BIO / GEOG / GEOL / OCEA 150
FIELD STUDY OF THE NATURAL HISTORY OF SAN DIEGO COUNTY

Spring 2015
Grossmont College

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Course Description

An exciting, team-taught, interdisciplinary, field-based study of the natural environment of the San Diego region, including related parts of Imperial, Riverside, and Orange Counties. Vans are utilized to visit sites that best illustrate (1) the region’s physical environment (including tectonics, geologic history, geomorphology, hydrology, meteorology, climatology, and soils), (2) the evolutionary response to environmental variation (focusing on coastal sage scrub, chaparral, and desert ecosystems), and (3) the interaction of humans with the natural environment. Emphasis on field measurement includes use of GPS, compass, clinometer, maps, the current Jepson plant taxonomy, etc. Four weekends in spring semester only. Overnight camping required. Students with credit in Geography 150 will not be able to enroll in Biology 150, Geology 150, or Oceanography 150.

Course Objectives / Student Learning Outcomes

The student will:

a. Utilize an interdisciplinary, systems-based approach to examine the San Diego region, focusing on its natural attributes and how they have affected, and are affected by, human interaction.

b. Observe in situ, identify in situ, and, where appropriate, analyze in situ the geologic processes, structures, and type locales most responsible for, and most illuminating of, the geologic production of the Greater San Diego Region. These include, but are not limited to:
   1) The transform plate boundary that dominates the Greater Southern California Conurbation as expressed by the San Andreas System of Faults;
   2) The Mesozoic-age subduction zone responsible for emplacement of the Peninsular Range Batholith (PRB);
   3) The age and petrologic relationships expressed spatially across the western vs. eastern PRB;
   4) The Eocene-age transgressive/regressive sedimentary rock units and stream-delta deposits the underlie the city of San Diego, Santee, Grossmont College, etc.;
   5) The isolated occurrence of Miocene-age volcanism signaling the opening of the L.A. Basin;
   6) The Late-Cenozoic opening of the Salton Sink Spreading Zone as recorded in the complex sedimentary record exposed at Split Mountain, and, producing today’s geothermal activity;
   7) The recent “Ice-Age” climate changes, sea-level changes, and ecosystem changes recorded in the sedimentary and fossil record of the Borrego Badlands, and expressed topographically by the marine terraces upon which urban San Diego is built;
   8) The relationship of San Diego’s long sandy northern beach system to weathering of rocks of the PRB, then subsequent transport by area streams, then longshore transport by wave energy, then eventual termination at La Jolla Shores due to the Rose Canyon Fault Zone.
c. Identify (1) minerals, (2) rock types, (3) facies across zoned plutons, and (4) sediment change across gradational systems doing so by using hand lenses, ternary diagrams, and applications of Bowen’s Reaction Series, measure the trend of fold axes and strike-and-dip of strata using compasses and clinometers, plot field data (such as strike-and-dip) onto topographic base maps.

d. Explain the modern Salton Sea in terms of (1) the agricultural development of the Imperial Valley, (2) its unique water chemistry as controlled by numerous variables, and (3) the relationship of its size, chemistry, and ecosystem viability in the context of the water wars that have produced the current water transfer agreement between the Imperial Valley and San Diego.

e. Relate wave sets observed at coastal sites to real-time swell model forecast/nowcast maps.

f. Utilize appropriate field tools and techniques (GPS, compass, clinometer, topographic maps, geologic maps, hand lenses, current Jepson plant taxonomy, salinity refractometers, thermal infrared sensors, barometers, pyschrometers, anemometers, and weather maps) to determine latitude/longitude, and to measure the atmospheric state variables, water salinity, slope azimuth, etc.

g. Correctly interpret real-time surface-level and upper-level weather maps in order to explain current atmospheric states and sky conditions such as cloud presence and cloud types, precipitation, temperature, wind direction and wind speed, dew point temperature, and relative humidity.

h. Recognize synoptic and mesoscale weather patterns common to the Greater San Diego Region both as observed in the field and as expressed on actual real-time upper-level weather maps.

i. Recognize the visible features of the subtropical dynamic high and identify its almost constant dominance as a major factor producing the Mediterranean-style climate throughout much of California.

j. Recognize examples of flora and fauna in the context of regionally significant plant families and plant communities and be able to identify specific individuals at the genus and/or species level using the most current Jepson taxonomy in order to understand better the evolutionary relationships that exist across ecosystems and thus the special evolutionary plant responses to Mediterranean (Cs), Semi-Desert (BS), and Desert (BW) climates of the Koppen climate classification system.

k. Contrast transmontane versus desert ecosystems and the influence of soil, slope azimuth, microclimates, and average annual precipitation on plant diversity and adaptations—specifically, collect vegetation transect data in coastal sage scrub, oak savanna, mixed chaparral, manzanita-dominated chaparral, juniper-pinyon, cactus scrub, and desert playa ecosystems.

l. Recognize, compare/contrast, and explain the distribution of all native species of the genus Quercus (the oaks) across the Greater San Diego Region in the context of natural selection imposed by microclimate variations or by pollen-scattering via known wind patterns, explain “spot” versus “swarm” hybridization as it exists locally within the white and black oaks.

m. Relate tectonics to topography and thus explain patterns of human migration and land use.

Course Content

a. Identification of plants and recognition of adaptive strategies of transmontane and Sonoran Desert vegetation with particular attention to variations in structure, function, and spacing as related to changes in elevation, drainage, soil profile, and sun exposure. Tour the Anza-Borrego Visitor’s Center and also study Amerindian and European pioneer travel routes and settlements in the East County.

b. General geography and geology of the San Diego region and Peninsular Ranges with emphasis on geologic history, rock types, topography, and climate zones.

c. Historic and modern land uses of the Imperial Trough and their effects on flash flood potential, overuse of “fossil” groundwater, destruction of indigenous plants and animal species, and the threats posed by introduced non-native flora and fauna.

d. Geology of the Peninsular Batholith, including the gold mining districts of Julian, Elsinore Fault
Zone, and the spreading ridge and transform fault tectonics of the Salton Trough; creation of the artificial Salton Sea, its ecology, hyper-salinity, and prospects as an agricultural and urban waste sump; on-site review of irrigation on current water and economic politics of Southern California.

e. Structure and displacement of the San Andreas plate boundary in Painted Canyon, its effects on East County and Imperial Valley seismic activity, volcanism, and geothermal activity.

f. Crystalline/sedimentary stratigraphy and coastal sage communities of San Diego’s marine terraces, as established at San Onofre and Torrey Pines; analysis of shoreline faulting of the Rose Canyon Fault and resultant shaping of La Jolla; measurement of velocity and discharge of San Diego County streams and the impact of urbanization on those watersheds. Wave refraction, longshore transport, and littoral cells that form county beaches, peninsulas, and coastal landforms; the role of dam construction, land use planning, and beachfront housing in beach erosion and coastal retreat.

What to Bring

1. Sense of humor, old fashion work ethic, volunteerism
2. Sleeping bag with pad or thin air mattress (rolled up pants can serve as a pillow)
3. **Tent, if you have one, although it’s nice to sleep under the stars (weather permitting)**
4. Layered clothing for mountains and the desert (warm days, cool nights), jacket, both long pants and hiking shorts
5. Water bottle—you can refill it at several stops along the way
6. Light-weight backpack or knapsack to carry your water/notes on hikes
7. Flashlight, whistle, medications, sunscreen
8. **A camera**
9. Money for food/snacks (See logistics page for each trip for specifics)
10. Completed exercises as assigned when arriving to the start of each Field Trip. At the end of the course, notebooks must be turned in to be graded. Once graded, your notebooks can be picked up in the Earth Science Department.
11. Note: Cell phones (including texting) are **not allowed during class time**, which is most of the time

What to Leave at Home

1. Cigarettes, smokes, cigars, pipes, and chew—the field trip is smoke-free…fire is always a risk
2. Stereo headsets / iPods / etc.
3. Drugs and alcohol

Needed Supplies (bring with you on trips)

1. One 360° compass protractor (4” diameter)—available for purchase at the book store
2. One three-ring binder, one clipboard, pencils and pens for note-taking

Grading

1. To complete the course successfully, students must attend all four field trip weekends.
2. A final exam will be given on the last day of the fourth weekend in which you may use the notes you from the previous trips.
3. A well-organized, fully noted and neatly compiled three-ring binder will be turned in with your final exam. It will also be graded. You can retrieve your binder at the end of the final exam week.
4. Pre-trip homework = 15%, Participation = 15%, Binder with notes = 40%, Final exam = 30%

Field Trip Dates: **Feb 28-March 1, March 14/15, April 11/12, and April 25/26**

For last-minute field trip notices and specific trip logistics: [http://www.grossmont.edu/people/gary-jacobson/geology-150.aspx](http://www.grossmont.edu/people/gary-jacobson/geology-150.aspx)