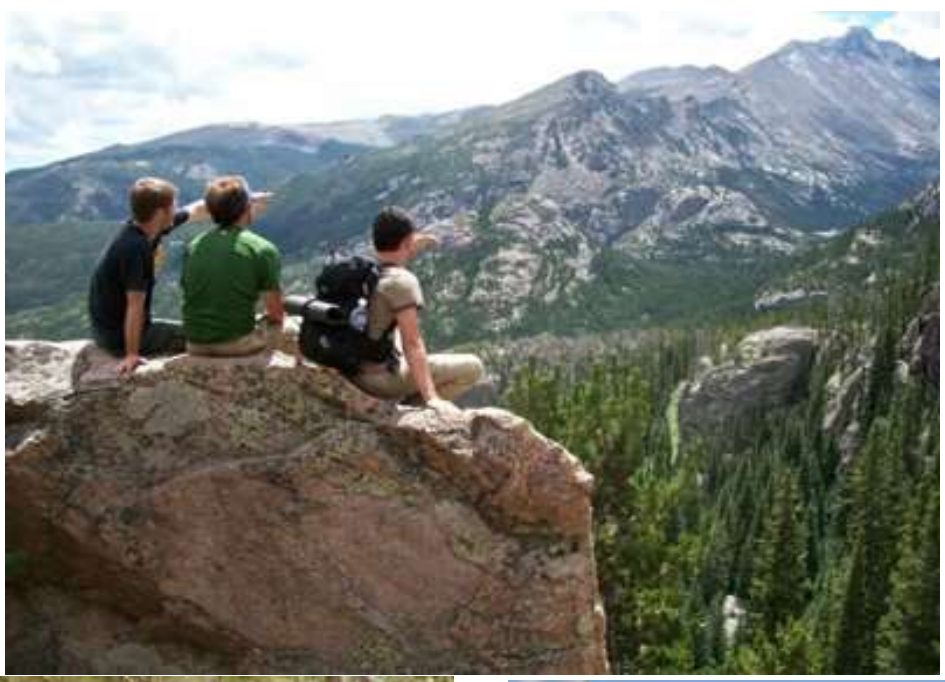
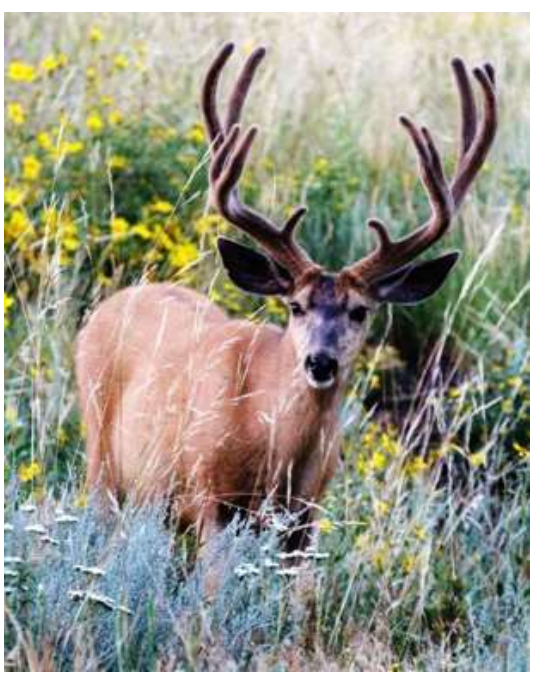
Colorado Ecosystem Field Studies

2024 Course Syllabus

Conducted by Ecosystem Field Studies





A 3-WEEK, COLLEGE-ACCREDITED, HANDS-ON SCIENTIFIC ANALYSIS OF THE MAJESTIC COLORADO ROCKY MOUNTAIN ECOSYSTEM

COURSE CREDITS: ENST 391-Colorado Ecosystem Field Studies for 3 undergraduate semester transfer credits through the Environmental Studies Program of the University of Montana at Missoula and is open to students from any university or major. ****While over 190 universities accept EcoFS courses for transfer credit, students must confirm with their department concerning exactly how these credits will transfer for their degree.****

DATES: July 19- August 8, 2024

CLASS SIZE: 18-22 Students

INSTRUCTOR: Steve Johnson, Affiliate Faculty of University of Montana Environmental Studies Program

CONTACT HOURS: Each day runs 8:30 am to 4:30 pm with a half-hour break: Total contact hours = 153
(20 days of 7.5 hours, 1 day (Day 9) of 3 hours)

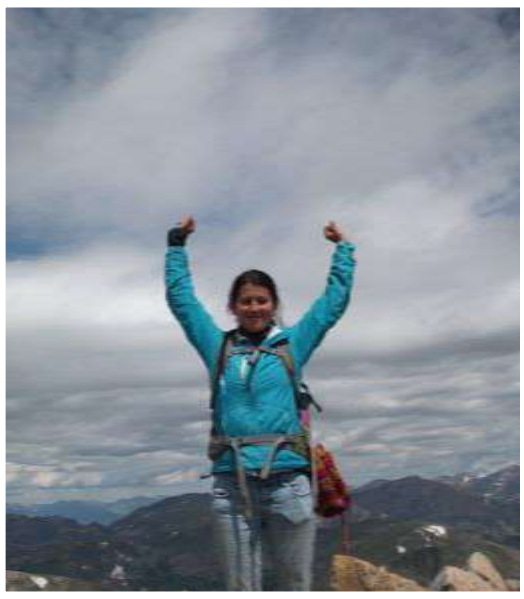
DESCRIPTION: EcoFS and Cal-Wood Education Center offer a unique opportunity to study a healthy and diverse Colorado Rocky Mountain ecosystem. Daily hikes, ecosystem explorations and hands-on scientific investigations create a robust, ecologically based academic learning experience. Students synthesize & apply information they have gained from their classroom & textbook context while actively studying & exploring a spectacular mountain environment.

To learn more & APPLY- visit

www.ecofs.org

ECOSYSTEM Field Studies

This is Where Your Classroom Education Comes to Life!



Colorado Ecosystem Field Studies is a hands-on, 21-day field class that provides incredible academic opportunities for experiential investigation of Rocky Mountain ecosystems. Ecological concepts & field methods of the Rocky Mountains are examined in greatest detail, yet the knowledge & techniques gained are applicable to any ecosystem. Instruction is delivered with inquiry-based activities incorporating observation & data collection, small working groups, lecture, focused exploration through daily hikes & explorations, guest speakers & off-site trips. During the second half of the course students create and implement an original ecosystem field research project.

Course Objectives:

Students will…

- **Achieve a deep knowledge base of the structure & functioning of the Colorado Rocky Mountain ecosystem.**
- **Gain expertise in utilizing a variety of ecosystem field tools & techniques.**
- **Learn rigorous scientific research skills including observation, hypothesis formation, sampling, mapping, modeling & data analysis.**
- **Develop a passion for a particular academic or career path within ecosystem science.**
- **Participate positively in a safe, rewarding & challenging group hiking/camping experience.**

Course Location

Nestled in the Colorado Front Range at an incredible basecamp at 8,000 ft.

Cal-Wood Education Center is a private, non-profit organization located on 1,200 acres in the foothills of the Front Range of the Rocky Mountains. It is located approximately 45-minutes northwest of Boulder and surrounded by US National Forest & just a few miles outside of Rocky Mountain National Park. This spectacular learning center lies at an elevation of 7,500-8,500 feet & contains miles of trails & vast tracts of montane forest, lush meadows, ponds, streams, & highly abundant wildlife.

Cal-Wood is utilized for a variety of educational programs such as school groups, professional trainings, retreats & summer camps. Cal-Wood has a conservation easement on the property & conducts an active natural resource management program with projects in forestry, wildlife, & non-native plant species. This course is based out of Cal-Wood's secluded, spacious Solitude Camp. Visit www.calwood.org for more info.

A Typical Day…

Our days are filled with academic adventure while hiking & exploring the Rocky Mountains

Students camp in individual tents and wake to a delicious camp breakfast. Typically, we have a morning class session with a short lecture relating to topics & activities of the day. We then hike to various areas of Cal-Wood for focused exploration & structured field activities with observation & data collection in small work groups. See details on topics and activities below. Expect 1-2 hours of lecture time and a 1⁄2- hour lunch break at a scenic location. There are four exciting off-site field trips to study other Colorado ecosystems. The first half of the course includes nightly homework assignments that synthesize & apply data & observations from the day. The second half phases into independent study relating to independent research projects.

The group returns to camp each day at 5:00pm, happy, tired & filled with the energy of natural discovery and scientific investigation. Total daily hiking averages 2-5 miles in rugged terrain & often off-trail. Students enjoy a healthy & hearty camp dinner (you will not go hungry!). The remainder of the day & evening is unstructured allowing for tent-work (homework), independent study, & personal time. We utilize the main Cal-Wood lodge for hot showers, wifi, laundry & emergencies. Campfires are a welcome end to the day at camp before a well-deserved rest.

Course Schedule of Topics & Activities:

Each day runs 8:30am-4:30 pm with a 30-minute lunch break.

Day 1- Cal-Wood & Camp Orientation

Pick-ups in Boulder for transport to Cal-Wood Education Center
To Solitude Camp base-camp - Introductions, camp setup

Lecture/discussion topics:

Outdoor safety - emergency scenarios & procedures, wildlife & other environmental concerns, health & hygiene
Course overview - syllabus, educational approach

Day 2- Rocky Mountain Geography & Climatology

Lecture/discussion topics:

Colorado geography - landscape features, topographical analysis
Maps - types, terms, research uses, GIS & Google Earth
Climatology - global & local processes, mountain factors, measurement, importance to ecosystems

Field activities:

North vs. south facing slope site comparison - create transects & measure climatological & geographic variables such as slope angle, aspect, elevation, air & ground temperature/humidity, cloud type/cover
Map skills - use of topographic maps
Compass - bearing & pacing skills, utilization for transects & research

Day 3- Biodiversity- macroinvertebrate collections

Lecture/discussion topics:

Biodiversity- species concept, adaptations, richness & abundance, diversity types & indices, research techniques
Cal-Wood invertebrate overview- common aquatic & terrestrial groups, importance & role in ecosystem, collection & observation methods
Field observation & the scientific method- scientific observations & recording

Field activities:

Biological collections - collect, observe, & identify terrestrial & aquatic macro-invertebrates, compare populations in varied communities, analyze adaptations
Animal communication study - observe & classify animal calls & sounds

Day 4- Geology- rock & landscape investigations

Lecture/discussion topics:

Geologic processes - geologic timescale, plate tectonics, erosion, importance to ecosystem structure & functioning
Formation of Colorado Rocky Mountains & the Front Range- major geologic episodes, landscape features, mining history
Rocks & minerals - Front Range rock & mineral types, identification methods, human use, minerals & biotic organisms

Field activities:

Geologic investigation - hike the Cal-Wood valley to observe, map & measure geologic features, formations &mineral deposits
Rock/mineral collection - analyze & identify rocks & minerals using geologic hammers & hand lens

Day 5- Ecosystem Ecology- soil & water analysis

Lecture/discussion topics:

Abiotic ecosystem processes - biogeochemical cycles, energy flows
Soil - formation, composition, classification, ecosystem importance
Water - physical & chemical factors, mountain hydrology, measurement techniques

Field activities:

Soil analysis & collection - dig soil pits, identify horizons, measure water infiltration rate, soil moisture, temperature. In lab setting classify soil texture, sorting, & perform chemical tests for Ph, NPK levels. Compare parameters in different habitat types.
Water quality analysis - chemical/physical tests of pond & stream. Measure turbidity, flow, temperature, Ph.

Assignments

+Percentage of Overall Grade

35% = Daily reading & "tentwork" assignment. Tentwork is given nightly for first half of course to synthesize & apply data & observations.

15% = 10-minute field presentation on the research project

30% = 10-page written research paper expanding on field research project. Due 2 weeks after course ends.

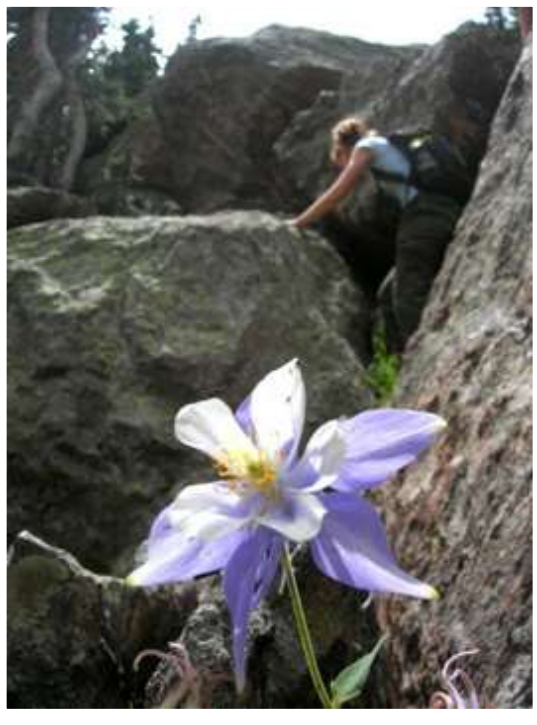
10% = Course participation

10% = Final written exam (via email). Due 1 week after course ends.

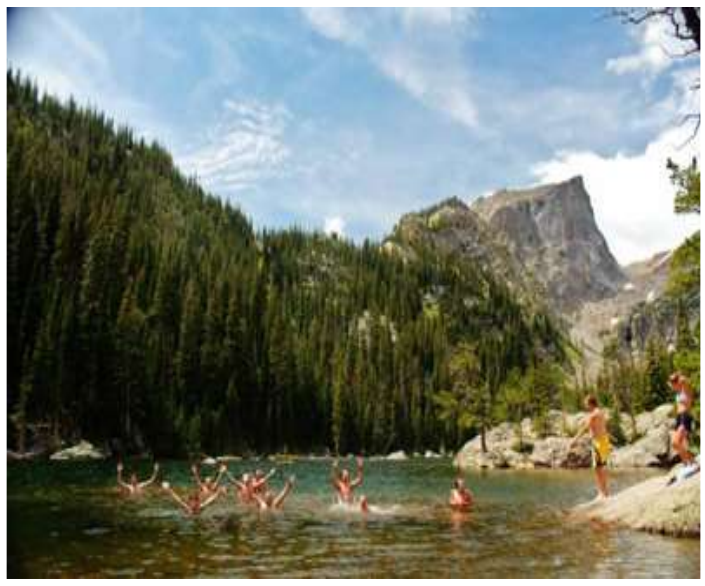
Readings

National Audubon Society Field Guide to the Rocky Mountain States, Alden & Grassy, 1999

How to Do Ecology- A Concise Handbook, Karban & Huntzinger, 2nd Edition 2014



Day 6- Ecosystem Trip to Indian Peaks Wilderness Area



Lecture/discussion topics:

Colorado Front range life zones - elevational impact on biological communities & ecosystem components

Sub-alpine life zone focus- species of interest, geologic & geographic differences

Field activities:

Off-site Ecosystem investigation Journey to the Brainard Lake National Recreation Area, a spectacular high-elevation location that contains the Indian Peaks Wilderness Area. Hike through the sub-alpine life zone community with old-growth forest & past glacial lakes & features to reach the beautiful Lake Isabelle at over 10,000 ft.! Compare ecosystem variables & species composition/diversity to the lower elevation of Cal-Wood.

Day 7- Wildlife Ecology & Animal Behavior

Lecture/discussion topics:

Colorado/Cal-Wood wildlife overview- common species, species of population concern & ecosystem importance

Animal Behavior- animal observation skills, pros & cons of behavioral studies, ethogram usage

Wildlife research techniques - sampling methods, intrusive vs.non-intrusive techniques, population studies

Field activities:

Animal behavior study- observe & document behavioral variables using ethograms & other wildlife tools

Wildlife evidence analysis - field identification & measurement of signs, tracks, scat, markings, shelters etc.

Day 8- Colorado Forest Ecology

Lecture/discussion topics:

Colorado forest ecosystems – common tree species, insect & diseases, role of fire, forest monitoring & management, **human** utilization, **Community Ecology** – forest inter-relationships, community types

Field activities:

Forestry Study- conduct site surveys & calculate forest densities, volume, spacing & canopy cover. Identify tree types, measure diameter, height, fire history, insect/disease infestation. Determine age & growth history by extracting & analyzing tree core samples with increment borers.

Day 9- Research Design

Lecture/discussion topics:

Book discussion group activity for the How to Do Ecology textbook

Convene at 1:00 pm

Day 10- Ecosystem trip to Rocky Mountain National Park

Lecture/discussion topics:

Rocky Mountain National Park - history, geography, ecosystem issues, wildlife species of interest

Geologic characteristics - glacial mechanics & features- moraines, U-shaped valleys, cirques, lakes

Sub-alpine life zone - ecosystem characteristics, species variation

Field activities:

Off-site Ecosystem Investigation- hike from the Longs Peak Trailhead of Rocky Mountain National Park through majestic sub-alpine old growth forest to alpine treeline. End at the incredible Chasm Lake beneath Longs Peak at 11,7000 ft.! Identify dramatic geologic and geographic features and alpine wildlife.

Day 11- Vegetative Survey & Pollination Study

Lecture/discussion topics:

Plants - classification, physiology, role in ecosystem processes

Fungus & lichens - characteristics & ecosystem function, diversity

Field activities:

Vegetative surveys - identify, classify, & measure flora in quadrats, calculate relative abundance & diversity indices, observe features & physiology in lab setting

Pollination analysis - record & measure pollination visits to flowers.

Day 12- Ecosystem trip to the Boulder Grasslands & Eldorado Canyon State Park

Lecture/discussion topics:

Grassland & foothills life zones - ecosystem characteristics, species of interest, abiotic comparison, elevational variables

Geologic characteristics- sedimentary formations & features, fossils

Colorado water conservation- ecosystem impact

Field activities:

Off-site Ecosystem investigation- Travel down in elevation to 5,500 ft, & hike through pristine grassland communities of near Boulder. Continue into dramatic Eldorado Canyon State Park & observe spectacular sedimentary formations along the swift-flowing South Boulder Creek. Compare ecosystem variables & species composition.

Dinner in Boulder & Boulder Exploration

Day 13- Sampling Methods

Lecture/discussion topics:

Ecosystem sampling methods -transects & quadrats, randomization, stratification, replication, scope of projects

Field activities:

Group pilot projects

Independent research- process scientific observations, devise hypotheses, create initial methodology & research design

Individual consultations- advisement for research projects

Day 14- Independent Research Projects

Field activities:

Independent research- process observations, refine hypotheses & experimental design, begin data collection

Day 15- Independent Research Projects

Field activities:

Independent research- intensive data collection

Day 16- Restoration Ecology

Lecture/discussion topics:

Ecosystem restoration overview - goals & methods

Current Cal-Wood restoration projects- forestry, wildlife, non-native plants

Field activities:

Independent research - intensive data collection

Day 17- Ecological Data Analysis

Lecture/discussion topics:

Basic data analysis – basic analysis methods, statistics overview

Field activities:

Independent research - intensive data collection

Day 18- Ecosystem trip to Indian Peaks Wilderness

Lecture/discussion topics:

Alpine tundra life zone - ecosystem characteristics, wildflower populations, alpine species of interest & concern, climatological extremes

Field activities:

Ecosystem analysis- ascend above treeline, along a glacial moraine & permanent snowfield to a pass along the Continental Divide. If weather & energy permit, we will attempt the summit of Mt. Audubon at 13,320!

Day 19- Presentation Prep

Lecture/discussion topics:

Presentation techniques - effective communication & displays

Field activities:

Independent research -final data collection, data analysis

Day 20- Student Presentations

Field activities:

Student presentation of field research projects

Day 21- Student Presentations/Closing

Field activities:

Student presentation of field research projects

Camp breakdown, Closing

Course ends at 5:00pm

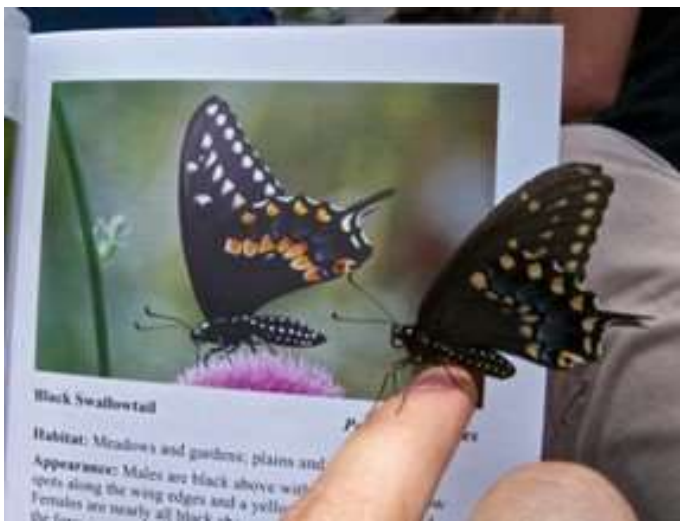
About the Research Project

The culminating assignment is a field research project & presentation. Students develop an original research project based upon scientific field observations they perform. In their project, students will process observations, formulate hypotheses, design an experimental methodology, conduct background research, & collect & analyze field data. A culminating class presentation outlines the research project & expands on key concepts. Finally, post course, students complete a written scientific research paper that encapsulates the project.

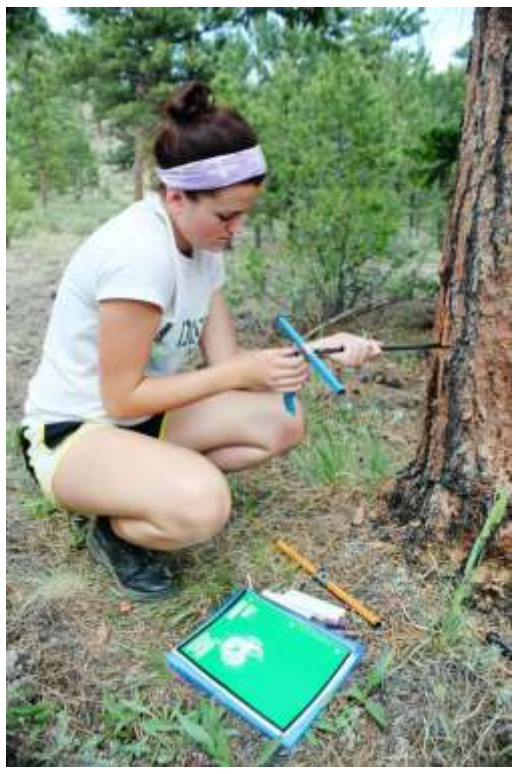
No specific scientific research background is necessary to take this course. This is an excellent opportunity to learn if field research is a good fit for you. Additionally, for students who have research experience, this course is an opportunity to take their skills to a higher level.

For a Full List of Past Research Topics See Below

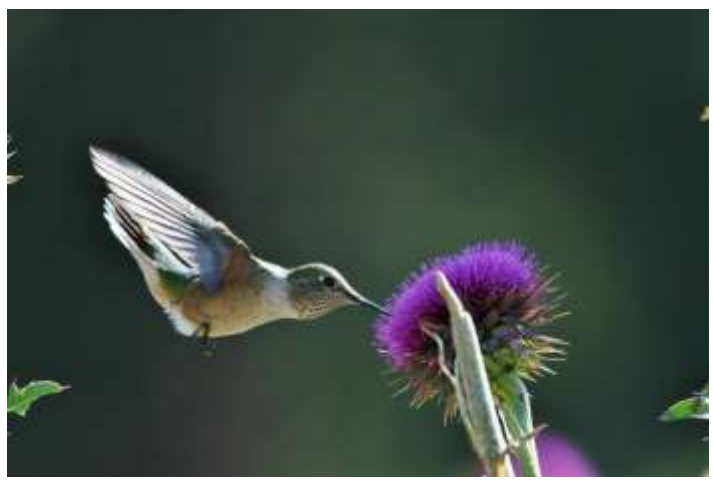
Colorado EcoFS Past Research Topics



2023
Variation in Pollination Between Different Insect Groups
Woodpecker Feeding Behavior Patterns Related to Tree Preferences
Slope Aspect Effects on Tree Seedling Regrowth After Wildfire
Rock Composition at Various Elevation and Locations
Lichen Pigment on Shaded vs Exposed Rocks on North and South Facing Slopes
Non-native vs. Native Plant Species and Abundance of Insect Herbivores
Variation in Pollination of Wildflowers with Respect to Nativity and Species
Anthropogenic Effects on Soil pH and Chemical Nutrients on Trails and Roads
Difference of Lichen Species Abundance and Diversity on Different Slope Aspects
Effect of Pitch on Color Variations in Ponderosa Pines in Cal-Wood
Paths and Patterns of Mule Deer Throughout Cal-Wood
Behavior Comparison Between Cabbage White Butterflies and Wood Nymphs
Comparison of Soil NPK between Upper and Lower Ponds
Number of Flowers Per Individual Plant and Plant Deaths Effect on Pollen Viability
The Proportions Of Squirrel Behaviors During Daytime
Lupines and Their Effect on Soil pH and Flora Biodiversity
Influence of High Mortality Wildfire on Ponderosa Pine and Douglas Fir Sapling Populations
The Effect of Flower Morphology on Rate of Insect Pollination
Human Activity Effect on Chipmunk Populations
The Impact of Aspect on Diameter of Ponderosas Pines
Tree Swallow Hunting Behaviors and Frequency of Swarm Events
The Effect of Elevation on Fruiting Fungal Species Richness at Varying North-Facing Slopes



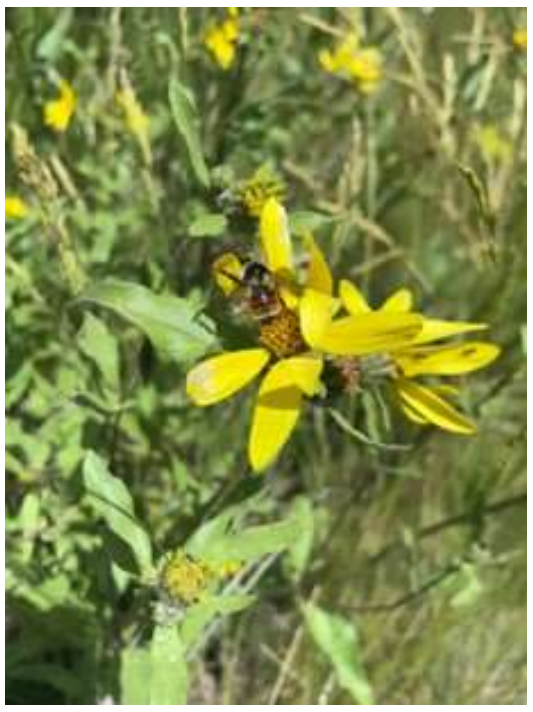
2022
Ball Cactus Abundance and Growth Patterns in Comparison to Neighboring Flora
Comparison of Canada Thistle and Bull Thistle in Disturbed and Undisturbed Sites
Mule Deer Feeding and Resting Behavior
Population Distribution and Health of Aspen Groves
Soil pH Variation in Response to Elevation Change
Grasshopper Abundance and Behaviors in Burned and Non-burned Areas
Ability of Desiccated Moss to be Rehydrated Based on the Moistness of its Habitat.
Great Red Paintbrush Abundance in Relation to Proximity to Aspen Groves
Lichen Diversity on Varying Rock Types
Ant Colony Distribution in Varying Ecological Communities
Shelf Fungi Mushroom Distribution on Varying Tree Species
Growth Rate of Ponderosa Pine based on Soil Type and Nutrients
Bee Preference for Wildflower Color
Abundance of Western Terrestrial Garter Snakes in Varying Communities
Correlation Between Water Flea Abundance and Macroinvertebrate Diversity
Douglas Fir Health and Size on Varying Slopes
Soil Infiltration Rates in Burned vs Non-burned Areas
Steller's Jay Behavior and Vocalization Patterns



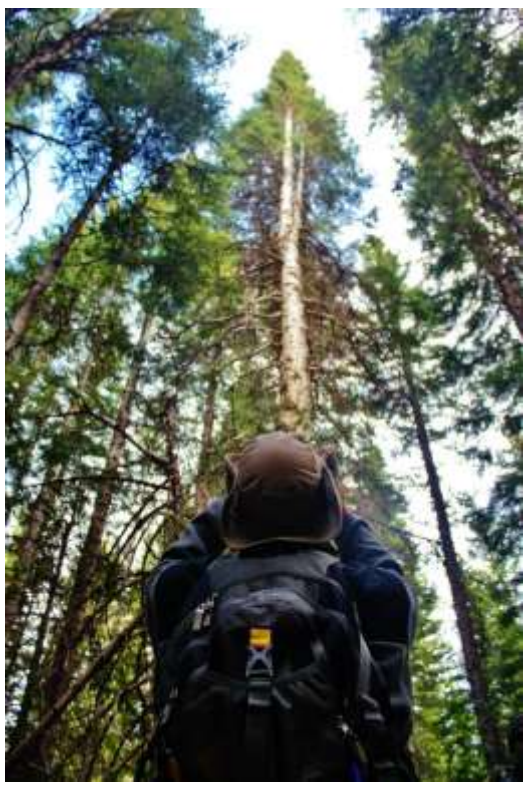
2021
Growth Rate of Ponderosa Pine Affected North vs South Facing Slope
Wildfires Effect on Forb Abundance and Diversity
Tree Preference for Antler Rubs in the Montane Forest
The Difference in Bladder Snail Populations in the Upper versus Lower Ponds
Preference of Lichen for Dead vs Live Trees
Forest Canopy Coverage on North and South Facing Slopes
Pollination Rates of Three Different Cal-Wood Flowers
Abundance and Variation of Backswimmers in the Upper and Lower Ponds
The Effects of Wildfire’s on Native and Invasive Groundcover
Golden Mantle Ground Squirrel Social Behavioral Analysis
Optimal Soil Conditions for Common Yarrow
Potassium Level Variation at Igneous Outcrops
Plant Diversity in Different Ecological Communities s
Growth Rate of Ponderosa Pines vs Douglas Firs
Abundance of Mushroom Diversity between Different Communities

2019
Comparison of Willow Growth at the Lower and Upper Ponds
A Study of Harebell Abundance in Forests vs. Meadows Based on Soil Moisture
Relative Abundance of Creeping Thistle to other Flora in Two Regions
Butterfly Behaviors near Mineral Licks
Cacti Habitat and Growth at Cal-Wood
Comparing Invertebrates in Varying Levels of Pond Vegetation
Common Nighthawk Feeding Behaviors
Slope Aspect Affects on Yearly Growth Rate of Ponderosa pine
Nutrient and pH Differences of Upper and Lower Pond
Population Distribution of Rocky Mountain Juniper
Forest Health in Relation to Stand Density
Pollinator Diversity on Common Groundsel
Vascular Aquatic Plants and Quality of Water that Contributes to Plant Growth
Does the Invasive Bull Thistle Decrease Nearby Plant Diversity?
Comparison of Wildflower Biodiversity in Forest and Meadows
How Does Parent Material Affect Soil Characteristics
Moss Distribution on North vs South Facing Slopes
Common Nuthatch Feeding Behaviors on Ponderosa Pines

<u>2018</u>
Chemical and Physical Analysis of the Upper Pond at Cal-Wood
Soil Particle Size Effect on the pH of Water
The Relationship between Signs of Erosion and Tree Density
Moisture Content, pH, and Soil Type Relationships to Wax Currant
Species Richness of Aquatic Macroinvertebrates of the Upper and Lower Ponds
Caddisfly Larvae Density in the Central Gulch
Tree Density and Overall Stand Vigor
Comparing Soil Nutrients in Forest and Meadow Ecosystems
Bird Species Populations of Ponderosa Pine
Lichen Abundance on the North and South Slopes
Abiotic Conditions Preferred by Common Bergamot
Populations and Size of DragonFly Larvae
How Aspect, Slope & Elevation Influence Cactus Species
Canada Thistle Gall Distribution on Varying Shrub Species
Sap Production of Douglas Fir Trees based on Slope Aspect
Mule Deer Population Distribution based on Scat Abundance
Soil Moisture Content and Aspen Grove Distribution



<u>2017</u>
The Effect of Slope Aspect on Species Diversity of Lichen
Aspect and Level of Disturbance as Determinant of Common Mullein Density
Soil Infiltration Rates on Social Trails vs Established Trails
Effects of Abiotic factors on Mule Deer Habitat Preference
Ant Colony Distribution and Territorial Range
Pollinators Preference for Differing Wildflower Color & Patterns
Water Quality Analysis of Central Gulch
Testing the Group-Size-Effect in Mule Deer
Water Infiltration Rate into Soil and Its Effect on Tree Growth Rate
Distance from Riparian Area Effect on Plant Diversity
Spatial Distribution Role on the Health of Quaking Aspen Groves
Ponderosa Pine Growth Rate in Relation to Diameter
Common Lupine Distribution and Soil Nutrients
Common Raven Social Behaviors at Differing Times of Day
Rate of Pollinator Visits to Two Flower Species
Soil Potassium Levels in Proximity to Rock Outcrops



For all further course info including details on costs, credits & application please visit:

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