



This course was developed in 2022 with funding from Career Connect Washington and participation from CTE teachers representing Highline School District, North Thurston Public Schools, and Yakima School District. Additional writing support was provided by Peninsula College, the Mountains to Sound Greenway Trust, 10,000 Years Institute, Manulife Investments, and the Department of Natural Resources. This working document will be periodically updated while working with CTE teachers across Washington to provide local resources and relevant materials and opportunities to engage youth in learning about restoration ecology in Washington State.

Advanced Restoration Ecology	
Course Title: Advanced Restoration Ecology	Total Framework Hours: 180 hours
Suggested CIP Code: 030201	Exploratory <input type="checkbox"/> Preparatory <input checked="" type="checkbox"/>
Date Last Modified: 1/19/2023	
Career Cluster: Agriculture, Food and Natural Resources	Cluster Pathway: Natural Resource Systems
Course Summary: This course applies scientific, restoration, and social studies ecology principles to the restoration of Washington habitats. The course builds upon topics covered in Introduction to Restoration Ecology to focus on safety, well-being, and ethics; historical, contemporary, and contemporary land management; plant identification and watershed ecology; restoration ecology management plan implementation; and career pathways. Students will complete a Supervised Agricultural Experience (SAE) in a local natural area as part of the course.	
Requested Course Equivalency: 1.0 science OR social studies	Total Number of Units: 7
Course Resources: Online folder to be shared with teacher	

Unit 1: Safety, Well-Being, and Ethics	Total Learning Hours for Unit: 10
Unit Summary: This unit will highlight the skills necessary to work safely and effectively on a restoration work crew.	
Competencies:	
<ol style="list-style-type: none"> 1. Understand the safe and proper use of tools for manual and chemical restoration practices (including cleaning, maintenance, and storage). 2. Engage in field safe field work procedures (ex: pacing, adequate food, water, sleep, and use of personal protective equipment, road rights-of-way). 	

3. Work on a crew successfully and safely (includes skills in listening, following directions, keeping other crew members safe).
4. Understand and adhere to community partner safety protocols.
5. Understand basic first aid relevant to restoration ecology.
6. Practice Leave No Trace and low ecological impact practices.
7. Practice basic navigation skills.

Performance Assessments: *These can be locally developed or use the suggested assessments below.*

Assessments will be formal and informal, written, verbal and practical. Students can:

- Perform field work safely and properly (ex: pacing, adequate food, water, sleep, use of personal protective equipment, safety while working in road rights-of-way).
- Adhere to safe crew practices (includes skills in listening, following directions, keeping other crew members safe).
- Demonstrate safe and proper hand tool use for manual and chemical restoration practices.
- Adhere to the community partner's safety plans and protocols.
- Use Leave No Trace and low ecological impact practices in the field.
- Lead or assist in first aid skill role play activities.
- Demonstrate how to track locations using a compass, map, and GPS.
- Read a weather report and make safety decisions based on forecast.
- Lead or assist a group discussion to create shared group norms for communication and safety.
- Record and update tool inventory sheets.
- Assist community partner to ensure that tools are cleaned, maintained, and stored properly.
- Facilitate a pre- or post-safety meeting for onsite restoration crew work.
- Complete an OSHA job hazard assessment form.
- Review and discuss herbicide labels for required PPE, application limits, and public notifications.
- Demonstrate familiarity with a Satellite phone.

Related to Supervised Agricultural Experience (SAE):

- Create a safety plan that includes protocols to be used for on-site restoration work.
- Include examples of relevant hazard and safety signage that should be used in restoration work, as seen in public areas (ex: planting areas, road signs, snags).

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed for all students.

Suggested skills include:

- 3.B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member
- 7.A.1 Adapt to varied roles, job responsibilities, schedules, and contexts

- 4.B.1 Use information

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards: Agriculture Food and Natural Resources Standards: Natural Resource Science (NRS)

NRS.03. Develop plans to ensure sustainable production and processing of natural resources.

- NRS.03.02. Demonstrate cartographic skills, tools, and technologies to aid in developing, implementing, and evaluating natural resource management plans.
- NRS.03.02.01.a. Summarize how to use maps and technologies to identify directions and land features, calculate actual distance and determine the elevations of points.

AFNR Cluster Skills

- CS.03. Examine and summarize the importance of health, safety, and environmental management systems in AFNR workplaces.

Career Ready Practices (CRP) Strand

- CRP.09.03. Demonstrate behaviors that contribute to a positive morale and culture in the workplace and community.

Unit 2: Historical, Traditional, and Natural Land Management	Total Learning Hours for Unit: 40
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Unit Summary: Through field work with partner agencies, students will analyze goals, objectives, and perspectives that influence practices used while restoring ecosystems.

Competencies:

1. Understand land management practice concepts (ex: tragedy of commons of human and nonhuman stakeholders, ecological services, conservation vs. restoration).
2. Explore ownership history, use, and restoration of the site being studied.
3. Understand tribal sovereignty and the differences between tribal lands and Usual and Accustomed Areas (U&A).
4. Describe historical and contemporary traditional ecological knowledge concepts, including fire ecology and ethnobotanical plant harvesting.
5. Examine the differences in land management practices, goals, and use between DNR, USFS, private, and other land managers.
6. Apply learning about land management to restoration ecology field activities.

Performance Assessments: *These can be locally developed or use the suggested assessments below.*

Assessments will be formal and informal, written, verbal and practical. Students can:

- Identify tribal lands of the region where restoration will be completed.
- Research the ownership and management history of a local restoration site.
- Read about the Boldt Decision and discuss why this decision is important in land management decision-making protocols. [Teacher may refer to Since Time Immemorial curriculum on OSPI website: Our Foundation: Foundational Documents and the Boldt Decision (Boldt I and II), Environmental Issues: The Boldt Decision, and Native Knowledge 360.]
- Research the history of Washington public land management.
- Explain the similarities and differences between two or more restoration management plans' objectives (ex: tribal, public, private).
- Participate in locally relevant practices (regarding a plant, person, initiative, organization, and/or ethnobotanical practice).
- Evaluate the benefits and drawbacks of using prescribed fire as a restoration tool for an identified site.
- Conduct an interview with professionals from a private or public agency.
- Research historical and contemporary tribal restoration projects.
- Based on research findings, recommend relevant land management and restoration practices in the field.

Relate to SAE:

- Research and present history of the ownership, use, and restoration of a local restoration site.
- Use a decision matrix to establish restoration priorities (offsite considerations: stakeholders, including tribal).
- Identify relevant regulations affecting restoration activities and outline a timeline for approval processes.
- Prepare and deliver a presentation about a management strategy or agency restoration initiative.

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed for all students.

- 6.A.1 Use technology as a tool to research, organize, evaluate, and communicate information
- 4.B.1 Use information accurately and creatively for the issue or problem at hand

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards: Natural Resource Science (NRS)

- NRS.02.01. Analyze the interrelationships between natural resources and humans.
- NRS.02.02. Assess the impact of human activities on the availability of natural resources.
- NRS.03.02. Demonstrate cartographic skills, tools and technologies to aid in developing, implementing and evaluating natural resource management plans.

ANFR Cluster Skills

- CS.05 Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

Career Ready Practices (CRP) Strand		
<ul style="list-style-type: none"> • CRP.05.01. Assess, identify and synthesize the information and resources needed to make decisions that positively impact the workplace & community. • CRP.05.02. Make, defend and evaluate decisions at work and in the community using information about the potential environmental, social and economic impacts. • CRP.08.01. Apply reason and logic to evaluate workplace and community situations from multiple perspectives. 		
<i>Aligned Washington State Academic Standards</i>		
Environment & Sustainability	Standard 3: Sustainability and Civic Responsibility: Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.	
Science	HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	
Social Studies	<p>C3.9-10.1 Analyze the impact of constitutions, laws, treaties, and international agreements on the maintenance of national and international order.</p> <p>C3.9-10.2 Analyze relationships among governments, civil societies, and economic markets.</p> <p>C3.11-12.1 Evaluate the impact of constitutions, laws, treaties, and international agreements on the maintenance of national and international order or disorder.</p> <p>C3.11-12.2 Critique relationships among governments, civil societies, and economic markets.</p> <p>C3.11-12.3 Evaluate the impact of international agreements on contemporary world issues.</p> <p>C3.11-12.4 Evaluate the impact of international organizations on United States foreign policy.</p> <p>G2.11-12.2 Analyze how the United States balances protections of the environment and economic development.</p> <p>G3.11-12.4 Evaluate how changes in the environmental and cultural characteristics of a place or region influence spatial patterns of trade and land use.</p> <p>G2.11-12.3 Evaluate the impact of human settlement activities on the environmental and cultural characteristics of specific places and regions.</p>	
Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing Explanations and Designing Solutions	For: HS-LS2-7 LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS4.D: Biodiversity and Humans ETS1.B: Developing Possible Solutions	Stability and Change

Unit 3: Plant Identification and Watershed Ecology	Total Learning Hours for Unit: 40
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Unit Summary: This unit will explore components of watersheds and factors that influence ecological systems in watersheds. Students will build upon their knowledge of plant identification to identify the plant species that are found within the watershed and how plant succession occurs within the watershed.

Competencies:

1. Analyze how *native, non-native, invasive, and noxious* plants interact with each other in watersheds.
2. Describe how biotic and abiotic components interact within watersheds.
3. Describe how watershed functions influence ecosystem health.
4. Outline elements that comprise a watershed (including hydrology, geology, soil, vegetation, and topography).
5. Understand how vegetative cover impacts watershed quality, ecosystem services and ecosystem health.
6. Evaluate water quality factors (including dissolved oxygen, water temperature, pH, turbidity, conductivity, flow, and velocity).
7. Assess human impacts on watersheds (ex: pollutants; structural changes such as pavement, dams, or culverts).

Performance Assessments: *These can be locally developed or use the suggested assessments below.*

Assessments will be formal and informal, written, verbal and practical. Students can:

- Identify traits that allow plants to adapt and compete for resources in watersheds (ex: allelopathy, growth rates, seed viability and germination).
- Use plant characteristics and field identification keys (including dichotomous keys) to identify plant species in a watershed.
- Evaluate parameters of a watershed to ensure water quality is within acceptable conditions and recommend remediation strategies based on results.
- Design a rain garden or simulated rain garden model.
- Assess fish passage limitations with community partner (ex: culverts and dams).
- Use [Salmon Scape](#), [WRIA maps](#), aerial, LIDAR, and/or topographic maps to define a watershed's boundaries.
- Write a Claim Evidence Reasoning document related to given data sets on water quality and soil characteristics.
- Identify water quality values associated with various vectors of contamination, such as fecal coliform colonies present indicate an increase in animal waste runoff.
- Participate in traditional land use practices (ex: planting or harvest techniques).
- Identify culturally relevant resources with the help of local elders and tribal representatives.
- Recommend restoration strategies to mitigate human impacts on local watersheds.

Related to SAE:

- Use terminology and scientific names to accurately describe forests, trees, and vegetation in report or presentation.
- Complete a water quality analysis and present results orally or in written report.

- Present a case study of historical impacts and restoration within a watershed.
- Create a percent coverage diagram to assess the success of restoration management strategy.
- Perform a watershed site assessment (ex: stream percentage cover, water quality, and any additional biotic or abiotic factors).
- Complete [stormwater management certification](#).

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed for all students.

- 7.A.1 Adapt to varied roles, job responsibilities, schedules and contexts
- 4.B.1 Use information

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards: Natural Resource Science (NRS)

- NRS.01.05. Apply ecological concepts and principles to terrestrial natural resource systems.
- NRS.04.01. Demonstrate natural resource protection, maintenance, enhancement and improvement techniques.
- NRS.02.03. Analyze how modern perceptions of natural resource management, protection, enhancement and improvement change and develop over time.
- NRS.04.03. Prevent or manage the introduction of ecologically harmful species in a particular region.

ANFR Cluster Skills

- CS.04. Demonstrate stewardship of natural resources in AFNR activities.
- CS.05 Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

Career Ready Practices (CRP) Strand

- CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.
- CRP.04.03. Model active listening strategies when interacting with others in formal and informal settings.
- CRP.09. Model integrity, ethical leadership and effective management.

Aligned Washington State Academic Standards

Environment and Sustainability

Standard 1: Ecological, Social, and Economic Systems -- Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels.

	Standard 2: The Natural and Built Environment -- Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.	
Science	NGSS Standards HS-LS2-7 Design, evaluate, and refine a solution for reducing the impact of human activities on the environment and biodiversity. HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem. HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	
Social Studies	G2.9-10.3 Explain that the environment is modified through agriculture, industry, settlement, lifestyles, and other forms of activity. G1.11-12.4 Analyze information from geographic tools, including computer-based mapping systems, to draw conclusions about an issue or event. G1.9-10.4 Explain relationships between the locations of places and regions, and their political, cultural, and economic dynamics, using maps, satellite images, photographs, and other representations. G1.9-10.3 Create maps that employ geospatial and related technologies to display and explain the spatial patterns of culture and environment.	
	Science and Engineering Practice	Disciplinary Core Idea
	Constructing Explanations and Designing Solutions	For: HS-LS2-7 LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS4.D: Biodiversity and Humans ETS1.B: Developing Possible Solutions
	Engaging in Argument from Evidence Scientific Knowledge is Open to Revision in Light of New Evidence	For: HS-LS2-6 LS2.C: Ecosystem Dynamics, Functioning, and Resilience
	Constructing Explanations and Designing Solutions	For: HS-ESS3-4 ESS3.C: Human Impacts on Earth Systems ETS1.B: Developing Possible Solutions
		Crosscutting Concept
		Stability and Change
		Stability and Change
		Stability and Change Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World

Unit 4: Restoration Ecology Management Plan Implementation	Total Learning Hours for Unit: 40
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Unit Summary: This unit will explore the implementation procedures and protocols for implementing restoration management plans. Students will consider pros and cons of management options that relate to local environmental variables at local restoration sites.

Competencies:

1. Develop botany skills that are relevant to restoration ecology management plans (ex: site selection, planting, pruning, propagation).
2. Develop a planting plan based on site conditions and consideration of current or future climate change impacts.
3. Learn how and where to procure plants.
4. Understand basic plant propagation methods.
5. Understand concepts of bioaccumulation and biomagnification.
6. Compare and contrast control methods of invasive plants within specific ecosystems (including manual, mechanical, cultural, biological, and chemical).
7. Consider unintended consequences of actions; review examples of biocontrol that are now invasive.

Performance Assessments: *These can be locally developed or use the suggested assessments below.*

Assessments will be formal and informal, written, verbal and practical. Students can:

- Explore a restoration-related topic of interest (ex: natural area management techniques, native and non-native plant identification, plant phenology, dispersal strategies, allelopathy, competition, seed bank, light availability, and soil moisture needs).
- Describe pros and cons associated with at least one invasive plant control method, and situations in which the control would and would not be applicable.
- Pilot test and evaluate at least one method of propagation in the field (ex: cuttings, seed planting, transplanting).
- Complete a species transect to compare species richness and restoration practices that have been used in different sites.
- Compare and contrast restoration interventions and tools (ex: snags, channeling, beaver dam analogs, artificial log jams, traditional ecological management practices, and fire ecology).

Related to SAE:

- Use criteria to evaluate appropriate management decisions and plans.
- Recommend appropriate management practices based on ecosystem types (ex: prairies, forested, aquatic).
- Create a management plan based on pros and cons and evaluate the consequences of different management strategies.
- Create a protocol for managing invasives at a local restoration site.
- Describe factors that were considered when selecting invasives management protocol.
- Determine action thresholds at which sprays will be used.
- Present a planting plan that considers future climate resiliency and adaptation.
- Describe how proposed planting plan meets management goals at a local restoration site.
- Describe factors that were considered when selecting plant suppliers.

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed for all students.

- 10.A.2 Prioritizes, plans and manages work to achieve the intended result

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards: Natural Resource Science (NRS)

- NRS.01.04. Apply ecological concepts and principles to aquatic natural resource systems
- NRS.02.03. Analyze how modern perceptions of natural resource management, protection, enhancement, and improvement change and develop over time.
- NRS.04.01. Demonstrate natural resource protection, maintenance, enhancement, and improvement techniques.
- NRS.04.03. Prevent or manage the introduction of ecologically harmful species in a particular region.

ANFR Cluster Skills

CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

Career Ready Practices (CRP) Strand

- CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge, and skills to solve problems in the workplace and community.
- CRP.04.03. Model active listening strategies when interacting with others in formal and informal settings.
- CRP.09. Model integrity, ethical leadership, and effective management.

Aligned Washington State Academic Standards

Environment and Sustainability	Standard 1: Ecological, Social, and Economic Systems -- Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels. Standard 2: The Natural and Built Environment -- Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.
Science	NGSS Standards HS-LS207: Design, evaluate, and refine a solution for reducing the impact of human activities on the environment and biodiversity. HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers.

	<p>and types of organisms in stable conditions but changing conditions may result in a new ecosystem.</p> <p>HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.</p> <p>HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</p>	
Social Studies	<p>G2.11-12.3 Evaluate the impact of human settlement activities on the environmental and cultural characteristics of specific places and regions.</p> <p>G2.9-10.2 Explain how humans modify the environment with technology.</p> <p>G2.9-10.3 Explain that the environment is modified through agriculture, industry, settlement, lifestyles, and other forms of activity.</p> <p>G2.9-10.4 Explain that humans cope with and adapt to environmental conditions.</p> <p>G2.11-12.1 Evaluate human interaction with the environment in the United States in the past or present.</p> <p>G2.11-12.3 Evaluate the impact of human settlement activities on the environmental and cultural characteristics of specific places and regions.</p> <p>SSS3.9-12.6 Assess options for individual and collective action to address local, regional, or global problems by engaging in self-reflection, strategy identification, and complex causal reasoning.</p>	
Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing Explanations and Designing Solutions	<p>For: HS-LS2-7</p> <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <p>LS4.D: Biodiversity and Humans</p> <p>ETS1.B: Developing Possible Solutions</p>	Stability and Change
Engaging in Argument from Evidence	<p>For: HS-LS4-5</p> <p>LS4.C: Adaptation</p>	Cause and Effect
Engaging in Argument from Evidence Scientific Knowledge is Open to Revision in Light of New Evidence	<p>For: HS-LS2-6</p> <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p>	Stability and Change
Constructing Explanations and Designing Solutions	<p>For: HS-ESS3-4</p> <p>ESS3.C: Human Impacts on Earth Systems</p> <p>ETS1.B: Developing Possible Solutions</p>	<p>Stability and Change</p> <p>Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World</p>

Unit 5: Restoration Ecology Laws and Agencies**Total Learning Hours for Unit: 30**

Unit Summary: In this unit, students will research and analyze state, tribal, and national restoration ecology laws that are designed to protect natural areas resources while balancing economic considerations.

Competencies:

1. Use key components of Department of Ecology's [State Environmental Policy Act](#) (SEPA) Forestry Assessment Guidelines and [watershed restoration-fish habitat enhancements RCW 43.21.030\(2\)\(c\)](#) to create a management plan.
2. Use the [fish habitat enhancement projects – permit and approval process](#) to create a management plan.
3. Use key components of US Fish and Wildlife's [Endangered Species Act](#) (ESA and NEPA) create a management plan.
4. Use wildlife data collected from the field to create a [habitat conservation plan](#) (HCP).
5. Understand culturally significant resources important to local indigenous populations.
6. Understand legal land descriptions to describe property boundaries (ex: map school land boundaries).
7. Understand the permitting process as it relates to restoration ecology work.

Performance Assessments: *These can be locally developed or use the suggested assessments below.*

Assessments will be formal and informal, written, verbal and practical. Students can:

- Familiarity with listed permits as they apply to local restoration work that may include:
 - National Environmental Protection Act (NEPA)
 - Washington Department of Fish and Wildlife (USFW) Hydraulic Project Approval (HPA)
 - USFW Section 10 (endangered species)
 - National Pollutant Discharge Elimination (NPDES)
 - Washington Department of Natural Resources Forest Practices Application Review (FPA)
 - Clean Water Act Section 404 (permit for discharge into waters of the United States)
- Identify culturally significant resources important to local indigenous populations.
- Research a public or private restoration ecology agency of interest.
- Interview a representative from a restoration ecology agency to learn about the organization's objectives and strategies.
- Develop and host a student-led town hall or presentation for the city council, tribal council or other decision-making body addressing a current issue using evidence from current restoration practices or tribal rules.
- Use wildlife data collected from the field to create a habitat conservation plan (HCP).
- Use legal descriptions to describe property boundaries.

Related to SAE:

- Map GIS data.

- Integrate mapped GIS data into the final report or presentation.
- Write a technical report that analyzes various agencies' restoration ecology objectives and strategies in relation to a chosen site.

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed for all students.

- Divide the students into teams, have them set up their team with specific responsibilities for a public presentation.
- FFA tie-in could be Forestry or Natural Resources CDEs.

Industry Standards and Competencies

Agriculture, Food, and Natural Resources (AFNR) Standards: Natural Resource Science (NRS)

NRS.02. Analyze the interrelationships between natural resources and humans.

- NRS.02.01. Examine and interpret the purpose, enforcement, impact and effectiveness of laws and agencies related to natural resource management, protection, enhancement and improvement (e.g., water regulations, game laws, historic preservation laws, environmental policy, etc.).
 - NRS.02.01.01.a. Distinguish between the types of laws associated with natural resources systems.
 - NRS.02.01.01.b. Analyze the structure of laws associated with natural resources systems.
 - NRS.02.01.01.c. Evaluate the impact of laws associated with natural resources systems (e.g., mitigation, water regulations, carbon emissions, game limits, invasive species, etc.).
 - NRS.02.01.02.a. Distinguish between the types of agencies associated with natural resources systems.
 - NRS.02.01.02.b. Analyze the specific purpose of agencies associated with natural resources systems.
 - NRS.02.01.02.c. Evaluate the impact and effectiveness of agencies associated with natural resources systems (e.g., regulation of consumption, prevention of damage to natural resources systems, management of ecological interactions, etc.).
- NRS.02.04. Examine and explain how economics affects the use of natural resources
 - NRS.02.04.01.a. Compare and contrast how the economic value of a natural resource affects its availability.
 - NRS.02.04.01.b. Assess whether economic value increases or decreases the conservation, protection, improvement and enhancement of natural resources.
 - NRS.02.04.01.c. Devise a plan to improve the conservation, protection, improvement and enhancement of natural resources based on economic value and practices.
 - NRS.02.04.02.c. Anticipate and predict how changes to the availability of natural resources because of human activity may impact a local, state and national economy.

NRS.03. Develop plans to ensure sustainable production and processing of natural resources.

- NRS.03.02. Demonstrate cartographic skills, tools and technologies to aid in developing, implementing and evaluating natural resource management plans.

- NRS.03.02.02.c. Use GIS data for a given area to devise a management plan for the management, conservation, improvement, and enhancement of its natural resources.

NRS.04. Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.

- NRS.04.01. Demonstrate natural resource protection, maintenance, enhancement and improvement techniques.
 - NRS.04.01.01.a. Identify and categorize different kinds of streams.
 - NRS.04.01.01.b. Assess and explain indicators of the biological health of a stream.
 - NRS.04.01.01.c. Create an enhancement plan for a stream.
 - NRS.04.01.02.a. Identify and categorize characteristics of a healthy forest.
 - NRS.04.01.02.b. Assess and apply the methods used to improve a forest stand.
 - NRS.04.01.02.c. Create a timber stand improvement plan for a forest.
 - NRS.04.01.03.a. Identify and categorize characteristics of a healthy wildlife habitat.
 - NRS.04.01.03.b. Assess and apply methods of wildlife habitat improvement.
 - NRS.04.01.03.c. Devise a comprehensive improvement plan for a wildlife habitat.
 - NRS.04.01.04.a. Identify and categorize characteristics of healthy rangeland.
 - NRS.04.01.04.b. Assess and apply methods of rangeland improvement.
 - NRS.04.01.04.c. Evaluate and revise a rangeland management plan.
 - NRS.04.01.05.a. Identify and categorize characteristics of natural resources that make them desirable for recreational purposes.
 - NRS.04.01.05.b. Assess and apply management techniques for improving outdoor recreation opportunities.
 - NRS.04.01.05.c. Evaluate the impact of recreational activities on natural resources and create an improvement plan.
 - NRS.04.01.06.a. Identify and categorize characteristics of healthy marine and coastal natural resources.
 - NRS.04.01.06.b. Assess and apply methods to improve marine and coastal natural resources.
 - NRS.04.01.06.c. Create an improvement plan for marine or coastal natural resources.
- NRS.04.02. Diagnose plant and wildlife diseases and follow protocols to prevent their spread.
 - NRS.04.02.01.a. Classify causes of diseases in plants and the correct authorities to whom some diseases should be reported.
 - NRS.04.02.01.b. Analyze a plant disease based on its symptoms, identify if the disease needs to be reported to authorities and determine which authorities it should be reported to.
 - NRS.04.02.01.c. Create a management plan to reduce infection and the spread of plant diseases in natural resource systems.
 - NRS.04.02.02.a. Classify causes of diseases in wildlife and aquatic species and determine the correct authorities to whom some diseases should be reported.
 - NRS.04.02.02.b. Analyze a wildlife or aquatic species disease based on its symptoms, identify if the disease needs to be reported to authorities and determine which authorities it should be reported to.

- NRS.04.02.02.c. Create a management plan to reduce infection and spread of wildlife or aquatic species diseases in natural resource systems.
- NRS.04.03. Prevent or manage introduction of ecologically harmful species in a particular region.
 - NRS.04.03.01.a. Categorize harmful and beneficial insects, as well as signs of insect damage to natural resources.
 - NRS.04.03.01.b. Analyze signs of insect infestation, identify if it needs to be reported to authorities and determine which authorities it should be reported to.
 - NRS.04.03.01.c. Create a management plan to reduce spread of harmful insects in natural resource systems.
 - NRS.04.03.02.a. Identify and classify invasive species common to a particular region.
 - NRS.04.03.02.b. Analyze signs of the spread of invasive species, identify if it needs to be reported to authorities and determine which authorities it should be reported to.
 - NRS.04.03.02.c. Create a management plan to reduce spread of harmful invasive species in natural resource systems.
 - NRS.04.03.03.a. Research and summarize strategies and benefits of preventing the introduction of harmful species to a particular region.
 - NRS.04.03.03.b. Assess and implement a plan for preventing the spread of harmful species for its effectiveness.
 - NRS.04.03.03.c. Identify potentially invasive species and devise strategies to prevent ecological damage that would result from the introduction of that species.

Aligned Washington State Academic Standards

Science	<p>HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.</p> <p>HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.</p> <p>HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.</p> <p>HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. *</p> <p>HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.</p> <p>HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*</p> <p>HS-ESS3-5: Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.</p>
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[HS-ESS3-6](#): Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

[HS-LS2-2](#): Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

[HS-LS2-6](#): Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem.

[HS-LS2-7](#): Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

[HS-LS4-6](#): Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

[HS-ETS1-1](#): Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

[HS-ETS1-2](#): Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

[HS-ETS1-3](#): Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

[HS-ETS1-4](#): Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Science and Engineering Practice	Disciplinary Core Idea	Crosscutting Concept
Constructing Explanations and Designing Solutions Analyzing and Interpreting Data Engaging in Argument from Evidence Using Mathematics and Computational Thinking Asking Questions and Defining Problems	ESS3.A: Natural Resources ESS3.B: Natural Hazards ESS2.A: Earth Materials and Systems ESS2.D: Weather and Climate ETS1.B: Developing Possible Solutions ESS3.C: Human Impacts on Earth Systems ESS3.D: Global Climate Change ESS2.D: Weather and Climate LS2.A: Interdependent Relationships in Ecosystems LS2.C: Ecosystem Dynamics, Functioning, and Resilience LS4.D: Biodiversity and Humans LS4.C: Adaptation	Cause and Effect Stability and Change Systems and System Models Scale, Proportion, and Quantity

	ETS1.A: Defining and Delimiting Engineering Problems ETS1.C: Optimizing the Design Solution	
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Unit 6: Career Pathways	Total Learning Hours for Unit: 10
<p>Unit Summary: This unit will expose students to various career pathways in the natural resources profession and provide opportunities for students to develop and enhance their employability skills.</p> <p>Learning Targets:</p> <ol style="list-style-type: none"> 1. Understand the key components to include in applications, cover letters, and resumes. 2. Describe individual skills and experiences that are relevant to natural resource jobs. 3. Understand components of a professional introductory email. 4. Compare employment sections of natural resource organization websites (both public and private). 5. Learn about natural resource jobs that relate to the student's career goals. 6. Articulate thoughts and ideas effectively using oral, written, and nonverbal communication skills in a variety of forms and contexts. 7. Know about job shadowing and internship opportunities. 8. Understand aspects of verbal and non-verbal communication in professional settings. 9. Recognize the importance and impact of one's digital presence on future employment opportunities. 	
<p>Performance Assessments: <i>These can be locally developed or use the suggested assessments below.</i></p> <p>Assessments will be formal and informal, written, verbal and practical. Students will be able to:</p> <ul style="list-style-type: none"> • Complete a self-assessment to identify qualifications and reflect on opportunities for future job skill growth. • Create a list of gained individual skills and experiences that are relevant to natural resource jobs. • Update resume and cover letter to integrate course learning and recent career-related experiences. • Write a professional introductory email. • Create Indeed or Linked In profile. • Prepare and participate in a mock interview for a natural resources position. • Contact a natural resources organization to request an informational interview. • Demonstrate professional introduction of self to stakeholders. • Conduct a job search. <p>Related to SAE:</p> <ul style="list-style-type: none"> • Present SAE project to the public and potential employers. • List knowledge, skills, and abilities gained in the course. 	

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed for all students.

Suggested skills include:

- 3.A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts
- 8.C.2 Demonstrates initiative to advance skill levels towards a professional level
- 8.A.2 Balance short-term and long-term goals

Industry Standards and Competencies

AFNR Cluster Skills

- CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

Career Ready Practices (CRP) Strand

- CRP.01.03. Identify and act upon opportunities for professional and civic service at work and in the community.
- CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.
- CRP.04.01. Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.
- CRP.04.02. Produce clear, reasoned and coherent written and visual communication in formal and informal settings.
- CRP.10.01. Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences.

Aligned Washington State Academic Standards

Environment & Sustainability

Standard 1: Ecological, Social, and Economic Systems -- Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels.
 Standard 2: The Natural and Built Environment -- Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.

Unit 7: Supervised Agricultural Experience (SAE) Project

Total Learning Hours for Unit: 10

Unit Summary: Students will demonstrate their learning by completing a Supervised Agricultural Experience Project (SAE). Students will work individually and, in a group, to consider their strengths as well as their areas for future learning in performing restoration work.

Competencies:

1. Understand the benefits of the SAE for skill development, leadership, and career success.
2. Understand the connection between SAE and FFA.
3. Describe the two types of SAE:
 - o Foundational SAE (Career exploration & planning (high school and beyond plan), Personal financial planning and management, Workplace Safety, Employability skills for college and career readiness, agricultural or forestry literacy)
 - o Immersion SAE (Entrepreneurship/Ownership, Placement/Internships, Research (Experimental, Analytical, Invention), School Business Enterprises, Service Learning)
4. Select an SAE topic that relates to course topics as well as the student's personal interests, academic goals, and career goals.
5. Develop procurement and funding plans.
6. Understand how presentation and reporting formats influence delivery of content to audiences.
7. Use systems thinking (interconnectedness, emergent properties, causality, feedback loops in an ecosystem) to develop SAE project.
8. Demonstrate flexibility.
9. Demonstrate self-directed learning skills.

Performance Assessments: *These can be locally developed or use the suggested assessments below.*

Assessments will be formal and informal, written, verbal and practical. Students will be able to:

- Select a final project format that effectively delivers content (ex: PowerPoint, YouTube video, report, radio public service announcement, poster, tri-fold display, brochure, map, website or blog, event, phone app, etc.)
- Write a report that investigates a topic covered in the course.
- Use Ag Experience Tracker (AET) System or equivalent utilized to track SAE Project.
- Outline the components to be used in final project:
 - o Determine the goals of the SAE project.
 - o Identify resources and data to be collected to meet project goals.
 - o Select the types of data that will be meaningful.
 - o Collect data to be used in the final project.
 - o Keep records that pertain to the chosen SAE project.
 - o Enter data into an Excel spreadsheet.
 - o Create maps that display necessary data.
 - o Cite sources that are included in the proposal.
- Prepare and deliver final project deliverables.

Leadership Alignment: Leadership activities should include 21st Century Skills embedded in curriculum and instruction for this unit of instruction. Include leadership skills that are being taught and assessed within the class for all students.

Suggested skills include:

- Students are responsible for entering their own data into the system and the data will be used in the annual Agriculture Education Report
- 8.C.2 Demonstrates initiative to advance skill levels towards a professional level
- 8.A.2 Balance short-term and long-term goals

Resources:

Future Farmers of America (FFA) Supervised Agricultural Experience (SAE) Washington FFA site: www.ffa.org

How to start a new chapter: <https://www.washingtonffa.org/starting-a-new-chapter>

SAE specific resources: <https://saeforall.org/> resources for students and teachers.

Industry Standards and Competencies

Agriculture Food and Natural Resources Standards: Natural Resource Science (NRS)

NRS.03. Develop plans to ensure sustainable production and processing of natural resources.

- NRS.03.01. Sustainably produce, harvest, process and use natural resource products (e.g., forest products, wildlife, minerals, fossil fuels, shale oil, alternative energy, recreation, aquatic species, etc.).
 - NRS.03.02.01.b. Apply cartographic skills and tools and technologies (e.g., land surveys, geographic coordinate systems, etc.) to locate natural resources. Create GIS maps that show different projects in a forest and the ongoing results of those projects.

AFNR Cluster Skills

CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways.

CS.01.05: Awareness: Desire purposeful understanding related to professional and personal activities.

Level 2

CS.01.05.01.b. Analyze the impact of trends and issues on the community.

Level 3

CS.01.05.01.c. Articulate current issues that are important to the local, state, national and global communities.

CS.01.05.02.c. Perform leadership tasks associated with citizenship.

Career Ready Practices (CRP) Strand

- CRP.01.03. Identify and act upon opportunities for professional and civic service at work and in the community.
- CRP.02.01. Use strategic thinking to connect and apply academic learning, knowledge and skills to solve problems in the workplace and community.

- CRP.04.01. Speak using strategies that ensure clarity, logic, purpose and professionalism in formal and informal settings.
- CRP.04.02. Produce clear, reasoned and coherent written and visual communication in formal and informal settings.
- CRP.10.01. Identify career opportunities within a career cluster that match personal interests, talents, goals and preferences.

SAE

- SAE.01.01 Students will establish and conduct Supervised Agricultural Experience Projects (SAE).
 - SAE.01.01.b. Explain the benefits of SAE projects to skill development, leadership and career success.
 - SAE.01.01.c. Explain the connection between SAE and FFA.
 - SAE.01.01.d. Explain the five types of SAE. (Entrepreneurship, Placement, Research, Exploratory, Improvement)
 - SAE.01.01.e. Explore ideas for SAE projects.
 - SAE.01.01.f. Explain how SAE projects support academic achievement.
 - SAE.01.01.g. Select and establish an SAE project.
 - SAE.01.01.h. Explain and keep records on established SAE projects.
 - SAE.01.01.i. Explain SAE project Supervision, visitation and assessment.
 - SAE.01.01.l. Explain the three-circle concept for SAE, FFA Leadership, Classroom/Laboratory in an Agriculture Education program.

Aligned Washington State Academic Standards

Science	Standards will be based on the SAE selected by the student
Environment & Sustainability	<p>Standard 1: Ecological, Social, and Economic Systems -- Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels.</p> <p>Standard 2: The Natural and Built Environment -- Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.</p>

21st Century Skills

Check those that students will demonstrate in this course:

LEARNING & INNOVATION Creativity and Innovation	INFORMATION, MEDIA & TECHNOLOGY SKILLS Information Literacy	LIFE & CAREER SKILLS Flexibility and Adaptability
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<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Think Creatively <input checked="" type="checkbox"/> Work Creatively with Others <input checked="" type="checkbox"/> Implement Innovations Critical Thinking and Problem Solving <input checked="" type="checkbox"/> Reason Effectively <input checked="" type="checkbox"/> Use Systems Thinking <input checked="" type="checkbox"/> Make Judgments and Decisions <input checked="" type="checkbox"/> Solve Problems Communication and Collaboration <input checked="" type="checkbox"/> Communicate Clearly <input checked="" type="checkbox"/> Collaborate with Others 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Access and /evaluate Information <input checked="" type="checkbox"/> Use and Manage Information Media Literacy <input checked="" type="checkbox"/> Analyze Media <input checked="" type="checkbox"/> Create Media Products Information, Communications and Technology (ICT Literacy) <input checked="" type="checkbox"/> Apply Technology Effectively 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Adapt to Change <input checked="" type="checkbox"/> Be Flexible Initiative and Self-Direction <input checked="" type="checkbox"/> Manage Goals and Time <input checked="" type="checkbox"/> Work Independently <input checked="" type="checkbox"/> Be Self-Directed Learners Social and Cross-Cultural <input checked="" type="checkbox"/> Interact Effectively with Others <input checked="" type="checkbox"/> Work Effectively in Diverse Teams Productivity and Accountability <input checked="" type="checkbox"/> Manage Projects <input checked="" type="checkbox"/> Produce Results Leadership and Responsibility <input checked="" type="checkbox"/> Guide and Lead Others <input checked="" type="checkbox"/> Be Responsible to Others
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