IFP – Ecology Syllabus

Summer 2015

ECOL 1000H – Introduction to Environmental Issues (3 credits)
ECOL 1000L – Introduction to Environmental Issues, Lab (1 credit)
ECOL 4160 – Ecology of North America (3 credits)

Instructors: Dr. John Kominoski, Dr. Paulo Olivas, Shelby Servais, & Sean Charles

Course Description
We are going to observe some amazing ecology this summer! Ecology is the part of biology that examines the interrelationships between organisms and their environment. As practitioners of a basic science, ecologists seek an accurate understanding of natural phenomena through observation and experimentation. At the same time, ecologists seek to utilize the gathered information toward preserving the ability of the earth to sustain all forms of life (including humans). This course will introduce you to the basic principles of individual, population, community and ecosystem level ecology. Additionally, you will be integrating the ecological concepts that you learn and observe with geology and anthropology throughout this course.

Course objectives:
Upon completion of this course you will be able to:

- Explain the ecological principles that pertain to populations, communities and ecosystems.
- Compare and contrast, from an ecological perspective, the different biomes that we will be visiting.
- Address a variety of environmental problems from an ecological perspective in both terrestrial and aquatic systems.
- Perform field sampling and observational research.
- Present scientific ideas and results in both written and oral formats.

Textbook & field guide: We will be using *Ecology, 2nd Edition* by Cain et al., and *Elements of Ecology, 8th Edition* by Smith & Smith as a reference textbooks. We have copies available for you to use when studying. We recommend that you use these textbooks as references for ecological concepts and then work on applying these concepts to the places that we will be visiting. Additionally, you have been provided with a field guide that contains assigned readings, maps and figures. We will announce assigned readings throughout the course and we expect you to carefully read the articles and be prepared for group discussions. Oftentimes we will carry our field guides with us into the field.

Course evaluation – ECOL 1000H

Exam (4)	400 (100 pts each)
Field notebooks	500
Projects (2)	500 (250 pts each)
Total	**1400 pts**

Course evaluation – ECOL 4160

Exam (4)	400 (100 pts each)
Field notebooks	500
Projects (2)	500 (250 pts each)
Group discussions (3)	150 (50 pts each)
Total	**1550 pts**

Grading scale: A = ≥ 90%, B = 80-89.5%, C = 70-79.5%, D = 60-69.5%, F = < 60%.

Exams: All exams are a closed-book examination of the material introduced prior to the date of the exam. All exams are cumulative because we will be revising concepts throughout the course and making connections between and among the places we visit. Exams will consist of 3-4 essay questions. We strongly recommend that you outline your thoughts and ideas first, and then go ahead and write your answers. We will only grade the formal prose, not the outline. We recommend that you give succinct (clear & concise) answers (i.e. write down enough information to answer the question and then stop writing – more does not equal better.). Grammar, sentence structure and clarity of expression are important, if we can't understand what you are trying to say then we can't give you credit for it.

Field notebooks: You will be required to keep a field notebook with detailed observations of the geology, ecology & anthropology that you observe. Your notebook will be evaluated for clarity, detail, thoroughness and how well you connect your observations to the scientific concepts that you are learning. Please remember that this is a field notebook, not a journal.

For example, at Zion NP you could write the following in your field notebook and earn the associated grade:

Notebook:	Grade
Zion national park is so cool! The Virgin River flows through a big canyon and there are cottonwood trees around the campground. We hiked up to Angels Landing (which was really scary!) and could see for miles. The trail up to Angels Landing zig-zagged back and forth through so many switchbacks. I thought my legs were going to fall off. After Angels Landing we…..	C
July 2, 2011. Zion national park is so cool! The Virgin River has created a big canyon. We are camped in the riparian zone of the Virgin River surrounded by cottonwood trees. Luckily I didn't observe any of the invasive tamarisk tree that we saw in Arizona. We hiked up to Angels Landing and I could observe the how erosion, transport and deposition of sediment by water has shaped this landscape. After Angels Landing we…..	B
July 2, 2011. Zion national park is so cool! We are on the edge of the Colorado Plateau and once again (just like the Grand Canyon) we are observing the amazing power the water can have on landscapes. The Virgin River has eroded away millions of tons of sandstone, and the erosion, transport and deposition of sediment is still continuing today. This was very clear from our perch way up on Angels Landing. Also we are observing another 'step' on the Grand Staircase that climbs from the Grand Canyon to Bryce Canyon. The riparian areas along the river are green, cool and full of life. This contrasts with the drier, hotter environment away from the river. After Angels Landing we….	A
❖ Students enrolled in ECOL 4130 are expected to make stronger connections between observations and ecological concepts introduced in lectures/discussion/readings. We also expect students in ECOL 4130 to be thinking about developing hypotheses based on the observations they are making and also include explanations of ways to test these hypotheses. Chapter 1 in Cain et al provides a good overview of lab and field experiments.	

Projects: You will be completing two projects, one along the Rio Grande (week 2) and the other in Idaho (week 6). For each project you will collect class data, analyze the date and turn in a written report. Students enrolled in ECOL 4130 are expected to be team leaders during the data collection and analysis portion of the project and you will be evaluated on your organization of the field project data and analyses.

Discussion leaders (ECOL 4160): As a group (i.e. all 3 of you working together), you will lead 3 separate group discussions throughout the course. For each discussion, we expect you to prepare a brief overview and summary of the scientific paper, have a set of prepared discussion questions and then lead the group in a discussion of the assigned readings. You will be evaluated on your introductory summary (scientifically correct, thorough), your prepared discussion questions, your ability to answer questions about the assigned readings and you ability to lead the group in a productive and meaningful discussion.

IFP – Ecology Weekly Curriculum

Week 1 (John)
1. Sapelo Island: Introduction to Ecology, Ecosystem Energetics, Marine & Coastal Ecology
paper: Sapelo Island Natural History and Invertebrates
paper: Deegan et al. 2012 Eutrophication of salt marshes

2. Land & Water Resources
Providence Canyon: Land Management, Erosion
Southeastern Water Crisis
paper: Soil erosion in Georgia
paper: Water wars: Atlanta & the Southeast

3. Land-Use Change: Continental & Coastal Implications
Mississippi River Overlook: Flooding and floodplain ecology; 100-year flood; nutrient loading to Gulf of Mexico
paper: Diaz and Rosenberg 2008 Science
paper: Boussard and Turner 2009 Frontiers
paper: Chambers et al. 2007 Science

Week 2 (John)
1. Cave Ecology – bats and disease ecology, aboveground-belowground linkages
paper: Frick et al. 2010 Science

2. Invasive, non-native species - riparian ecosystems
paper: Kominoski et al. 2013 Frontiers

3. Restoration & Natural Resource Management
Valles Caldera National Preserve
Emphasized Concepts: soil formation, plant communities, fire ecology
Elements of Scientific Writing – (why we write, format, falsifiability, null hypothesis)

4. Paleontology & Paleoecology
paper: Briggs et al. 2006 Frontiers
paper: Chen Benton et al. 2012 PNAS Permian Mass Extinction & biotic recovery

5. Energy Resources (fossil vs alternative) & Global Carbon Cycle
paper: Dukes 2003 Burning Buried Sunshine
paper: Do we have the energy for the next transition? Energy's tricky tradeoffs.
paper: Battin et al. 2009 The Boundless Carbon Cycle

6. Fire Ecology & Succession

Week 3 (John & Shelby)
1. Ecosystem Management (balancing multiple resource and environmental needs)

2. Southwestern Water (Glen Canyon Dam) – Cadillac Desert; water sustainability, food web sustainability, effects of 'natural' flooding
paper: Sabo et al. 2010 PNAS

4. Ecotones – drive along the Grand Escalante; elevational shifts in vegetation communities.

5. Erosion-Transport-Deposition = watershed (re)formation dynamics; view from Angel's Landing emphasizes this, so does increasing boulder size moving upstream in Virgin River Narrows
paper: Naiman et al. 2010 Ecosystems (select figures/text)

6. Sustainability – Las Vegas, coupled water-energy resource issues (dams, reservoirs, hydropower, power transport across Mojave Desert to Los Angeles, nuclear energy and waste).
paper: National Geographic articles (2007, April 2010).

Week 4 (Shelby)
1. Conservation Ecology (history of John Muir, Yosemite; Hetch Hetchy Reservoir, Monterey Bay)
paper: California's Water Footprint
paper: Yosemite's Twin

2. Geothermal Energy

3. Endangered Species Act (Mono Lake, California Seagull)

4. Owens Lake/River (Cadillac Desert, LA water wars, Mulholland's Dream)

5. Longevity and Organismal Size (Bristlecone Pine Forest, Sequoia's in Tuolomne Grove)

6. Agriculture vs. Wildlife – San Joaquin Valley
paper: California Water Wars: Of farms, folks & fish
paper: California agriculture & water

Week 5 (Paulo)
1. Trophic Cascades (kelp forest declines linked to overfishing and killer whales feeding on sea otters; overgrazing by sea urchins).
paper: Estes et al. 2011 Science

2. Keystone Species Concept – Rocky intertidal lecture (Paine's *Pisaster* vs. *Mytilus*)

3. Point Reyes Biodiversity Project
Emphasized concepts: zonation, environmental gradients, habitat heterogeneity, vertical and horizontal diversity.

4. Redwoods/Big Tree Wayside: Carbon Cycle, longevity, productivity

5. Klamath River (ESA, Salmon vs Agriculture vs Electricity), Dam removal tradeoffs, water, agriculture, and wildlife management
paper: Klamath River Dam Removal (NY Times & SFGate articles)
paper: Walking Wetlands

6. Population ecology (Lava Beds NM/Tulelake NWR: meta-population concept, growth = BIDE. migration) – lecture at NWR Visitor's Center

7. Lake Ecology – Crater Lake lecture

8. Dams and salmon – Cascade Stream Watch, Salmon River Dam removal

Week 6 (Sean)
1. Global Climate Change and Origins of life

2. Climate Models and Predictions – How climate models are generated and used to predict climate
paper: Climate Model Summary

3. Ecotoxicology and pollution

4. Restoration/remediation – If we build it, will they come?

5. Community ecology – biodiversity-ecosystem functioning; quantifying biodiversity and ecosystem functioning. Species loss in the Anthropocene (6^{th} mass extinction event)
paper: Palmer 2010 Beyond Infrastructure: Biodiversity Loss
paper: Forests of the Future: Assisted Migration

6. Idaho Acid Mine Drainage Project

Week 7 (Sean)
1. Extremophilic life forms – *Thermus aquaticus*
paper: Brock: Life at High Temperatures

2. Greater Yellowstone Ecosystem

3. Trophic dynamics – wolves, elk, willows
paper: Beschta and Ripple 2013 Ecology

Week 8 (Sean)
1. Alpine ecology – vulnerability, seasonal dynamics, climate change sentinels

2. Evolution – Life through Time (Denver Museum of Nature and Science)
paper: Dawkins: The Greatest Show on Earth