conservation, preservation, and human needs for natural resources and ecosystems.

10.2 Resource Management: Create or use a model to explain **the importance of resource management**, including renewable versus nonrenewable resources, and the role of conservation in maintaining ecological and economic stability. Propose sustainable practices for resource management in Tennessee.

10.3 Role of Ecosystem Services: Research and articulate **the role of ecosystem services** (e.g., water purification, pollination, climate regulation) in human well-being and ecological stability. Design a public awareness campaign to highlight the value of these services.

10.4 Promoting Ecological Sustainability: Develop and communicate the **ethical and social responsibilities involved in promoting ecological sustainability**. Develop an action plan to promote ecological sustainability in the school or local community, demonstrating how to implement sustainable practices in everyday life.

11. Team Project

11.1 Team Project with Data Analysis: As a team, **identify a problem,** such as designing and implementing a conservation project, and address a local environmental issue (e.g., habitat restoration in the Tennessee River Basin or addressing invasive species in state parks). **Research and utilize the Engineering Design Process to design a solution**. Document the following steps in an engineering design notebook for inclusion in the program portfolio. When possible, connect the problem to an existing CTSO event.

a. **Problem Identification**: Brainstorm specific problems and challenges within the program of study. Conduct basic research to understand the scope and implications of the identified problem. Identify one problem as a focus area.
b. **Research and Analysis**: Conduct in-depth research on chosen topics related to the problem. Locate and analyze a dataset, recognizing trends, relationships, and patterns related to the problem.
c. **Review the Stages of the Engineering Design Process**: Define the problem, research, brainstorm solutions, develop prototypes, test and evaluate, and iterate. Consider various research designs (e.g., surveys, experiments, or field observations) and sampling techniques (e.g., random, stratified, or convenience sampling). Consider constraints such as cost, efficiency, and environmental impact during the design process.
d. **Project Implementation**: Assign specific roles within the design teams (e.g., project manager, researcher, designer, tester). Design a solution tailored to address the identified problem or scenario. Document progress through design journals, sketches, diagrams, and digital presentations. (Note: Prototype is optional in the Level II course.)
e. **Presentation and Reflection**: Showcase the problem and solution to the class. Share the data that was analyzed and how it affected the solution. Discuss the design process and challenges. As a class, critically evaluate the effectiveness and feasibility of the solutions and propose potential improvements.

Standards Alignment Notes

*References to other standards include:

- P21: Partnership for 21st Century Skills Framework for 21st Century Learning
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.