CareerClusters® PATHWAYS TO COLLEGE & CAREER READINESS
Agriculture, Food & Natural Resources

Learning that works for Colorado CTE®

Colorado AFNR Course Scope and Sequence

Course Name	**Range Ecology**		**Course Details** **Course = 0.50 Carnegie Unit Credit**	Level 4 course in the Natural Resources/Environmental Science Pathway	
Course Description	This course expands student learning to the principles of rangeland ecology. Students will gain knowledge in career development, leadership, personal development, communications, ecology, and resource management.				
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.				
SCED Identification #	18505	Schedule calculation based on 60% of a semester instructional time. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.			
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at **https://www.cde.state.co.us/standardsandinstruction/essentialskills**					
Unit Number, Title and Brief Description	Suggested % of Instructional Time	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Unit 1: Analyze the different elements in an Ecosystem and the relationship of those interactions in relation to Rangeland	8%	**NRS.01.** Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.	**NRS.01.01.** Apply methods of classification to examine natural resource availability and ecosystem function in a particular region. *ELA: RST.11-12.1* *RST.11-12.8* *WHST.9-10.2* *WHST.11-12.2* *WHST.9-10.9* *WHST.11-12.9*	**NRS.01.01.01.a.** Summarize and classify the different kinds of natural resources using common classification schemes (e.g., living versus non-living, renewable versus nonrenewable, native versus introduced, etc.). **NRS.01.01.02.a.** Summarize the components that comprise all ecosystems. **NRS.01.01.02.b.** Analyze the interdependence of organisms within an ecosystem (e.g., food webs, niches, impact of keystone species, etc.) and assess the dependence of	

				organisms on nonliving components (climate, geography, energy flow, nutrient cycling, etc.). **NRS.01.01.02.c.** Conduct analyses of ecosystems and document the interactions of living species and non-living resources. **NRS.01.01.03.b.** Analyze how biodiversity develops through evolution, natural selection and adaptation; explain the importance of biodiversity to ecosystem function and availability of natural resources. **NRS.01.01.03.c.** Evaluate biodiversity in ecosystems and devise strategies to enhance the function of an ecosystem and the availability of natural resources by increasing the level of biodiversity.	
Unit 2: Identifying different types of range plants and how they impact range health	12%	**NRS.01.** Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.	**NRS.01.02.** Classify different types of natural resources in order to enable protection, conservation, enhancement and management in a particular geographical region. *ELA: RST.11-12.1* *RST.11-12.7* *RST.11-12.8* *WHST.9-10.2* *WHST.11-12.2* *WHST.9-10.7* *WHST.11-12.7*	**NRS.01.02.02.a.** Research and examine the characteristics used to identify herbaceous plants. **NRS.01.02.02.b**. Apply identification techniques to determine the species of an herbaceous plant. **NRS.01.02.02.c**. Evaluate the species of herbaceous plants present to assess the health of an ecosystem	

			WHST.9-10.9 *WHST.11-12.9* *MATH: MA.HS.N.Q.A* *SCIENCE: SC.HS.3.9*	(e.g., presence of native versus invasive plants, biodiversity, etc.). **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. 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. *ELA: RST.11-12.8* *RW.H2.1.2* *SCIENCE: SC.HS.3.9* *SC.HS.3.11*		
Unit 3: Understand the relationship biogeochemical cycles impact on rangeland	12%	**NRS.01.** Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.	**NRS.01.02**. Classify different types of natural resources in order to enable protection, conservation, enhancement and management in a particular geographical region. *ELA: RST.11-12.1* *RST.11-12.7* *RST.11-12.8* *WHST.9-10.2* *WHST.9-10.2* *WHST.9-10.7* *WHST.11-12.7* *WHST.9-10.9* *WHST.11-12.9* *MATH: MA.HS.N.Q.A* *SCIENCE: SC.HS.3.9* **NRS.01.03.** Apply ecological concepts and principles to	**NRS.01.02.05.a** Research and examine the characteristics used to identify non-living resources (e.g. soil types, climate, geography, etc) **NRS.01.02.05.b.** Apply identification techniques to determine the types of non-living resources in an area. **NRS.01.02.05.c.** Evaluate the non-living resources present in an area to determine the best practices for improving, enhancing and protecting an ecosystem. **NRS.01.03.01.a.** Classify different kinds of biogeochemical cycles and	

			atmospheric natural resource systems. *ELA. RST.11-12.1* *RST.11-12.7* *RST.11-12.8* *MATH: MA.HS.N.Q.A* *MA.HS.S.ID.A* *MA.HS.S.IC.A.* *MA.HS.S.IC.B* *SCIENCE: SC.HS.3.4* *SC.HS.3.7* *SC.HS.3.11* *SC.HS.3.12*	the role they play in natural resources systems. **NRS.01.03.01.b.** Assess the role that the atmosphere plays in the regulation of biogeochemical cycles. **NRS.01.03.01.c.** Evaluate and make recommendations to lessen the impact of human activity on the ability of the atmosphere to regulate biogeochemical cycles.	
Unit 4: Understanding soil management and the relationship to the types of successions.	8%	**NRS.01.** Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.	**NRS.01.05.** Apply ecological concepts and principles to terrestrial natural resource systems. *ELA: RST.11-12.1* *RST.11-12.7* *RST.11-12.8* *MATH: MA.HS.S.ID.A* *MA.HS.S.IC.A* *MA.HS.S.IC.B* *SCIENCE: SC.HS.3.11* *SC.HS.3.9*	**NRS.01.05.01.a** Research and describe the stages of ecological succession. **NRS.01.05.01.b.** Analyze and summarize examples of stages of succession. **NRS.01.05.01.c.** Evaluate the stages of succession present in an ecosystem and predict which species will become more prevalent through future stages of succession. **NRS.01.05.04.a.** Compare and contrast techniques associated with soil management (e.g., soil survey and interpretation, erosion control, etc.). **NRS.01.05.04.b.** Analyze a plot of land in order to determine which soil	

				management techniques would be most applicable. **NRS.01.05.04.c.** Devise a soil management plan to minimize erosion and maximize biodiversity, plant productivity, and the formation of topsoil.	
Unit 5: Discuss the challenge of invasive species and the relationship of the economic effects of Rangeland	8%	**NRS.01.** Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals. **NRS.02.** Analyze the interrelationships between natural resources and humans.	**NRS.01.06.** Apply ecological concepts and principles to living organisms in natural resource systems. *ELA: RST.11-12.1* *RST.11-12.8* *WHST.9-10.2* *WHST.11-12.2* *WHST.9-10.5* *WHST.11-12.5* *WHST.9-10.7* *WHST.11-12.7* *WHST.9-10.9* *WHST.11-12.9* *SCIENCE: SC.HS.2.12* *SC.HS.2.13* *SC.HS.3.11* **NRS.02.04.** Examine and explain how economics affects the use of natural resources. *ELA: RST.11-12.1* *RST.11-12.8* *RST.11-12.7* *WHST.11-12.2* *WHST.11-12.7* *WHST.11-12.8* *WHST.11-12.9* *RW.H2.1.2*	**NRS.01.06.02.a.** Research and summarize examples of invasive species. **NRS.01.06.02.b.** Analyze factors that influence the establishment and spread of invasive species and determine the appropriate steps to prevent or minimize the impact of invasive species. **NRS.01.06.02.c.** Evaluate the presence and impact of invasive species on natural resources in a given area and devise a plan to prevent, control or eliminate invasive species from that habitat. **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	

			SCIENCE: SC.HS.3.9	resources based on economic value and practices.	
Unit 5: Analyzing the impacts of humans on Rangelands	12%	**NRS.02.** Analyze the interrelationships between natural resources and humans.	**NRS.02.02.** Assess the impact of human activities on the availability of natural resources. *ELA: RST.11-12.1* *RST.11-12.2* *RST.11-12.7* *RST.11-12.8* *WHST.9-10.2* *WHST.11-12.2* *WHST.9-10.7* *WHST.11-12.7* *MATH: MA.HS.N.Q.A* *SCIENCE: SC.HS.2.6* *SC.HS.3.9* *SC.HS.3.11* *SC.HS.3.12*	**NRS.02.02.01.a.** Summarize the relationship between natural resources, ecosystems and human activity. **NRS.02.02.01.b.** Assess and explain how different kinds of human activity affect the use and availability of natural resources (i.e., agriculture, industry, transportation, etc.). **NRS.02.02.01.c.** Evaluate how the availability of natural resources can be improved through changes to human activity. **NRS.02.02.02.a.** Categorize the primary causes of extinction of living species due to human activity (e.g., overharvesting, habitat loss, invasive species, pollution, etc.). **NRS.02.02.02.b.** Assess causes of extinction and describe how those causes related to loss of biodiversity **NRS.02.02.02.c.** Devise a strategy for preventing the loss of species and biodiversity that takes into	

			NRS.02.03. Analyze how modern perceptions of natural resource management, protection, enhancement and improvement change and develop over time.	account the primary causes of species extinction from human activity. **NRS.02.03.01.a.** Summarize and categorize the different social considerations in regards to the use of natural resources (e.g., public versus private, laws and regulations, economics, green technology, etc.). **NRS.02.03.01.b.** Analyze how social considerations can affect the use and sustainability of natural resources.	
Unit 6: Develop management plans to increase Range health	5%	**NRS.04.** Demonstrate responsible management procedures and techniques to protect, maintain, enhance, and improve natural resources.	**NRS.04.03.** Prevent or manage introduction of ecologically harmful species in a particular region. *ELA. RST.11-12.1* *RST.11-12.7* *RST.11-12.8* *WHST.9-10.5* *WHST.11-12.5* *WHST.9-10.7* *WHST.11-12.7* *MATH: MA.HS.N.Q.A* *MA.HS.S.ID.A* *MA.HS.S.IC.A* *MA.HS.S.IC.B* *SCIENCE: SC.HS.2.6* *SC.HS.2.13*	**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.04.04.01.a.** Differentiate between	

			NRS.04.04. Manage fires in natural resource systems.	desirable and undesirable fires and research the role fire plays in a healthy ecosystem. **NRS.04.04.01.b.** Assess and apply techniques used to fight wildfires, manage prescribed fires and ensure human safety. **NRS.04.04.02.a.** Research and summarize how fire management techniques have evolved. **NRS.04.04.02.b.** Assess the effectiveness of techniques previously and currently used to prevent harmful fires.	

CAS Academic Standards Alignment: Online Version: https://www.cde.state.co.us/apps/standards/**;** Download version: https://www.cde.state.co.us/apps/standards/

Reading, Writing, and Communicating: (RST/WHST are Common Core Standards aligned; http://www.corestandards.org/ELA-Literacy/RI/introduction-for-6-12/)

- RW.HS2.1.2 – Integrate credible, accurate information into appropriate media and formats to meet an audience's needs.
- RST.11-12.1 – Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
- RST.11-12.7 – Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
- RST.11-12.8 – Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
- WHST.9-10.2 – Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
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- WHST.9-10.5 - Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

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- WHST.9-10.7 – Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
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- WHST.9-10.9 – Draw evidence from informational texts to support analysis, reflection, and research.
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Math:

- MA.HS.S-ID.A – Interpreting Categorical & Quantitative Data: Summarize, represent, and interpret data on a single count or measurement variable.
- MA.HS.S.IC.A - Making Inferences & Justifying Conclusions: Understand and evaluate random processes underlying statistical experiments.
- MA.HS.S-IC.B – Making inferences & Justifying Conclusions: Make inferences and justify conclusions from sample surveys, experiments, and observational studies.
- MA.HS.N-Q.A – Quantities: Reason quantitatively and use units to solve problems.

Science:

- SC.HS.2.6 – A complex set of interactions determine how ecosystems respond to disturbances.
- SC.HS.2.12 – The environment influences survival and reproduction of organism over multiple generations.
- SC.HS.2.13 – Humans have complex interactions with ecosystems and have the ability to influence biodiversity on the planet.
- SC.HS.3.4 – Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes, and these effects occur on different time scales, from sudden to very long term tectonic cycles.
- SC.HS.3.7 – The role of radiation from the sun and its interactions with the atmosphere, ocean, and land are the foundational for the global climate system. Global climate models are used to predict future changes, including changes influences by human behavior and natural factors.
- SC.HS.3.9 – Resource availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.
- SC.HS.3.11 – Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technologies.
- SC.HS.3.12 – Global climate models used to predict future climate change continues to improve our understanding of the impact of human activities on the global climate system.

Essential Skills:

<u>Problem Solver:</u>

- Critical Thinking and Analysis: The ability to apply a deliberate process of identifying problems, gathering information, and weighing possible solutions, including: making choices rooted in understanding patterns, cause-and-effect relationships, and the impacts that a decision can have on the individual and others.

Community Member:

- Civic Engagement: The ability to develop and apply knowledge, skills, and habits gained from experiences – within communities of diverse perspectives – to address issues, affect change, and/or solve problems.
- Global and cultural awareness: the ability to collaborate with individuals from diverse backgrounds and/or cultures to address national and global issues, and to develop complex, appropriate, and workable solutions.

Communicator:

- Data Literacy: The ability to identify, collect, evaluate, analyze, interpret, present and protect data.

Empowered Individual:

- Self-Management: The ability to manager one's emotions, thoughts, and behaviors effectively in different situations and to achieve goals and aspirations, including: the capacity to delay gratification, manage stress, stay positive and accountable, and feel motivation & agency to accomplish personal/collective goals.