Introducing EcoFS’ 2019
Colorado Ecosystem Field Studies
A Rocky Mountain field course developed by Professor Steve Johnson
Affiliate faculty of the University of Montana at Missoula’s Environmental Studies Program.

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

LOCATION: Cal-Wood Education Center, a 1,200-acre private, outdoor classroom near Boulder, Colorado in the foothills of the Rocky Mountains. Course location elevation is 7,500 - 8,500ft.

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 & is open to students from any university or major. While over 180 universities have accepted EcoFS courses for transfer credit, students must confirm with their department or advisor exactly how these credits transfer for their specific degree.

DATES: July 26 – August 15, 2019

CLASS SIZE: 20-22 Students

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
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 and field methods are examined in great 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 base-camp 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 & we utilize the main Cal-Wood lodge for hot showers, wifi, laundry & emergencies. Visit [www.calwood.org](http://www.calwood.org) for more info.

**A Typical Day...**

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

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. 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 group returns to camp @ 5pm, happy, tired & filled with the energy of natural discovery. 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. Students sleep (soundly) in personal tents.

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. Cal-Wood Lodge is a 10 minute walk from camp & available for hot showers, phone, wifi access, laundry, & emergencies.
Course Schedule of Topics & Activities:
Each day runs 8:30am-5:00pm 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, wind speed/direction, cloud type/cover
- Map skills - use of topographic maps & GPS
- 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 time-scale, 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
- Mica mine exploration - visit a historic Colorado mine, observe mica crystals in pure mineral form

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
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:
- **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 Lake Isabelle. Compare ecosystem variables & species composition 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:
- **Forest stand analysis** - 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- 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:
- **Ecosystem investigation** - hike from the Longs Peak trailhead through majestic sub-alpine, old-growth forest to alpine tree-line and ending at the incredible Chasm Lake beneath Long’s Peak. Identify dramatic geologic & glacial features.

Dinner in Jamestown

Day 10- Research Design

Lecture/discussion topics:
- Book discussion group activity for the *How to Do Ecology* textbook
- Convene at 1:00 pm

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.

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**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.

**Examples of past research topics:**
- **Correlation between age & circumference of ponderosa pine trees**
- **Communication patterns of golden mantle ground squirrels**
- **Slope angle as a determinant of plant species diversity**
- **Dragonfly nymph population differences in the Upper vs. Lower pond**
- **The effect of tree density on the average annual growth rate of douglas fir**
- **Comparison of wildflower diversity between riparian & non-riparian areas**
- **Great-horned owl dietary preferences based on pellet analysis**
- **Thistle abundance in disturbed & undisturbed montane meadows**
- **Moisture & infiltration rate variation in the soil of aspen groves**
- **Comparison of backswimmer leg lengths & swimming speeds**
- **Pollination visitation types & rates of the Colorado Columbine wildflower**
- **Elk population density on & off trail based on scat abundance**
- **pH differences in flowing vs non-flowing water sources**
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

Field activities:
- Ecosystem analysis - Hike through pristine grassland communities of 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

Day 13- Sampling Methods

Lecture/discussion topics:
- Ecosystem sampling methods - transects & quadrats, randomization, stratification, replication, scope of projects

Field activities:
- 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
- Individual consultations - advisement for research

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 tree-line, 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!

Dinner in Ward

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

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