This document lists and explains the research and management projects available for students to work on in the Rangeland Ecology & Management (REM) Program.

This first page gives a quick overview. Pages 2-3 provide more details for those interested in them. Page four gives a simple listing of project types and projects within them. The specific quarters (in **blue**) when projects are active are given at the end of each project name on page four. Subsequent pages provide more specific details about each project listed on page four.

Overview

1. Joining the enterprise (ASCI 490-02)
    a. Send an email to mhorney@calpoly.edu to request a permission number to add the enterprise with
    b. You must be willing to put approximately 30 hours per quarter (total) into work related to one or more enterprise projects
    c. Training/coordination meetings will be established by week 2; a survey of everyone's availability will be sent around at the end of the first week of classes to pick a day/time; these meetings can be attended in person and/or on video (Teams) except where training necessitates everyone's physical presence
2. Assigning project teams
    a. The first week of each quarter I will invite all enterprise members and student research volunteers to identify the three projects they are most interested in working on; and they will be assigned on that basis; I prefer to have at least three people working on each project
    b. I will accept a volunteer or assign a person to be team leader
3. Enterprise credit
    a. To receive credit for the enterprise you must accumulate at least 30 hours of work across all projects you helped with…unless circumstances beyond your control or exceptions given by instructor reduced your hours. And…
        i. Submit an email to the instructor by midnight Monday each week with a log of hours you put on each project in the previous week and a brief description of what you did. Put "ASCI490 hours" in the email subject line.

## Details

At the start of each quarter every project team will meet to establish objectives for the coming term and determine tasks and timelines. Some projects are with outside clients and those may require one or more meetings with them to accomplish this.

We will use the 2009 and 2017 Herrick et al. *Monitoring Manual for Grassland Shrub and Savanna Ecosystems* as a guide for setting objectives and workplans for most field projects. This is to be initiated by week 2. Then we'll set timelines for the project work and identify any anticipated obstacles to completing the work (could be weather, scheduling, need for materials, collaborators, etc.).

After that, each team can work largely on its own, with weekly updates to me on progress being made or obstacles which need to be overcome. By the last two weeks of the term each team will develop an end-of-quarter report outlining the initial objectives and work plan and include a week-by-week log of how things progressed. It will identify all objectives that were achieved, and those that were not, with explanations of why and how.

Students from any majors are welcome. These projects represent a wide range of disciplines, including grazing animal management, wildlife ecology, assessment and protection of soils, wildfire ecology, plant ecology & identification, applications of technology (especially geospatial technologies and data management & analysis), environmental engineering and survey methods (Civil Engineering & Biological Resources & Agricultural Engineering), and landscape design (Landscape Architecture).

Training will be provided to any who need it for specific tasks. While advanced skills and/or prior experiences are certainly desired and helpful, the purpose of the course is to add new skills to your capabilities as well as further develop skills you already have.

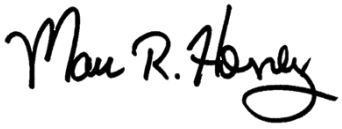
Most of the projects are intended to be worked on in teams. Students may organize teams of their own to tackle specific projects, else they can organize and develop *ad hoc* teams with those others who were recruited/volunteered.

I am always looking for students who are interested in leading/coordinating project teams. This is a resume-worthy role, especially for any interested in careers in management/administration. Students from majors offering training in organization and management (Communication Studies, Business) who would like to exercise those skills by assisting individual project teams or the larger REM program are invited to discuss opportunities with me.

Students wanting to exercise their GIS training are also needed. Nearly all projects on this list require GIS (electronic map design) support. We make heavy use of ArcGIS Pro, ArcGIS Online, and the ArcGIS Field Maps mobile app. Student project GIS analysts can get practice designing projects, developing reporting tools, producing Story Maps, designing geodatabase tools like related tables for ongoing data collection, and more. Working with the Environmental Geospatial Systems (EGS) Lab will add opportunities to get skill in photogrammetry techniques, LiDAR processing, and geostatistical analyses, as well as experience planning RPAS (drone) missions and operations.

Please contact me (mhorney@calpoly.edu) if you have questions about anything at all.

Marc R. Horney, Ph.D., CRM Lic. #83
Professor, Rangeland Ecology & Management



The projects listed on the following pages include a mixture of projects that are currently active (some only in specific quarters), and others that are available but do not presently have anyone currently working on them. Projects that are current priorities are highlighted yellow. Projects that have been worked on, but could use more, are highlighted grey.

## Rangeland Ecology (REcol)

- Annual Grassland Peak Production study (**Fall**/**Spring Qtrs**)
- Grass sample grinding (**All Qtrs**)
- Diablo Canyon South Ranch Peak Production monitoring (**Fall**/**Spring Qtrs**)

## Rangeland Conservation (RCons)

- Swanton Pacific Whole-Ranch Conservation Plan ("RMS") with USDA-NRCS (**All Qtrs**)
- Individual Conservation Plans for main campus ranch & farm properties (**All Qtrs**)
- Documentation of giant kangaroo rat habitat improvements from managed livestock grazing on the Carrizo Plain (**All Qtrs**)
- Planning and implementation of oak woodland planting at Cal Poly's Cheda Ranch (**All Qtrs**)

## Grazing Management (GrzMgt)

- Assist Dr. Marc in developing an Outcome-Based Management training program for Cal Poly's ranch properties (see https://fireadaptednetwork.org/outcome-based-management/ and https://progressiverancher.com/outcome-based-management-and-federal-rangeland-administration-reframing-adaptive-management-on-a-complex-institutional-landscape/)
- Residual Dry Matter (RDM) Monitoring (**Fall Qtr**)
- Brush Control (**All Qtrs**)
- Ranch Grazing Capacity project (any/all Cal Poly ranches; **All Qtrs**)
- Grazing for release of commercial trees in burn zone project (Swanton Pacific Ranch; **All Qtrs**)

## Geospatial Systems Lab Projects (GSL)

- Aerial laser scan (LiDAR) survey of wildland fuels accumulations and ecosystems (**All Qtrs**)
- Plant biomass estimations from LiDAR and structure from motion (SfM) photogrammetry (**All Qtrs**)
- Construction and field testing of a drone-based wildlife radio tracking system (**All Qtrs**)

## Property-Based Projects (PBP)

City of San Luis Obispo

- *Johnson Ranch Open Space Grasslands & Oaks* (**Spring Qtr**)
- *Prefumo and San Luis Creeks riparian vegetation and channel monitoring* (**All Qtrs**)

Grieb Ranch (https://griebranchlife.com/about) **NEW**

- Work on projects on a historic (est. 1878) San Luis Obispo ranch with Connie Grieb
- Primary tasks
    - Map and develop strategic plan for containing and reducing distaff thistle (*Carthamus lanatus*) and purple starthistle (*Centaurea calcitrapa*)
    - Organize workdays to clean and organize ranch's "goat camp" for occupancy to use goat herd for browsing brush on a site being prepared for burning
    - Many other potential projects…

Rainbow Ranch (Meare Wright), Creston area – beautiful ranch 45 min north of SLO, travel expenses can be covered for project work

- *Develop a rotational grazing plan with photos of the area before and after*
    - *Identify and create a list of plants currently growing in the area*
        - *Species composition and/or frequency*
- *Yellow starthistle and fiddleneck population reduction & management*

*Figure 1. Carthamus lanatus at Grieb Ranch*

# 1. Rangeland Ecology

**Purpose**: To better understand the components and processes of change in different rangeland ecosystems.
**Process:** Varied, depending on objectives.
**Useful Interests/Prior Training/Experience:** Rangeland Management, Plant Ecology, Fire Ecology, Grazing Animal Management, Wildlife/Native Plant Habitat Management, GIS
**Research Potential:** Senior project(s) and/or *Masters theses*
**Locations:** Cal Poly Ranches (Cheda, Chorro Creek, Equine Center, Escuela/Walters, Peterson, Serrano, Swanton Pacific), Diablo Canyon South Ranch, SLO City Johnson Ranch Open Space, and more…

a. Annual Grassland **Peak Production** study, with the University of California Cooperative Extension Service (Dr. Royce Larsen)

*Objective*: Maintain a continuous long-term dataset of annual grassland biomass production, weather records, species composition, and photographic records of plant growth and decay at study sites in Escuela Ranch pastures EU8 and W6. Part of a county-wide project with nearly 40 other ranches Analyze year-to-year differences in relation to weather and management variations.
*Process*: See below.

**NEW**: Computer Science student created an app for me that can automatically ingest folders containing photos and weather station data and export out videos made of the photos with daily and cumulative weather information stamped on them. Need someone to test this app and run it on datasets from Dr. Larsen (UC Davis, Cooperative Extension Service).

- Escuela Ranch study sites in W6 and EU8 pastures
  - Fall (late Sept-Oct) **FALL QTR**
    a. Move and mow study exclosure cages
       i. 3 cages in W6, 6 cages in EU8 (approx. 30 min/cage + 60 min travel)
  - Spring (late May) **SPRING QTR**
    a. Survey/photograph cage sites and clip/weigh samples
       i. 3 cages in W6, 6 cages in EU8 (approx. 60 min/cage + 60 min travel)
       ii. Record weights of dried samples and enter results and site survey data into database (approx. 2 hours)
    b. Swap out memory card from automatic camera card to retrieve photos and download weather station data from Hobo unit to laptop (15 min)
       i. Add accumulated precipitation and Growing Degree Day (GDD; https://en.wikipedia.org/wiki/Growing_degree-day) stamp to daily photos from camera using script (20 min)
       ii. Convert individual daily camera images into a video of vegetation growth for the entire season using script (40 min)
    c. Develop, maintain, and improve scripts for automated photo stamping and video generation as described in (b) above. Need Computer science programming skills…
    d. Organize and write annual results report and submit to Dr. Larsen (16 hours)

- Grass sample grinding (learn operation of Wiley grinding mill) **ALL QTRS**
  - Grinding grass samples for forage nutrient composition analyses
  - Need people who would be willing to put in a few hours a week running dried grass samples through the Wiley mill out at the Poultry unit. Nothing complicated, just have lots of samples to 'grind' through.
- Diablo Canyon South Ranch Peak Production monitoring (assist ranch manager, Wyatt Mello, Dr. Marc, and Pacific Gas & Electric (PG&E) environmental specialist Kelly Kephart in learning about the ranch's productivity on the outskirts of California's last remaining nuclear power plant)

**FALL/SPRING QTRS**

  - Fall (early Oct)
    a. Move and mow study exclosure cages (fall)
       i. 3 cages in Adobe 1 pasture, 3 cages in ?? pasture (approx. 30 min/cage + 60 min travel)
  - Spring (late May)
    a. Survey/photograph cage sites and clip/weigh samples
       i. 3 cages in Adobe 1 pasture, 3 cages in ?? pasture (approx. 60 min/cage + 60 min travel)
       ii. Record weights of dried samples and enter results and site survey data into database (approx. 2 hours)
    b. Swap out memory card from automatic camera card to retrieve photos and download weather station data from Hobo unit to laptop (15 min)
    c. Add accumulated precipitation and GDD stamp to daily photos from camera using script (20 min)
    d. Convert individual daily camera images into a video of vegetation growth for the entire season using script (40 min)
    e. Organize and write annual results report and submit to Wyatt Mello and PG&E staff (8 hours)

## 2. Rangeland Conservation

**Purpose**: To minimize, mitigate, and repair environmental and ecological damages to sustain yields of agricultural products and/or levels of ecosystem services.
**Process:** Utilize USDA-NRCS practices and technical guides for identifying conservation concerns and prescribing corrective measures. Include or develop other Best Management Practices (BMPs) as required.
**Useful Interests/Prior Training/Experience:** Rangeland Management, Agricultural Engineering, Civil Engineering, Hydrology, Soil Science
**Research Potential:** Senior project(s)
**Locations:** Swanton Pacific Ranch. Potential future locations include Cal Poly Campus Ranch Properties (Cheda, Chorro Creek, Equine Center, Escuela/Walters, Peterson), and the Return to Freedom Prefumo Canyon Wild Horse Sanctuary.

a. Swanton Pacific Ranch Conservation Plan ("RMS") with USDA-NRCS. **ALL QTRS**

- USDA Natural Resources Conservation Service (NRCS) staff have agreed to train students in developing "Resource Management System" (RMS) conservation plans for Swanton Pacific Ranch.

- An RMS is a plan for addressing all SWAPA+H (soil, water, atmosphere, plants, animals, and human) conservation concerns in a farming, forestry, or ranching unit. It identifies all resource problems discovered in a survey of the planning unit and provides a set of treatment alternatives for each one. See the description beginning on page 3 of https://efotg.sc.egov.usda.gov/references/Delete/2009-1-31/FOTG_3_INTRO.pdf.
- Develop separate plans for areas with different primary uses: (1) commercial timber (forest), (2) grazing livestock production (coastal grassland terraces), and (3) crop production (Scott Creek floodplain). The connected riparian systems, especially Scott Creek, might be another (4). These could be planned by different students/teams of students over time.
- Where an RMS cannot be achieved in a single effort, a progressive planning process may be used to achieve it over a longer period. This is an incremental process of building a plan consistent with the decision-makers' ability to implement it.
- Completed RMS plans can offer a basis for identification of conservation concerns, prioritization of conservation projects, and monitoring of their impacts if/when implemented.

- The Capitola (Santa Cruz) NRCS Service Center has agreed to provide office space and support for at least one Cal Poly Student as an unpaid Earth Team Volunteer. Students would work with NRCS staff on conservation projects on private farm and ranch lands in Santa Cruz County, and carry that experience over to the process of organizing a RMS plan for SPR.
  - NRCS and SRM staff are working on rolling the Earth Team Volunteer positions into federally funded Pathways internship positions, and potentially expanding it to include opportunities for Cal Poly students at the Templeton and/or Santa Maria field offices.

b. Develop similar RMS planning processes for Cal Poly ranches and farming units. **ALL QTRS**

*Objective*: Establish ranch/farm-level conservation plans for all Cal Poly working lands. Use these as guides for their sustained use, future improvement, and to provide students with training in monitoring and managing environmental impacts of agricultural operations. This experience working with NRCS staff and applying agency procedures will open professional employment into the agency for students.

c. Documentation of habitat improvements on the Carrizo Plain **ALL QTRS**

See example: https://storymaps.arcgis.com/stories/acf70187443041e18bc29c88d970b32d

- Document the work of Sequoia Riverlands Trust (SRT) staff and ranchers Dale Kuhnle and Rowley Twisselman in managing sheep and cattle grazing for the benefit of giant kangaroo rats (endangered), San Joaquin kit foxes (endangered), pronghorn (locally threatened), and elk.

  From Ben Munger, SRT Director of Mitigation and Land Management: "*Telling our story has not been a top priority - mainly we are heads down type of managers since 2015. We have three Conservation Biologists who do all the work documenting wildlife populations spatially and two of them are graduates of Cal Poly (one of them*

*is getting her MS on campus now). I mainly coordinate with the ranchers, CDFW, solar companies, and now Nature Conservancy who are our new neighbors to the west along Branch Mountain Road.*

*We need to tell our story that revolves around the concerns of rural solar development upon wildlife, the local economy, and ranching. We are only a small part of the "stewardship economy", but we are also a successful story of combining grazing with solar development that benefits ranchers and wildlife.*

*I think your students would be excellent story tellers and I think they would connect with our Conservation Biologists who are using technology and mapping techniques in combination with intensive pedestrian surveys. We also just finished a large summation of wildlife populations, which we do every five years, and the data is fresh and shows some stunning increases in population numbers and territory up into the Temblor Range.*

*Our Conservation Biologists work with Dr. Tim Bean (BIO Dept, spatial ecologist) from Cal Poly frequently and we've had some of his grad students doing work on land we manage. So, we have a relationship with Cal Poly, but it is very focused on wildlife biology, which is only half the story! The rangeland management part of the story is yet to be told, where we can talk about ideas - like a stewardship economy*."

- This project would involve doing video interviews with SRT staff and the ranchers, capturing their stories about what they have been doing over the years, and what changes in habitats and animal populations they have observed. Also mapping and taking photos/videos of the landscapes where the projects have been done, and collecting/organizing evidences of changes that are being observed.
- Including students from Ag Communications (Brock Center) in this would be a huge boost because of their multimedia skills.

**Research Potential:** Senior project(s)

## 3. Grazing Management

a. Implement an Outcome-Based Grazing Management training program for Cal Poly **ALL QTRS**

**Purposes**: (1) Increase academic value of Cal Poly ranch lands to students and faculty across colleges/majors, (2) create opportunities for students to develop and exercise skills in multidisciplinary problem-solving and planning, and (3) open career paths to new professional specialties developing in the USDI-BLM, USDA-USFS, the Audubon Society (https://ca.audubon.org/conservation/conservation-ranching), and other land conservation and management agencies and organizations.

**Process:** Model the management of one or more Cal Poly ranch properties on the USDI-Bureau of Land Management's new "Outcome-Based Grazing" process which is progressively being implemented as a new approach for management of grazing allotments within NEPA authority. (https://www.partnersinthesage.com/outcome-based-grazing).

1) Establish an "allotment management" team from students and faculty advisors with backgrounds in rangeland ecology/management, plant ecology/science (BIO/ENVM), environmental engineering (BRAE, ENVE), hydrology (CE, ENVE, ENVM), soils (ERSC), wildlife (ASCI, BIO, ENVM), recreation (EIM), etc. to do the work of a BLM field office team in establishing ecosystem and land use objectives for one of Cal Poly's ranches (propose beginning with Escuela/Walters), and a process for evaluating and updating those objectives

annually. Objectives could include things like specific levels of fall grassland biomass ("RDM"), shrub densities in specific areas, other wildlife habitat parameters, restricting weed population growth, reducing accelerated erosion and fuel accumulations, etc.

i) The student allotment management team would then meet with the ranch livestock management staff (or the student beef enterprise management team, as with the Escuela ranch) to discuss the importance and feasibility of the objectives. These objectives are not necessarily things that can be addressed by livestock management, but many will be.

ii) Allotment objectives revised if needed based on feedback from livestock management staff. Annual allotment objectives finalized and approved by allotment management group and submitted to ranch livestock management staff.

- Allotment management team must then prepare a monitoring plan for evaluating progress towards these objectives. This plan should include schedules for when monitoring work is to be done, who will be responsible for doing it, how long it is anticipated to take, and when the monitoring results will be ready for distribution to the livestock management staff and faculty advisors. If current conditions information does not exist for any objectives, the monitoring plan should state how and when that will be obtained. Much of this work will be performed by members of the allotment management team with support from the ASCI 290/490 Rangeland Research & Management Enterprise.

iii) In reply to the allotment management objectives, ranch livestock management staff will develop and submit their proposals for livestock management in the coming year to the allotment management team, explaining how that management is intended to aid in accomplishing the allotment management objectives. Proposal must include kinds, numbers, and approximate average weights of animals by type (cattle: cows, bulls, heifers, yearlings, calves), estimated pasture entry/exit dates, total AUMs of use by pasture for the year, and the percentage of those AUMs used per month.

iv) At the end of the ranch management "year," ranch livestock management staff will submit a report to the allotment management team on the actual livestock management for the year, identifying any deviations from the original plan, and explanations for why.

v) Allotment management team and ranch livestock management staff will meet to discuss the year's monitoring results and livestock management report in the context of making progress towards the annual allotment objectives. A report summarizing results and recommendations for the following year will be developed by the allotment management team and submitted to the ranch livestock management staff for review before publication. The ranch livestock management staff will have the right to add an addendum/rebuttal to the report addressing any content which they disagree with.

**Useful Interests/Prior Training/Experience:** Rangeland Management, Grassland Ecology, Grazing Management, Livestock Production, Wildlife Management, Plant Ecology, Environmental Engineering, GIS

**Research Potential:** Senior project(s) and/or *Masters theses*

**Locations:** Escuela/Walters ranch, Swanton Pacific ranch, potentially any other Cal Poly ranch facilities.

b. Residual Dry Matter (RDM) Monitoring **FALL QTR**

**Purpose**: "RDM" is the amount of dead grass biomass remaining to cover the soil surface in grazed annual grasslands just prior to first germinating rains in fall. Sufficient RDM is required to ensure germination of annual grass seed and protect the soil surface from erosion, so regularly having the recommended amount of RDM in pastures is considered a sign of good grazing management. The purpose of RDM monitoring is to verify whether this is being consistently achieved. Each pasture should be assessed at least once every three years, *ideally* every year when logistically feasible.

**Process:** Use adaptation of the *Comparative Yield* method with ArcGIS Field Maps to find and visually estimate fixed 1'x1' plots of dead herbaceous plant biomass plant residues. Sampling points have already been established in all ranch pastures and are loaded in Field Maps. Upon beginning work at a ranch, students must establish five reference plots (nearly no vegetation = 1, heaviest vegetation = 5) to photograph, then clip, bag, dry, and weigh.

**Useful Interests/Prior Training/Experience:** Rangeland Management, Grassland Ecology, Grazing Management, GIS

**Research Potential:** Senior project(s) and/or *Masters theses*

**Locations:**

i. Cal Poly:
   1. Cheda ranch (small ruminant unit), 133 acres
   2. Chorro Creek (beef cattle), 425 acres
   3. Escuela/Walters (beef cattle), 2,000 acres
   4. Equine Center, 196 acres
   5. Peterson ranch (beef cattle), 417 acres
   6. Swanton Pacific ranch (beef cattle), 1,500 acres

ii. **Diablo Canyon, South Ranch (October); 5,000 acres**

iii. Harris Ranch; Gaviota, along NB Hwy 101, 30 acres

iv. Return to Freedom Prefumo Canyon Wild Horse Sanctuary (west of Laguna Lake), 500 acres.

b. Ranch Grazing Capacity project **ALL QTRS**

**Purpose**: Estimate carrying capacity for Cal Poly ranches, beginning with Swanton Pacific.
Process: Use USDA Soil Survey and RDM objectives to develop proposals for what combinations of animals (cattle, horses, small ruminants) make sense for long-term projects and enterprises.

**Process**: Parse predicted soil map unit forage production information for historical low/moderate/high growth years from USDA SSURGO GIS. Subtract RDM requirements from that and estimate the numbers of managed animals that could be sustained on the ranch through low and moderate level growing seasons.

**Useful Interests/Prior Training/Experience:** Rangeland Management, Grazing Animal Management, GIS

**Research Potential:** Senior project(s)

c. Grazing for release of commercial trees in burn zone project **ALL QTRS**

**Purpose**: To investigate if livestock could be used to suppress weeds and shrubs in the forested area to accelerate the recovery of burned commercial timber species (coastal redwoods and Douglas fir). Need a literature review on this (some articles already collected), with a proposal for how animals could be managed for this purpose to follow.

**Process**: Review spring 2023 Swanton goat and sheep brush browsing test report from Helen Dubee, and her recommendations for how to proceed. Connect that to literature review on the topic and develop a proposal for re-running the browsing test to get more useful information.

**Research Potential:** Senior project(s) and/or *Masters theses*.

## 4. Advanced Technology Studies (in collaboration with the Geospatial Systems Research Laboratory; "GSL")

a. Remote measurement of wildland fuels accumulations. **ALL QTRS**

- *Objective*: The EGS Lab is primarily investigating methods of measuring accumulations of wildland vegetation (potential wildfire fuel) from aircraft. Need assistance measuring grasses, shrubs, and trees on the ground to test aircraft sensors against. Also looking for students interested in learning how to analyze laser scan data and imagery for vegetation characteristics. Opportunities to learn advanced field survey methods, processing and analysis of sensor data, planning and operation of RPAS (drone) surveys, and about fuel management practices and wildfire behavior.
- **Useful Interests/Prior Training/Experience:** Rangeland Management, Plant Ecology, Remote Sensing, GIS
- **Research Potential:** Senior project(s) and/or *Masters theses*

b. Estimating herbaceous plant biomass from measurements from laser scans (LiDAR), ultrasound scans, and structure from motion (SfM) photogrammetry. **SPRING QTR**

- *Objective*: The EGS Lab has a Vapor-55 helicopter drone equipped with a Yellowscan Explorer LiDAR (airborne laser scanner), a Micasense Altum multispectral imager, and a Sony alpha 6000 camera. We are also planning to equip it with an ultrasound scanner from TopCon. Each of these technologies have been used for estimating the quantity/ density of herbaceous plant material. We would like to put them through much more rigorous tests and compare their performance against each other under different conditions.
- **Useful Interests/Prior Training/Experience:** Rangeland Management, Plant Ecology, Remote Sensing, GIS
- **Research Potential:** Senior project(s) and/or *Masters theses*.

c. Construction and field testing of a drone-based wildlife radio tracking system **ALL QTRS**

- Continuing Electrical Engineering (EE) senior engineering team project, in 4$^{th}$ year Co-Advisors, Dr. Dean Arakaki (EE) and Dr. Marc Horney (ASCI). Anticipate testing of first directional antenna prototype this year. Need assistance of students with experience using directional antennas for tracking wild animals with VHF radio transponders.
- **Useful Interests/Prior Training/Experience:** Wildlife Management, Electronics, GIS/Geospatial Technologies
- **Research Potential:** Senior project(s)

## 5. Property-Based Projects

**City of SLO Projects**

*a. Johnson Ranch Open Space Project* **SPRING QTR**

- Document grassland species frequency and productivity in response to compost application (spinoff of carbon sequestration trial by Dr. Seeta Sistla; NRES). Rangeland Management, Weed Management, Plant Ecology and GIS would be useful skills/interests. Senior project potential.
  - Transect procedures
    a. Changes in plant species frequency (Nested-Rooted Frequency method)
    b. Changes in weed species population (Belt transect method)
  - Random plot procedures
    a. Changes in biomass production (Comparative Yield method)
- Develop and initiate a life-history dataset for 86 oak trees planted by the San Luis Obispo Rotary Club in 2018. Build GIS geodatabase for building annual records of tree growth and change over time that can be connected to weather and management records. Plant Ecology and GIS would be useful skills/interests. Senior project potential.

*b. Riparian Survey* **ALL QTRS**

- Document conditions of riparian channel vegetation in Prefumo and San Luis creeks prior to and after grazing by goats to evaluate effectiveness of this treatment in opening the channel for debris removal by hand crews and suppressing invasive plant species.
- Work with Beth Reynolds and SLO City staff to develop grazing management plans for key segments of both creeks
  - Monitor and evaluate the results of these plans in detail
- Meet with Central Coast Regional Water Quality Control Board staff to develop protocols to mitigate negative water quality and riparian habitat impacts of grazing
  - Monitor effectiveness of these protocols

Senior project underway, but this project can support many more. Riparian Management, Plant Ecology, Grazing Management, and GIS would be useful skills/interests.

Grieb Ranch (https://griebranchlife.com/about) **NEW**

- Work on projects on a historic (est. 1878) San Luis Obispo ranch with Connie Grieb
- Primary tasks
  - Map and develop strategic plan for containing and reducing distaff thistle (*Carthamus lanatus*) and purple starthistle (*Centaurea calcitrapa*) **ALL QTRS**
  - Organize workdays to clean and organize ranch's "goat camp" for occupancy to use goat herd for browsing brush on a site being prepared for burning **ALL QTRS**
  - Many other potential projects…

*Figure 2. Grieb ranch's goat/sheep camp facility.*

**Rainbow Ranch projects**

- Multiple projects at a private, scenic 2,800-acre ranch property in the Creston area (~40 min from campus)
- Property owners are willing to support students interested in any of the following (and more) by covering costs associated with mileage, equipment, etc. All with senior project potential.
- Projects:
  - Develop a grazing management plan for the ranch (Rangeland Management, Grazing Animal Management, GIS) **ALL QTRS**
    a. Develop based around multiple species (cattle, goats, sheep), and ranch management objectives
    Senior project potential.
    b. Survey and map the distribution and abundance of native plant species on the ranch
    i. Include conservation management for these populations in the grazing plan
    Senior project potential.
  - Develop a plan for the reduction and management of yellow starthistle and fiddleneck populations in hayfields and pastures (AEPS/Weed Science, Plant Ecology, GIS) **ALL QTRS**
    a. monitor the effectiveness of treatments

    Senior project potential.

  - Determine whether Yeoman's plow practices have in any detectable way influenced soil water retention or plant productivity. See (https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=19817) (Rangeland Management, Soils, Hydrology, Plant Ecology, GIS) **ALL QTRS**
    Senior project potential.