SCOPE AND SEQUENCE

THE PATRICIA A HANNAFORD CAREER CENTER

Course Name: Natural Resource Management 1&2

Instructor: Aaron Townshend

Career Cluster: Energy and Natural Resources

Sub-Cluster: Conservation & Land Management, Ecological Research & Development, Environmental Protection, Resource Extraction

Career Cluster: Agriculture

Sub-Cluster: Agribusiness, Plant Systems

HS Course Credits: 1 math, 1 science, 1 elective per year

Fast Forward Optional Credits: CCV (Introduction to Environmental Science), WMCC (Dendrology & Intro to Tree Shrub Identification)

Tier 2 Credentials: LEAP (Logger Education for Advancing Professionalism), GOL (Game of Logging, Ducks Unlimited Ecology Conservation & Management Certification

Tier 1 Credentials: First Aid & CPR, GOL 1&2

CTSO/Enrichment: FFA

Recommended Preparation For Success In This Course: Working outdoors in a variety of challenging conditions within a team structure.

Tagline: "A Land Ethic…reflects the existence of an ecological conscience…. a conviction of individual responsibility for the health of the land." (Aldo Leopold)

Student appeal: Natural Resource Management is for students who are looking to get outside**!** That is, outside of your comfort zones with challenging timber harvests and wildlife management projects, requiring teamwork and individual responsibility, working both inside and outside of the classroom environment, and partnering with professionals in the field in our local natural resource economy.

Course Description: Natural Resource Management is about making thoughtful decisions about how we interact with the environment to ensure long-term health and productivity of natural systems. This two-year program alternates between (1) land use & wildlife management, and (2) Forest Science where students may join the class at any time (there are no “introductory” and “advanced” sections). Through this varied curriculum, students learn skills that will help them take on careers and post-secondary training to keep our forest ecosystems in balance.

Forest Science (“Year 1” - alternating years)
Students learn how forest ecosystems play an essential role in the preservation of biodiversity, mitigate the effects of climate change, and learn how to manage forests as resources for the economies of today and future generations. Harvesting trees, skidding logs, operating a sawmill, producing maple syrup, and developing forest management plans are all cornerstones of the curriculum that encourages students to step beyond their comfort zones.

Land Use and Wildlife Conservation (“Year 2” - alternating years)
Students study the relationships between water quality, soil science, and wildlife conservation efforts. They learn how to operate heavy equipment, utilize GIS mapping software, and work closely with industry professionals to design and execute comprehensive projects for wildlife restoration and agricultural activities. Students create “legacy” projects that add value to the community for future generations to enjoy.

Proficiencies/Learning Targets:

LT 1: Demonstrate comprehensive professional readiness by developing a list of personal and work-related values (norms), reading, summarizing, and effectively communicating reactions to industry-level articles, practicing appropriate workplace safety according to OSHA 10 standards, and preparing and presenting a project proposal for an agricultural activity

LT 2: Master spatial analysis and mapping techniques by using rulers, GPS, compasses, and map scales to measure acreage and distance, interpreting all aspects of USGS topographic maps including coordinate systems (UTM & Lat/Long), employing surveying equipment to level and square building sites, calculate slopes, and develop topographic maps, and utilizing GPS and ArcGIS technology to create precise and professional maps.

LT 3: Demonstrate proficiency in forest management by communicating understanding of forest ecology and silvicultural practices, identifying common forest pests and diseases, conducting accurate timber cruises to determine stocking levels, and providing treatment recommendations based on site productivity, stocking, and species composition.

LT 4: Design and execute a sustainable forestry operation that integrates Vermont AMPs to minimize erosion, safely operate a chainsaw following "Game of Logging" specifications for felling, limbing, bucking, and skidding trees, while scaling and processing logs according to industry standards to maximize value and performing routine maintenance to optimize chainsaw performance and longevity.

LT 5: Effectively manage agricultural land by implementing erosion prevention techniques such as water bars, silt fencing, and buffer zones, accurately measuring slopes and communicating their implications on agricultural activities, assessing soil drainage properties and communicating their impact on agricultural activities, and measuring soil chemistry aspects including pH and nutrients to strategize manipulation for optimal agricultural productivity.

LT 6: Demonstrate comprehensive knowledge of freshwater ecosystems by assessing water quality using EPA standards for chemical, biological, and physical indicators, explaining the impacts of human activities on aquatic ecosystems, identifying native fish species and discussing management efforts, and understanding the anatomy and physiology of freshwater fish.

LT 7: Demonstrate proficiency in wildlife management by communicating important principles and laws, explaining habitat and niche requirements along with population dynamics of wildlife species, collecting and documenting scientific wildlife data using GPS and GIS systems, and identifying key wildlife species such as waterfowl, rodents, and predators while detailing their relevant biology.

LT 8: Demonstrate expertise in conservation and excavation operations by safely and proficiently operating equipment such as excavators and dozers, performing routine maintenance tasks including greasing, fluid changes, and adjustments on conservation equipment, interpreting site plans for excavation projects and estimating material costs, and identifying tools and materials essential for various excavation projects including subsoil drainage, road construction, and slab/pier foundations.

LT 11: Proficiently apply arboricultural rigging and climbing techniques by demonstrating knowledge of standard knots (scaffold hitch, clove hitch, bowline, running bowline, cow & timber hitch, fisherman's, Blake's hitch), building a rigging rope system with a 5:1 mechanical advantage, setting up a lowering rigging system with a "portawrap", block, and hitches, and establishing an SRT or DRT climbing system with appropriate friction saver placement for effective work positioning.

LT 12: Demonstrate comprehensive knowledge of plant biology by identifying tree species through examination of twigs, bark, leaves, fruit/cone, and silhouette, explaining the structure and function of basic plant anatomical parts, distinguishing between angiosperms and gymnosperms, and communicating the impact of invasive plant species on native ecosystems.

LT 13: Solve equations and inequalities in one variable. (HSA.REI.B)

LT 14: Define trigonometric ratios and solve problems involving right triangles. (HSG.SRT.C)

LT 15: Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* CCSS.Math.Content.HSG.MG.A.1

LT 16: Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* CCSS.Math.Content.HSG.MG.A.2

Standards: Standards are aligned with Vermont's CTE Forestry and Natural Resources Critical Proficiencies Anchor Standards (VT), which derive from and are aligned with the Common Career Technical Core Standards for the Agriculture, Food, and Natural Resources as well as with LEAP Ducks Unlimited Conservation Certification

Additional standards alignment includes:

PAHCC Habits of Work: Safety, Work Ethic, Reliability, People Skills

PAHCC Transferable Skills: Creative and practical problem solving; Inquiry; Informed and Integrated Thinking.

CCTC - Career Ready Practices

Unit and Essential Question(s)	Estimated # of Classes Periods *(assumes 120-minute classes)*	Learning Targets
Forest Science ("Year 1")		
Unit 1: Chainsaw Safety and Maintenance *How may chainsaw safety and efficient operation be improved through effective maintenance?*	16 classes	**Learning Targets: LT 4, LT 8, LT 13** ● Perform routine maintenance on a chainsaw (sharpening, calculate fuel/oil ratios, optimize performance)
Unit 2: Timber Harvesting and Processing *How can the logging industry improve efficiency in the harvesting and processing of wood products?*	16 classes	**Learning Targets: LT 3, LT 4, LT 13, LT 15** ● Design a harvest plan that adheres to the Vermont AMPs to minimize erosion ● Safely fell, limb, buck, and skid a tree according to "Game of Logging" specifications ● Scale logs according to industry standards and process logs for maximum value (Calculate log volume and analyze efficiency of different scales)

Unit 3: Plant Anatomy and Dendrology *How did the diversity of plant species evolve to be successful in a variety particular ecosystems?*	16 classes	**Learning Targets: LT 3, LT 12** ● Identify tree species by examining twigs, bark, leaves, fruit/cone, and silhouette ● Communicate the structure and function of basic plant anatomical parts ● Explain key differences between angiosperms and gymnosperms ● Communicate types of invasive plant species and how they are harmful to native species
Unit 4: Forest Ecology and Silviculture *How may forest resources be sustainably managed in the changing climate?*	16 classes	**Learning Targets: LT 3, LT 4, LT 13, LT 15, LT 16** ● Communicate an understanding of forest ecology and silvicultural practice ● Identify common forest pests and diseases ● Complete an accurate timber cruise and determine stocking levels (Utilize basal area calculations vs. density data) ● Make treatment recommendations based on site productivity, stocking, and species composition
Unit 5: Mapping and Land Measurement *How can survey equipment be used to effectively design excavation projects.*	16 classes	**Learning Targets: LT 2, LT 13, LT 15, LT 16** ● Use rulers, GPS, compasses, and map scales to measure acreage and distance ● Interpret all aspects of a USGS topographic map including coordinate systems (UTM & Lat/Long) ● Use surveying equipment to level and square a building site, calculate slope, and develop a topographic map ● Utilize GPS and ArcGIS technology to create professional and accurate maps

Unit 6: Arboriculture *How can arboriculture skills be applied to improve the resilience of our urban forests?*	16 classes	**Learning Targets: LT 11** ● Demonstrate knowledge of standard knots (scaffold hitch, clove hitch, bowline, running bowline, cow & timber hitch, fisherman's, Blake's hitch) ● Build a rigging rope system with a 5:1 mechanical advantage ● Set up a lowering rigging system with a "portawrap", block, and hitches ● Set up a SRT or DRT climbing system and work positioning climbing system with appropriate friction saver location
Land Use and Wildlife Conservation ("Year 2")		
Unit 7: Water Quality and Land Use *How can principles of healthy aquatic ecosystems be applied to sustainable agricultural projects?*	16 classes	**Learning Targets: LT 6, LT 13** ● Determine water quality using the EPA standards for chemical, biological, and physical indicators (Calculate BMI index) ● Demonstrate an understanding of how aquatic ecosystems are affected by human activities ● Identify native fish species and communicate management efforts ● Demonstrate an understanding of basic freshwater fish anatomy and physiology
Unit 8: Soil Science *How are characteristics of soil used to determine the potential land use?*	16 classes	**Learning Targets: LT 4, LT 5, LT 13** ● Prevent soil erosion in specific situations (water bars, silt fencing, buffer zones) ● Accurately measure slope and communicate the implications on agricultural activities ● Determine drainage properties of soil and communicate the implications on agricultural activities ● Measure aspects of soil chemistry (pH & nutrients) and how they can be manipulated

Unit 9: Wildlife Science *What is the next chapter of wildlife management practice as the climate and geopolitics change?*	16 classes	**Learning Targets: LT 6, LT 7** ● Communicate important wildlife management principles and laws ● Explain habitat & niche requirements and population dynamics of wildlife species ● Collect and document scientific wildlife data using GPS and GIS systems ● Identify important wildlife species (waterfowl, rodents, predators) and their relevant biology
Unit 10: Conservation Equipment Operation and Maintenance *How can heavy equipment be used to enhance wildlife habitat while protecting soil and water?*	16 classes	**Learning Targets: LT 8, LT 13** ● Operate conservation equipment (excavator, crawler/dozer, etc...) safely and proficiently ● Perform routine maintenance (ie: greasing, fluid changes, adjustments, etc...) on conservation equipment ● Interpret site plans for excavation projects and estimate costs of materials for projects (Create balance/expense reports sheets in spreadsheet format) ● Identify tools and materials used in a variety of excavation projects (subsoil drainage, road construction, slab/pier foundations…)
Unit 11: Leadership and Professionalism *How can preparedness and professionalism improve the likelihood of financial and personal success?*	16 classes	**Learning Targets: LT 1** ● Develop a list of personal and work-related values (norms) ● Read, summarize, and communicate a reaction to industry-level articles ● Demonstrate appropriate workplace safety practices (OSHA 10) ● Submit and present a project proposal for an agricultural activity