Cal Poly Land

A Field Guide

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Editor:
Steven Marx

A Project of The Cal Poly Land Centennial Seminar

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Preface

Paul J. Zingg, Provost and Vice President for Academic Affairs

Leaping the Fence

In the early 18th century, influenced by the intellectual energy of the Enlightenment, Western notions of the relationship between settled human communities and their surrounding natural landscapes underwent a dramatic change. Previously, two views dominated. One considered the wild and wondrous wilderness areas and forests beyond the boundaries of town and village as inaccessible and uncontrollable. These were regions that evoked curiosity, to be sure, but fear of the unknown severely restricted their exploration and incursion. Another view emphasized the necessity of human control over nature. Often taking the form of grand, formal gardens, such as those at Vaux-le-Vicomte in France or Caserta in Italy, these environments were demonstrations of affluence, designed to impose order over a large portion of a vast landscape by "improving" upon a potentially magnificent, but notably unkempt, nature.

Led by a trio of English landscape designers, Charles Bridgeman, William Kent, and Lancelot "Capability" Brown, though, a third view developed – a view that sought to reconcile the extremes and to promote a greater sense of seamlessness between the tamed and untamed natural environment. The instrument that these men invented to do this was called the "ha ha," not the sound of laughter, but an expression as when one is pleasantly taken by surprise. The ha ha was essentially a sunken barrier, such as a ditch, instead of a raised enclosure, such as a wall or fence or hedge. Its purpose was to prevent cattle or sheep (or neighbors or forest wildlife) from crossing from the land beyond the ditch into the cultivated fields and gardens of one's private property. But its consequence – the removal of physical barriers of view – was to create a sense that the tended areas and the surrounding countryside were one and undivided. It was, in other

Bull test area and Caballo Peak

words, as the British author, Horace Walpole, described, the product of a vision that "leaped the fence and saw that all nature was a garden."

The Enlightenment also witnessed some fence leaping in the world of higher education. Although the classical trivium and quadrivium continued to dominate the curriculum, the goal of perfecting society through applied reason influenced the addition of new subject areas, such as economics and geography, both of which had a clear practical orientation. Benjamin Franklin's new University of Pennsylvania, founded in 1740, for example, aimed to marry "the useful and the ornamental" in a way that set the tone for a new definition of a liberal arts education, particularly as it served the larger purposes of American society. Franklin's vision has been acknowledged ever since as the American academy has particularly focused on its responsibility to connect the intellectual and the utilitarian and to regard public service as not only legitimate, but privileged, faculty work.

At Cal Poly, as throughout American higher education, we are the inheritors of these notions of the Enlightenment that emphasize a more engaged approach to living with our natural environments and a more connected relationship between learning and the needs of society. Cal Poly has a special obligation and opportunity to see these things happen because it is blessed with a magnificent land endowment of over 9200 acres, two-thirds of which form the University's main campus and related ranches in San Luis Obispo County, and the remainder located at the coastal Swanton Pacific Ranch about twelve miles above Santa Cruz. The University must protect these lands for the future support of an institutional educational mission that is significantly and historically focused on the study and use of the land, to preserve the beauty and serenity of these magnificent land parcels, especially those which have been identified as environmentally sensitive areas, and to act in a way consistent with the best practices of responsible land stewardship and ecological integrity.

We are not engaged, however, in mere academic exercise, something perhaps suggested in the notion of "ecological literacy" or the phrase "the greening of the campus," as important as the development of environmental awareness and sensitivity may be. What we are about through the agency of our lands is "leaping a fence" of our own – that is, connecting the formal curriculum of our lectures and laboratories, studios and seminars, to the informal curriculum of the land itself, a land that awaits exploration and study, discovery and consideration, from the perspective of a myriad of academic disciplines that can be brought together for the task. Indeed, the new Cal Poly Master Plan recognizes this relationship by designating

lands for "outdoor teaching and learning." The land, in other words, is both teacher and subject. It affords reason for our work, inspiration for its undertaking, and an opportunity to examine and shape personal, institutional and societal values in the verdant, sometimes rough or muddy, process.

As Thomas Aquinas asserted, a university is a place of people and ideas. Cal Poly is rich in people and ideas because it is a special "place" on the landscape of American higher education. But the actual, physical place of Cal Poly – both its location on the California Central Coast and the necessarily physical expression of its traditions – may be the University's greatest asset. *Cal Poly Land: A Field Guide* celebrates this place, this living and learning center, and the lessons it will teach us and generations to come.

Introduction

Steven Marx, English Department

When we see land as a community to which we belong,
we may begin to use it with love and respect.
– Aldo Leopold

This book is about the "community to which we belong"–we, the students, faculty and staff of Cal Poly University and our neighbors.

Cal Poly Land encompasses nearly 10,000 acres in four large parcels--two in San Luis Obispo county, and two in Santa Cruz county--making us the second largest university landholder in California and one of the largest in the nation. This land comprises one of Poly's most valuable assets. Its "outdoor teaching and learning facilities" provide laboratories for education and research, house ecosystems and lifeforms, grow food and fiber, inspire recreation and renewal, and remain our legacy from past to future generations. Cal Poly's land has been central to its evolving identity. Enjoying, knowing, using, and taking care of this land are our common concerns. These particular 10,000 acres sustain our work and define our institution.

This book aims to increase appreciation and understanding of the land, to enhance our sense of place. At a 1989 conference on the Cal Poly campus, the eminent cultural geographer, Yi-fu Tuan, articulated the value of that sense:

> Place supports the human need to belong to a meaningful and reasonably stable world, and it does so at different levels of consciousness, from an almost organic sense of identity that is an effect of habituation, to a more conscious awareness of the values of middle scale places such as neighborhood, city and landscape, to an intellectual appreciation of the planet earth itself as home.

Old dairy barn (1910) at Serrano Ranch

Despite this basic human need, many students graduate from the University never having walked up Poly Canyon and unable to distinguish Coast Live Oak from Poison Oak. Not only does such alienation from their surroundings impoverish them emotionally and intellectually, it also renders them incapable of responding to the growing environmental crisis immediately before us.

How will Cal Poly itself face that crisis? The University has recently addressed the pressures of population growth and the conflicting demands for development and conservation by initiating an ongoing process of land-use planning. In the words of the Master Plan, that process "depends on an improved and expanded understanding of these valuable assets as a basis for its recommendations."

Learning about our land leads to what Aldo Leopold called "a land ethic": "The land ethic simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively: the land." Half a century ago, Leopold observed that "Perhaps the most serious obstacle impeding the evolution of a land ethic is the fact that our educational and economic system is headed away from, rather than toward, an intense consciousness of land." The authors of *Cal Poly Land: A Field Guide* – faculty, staff and students – offer it to help shift the direction of this educational community, heading it toward rather than away from a land ethic of our own.

This book is one of several products of the Cal Poly Land Project, an interdisciplinary faculty seminar established in Spring 2000 by Provost Paul Zingg as part of the University's Centennial celebration to illuminate "How different disciplinary lenses inform our understanding of a particular issue or topic." The Project attempts to integrate a somewhat fragmented university community by adopting the methods of "Place Study," which link remote academic disciplines and cross barriers between nature and culture, knowledge and feeling, theory and practice.

The concreteness of a topic defined by place and centered on the natural environment complements Cal Poly's enthusiastic engagement with the "virtual reality" of computer technology. Tools like GIS and three-dimensional-modeling enhance knowledge and control of the material world, but walking a watershed or sitting in an oak grove can teach some things inaccessible through a monitor. The Cal Poly Land Project balances teaching of computer literacy with environmental literacy.

The Centennial Seminar enlisted the University Architect and 19 faculty members from 15 departments and three Colleges to meet in a monthly class and teach one other about various aspects of Cal Poly Land.

Some made presentations, some led field trips, one took photographs, and one designed this book. Several invited their own students to attend seminar meetings or hired them as project assistants.

Beginning in Spring 2002, Cal Poly Land is the subject of a course developed by members the faculty seminar. Interdisciplinary and team-taught, the course includes weekly classroom presentations, discussions, and hikes. Subtitled, "Nature, Technology and Society," the course occupies a critical position in a Polytechnic University.

During its first year of operation, the Cal Poly Land Seminar produced an extensive website, <http://polyland.lib.calpoly.edu>. This website displays, updates and archives the material produced by seminar members. It catalogues the growing repository of research studies concerning Cal Poly Land stored in the Robert E. Kennedy Library, and it includes full-text digital versions of some of the most widely applicable ones.

This Field Guide is the third project of the Cal Poly Land Seminar. A tribute to the community to which we belong, the book is also its product. Many members of this community have donated their expertise, talent, time, and effort to its creation. In addition to the dozens of student, faculty and staff contributors whose names are listed in the text and in the credits at the end of the book, special recognition goes to:

Brian McGlynn, principal book design and production assistant; Patrick Concepcion, chief illustrator; Anna Chaffin, image processor; Melody Demerit, copy editor.

Thanks also to Dr. Barbara Bailey and Mrs. Louise Marx for gifts in support of the project.

Most of the material in this book is primary—based on original research and observation by the authors, who are authorities in their own fields. When other authorities have been consulted or cited, references appear in endnotes.

Places

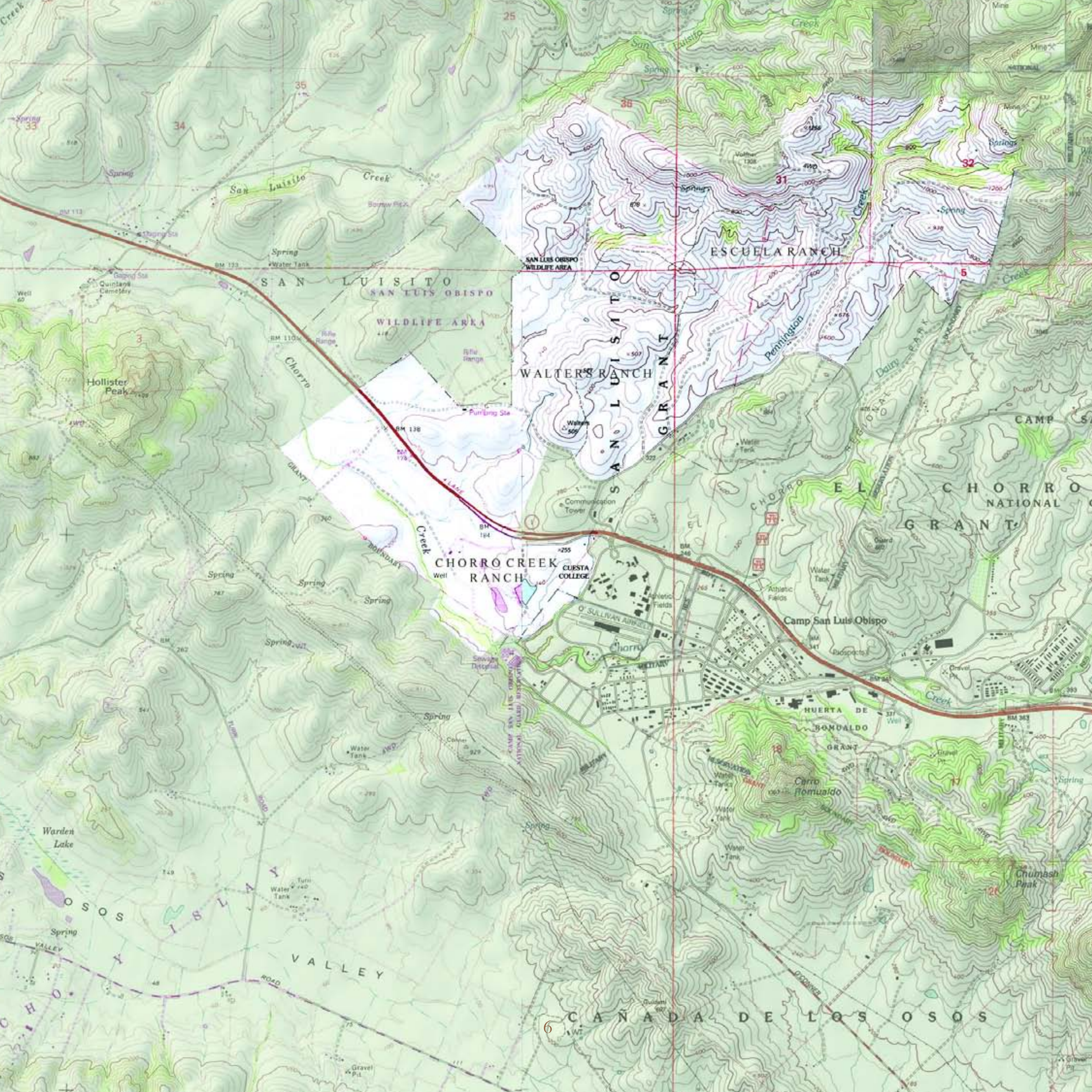
The maps and pictures that follow offer an over-view of Cal Poly's locations and places. The University's 10,000 acres is divided into four parcels: two in San Luis Obispo County of about 3000 acres each, and two in Santa Cruz County of about 3200 and 500 acres. Though separated by 180 miles, all these properties lie within the same geomorphic province of California—the Southern Coast Range.

Cal Poly Land in San Luis Obispo County

Cal Poly Land in Santa Cruz County

In San Luis Obispo County, Cal Poly Land lies between five and 12 miles from the Pacific Ocean. The double-page spread on the overleaf shows the two parcels in relation to adjoining land. The following two pages display them separately. On the left are the Chorro Creek Watershed Ranches; on the right are the Main Campus and San Luis Obispo Creek Watershed Ranches.

Main Campus and San Luis Obispo Creek Watershed Ranches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SAN LUIS OBISPO WILDLIFE AREA
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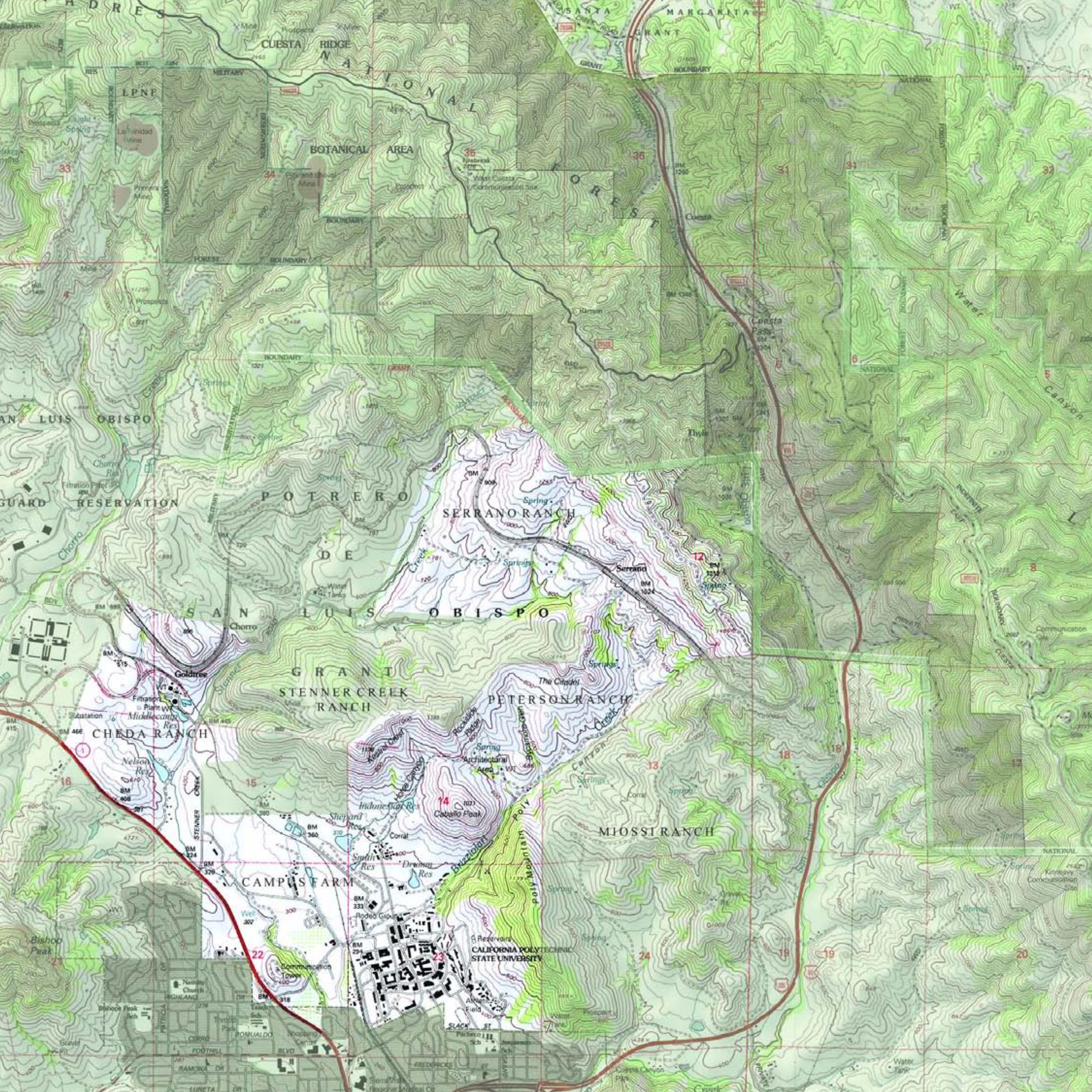
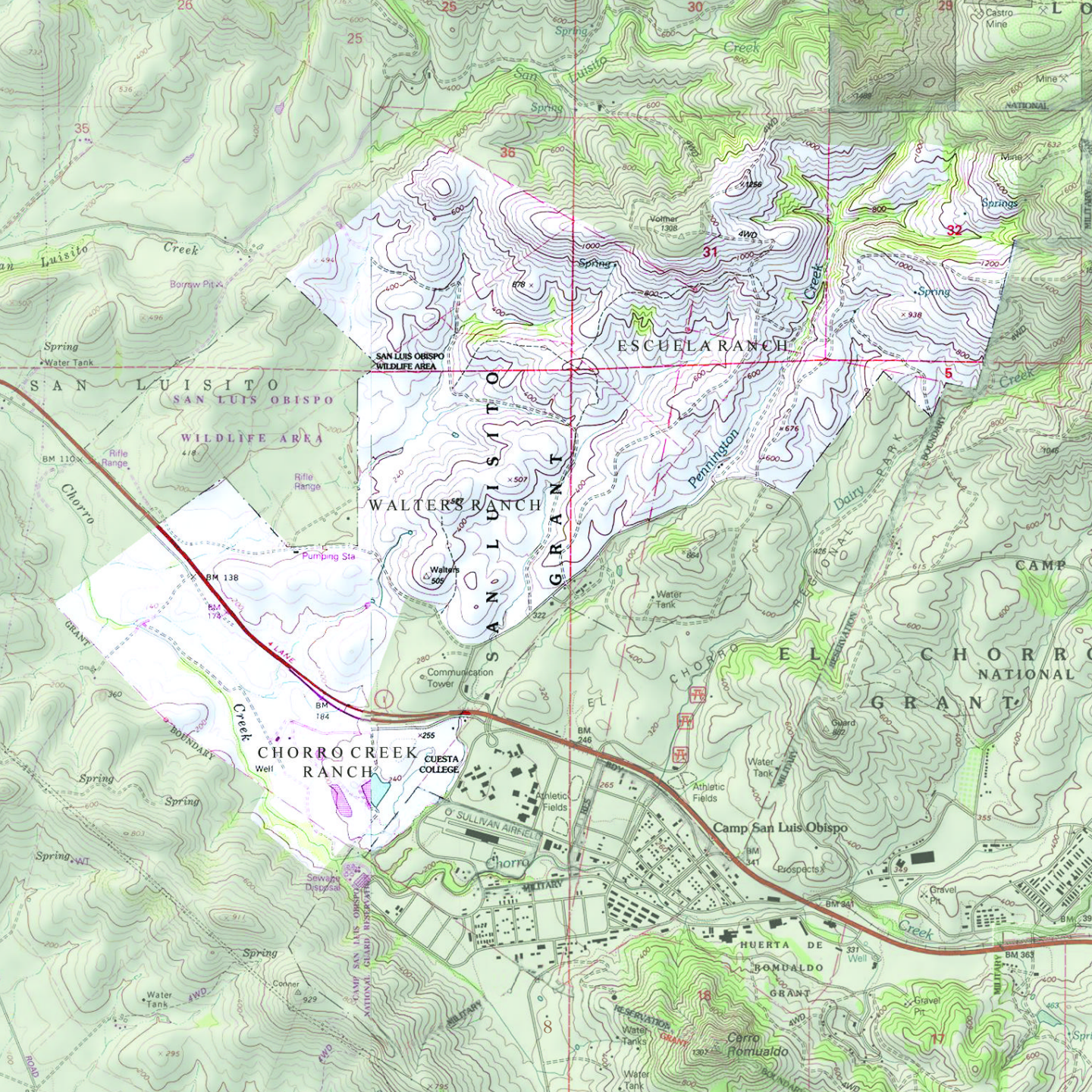
WALTER'S RANCH
SAN LUISITO GRANT
CHORRO CREEK RANCH
CUESTA COLLEGE
Communication Tower
Hollister Peak
San Luisito Creek
Chorro Creek
Pennington Creek
Dairy Creek
EL CHORRO GRANT
NATIONAL
CAMP
Camp San Luis Obispo
Athletic Fields
O'SULLIVAN AIRFIELD
Sewage Disposal
HUERTA DE ROMUALDO GRANT
Cerro Romualdo
Chumash Peak
Warden Lake
OSOS
VALLEY
CAÑADA DE LOS OSOS
Spring
Water Tank
Well
Pumping Sta
Rifle Range
Borrow Pit
Gravel Pit
Quintana Cemetery
Gaging Sta
Mine



CUESTA RIDGE
NATIONAL
LPNF
BOTANICAL AREA
FOREST
BOUNDARY
Cuesta
Cuesta Pass
SAN LUIS OBISPO
GUARD RESERVATION
POTRERO
DE
SAN LUIS OBISPO
SERRANO RANCH
Serrano
Chorro
Goldtree
GRANT
STENNER CREEK RANCH
PETERSON RANCH
The Citadel
CHEDA RANCH
Substation
Architectural Area
Indonesian Res
Caballo Peak
Shepard Res
Smith Res
Drumm Res
MIOSSI RANCH
CAMPUS FARM
Rodeo Grounds
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
Bishop Peak
Communication Tower
SANTA MARGARITA
GRANT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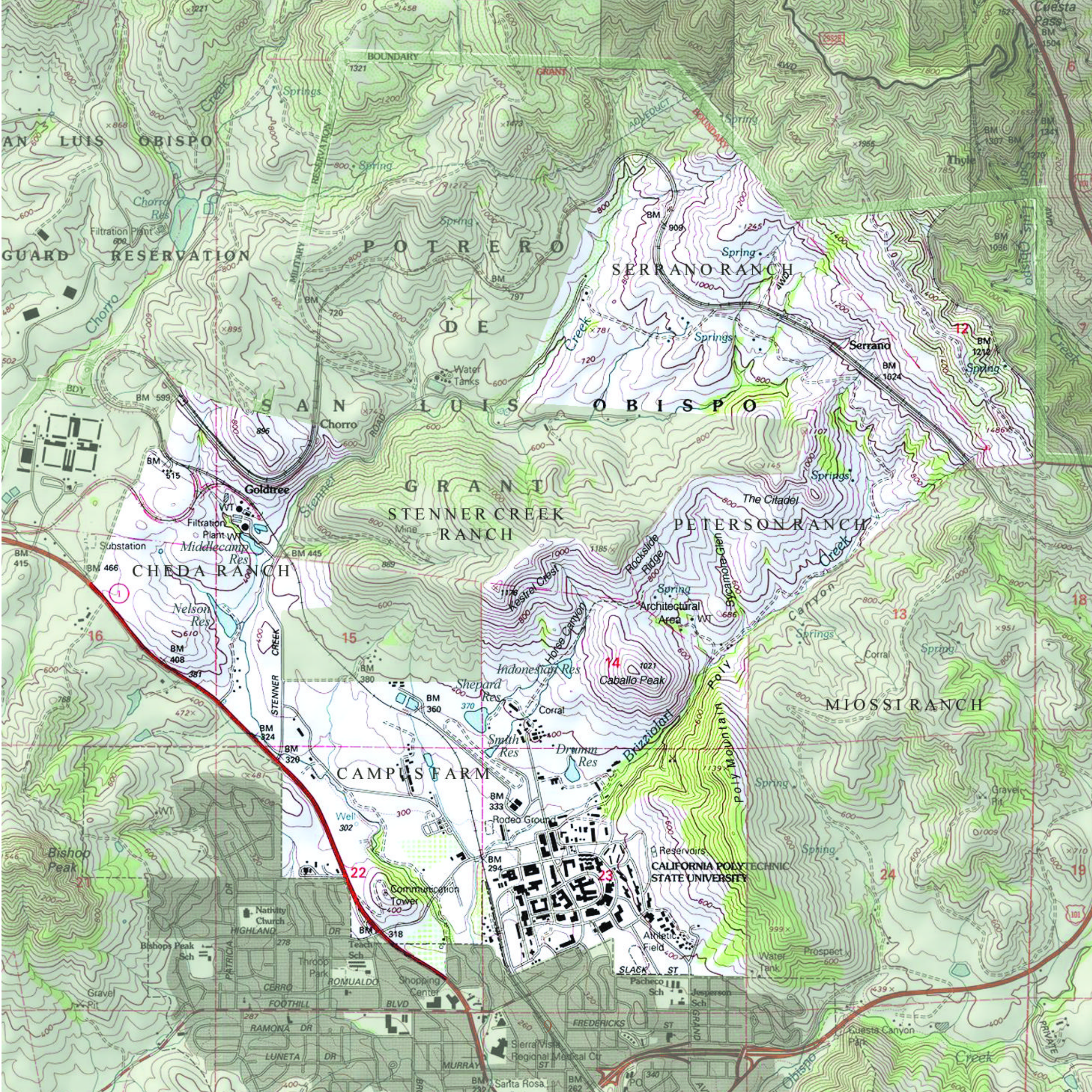
San Luisito Creek
Chorro Creek
Dairy Creek
Borrow Pit
Rifle Range
Pumping Sta
Communication Tower
Sewage Disposal
Athletic Fields
Water Tank
Water Tanks
Gravel Pit
Prospects
Guard
Conner
Walters
Volther
Castro Mine
Mine
Springs
Spring
Well
BM 110
BM 138
BM 174
BM 184
BM 246
BM 341
BM 363
4WD
ROAD
MILITARY
RESERVATION
BOUNDARY
NATIONAL GUARD RESERVATION
CAMP SAN LUIS OBISPO
GRANT
A LANE

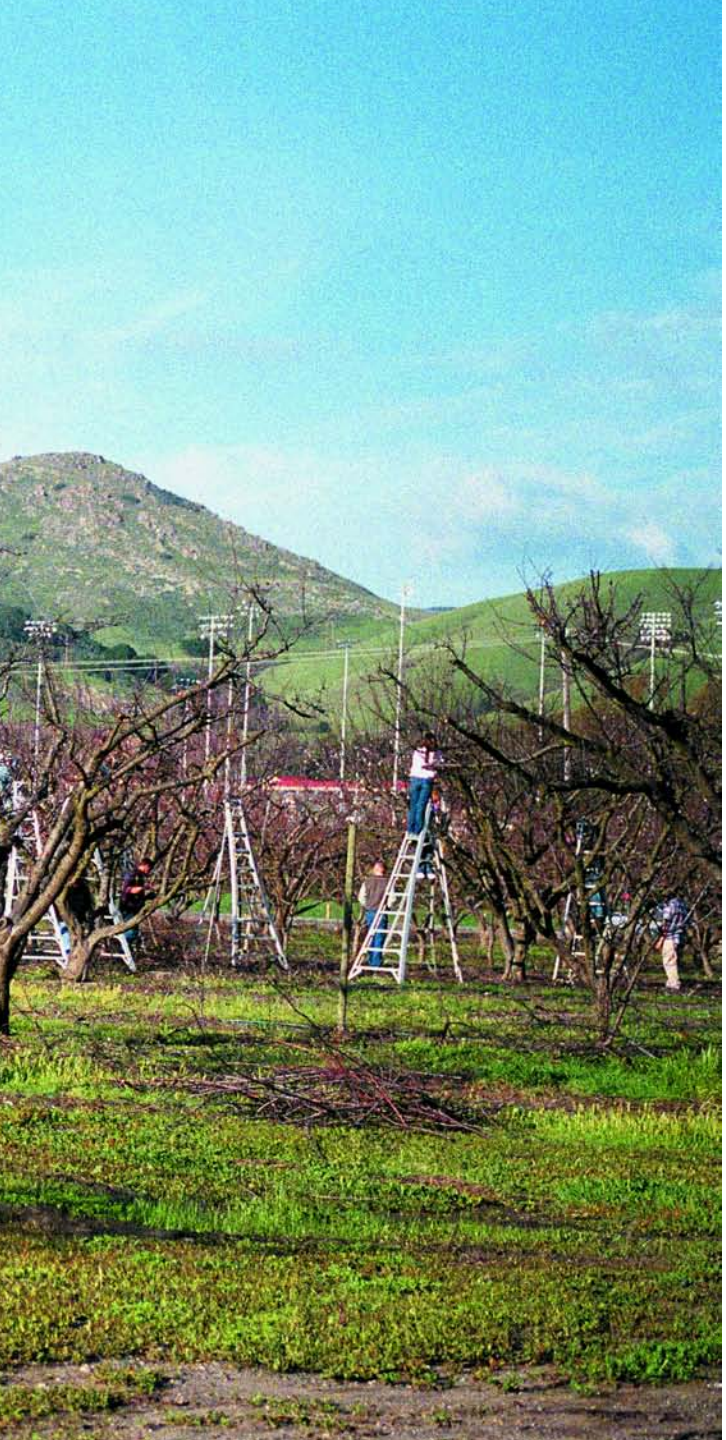


SAN LUIS OBISPO
GUARD RESERVATION
POTRERO DE SAN LUIS OBISPO
GRANT
SERRANO RANCH
STENNER CREEK RANCH
CHEDA RANCH
PETERSON RANCH
MIOSSI RANCH
CAMPUS FARM
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
Chorro Res
Filtration Plant
Water Tanks
Chorro
Goldtree
Middlecamp Res
Nelson Res
Substation
Serrano
The Citadel
Architectural Area
Caballo Peak
Indonesian Res
Shepard Res
Smith Res
Drumm Res
Corral
Rodeo Ground
Reservoirs
Communication Tower
Bishop Peak
Nativity Church
Bishops Peak Sch
Teach Sch
Throop Park
Shopping Center
Athletic Field
Pacheco Sch
Jesperson Sch
Sierra Vista Regional Medical Ctr
Cuesta Canyon Park
Cuesta Pass
Thyle
Stenner Creek
Poly Canyon Creek
Brizziolari
Poly Mountain
Rockslide Ridge
Sycamore Glen
Kestral Crest
Horse Canyon
HIGHLAND DR
FOOTHILL BLVD
RAMONA DR
LUNETA DR
MURRAY
FREDERICKS ST
SLACK ST
GRAND
PATRICIA DR
ROMUALDO
CERRO
Santa Rosa

Main Campus

The main campus consists of the University's Instructional Core—155 acres situated on sloping terraces at the base of Poly Mountain and bounded by Brizzolara Creek and the railroad tracks—and the Extended Campus, which includes the campus farm and residential, recreational, and parking facilities.

View from Caballo Peak showing Brizzolara-Stenner-San Luis Creek watershed



Campus Farm

Lying between the lower slopes of Cuesta Ridge and Highway 1, rich soils grow orchards, row crops, experimental crops, and pasture. The campus farm contains animal units, environmental horticulture facilities, the arboretum, and irrigation research center. Four reservoirs provide water for livestock and irrigation.

Pruning class in Crops Unit Orchard, Kestrel Crest and Rockslide Ridge in background

Poly Canyon

This is the watershed created by Brizzolara Creek, which originates on the steep upper slopes of Cuesta Ridge, flows southwest through the rolling hills of the Peterson Ranch and the gorge beside Poly Mountain, borders the Campus Instructional Core and terminates in Stenner Creek. Poly Canyon contains an ecological study area, botanical garden, architectural study area, and hiking trails.

Peterson Ranch and Lower Poly Canyon

Stenner Canyon

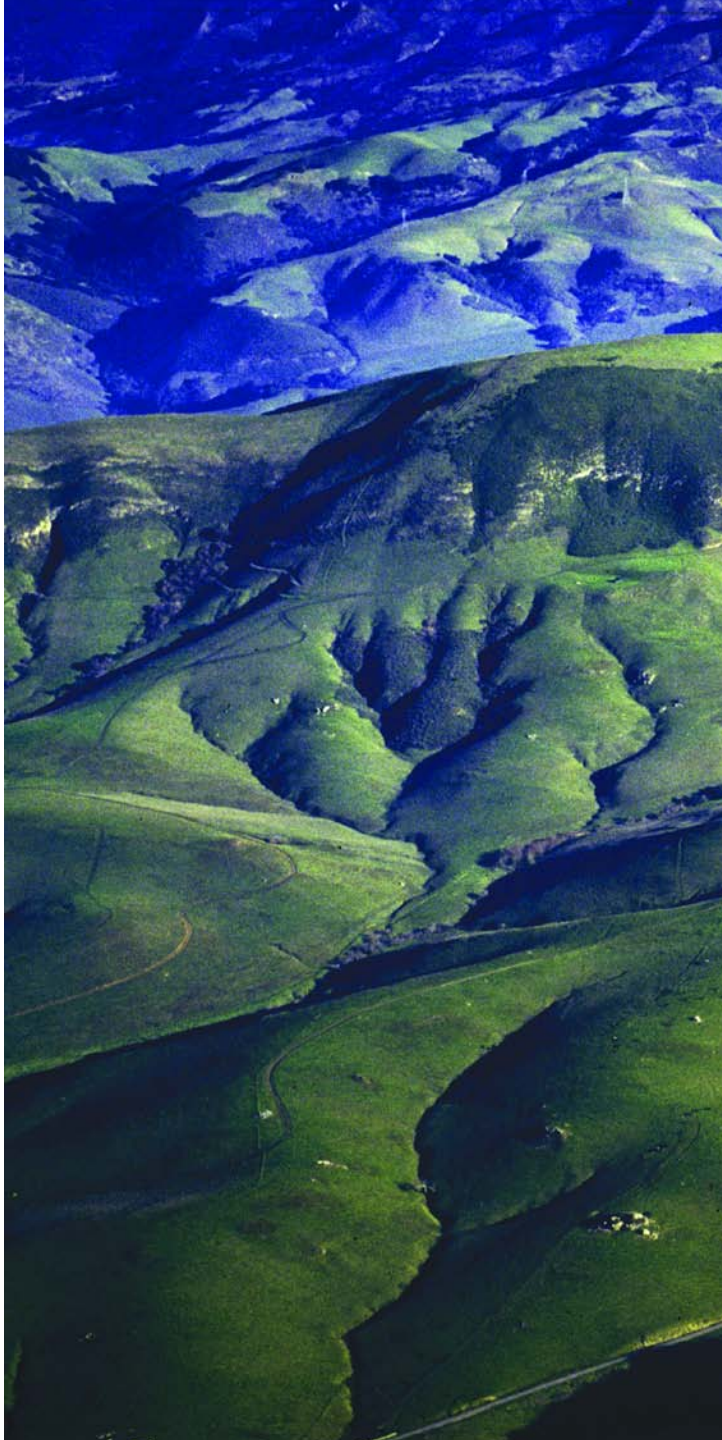
Stenner Canyon is the watershed created by Stenner Creek, north and west of the Central Campus. It runs parallel to Brizzolara Creek, down Cuesta Ridge, through Serrano Ranch, the Kirshner property, and the gorge spanned by the Union Pacific railroad trestle. It drains Cal Poly's agricultural lands, and terminates in San Luis Obispo Creek near Marsh and Higuera streets.

Stenner Canyon, East Cuesta Ridge

Pennington Canyon

Originating in the mine-ravaged upper slopes of Cuesta Ridge, Pennington Creek flows down to the alluvial floodplain of Chorro Creek through Escuela and Walters Ranches. Pennington Canyon contains the remains of an old homestead, a biological preserve of 211 acres, student enterprise cattle rearing operations and hiking trails.

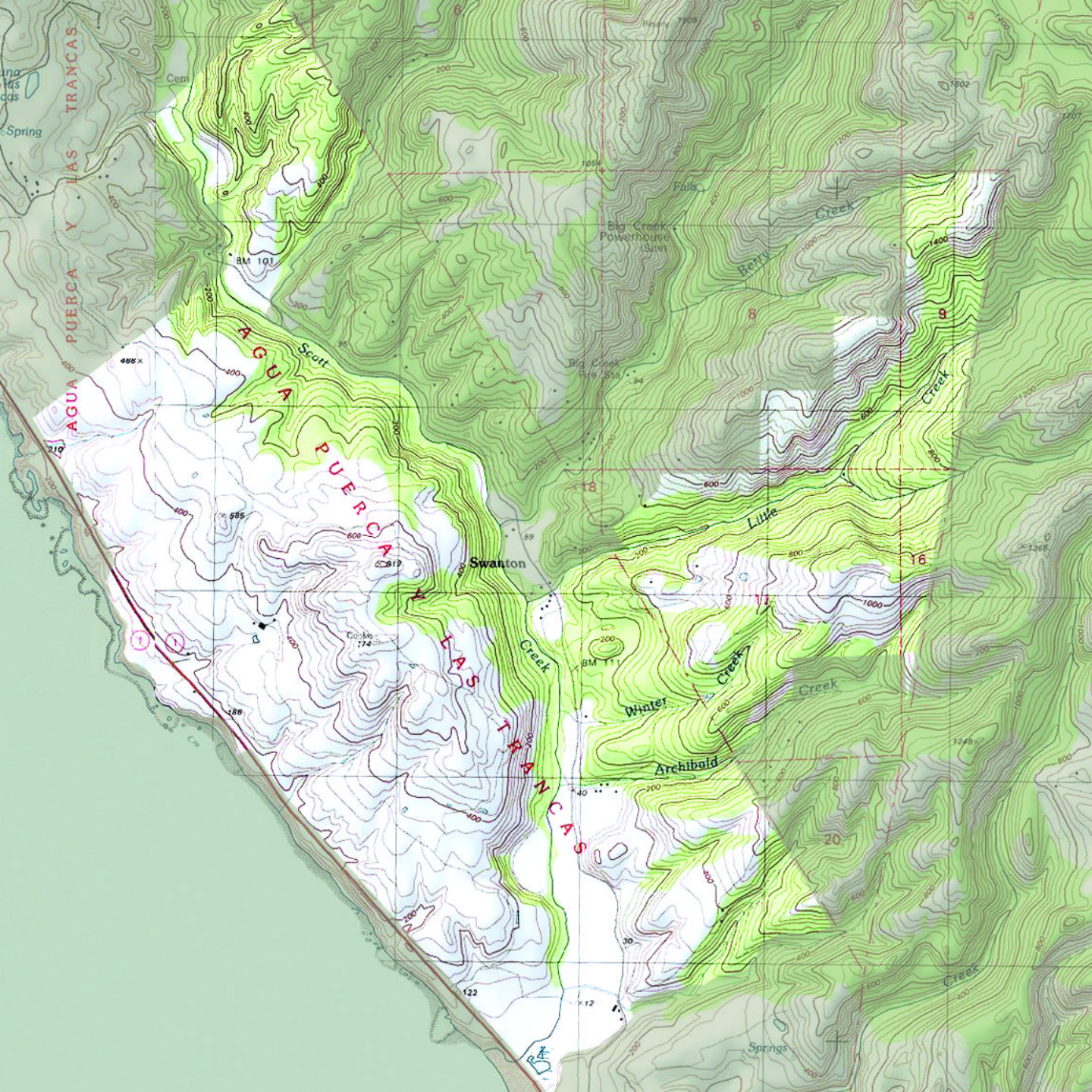
Mt. Vollmer and Escuela Ranch



Chorro Creek Ranch

Separated from the adjoining Cal Poly properties of Walters and Escuela Ranch by Highway 1, Chorro Creek Ranch straddles Chorro Creek, which drains into the Morro Bay National Estuary. It includes two reservoirs, an equipment barn, the campus farm manager's residence, pasture and cropland, and 150 acres of newly planted vineyard. The three ranches are referred to collectively as Chorro Creek Watershed or Western Ranches.

Hollister Peak from Alfalfa field, Chorro Creek in middle ground


AGUA PUERCA Y LAS TRANCAS
Scott
Swanton
Creek
Winter
Archibald
Big Creek Powerhouse
Falls
Berry
Little
Creek
Springs
BM 101
BM 111

Swanton Ranch

Swanton Pacific Ranch consists of a diverse landscape overlooking the Pacific Ocean, 12 miles north of Santa Cruz. Scott Creek, a year- round stream reaching to the ocean, bisects the property. Croplands are primarily in the Scott Creek valley, with approximately 125 acres of irrigated land. Forested areas exist throughout the property and are made up of 80 year-old second-growth stands of redwood and Douglas fir. These are being managed commercially on an uneven-aged, sustained-yield basis. The majority of the forest lies in the Little Creek watershed, a tributary of Scott Creek. Rangeland accounts for approximately 1,900 acres of the land use, primarily on bluffs on the ocean side of the ranch.

The ranch is also home to a one-third scale small gauge steam railroad that follows 1.5 miles of track near Scott Creek and croplands. This railroad was part of the Panama-Pacific Exposition that was hosted in San Francisco in 1915 to demonstrate the recovery from the 1906 earthquake. The railroad is maintained and operated by the Swanton Pacific Railroad Society.

The ranch was given to Cal Poly in the will of Al Smith, who died December 18, 1993. Al was an alumnus of Cal Poly's Crop Science and Agricultural Education programs.

The Valencia Creek property located east of Aptos is non-contiguous with Swanton Pacific Ranch. It consists of 500 acres zoned Timber Production Zone (TPZ) for growing and harvesting timber. It serves as a resource for forestry education and for generating revenue.

Scott Creek valley and farm in foreground, Little Creek watershed in background

Geology

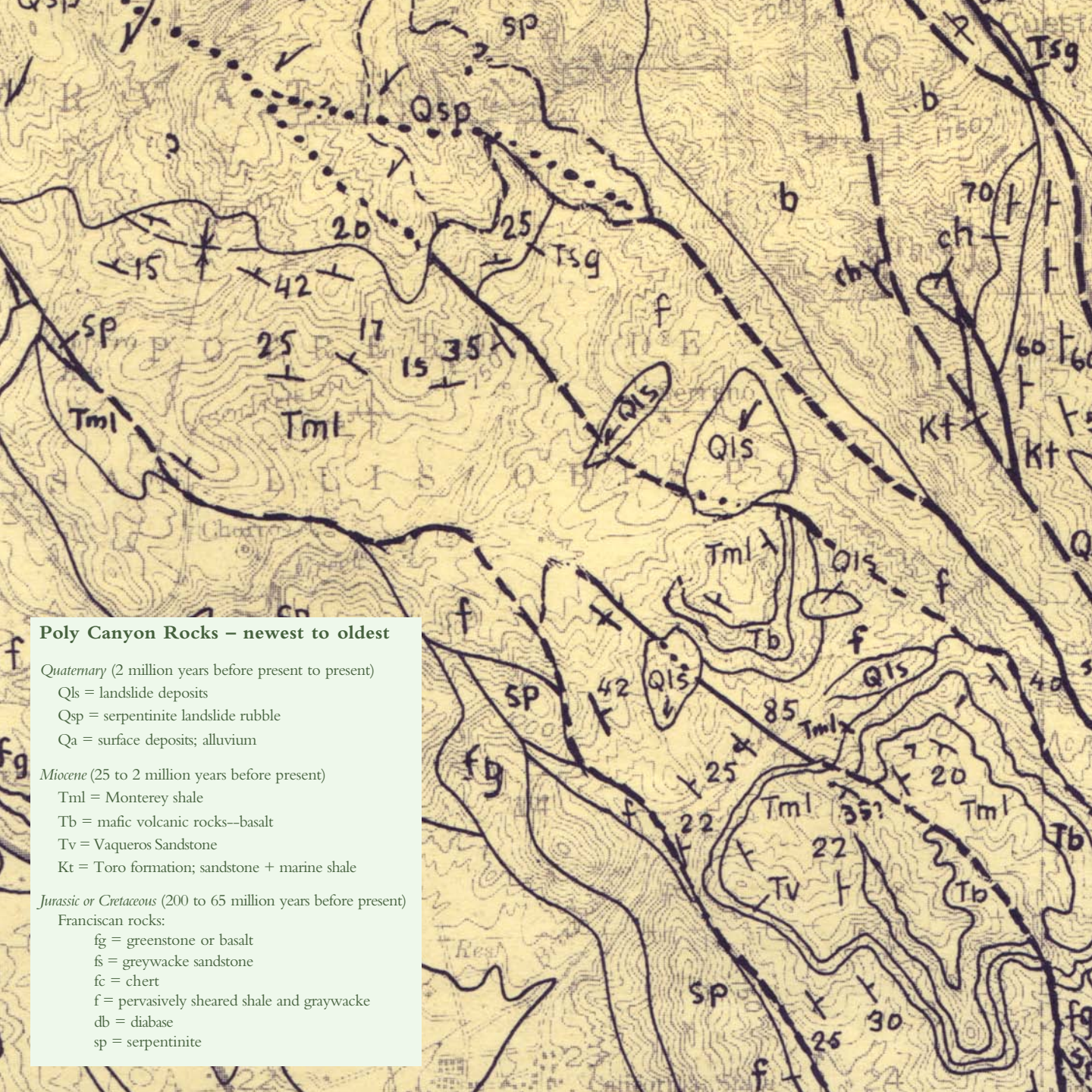
David Chipping, Physics Department

Cal Poly Land is situated in the midst of one of the world's most active and complex geological regions: the Southern Coast Range of California. The familiar slope of the central campus, the signature ridge of Poly Mountain, the idyllic glade of Poly Canyon, the upper drainages of Brizzolara, Stenner, and Pennington creeks and the steep escarpment of Cuesta Ridge reveal some of earth's fundamental features and forces. The variety of landforms and rocks here create a diversity of habitats that support an extraordinary range of plant and animal communities. In the last 25 years, scientists have generally agreed that these changes can be explained with the theory of Plate Tectonics—the drift and collision of continent-sized sections of the earth's crust over eons of time. Cal Poly Land has been formed by the movements of these plates in all three dimensions.

Our present location has been subject to the collision resulting from the eastward movement of the Pacific plate against the North American plate, which has folded and cracked at the leading edge of the continent to form the parallel series of ridges and valleys of the Santa Lucia Mountains. It's been subject to vertical movement resulting from the Pacific plate's sliding under and pushing up the North American plate. And it's been subject to north-south movement as a result of the plates sliding by one another at the rate of one and a half inches a year along the San Andreas fault a few miles east of Cal Poly.

Our story starts about 180 million years ago, the late Jurassic Period, when the rocks that form much of the campus were the sea floor of the Pacific Ocean. At that time, the western coast of North America lay along the zone now occupied by the foothills of the Sierra Nevada, 100 miles or so to our east. The region between that coast and our county—now, the Great Central Valley—was occupied by a continental shelf covered by shallow sea water. The area of today's Coast Ranges was occupied by a deep ocean trench.

Cuesta Ophiolite exposed at top ridge, Serrano Ranch



Poly Canyon Rocks – newest to oldest

Quaternary (2 million years before present to present)

- Qls = landslide deposits
- Qsp = serpentinite landslide rubble
- Qa = surface deposits; alluvium

Miocene (25 to 2 million years before present)

- Tml = Monterey shale
- Tb = mafic volcanic rocks--basalt
- Tv = Vaqueros Sandstone
- Kt = Toro formation; sandstone + marine shale

Jurassic or Cretaceous (200 to 65 million years before present)

Franciscan rocks:

- fg = greenstone or basalt
- fs = greywacke sandstone
- fc = chert
- f = pervasively sheared shale and graywacke
- db = diabase
- sp = serpentinite

Way off to the west was an ocean ridge, from which new sea floor of the Pacific Plate oozed up as lava from a fissure in the earth's crust. This solidified under water into igneous rocks called basalt, gabbro, peridotite, and serpentinite.

As the sea floor aged, it gathered a veneer of ocean sediments dominated by the silica bodies of planktonic radiolarians. These creatures lived at the surface of the sea, but when they died their bodies sank to the bottom like a thin snow. The original deposits would have resembled chalk, but recrystallization under pressure resulted in the formation of chert, a metamorphic rock with the appearance of dull china in a variety of colors.

The sea floor moved towards the edge of the North American plate, which was itself moving westward. They met in this region, creating what is called a subduction zone. Here, the denser oceanic seafloor was pushed or "subducted" under the lighter continental crust, disappearing like stairs at the end of an escalator.

Over time, slivers of oceanic crust jammed up against the western edge of the Americas, like wads of paper that might pile up at the end of the machine, mixing with layers of sediment eroded from the mountains and spreading westward from North America itself. These geologic materials either stayed close to the land surface, or were fragmented and dragged downward into the depths of the subduction zone.

The larger, more intact slab of sea floor that remained close to the surface in this area is called the Cuesta Ophiolite, and is exposed along the northern edge of the campus, above Stenner Canyon.

The basaltic lavas of the old ocean floor produced a distinctive red, iron-rich soil that can be seen on the lower sections of Poly Mountain and Caballo Peak.

However, most of Cal Poly Land is made of the material that was fragmented as it entered the subduction zone, where it was shredded, mixed with sediment like fruit in the batter of a fruit cake, and in some cases raised to very high pressures by being pulled to depths near the base of the earth's crust. We call the resultant rock a "melange," and it has been assigned the name Franciscan Formation.

One prominent ingredient of the Franciscan melange is serpentinite, which consists primarily of peridotite derived from the ocean mantle that has been metamporhosed by pressure and heat into a plastic, malleable consistency.

About 60 million years ago, at the beginning of the Cenozoic era, the whole undersea complex of

trench and subduction zone was uplifted into a mountain chain by pressure from the underlying subducted material. These mountains in turn were gradually worn away, and by 40 million years ago—the Oligocene Age—this region had become a series of marine basins and associated highlands that resembled today's Channel Islands.

Erosion into this deepening marine basin deposited new layers of sediment onto the older Franciscan formation. These layers were compressed into the light colored sandstone of the Vaqueros formation and the finer grained muds of the Rincon Shale formation, which can be seen in the headwaters of Brizzolara Creek along with volcanic rocks that come from lavas brought to the surface during the same period.

Around 24 million years ago, during the Miocene epoch, new volcanic forces associated with the north-south movements of the San Andreas transform fault system produced the dacite granite making up the Morros or Seven Sisters that dominate the southern horizon from the campus.

The marine basins sagged downward and deepened, and shales of the Monterey formation were deposited. Some 4-5 million years ago, during the Pliocene epoch, the uplift of the present Coast Ranges began, due to a slight change in plate motion. This ended marine conditions and squeezed up mountains to a greater height than we see today. Erosion then stripped most of the rocks that postdated the Franciscan formation from the area, but the "Citadel" in upper Poly Canyon displays a tiny remnant of such later, non-Franciscan rocks.

The squeezing during this time moved the plastic serpentinite upward along fault zones, and as these linear injections of rock are erosion-resistant compared to other components of the melange, they remain today as the dominant ridges. The serpentinites form hills that are very rocky in appearance, lacking thick soil cover because the rocks lack the nutrients needed for most common plants. Those plants that occupy serpentinite hillsides are specialists, and include some rare species. The ridge sporting the Cal Poly "P" is serpentinite, as is Caballo Peak on the other side of Brizzolara Creek above Horse Canyon.

Volcanic basalt from the melange lies directly in front of this ridge. It supports a much darker and denser chaparral. The bulk of the campus core is constructed on an extensive sandstone block within the melange, fragments of which can be seen on the road into Poly Canyon.

Sandstone on Poly Canyon Road

The Morros from Horse Canyon Saddle

Caballo peak from Poly Canyon road, showing line separating basalt from serpentinite.

The melange has resulted in a varied assemblage of rock types that are scattered over the farmlands. The once squishy clays that form the weak melange matrix—material that binds the melange together—have resulted in unstable hill slopes and many landslides.

The landforms that we see today are formed from erosion of once higher mountains composed of materials deposited on top of the melange. These eroded materials left behind the San Luis, Chorro and Los Osos valleys, with the erosion resistant components remaining as hills.

One distinctive geological feature of Cal Poly. Land is the series of adjoining hollowed bowls between Cuesta Ridge and the range of serpentine hills fronting on the Chorro Valley, bowls drained by dramatic canyons carved through that front range by Brizzolara Creek, Stenner Creek, and Pennington Creek.

Similar formations can be observed on the adjoining land in the drainages of San Luis Creek, Chorro Creek, and Dairy Creek. During times when sea level was lower due to Ice Ages, water flowed off the land at greater velocity and thus carved the landscape. The current "water gaps" may be very old, and might reflect the paths of ancient streams that flowed along those courses before the serpentinites became exposed at the surface. Provided that the streams had enough power to cut through the serpentinite, they could keep flowing in the same direction as they cut through the ridges.

During interglacial periods, erosion quieted down. Erosion has been in pulses, and these pulses are manifest in a series of stepped land surfaces that were cut into the hills while they were slowly being uplifted. These surfaces, called terraces, form a series of stairs that cross the central campus and campus farm.

On the Nature of Serpentine

It would seem that nothing speaks dependability and forthrightness like a rock. Think of the metaphor, "She loves me like a rock," as pop idol Paul Simon sang. Or, more deeply lodged in all those who grew up in the Christian tradition, Christ's founding of the church on Simon, called Peter from *Petrus*, the Greek for rock: "On this rock I shall build my church."

So, one would imagine that a rock could not lie. And yet, look at serpentinite. Yesterday, on our walk through the grass of the burnt California hills, we sat on a broken sheep wall made of the material. It presents characteristics which, in a human being, would seem contradictory.

Sepentinite is green, the color of living things. Green for woods, green for birth, green for the rich excessive exhilirating extraordinary exciting universe of growth. Green for all goodly things, green for go. And yet, serpentinite is the very opposite of fertile. Here is a rock which weathers into a soil which cannot lend life to most plants.

The serpentinite looks as hard and obdurate as obsidian. Yet, as I sat on it and played with the thin slabs protruding from the stones, it broke neatly between my not-very-strong fingers. Lifting it, I found it as insubstantial as a cavalier's kiss.

And, finally, the serpentinite looks sharp, as if it would cut through flesh and bone and surely, if one fell from a great height, one would be injured by its teeth. Yet, when I sat there touching it, palm sliding over the hard curves, fingers spread across the mottled surface, feeling the textures slide from rough to slick beneath anticipant nerves, movement slowing, breathing slowing, thinking slowing, pausing, pausing, sun moving over head and throat, hot grasses breathing open toward noon, hands aware, alive, awake, opening tactilic anticipation, fingering the so very hard yet very giving, I noted that the rock was far softer than it appeared on first observation.

Thus does a rock enact its strange slow relationship with its surrounding in a way not unlike beings with far less time on their hands.

– Kake Huck, Journal entry English 513, "Reading and Writing the Landscape"

Rockslide Ridge, a serpentinite intrusion


OBISPO
BM 1024
PACIFIC
Creek
Spring
Spring
Spring
Brizziolari
1185
1021
1145
1107
1143
1139
686
13
14
1
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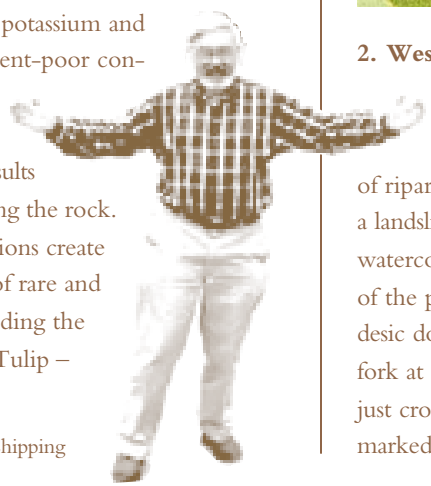
A Geological Tour of Poly Canyon

1. Serpentinite Outcrops

View of serpentinite outcrops on the back of Caballo Peak across an unnamed creek on the south side of the architectural area. The serpentinite weathers to soils deficient in many soluble metals such as potassium and sodium, creating nutrient-poor conditions that result in poorer vegetation cover. This in turn results in soil erosion, revealing the rock. However these conditions create habitat for a number of rare and beautiful flowers including the San Luis Obispo Star Tulip – *Calichortus obispoensis* – and the Yellow Mariposa lilly – *Calichortus clavatus*. There is a fault line approximately along the line of the creek, or at this location below the spring or seep on the far side.



Professor David Chipping

2. Westward Fork

Looking westward at the fork in the road in the architectural area. The distant line of riparian vegetation marks the eastern margin of a landslide. The same line of vegetation follows a watercourse that continues downhill to the right of the picture and fills the gully below the geodesic dome, and it converges with the westward fork at the barbeque pit above the bridge we have just crossed. The frontal lobe of the landslaide is marked by the fork in the road. The creek on the

west side of this area, seen in site #1 marks the western edge of the slide. The slide complex originates in the big scoop from the serpentinite hill—Rockslide Ridge—in the background.

3. Serpentinite Boulders

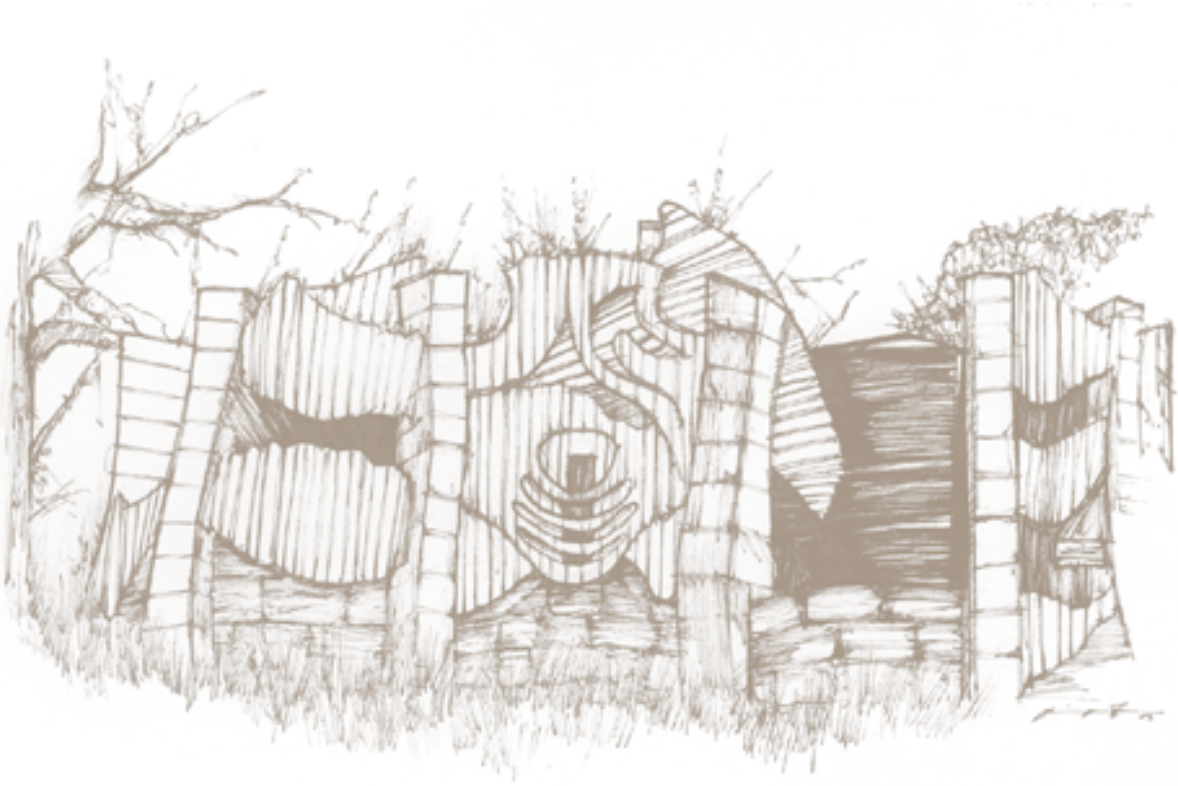
Serpentinite boulders on the landslide probably rolled down from Rockslide Ridge seen in the background. Along with Kestrel Crest to the west, and Caballo Peak and Poly Mountain to the south, Rockslide Ridge is part of a range of serpentinite hills that guards Cal Poly Land's back country. Running parallel to the taller escarpment of Cuesta Ridge, the same range secludes Reservoir Canyon from the City of San Luis Obispo and Pennington Canyon from the Chorro Valley.

4. Erosive Stream

Stream on the west side of the landslide, north of the main architectural area. The slide forced the stream into the hillside, hence the steep erosive cut. Bare serpentinite slopes are on the far side.

5. "Knockers"

"Knockers" in the Franciscan melange that occur near the upper portion of the landslide, west of the slide, and east of the fault. These rocks are mostly blocks of conglomerate.



6. Water Tank

The tank, built by students as a water supply for residences in the Architectural Study Area, collects water that is seeping from the landslide. A younger slide mass covers the older mass, and water drains from the contact between the two slide masses. Springs are common in landslides, as wetness was one reason for the initial slide.

7. Conglomerate

Conglomerate rock pebbles are probably Cretaceous in age. They were well rounded from the activity of either a beach or a river, but that marine environment was later subducted.

8. Eastern View of Bedrock

Looking east toward The Citadel--a structural syncline that parallels Cuesta Ridge. The brown grasses are underlain by the Franciscan Formation melanges, and dominated by highly sheared shales. The dark vegetation is comprised of much younger marine shales and volcanic deposits of Miocene age. These were deposited on the eroded Franciscan Formation after it was uplifted into mountains and then eroded again to below sea level. This is a good example of how bedrock has affected the vegetation, and you can clearly see the unconformity between the Franciscan Formation and the younger rocks.

9. Serpentinite Springs

Fault-bounded hard edge between the rocky serpentinite and the grass covered Franciscan Formation melange. Springs exist along this interface, as water can move through the fractures in the serpentinite, but not through the melange. Water in springs, seeps, and wells, generally originates as rainfall that has soaked into the soil and percolated into underlying rocks. Permeable rocks store and transmit water and are called aquifers.

10. Spineflower

A serpentinite endemic plant (*Chorizanthe*) which is in the buckwheat family. The grasses are also native bunchgrasses that used to be more common in California but which have been lost due to grazing and introduced European grasses. As the latter don't do well on the serpentinite, the native grasses can still be found in abundance.

11. Melange Boundary

At the boundary with the melange, we start to see severe cracking in the soils, characteristic of Diablo clay, which swells when wet in Winter and shrinks during Summer drought.

12. Franciscan Melange

A deeply dissected landscape of Franciscan melange crossed by the railroad tracks. There is evidence of many landslides along the sides of the valleys. Only the lower ends of the gullies converging in Brizzolara Creek remain wet long enough to support trees. Note the lack of young oaks, an artifact of grazing.

13. Miocene Shales

Miocene shales exposed by recent grading along the road. These appear to have a high ash content.

14. Spheroidal Weathering

Spheroidal weathering in Miocene diabase. The rock has weathered and its feldspar minerals have converted to clays that are light in coloration. Differential stresses due to the shrink-swell potentials of the weathered rock have produced the concentric cracking or "spheroids."

15. Coast Live Oak Woodland

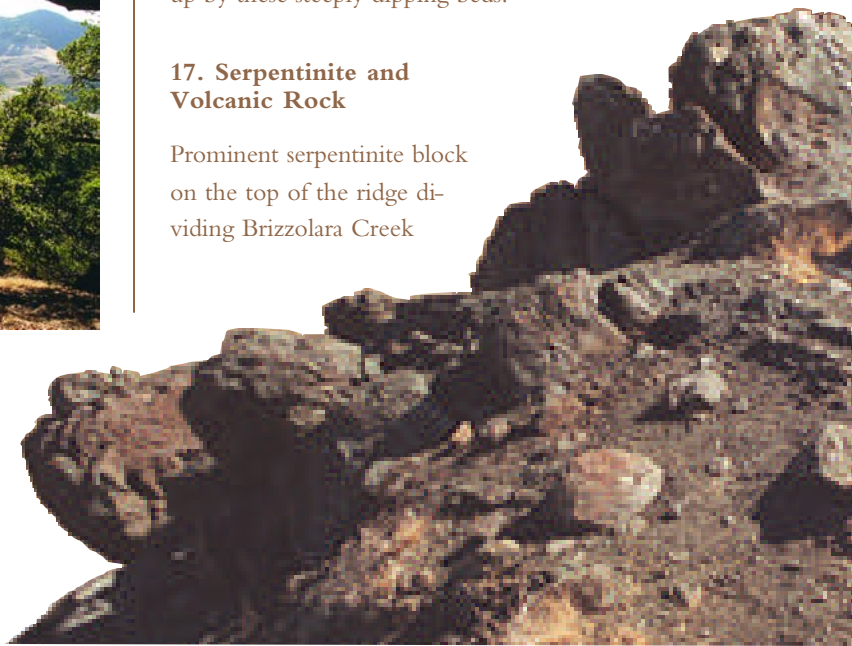
Passing through Coast Live Oak woodland that takes advantage of the higher water content of soils on the northeast and north side of the hill, and also of the water stored in the highly fractured bedrock.

16. Bedding Plane

Bedding plane occurs in fine grained, cherty sandstones and shales within a block of hard rock within the Francsican Formation. The trail here crosses the top of a very steep slope that is held up by these steeply dipping beds.

17. Serpentinite and Volcanic Rock

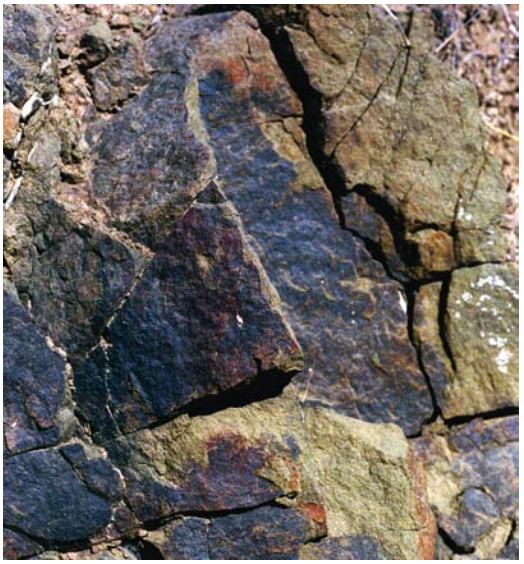
Prominent serpentinite block on the top of the ridge dividing Brizzolara Creek



watershed from the Stenner Creek watershed. Just below this outcrop a recent landslide in the Franciscan melange can be observed.

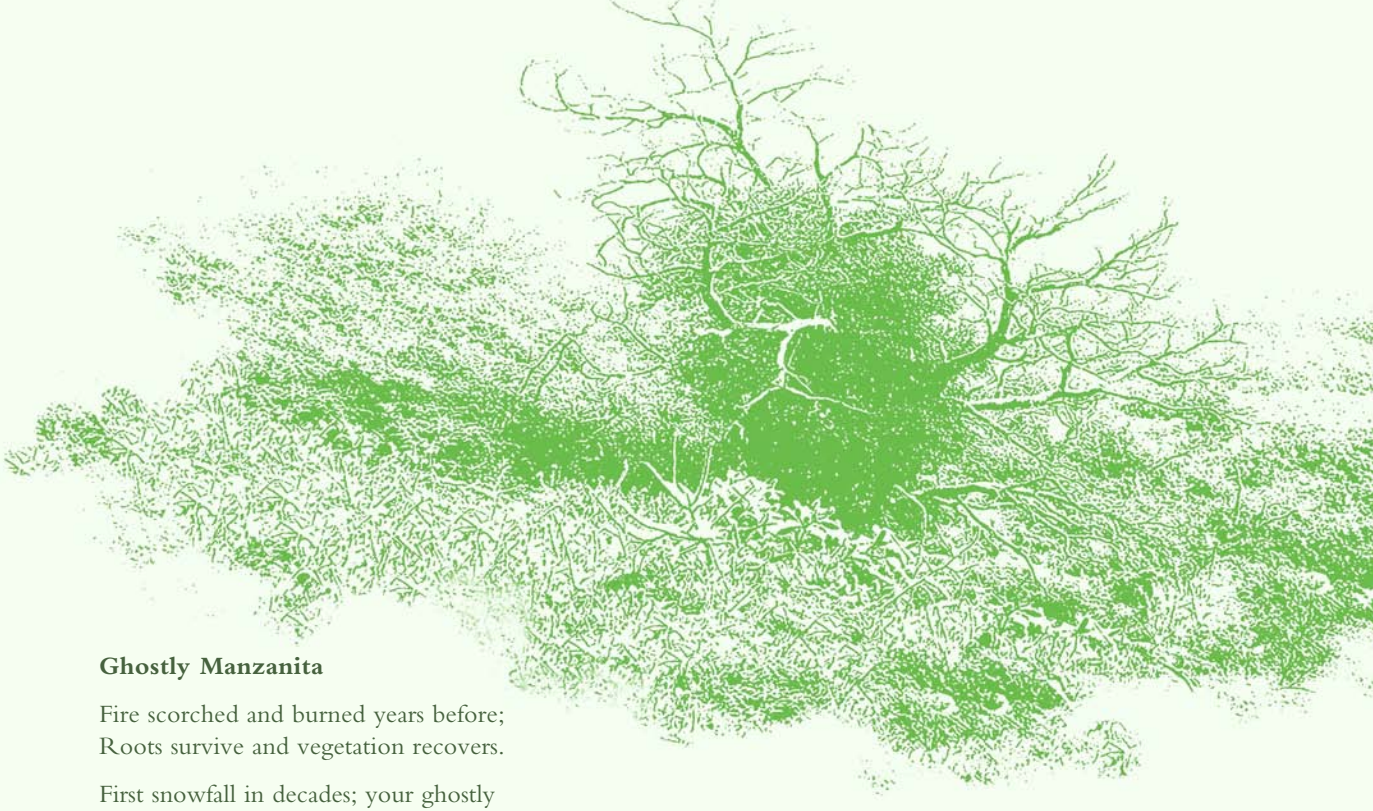
18. Colluvium

Colluvium is the mixture of soil and unconsolidated rock fragments deposited on a slope. Here it is revealed by the road cut. It is derived from slope wash from the hillside above the railroad track and contains fragments of the volcanic rocks that form the skyline. The ridge is a relatively large block of the volcanic rocks of the old Jurassic-Cretaceous sea floor that wedged into the subduction zone without being totally fragmented like the melange.



19. Red Chert

Thin bedded red chert, formed from ancient siliceous plankton (radiolaria) within the Franciscan melange. The high iron content allows this to be called "jasper."



Ghostly Manzanita

Fire scorched and burned years before;
Roots survive and vegetation recovers.

First snowfall in decades; your ghostly
Branched arms reach out to capture moisture.

The specter of internal dormant life springs
Forth after winter rains and frozen snow.

Solid water forms are transient in this warm
Mediterranean climatic zone near the ocean.

All traces of snow are melted within one day's sun;
Feeding the soil with new moisture to bathe hungry roots.

Keep the faith, you twisted hungry apparition;
Warm sunlight brings sugar production from your leaves.

A tasty dessert for a hearty species adapted to
Survive fire, wind, fog, and shallow rocky soil.

– Tom Rice, Professor Soil Science

Climate

Margot McDonald, College of Architecture and Environmental Design

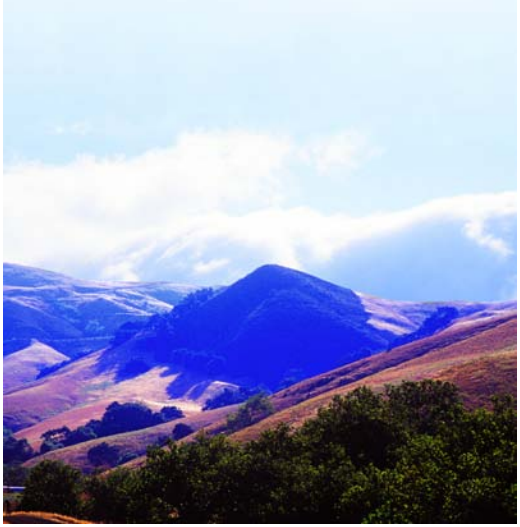
Cal Poly Lands located in San Luis Obispo County experience a collection of idyllic microclimates due to their geographical position relative to the Irish Hills and San Luis Range to the south and west, and the Santa Lucia Range to the east. These ridges create sheltered valleys that retard the persistent summer coastal fog common to neighboring communities to the west and the wide seasonal temperature variations of the Salinas and San Joaquin Valley north of the Cuesta Grade. The elevation in the region ranges from an average of 62 feet above sea level in the city to 2900 feet in the Santa Lucia Range.

From a global perspective, the region's climate type is termed Mediterranean, with warm dry summers, mild wet winters, and a strong maritime influence. This classification is a rare distinction shared by approximately two percent of the world and mostly by locations with westerly ocean coastlines, such as parts of California, Chile, South Africa and Australia. The specific occurrence of this climate type in San Luis Obispo, situated 12 miles east of the Pacific Ocean, is moderated by a continental influence whose dominance increases with distance from the coast. Seasonal transition is visible in the landscape in late Spring, when grasses change from verdant to golden hue, and in Winter, when green returns.

The large-scale weather patterns in the region are shaped by seasonal changes in upper level winds and solar radiation. In spring and summer, the North Pacific high pressure system drives the upwelling of cold, nutrient rich, ocean waters to the surface, producing the characteristic condensation that usually takes the form of coastal fog.

Daytime warming of the local land mass pulls cool ocean breezes and any accompanying coastal fog onshore during the late afternoon. The pattern reverses at night with cooling at the earth's surface.

In late fall and winter, the North Pacific high is weakened and storm systems are more likely to reach the region. Storms out of the north result in moderate precipitation, whereas the less common southerly



A wall of fog condenses at the top of Cuesta Ridge

storms can bring with them large amounts of tropical moisture.

Snowfall occurs rarely and only at the higher elevations in the region, as it did in December 1990 when two inches of snow accumulated on Cuesta Ridge.

During sunny winter days, warm coastal air rises up slope when it meets mountains, becomes less dense and then cools. The cooled air condenses into fog and is halted when meeting warmer valley air mass on the opposite downslope side.

The regional vegetation adapts to stresses presented by the Mediterranean climate with evergreen leaves that are small, hardened, and grayish, drought-deciduous leaves that fall off during the dry season, with photosynthetic rates that are higher in winter or spring when water is most available and temperatures are mild, and with deep tap-roots and shallow roots that collect the earliest rains.

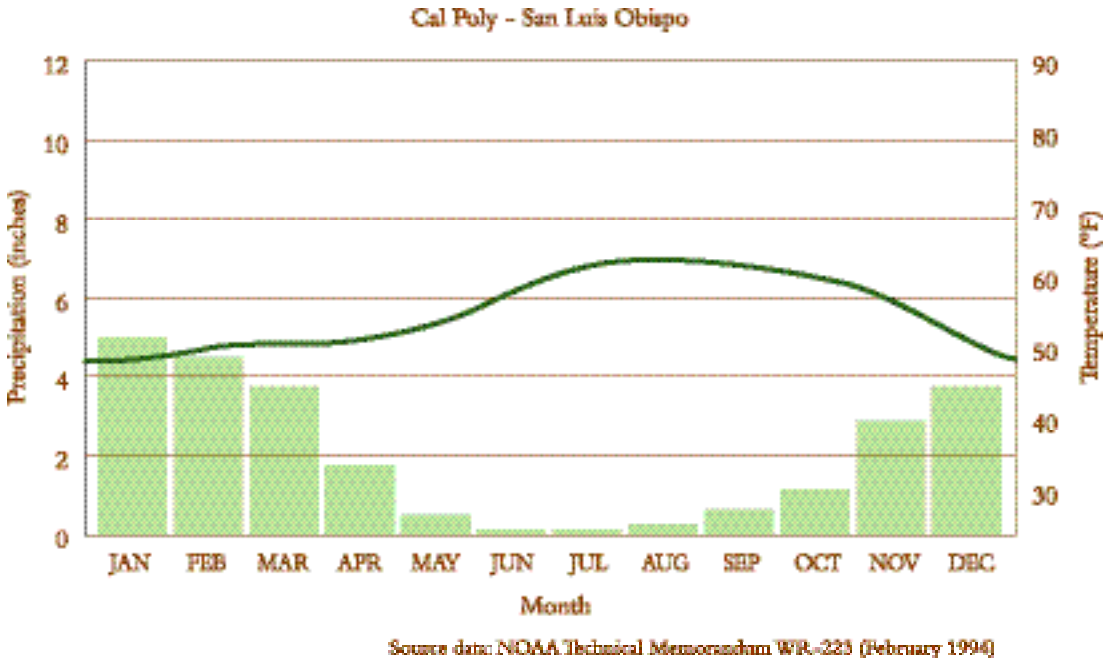
Differences in plant and soil types are evident throughout the landscape, especially when comparing those located on sunny, south-facing slopes with others on moist, shaded north slopes.

Riparian zones, such as those found along Brizzolara, Stenner, and Pennington creeks, are signalled by water-tolerant sycamores and willows.

Weather conditions for Cal Poly Land have been recorded continuously for over 100 years by the U.S. Weather Bureau. Based on records covering

Oak woodlands on north-facing slopes, in upper Poly Canyon

the period of 1961-1990, the variation in temperature ranges from an annual average maximum temperature of 71°F to an annual average minimum temperature of 47°F. Warmest months are typically August and September and coolest months are December and January. Relative humidity is an annual average of 75%. Average annual rainfall is 23.5 inches. Flooding occurs on average every 13 years. There is an average of 2800-3200 hours of sunshine annually, which equates to 70% possible sunshine hours. There are 256 clear, 44 partly cloudy, and 65 cloudy days annually based on averages for the same historical period. Winds are predominantly out of the northwest and have been statistically estimated to average five mph at Cal Poly.



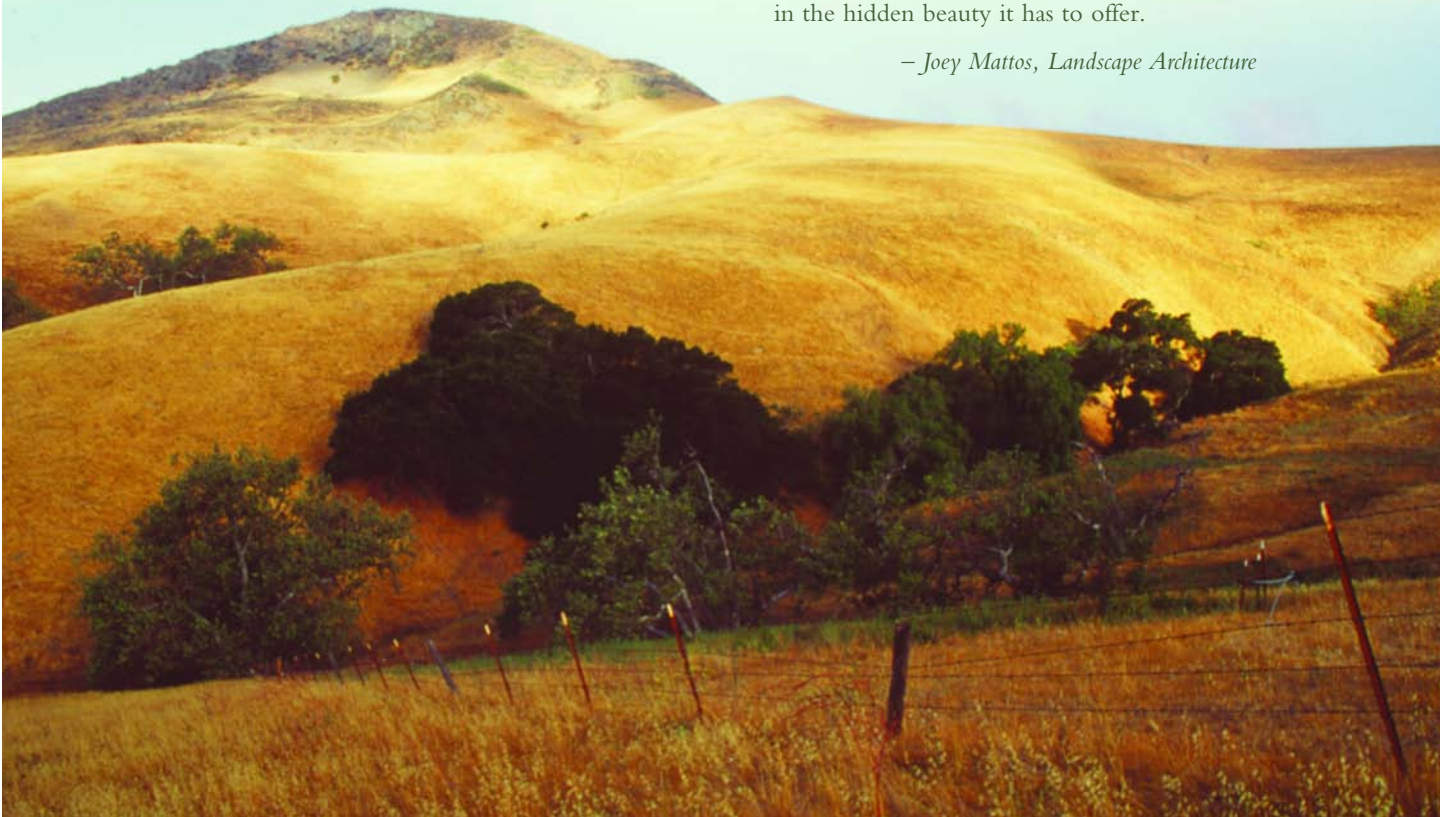
Spring has turned the golden hue of the hills into a sea of green wealth. The slender stocks of grass dance in the cool breeze of this afternoon. The leaves tremble with the anticipation of a spring storm, while their roots await the nourishment of the quenching rain. The sweet aroma of the grasses drifts in the currents of the northerly winds. As the grass blades sway in the increasing winds, they orchestrate an eerie halloo throughout the landscape. My hands filter through the soft foliage being careful of the razor sharp edges. Its sweet smell is equaled only by its savory flavor.

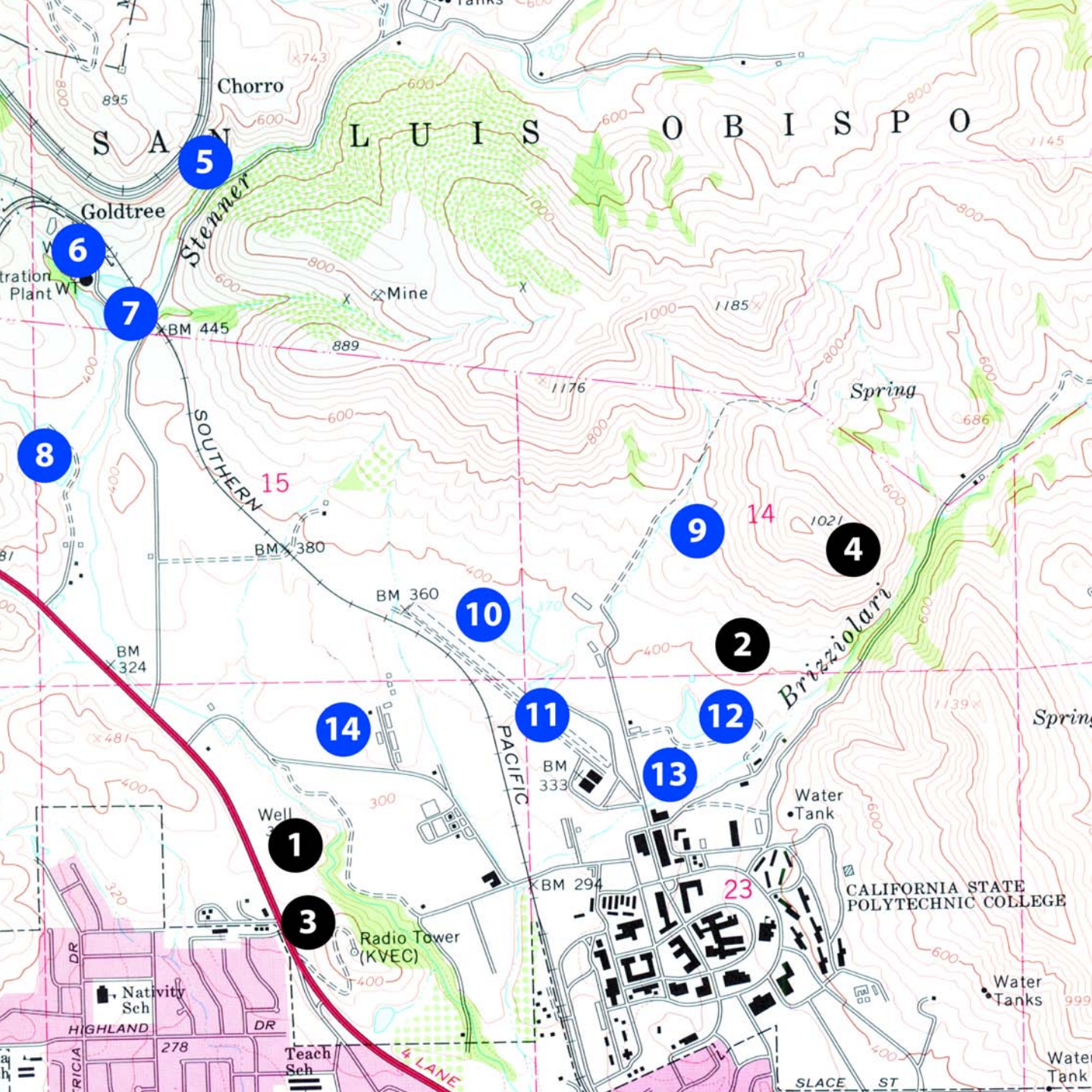
– Ric Hendricks, Landscape Architecture

Today I would like to say good bye to a good friend, a pleasant season we call spring. Good bye to the various shades of green that visually grace us. So long to the soft wavy grasses that grew adjacent to the creek that ran near my temporary dwelling. Farewell to the luscious Irish green hills that reminded me of a time when I was visiting in that country.

For the next nine months I must search harder, look deeper. I need to get reacquainted with the golden hills, sprinkled with darker shades of green present in the coast live oak and chaparral communities. I need to say hello to the dry landscape and take pleasure in the hidden beauty it has to offer.

– Joey Mattos, Landscape Architecture




Chorro
S A N L U I S O B I S P O
Stenner
Goldtree
Mine
BM 445
SOUTHERN
15
BM 380
BM 360
BM 324
14
PACIFIC
BM 333
Well
BM 294
Radio Tower (KVEC)
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CALIFORNIA STATE POLYTECHNIC COLLEGE
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Soil and Water

Delmar Dingus, Soil Science Department

Soil Resources

In addition to climate, soil and water are the primary factors that create ecosystems. The interactions among these three make for the particular conditions of life on Cal Poly Land. The property purchased by the State Legislature in 1902 for the site of Cal Poly was not prime agricultural land. According to a historian of the time, "It was hilly, scantily supplied with water, the soil poor and thin. To the objection that it was not well adapted to agriculture the directors countered with the reply that that was a point in its favor. Anybody could succeed with good land." Campus land has expanded vastly since that time, but the proportion of "good" vs. inferior soil still provides the challenges envisioned by the founders.

Land Capability Classes

Modern soil scientists divide land into eight Capability Classes designated by the degree of management they require for intensive crop production. Soils are grouped by depth, degree of slope, flooding potential, drainage condition, erosion hazard, extreme pH, and amounts of cobbles and stones present.

- Class I and II soils are nearly level, deep, well drained, and free of cobbles and stones. Of the 6,000 acres of land owned by Cal Poly in San Luis Obispo County, only 89 acres fit into these two categories.
- Class III and IV soils reduce the choice of plants to be grown and require special conservation management practices, such as reduced tillage, contour farming, crop selection, and creation of drainage terraces. About 140 acres of land on campus fit into these two capability classes.
- Class V and VI land consists of areas unsuitable for crop production because the soil can flood, because it contains excessive amounts of stones, or because it has steep slopes and a high erosion hazard. These soils

have limited use for pasture or woodlands. About 2,500 acres of Cal Poly Land in San Luis Obispo County fits into these categories.

- Class VII land has severe physical limitations for grazing and woodland production. Class VIII land is not suitable for any kind of commercial plant production. Land use is restricted to wildlife habitat and recreation activities. Over 3,000 acres of campus land falls into these capability classes.

Much of the class III and IV soil found on campus has been severely damaged or removed from agriculture production by infrastructure development. In the future, it will be increasingly more difficult to retain the 89 acres of prime agriculture land we possess for "hands-on learning" of the food production process.

Soil Types

The diversity of soil types on campus reflects the difference in parent materials upon which the soils have formed. These soils can be grouped into five distinct categories:

- soils that form from alluvium – water transported earth materials
- soils that form from meta-sedimentary or metamorphic parent materials – sedimentary rock altered by exposure to heat and pressure
- soils formed from shale
- soils formed from sandstone
- soils formed from the metamorphic rock, serpentinite

Salinas Soils

The most productive soils at Cal Poly are those formed from the water-transported parent material that has been deposited by flooding along Chorro, Stenner, and Brizzolara creeks. The area around the Crops Unit, the Citrus Orchard, the alfalfa fields along Highland Drive and Field 25—the vegetable plots along Highway 1—are underlain by these soils.

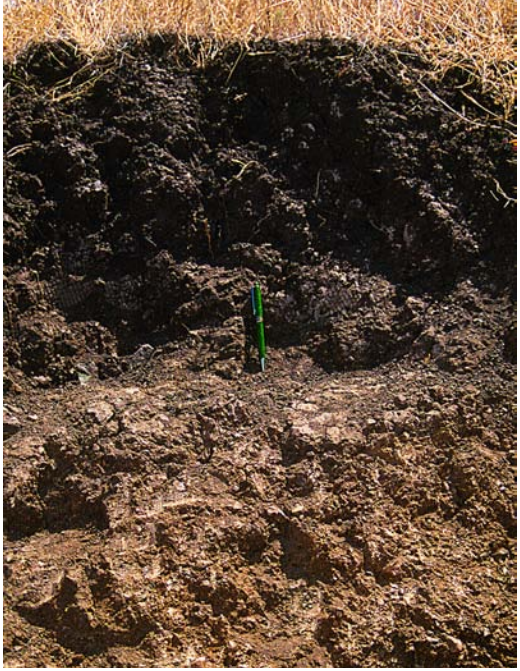
1. Salinas soil on Field 25, along Highway 1

Erosion of soil materials from steep slopes during winter storms and their subsequent deposition on the flat alluvial plains near the crop facilities have created a group of young soils well suited for intensive agriculture. Past floods have deposited well over two feet of clay loam soil material in this area.

Los Osos Soils

On upland sites the soils vary greatly in response to changes in parent materials. For example, the Los Osos soil – the oldest on campus – is formed from a sandstone parent material. It typically has a 14-inch top layer overlying a heavy clay horizon that extends to over 39-inches in depth. The Los Osos soil is subject to mass movement down slope when saturated with water. The clay layer restricts the soil's suitability for intensive uses, but promotes the growth of grassland vegetation and makes it well suited for grazing.

2. Los Osos soil at the mouth of Poly Canyon



Diablo soil on pastureland where slopes are over 8 %.

Diablo Soils

In some areas the Diablo clay occurs intermixed with the Los Osos soil, particularly where old mudstone deposits outcrop. The Diablo soil is classified as a Vertisol. It has the capacity to invert itself through the shrinking and swelling process. During summer when the soil is dry it shrinks and contains large cracks. Material on the surface falls down the cracks to the bottom. Repeated cycles of shrinking and swelling create a churning effect in the soil. On gentle slopes the soil can be dry-farmed or even irrigated for vegetable production with success. But it is especially difficult to cultivate when wet. Building on the soil presents special challenges. Tarweed species thrive well on Diablo soil and can be used by an observer to determine the soil's lateral boundaries.

Lodo Soils

The Lodo soil occurs in upland settings where sandstone has been thermally modified by the intrusion of serpentinite or granite. The cooked sandstone breaks down into a clay loam soil having a rooting depth of less than 20 inches. Distinct horizons are not always seen due to the process of "pedoturbation" (mixing of soil) by go-

The Lodo soil profile is reddish in color.

3. Lodo soil growing citrus and avocados on Radio Tower Hill.

On slopes less than 15 percent, the Lodo soil can be used for grazing and limited tree crop production when terraced. In many cases, landowners

soil and underlying rock material and sell the mixture known as "redrock" for road base and fill.

Serpentinite Soils:
Henneke and Cuesta

The ridge tops around the campus and above the Poly "P" are shaped by serpentinite rock material, formed from a plastic magma injected into surrounding sandstone. Formed at relatively low temperature – around 500C – and high pressure – around 25,000 psi – serpentine crystals are fibrous, but the rock breaks down rapidly into smectite clays that are non-fibrous and not hazardous to breathe. Nickel for making cannons was mined from local serpentinite deposits.

The soils on this parent material possess a low agriculture potential. They are separated into the Henneke and Cuesta series. The Henneke soil is less than 19 inches in depth, while the Cuesta is much deeper. The rock, being deficient in calcium and high in magnesium, limits the growth of many common species found on adjacent sedimentary materials. The plant community on the rock outcrop includes numerous rare species.

4. Native bunch grass and yucca plants growing on Henneke soil

Vertisol

Pacific tectonic plates of ocean sediment and
Deep crustal ultramafics are pasted onto the continent's edge.

Upheaval and resulting earthquake temors rattle the earth
Bringing these lithologies onto the dry upland surfaces.

Weathering and decomposition produces smectite and
Montmorillonite clays that erode onto valley floors.

Inverted soils develop within the marine parent materials.
Organic matter and grass humus blackens the surface and subsoil.

Mediterranean climates wet and dry the soils each year and
Deep cracks swallow and engulf organic rich topsoils.

Animals step gingerly on the cracked dry clays to
Avoid falling into them and suffering broken walking limbs.

Buildings and roads constructed on these soils will
Crack and crumble in short periods of time.

Saturated clayey hillslopes are subject to mass movements as
Rotational slumps and complex blocks of land succumb to gravity.

– *Tom Rice, Professor Soil Science*

Water Resources

Land and water are two essential components of a vibrant ecological system. Human history demonstrates that development and preservation of both are required to achieve great deeds, build cities, and provide for the food, fiber, and shelter needs of the population. The story of water on campus is one of planned development and wise use.

Water History

From the earliest of times San Luis, Chorro, Stenner, and Brizzolara Creeks provided water to meet the needs of a small population of original Americans in the area. As Europeans settled San Luis Obispo, they brought with them the technology to build small dams on each of the creeks and systems for distributing the water as needed for producing food, fiber and feed for livestock. These dams have been recently removed by the Department of Fish and Game to restore fish migration. They were no longer needed since subsequent generations developed an extensive system of water storage and distribution.

The Salinas Dam and Santa Margarita Lake were constructed in 1942 to furnish water to Camp San Luis during World War II. The water from the lake was never used for that purpose, however, and was turned over to the City of San Luis Obispo and Cal Poly. Whale Rock Dam and Reservoir near the town of Cayucos was developed as a joint project by the City of San Luis Obispo, Cal Poly, and the Men's Colony in 1957-8.

5. Stenner Canyon pipeline

Water Distribution

The pipeline from Santa Margarita Lake tunnels through Cuesta Ridge. The 24-inch pipelines from both lakes enter the campus above Stenner Creek and descend through Stenner Canyon.

6. Water filtration plant

The pipelines converge at the water filtration plant near the railroad trestle, off Stenner Road. Here water is treated and then distributed to the campus and city.

10. Shepard reservoir

7. Middlecamp Reservoir

Gary Ketcham, the Campus Farm Manager, has developed a unique system to use water for irrigation on Cal Poly Land. Water from the pipelines is first fed into Middlecamp Reservoir, named in honor of former Farm Manager, Lionel Middlecamp.

The overflow of water from Middlecamp is fed into Nelson reservoir for farm distribution and for ground water recharge, following the route of a ditch originally hand-dug by early residents of the Cheda Ranch to transport water from a dam on Stenner Creek.

In addition, runoff water from upper Stenner and Brizzolara Creeks recharges the groundwater near the Crops Unit and the Citrus Orchards. Wells at Field 25 and in the lemon orchard tap into these water sources to help sustain farming operations.

Water is also pumped from Middlecamp reservoir to the Indonesian Reservoir for redistribution. In winter and spring it traps water from the system of springs and creeks draining Kestrel Crest and Caballo Peak, which rise just above it. The Indonesian Reservoir was built in the mid 1960s by a group of agriculture students from Indonesia.

Overflow water from Indonesian reservoir feeds the creek that runs through the Arboretum and supplies water by gravity feed through a riparian drainage way to Shepard reservoir, which is sur-

8. Nelson Reservoir

9. Indonesian Reservoir

rounded by a thick margin of tules providing a nesting area for many water birds. Water from Shepard Reservoir is used to irrigate some agricultural fields and the Sports Complex.

Shepard Reservoir connects to Smith Reservoir through an artificial ditch, which cascades into a natural stream. Smith Reservoir has been designated a Biologically Sensitive Area, since its secluded habitat is home to rare migratory and nesting birds. It is buffered by a restricted area closed to the public. These reservoirs are named in honor of former agriculture Deans Vard Shepard and Warren Smith.

11. Smith Reservoir

12. Drumm Reservoir

Drumm Reservoir, near Herdsman Hall, has been redesigned and converted to a state-of-the-art Irrigation Training and Research Center (ITRC) facility by Dr. Charles Burt. Funded by the State Department of Water Resources as well as many private sources, it includes a set of pipe junctions, valves and monitors that simulate the waterworks of the State Water Project. It is named in honor of George Drumm, former Dairy Department Head.

A CIMIS (California Irrigation Management Information System) station is located adjacent to the irrigation practice field on Via Carta. This station measures precipitation, humidity, temperature, wind speed, and other weather data. That data can be used to construct a water budget and to aid in determining the timing of irrigation.

13. CIMIS station

Recycled Water

Three additional water catchments are located on campus. They are used to recycle wastewater from the swine and dairy units. Water used to hose out the barns flows downhill to settling ponds where solid wastes are deposited on the bottom and then are removed either with a conveyor belt or during periodic draining. This waste is dried and recycled as compost.

14. New dairy lagoon

Water from the wastewater ponds is pumped to giant water cannons for distribution onto campus pasturelands. By applying the water to the soil, nutrients, pathogens and sediments are removed and the groundwater is recharged.

The new dairy lagoon is also used to recover recyclable methane from the dairy wastewater as part of an energy recovery project directed by Dr. Doug Williams.

The growth of Cal Poly has resulted in a loss of water for the campus farming operations. Originally, the farm was allocated 1200 acre-feet of water from Whale Rock Reservoir. As the campus student population grew, that allocation was cut to 600 acre-feet. At present the water allocation for farming operations is only 459 acre-feet. To sustain the campus instructional ecosystem, we will either have to develop additional water supplies or become more creative with how we use the resources available.

Vegetation

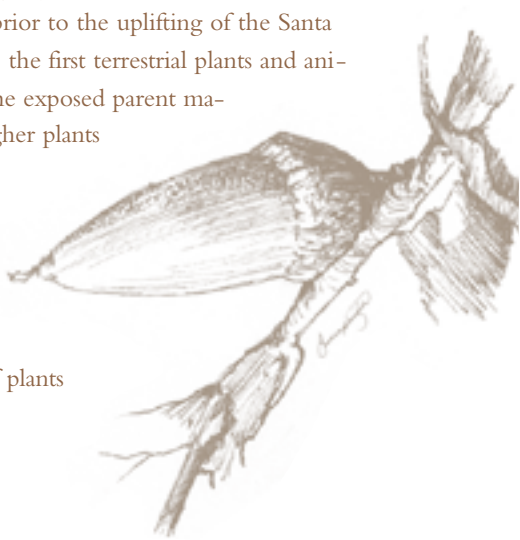
V.L. Holland, Biological Sciences Department

Cal Poly is located in the Central Coast Biological Region of the South Coast. The campus sits along the western margin of the Santa Lucia Mountains, about ten miles from the Pacific Ocean halfway between Los Angeles and San Francisco. The local plants and animals are composed of an interesting mixture of northern and southern California species, many of which reach their northern and southern limits in this vicinity. Cal Poly Land has a diverse range of natural habitats that support unusually rich biodiversity. Anyone who has walked up Poly Canyon or simply looked at the open hillsides and valleys on campus has noticed a complex pattern of different landscapes, habitats, and vegetation.

The vegetation ranges from forests dominated by large trees to grasslands with colorful wildflowers and grasses to brush-covered steep hillsides with outcrops of exposed rocks on which there is little or no plant cover.

If you had visited the area now occupied by Cal Poly five million years ago, you would have observed the marine environments that dominated the area around San Luis Obispo prior to the uplifting of the Santa Lucia Mountains during the Pliocene Epoch. As the mountains formed, the first terrestrial plants and animals gradually colonized the newly exposed terrestrial environments. The exposed parent materials underwent chemical and physical weathering. Soils, on which higher plants could grow, began slowly to develop. The mountains gradually eroded, forming the complex series of hillsides, canyons, valleys, and streams that characterize Cal Poly's landscape today. This variety of environments accounts for the diversity of local plants and animals.

Cal Poly's diversity of plant life can be examined both in terms of its *flora* and *vegetation*. Flora consists of all the different species and varieties of plants



Oak Woodland on Poly Mountain

that occur within an area.

Floras include both vascular and non-vascular plants. Vascular plants have specialized tissues that transport water, minerals, organic compounds and other substances throughout the plant body as does the circulatory system in animals. Vascular plants include club mosses, horsetails, ferns, conifers, and flowering plants. These plants, especially flowering plants, are the tallest, most dominant, and most conspicuous portion of the flora and vegetation on earth. Non-vascular plants (algae, liverworts, mosses and fungi) are also common and are important components of any flora; however, because they lack vascular tissue, they are smaller, less conspicuous components of most floras. Cal Poly has a diversity of both vascular and non-vascular plants.

The flora on the campus also consists of species of different origins. Most of the plants on the relatively undisturbed hillsides and in the canyons on campus are California natives. *Native plants* are those that existed in California before Europeans visited and colonized the state in the 1700's and brought in plants from their homelands. *Alien, exotic,* or *introduced plants* are those that were brought into the state during the past few centuries. Some were accidentally introduced while others were purposefully brought to California as garden, landscape, or agricultural plants. Most cultivated plants have not spread significantly into natural areas and are not part of the natural vegetation of the state or campus; however, some have escaped from cultivation and become a naturalized part of the California flora. Plants that have become established, integral parts of various natural communities and grow with native plants in nature are referred to as *naturalized species*. Naturalized species are now an obvious and rapidly growing part of the California flora. Some naturalized plants dominate disturbed sites such as roadsides, agricultural fields, and vacant lots and are usually referred to as weeds. The grasslands of California are now dominated by many of these weedy plant species. Some of these have spread rapidly, replacing native plants or reducing agricultural productivity. These are referred to as noxious weeds, and humans go to great efforts to try to eradicate them.

Vegetation refers to the life-form or general aspect (physiognomy) of the plant life in a particular site or region. There are many different types of vegetation, such as grasslands (dominated by herbs), shrublands (dominated by shrubs), and woodlands and forests (dominated by scattered to dense stands of trees). Vegetation is usually divided into a variety of recognizable groupings of plants called plant communities. A *plant community* is an assemblage of plant species growing together in a particular area (habitat or environment). Plant communities provide habitat for, and exist in tandem

Grassland, riparian corridors, oak woodlands, coastal scrub, and chaparral mosaic in upper Poly Canyon

with, populations of wildlife species that are as dynamic and varied as the vegetation they inhabit. A biotic community includes both the animal life and the plant community.

The diversity of plant communities found on Cal Poly land has developed in response to the interaction of a complex of environmental features such as local climate (wind, temperature, rainfall, fog), topography, slope, aspect, soils, parent materials, biotic components, fire, location of waterways, and natural historical events. For example, some habitats are favorable enough to support trees as the dominant species, such as coast live oak woodland and riparian woodland. Some environments are too harsh for tree growth and support either shrublands or grasslands. Other areas have permanent standing water and support wetlands

or marshlands dominated by various aquatic and semi-aquatic herbaceous plants.

Where environmental features change sharply, such as between the terrestrial and wetland habitats around a lake, there is a sharp change in the vegetation. However, where the environmental gradient changes more gradually, such as along a slope, plant communities also change gradually. In areas of gradual change, communities overlap forming transition areas or ecotones in which species from the two communities grow together. An ecotone can be observed along the banks and slopes above Brizzolara Creek. The coast live oak woodland that covers the upland slopes above the creek gradually grades into the riparian woodland along the creek channel and banks, and coast live oaks remain an important component of the riparian woodland along the creek.

Plant communities also change over time. In some years many, colorful wildflowers grow in an area of grassland, but in other years this same area may be dominated by grasses with few wildflowers as a result of different weather conditions. Plant communities can also change over time as a result of natural and human-caused disturbances like fires, floods, grazing, and plowing. A chaparral fire will burn the shrubs down to the soil surface leaving just ash and burnt plant skeletons. However, nature has a remarkable ability to recover from disturbances like fire through the process of natural succession. The first year after a fire, the chaparral area is first covered by many herbaceous plants, some of which are fire annuals that only appear following a fire. Gradually the shrubs will sprout from their basal burls or from seeds in the soil and start to reestablish their dominance.

After several years, it is difficult to tell that a fire ever occurred, as the community

Regrowth after Highway 41 fire

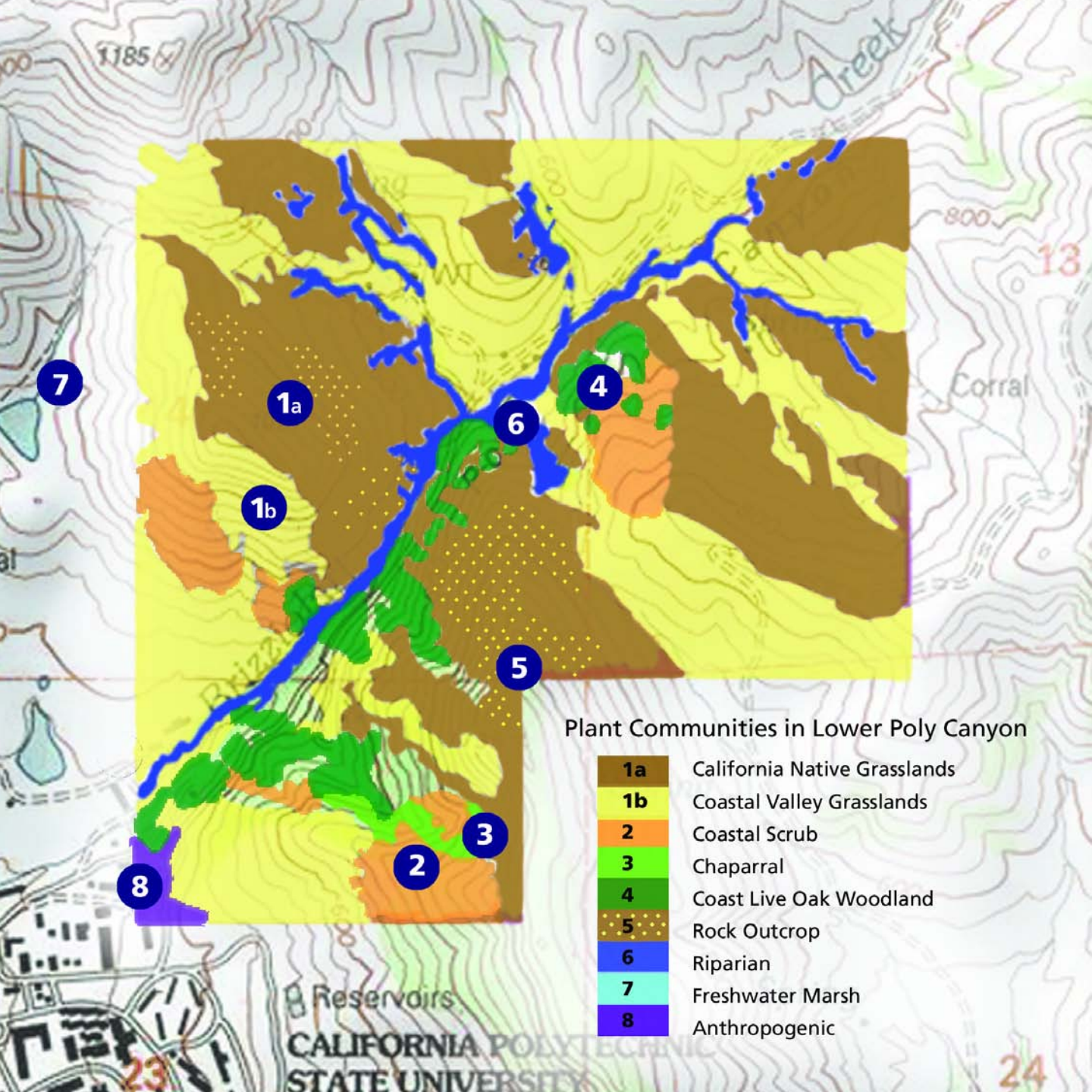
completely regenerates itself on the site. Other areas change more slowly through time, such as areas where soil is just starting to develop. This type of succession can be observed on the rocky ridges where small pockets of soil are gradually forming and support patches of herbs or small shrubs in an otherwise barren landscape.

Past and present land-use and other human influences have resulted in changes in the flora, vegetation, and wildlife on campus. Some of these changes have resulted in the complete loss of the natural community, due to conversion to various agricultural uses such as pastures, orchards, vineyards, or row crops. Other changes are not as significant but apparent, such as the presence of blue gums and pepper trees along Brizzolara Creek, or scattered olive and almond trees on the hillsides. Few if any areas of campus have completely escaped some form of human impact.

The bare Earth…
Brought forth the tender Grass, whose verdure clad
Her Universal Face with pleasant green,
Then Herbs of every leaf, that sudden flowered
Opening their various colors, and made gay
Her bosom smelling sweet: and these scarce blown,
Forth flourished thick the clustering Vine…
add the humble Shrub,
And Bush with frizzled hair implicit: last
Rose as in Dance the stately Trees, and spread
Their branches hung with copious Fruit; or gemmed
Their Blossoms: with high Woods the Hills were crowned,
With tufts the valleys and each fountain side,
With borders along the Rivers. …
God saw that it was good:
So evening and morn recorded the Third Day.

– John Milton, *Paradise Lost*

Coast Live Oak leaf


7
1a
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Plant Communities in Lower Poly Canyon
1a California Native Grasslands
1b Coastal Valley Grasslands
2 Coastal Scrub
3 Chaparral
4 Coast Live Oak Woodland
5 Rock Outcrop
6 Riparian
7 Freshwater Marsh
8 Anthropogenic
Reservoirs
CALIFORNIA POLYTECHNIC
STATE UNIVERSITY

Cal Poly's Plant Communities

Because plant community boundaries are dynamic and variable, their classification is not always clear-cut. The classification system used in this book follows that of Holland and Keil (1996).

1. Grasslands

Grassland communities are dominated by native and introduced grasses and forbs (non-grassy herbs or wildflowers). The common herbaceous (non-woody) plants are annuals, perennials, or a mixture of the two. Grasslands sometimes form extensive prairies. They are one of California's most characteristic communities and cover about 10% of the state. California is sometimes referred to as the golden state because these large areas of grassland turn golden-brown during the dry summer months when the herbs die or go dormant. Grasslands cover most of the lower hillsides and valleys around the Cal Poly campus. Some view grasslands as monotonous and uniform; however, they are very diverse and often have beautiful wildflower displays in the spring.

Several environmental factors combine to favor development of grassland communities. Climatically, grasslands are typically found in areas of low and often irregular winter precipitation with hot, dry summers and long periods of drought. Grasslands occur on a variety of soil types, ranging from coarse and gravelly soils to very fine clays, but are most common on fine textured, deep, alluvial soils common to valley areas. Because most grassland soils are deep and fertile, they represent some of most productive agricultural soils in the state. As a result, many of California's grasslands have been given over to agriculture. Grassland soils generally have adequate winter and spring moisture to support grasses and other shallowly rooted herbaceous plants but are too dry to support oaks or other woody plants, although occasional trees and shrubs are sometimes found scattered in grasslands.

Grassland communities form a mosaic on Cal Poly Land with coastal scrub, chaparral, coastal live oak woodland, and riparian woodland. They integrate with coastal live oak woodlands on moist, north-facing slopes and canyons, with coastal scrub and chaparral on arid, steep, rocky slopes, and with riparian communities in aquatic and semi-aquatic areas along creeks and ponds. These grasslands often form part of the understory vegetation in these associated communities.

The Native American Indian tribes did not have domesticated livestock, but they did hunt and depend on wild game. Most of the California Indian tribes practiced grassland burning to improve the ability of the land to support game species. This burning tended to keep the oak woodlands more open with less shrubby cover and favored fire-adapted plants such as the California native

Native bunchgrass tussocks above Poly P

grasses, which are well adapted to periodic fires. However, in the last century removal of oaks has converted some California oak woodlands to open grasslands, especially where oaks have been cleared for firewood or agriculture. Oak woodlands continue to be lost and converted to open grasslands at an alarming rate.

If you had visited California in the 1700s, before Europeans colonized the state and brought in plants from their homelands, you would have seen valleys and dry hillsides covered by California native grasslands. These grasslands were composed of various species of California native perennial grasses that grow as individual bunches or tussocks with a diversity of native annual or perennial wildflowers growing among the tussocks. California native grasslands were the dominant vegetation on over 17 million acres of California land area prior to Spanish settlement.

A few small scattered surviving stands of California native grasslands remain, but are restricted to areas with light or no grazing histories and somewhat harsh soil conditions under which introduced grasses are not as competitive. Only about 10,000 acres of California native grassland remains intact and less than 1% has any protected status. Some of the finest examples of native grasslands in the state are found on the Cal Poly Land, where they grow on the hillsides and along the slopes of Poly Canyon, especially on soils derived from serpentinite. Cal Poly's native grasslands represent about 5% of the remaining native grasslands in the state. Efforts to protect the surviving stands of native grasslands should be strongly encouraged. They represent what is left of an important California heritage.

California's native grassland is changing. Perhaps the most important factor was the introduction of cattle, sheep and horses during the Spanish mission period, which led to heavy overgrazing of California's grasslands. From the end of the last ice age (about 12,000 years ago) to the introduction of livestock by the Spanish in the 1700's, California's grasslands were lightly grazed by a few species of large herbivores such as pronghorn antelope, tule elk, and deer. The native herbivores moved through the grasslands seasonally in herds. Native grasses have their growing buds at the base of the tussocks, and these were not affected by the light, seasonal grazing of the native herbivores. However, native grasses lack adaptations to heavy grazing by introduced livestock and have declined markedly partly because of it.

Along with the domestic livestock, many alien plant species were introduced to California from the Mediterranean region in packing, ballast, grain shipments, and hay from Spain, or were carried into California by livestock. These annual grasses introduced from the Old World are more tolerant of grazing, reproduce quickly, and do not need to

California poppy *Eschscholzia californica*

This annual (or perennial, from a taproot) grows to two feet tall. The flower bud is upright. As the flowers open, the cone-like calyx is pushed off by the expanding petals. The four petals are a brilliant golden yellow with the bases tinged orange. The bloom is from February through September. The flowers become smaller in late-flowering plants. The fruit is a cylindric capsule that splits open lengthwise and is sometimes ejected with a "pop." The California poppy is a native species found in open, grassy, and disturbed places. It is our state flower.

store food reserves. Over the years, their seedlings have out-competed and replaced native species. The modified grasslands along California's central coast, including the Cal Poly campus, are referred to as coastal valley grasslands, differentiating them from native grasslands.

Grasses and forbs introduced into California during the period of Spanish settlement and tolerant to heavy grazing now dominate many grasslands on campus. Some of these species are also common in other areas of disturbance such as along roadsides, in vacant lots, and in pastures.

The coastal grasslands provide a foraging and nesting habitat for a wide range of vertebrates including birds, mammals, reptiles and amphibians. Several small birds such as western kingbirds, sparrows, and finches forage in the grasslands and some, like the western meadowlark, use open grasslands for nesting. Small rodents such as western harvest mice, gophers, and California voles are plentiful and feed on the seeds and shoots of the grassland plants, while the burrows of ground squirrels open up a subterranean habitat. Raptors such as the hawks, American kestrels, and common barn owls hunt in grassland areas, controlling the rodent populations. Raptors commonly use the adjacent trees and shrubs to observe prey in the grasslands. Mule deer forage in the grasslands while bobcats, coyotes, and

Common Native Grasses

Elymus glaucus	wild blue-rye
Koeleria macrantha	June grass
Melica imperfecta	melic grasses
Muhlenbergia rigens	deer grass
Nassella lepida	slender needle-grass
Nassella pulchra	purple needle-grass
Vulpia microstachys	small fescue
Bromus carinatus	California brome
Danthonia californica	California oat-grass
Poa secunda	Malpais bluegrass

Associated with these perennial grasses is a mixture of annual and perennial forbs.

Achillea millefolium	yarrow
Calandrinia ciliata	red maids
Calystegia macrostegia	wild morning glory
Chlorogalum pomeridianum	soap plant
Dichelostemma capitatum	blue dicks
Eschscholzia californica	California poppy
Lupinus bicolor	miniature lupine
Lupinus nanus	sky lupine
Lupinus succulentus	succulent lupine
Ranunculus californicus	buttercup
Sisyrinchium bellum	blue-eyed-grass
Viola pedunculata	johnny jump-up
Zigadenus fremontii	Fremont death camas

Purple needlegrass *Nasella pulchra*

Nasella has a 12 to 40 inch unbranched stem. The single floret per spikelet has a distinctive one and a half to four inch awn that is strongly bent, except the tip which is straight. *Nasella* derives from the Latin word *nassa* meaning "basket with a narrow neck." *Pulchra* means "beautiful."

Blue-eyed grass *Sisyrinchium bellum*

A perennial whose 12-inch stems are branched and somewhat flattened. The deep blue-purple flowers have yellow centers. They bloom from March through June. The fruit is a dry capsule. *Bellum* means "pretty" or "beautiful." Spaniards called blue-eyed grass *azulea* for its blue color.

mountain lions prey upon them and the rabbits and mice. Some amphibians and reptiles, such as pacific chorus frogs, western fence lizard, alligator lizard, kingsnake, and gopher snake, breed as well as hunt in the grasslands. In addition, various species of bats may nocturnally forage within this habitat type.

A diversity of insects and other invertebrates live in the grassland, many of which are prey species for lizards, rodents, and birds. The grassland habitats are contiguous with the coastal scrub, woodlands, and wetlands on the campus. As a result, many wildlife species graze or hunt in the grasslands and seek shelter and perch sites in the adjacent shrubs and trees.

Serrano Ranch grassland

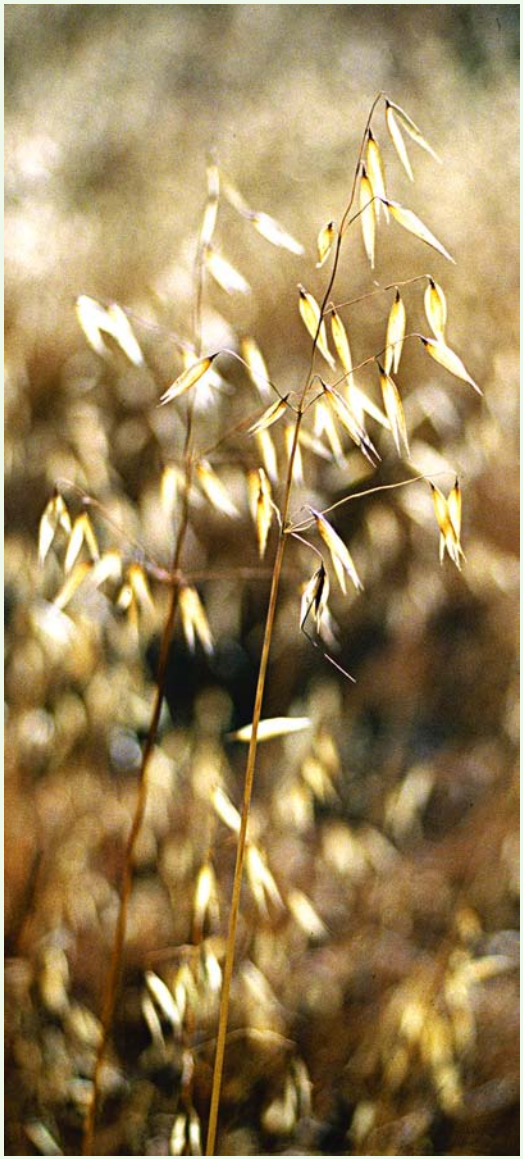
Alien Grasses and Forbs

Alien Grasses

Avena barbata	slender wild oats
Avena fatua	common wild oats
Brachypodium distachyon	false brome grass
Bromus diandrus	ripgut brome grass
Bromus hordeaceus	soft chess brome
Bromus madritensis	Spanish brome
Hordeum murinum	foxtail barley
Lolium multiflorum	Italian ryegrass
Vulpia myuros	rattail fescue

Alien Forbs

Brassica nigra	black mustard
Erodium botrys.	storkbill filaree
Hirschfeldia incana	perennial mustard
Lactuca saligna	slender lettuce
Lactuca serriola	prickly lettuce
Picris echioides	bristly ox-tongue
Plantago lanceolata	English plantain
Silybum marianum	milk thistle
Sonchus oleraceus	common sow-thistle



Slender wild oats *Avena barbata*

Stalks measure 12 to 24 inches or more. The spikelets are usually two-flowered. Each floret has one awn 3/4 to 1 1/2 inches long. The awn is twisted below its bend. The pedicels are very soft, so the fruits dangle.

2. Coastal Scrub

Coastal scrub communities occupy a narrow discontinuous band along the entire coast of California. Largely restricted to the mountain ranges in the coastal zone, some stands of coastal scrub extend inland as far as the interior coastal ranges in central and southern California. While coastal scrub communities cover less than 3% of the state's land area, they are very common along the central coast and on Cal Poly Land.

Coastal scrub communities are dominated by small to medium sized (three to nine feet tall) shrubs and include an understory of scattered herbaceous plants. The dominant shrubs are soft-stemmed plants with thin, drought-deciduous leaves, which undergo significant dieback during the summer drought. Coastal scrub is sometimes referred to as "soft chaparralæ" as opposed to the "hard chaparral" or "true chaparral." These communities are also sometimes called "coastal sage scrub" because

they occur in coastal areas and are often dominated by various species of *Salvia* (sages) and *Artemisia californica*.

Coastal scrub communities typically occur on the dry, steep hillsides of the coastal mountains, in coarse, shallow, infertile soils. The soils have moisture available in the upper horizons only during the winter and spring growing season. During the summer and early fall, the soils dry out and have little or no deep subsurface moisture available for plant growth. Coastal scrub plants adapt to these soil conditions by developing shallow root systems to take up surface moisture during the six months when soil moisture is available and then by going dormant for the dry season.

Many of the dominant shrubs of the coastal scrub, such as black sage and California sagebrush, are pungently scented with oils that are volatized. On a warm day, their perfumelike essence is heavy in the air. These compounds fall to the soil and can be toxic to other plants. The lack of understory vegetation in coastal scrub has been partially explained by *allelopathy*, which results from the build-up of these toxic compounds in the soil. As a result, the border between coastal scrub and grassland areas on the hillsides around Cal Poly is often sharp and displays a bare zone. Small animals use the coastal scrub for cover and venture out only a short distance from this protection to harvest seeds and herbs, adding to the bare zone.

The foliage of many of the dominant plants contains highly flammable volatile oils and resins. As a result, brush fires are common in coastal scrub communities during summer and fall when the plants are dormant and dry. Fires consume all of the above-ground portions of the plants, but the underground burls are protected, and many of the shrubs are able to sprout vigorously from these root crowns after a fire. Other coastal scrub species are killed by fire but are able to reestablish through seeds stored in the soil, many of which are stimulated to germinate by the heat of the fire. Enhanced soil fertility from the ash contributes to a lush growth of herbaceous species following the fire. Coastal scrub species are the first to become established after a fire due to their rapid initial growth. Many of the first plants to come in after a fire are leguminous species, such as lupines, which have nitrogen-fixing root nodules that also contribute to the fertility of the soil.

Loss of coastal scrub as a result of urbanization and agriculture has been so significant in recent years that ecologists have been trying to preserve the remaining coastal scrub habitats, which are considered sensitive.

Coastal scrub vegetation, with its dense shrub canopy and high diversity of plant species, provides excellent cover, nesting sites, and foraging opportunities for a wide variety of amphibians, reptiles, birds, mammals, and other animals. Some

Coastal scrub on Poly Mountain

Common Coastal Scrub plants

Artemisia californica	California sagebrush
Baccharis pilularis	coyote bush
Eriophyllum confertiflorum	golden-yarrow
Lotus scoparius	deerweed
Mimulus aurantiacus	bush monkey-flower
Rhamnus crocea	redberry
Ribes speciosum	fuchsia-flowered gooseberry
Salvia mellifera	black sage
Toxicodendron diversilobum	poison-oak

California sagebrush *Artemisia californica*

Aromatic evergreen shrub five to eight feet tall, somewhat drought-deciduous, with grayish green leaves divided into narrowly linear lobes. Florets in quarter inch heads. Blooms from August through February.

Coyote bush *Baccharis pilularis*

Plants have a profusion of white flowers blooming from August to November. Chumash treated poison oak rash with a decoction of the leaves.

Bush monkeyflower *Mimulus aurantiacus*

A two to four foot tall evergreen with two inch sticky leaves whose edges are rolled under. The showy orange-yellow to apricot-colored tubular flowers bloom March through July.

Fuchsia-flowered gooseberry *Ribes speciosum*

A three to six foot tall evergreen spiny shrub with three-lobed shiny dark green leaves, showy hanging, magenta-red and tubular flowers that bloom January through May and are hummingbird-pollinated.

Black sage *Salvia mellifera*

A drought-tolerant deciduous three to six foot shrub, with aromatic foliage. Leaves are one to three inches long. Pale blue-lavender flowers occur in half to one and a half inch wide, tight, widely spaced, ball-like clusters around the stem. They bloom from April through July.

Poison-oak *Toxicodendron diversilobum*

A deciduous perennial with highly variable growth habits: vine, ground cover, shrub. Leaves appear shiny bright green or red in spring then turn dull green or dusty red in summer. Its resinous leaves can be confused with blackberry leaves that also have three leaflets. However, western poison oak leaves and branches lack any spiny or hairy projections, and the leaflets tend to have more rounded tips. The tiny yellowish green flowers occur from April through May followed by creamy white to brownish berry-like fruits. This plant causes severe contact dermatitis. Yedra (or hiedra, ivy) was used by Chumash externally in cauterization and in the healing of skin disorders (warts, cancers, persistent sores). A decoction of its root was used internally to cure dysentery and diarrhea.

Hummingbird sage *Salvia spathacea*

A one to three foot tall perennial herb with three to eight inch coarse oblong leaves. Its brilliant magenta-red flowers bloom in spikes of several whorls from March through May. Flowers are hummingbird-pollinated.

shrubs provide abundant nectar resources for insects and hummingbirds, and dense shrubs provide protection for small mammals and birds. Barren soil in patches among the shrubs indicates both rodent and bird consumption of small herbs and grasses as well as an allelopathic effect of foliage and leaf litter. Insects attracted to flowers and vegetative material in coastal scrub provide excellent food for insectivorous birds. Because coastal scrub occurs in a mosaic of habitat types, wildlife species of associated habitats such as grasslands and oak woodlands may be found using the coastal scrub.

Succulent Lupine *Lupinus Succulentis*

Over sixty species of Lupine grow in California, all of them legumes in the pea family. Some are annuals, some perennials, some are shrubs. They belong to the Pea family, Leguminosae, and are natives mainly of North America, though some are found in Europe. These plants contribute fertility by fixing nitrogen, but are called Lupinus, Latin for "wolf," because they were thought to rob the soil. Leaves are palmately compound – shaped like an open hand. The purple, pea-shaped flowers occur in clusters on either side of the spikelike stem. Seed pods are covered with short hairs. The tissues of this plant contain alkaloids which are toxic.

3. Chaparral

Chaparral vegetation consists of woody, stiffly branched, leathery-leafed shrubs that form an impenetrable entanglement four to twelve feet high. Chaparral communities are often referred to as "hard chaparral" or "true chaparral," in contrast to coastal scrub or "soft chaparral." People who have tried to walk through it refer to the experience as "swimming through the chaparral" because their feet rarely touch the ground.

While some of the common shrubs, like *Adenostoma fasciculatum* (chamise), have small, needle-like leaves, most chaparral shrubs (e.g., manzanitas) have broad, hard, thick leaves with waxy coverings called cuticles.

Such leaves reduce water loss, an adaptation to dry habitats.

The interlaced chapparal canopy casts dense shade preventing the growth of herbaceous species. Chaparral litter decomposes slowly and forms a thick layer of duff that makes seedling establishment difficult. The chaparral foliage and leaf litter give off phytotoxins that inhibit the germination and establishment of herbaceous species through allelopathy. Herbivores eat the seeds and seedlings of the herbs in the understory and create the characteristic bare zone found under and around chaparral.

Chaparral is among the most common and widespread plant communities in California, covering about 10% of the state, including some of the upper hillsides on Cal Poly Land. The term "chaparral" derives from the Spanish *el chaparro,* meaning shrubby, evergreen oak, even though scrub oaks are not always present in the chaparral. The cowboy's chaps, derived from *chaparojos*, were used to ride through this prickly community.

Chaparral occurs on steep, hot, dry hillsides that have shallow, infertile, rocky soils. Because chaparral shrubs can send roots down cracks in the bedrock and subsoils, they often have access to deeper water supplies. As a result, chaparral shrubs remain photosynthetically active throughout the year, unlike coastal scrub species, which go dormant in the summer and fall when the shallow soils dry out.

Chaparral, like coastal scrub, is closely associated with fire. The resinous foliage, numerous woody stems, accumulated litter, and standing dead branches combine to make chaparral shrubs highly flammable, particularly during the long dry summer season. However, chaparral shrubs have several adaptations to fire. They produce seeds at an early age. This occurs in some species of manzanita (*Arctostaphylos*) and buckbrush (*Ceanothus*) that do not resprout from woody plant parts. They produce two types of seeds, those that germinate under "normal" conditions and those that require scarification, a heat treatment from fire, in order to germinate. They sprout after a fire from underground woody plant structures called lignotubers (woody tap-roots), basal burls, or root-crown burls. These structures have vegetative buds located several inches below the soil surface which remain dormant until the winter rains following a fire. Some species, such as poison oak (*Toxicodendron diversilobum*), have extensive underground rhizomes. Others, like wild cucumber vine (*Marah fabaceus*), have huge fleshy roots deep under the soil surface.

Some chaparral shrubs on campus, such as *Arctostaphylos obispoensis* (San Luis Obispo manzanita and *Quercus durata* (leather oak), are serpentinite endemics, or plants found only on serpenti-

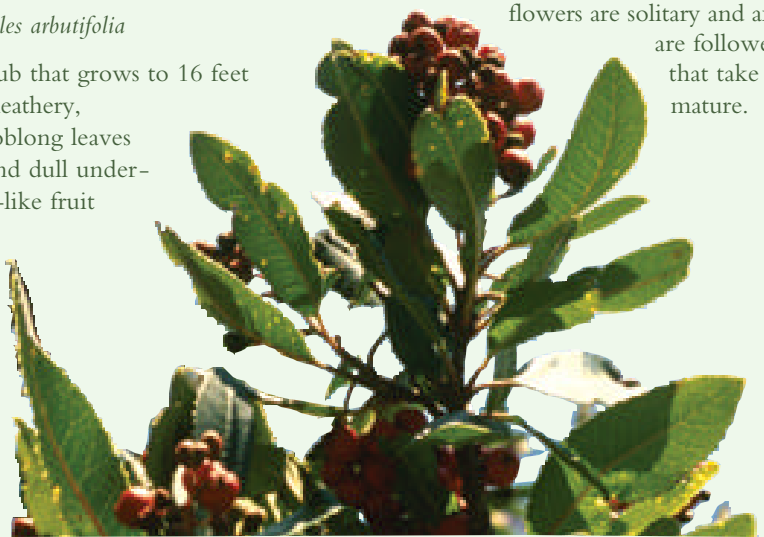
Hard Chapparal above quarry in Poly Canyon

Flannelbush *Fremontodendron californicum*

A six to 15 foot evergreen shrub. Its branches and leaves are densely covered with hairs. Its soft, leathery leaves grow to between 1/3 and two inches, ovate in shape and palmately to pinnately lobed. The showy two inch radial flowers of the flannelbush are vivid yellow and sometimes have reddish margins. *Fremontia* is named after John C. Frémont.

Toyon *Heteromeles arbutifolia*

An evergreen shrub that grows to 16 feet with one to four leathery, sharply toothed, oblong leaves with shiny tops and dull undersides. Red berry-like fruit occur from November through January making it an important food source for wildlife. Chumash used its berries for food. Its hard wood was fashioned into tools and used for fuel and in rituals.



Leather oak *Quercus durata*

An evergreen shrub three to ten feet tall with half to one inch spiny, convex leaves hairy on both surfaces. Male flowers are minute, cream-colored, and occur in catkins. Female flowers are solitary and axillary. They are followed by acorns that take one year to mature.

Birch-leaf mountain mahogany
Cercocarpus betuloides

An evergreen shrub six to 24 feet tall. Its half to two inch leaves are oval shaped with serrated margins above the middle. The blooms appear from March through April. The fruit is hairy and cylindrical with a long stalk still attached.

Holly-leafed cherry *Prunus ilicifolia*

An evergreen shrub to 30 feet with alternate, leathery, ovate, spiny-toothed leaves and tiny white flowers from April through May followed by 1/2 to 3/4 inch purplish red drupes. *Prunus* is the ancient Latin name for "plum." *Ilicifolia* means "holly-like leaves." The fruit and seed were eaten by native Californians.

Coffee-berry *Rhamnus californica*

An evergreen shrub that grows to 15 feet with characteristically reddish twigs. Its one to three inch leaves are shiny, dark green on the upper surface and a yellowish green on the lower surface. The greenish or white flowers occur nearly year-round followed by coffee-colored or blackberry-like fruits.

Chamise *Adenostoma fasciculatum*

An evergreen shrub that grows to 12 feet tall. Chamise has 1/8 to 1/2 inch needle-like leaves. Tiny creamy white flowers are found at the tips of branches. Chamise blooms from May through July. The hard wood of *chamiso* was used by Chumash to manufacture various tools. The leaves were made into tea for childbirth or menstrual complications.

nite. Other species, such as chamise, toyon, and buckbrush, are not restricted to serpentinite but can grow on it and on many other soils.

In Poly Canyon, chaparral patches are most often found on the uppermost slopes and hilltops. From a distance, one can observe the patches of the dark, evergreen chaparral in the upper portions of the gray-green coastal scrub.

Chaparral has a dense shrub canopy and, like the coastal scrub, provides excellent cover, nesting sites, and foraging opportunities for a wide variety of amphibians, reptiles, birds, mammals, and other animals. The dense shrubs provide protection for small mammals and birds, and patches of barren soil among the shrubs indicate consumption of seeds and small herbs by rodents and birds that use the chaparral. Many wildlife species venture out from the protective cover of the chaparral into more open grasslands for foraging. The wildlife species found in chaparral overlap and integrate with other nearby habitat types, especially grassland, coastal scrub, oak woodland, and riparian woodland.

Coast Live Oak woodland, Poly Mountain

4.Coast Live Oak Woodland

Oak woodlands are the most characteristic vegetation in the rolling foothills of the California mountains, both coastal and interior. They cover about 10% of the state. There are several types of oak woodland communities, each composed

Solitary oak in grassland

of trees that are endemic, i.e. unique to California. Many think that oak woodlands should be declared California's state vegetation type.

Cal Poly's oak woodlands are referred to as coast live oak woodland because their dominant tree is *Quercus agrifolia* (coast live oak). The term "woodland" is used instead of "forest" to indicate that they are composed of somewhat smaller trees and their canopies usually do not overlap. Coast live oak woodlands are found in the coastal foothills below 2000 feet from Sonoma County to Baja. They grow within a 50-mile radius of the ocean but outside the influence of its salt spray. Fog is common in these areas, and soils are typically well drained and moderately deep. Coast live oak woodlands are most common on moist north-facing slopes and along ravines and drainages

Coast Live Oak *Quercus agrifolia*

A 20 to 82 foot evergreen. Oaks can be extremely long-lived: from 250 to 600 years. It has one to two and a half inch leathery, spiny-toothed, ovate, dull green leaves. The male flower is a catkin near the base of a twig, and the female a single flower surrounded by a cup of scale-like bracts. Blooms appear from March through April. The slender, pointed acorns mature in one year. *Quercus* is the ancient Latin name for oak. From this name we derive "cork," a product of some species of oak. Its Spanish name is *Encina*. Oak has been highly valued by Chumash for fuel, bowmaking, games, cooking utensils, cradles, dye, medicine, and food. The acorns were dried, finely ground, and leached of tannins, then cooked into an unseasoned mush.

New oak leaves and flowers

between grassland or coastal scrub covered hillsides. Coast live oaks are always the dominant tree and sometimes the only tree in the woodland. They are also a common component of the riparian community along campus creeks.

Twenty-million-year-old fossils of coast live oak found in the Pacific Northwest reveal little change in the species over time. Coast live oak is a live (evergreen) oak. It has hard, tough leaves with a thick waxy cuticle that are extremely variable, even on the same tree. The outermost leaves are thick, small, and convex with two to three layers of photosynthetic cells, characteristics that help reduce water loss. Leaves found beneath these in the shady portion of the tree canopy are broader, thinner, and less drought-tolerant because they are in the more protected portion of the tree canopy.

Coast live oak woodlands are variable in structure. On dry, exposed hillsides, they overlap with grasslands forming savanna-like woodland with widely spaced trees. In moist, protected canyons and north-facing slopes, coast live oaks are dense and form closed-canopied woodlands composed of very old trees one to five feet in diameter. It is common to find *Umbellularia californica* (California bay-laurel) mixed with the dominant coast live oaks in moist sites. *Heteromeles arbutifolia* (toyon) is also common and sometimes attains the size of small oaks.

The understory, like the overstory, is variable in coast live oak woodlands. In the open woodlands, dense grassland occurs among and under the oaks. On moist slopes and canyons, the understory consists of a thick layer of leaf litter and a sparse to dense cover of shade-tolerant shrubs and herbs. Typical understory plants in these areas are shrubs: *Rubus ursinus* (wild blackberry), *Symphoricarpos mollis* (snowberry), *Heteromeles arbutifolia* (toyon), and *Toxicodendron diversilobum* (poison oak); herbaceous plants: *Pteridium aquilinum* (bracken fern), *Polypodium californicum* (polypody fern), *Pholistoma auritum* (fiesta flower), and *Claytonia perfoliata* (miner's lettuce).

Oak woodland vegetation provides vertical and horizontal structure: nesting sites for birds and shelter for numerous mammals. The woodland also supports numerous insects and small mammals that are important food sources for other vertebrates in the area. Snags provide roosts for raptors and nesting cavities for owls, kestrels, woodpeckers, nuthatches, wrens, chickadees, and bluebirds. The woodland vegetation moderates environmental conditions reducing wind and temperature variation experienced by grassland and coastal scrub communities.

5. Rock Outcrop Communities

Rock outcrops provide specialized habitats for many plants and animals. Rock outcrops are sparsely vegetated by extremely drought tolerant species on their surfaces and by moisture-requiring species in their crevices. Drought tolerant herbs and shrubs include: *Artemisia californica* (California sagebrush), *Eriogonum fasciculatum* (California buckwheat), *Epilobium canum* (California fuchsia), *Hazardia squarrosa* (saw-toothed goldenbush), and *Yucca whipplei* (yucca). Common herbs include: *Chlorogalum pomeridianum* (soap plant), *Dudleya lanceolata* (dudleya), *Dichelostemma pulchellum* (blue dicks), *Salvia colum-*

Rock outcrop community, Poly Mountain

bariae (Chia), *Phacelia distans* (phacelia), and *Astragalus curtipes* (locoweed). Native bunch grasses are also common, especially the needlegrasses, *Nassella pulchra* and *Nassella lepida.* In more moist sites, one finds several species of ferns such as *Pellaea andromedifolia* (coffee fern) and *Pentagramma triangularis* (goldback fern). Resurrection plant, *Selanginella bigelovii* (club moss), is common on some of the driest areas of the rock outcrops that are just beginning to develop a thin soil layer. This plant is called resurrection plant because it dries out and looks dead during the dry season, but once water is supplied the plant resurrects itself and turns bright green.

On Cal Poly Land many of the outcrops are serpentinite. Serpentinite is a metamorphic, magnesium silicate rock, often green in color and slippery to the touch. Serpentinite and the soils derived from it have a number of traits inimical to plant growth. It is low in some essential nutrients, especially calcium, and high in magnesium. In addition, it is often high in toxic elements such as nickel and chromium. Serpentine rock and soil support endemic floras including many rare and endangered species such as *Calochortus obispoensis* (San Luis mariposa lily).

Wildlife species found on rock outcrops include those listed for the grassland and coastal scrub communities.

Yucca *Yucca whipplei*

Yucca has one to three foot long gray-green sword-like leaves. It blooms through April and May with fragrant hanging cream-colored flowers. Pollination is done at night by yucca moths who lay their eggs in the flowers' ovaries. Each plant dies after fruiting. Chumash used its fibers for fishing lines and nets, for threads to sew canoe planks together and for tatooing.

Farewell-to-spring *Clarkia deflexa*

Clarkia is an annual herb that blooms in late spring when most wildflowers have gone to seed. Buds point down and rise to vertical position as they bloom. It is named after one of the leaders of the Lewis and Clark expedition.

Yellow mariposa lily *Calochortus clavatus*

This lily grows 20 to 40 inches tall from bulbs. The three petals are deep, vivid yellow against which the six purple anthers are prominent. Blooms appear April through June.

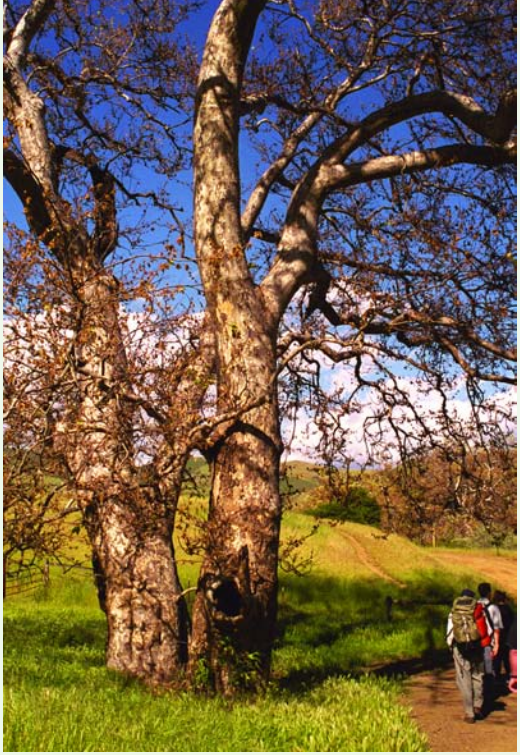
San Luis mariposa lily *Calochortus obispoensis*

A rare and splendid wildflower that grows one to two feet tall from a bulb (pictured here among yucca leaves). The blossom is erect and contains two to six flowers. The three ovate petals measure about half to one inch long. They are deep yellow to orange and coarsely hairy inside, fringed with a dark tuft of hairs at the tip. Each petal has a round nectary which is nearly hidden by dense hairs. Blooming usually occurs around late May or early June. The bulbs of the star tulip were eaten by the Chumash. *Calochortus* is Greek and means "beautiful grass." *Obispoensis* refers to San Luis Obispo, California, the only county where this species occurs. The San Luis mariposa lily is the logo for the local chapter of the California Native Plant Society.

Riparian spring and water course

6. Riparian Communities

Ribbons of lush, green riparian woodlands in an otherwise arid area are striking landscape features on campus. These woodlands are restricted to waterways such as drainage channels, creeks, streams, lakes, reservoirs, and marshes. They are composed of a variety of hydrophilic (water-loving) trees, shrubs, and herbs. The lateral extent of the riparian woodland corridor depends on the size and nature of the creek banks, the amount of water carried, and the depth and lateral extent of subterranean aquifers. Most of the trees and shrubs of the riparian corridors are deciduous



Western sycamore *Platanus racemosa*

This is a 30 to 115 foot deciduous tree that grows rapidly. The tree is often divided ne ground into several secondary trunks, with spreading limbs at the top that form a bro open head. The Sycamore has 5 to 13 inc palmate, five-lobed, thick velvety leaves an inch heads of yellow-green male flowers a female flowers from February through Augus The bloom is followed by a one inch, dense, globular seed pod.

The bark is reddish brown on the lower part the tree and smooth and light gray above. As tree grows, the old bark flakes off because it is rigid (unlike the bark of most other trees) and is unable to expand with the trunk and limbs. As a result, the sycamore has a characteristic scaly appearance where the smooth, greenish white bark has been exposed.

The sycamore looks gnarled and it grows at seemingly odd angles. This is due to anthracnose (*Gnomonia platani*), a fungal infection. In years of cool, wet spring weather, trees can be completely defoliated by the disease. A new crop of leaves later forms in the drier summer months. *Platanus* comes from the Greek *platys* "broad," referring to the size of the leaves. *Racemosa* comes from the Latin *racem* "a cluster," referring to the chains of fruiting heads.

Early Californians fashioned the burl-like growths of what they called the "aliso" into bowls.

Second growth of leaves and twigs

plants that require a permanent water supply. However, patches of riparian woodland can also occur in depressions and canyons where the water table is shallow or around seeps and springs. Where permanent, slow moving pools of water occur along the creeks, patches of freshwater marsh have become established. Several creeks and drainages on Cal Poly Land support wetland vegetation, ranging from broad swaths of dense riparian forests to narrow corridors of mostly aquatic and semi-aquatic shrubs and herbs.

The most highly developed riparian woodlands occur along Brizzolara and Stenner Creeks, which traverse the campus core, and along Pennington and Chorro Creeks, which traverse the campus ranchlands near Cuesta College. Common riparian trees include: *Salix lasiolepis* (arroyo willow), *Salix laevigata* (red willow), *Populus balsamifera ssp. trichocarpa* (black cottonwood), and *Platanus racemosa* (sycamore).

Quercus agrifolia (coast live oak), *Umbellularia californica* (California bay-laurel), *Heteromeles arbutifolia* (toyon), and *Sambucus mexicana* (elderberry) join these riparian trees along several creeks.

Common understory shrubs include the following: *Heteromeles arbutifolia* (Toyon), *Rhamnus californica* (Coffee-berry), *Rubus ursinus* (California blackberry), *Salix lasiolepis* (Arroyo willow), and *Toxicodendron diversilobum* (Poison-oak). Common native herbs include: *Artemisia douglasiana* (Mugwort), and *Salvia spathacea* (Hummingbird sage). Native grasses are mostly *Bromus carinatus* (California brome), *Elymus glaucus* (Blue wild rye), *Leymus condensatus* (Giant wild rye), and *Melica imperfecta* (Coast range melic). Common alien forbs include *Carduus pycnocephalus* (Italian thistle), and *Foeniculum vulgare* (Fennel). Alien grasses are mostly *Bromus diandrus* (Ripgut brome), *Polypogon monspeliensis* (Rabbitfoot grass), and *Piptatherum miliaceum* (Smilo).

Riparian communities have a significant effect on the environment. Seasonal fluctuation in light is available to riparian understories because most of the dominant trees are deciduous. When the trees are in their winter-dormant leafless condition, direct sunlight reaches the ground or the water surface of the stream. Some herbaceous species and shrubs actively grow and flower while the trees are leafless.

When deciduous trees are in full leaf, they cast dense shade, reducing the light energy that reaches the ground or water. Daytime temperatures beneath the tree canopy are often several degrees lower than temperatures in full sunlight. The tree cover also decreases wind velocity. Relative humidity is increased in a riparian corridor by moisture evaporated from leaves, the soil, and water.

Unlike the plants of many other communities of

Arroyo Willow *Salix lasiolepis*

Arroyo Willow grows to 30 feet, spreads underground, and has long, narrow leaves on yellowish twigs. Flowers bloom in catkins from March to May. *Sal* means "near," *lis* means "water" in Celtic. *Lasio* means "shaggy/hairy," *lepis* means "scale." Its tea was also used to treat sore throats and cure fevers. Chumash used branches as fishing poles, switches, whips, and firewood. Salicylic acid is the active ingredient in aspirin.

California, riparian dominants are active in summer and dormant in winter. Many of the understory plants are similarly summer growing species. The availability of either surface water or shallow subsurface water in a riparian corridor allows the plants to remain metabolically active at times of the year when moisture stress is extreme in adjacent upland areas.

Many plant species in a riparian community are adapted to the effects of periodic flooding. Some have deep root systems that firmly anchor them against the force of flowing water. Some, such as willows, rushes, and sedges, have flexible stems that are bent by the water but recover after the flood waters have subsided. Many riparian plants have rhizomes that are protected from flood-damage by layers of sediments. Others have no particular adaptations but can persist if they become established among large rocks.

The creek channel is generally flushed of vegetation during winter/spring storms. Temporary vegetation then develops on the sand and gravel bars along the creek and the slowly flowing stream of the main channel. Species such as *Rorippa nasturtium-aquaticum* (Watercress), *Polypogon spp.* (Rabbitsfoot grass), and *Carex spp.* (Sedges) establish themselves in the creek channel.

Riparian woodlands provide excellent cover, nesting sites, and foraging opportunities for amphib-

ians, reptiles, birds, and mammals. The multilayered canopy composed of trees, shrubs, and herbs provides vertical structure and a variety of microhabitats. The creek area provides a source of moisture in an otherwise arid environment especially in summertime.

Riparian woodland vegetation influences fish habitats by moderating the temperature and providing cover and food. Vegetation also slows the water velocity, providing resting areas for fish and increasing habitat complexity, which can lead to greater species diversity. Riparian vegetation provides hiding places for both adult fish and fry to escape predation and may also provide increased substrate for fish food and for egg attachment. Small fish use slower water along margins of larger creeks and depend on insects that live in the riparian vegetation for food.

Riparian vegetation decreases erosion from stream banks and adjacent uplands, maintaining stream purity and reducing sedimentation, which is important because heavy silt loads destroy habitat for fish and invertebrates. The loss of riparian trees and shrubs undercuts banks and decreases fish populations.

Species that occur in creeks include resident fish like three-spine stickleback and prickly sculpin, and other amphibians, reptiles, birds, and mammals.

California bay-laurel
Umbellularia californica

An aromatic evergreen that grows to 148 feet tall. It has shiny, deep green leaves. Yellow-green flowers bloom December – May. The fruit resembles an olive. Early Californians used the burls of laurel to form bowls. Tea from the leaves was used to fight colds. Rheumatism was treated with laurel leaves in a hot bath. The fruit was eaten raw or boiled; the kernel roasted and ground for cake flour. Bay leaves are widely used for cooking today.

7. Freshwater Marsh

Freshwater marshes occur in nutrient-rich mineral soils that are saturated most of the year. Such sites commonly occur around springs and along the margins of ponds, reservoirs, or lakes and in the flood plains of slow-moving streams.

Freshwater marshes are dominated by aquatic and semi-aquatic species. The tall dominant plants include: *Typha* (cattails), *Scirpus* (bulrushes, tules), *Carex* (sedges), *Eleocharis* (spike-rushes), and *Juncus spp.* (rushes).

Tules and willows at Shepard Reservoir

(docks), *Polygonum spp.* (smartweeds), *Rorippa nasturtium-aquaticum* (watercress), and *Epilobium watsonii* (willow herb). Freshwater marsh vegetation often grades into a band of riparian woodland dominated by *Salix lasiolepis* (Arroyo Willow).

Some freshwater marshes are found where the water table is so close to the soil surface that it can be tapped in the dry season, such as seep areas in hillside drainages. Other freshwater marshes are seasonal communities. During the winter and spring these areas are dominated by *Juncus, Carex, Eleocharis,* but in summer the soil surface dries and hardens and grassland species predominate.

Riparian and freshwater marshes are sensitive habitats. Over half of the wetland and riparian vegetation in the contiguous 48 states and over 90% of the wetlands in California have been destroyed, and few of the remaining riparian and wetland areas have not been damaged to some extent. Loss of riparian ecosystems is due largely to urbanization and human activities, especially clearing for agriculture, building structures, paving in flood plains, modifying stream channels, diverting and storing water, and mining. Even outdoor recreational activity can destroy natural plant diversity, lead to soil compaction and erosion, and disturb wildlife.

Wise management of remaining riparian ecosystems and restoration of disturbed riparian areas is

Common freshwater marsh plants

Carex spp.	sedges
Cyperus spp.	umbrella sedges
Eleocharis spp.	spike-rushes
Juncus spp.	rushes
Polygonum spp.	smartweeds
Rorippa nasturtium-aquaticum	watercress
Scirpus spp	tules
Typha spp.	cattails

Rush *Juncus effusus*

The round stems of rushes grow in clumps and spread by stout, branched rhizomes. Leaves are basal and have no blade. The terminal blossom appears to be lateral; each has many flowers. *Juncus* comes from the Latin, "to join" or "to bind." *Effusus* means "spread out." Chumash extensively used *Juncos* (Spanish) to weave baskets, clothing, and mats.

Blue Gum *Eucalyptus globulous*

Blue gum trees grow to about 150 feet tall. Their bark peels off in irregular patches seasonally. The aromatic leaves of the older branches are four to eight inches long and somewhat sickle-shaped. The sepals and petals are fused into a warty-textured bud cap from which a profusion of cream-colored stamens emerge. Bloom is from December through May. The one-inch fruit is a warty, woody capsule. It was brought here from its native Australia to be farmed for wood for furniture and railroad ties, but turned out to be unusable. It has proven to be extremely invasive since no animals on this continent eat blue gum and keep its growth in check. Because of the oils it exudes, most other plants cannot grow in its immediate vicinity.

Blue gum have escaped from cultivation or have been planted along some creeks, as have several other exotic species such as *Olea europaea* (olive), *Phoenix dactylifera* (date palm), and *Schinus molle* (Peruvian pepper tree).

important because of their high value as fish and wildlife habitat. Riparian ecosystems are more structurally diverse and more productive in plant and animal biomass than adjacent areas. Riparian areas supply food, cover, and water and serve as migration routes and forest connectors between diminishing wildlife habitats. They are particularly important to migratory birds of the Pacific Flyway. Loss of these wetlands in California makes the protection and management of those on Cal Poly Land even more significant.

Interconnected, overlapping riparian and marshland habitats on campus support a rich animal life. Many of the same wildlife species use both riparian and freshwater marsh areas.

Typical amphibians and reptiles include red-legged frog, southwestern pond turtle, Pacific chorus frog, Western toad, bullfrog, gopher snake, and California slender salamander. Birds living in freshwater marsh communities include American coot, mallard duck, black-crowned night heron, great blue heron, snowy egret,and songbirds like red-winged blackbird and song sparrow. Mammals frequenting wetlands include raccoon, coyote, and mule deer.

8. Anthropogenic Communities

Few areas have escaped human impacts. Past and present land use has caused significant changes in the flora, vegetation, and wildlife on Cal Poly Land. Some uses have resulted in the complete loss of native vegetation while others have resulted in introduced plants invading native communities. Areas dominated by plants introduced by humans and established by human disturbance are *anthropogenic communities*. Some are entirely artificial like cultivated row crops, lawns, vineyards, and ornamental plantings. Others are assemblages of

Eucalyptus windbreak at Serrano Ranch

weedy species that have invaded disturbed areas along roads and fields. The anthropogenic communities on campus can be divided into pastoral, ruderal, and plantation and urban mixes.

Pastoral communities occur in upland pastures that were once covered by California native grassland. Repeated disturbance to the vegetation and soil by grazing animals maintains a mixture of herbaceous species tolerant of the existing grazing regime. Few, if any, native plants are found in pastures.

Ruderal communities occur in areas of ongoing or past disturbances such as roadsides, cattle trails, hiking trails, and vacant lots. These areas generally have a plant cover of introduced weedy grasses and forbs, although some natives are also present.

Plantations and urban mix communities include windbreaks and ornamental plantings of non-native plants that have escaped cultivation and become part of the local vegetation. On Cal Poly Land the most extensive of these man-made forests are *Eucalyptus spp.*, mostly *Eucalyptus globulus* (blue gum). Others include: *Acacia melanoxylon* (blackwood acacia), *Casuarina sp.* (She-oak), *Grevillea robusta* (silky-oak), *Olea europaea* (olive), *Phoenix dactylifera* (date palm), *Pistacia atlantica* (pistachio), *Prunus dulcis* (almond), *Prunus spp. Anthro* (cherry, apple), and *Schinus molle* (Peruvian pepper-tree). Some of the planted species are native to California but not to the Cal Poly campus such as *Pinus radiata* (Monterey pine), *Cupressus macrocarpa* (Monterey cypress), and *Juglans californica* (black walnut). In addition one commonly finds many shrubs and perennials like *Agave americana* (century plants), *Opuntia sp.* (prickly-pear cactus), *Cortaderia jubata* (pampas grass), and *Genista monspessulana* (French broom). Ornamental vines such as *Asparagus asparagoides* (garden-smilax), *Hedera helix* (English ivy), *Lonicera japonica* (Japanese honeysuckle), and *Vinca major* (periwinkle) often spread from developed areas into adjacent undeveloped areas on campus, including the riparian vegetation along creeks.

On Cal Poly Land several raptor species such as Great horned owl, Barn owl, Red-shouldered hawks and red tailed hawks nest in plantation trees. Portions of the eucalyptus plantations may also be used for roosting by monarch butterflies.

Sycamore leaf and seeds

Common Weeds

Alien Forbs

Anthemis cotula	mayweed
Brassica spp.	wild mustard
Cirsium spp.	thistles
Centaurea solstitialis	yellow star-thistle
Erodium spp.	filarees
Foeniculum vulgare	fennel
Hirschfeldia incana	perennial mustard
Lactuca spp.	wild lettuce
Medicago polymorpha	bur-clover
Picris echioides	bristly ox-tongue
Plantago lanceolata	english plantain
Polygonum arenastrum	knotweed
Silybum marianum	milk thistle
Sonchus spp.	sow-thistle

Alien Grasses

Avena spp	wild oats
Brachypodium distachyon	false brome
Bromus diandrus	ripgut brome
Bromus hordeaceus	soft chess brome
Bromus madritensis	red brome, spanish brome
Hordeum murinum	foxtail barley
Lolium multiflorum	annual ryegrass
Vulpia myuros	rattail fescue

Wildlife

Rocks breed soil. Soil, along with water and climate breeds vegetation. Vegetation breeds wildlife. This introduction to wildlife on Cal Poly Land opens with a bird walk and concludes with a gallery of mammals, reptiles, amphibians and fish.

Birds

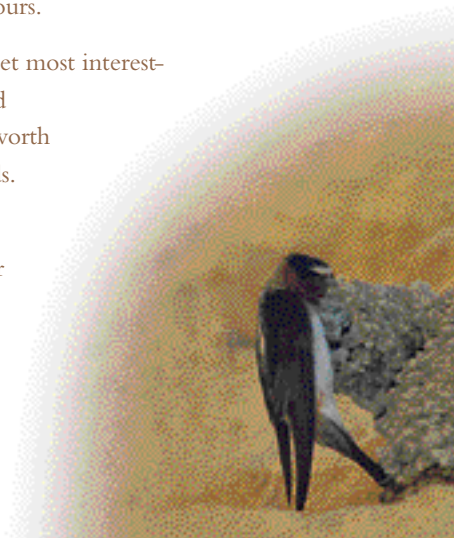
Johanna Rubba, English Department

Parallel to the universe of our daily lives runs the universe of the birds. As we stroll or hike or trot unawares about Cal Poly Land, the birds are busy with their secret industry of hunting bugs, raising babies, avoiding predators, or charting a course on a 2000-mile spring or autumn migration. Colorful, quirky, with melodious and distinctive songs, the birds surround us. Getting to know them is as easy as focusing a pair of binoculars.

San Luis Obispo County's mixed habitats and mild climate overlap the winter and spring destinations of many migrant species, while others reside here year-round, providing world-class birdwatching opportunities. One of my first birdwalks in the county was on the main campus of Cal Poly and up Poly Canyon. It was midwinter; we observed an astonishing variety of species in just a few hours.

In what follows, I will describe some of Cal Poly Land's most easily observed yet most interesting birds, focusing on the riparian, grassland, and woodland habitats of Poly and Pennington Canyons. Before venturing into those quiet places, however, it is worth pointing out that one needn't take a two-hour walk to remote spots to see birds. The main campus abounds with lovely species.

Who, for instance, has walked by Fisher Science Building during spring quarter free of the fear of acquiring a smattering of **Cliff Swallow** poop? These birds' high-pitched cries and jug-like mud nests are daily experiences; take a closer



Wild turkeys at Serrano Ranch

look to see their distinguishing marks – dark wings, tail and back with a tan rump spot and tan crossbar just above the beak.

Lesser Goldfinch

At any time of year, but especially in spring, one might pause on the way across campus, arrested by the canary-like warble of a **Lesser Goldfinch** – a 4-inch bird with olive-green back, yellow belly, black cap, and streaks of white in the wings. These travel in flocks from tree to tree, and can also be noticed by their minor-keyed, mournful up- or down-keening whistles. Males perch on a branch or treetop to sing out their territorial boundaries. Lesser Goldfinches have provided me with many a musical respite in my daily rounds on campus.

Anna's Hummingbird

Perhaps best-loved are the year-round-resident **Anna's Hummingbirds**, tiny (3.5") but fierce loners treading the thin line between energy consumption and expenditure as they buzz from flower to flower, seeking nectar. Their backs are metallic green, bellies grayish; males sport a dark red helmet and throat that catches fire when angled towards the sun. They perch frequently, scooping side-to-side for competitors and grinding out their humble song, which sounds rather like a rusty key in a wind-up toy. As they feed, they emit regular chips and occasionally, in flight, a single, extraordinarily loud bink.

Also recognizable by voice are the **Cedar Waxwings**. Listen during the fall and winter months for the extremely high-pitched tweeeee of a flock moving among the treetops or feasting on orange firethorn berries outside the Math building. These 6-inch beige birds are stunningly outfitted with Mohawk-like crest, black bandit's mask, a bright orange spot in the dark wing and a bar of yellow across the tail-tip, as if each bird had been dipped

Cedar Waxwings

one centimeter into a pot of bright yellow paint. I once watched as flock after flock, about 200 Cedar Waxwings, flew into the top of a tree in front of Yosemite Residence Hall.

Yellow-rumped Warbler

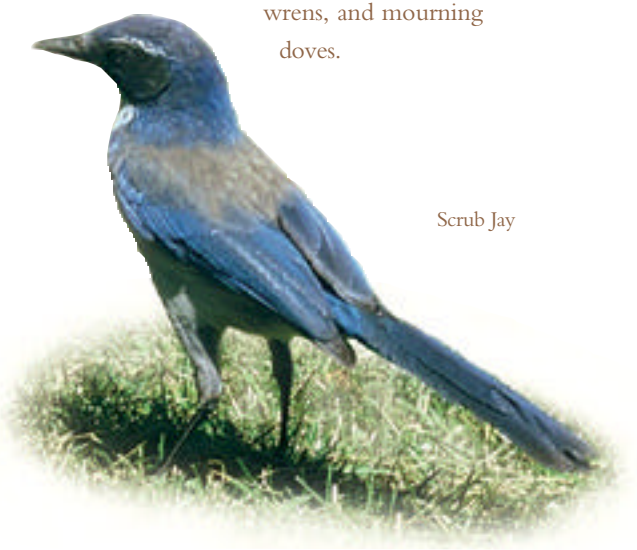
Birdwatchers prize sightings of warblers, small needle-beaked birds of many varieties. Winter brings hoards of **Yellow-rumped Warblers** to campus and surrounding lands. They move quickly through the trees and bushes, picking insects off branches and out of the air. Look for about five inches of brownish bird with a yellow spot at the base of the spine right above the tail, yellow patches on the side of the breast, white belly, and white in the wing and tail. In spring, the male's brown plumage turns black and the top of the head and throat are bright yellow; but these birds generally breed elsewhere.

A somewhat odious, though pretty, bird that frequents all habitats is our local "blue jay," the **Scrub Jay** (the true Blue Jay is an eastern bird). About a foot long, the Scrub Jay has a bright blue cap, wings, and tail, with a white throat and beige belly. It is much larger than the Western Bluebird (see below), and is much more numerous. Jays make a variety of harsh, loud squawking sounds. I find them obnoxious for their noisiness and their habit of preying aggressively on other birds, not discriminating between plentiful and endangered species. Like other jays, they are bold and will eat most anything, pestering picnickers. I put them in my "rat-bird" category, along with crows and gulls, which have similar habits.

Walks through Poly Canyon, Stenner Canyon and Pennington Canyon lead through several habitats that promise rich bird sightings.

First, look down. Several species of birds often alight on the ground to scratch about looking for seeds or to take dust baths. The most common that you will see in woodland habitats are sparrows, juncos, towhees, wrens, and mourning doves.

Scrub Jay



White-Crowned Sparrow

Several species of sparrows (small birds 3-5" in size, with thick, triangular beaks for cracking seeds) live in or visit our county, but the easiest to find are the **White-Crowned Sparrow** and the Song Sparrow. The White-Crown's name is a bit misleading. The bird's crown is actually striped black and white, adding a striking cap to an otherwise ordinary bird of the LBB (little brown bird) variety. The rest of the bird is gray (belly) and brown (back). The bill may be either yellowish or pinkish. Sparrows usually work in flocks, so where there is one there are more. Listen for very thin tseep-tseep sounds from within bushes, or watch for males proclaiming their territory from atop a bush or fence wire.

Song sparrows are often found alone in bushes or underbrush as well as in trees. They are dark brown, their chests dull white flecked and streaked with brown; the streaks come together in the middle of the breast in an uneven spot. Aptly named, they sing quite sweetly. Song sparrow melodies vary somewhat, but the local "dialect" features two-three introductory whistles followed by a string of repeated clear notes on one pitch, ending with a short but varied coda.

Dark-eyed **Juncos** are distinctive little birds, white on the belly, with brown backs and a charcoal-grey "hood" – the entire head and upper chest is dark grey down to a clear line on the breast, as if the bird were wearing an executioner's hood; the dark eye shines in the midst of the grey. Their grey tails are edged in white – an easy clue to look for when the birds are flitting about.

If you hear rhythmic, short bursts of rustling under bushes, you have probably happened upon a Towhee, doing its amusing back-and-forth, back-and-forth dance. The plain **California Towhee**, about 8-10," with a long tail, tan in color with rusty coloring under the tail and buffy throat, is quite common and not very timid. They often come out of the brush into trails or open

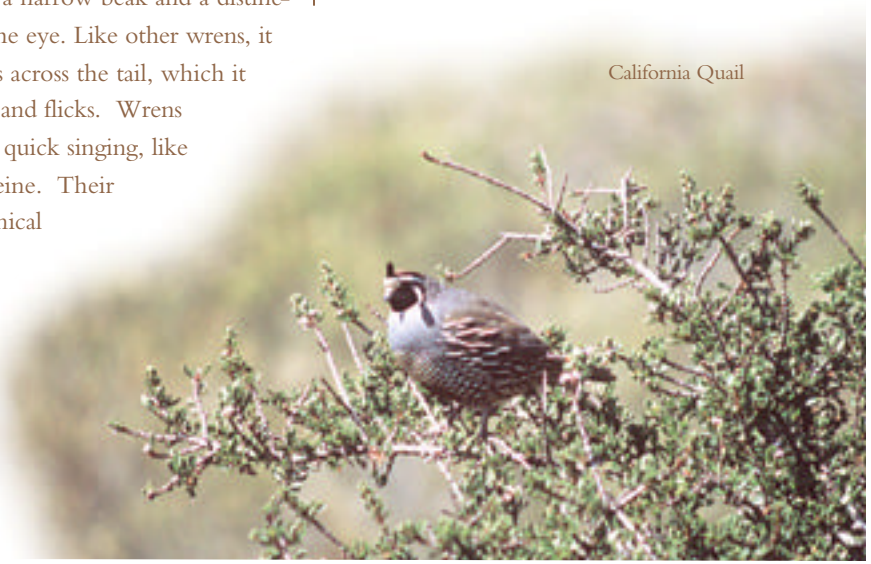
spaces. Their chink, chink is a familiar sound to hikers in nearly all brushy habitats.

Bewick's Wren

Several species of wren grace our area. Widespread across habitats is **Bewick's** (pronounced "Buick's") **Wren**, a 4" LBB with a narrow beak and a distinctive white stripe over the eye. Like other wrens, it has narrow black bands across the tail, which it often cocks straight up and flicks. Wrens are quick-moving, and quick singing, like Song Sparrows on caffeine. Their movements are mechanical and abrupt.

We cannot leave this section without considering the prototypical ground bird, the **California Quail**. Large (9-11") and tubby, an apostrophe-shaped topknot sprouting from its forehead, a quail is always fun to see. They are brown on the back, have black heads with white striping, gray breasts, and bellies that look scaled. Quail are flockers, and often post a sentry bird on a low branch to warn ground-foraging compatriots of trouble. Listen for their noises – a strange, rapid, bubbly pwip pwip pwip; an almost human raaaa! And the distinctive, nasal chi-CA-go, chi-CA-go that it is famous for. In springtime quail produce large numbers of babies that are often seen skittering across roads and trails in undeveloped areas that provide brush for cover, whether low scrub or streamside understory. They are frequent in Poly and Pennington Canyons.

California Quail



Western Meadowlark

toire some colorful species: the Western Meadowlark, and the Western Bluebird.

Among the sweetest of birds is the **Mourning Dove**. Large (12") but graceful, with a short neck and small head, doves are often seen walking about on the ground in pairs, heads moving back and forth like pigeons. These are the birds that play chicken with you on the road – you swear they will not get off to the side in time, but they always do. They are grey, with a black spot behind and below the eye and a somewhat rosy breast. Most distinctive is their long, triangular tail, which comes to a point and is edged in black and white. Doves often flush, so their tail shapes and edges can be clearly seen. They often perch on telephone wires as well. Their name comes from their plaintive call – who-ooo, whooo, whooo, whooo, higher-pitched on the ooo.

Now shift your gaze upward slightly to the level of high grass, wire fences, fenceposts and tall weeds, ranging between the ground and the telephone wires. In open grasslands, like those below the Poly P, you may continue to spot sparrows and goldfinches, but you may add to your repertoire some colorful species: the Western Meadowlark, and the Western Bluebird.

Keep an eye out for flocks of miniature flying footballs – brown birds pointy at each end but quite fat in the middle, about 9" in size. When they land or perch, they seem dull, being mottled brown overall with some white in the tail and a white eye stripe, but when one turns to face you, you'll be rewarded with the sight of a bright yellow breast with a strong black V below the throat. These are **Western Meadowlarks**, year-round residents of open grasslands. They favor perching on tall stalks or fenceposts when they are not strutting about in the grass. From a perch the Meadowlark sings its striking song of clear, flutelike notes, whistles, and gurgles with abrupt pitch changes, usually ending on downward gurgling notes. It reminds me of breaking glass.

Sure to produce oohs, aahs, and dropped jaws on a beginner's birdwalk is the neon blue of the male **Western Bluebird**, medium-sized (7"), with a needle-like bill. The blue of the wings and head is almost unbelievable in bright sunlight, making this bird a favorite for many. The blue continues on the bird's throat, but its breast is rusty red, with some rusty continuing onto the bird's back. These

Western Bluebird

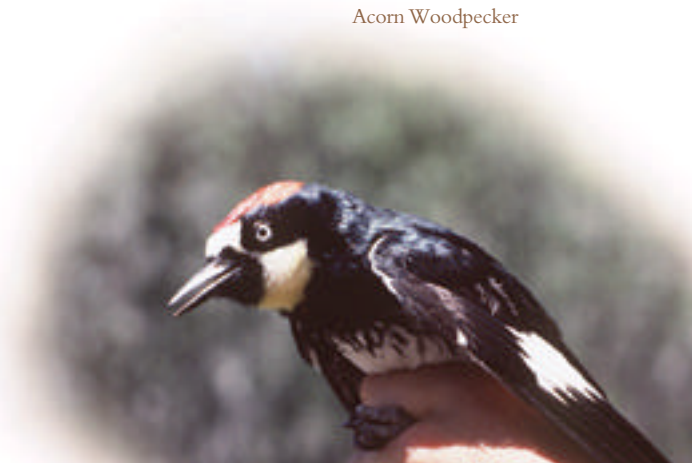
birds are often spotted in flocks in open fields and on fences and phone wires, or in male/female pairs.

Let us move a bit higher now into the trees, and consider woodland birds that frequent solitary oaks, oak or evergreen groves, and streamside trees. Poly, Stenner and Pennington Canyons abound in these, sometimes near the streams and sometimes on hillsides or in groves scattered about open grasslands.

The tiniest bird you might see (apart from a hummingbird) is the **Bushtit**. You are likely to hear them before you see them. Bushtits travel in dense flocks and keep track of each other by emitting an almost constant deep pee-deep deep deep. They move from bush to bush or from tree to tree, often venturing one by one across dangerous open spaces where they might easily be snatched by a hawk or falcon. They are plain gray with some brown on the face, short needly bills, and (relative to their 4" overall length) long tails. These birds are common in all vegetated areas, including built-up locations.

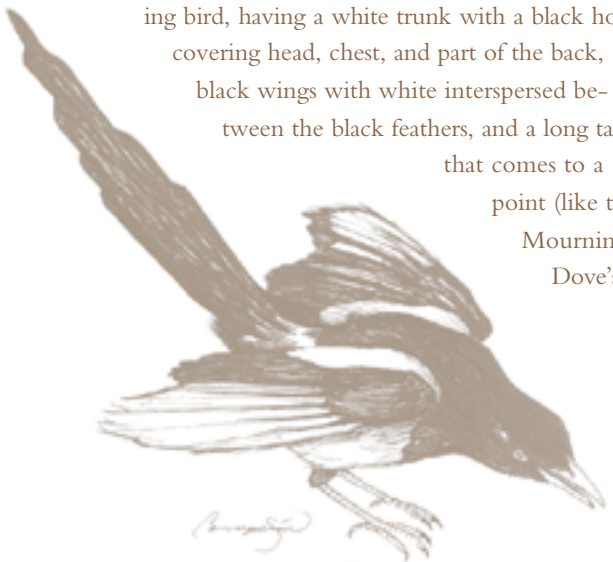
Novices and veteran birders alike enjoy seeing woodpeckers, with their dramatic plumage and (in the male) red-marked heads. Though no western woodpecker has a completely red head (the Red-headed Woodpecker is an eastern bird), our males oblige with bright scarlet patches on the back of the head. Our most striking and abundant woodpecker is the **Acorn Woodpecker**, so named for its habit of drilling holes in tree trunks and inserting acorns for later consumption. In your walks you may happen upon trees that have been appropriated for food storage in this way; they look like they have been hit numerous times with large-caliber buckshot. Around 9" long, this woodpecker is mostly solid black.

Acorn Woodpecker



Males have a red cap and both sexes have white eyes and a yellow band around the throat that extends onto the cheek and narrows across beak and forehead. They are easily recognized in flight thanks to large patches of white on the wings and above the tail. And you may hear them before you see them. They are talkative birds and make loud, unusual sounds: one which my bird book describes aptly as whack-up, whack-up, whack-up and another, a nasal, almost pigeon-like trill. Acorn woodpeckers frequent any habitat that features oak trees. They are often seen climbing on poles or high fence posts.

In dry, open areas you'll find the **Yellow-Billed Magpie**, a crow-sized (16-18") bird with crow-like habits: much squawking, eclectic in its eating habits, and moving about in flocks. This is a striking bird, having a white trunk with a black hood covering head, chest, and part of the back, black wings with white interspersed between the black feathers, and a long tail that comes to a point (like the Mourning Dove's) and shows iridescence in bright sunlight. This bird is special in another way. Though magpies abound in other parts of the country and the world, the magpie with the yellow bill occurs exclusively in California's Salinas and San Joaquin Valleys and their margins, including us.



Favored among birders and non-birders alike are owls, symbols of wisdom in some cultures but having more sinister symbolism in others (some Native American tribes associate the owl with death). Several species of owl are found in our area, but most are hard to see, being nocturnal in their habits. One that you might well observe during the day, napping on a high tree branch, is the **Great Horned Owl**. It is a huge bird, 18-25" long and large-bodied. It has a large, round head, with feathery tufts that sprout above each huge, yellow eye. Finding one of these staring at you can chill you to the bone. They are mottled brown with barred chest and belly, and a white "bib" at the throat. If you're really lucky hiking about in the spring, you may

happen upon some Great Horned babies, which are the size of crows and are gray and very fluffy. Owls are easily recognized in flight because of their round heads; their beaks do not show, as they are curved and tuck into the bird's face.

It is time to direct your gaze upward to the skies, in search of some of our most striking birds, the raptors. These come in small (kestrels), medium (shrikes, kites and Harriers) and large (Red-tailed hawks, Red-shouldered hawks, and Golden Eagles – yes, we have eagles!), and feed upon reptiles, rodents, and other birds. The largest birds of prey may target lambs, fox pups, rabbits, kittens and cats. They often have fierce yellow eyes, curved, sharp beaks for tearing flesh, and hooked talons for grabbing and lifting their prey.

American Kestrel

The **American Kestrel**, known in vernacular as the Sparrow Hawk, is a small (9-12") but colorful bird of prey, with a rusty back and tail (tipped in black) and blue-gray wings. Its face is marked by two black sideburn-like stripes. Like other raptors, it soars and circles, often at low altitudes 20-60 feet above open grasslands and between stands of trees, looking for prey; it has also given us a verb, kestreling. This refers to the bird hovering in one place, tail spread, its wings rapidly beating, head bent groundwards. Kestreling is sometimes followed by a sharp dive for the prey the bird has been watching. Kites and hawks also kestrel. American Kestrels can be found in most any open location, including stock-grazing lands on campus as well as in the open areas of Poly and Pennington Canyons. Its call is a high-pitched kleer, kleer!

A favorite of mine, spotted often in the Pennington area, is the **White-tailed Kite**, known until recently as the Black-shouldered Kite. Both are accurate descriptions. One often spots large white birds in our area, usually they are gulls coming in from the beach; but if you see a white bird slimmer and smaller than a gull, look closer for black shoulders and a gray back and wingtops, a small, dark beak and orange eye – a kite. They are beautiful and graceful in flight, and often kestrel.

Red-shouldered hawk

Striking and yet easy to see are our two most common hawks, the Red-tailed and the Red-shouldered. **Red-shouldered hawks** are not shy of civilization and may be seen on campus, at Cuesta park, on telephone wires along Los Osos Valley Road, or in any of Poly's wild lands (I have photos of one perched on a fence in my front yard a mile from campus). About 17-24" in size, they are quite colorful, with rusty barred chest, rusty shoulders, and black-and-white-striped wings and tails. They are magnificent to see in flight, and often fly low enough to recognize and enjoy without binoculars. Their call is a clear, two-syllable kee-yeer, often repeated several times.

The even larger (19-25"), the **Red-tailed hawk** is shyer of civilization, but quite common over less-developed open lands and wooded lands alike. Its call, a single, downslurred, hoarse and threatening kerrrrr! would certainly frighten a mouse. The bird is brown above, beige with black flecking from below. Wait for it to turn its back toward you to see its bright rusty-red tail, which often glints in the sun.

If you're really lucky, you'll see a Golden Eagle, sometimes found in the Pennington Canyon area. This is a hu
bird, 30-40" in length v
wingspan up to 7'. It i
ly dark brown in color
ful specimens show wh
the root of the tail and
wings. These spots darke
matures. You will know it mainly by size; it will be too big to be anything else.

Dark birds that may be mistaken for eagles are crows, which are solid black and significantly smaller (17-21"), more abundant and far noisier, and **Turkey vultures** (known to insiders as TV's), whose wings are half gray on the underside and whose pink heads will show up in binoculars. TV's often teeter unsteadily as they fly, as though drunk or not used to flight.

Let us now turn to watery areas. The various small reservoirs and ponds on campus host water-dwellers as well as water seekers. It is best to ap proach watery areas slowly, as most herons and wild ducks startle easily and may fly away or cruise far from view.

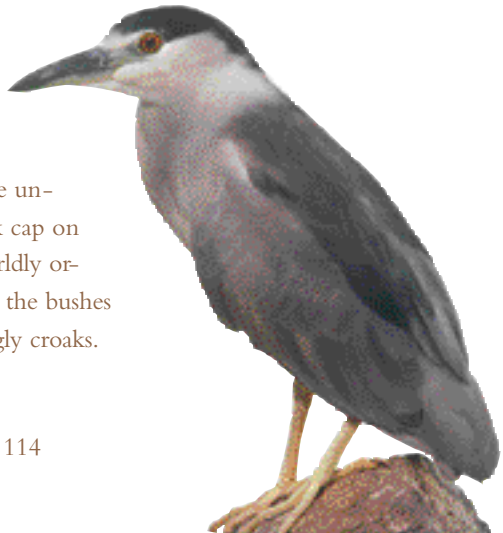
Another view of vultures

I forever see vultures with their great wings outstretched, riding the sky. In all of my bird-watching I have never seen a vulture flap its wings... until today. It seems so unvulture-like, to want to get anywhere in a hurry. The

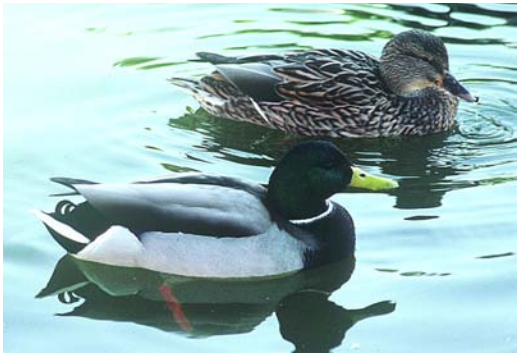
ular water bird you might find is **Heron,** a huge yet graceful bird g stock still near or in shallow ajestically from one watery loca- s legs trailing behind its huge, ings, its neck folded in upon it- Blue Heron has a light blue- tan and white neck, and black hite face, with dramatic plumes ming off the head and chest dur- g spring mating season. When artled, it might call out with a oad, harsh croak--the bigger the ron, the deeper the sound.

Also striking is the **Great Egret** (egrets are a variety of heron), a little smaller than the Great Blue at about three feet, but also graceful and hard to miss, as it is a pure, snow-white, with a large yellow bill and long black legs. Its behavior is similar to the Great Blue's, but Great Egrets are a bit less shy. I have seen them standing about on the side of a busy road!

Resident at Smith reservoir are several **Black-crowned Night Herons**, stocky birds usually hunched and very still. They are white underneath with gray wings, a black back, and a black cap on the head. The bill is black and the eye an otherworldly orange. They resent visitors and will often flush from the bushes and trees as you come near, uttering reproachful, ugly croaks.



Common as dirt in all watery areas is the **American Coot**, a plump, charcoal-gray bird with an orange eye and white bill that extends into a horny forehead plate. Coots congregate in large groups and dabble about in ponds; their heads pump back and forth as they swim. Their sound is a remarkable, scraping kaak. It is amusing to watch them take off from the water, as they paddle clumsily for a good ways before achieving flight.



Male and felmale Mallard

Though wild ducks sometimes visit Cal Poly waters, their numbers and species are unpredictable, and to identify them you are best off using a field guide. Reliably present, however, is the common but colorful **Mallard**, a large (20-28"), yellow-billed duck with an iridescent green head, white neck-ring, reddish-brown chest, and beige back. The tail is black with a white tip, and there is a square of glossy blue just under the rear wing. The female Mallard, as is true of nearly all female ducks, is completely different, being a mottled brown all over. Mallards are gregarious, noisy, busy, and not particularly shy.

Ponds and streams are usually bordered by reeds, marshy grasses, sycamore and willow trees, along with larger and more common eucalyptus, oaks, and other trees. Among the foliage, especially in spring and fall migration periods (March-June and late August to late October), your chances are good of sighting what for me is the most magical of wild birds, the warbler. Tiny (4-5"), needle-billed, colorful, and quick, obsessed with the ceaseless task of finding food, warblers are oblivious to their own beauty.

It takes a little persistence to spot and stay with a warbler, for they are small and move fast, but they do have the trait of "working over" a tree or bush they are in, so that if the bird disappears, it likely will reappear soon a short distance away in the same bush or tree. The **Yellow Warbler** is stunning, solid, bright yellow all over, with faint red streaks on the chest. Its song is a high-pitched tseet-tseet-tseet-

tsiddily-tseet, dipping down on the tsiddily and rising again in pitch at the end.

Wilson's Warbler has a bright yellow belly, plain greenish back, a large black dot on its head like a yarmulke, and a tiny black gleaming eye. It has a rapid song that drops in pitch, twee-twee-twee-tway tway tway.

If, while you are out walking on Cal Poly Land, the gods of birdwatching smile upon you, you might be blessed with a sighting of one of our less common but more spectacular residents: the **Western Tanager**. There's no mistaking this bird—about 7" in size, it has a bright yellow body, black back and wings (with a yellow and a white wing bar), and, in spring and summer, a bright red head. This fantastic plumage makes it easy to spot. In winter, the male comes to resemble his mate: bright yellow on the underbody, and olive green on the head and back. Look for this bird among the trees, especially pines and other conifers.

Birdwatching requires some patience and traipsing about, and is sometimes frustrating. But there must be a reason why it is America's fastest-growing hobby. For me, the attraction of the birds is their beauty – the perfection of smooth color, the bright contrasts – and their unconscious grace. As I, rapt, watch some gloriously-colored tiny bird moving about, I have the sense of witnessing a secret, important ritual. And I am. The birds have been with us for millions of years, occupying a crucial niche in helping to manage plant and insect life, performing daunting feats of migrating thousands of miles, often over long stretches of water. Watching the birds and learning their traits clarifies the importance of habitat. Though wide-ranging and abundant, bird life is fragile and crucially dependent on preservation of wild land. Losing the birds, we would lose not only great beauty and variety, but also a crucial link in the ecological chain that sustains all life.

Western Tanager

Mammals

The class of Mammals is defined by several features. They are named for the mammary glands which nourish the young with mother's milk. Mammals all bear live offspring rather than hatching eggs. Excluding whales, all mammals have hair. They are considered more adaptable than other animal classes because of their highly developed brains and because of being "warm-blooded"-- the ability to regulate their internal temperatures and moisture in a wide range of temperatures and aridity. Mammals are also defined by their lower jaws being directly hinged to their skulls, by the configuration of bones transmitting sound through their middle ears, and by the presence of a diaphragm separating heart and lungs from the abdominal cavity.

Carnivores

Carnivores occupy the top of the natural food chain and have large brains and learning capacities. Many carnivores are omnivorous and all have three pairs of upper and lower incisors. They play an essential role in maintaining the balance of ecological systems. They keep game populations stable by holding their numbers within the carrying capacity of their habitats and selecting for the most adaptable individuals. Carnivorous mammals usually establish territoritories, which they mark with secretions from anal or scent glands.

Coyote

23 to 26 inches high at the shoulder, it weighs between 20 and 40 pounds, has a grayish to reddish gray coat, and is active mostly at night

Long Tailed Weasel

8 to 15 inches, between 1/4 and 1/2 pound, its black nose and eyes are bright against the brown face, reddish brown above and whitish below. Because of their fierce, adroit and voracious behavior, weasels are effective in controlling the population of mice, rats, gophers and other rodents.

Striped Skunk

13 to 16 inches, between 6 and 14 pounds, it is black with two broad white stripes that run up its back and meet on its head. After warning behavior like foot-stamping, skunks spray a yellow liquid with an offensive odor up to twelve feet. It is produced by glands on either side of the anal opening. The odour arises from the decomposition of certain organic sulfur-containing compounds in the liquid.

Raccoon

Distinguished by a masked face and long, banded tail, it has five-clawed toes on each foot and walks flat on the soles of its feet. It may den in hollow trees, caves, or burrows in the ground. Raccoons are social and stay in family groups; they are nocturnal.

Badger

16 to 28 inches, between eight and 25 pounds, its flattish body has short, bowed legs, shaggy grayish fur, and a white stripe from shoulder to snout. It is active both night and day. It frequently digs in California ground squirrel colonies.

Gray Fox

14 to 15 inches high at the shoulder, between seven and 13 pounds, it is grayish above and reddish below and on the back of the head. It is active mostly at night.

Mountain Lion, Puma, Cougar

38 to 72 inches, between 75 and 275 pounds, it is tawny above and white to buff below. Juveniles are buff with black spotting. The long tail is black-tipped. Mountain lions are mostly nocturnal. They sound like domestic cats but louder; their mating call is a harsh scream.

Bobcat

24 to 44 inches between 14 and 68 pounds, tawny-colored with short, stubby tail, its ears are somewhat tufted.

Bats

Bats have elongated hand bones and muscles covered by a membrane of skin that resembles wings. They are able to walk and climb as well as fly. They may swing from branch to branch. At rest, they hang upside down by their feet. Their eyes are small, and they have poor vision. However, they have highly developed echolocation, projecting through their noses and/or mouths 30 to 60 squeaks per second which is inaudible to humans. They live up to 20 years. They are insectivorous and can be seen at dusk catching bugs while flying over ponds, woodlands, and grasslands.

Pallid Bat

The pallid bat has big ears. It is cream-colored or beige above and almost white below. Active at night, it eats a variety of insects, as well as scorpions and lizards.

Rabbits and Hares

Rabbits and hares have two pairs of upper incisors which continue to grow but are worn down by use, long ears, and hind legs adapted for jumping. Their eyes bulge to the sides of their heads, providing them with a wide field of vision that protects them from predators. Their sense of smell is well developed. They sense vibrations in the ground and thump with their hind legs to communicate with one another. They are grazers.

Desert Cottontail

With a body, 12 to 13 inches and 2 to 3 inch tail, this rabbit is buff-brown above and white below, and it has moderately long ears. It is most active at dawn and dusk.

Black-Tailed Hare, Jack Rabbit

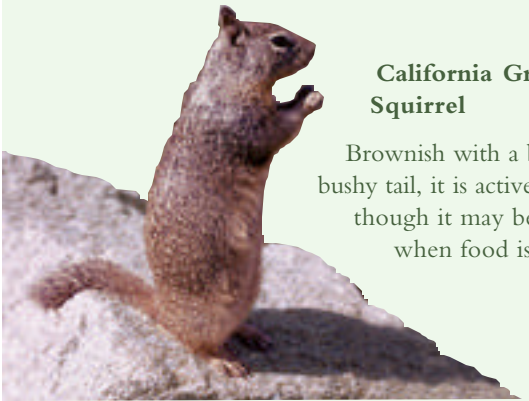
It is sandy-gray peppered with black above and white below, and it has very long ears.

Rodents

Rodents are the most numerous and diverse group of mammals. They have only two pairs of incisors, upper and lower. They have no canines before the molars, only a gap. As in rabbits and hares, the continually growing incisors are maintained by gnawing. Rodents' eyes bulge from the sides of their heads which permits them to see in front of and behind them.

Western Gray Squirrel

Grayish with white belly, it has a long, bushy tail banded in gray, white, and black. It is active year-round, especially in early morning and late afternoon. It makes large, round, hollow nests of leaves.



California Ground Squirrel

Brownish with a brown-gray bushy tail, it is active year-long, though it may become dormant when food is scarce and/or temperatures are extreme, especially in late summer. It burrows in the ground creating a central entrance mound from which radiate numerous pathways, and usually prefers heavily grazed pastures.

Pocket Gopher

Though active day and night, it is seldom seen, as it lives almoster entirely derground. However, mounds of dirt covering its burrow entrances can often be observed in moist moderate soils.

Deer mouse

With a 3 to 4 inch body and 2 to 5 inch tail, the deer mouse is gray-reddish brown above and white below. Its tail is bicolored and short-haired. It has two rows of cusps on its teeth and has internal cheek pouches. It is active yearlong and is nocturnal.

Dusky-footed woodrat

With a six to seven inch body and a 6 to 12 inch tail, the woodrat is buff-brown above and gray-white below. Its face is grayish. Its belly is often washed with a tan color. Its feet are two-toned: a dusky color with white toes. Its tail is brown above and lighter below. Mostly nocturnal, it builds elaborate stick houses on the ground or in trees. Woodrats love anything shiny. They eat green vegetation, as well as seeds, fruit, and nuts.

Marsupial

Marsupials are distinguished by the fact that females have no placenta, but rather a pouch in which newborn embryos and older juveniles are nourished and carried.

Opossum

It is the size of a house cat. The fur on its back is white, brown or blackish. Its long, naked, prehensile tail is conspicuous. The opossum is active yearlong, at night. It inhabits moist woodland and brushy habitats in riparian, woodland, scrubland, and urban communities. Females have no placenta, rather a pouch

in which newborn embryos and older juveniles are nourished and carried.

Even-Toed Hoofed Mammal

Even-Toed Hoofed Mammals are herbivorous, and their molar-like teeth teeth are well adapted for grinding vegetation. They have a cartilaginous pad instead of incisors at the front of their upper jaw. Males have bone antlers that are shed each year and become larger and have more points as the individual reaches maturity. Females are generally smaller than males. Fawns have spotted coats.

Mule Deer, Black-Tailed Deer

It is three to six feet in length. Males weigh between 110 and 475 pounds, females between 70 and 160 pounds. In summer mule deer are reddish or yellowish brown above; in winter grayer above and are creamy-tan below. The tail is white above and tipped with black (mule deer) or is blackish/brownish above and to the tip (black-tailed deer). Fawns have spotted coats. Deer are active yearlong, day and night.

Reptiles

The class of reptiles is more than 300 million years old and includes the dinosaurs. Birds and mammals both evolved from reptiles. Their brains are smaller in relation to their size than those of mammals. They are distinguished by having dry scales covering their bodies. They share with animals higher on the evolutionary scale the method of reproduction requiring the male to place sperm inside the female. The internal body temperature of reptiles is not constant, but is altered by that of the environment so that they become dormant when cold. Reptiles produce eggs with a special "amniotic" membrane which protects them in arid conditions.

**Western Fence Lizard,
Blue-Bellied Lizard**

Between two and three inches, black grey or brown blotched back with blue along the sides of the belly, it has keeled scales over all its back and tail. Its young hatch from eggs.

Horned Lizard

Also often called "horny toads," they are armed with sharp spines atop their heads and sharp scales on their backs. The coast horned lizard ranges from two to four inches long. It has large scales along the rear margin of its head.

California Alligator Lizard

Its body measures between three and seven inches, its tail between five and eight inches. Because of its small legs and the way it moves, it is often mistaken for a snake. When caught it can shed its long tail and a grow a new one. The shed tail often wiggles for several minutes after it has been broken off.

Gopher Snake

36 to 100 inches in length the coloration of its back may resemble that of a Western rattlesnake: yelllowish or cream-colored with dark blotches. It preys on rodents.

California Red-Sided Garter

18 to 52 inches long, it has yellow or white stripes on its back and sides. It feeds upon earthworms, frogs, fish, and mice. It senses odors with its red forked flickering tongue and exudes a foul smelling discharge if handled. Young are born alive in litters of 20 to 40.

California Kingsnake

Banded in black or dark brown and white or pale yellow, this snake ranges from 30 to 82 inches in length. It is called "Kingsnake" because it eats other snakes, including rattlesnakes, to whose venom it is immune. It locates its prey at night by odor and seizes and crushes its victims by constriction. It defends itself by curling its body into a ball surrounding its head and hurling odiferous secretions and excrements at its attackers.

Western Rattlesnake

It has a 15 to 65 inch heavy, dark-blotched body with a light stripe that runs from behind its eye to the corner of its mouth and a triangular-shaped head. Its poisonous, long, hollow fangs fold back into its mouth when not in use. The rattle, at the tip of the tail, is made of a series of loose-fitting horny segments. Up to six segments can be added to the rattle each year, depending on the availability of food.

Southwestern Pond Turtle

It is four to eight inches long, olive green, dark brown or black, with no distinctive colors on its shell. The species is in serious decline to due losses of wetland habitat.

Amphibians

Amphibians can live both in water and on land, hence the Greek root of their name meaning "both" and "life." Amphibians originated as the first life forms to emerge from the water, and reptiles evolved from them. They have since developed new adaptations to the environment including mucus glands which keep their skin moist. Destruction of habitat caused by acid rain, global warming, and ozone depletion in recent years have contributed to a dramatic reduction in the population and distribution of many amphibian species.

California Newt

Two to three inches long, it is brown-tan above, yellow-orange below and has rough, dry skin when on land and smooth, swollen skin in water, where it breeds. It eats earthworms, snails, slugs, sowbugs, and insects.

Monterrey Salamander

One to three inches long, it has a reddish-brown back with orange sides and a pale belly with fine black specks. Its tail appears swollen as its body is constricted at the base of the tail. If injured, it may drop its tail. The tail exudes a sticky, milky toxin.

Pacific Tree Frog

One to two inches long, it is slender-waisted, long-legged with a large head and rounded snout. Prominent adhesive toe pads are climbing. It changes color rapidly. Its are tinged in yellow.

Western Toad, California Toad

Two to five inches long, it has a white stripe down its back. It doesn't cause, but has warts and may be tinged with dark blotches.

California Red-Legged Frog

Two to five inches long, it is red over a yellow ground on the lower abdomen and ventral surface of its hind legs. It often has a blackish mask bordered by a whitish jaw stripe. It eats insects and small crustaceans and inhabits riparian communities in quiet pools of streams and ponds.

Fish

Fish are cold blooded animals with backbones that live in water. They breathe through gills which extract the oxygen dissolved in the water. In place of arms and legs they have fins. Most fish are covered with overlapping scales, which keep growing in rings like those of trees as the fish increases in size. Most fish keep growing as long as they live.

Fish swim by moving their bodies sideways and waving their tails. They have streamlined bodies to speed them through the water, eyes that are flat, gills covered with flaps, and skin covered with a lubricating coat of slime.

Bullfrog

Three to eight inches long, it is green or brows above and whitish below. Its legs are banded and blotched in greyish brown. It lives four to five years. A bullfrog can leap up to six feet. It is territorial and protects its domain with calls, displays and attacks. Males and females call to one another at breeding time. It is not native to California and its population can grow out of balance with the ecosystem since their toxic skin secretions deter predators.

Rainbow Trout

This native of the western states has been transplanted throughout the continent. It can reach 40 inches but is much smaller in campus creeks. It appears metallic blue above and silvery white below with small dark spots on the back and sides and a distinctive red band along its sides. It spawns every spring and its life expectancy is four to five years.

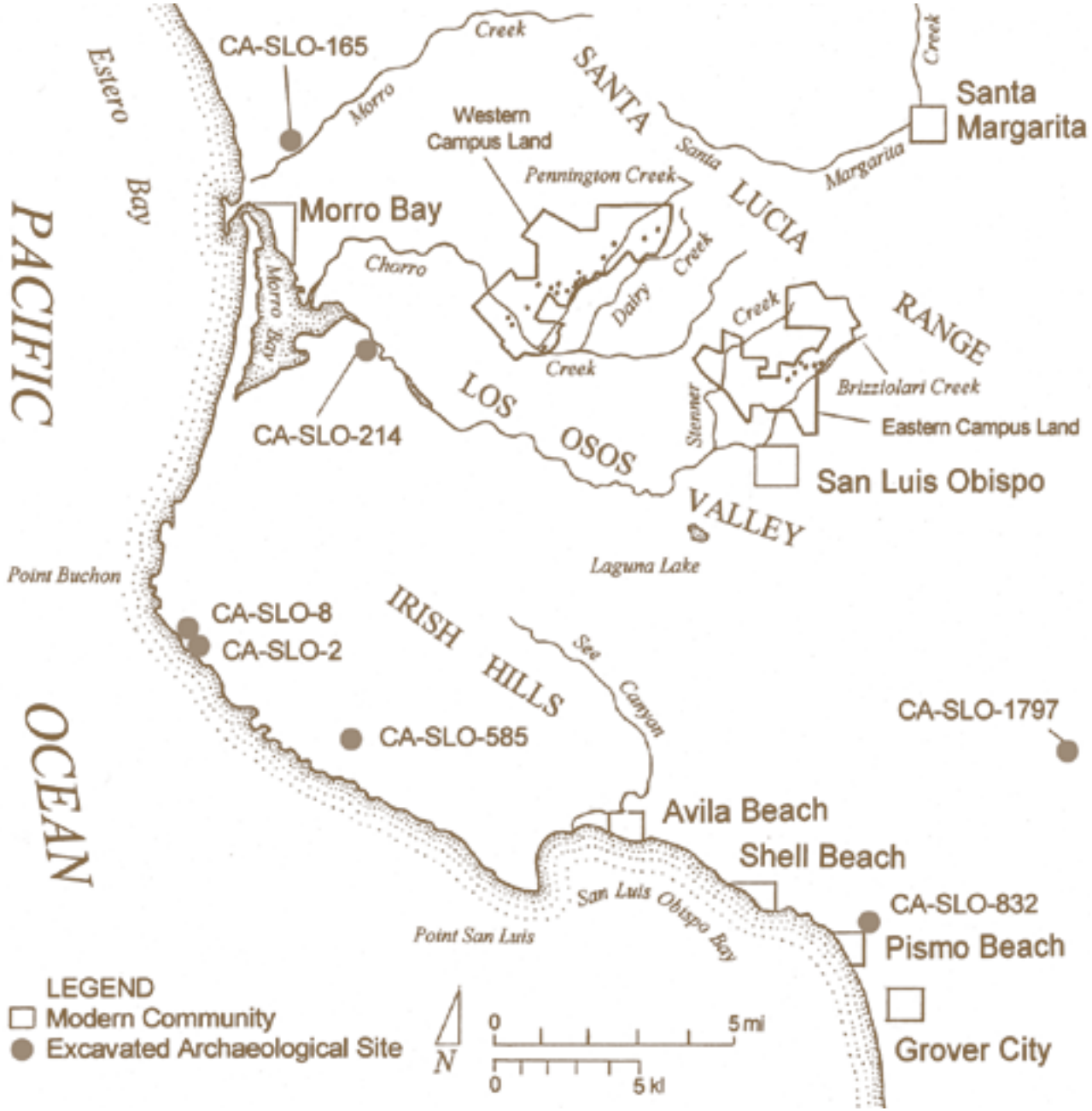
Speckled Dace

This fish, loosely classified as a minnow, reaches a maximum length of five inches. It has dusky olive black and grayish green sides with a dark stripe and speckles or blotches. This is an important source of feed for larger fish, and some subspecies are threatened.

Steelhead

It begins life in freshwater, rears in streams, and then migrates to the ocean where it spends anywhere from one to five years and finally returns to its "home stream" to spawn and complete the cycle. Resident rainbow trout are the non-migratory form of steelhead, opting to remain in freshwater for their entire life.

This selection of pictures and descriptions of Wildlife on Cal Poly Land is indebted to the work of several students in the Department of Biological Sciences. Two mammal surveys were conducted at Peterson Ranch in 1998 by Cal Poly students Anthony F. Giordano, Cary Gudgeon, and Cara Drake. A total of 23 species of mammals were detected in these surveys. A reptile and amphibian survey was also conducted on Peterson Ranch in 1998 by Cal Poly student Carrie Black. She found a total of six species of reptiles and four species of amphibians. The Federally listed Red-legged frog (*Rana aurora*) was observed in this riparian area. The descriptions of animals are adapted from a 1997 Master's Thesis in Biological Sciences entitled, *Poly Canyon Revisited: A Field Guide*, with permission of author, Danielle DeRome.


CA-SLO-165
Estero Bay
PACIFIC OCEAN
Morro Creek
SANTA LUCIA RANGE
Santa Margarita Creek
Santa Margarita
Western Campus Land
Pennington Creek
Morro Bay
Morro Bay
Charro Creek
Dairy Creek
Creek
Creek
Brizzolari Creek
Eastern Campus Land
Stenner Creek
CA-SLO-214
LOS OSOS VALLEY
San Luis Obispo
Laguna Lake
Point Buchon
CA-SLO-8
CA-SLO-2
IRISH HILLS
See Canyon
CA-SLO-585
CA-SLO-1797
Avila Beach
Shell Beach
CA-SLO-832
Pismo Beach
San Luis Obispo Bay
Point San Luis
Grover City
LEGEND
Modern Community
Excavated Archaeological Site
N
0
5 mi
0
5 km

Archaeology and Prehistory: 8300 B.C.- A.D.1587

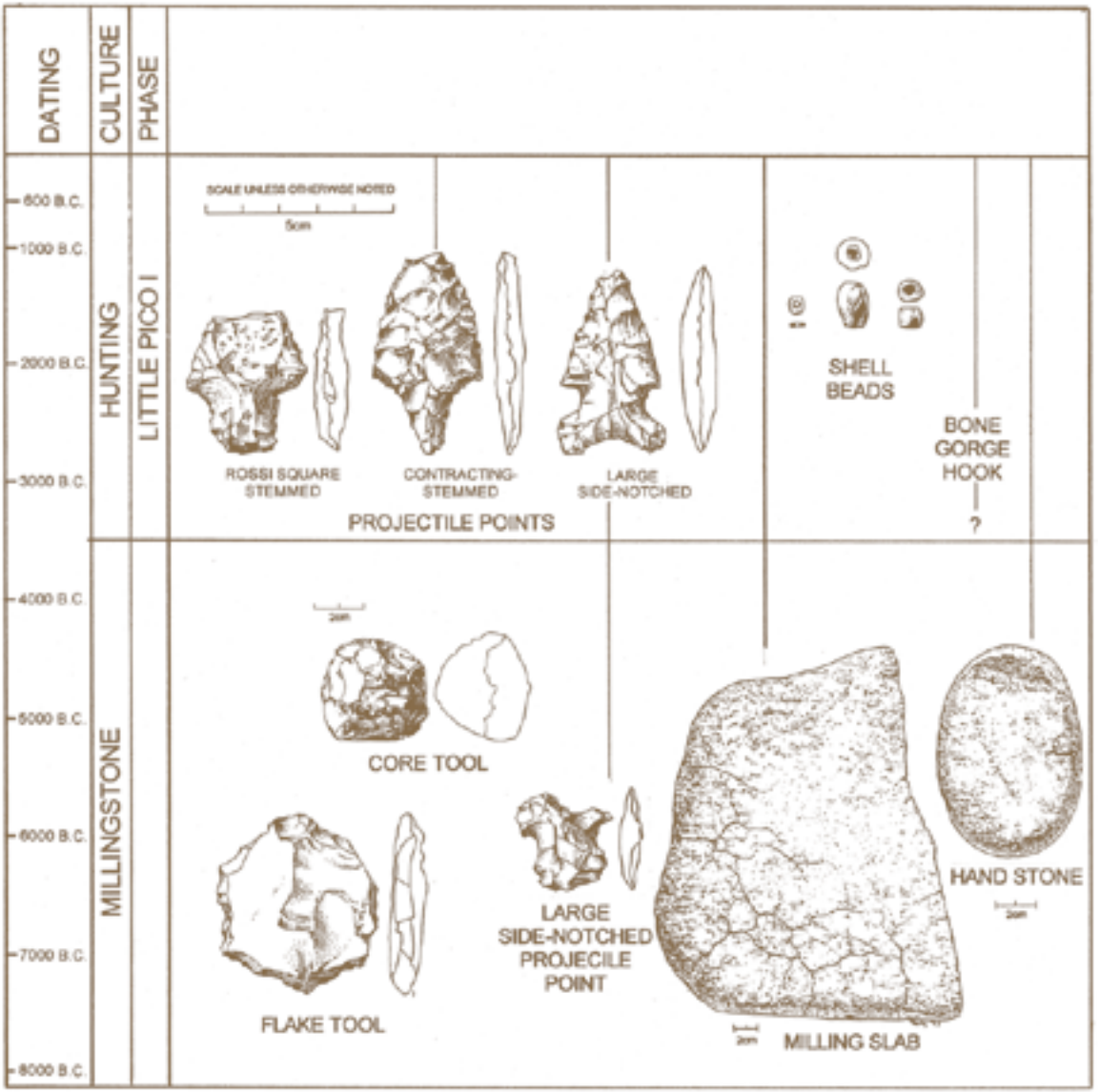
Terry Jones, Robert Weaver, and Leanna Flaherty, Social Sciences Department

Most students will go through their entire academic careers at Cal Poly without ever discovering that campus lands contain remnants of prehistoric human occupation dating to perhaps 10,000 years ago. Although archaeological sites on the Cal Poly campus have been studied only minimally, research in the surrounding area has shown that San Luis Obispo County harbors a rich archaeological record with significant antiquity. Study of the region's prehistory is an ongoing process that involves continual reassessment as new sites are discovered and new excavation findings are generated. Inventory of archaeological sites on Cal Poly Land is part of this larger research process.

Archaeology in San Luis Obispo County

The San Luis Obispo area was generally overlooked when archaeological studies began in California at the beginning of the 20th century. Researchers from U.C. Berkeley at that time focused on sites in the San Francisco Bay area, with work soon following in the vicinity of Santa Barbara. The latter became an early focus of archaeological study in part due to the cultural sophistication of the hunter-gatherers who inhabited the area at the time of historic contact, the Chumash. Speakers of the Chumash language also inhabited most of San Luis Obispo County, including the Cal Poly campus, but local Chumash culture was less complex and population levels were considerably lower than in Santa Barbara. The rich archaeological record of San Luis Obispo County was not discovered until much later when federal and state historic preservation laws passed in the 1960s and 70s forced government agencies and developers to conduct archaeological studies. Since the 1960s, excavations have been conducted regularly in San Luis Obispo County at locations where sites have been threatened by proposed development. Also during the 1960s, Cal Poly hired its first archaeologist, Jay von Werlhof, as a faculty member in the History Department.

Archaeological sites off campus are designated by three-digit numbers, and sites on campus are depicted by dots.

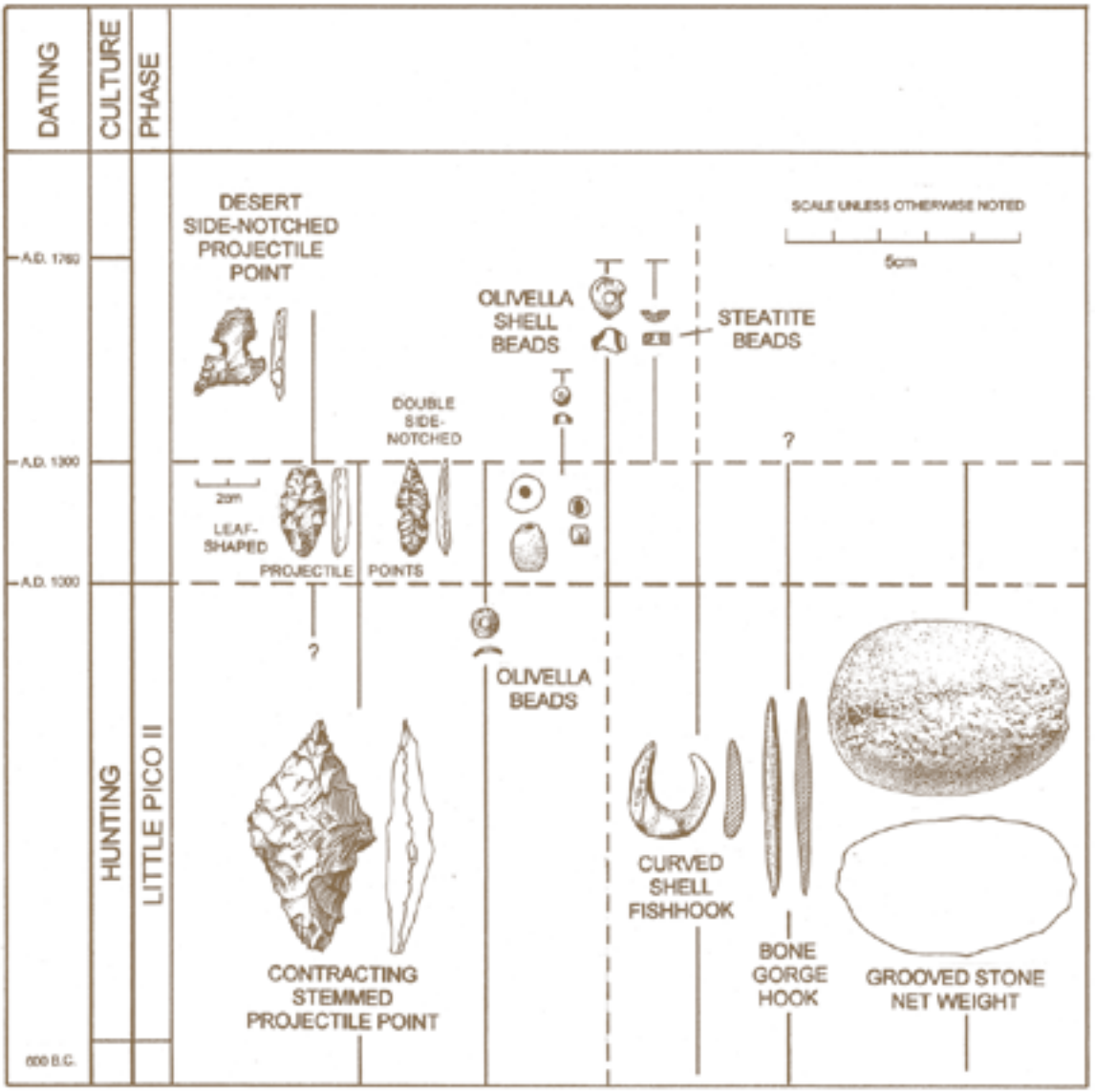

DATING
CULTURE
PHASE
600 B.C.
1000 B.C.
2000 B.C.
3000 B.C.
4000 B.C.
5000 B.C.
6000 B.C.
7000 B.C.
8000 B.C.
HUNTING
MILLINGSTONE
LITTLE PICO I
SCALE UNLESS OTHERWISE NOTED
5cm
ROSSI SQUARE STEMMED
CONTRACTING-STEMMED
LARGE SIDE-NOTCHED
PROJECTILE POINTS
SHELL BEADS
BONE GORGE HOOK
?
CORE TOOL
FLAKE TOOL
LARGE SIDE-NOTCHED PROJECILE POINT
MILLING SLAB
HAND STONE

Field classes supervised by von Werlof resulted in discovery of the first archaeological sites on campus. Following von Werlof's departure in the 1970s, survey of campus archaeological sites has occurred sporadically in response to development projects. The net results of the archaeological studies completed during the last three decades have been a significant advance in understanding of local prehistory and a partial inventory of archaeological sites on Cal Poly Land.

San Luis Obispo Prehistory

San Luis Obispo prehistory can be described as a succession of three prehistoric cultures: Milling Stone (8300-3500 B.C.), Hunting (3500 B.C. -A. D. 1250), and Canaliño (A.D.1250-1769). The age of the Milling Stone Culture and its heavy representation in San Luis Obispo County have only become clear in the last few years. An important discovery at the Diablo Canyon Nuclear Power Plant site in the 1970s suggested that human occupation in the area dated to between 8000 and 7000 B.C., but this finding was not immediately accepted by all California archaeologists. Since then, antiquity in this range has been corroborated by findings from a number of other sites including one near Pismo Beach, and another near the community of Paso Robles. Also important are findings from another site situated midway between San Luis Obispo and Arroyo Grande, known as Cross Creek (CA-SLO-1797). Investigated in 1996 for the State Water Project, Cross Creek produced a basal radiocarbon date of ca. 8300 B.C., making it one of the oldest coastal sites in western North America. More importantly, the site's stone tool assemblage included an array of grinding tools and crude cobble choppers, typical of the California Milling Stone Culture. The Cross Creek Site is the oldest manifestation of the Milling Stone Culture yet discovered. The coastal and inland setting of these and other Milling Stone sites and the large numbers of grinding tools suggest an adaptation that emphasized shellfish and vegetable resources with little use of large game animals.

Around 3500 B.C. the Milling Stone Culture was replaced by the Hunting Culture. Marked by dense accumulations of stone projectile points, the Hunting Culture represents a society that was much more intensely involved in hunting and fishing than the earlier Milling Stone people. Good examples of hunting culture sites are known in Diablo Canyon, Morro Bay, and the northern San Luis Obispo coast near Cambria. Hunting Culture sites also show evidence of wide ranging trade in the form of volcanic glass (obsidian) from distant sources in the eastern Sierra Nevada and the North Coast Range. Whether the Hunting Culture represents an adaptive out-


DATING
CULTURE
PHASE
A.D. 1750
A.D. 1300
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600 B.C.
HUNTING
LITTLE PICO II
DESERT SIDE-NOTCHED PROJECTILE POINT
SCALE UNLESS OTHERWISE NOTED
5cm
OLIVELLA SHELL BEADS
STEATITE BEADS
DOUBLE SIDE-NOTCHED
2cm
LEAF-SHAPED
PROJECTILE POINTS
?
OLIVELLA BEADS
?
CONTRACTING STEMMED PROJECTILE POINT
CURVED SHELL FISHHOOK
BONE GORGE HOOK
GROOVED STONE NET WEIGHT

growth by the Milling Stone people or the intrusion of a new population is a topic of ongoing debate.

The local cultural sequence shows another interval of significant change between A.D. 1000 and 1250, when the Hunting Culture disappeared. This period is marked by the appearance of small, light projectile points associated with the bow and arrow, which was a relatively recent innovation in California prehistory. Many new sites appear in the area at this time, including some on the shoreline of Morro Bay. The fish, bird, sea mammals, and shellfish of Morro Bay were important resources throughout the regional prehistory. Sites dating to the Canaliño Period on the bay in many cases are not the same ones that were inhabited by Hunting Culture peoples, suggesting a disruption in settlement around A.D. 1250. The abandonment of sites at this time and movement to new ones may have been related to droughts during the Medieval Climatic Anomaly (A.D.800-1350), when Morro Bay may have provided a refuge for prehistoric peoples. Whether the disruption marks the initial arrival of Chumash speakers into the area or ongoing ethnic presence by a Chumash group that had arrived earlier is unclear. When the first European seafarers passed along the shoreline of San Luis Obispo County in 1587, however, settlements of Chumash people were noted at San Luis Obispo Bay and Morro Bay.

Archaeological Sites on Cal Poly Land

The former presence of the Chumash and earlier prehistoric cultures on Cal Poly Land is represented by 24 known archaeological sites. Since the campus has not been completely inspected archaeologically, it can be assumed that more sites remain to be discovered. It is likely that one or more sites were destroyed or buried by the initial development of Cal Poly facilities. Of the sites so far discovered, very little is known, but surface finds and limited excavation suggest they span the full temporal range of San Luis Obispo prehistory. The most common sites are scatters of chipping debris—small flakes of stone that represent places where prehistoric people manufactured stone tools. A number of these have been recorded in the western acreage of the campus along Pennington Creek. More substantial sites are marked by what are known as "middens" (deposits of prehistoric garbage). A few such sites, marked by blackened soil (the result of prehistoric campfires), shells (the remains of shellfish collected from Morro Bay, transported inland, and eaten), and pieces of animal bones (from marine and terrestrial animals that were hunted and eaten), occur on the lands adjacent to campus. Many are found along the shore of Morro Bay as well. Also common at Cal Poly are bedrock mortars, cup-like depressions that native people ground into rock outcrops. These features were used in conjunc-

tion with stone pestles to process vegetable foods such as acorns, pine nuts, and grass seeds. Bedrock mortar sites are known from both the Pennington Creek drainage and Poly Canyon. Because archaeological sites are non-renewable resources that can be subjected to vandalism, exact site locations must be kept confidential.

Bedrock mortars in Horse Canyon

History

Alison Preston, English Department

By the time Cal Poly was founded in 1901, the land being broken for the first campus building had already experienced over 10,000 years of human use and the profound effects of human alteration. In order to tell the full story of Cal Poly, one must also take into account the history of its land. For millennia, the region now encompassed within Cal Poly's boundaries hosted an array of physical ecosystems and native peoples. These inhabitants interacted with the environment and became an important evolutionary component in the fashioning of Cal Poly's contemporary landscapes. To this day, this legacy is still evidenced in the landscape patterns on the non-cultivated lands and in the fertile fields and pastures on which Cal Poly has built its reputation. What we associate with the contemporary landscape is actually the cumulative effect of numerous environmental fluctuations, human intervention in the physical processes, and the impact of the ecological setting on its inhabitants. To tell the story of Cal Poly Land is to relate its history, the physical setting of the land itself, and the changes both intentional and unintentional made by its human inhabitants.

The Chumash Legacy, ca. 8,000 B.C. - 1587 A.D.

As far back as 10,000 years ago, paleo-Indian peoples occupied the land in the vicinity of Cal Poly and began the process of humanization revealed in its contemporary setting. These early inhabitants were skillful hunters and gatherers who exploited the flora and fauna of the region. Even if they never set foot within the boundaries of Cal Poly, the effects of their modifications would have been manifested in campus ecosystems.

The final native group to occupy and use Cal Poly Land was the Obispeño Chumash. Their territory extended from the coast, inland to the Santa Lucia Mountains in the east, Point Estero in the north, and to


121°
35°
Salinas R.
Obispeño
tilhini
Kulait^hqepe
Pismo
pismu?
Tematatimi
Huasna
(?a)wasna
Walekhe
Nipomo
nipumu?
Setjala
kasmali
Pacific Ocean
Lospeo
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step
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Purisimeño
Na Upo
Amuwu
Lompoc
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Santa Ynez R.
Nocto
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Tepusquet
Jalama
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Tejas
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kumqaq
0 10 20
Miles
Kilometers
0 10 20

a shared boundary with the Purisimeño Chumash at approximately Pismo Beach in the south. This was a habitat of great variety at the interface of the northern and southern plant associations and warm-water and cold-water marine life. Due to their fortuitous location, from the earliest times the Chumash enjoyed an abundance of wild plant foods and land and marine mammals. Their resource strategies involved seasonal migrations between the coast and the interior. For the most part, they occupied the coastal areas during the winter months, and in the late spring travelled inland, following their seasonal migration routes along Chorro and San Luis Obispo Creeks. Nonetheless, the abundant resources within Cal Poly's frontiers were easily accessible and intensely used. Archaeological evidence has revealed numerous stone mortars employed for grinding acorns and other seed in the vicinity of the campus around where the Chumash would have established their seasonal encampments.

Despite many prevailing myths about the Native Americans living in harmony with the plants and animals of the land, the Chumash were in fact a highly complex non-agricultural group adept at manipulating the environment to their best advantage. Some observers noted with contempt that they appeared merely to wander around haphazardly picking up whatever plants they might find. However, the Obispeño Chumash were actually better off not utilizing traditional methods of agriculture. Since rain seldom fell during the growing season, agriculture would have been difficult at best and an inefficient expenditure of valuable resources. To someone experienced with and able to exploit the natural environment, there

"Gathering Acorns"

Map of Chumash territory.

was an abundance of plant and animal resources that could be harvested for food, fuel, material items, and building materials.

The Chumash also actively worked to modify their environment and increase its productivity. One of their most effective techniques was the periodic burning of vegetation. Periodic burning allowed the Chumash to manipulate their environment, encouraging the growth of desirable plants, increasing plant diversity, and enhancing the conditions for essential acorn-producing oaks. At the landscape level, intentional burning structured ecosystems into patterns whose legacy is still apparent in the non-cultivated lands of Cal Poly.

To the eyes of a Chumash, the hillsides around Cal Poly would have looked very different than they do today. The entire region would have appeared much more open, trees and chaparral would have been limited, and the hillsides would have been dominated by native grasslands abloom with seasonal wildflowers, perennial bunch grasses, and broad-leaved native annuals. Even in the oak woodlands, the dominant characteristic would have been that of a prairie. The observations of the first Europeans to witness this land are full of extravagant praise for the abundant wild grains and lush meadowlands around the settled areas. Beginning shortly after Columbus, the intensity and nature of the human interaction with Cal Poly's ecosystems would profoundly change owing to consequences of colonialism. Nevertheless, the environmental legacy of the Chumash people continues to endure.

The Contact Period of Spanish Exploration, 1587 - 1769

The arrival of the first Spanish explorers initiated another stage in the evolution of Cal Poly's land. Beginning in 1587 and prior to 1769 and the first California settlements, the coastal area of San Luis Obispo was visited by periodic landfalls of Spanish and other old world explorers. During this initial contact period, explorers inadvertently brought with them foreign germs and the seeds of various weeds and grasses which were conveyed from the old world in their ships and food supply and disseminated in the new world via their clothes and animals. The arrival of the Spanish on the Central Coast, however, had unforeseen ecological consequences that initiated a period of cultural and environmental turbulence. The land where the Chumash had lived was to undergo another stage of its evolution.

The introduction of the exotic flora that arrived with the first Europeans rapidly supplanted the native Chumash gardens. Many of the introduced species proved hardier than their native cousins, and found the Mediterranean climate of California particularly adaptable. In fact, several

Map of Spanish Exploration

hundred species of foreign weeds and grasses were eventually introduced to California from South America and the Old World, and even the ostensibly natural landscape that is recognizable today is far from the native one. Furthermore, the introduction of Old World diseases decimated the Chumash population, and contributed to the cessation of traditional land management practices. As their population declined, many villages became sparsely populated, and the remaining Chumash were unable to maintain their crucial role as ecological managers, thus allowing the environment to shift from one in which the Chumash dominated to one that was vulnerable to further cultural and ecological changes that would occur as a result of missionization. The impact would eventually alter the appearance of the Chumash's well-tended garden.

The Mission Lands, 1769 - 1834

In 1769, the Spanish took possession of California and began the settlement process that included mission establishment. The mission at San Luis

Mission Lands

Obispo was founded in 1772 as a means of colonizing the frontier lands – including what is now Cal Poly – and converting the local Chumash to become loyal followers of the church. From the outset, Mission San Luis Obispo was a center of ranching and agricultural production. These lands were used as crop land and ranch land, and for the first time established the precedent of San Luis Obispo as a rich agricultural region. Grazing became the predominant enterprise, and in its prime, the mission land held 80,000 head of cattle, over 70,000 sheep, 5,000 to 6,000 horses, and an equal number of mules. The mission lands would have had the appearance of a great unregulated pasture: none of the range would have been fenced, and the stock was allowed to graze at will.

Since the land the Chumash tended had never experienced the impact of domesticated animals, dramatic changes resulted. The grasslands that the Chumash cultivated would have made excellent fodder for the grazing animals, which left trampled terraces on the pristine hillsides and reduced the productive grasses to stubble. Nevertheless, the mission fathers had a different aesthetic: the productivity of their lands and the size of their

herds made them the envy of all the other missions. Due to the abundant harvests of wheat and numerous cattle and sheep, it was one of the wealthiest missions in all of California. In time, this attitude continued as the Chumash lands were considered a resource to be utilized by those who could most effectively take advantage of their economic production.

The Mexican Ranchos, 1834 - 1848

Secularization of the missions occurred in 1834, twelve years after Mexico annexed California as a territory in 1822. Subsequently, the Mexican government granted the mission lands to applicants of Spanish and Mexican descent as well as to those Yankees and other foreigners who could establish their qualification. San Luis Obispo county hosted thirty-five land grants, three of which were located on land that is currently part of Cal Poly: Rancho San Luisito, granted to Guadalupe Cantua in 1841, which consisted of 4,389 acres; Rancho El Chorro, granted to Captain John Wilson and his partner James Scott in 1845, which consisted of 3,167 acres; and Rancho Potrero de San Luis Obispo. Approximately two thousand acres of the latter had originally been acquired by Estevan Quintana in the late 1820s; however, a 3,506 acre parcel comprising the same land was later granted to Maria Concepcion Boronda in 1842. For a number of years Boronda's title was in question, and Quintana was able to retain control of the land, later passing it on to his heirs.

The Ranchos continued many of the agricultural practices established during the Mission period. Ranching was still the predominant industry, and the three ranchos grazed thousands of head of cattle, horses, and sheep. During the Gold Rush, the cattle industry boomed as the ranchers strove to supply the influx of prospectors and immigrants with food and supplies. Then as the mines began to play out and the wave of immigrants decreased, severe floods occurred in 1861 and 1862, followed by even more disastrous droughts from 1862 through 1864. The combination of the dwindling Gold Rush market, natural disasters, and continued overgrazing contributed to the depletion of the grasslands, which were unable to support the excessive number of herds. Furthermore, many of the rancheros had neglected to modernize their methods, and without diversified crops or herds they suffered irreparable financial losses. Meanwhile, ongoing conflicts regarding property rights and boundaries often carried on for years while the estates dwindled and land was lost to pay attorney's fees. As a consequence, all the old Californio families were ruined, and many forced to sell their once promising ranchos at a substantial loss.

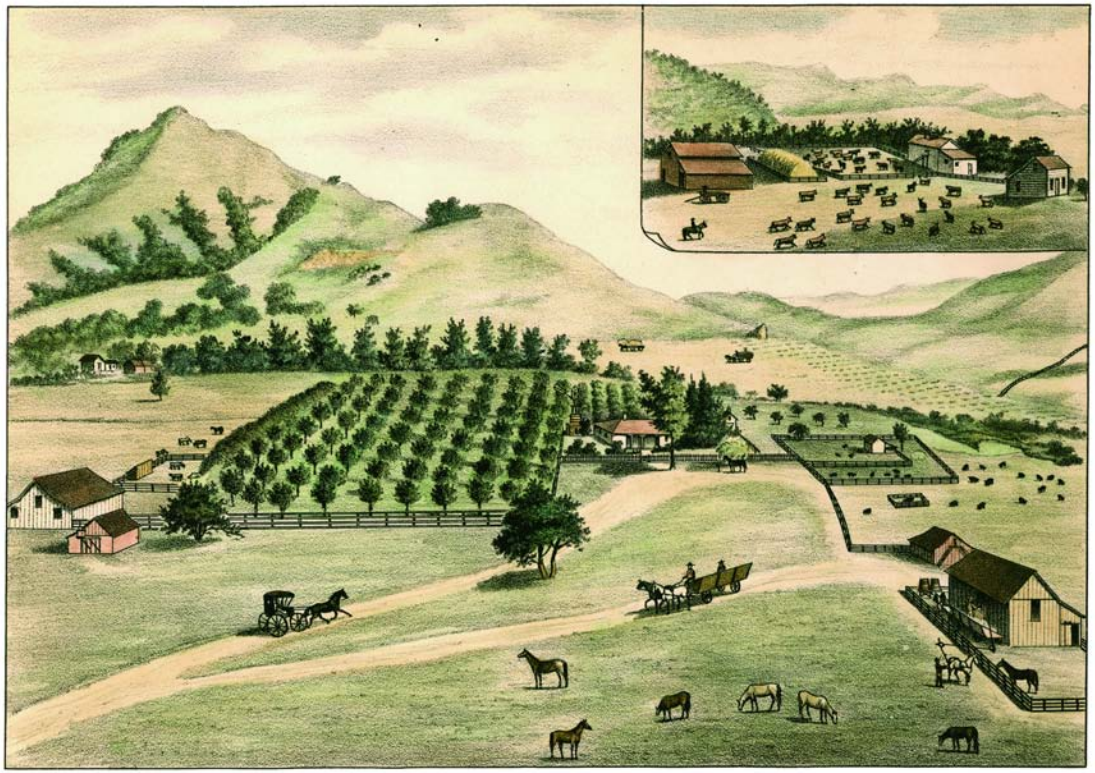
35. MEXICAN LAND GRANTS—SAN L

IS OBISPO

San Luis Obispo County

Grant Number	Name	Acres
339	Arroyo Grande	4.437
318	Ascunción	39.224
317	Atascadero	4.348
332	Bolsa del Chamisal	14.335
331	Cañada de los Osos y Pecho y Islay	32.451
314	Cholame (Monterey)	26.622
337	Corral de Piedra	50.911
342	Cuyama (Santa Barbara)	48.828
341	Cuyama (Santa Barbara)	22.193
328	El Chorro	5.167
353	Guadalupe	45.682
340	Huasna	22.153
315	Huer-h-uero	15.685
330	Huerta de Romualdo or El Chorro	

Grant Number	Name	Acres
325	Moro y Cayucos	8,845
351	Nipoma (Santa Barbara)	57,888
320	Paso de Robles	25.993
321	Piedra Blanca	48.806
336	Pismo	8.839
334	Ranchito de Santa Fe	166
326	San Bernardo (Cane)	4.379
324	San Gerónimo	8.893
327	San Luisito	4.390
329	Potrero de San Luis Obispo	3.506
354	Punta de la Laguna (Santa Barbara)	26.648
335	San Miguelito	14.198
322	San Simeon	4.469
338	Santa Manuela	16.035



"Chorro Ranch" owned by J.H. Hollister, 1883

American Farms and Ranches, 1848 - 1901

Within a year, Anglo-American investors arrived in the county eager to buy the once profitable lands at bargain prices. A dramatic change in the use and appearance of the landscape occurred as a result. First, the landscape diversified as the more fertile lowlands of the former cattle grazing lands were devoted to agriculture. All manner of irrigated and dryland crops were grown, and orchards and vineyards were established. Second, although stock raising was still important, during these years many of the cattle ranchers made the transition to sheep, which were better adapted to the drier climate and depleted rangelands. Many miles of rock fences were erected to corral the grazing sheep. Third, dairying became extensive as new

Ranch and Residence of Pedro Quintana, 1883

immigrants arrived and found the county one of the finest in the state for that purpose. Although much of the land still remained uncultivated, during this time the landscape began to assume an appearance familiar to many Americans, one with smaller, intensively cultivated fields and orchards, and the surrounding hillsides stocked with sheep and cattle. The orchards and cultivated fields and the permanent fixtures of the dairy and ranching industries represented a long-term commitment of these newcomers to the region and a transition in land use from the great, unregulated cattle pastures predominant during the mission and rancho periods to one with which the county continues to be identified today. The legacy of this period is still evidenced in the remnants of the original

home sites, outbuildings, fence lines, campus property boundaries, and most apparently in the continued land use that characterizes the Cal Poly campus and supports many of its agricultural programs.

The Founding of California Polytechnic School, 1901 - 1903

The impetus for Cal Poly's founding came from Myron Angel, who had come to San Luis Obispo in 1883 on assignment for the Thompson and West Company to write a history of the region to accompany the county atlas. He liked what he saw, a purchased a home and settled permanently in San Luis Obispo. During this decade, the town was already experiencing an influx of growth, and Angel, in conjunction with several of the other town principals, sought a means to increase its influence and prestige. At this time, successful town planning included the triumvirate of industry, agriculture, and education. San Luis Obispo had already achieved the first two, and Angel and the others felt it was time to incorporate the latter. Thus, in 1896, the town leaders introduced the idea to Assemblyman Warren John and Senator Sylvester C. Smith who promptly submitted a bill to found a normal school (or teacher's college) to the State Legislature. However, their proposal was unsuccessful, and the town leaders were urged to consider an alternate proposal for a polytechnic school. This bill overwhelmingly passed both houses of the legislature, and on March 8, 1901 the founding legislation officially creating Cal Poly School was signed.

The final key in assuring the project was the completion of the Southern Pacific Railroad Coast Route from San Francisco to Los Angeles. A mainline railroad had been late in arriving in San Luis Obispo despite its presence in much of the rest of the state decades earlier. The progress of the northern Coast route was hampered by the difficult terrain of the Santa Lucia Mountains, and the arduous task of constructing the seven tunnels through the Cuesta Grade. The work commenced in 1894 when track was laid to San Luis Obispo, but one final obstacle presented itself before the link was complete. Nine hundred thirty-five feet of steel trestle had to be installed over Stenner Creek ninety feet below. The next con-

Construction of Administration Building, 1902

Barley Shocks, 1912

struction goal was to complete the link to Los Angeles, thus making the coast line complete. Finally, in 1901, trains from both San Francisco and Los Angeles came through San Luis Obispo, ending its years of isolation.

The Founding Act of Cal Poly allocated $50,000 for the selection and purchase of a site as well as the construction, furnishing, and initial maintenance of the buildings. In August 1902, the trustees settled upon a 281 acre site located at the northern corner of the city and adjoining the tracks of the Southern Pacific Railroad. The tract offered sufficient acreage for planting and rolling hills suitable for grazing, as well as the additional advantage, the Southern Pacific officials were happy to remark, of providing a pleasant visual diversion to travelers on the railroad. By the following year, the first school building had been constructed and classes were underway. Although not wholly coincidental, the foundation of Cal Poly continued the legacy of agriculture and ranching with which San Luis Obispo had been associated since its mission days.

California State Polytechnic School: The Early Years, 1903 - 1942

Vocational training was the primary aim of the school, and the surrounding land was devoted to the hay, grain, fruit, and grazing for which it was suited. Over the next three decades, the new institute's reputation as an agricultural polytechnic continued to grow. The land that Cal Poly owned was

intensively used for a wide diversity of farming and ranching operations, and the farms subdivided into many units to allow training in the various fields. Nevertheless, Cal Poly again felt the need for expansion, and appealed successfully to the state legislature for further allocations to purchase additional farmland in order to enlarge its campus and accommodate the growing number of student projects. By 1942, Cal Poly encompassed 1,120 acres, and much of the land that currently makes up the main campus was in the possession of the school.

California State Polytechnic College: The Growth Years, 1942 - 1982

During the 1940s, Cal Poly acquired a number of additional land parcels in order to keep pace with increasing enrollment, to further the growth of its agricultural programs and to ensure its mission of learn-by-doing student projects. Meanwhile, Cal Poly itself was changing. During the post-war boom, many military personnel who had been stationed at Camp San Luis Obispo and Camp Roberts returned to the Central Coast to attend Cal Poly. The school experienced an explosive growth during this period: the enrollment in 1933 was 177, by 1948 it was 1,250, and by 1966 it had grown to 7,740 students. This influx of students brought the campus greater recognition, and in 1947 initiated the start of four-year bachelor degree programs. In order to accommodate the growth of both its enrollment and the prestige of its programs, the administration felt the pressure to further enlarge the school. During the years of 1942 through 1958, Cal Poly acquired an additional 1,905 acres from private land holdings. Most of the land parcels acquired during this period was for grazing, agriculture, or dairying.

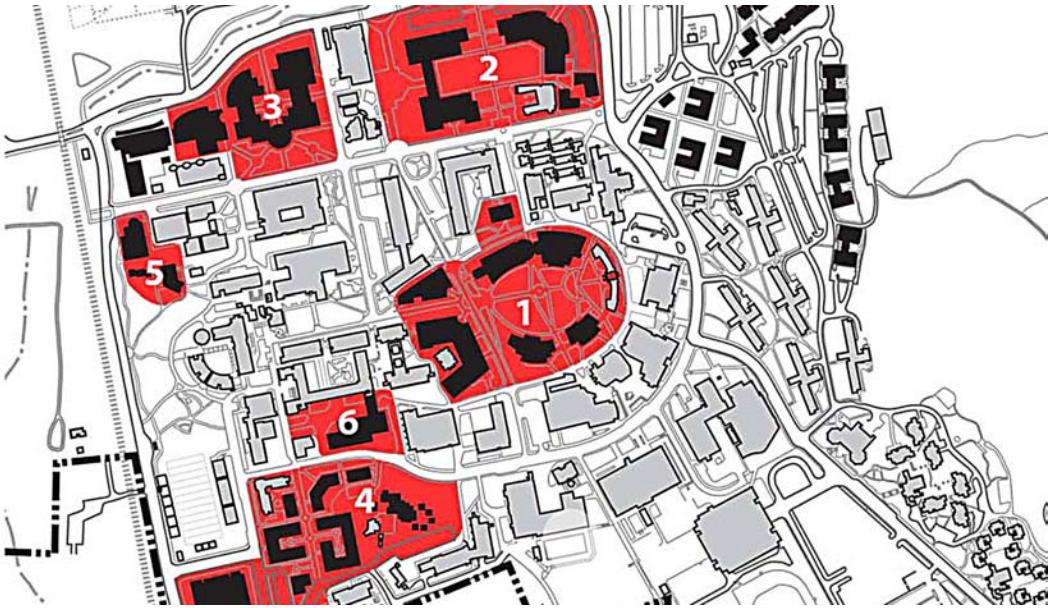
The central campus continued to grow, acquiring its characteristic horseshoe shape, and many new buildings were erected. The loss of former grazing and crop land for buildings and project areas created a need to expand elsewhere; however, contiguous parcels from private holdings were unavailable. The next stage of Cal Poly's growth required lease or purchase from state and federal authorities. Between 1961 and 1968, 3,095 acres, located primarily in the region known as the Western ranches – separated from the main campus by El Chorro Regional Park Camp San Luis, and California Men's Colony– were added for cropland and grazing. In 1982, Cal Poly received its final large acquisition within the county of approximately 743 acres from the U. S. Department of Education, completing the Western ranches. With this acquisition, the land encompassing and surrounding the main Cal Poly campus totaled nearly 6,000 acres, which is now used for a variety of instructional and student projects, agricultural, architectural, engineering, and academic programs.

Aerial view of campus core, 1968

The Present and Future of Cal Poly

After the last major land acquisition, it seemed unlikely that Cal Poly would undergo additional physical expansion due to the lack of affordable, available land within the immediate vicinity of the campus. However, in December 1993, Cal Poly received the 3,200 acre Swanton Pacific Ranch left to the school in the will of Albert (Al) Smith, a 1940s alumnus. The ranch is located 178 miles from the campus and twelve miles north of Santa Cruz. It consists of approximately 125 acres of irrigated crop land, 1,900 acres of rangeland, 500 acres of Timber Preserve Zone used for commercial harvesting, a number of forested areas consisting of second growth redwood and Douglas fir, and a small one-third gauge steam railroad.

Although any further growth is most likely limited, in recent years the main campus has experienced an intensification of land use and facilities. Currently, a Master Plan for the redesign of the



Master Plan proposed campus core, 2001

main campus is being developed.

A projected enrollment increase of 3,000 students over the next twenty years imposes an even greater pressure on the existing campus facilities. An expanded campus core is planned in order to improve the buildings, laboratories, and technology to meet California's demand for a well-educated workforce, particularly in the technological fields. New student housing communities, built at the margins of the campus core, are one of the central features of the plan. The direction and growth of the campus under the new Master Plan take on importance as the complex issues of land preservation and use are matched by the equally complex demands of Cal Poly's future over the next one hundred years.

Agriculture

Rob Rutherford, Animal Sciences Department

Cal Poly Land has been acquired to support our mission as a site of agricultural education. The dual roles of Julian McPhee, who served as the President of Cal Poly from 1933 to 1967 and at the same time as Chief of the State Bureau of Agricultural Education, demonstrate this mission.

Agriculture has traditionally been defined as the production of food and fiber. Those involved with traditional agriculture are manipulating the ecosystem processes of water cycle, mineral cycle, and solar energy flow in order to create products desired by society. The only sustainable source of wealth is that which evolves from the photosynthetic process. Because of the great efficiencies which have come as a result of advances in technology, most citizens are far removed from agriculture and therefore not aware of how it remains key to their survival. Allan Savory states, "All civilization is city-based, and therefore, our goal is to create sustainable cities. But cities can only be sustained in the presence of viable rural economies. When agriculture fails, all business fails."

Professor Rollin Strohman and students producing GPS topo maps at beef unit

Campus farm from Cheda Ranch

Historical Overview

From its inception, a tenet of Cal Poly was to train the hands as well as the mind. This training occurred in a laboratory called the Cal Poly farm. Students were directly involved in growing crops and livestock and marketing them as a part of their regular class programs. In the early years, virtually all of the production from the farm was consumed by the campus community. As with agriculture in general, the producers soon created more than the local campus could consume, and products were marketed in the local community.

Cal Poly Farm 1908

Because technology was relatively simple, the crops and animals produced on the campus were typical of the area – grains, vegetables, deciduous fruits, dairy and beef cattle, and sheep.

As irrigation technology evolved, Cal Poly was able to initiate the growing of crops that had only been cultivated elsewhere, such as citrus, alfalfa, and kiwi fruit. As environmental control technology became available, some farmland was dedicated to buildings that house swine, dairy cows, and poultry. In addition to adopting tested farming techniques, agriculturalists at Cal Poly encouraged the use of land for experimental alternatives such as flowers and goats, but only to the extent that the economic success of the venture would not be compromised.

Administrative Structure

To farm and ranch the thousands of acres of Cal Poly land, faculty, staff, and students are intimately involved in the operation of the farm. However, this is not enough to ensure successful management of the operation. A full-time farm opera-

tions staff has been a part of Cal Poly agriculture for many years. Cal Poly created twelve-month appointments for faculty who manage agricultural activities, in contrast to our sister institutions in the state, who routinely hire technicians to oversee farm operations.

Agriculture on Cal Poly Land is administered by several different entities. The State of California owns the land, trees and shrubs, and most of the buildings on the farm. The State also is charged with delivering water and power to the farm and with removing waste. The salaries of the faculty, farm operations staff, and managerial technicians have typically been included in the state budget.

A faculty "land use committee" within the College of Agriculture recommends how the lands are to be used; however, final decisions about acreage allocation rest with the central University Administration. Ultimately, the President, after consultation with key staff, makes decisions of major impact, such as conversion of agriculture production to non-agriculture uses or conversion of large tracts from one agricultural use to another, such as grazing to grapes.

The Cal Poly Foundation, an institution originally established to be the "bank" for the agriculture enterprise projects on campus, continues to play a key role in the success of the farm. As the "bank," the Foundation provides accounting services, and handles grants, gifts, endowments, and the operating capital for the agricultural enterprise operations. The

Foundation has funded many capital improvements on the Campus Farm and ranches, while the College of Agriculture Farm Operation maintains all fences, irrigations systems, roads and livestock watering facilities.

With the development of the Student Project Dairy, and then later with the use of privately owned horses for education, and finally with the increasing number of research trials for off-campus entities, large numbers of animals on campus today are not owned by the Foundation.

Management decisions are based on two priorities: first, to provide educational experiences for undergraduate students, and second, to create a net profit, since the ag operations are expected to fund themselves.

The economic organization of the farm is complex. Student labor costs are paid primarily by income from Foundation operations, with the augmentation of some State funds, like work-study grants. Current research projects pay some students who manage the livestock and crops. The Foundation taxes each operation to cover banking costs. Production is marketed by direct sales on the farm, in local farmers' markets, and as commercial sales off campus, out-of-state, and through catalog and internet publicity.

The Foundation retains the profits from ag operations each year and uses those funds to offset the losses that occur in some parts of the farm. Profits are also used to fund acquisition of new stock, establish new infrastructure, and purchase equipment. Recently, responsibility for covering losses and reinvesting profits has shifted to production departments, including Animal Science, Dairy Science, Crop Science, Food Science and Nutrition, Natural Resources Management, and Environmental Horticultural Science.

Enterprise project: students selling U-pic fruit at Crops unit

Agricultural Education Curriculum

The agriculture laboratory classes utilizing Cal Poly Land teach the use of emerging experimental techniques and equipment. Applied in nature and usually in partnership with businesses or agencies of the state, the research component of agricultural education involves efforts to develop

new knowledge – for example, testing the effectiveness of growth hormones in meat and milk production, applying irrigation technology using continual measurement to calibrate optimum soil moisture, and doing market research for new food products like "brocciflower."

Student enterprise activities provide another unique Cal Poly experience. Students participate in one of many group projects conducted through the production departments of Animal Science, Dairy Science, Crops Science, and Environmental Horticultural Science. Students receive academic credit in recognition of the skills and knowledge acquired. If profits result from their efforts, the students are entitled to a share. The motto is "earn while you learn."

Non-traditional Agriculture

In addition to the production of food and fiber, agriculture at Cal Poly encompasses a diverse array of related activities. The Department of Environmental Horticultural Science is dedicated to the green industry: ornamental plant production and landscape design and maintenance. Its students learn the techniques of commercial gardening, plant production, turf management, and pest management using a variety of greenhouses and materials-processing facilities. To showcase their techniques and skills, students working with faculty and support staff have created a botanical garden and arboretum, opening upon broad views of the central campus, the city, and the surrounding mountains.

Leaning Pine Arboretum, west of Field C9, students maintaining Mediterranean collection

Overgrazed pasture

In these formal and informal gardens featuring native and non-native plantings, visitors can find solitude, quiet and beauty, and models for landscape and park design.

Surrounding the Arboretum on three sides is the Equine unit, devoted to the care of pet and recreational animals. Because it requires knowledge of nutrition, health care, breeding, and training, it falls under the aegis of Animal Science. Increasing numbers of students intend to build their careers around companion animal care, including the field of veterinary medicine.

Challenges facing Cal Poly Agriculture

Like farmers and ranchers everywhere, Cal Poly agriculturists face a variety of environmental challenges. One is a shortage of good quality irrigation water. Another is the depletion of soil caused by over-reliance on chemical fertilizers and pesticides. Finally, there is the need for better protection of sensitive natural resources against soil erosion and both organic and chemical pollution.

It will be difficult to find new faculty with both

the required academic credentials and with the practical skills to prune a peach tree, milk a cow, drive a row crop tractor, deliver a litter of pigs, process poultry, move irrigation pipe, and shear a sheep. These are necessary to manage the campus farm and to represent Cal Poly on state and national commodity boards.

Pesticide application at Cheda Ranch

As the central campus expands, agricultural facilities are being pushed to more remote areas of the campus and reduced in size and thereby in economic viability. Students have to travel farther to reach their classes, and farm operations recede from public view, reflecting the statewide competition for land between urban and agricultural interests and the national trend to lose awareness of the productivity and fragility of good land.

Addressing the Challenges

Cal Poly Agriculture is orienting many of its land uses to face these challenges. The 2001 Master Plan declares that there shall be no more conversion of class I and II land to non-agricultural uses. It also contains areas to be used for classrooms, offices and residences within specific limits, promoting intensification of development on the central campus and discouraging sprawl into agricultural and nature preserves.

The University has fostered the development of small-scale experiments following the principles of sustainable agriculture, which combine new technology with time-honored farming practices.

Recycling of agricultural resources and wastes is being encouraged with research projects and the creation of a profitable composted manure business enterprise, using solid residues from the wastewater reclamation system in the dairy as well as barns throughout the campus.

Methane gas produced by the dairy wastewater lagoon is being collected and converted to electric power in a partnership between Agriculture and Engineering.

Cal Poly has changed grazing management on a large scale in order to enhance the

Preparing compost from Dairy for commercial sale

health of the watersheds which we share with the other communities of this area.

We are located in a region with seasonal humidity at the soil surface; therefore, the only way to cycle carbon throughout the year is through the wet gut of ruminant animals. We have known for a long time that the land was good for the grazing animal. We are now discovering that grazing animals are good for the land. Perennial plants, including many natives, require the grazing and impact of herds of ungulates in order to thrive. By avoiding overgrazing of plants and over-resting of rangelands, Cal Poly can help restore the health and diversity of our watersheds.

In our crop enterprises, increasing efforts are being made to explore the use of polycultures as a way to achieve integrated pest management. New advances in orchard and vineyard floor

management promise to reduce erosion, improve plant nutrition, and reduce crop loss to pests and disease.

Finally, care is taken to maximize compatibility between agricultural uses of land and the needs of wildlife whose habitats it shares or creates. Smith Reservoir, for example, was created as part of the farm irrigation system but has evolved into a natural bird sanctuary, which is now protected from disturbance by a fenced buffer.

As it enters its second century, Cal Poly's use of its farm land for Agricultural education will have a strong effect on the future, just as it did one hundred years ago. In the words of Wendell Berry, "There can be no human economy apart from Nature or in defiance of Nature." Teaching the skills and knowledge to make the land productive along with respect for its value and stewardship of its resources remains our mandate.

Irrigating with recycled wastewater from Cal Poly Dairy

Student Experimental Farm

The Student Experimental Farm, established in 1989, started as a graduate student project under the direction of BioResource and Agricultural Engineering Professor Doug Williams. Since that time, the Student Farm has become a haven for students and community members interested in alternative and ecological farming methods. The two-acre site was the first parcel of land at Cal Poly to become certified organic by California Certified Organic Farmers (CCOF) in 1996. The University has increased its support of this unique site in recent years, most notably through infrastructure improvements and the creation of a paid Student Farm Manager position in the fall of 2001.

Through the Enterprise system, students learn about all aspects of small-scale farming, from propagation to marketing. Many student projects (such as an award-winning strawbale building) demonstrate how agriculture can be linked to other areas of human endeavor through ecological design.

The Sustainable Agriculture Resource Center (SARC)

The SARC was founded in Fall 2000 as an informal program within the College of Agriculture. Sustainability encompasses three main goals: environmental health, economic viability and social responsibility in the long term.

Cultivating organic crops

Strawbale House at the Student Experimental Farm

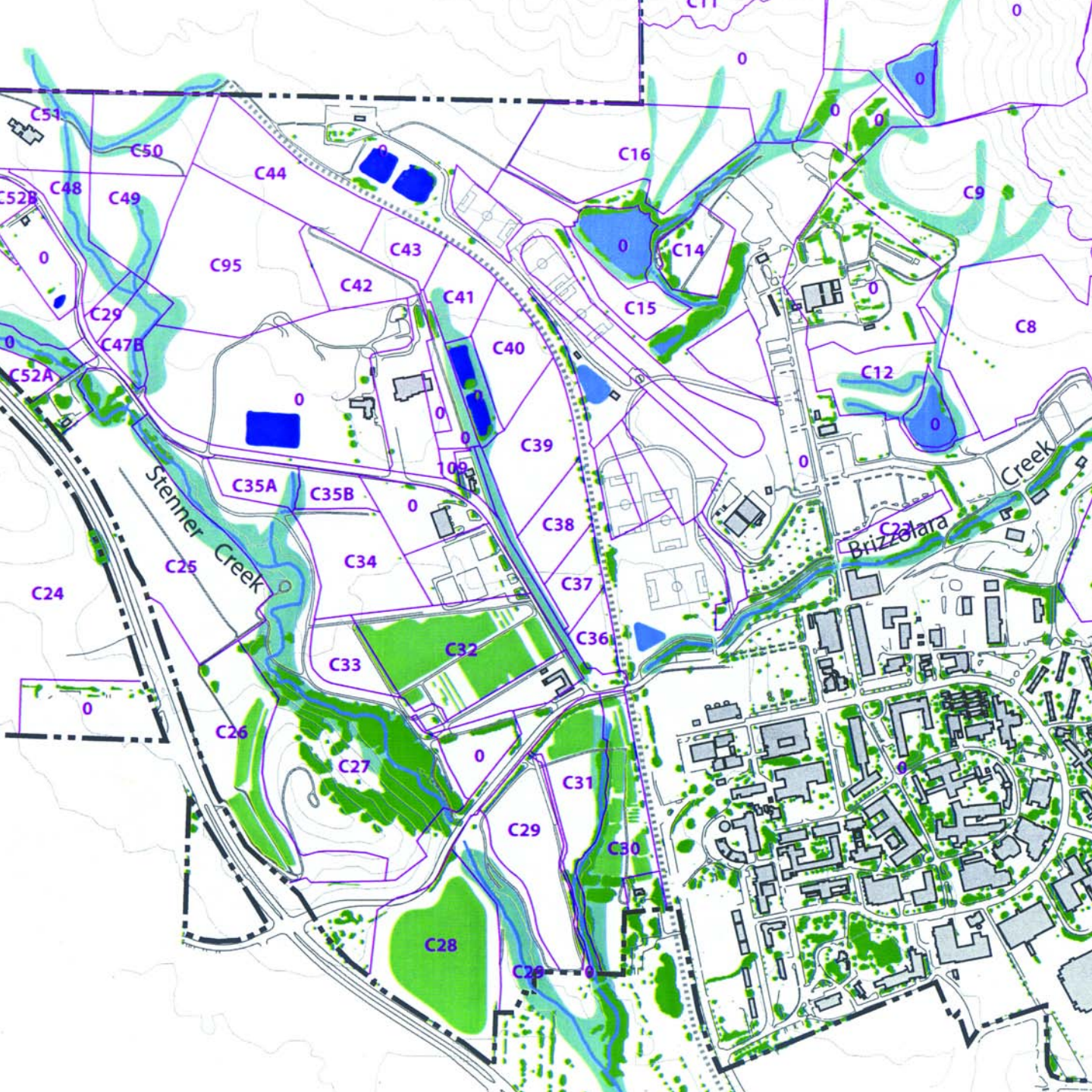
Customers picking up produce

The SARC was instrumental in developing Cal Poly's first course in Organic Agriculture (AGX215), taught by Drs. John Phillips and Thomas Ruehr. The SARC has coordinated several Extended Education classes and community workshops on topics such as composting, market gardening, nutrition, strawbale architecture, Biodynamic agriculture and Permaculture design.

Community Supported Agriculture

In the spring of 2000, Cal Poly student Terry Hooker initiated a program that links consumers directly with their farmers. One of more than a thousand Community Supported Ag (CSA) programs across the United States, Cal Poly's CSA works by selling "shares" in the farm to community members who are then entitled to a portion of the harvest distributed in weekly allotments over the next eight months. Members and their children pick up their produce right at the farm, thus enabling them to see first-hand where their food comes from.

– *Hunter Francis, Graduate Student in Agriculture*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Brizzolara
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A Tour of Agricultural Facilities

Cal Poly grows a wide variety of crops and livestock, their location on Cal Poly Land determined by topography, fertility, and the availability of water. Together these factors make up soil classification categories further described in the chapter on soils.

The limited amount of Class I and II soil—that which is most valuable for agriculture—is found near Brizzolara and Stenner creeks, where they meander through the campus.

The Crop Science Department makes intensive use of this land. Most undergraduate courses include labs and exercises conducted on the campus farm. Students are fortunate to have direct access to the Department's field and greenhouse facilities since they are within walking distance of the central campus.

The department maintains 60 acres of fruit orchards and grape vineyards, 15 acres for vegetable crops, 380 acres for agronomic crops, and five acres of test plots and gardening plots for studies in postharvest technology and applied entomology.

Field C30, bordered by the railroad tracks and the deep channel of lower Brizzolara Creek, is dedicated to citrus and avocado cultivation.

The Department of Animal Science also uses Class II land—irrigated pasture— for grazing cattle and sheep.

Some Class II land is used for barns, corrals, and other confined animal units which need to be located on relatively level terrain and close enough to the campus core to be serviced by power, water, and sewer infrastructure. This location allows students to reach their agricultural laboratories and classrooms and still maintain their academic schedules. The Cal Poly Poultry unit, recently created with help from Foster Farms and other industry leaders, is the largest and most modern at any University in the Western United States.

The Animal Science and Crop Science departments collaborate by grazing sheep at a time of year when cool weather precludes the curing of alfalfa hay; new electric fencing controls access to the creek.

Interdepartmental cooperation has resulted in multiple cropping of a given area, specifically, the grazing of crop residue following harvest of the primary product.

Campus Farm map with fields and natural features marked

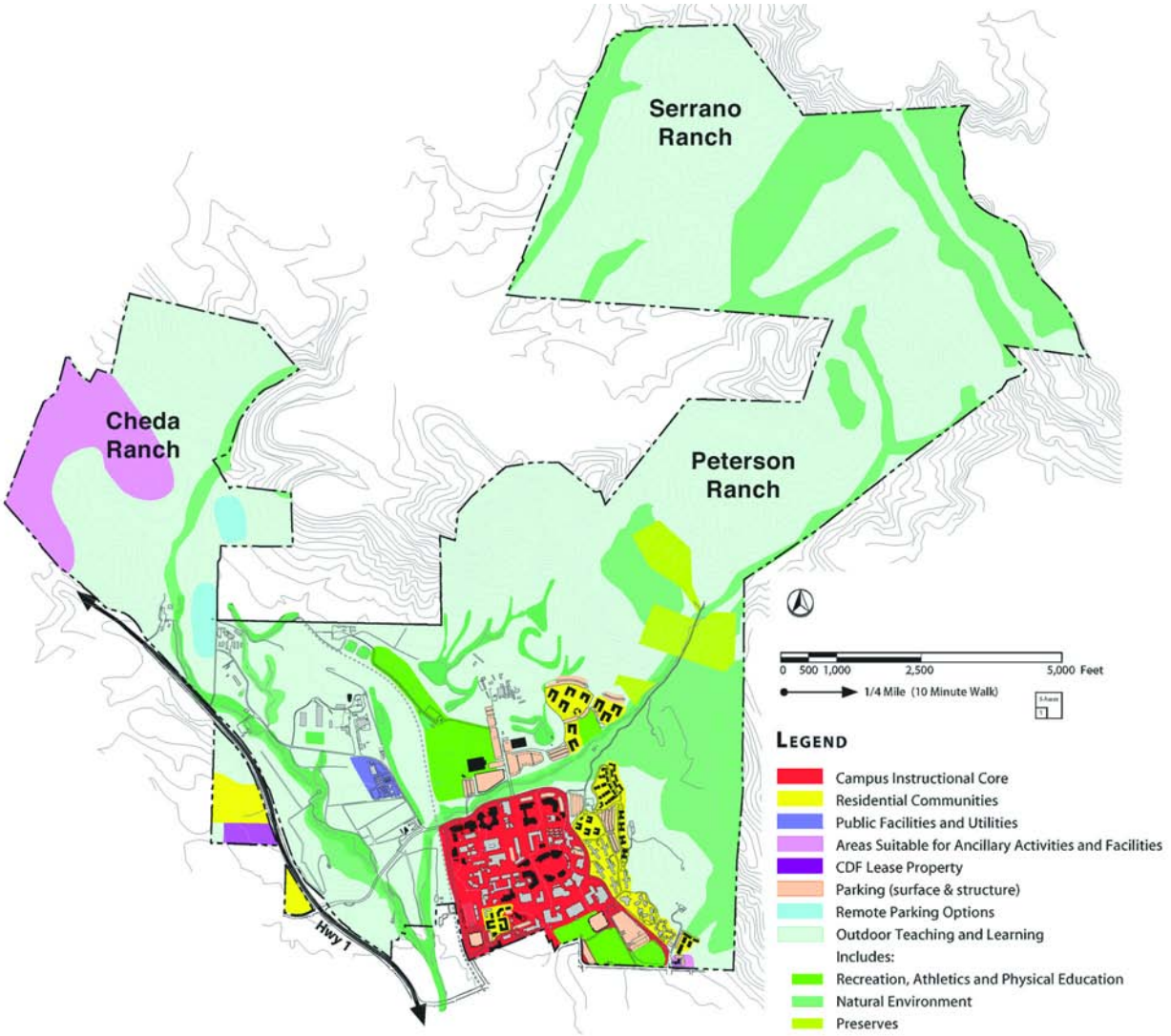
A Bee Story

It has long been known among older beekeepers and practioners of alternative medicine that beestings can alleviate the pain of certain types of arthritis. Starting in about 1993, a blind arthritic man, C.P. Crane, called my office asking if I would help him "get stung" on the hands to relieve his arthritis pain. It turns out he had been treated by this "apitherapy" successfully in the past, but now that he was blind he needed help from someone.

I agreed to meet him at a campus bus stop on a given date and time; then we proceeded to the apiary for his stings. He walked with a cane with a wheel on the bottom, quite slowly I might add. We entered the apiary, I placed his hand on the hive entrance, and he was quickly stung. He and I then departed in my truck without incident and I returned him to the bus stop. On the drive out, he commented that his arthritis pain was already starting to subside. This pain relief usually lasted about three months, he said.

We kept this apitherapy routine going for over three years. C.P. would call; I would take him to the Cal Poly hives for his stings, then back to the bus stop. However, I changed the routine one day and took him to some hives on radio tower hill instead of my usual apiary location. These hives were difficult to access, being on a narrow shelf on the hillside. Worse, the prevailing westerly wind buffeted the hives each day causing the bees to be aggressive and testy. On the day that we visited the hilltop hives, C.P. placed his hand on the first hive as usual, but this time was quickly stung several times. Many bees began to pour out of the hive and sting both C.P. and me as we tried to hastily retreat to the pickup, cane with wheel and all. By the time we got inside the truck along with many bees that had followed us, we were stung pretty badly on all parts of our upper bodies and heads. I received 15 or so stings, C.P. about the same. I never heard from C.P. after that and always wondered how he was doing with his arthritis.

– *Mark Shelton, Associate Dean of Agriculture*


Serrano Ranch
Cheda Ranch
Peterson Ranch
Hwy 1
0 500 1,000 2,500 5,000 Feet
1/4 Mile (10 Minute Walk)
LEGEND
Campus Instructional Core
Residential Communities
Public Facilities and Utilities
Areas Suitable for Ancillary Activities and Facilities
CDF Lease Property
Parking (surface & structure)
Remote Parking Options
Outdoor Teaching and Learning
Includes:
Recreation, Athletics and Physical Education
Natural Environment
Preserves

Though much of Cal Poly's agricultural activity is concentrated in the Campus Farm located on the floodplain of Stenner and Brizzolara Creeks, most of its agricultural land lies remote from the central campus: in the adjoining uplands that form foothills of the Santa Lucia Mountains, in the three thousand acres located five miles northwest of the campus in the Chorro Valley, and in the rich bottom land and steep hillsides of Swanton Ranch in Santa Cruz county.

According to Gary Ketcham, Campus Ranch Manager, these acreages are put to use by ranching operations that require large expanses of land to sustain the animals involved in food and fiber production. In a period of average rainfall, between seven and 25 acres of Cal Poly Land are needed to feed a single cow and her calf year-round, depending on the quality of soil. To achieve this yield, the land must be maintained with fencing, gates, and water supplies. These are necessary for rotating livestock between richer lowland and poorer upland pastures, preventing overgrazing, and promoting regrowth. Different conditions of grasslands within fencelines mark different stages of use.

At the head of Poly Canyon road one finds the Peterson ranch, a 650 acre bowl bounded by Brizzolara creek to the southeast, serpentine ridges to the west and Cuesta ridge to the northeast. Purchased by the university in 1950 to provide additional grazing land for its growing herds of horses and cattle, the ranch has been continually farmed since the early 1900's, as evidenced by the complex of houses, barn, and corrals still used by present-day caretakers.

Peterson Ranch buildings

The steep slopes and rolling hills of Peterson ranch are used for both horse and cattle grazing. According to Mike Lund, Professor of Equine Science,

The horses run free at the Peterson ranch 24 hours a day, all year long, with some of the individuals changing

Mare and foal at horse unit

places when needed at home for class.

Some of the behavior we observe is a definite pecking order with more jockeying for position every time new animals are added. They tend to graze around water sources first and then spread out farther and farther. Also, they like to hang out on the tops of hills when flies are around and in the shade of trees on hot, still days.

Students get the opportunity to observe and learn the unique grazing habits of horses and are able to see the behavioral aspects of horses' social systems as well.

Our riding classes routinely use the extensive trails as a way to improve their riding skills in the varied terrain of Cal Poly's rangeland. The public frequently uses the trails with their personal horses, especially on weekends. Generally these folks and hikers, joggers and bicyclists do a good job of sharing the trails and closing gates.

Horses share the space of Peterson Ranch with cattle kept here for classroom instruction, enterprise activities or research endeavors. Recently a strong emphasis has been placed on sustainable management of these grazing lands. According to Mike Hall, Professor of Animal Science, *Sustainability is viewed as both improvement of the environment and profitability for Foundation Beef Operations and enterprises. Together they will hopefully ensure the future of the campus grazing lands.*

The grazing method utilized on the majority of the land dedicated to beef cattle grazing is classified as rest/rotational grazing, which means that animals graze and are then moved to another pasture to allow a period of rest for the plants within each pasture before the animals return. Economical high-tensile electric fencing

Electric fence protecting riparian area

has been constructed to make grazing areas smaller so adequate rest can be achieved before animals return to graze an area.

Gravity fed storage tanks have been constructed, many miles of water lines have been laid, and stock water points have been established in recent years to keep cattle out of the creeks to improve water quality and prevent contamination. This type of grazing method benefits both the grazing animal as well as the environment and serves as an excellent classroom demonstration for our Cal Poly students.

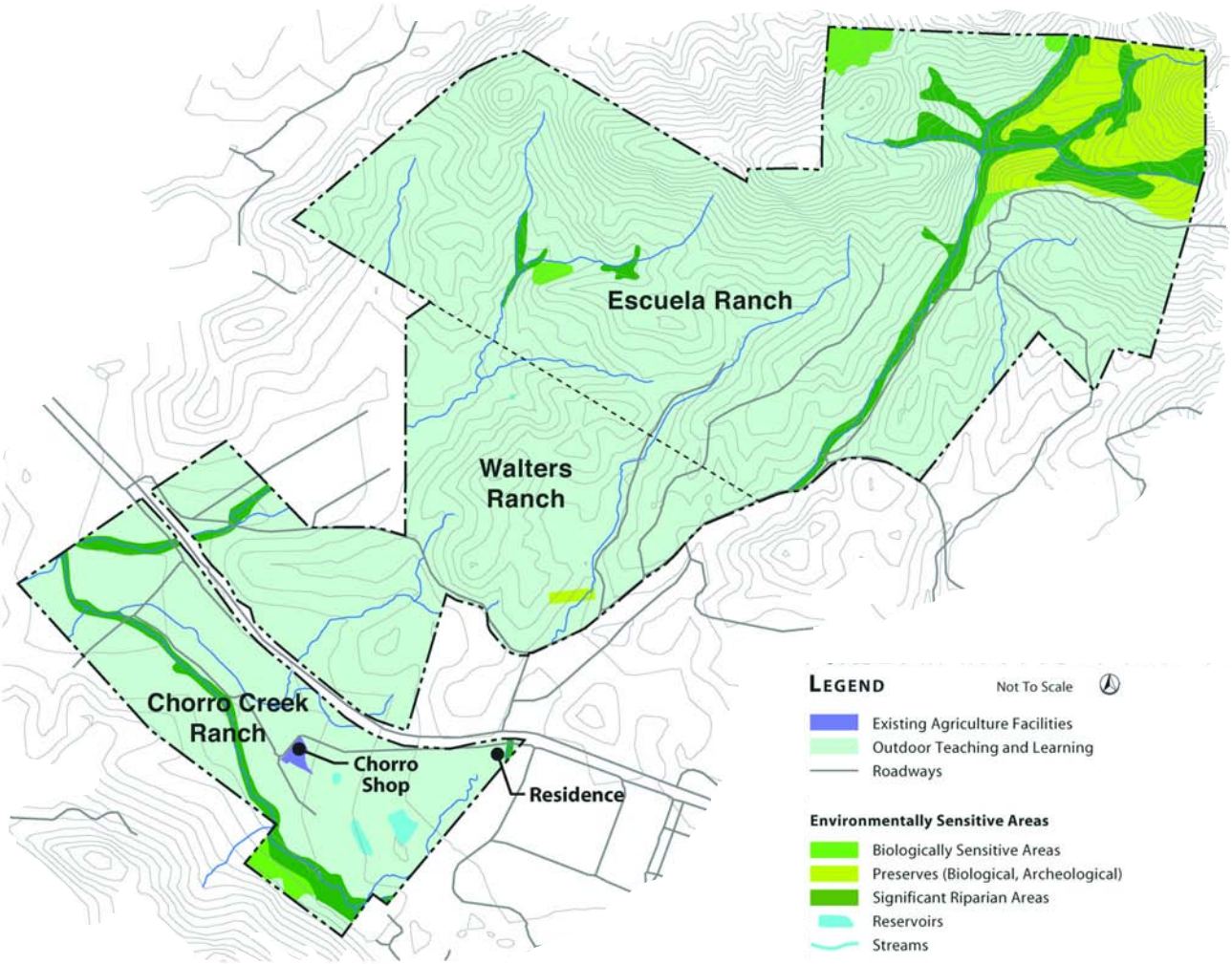
These lands act as a 'living laboratory' for the Cal Poly campus to witness firsthand what can be done to improve water quality along with improving the biodiversity of both plants and animals.

The 544-acre Serrano Ranch, purchased by Cal Poly in 1950, adjoins the Peterson Ranch at the crest of the divide between Brizzolara and Stenner watersheds and occupies the headwaters of Stenner Creek. It can be reached by vehicle from Stenner Creek Road. Also known as the Wells property, the ranch was farmed in the late 1800s by Portuguese immigrants who raised hogs, cattle, sheep, dairy cows, and hay. After the railroad divided the property in 1901, cattle were herded to the upper pastures through the concrete tunnel which carries the westernmost tributary of the creek. Serrano was the home of the commercial cow herd and also the Registered Shorthorn herd until 1968, when the lower 300 acres of the ranch were fenced for a commercial sheep flock. Serrano Ranch was the first property at Cal Poly on which management-intensive grazing started the trend towards a more bio-diverse sustainable rangeland.

Sheep on Field 29 during winter

In the year 2000, sheep operations were consolidated at the Cheda Ranch, to the west. Named after the family which farmed the land crossed by the Stenner railway trestle, this land was also acquired by the University in 1950. It includes the Trestles vineyard, Middlecamp and Nelson reservoirs, a hand dug irrigation ditch bringing water from a dam in upper Stenner Creek, and a beautiful old barn built in 1900 with laminated timbers and shaped like a gothic cathedral.

Further afield lie the three thousand acres known


Escuela Ranch
Walters Ranch
Chorro Creek Ranch
Chorro Shop
Residence
LEGEND
Not To Scale
Existing Agriculture Facilities
Outdoor Teaching and Learning
Roadways
Environmentally Sensitive Areas
Biologically Sensitive Areas
Preserves (Biological, Archeological)
Significant Riparian Areas
Reservoirs
Streams

as the Western ranches, acquired by Cal Poly through a complicated series of transactions between 1961 and 1982. Escuela and Walters Ranches extend from the upper reaches of Pennington Creek to Highway 1, their watersheds draining into Chorro Creek and Morro Bay.

Agricultural use of this land is focused on cattle grazing and its attendant activities. At the site of a 19th century corral that appears on old maps of Rancho San Luisito, the University has constructed a cattle-working corral complex, a scale, a classroom and equipment building, and feed storage shed surrounded by 11 fenced grazing units. The ranch supports about 200 head of commercial beef cattle for student enterprise management.

Chorro Creek Ranch contains about 300 acres of arable land used by student enterprise projects that grow hay, grain, alfalfa, and grapes. The Foundation's registered Angus cattle herd grazes on 235 acres of range.

Here the university has constructed two earthern reservoirs, an extensive irrigation system, a livestock corral and a multipurpose crops and machinery building. The College of Agriculture has partnered with the Gallo wine corporation to plant 150 acres of new vineyards.

Chorro Creek Ranch lies in the floodplain of Chorro Creek. In recent years the University has

Cattle herd at Escuela Ranch

collaborated with the Department of Fish and Game and the Morro Bay National Estuary Program to restore the natural riparian vegetation along the creekbed and in several fields in order to improve fish habitat, stabilize the channel, and trap sediment before it reaches Morro Bay. This project reverses the efforts of earlier agriculturalists to clear such areas for cultivation. In return, grazing rights have been provided to Cal Poly on adjoining property purchased by the Estuary Program. This collaboration exemplifies developing alliances between agriculturalists and environmentalists based on the perception of common long-term interests in stewarding the land.

Technology

Alypius Chatziioanou, Civil and Environmental Engineering
Rex Wolf, University Architect
Ed Johnson, Energy and Sustainability Manager

Cal Poly in 1905

Having explored Cal Poly Land first as a place in nature – its geology, climate, vegetation and wildlife – and then as a place where nature has been domesticated by humans in the endeavors of agriculture, we turn now to the place where the natural has been transformed into a built environment, a landscape of technology.

Reading this landscape can be as gratifying as learning about rocks, plants and birds, particularly within the culture of a polytechnic university. Knowing something about the design, construction, and history of the artificial world we inhabit allows us to appreciate its accomplishments as well as critique its failures.

It's been traditional to oppose both nature and the arts to technology. Now, more than ever, it is necessary to promote their complementarity, to find a sustainable technology, a humane science, a practical aesthetic.

Just as the foundation of civilizations in river valleys throughout the world can be attributed to the presence of arable land, it can also be traced to the availability of transportation. Cal Poly was founded both as an agricultural and as a technological school, and it was the presence of the railroad, the most powerful form of transportation technology in its day, that accounts for the location of Cal Poly on the land it now occupies.

According to *A Historical Sketch of the California State Polytechnic School, 1903-1923*, California's Governor Gage had twice refused to sign a bill appropriating the money for establishing the school until he received a phone call from a Mr. Herrin, chief lawyer for the Southern Pacific Railroad, informing him that the owners wanted a college alongside the tracks in San Luis Obispo to provide a picturesque view for passengers. In fact, early pictures of the campus usually include a train.

The completion of the Southern Pacific's north-south rail link "over the Cuesta" a few years earlier had constituted a significant triumph of late nineteenth century industrial technology. It required seven tunnels, from 3700 to 270 feet long. *The Tribune* reported that "Stonework of the many culverts were marvels of hand work."

Coast Starlight rounding horseshoe curve

To put in the 80 foot steel span over Brizzolara creek, "Excavations were made …twenty five feet below the bed of the stream to lay a solid mass of granite block and cement."

In 1893, a year before the first train arrived, a reporter wrote a flowery description that still rings true to anyone who's taken the ride around the

three hairpin curves from which the engineer can see the caboose: "Imagine the approach to this city with the train emerging from the tunnels, sweeping down the grade through the Potrero [Cal Poly Land in Poly and Stenner Canyons]… then rounding the great loop and turning directly back with the pretty town in its path, and the wide landscape of mountain and valley, rock and river, fertile fields and masses of orchards on every hand."

Building the trestle crossing Stenner Creek provided the dramatic climax of this feat of construction. Crowds came out of town on the Chorro wagon Road, later Highway One, to watch as crews again dug 25 feet down to bedrock to place 24 massive granite piers as supports for the prefabricated steel sections of the 935 foot span. These arrived from Pittsburgh in more than 50 freight cars "scattered along the tracks… all the way back to Templeton."

"In order to get some sections of the bridge in place, a sidetrack was constructed alongside the line of the bridge down to the bed of the creek, a drop of ninety feet. A stationary engine let loaded flatcars down to the creek bottom over a stretch of about five hundred feet of slope. Then each piece was hoisted by a kind of derrick into the desired position and a crew riveted it into place."

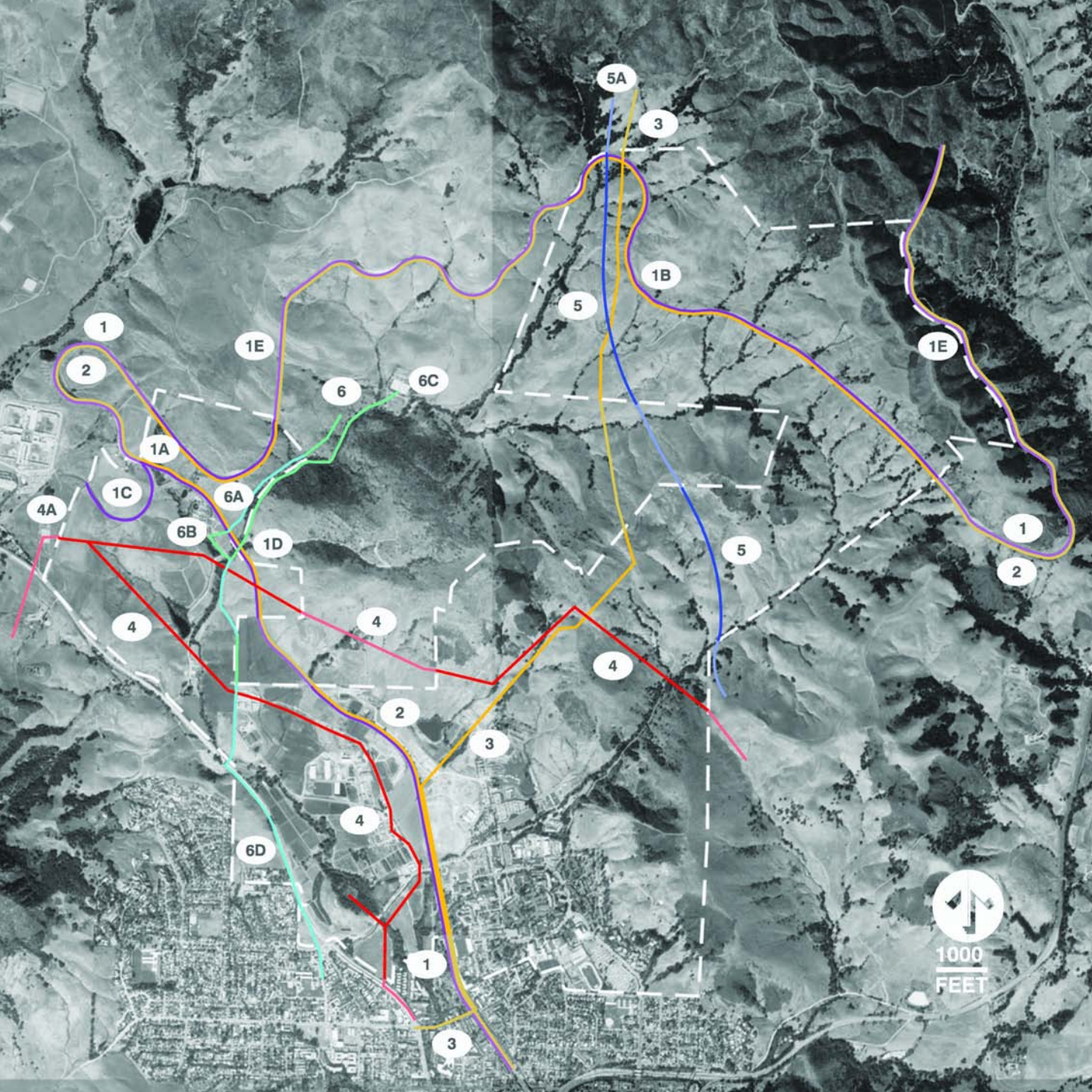
On May 7 1894, the rail link connecting San Luis Obispo to San Francisco with daily service was completed, and the first train chugged into town carrying dignitaries from all over the state and setting off three days and nights of public celebration.

The railroad remains one of the prominent features of Cal Poly Land, its snaking right of way accentuating the graceful curves of the hills, the afternoon sun glinting off the silver surface of The Coast Starlight, the mournful whistle of laboring freights piercing the late night silence of the canyons.

The mystique of railroad technology is preserved at Swanton Ranch, where a statewide organization of hobbyists maintains a historic narrow gauge system originally built for the San Francisco Pacific Exposition in 1905. This facility was assembled by Al Smith and entrusted to Cal Poly as part of the Swanton bequest.

Swanton Pacific railroad project

Illustration from May 1894 souvenir edition of San Luis Obispo Tribune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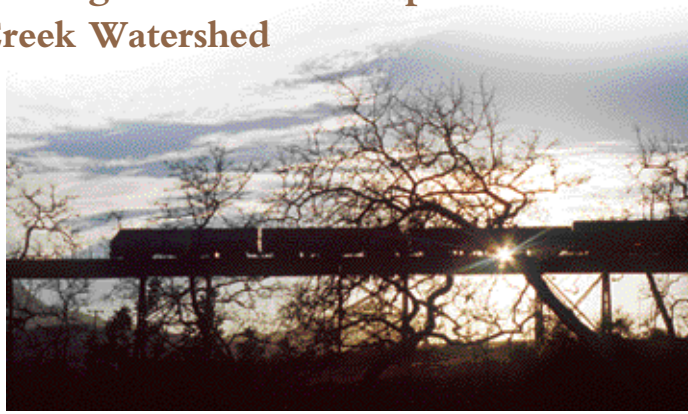
Public Infrastructure Passing through Extended Campus
San Luis Obispo Creek Watershed

The railroad is one of many technological networks embedded in University land. By virtue of its central location on the Pacific coast, midway between San Francisco and Los Angeles, Cal Poly lies at the crossroads of major state, national, and global infrastructures.

This map displays parts of that infrastructure offering no direct service to the campus but licensed to pass through campus land with legal easements, rights of way, lease agreements, or deeds.



Coast Starlight crossing Stenner trestle

1. Railroad [purple]

The Railroad owned the land before Cal Poly came into existence. The current owner is Union Pacific; Southern Pacific was former owner. Amtrak leases this single-track line for passenger service.

1A. Goldtree and **1B.** Serrano -- former small communities and stops for fuel and water no longer in existence.

1C. Traces of former rail spurs that led to Camp San Luis and to chromium mines on upper Cuesta Ridge.

1D. Stenner trestle and **1E.** tunnels.

2. and 3. Telecommunications [yellow]

2. ATT and Sprint North-South fiber optic trunk lines are buried along the railroad right of way. When landslides washed out part of the track in 1996, Visa card service was interrupted between San Francisco and Los Angeles.

3. ATT East-West fiber-optic trunk line buried in 2001 to replace coaxial cable installed in 1953. The total paid for the easement in perpetuity was $760. This line comes across the Pacific Ocean, lands under the beach at Montana De Oro, goes through Cal Poly, over Cuesta Ridge, and then heads east to Bakersfield.

4. Electric Power [red]

PG&E's 70 kV transmission line from the Morro Bay power plant, where electricity is produced by gas fired turbines, to the substation on the corner of Orcutt and Southwood roads which feeds power to the City of San Luis Obispo. This line passes through the campus farm, Horse Canyon and Peterson Ranch and then continues across the adjoining ranch into Reservoir canyon and up over High School Hill to the substation. A line branching off at Peterson Ranch serves Cal Poly.

4A. From the PG&E Gold Tree substation near the Men's Colony, a 12kV line passes through Cal Poly along Mount Bishop Road serving northern parts of the city. Along the way, a few minor Cal Poly loads are served including irrigation wells, orchard frost wind machines, and the equipment on Radio Tower Hill.

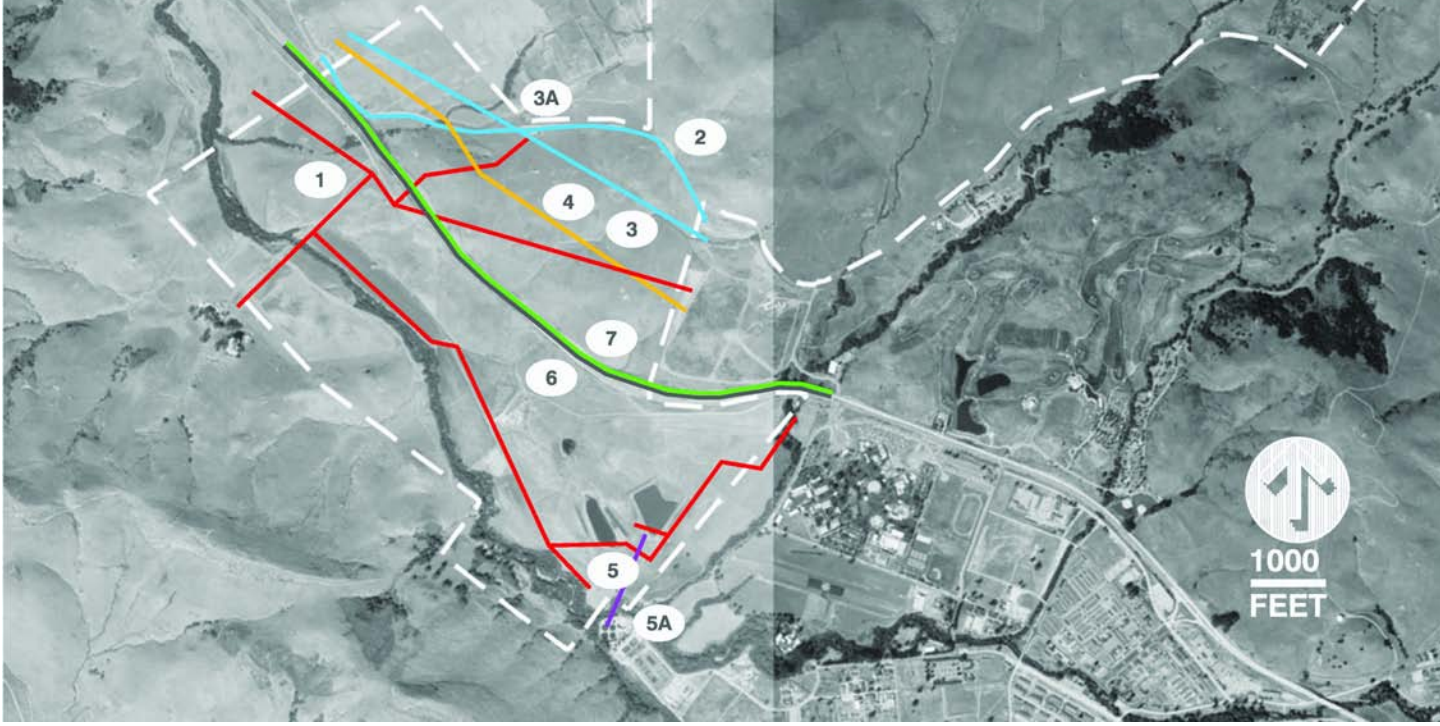
5. State Water [dark blue]

A branch of the State Water Project (SWP) conveying water from Northern to Southern California. This branch comes from the Central Valley via Santa Margarita, goes through a tunnel in Cuesta Ridge at the top of Stenner Creek, and passes through Cal Poly Land towards its terminus in Santa Barbara. Recognizable by the pillbox manhole covers distributed across the landscape, this 42 inch wide pipeline was completed in 1996 amid controversy about environmental consequences. The city of San Luis Obispo voted twice not to be part of the State Water Project.

5A. A spur tees off below the tunnel and heads west to feed Morro Bay.

6. City Water [light blue]

San Luis Obispo gets its drinking water from Whale Rock Reservoir in Cayucos and Santa Margarita Lake (or Salinas Reservoir). From Santa Margarita a 24 inch pipeline goes through the Cuesta tunnel and passes above ground west of Stenner Creek **[6A]** on its way to the newer City filtration plant **[6B]** near the railroad trestle. This facility replaces an earlier city filtration plant **[6C]** on upper Stenner Creek Road that is still used for treated water storage fed from a newer line under Stenner Creek Road. A smaller exposed pipe west of Stenner Creek delivers creek water to Cal Poly for agricultural irrigation. From the filtration plant the water is pumped through two mains—one under California Boulevard serving Cal Poly on the way, and the other along Highway One to the City **[6D]**.



Public Infrastructure Passing through Chorro Creek Watershed Ranches

1. PGE 12kV network of lines from Morro Bay feeding irrigation wells and farm structures at the Western Ranches.

2. State Water line to Morro Bay.

3. Whale Rock Water line to city treatment plant and Cal Poly. **3A** indicates a booster pump station that runs only at night.

4. Southern California Gas main transmission line.

5. Reclaimed California Men's Colony (CMC) and Cuesta College water line that can feed an irrigation pond at Chorro Creek ranch. **5A** indicates the sewer treatment plant (not on Cal Poly Land).

6. Highway 1.

7. Overhead telecommunications lines running along Highway 1 used by several telecommunications companies.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Infrastructure Servicing Cal Poly

1. Roads [green]

1A. Highway 1 – This scenic highway runs from the Mexican border to Canada. One of its most beautiful sections begins at the Highland Drive entrance to campus.

1B. Stenner Creek Road – Owned and maintained by the County from Highway 1 to Cal Poly's Serrano Ranch gate beyond the old City water treatment plant.

1C. Poly Canyon Road – Serving the multiple needs of instruction, research, recreation, and farm maintenance. This road is now closed to public vehicles for safety and environmental protection.

The farm roads throughout Cal Poly Land are maintained by Farm Operations under the College of Agriculture. Only the main routes are all-weather roads [green dashed line] with many tracks impassable during the rainy season. The major maintenance activity is spreading "red-rock" quarried on the hillside above Poly Canyon over the road surface. The farm roads are a source of erosion and sedimentation in Cal Poly creeks. The recently adopted Water Quality Management Plan will institute practices that minimize the impact of these roads.

Alternate Transportation

The recently adopted Cal Poly Master Plan outlines a vision whereby reliance on the SOV (Single Occupant Vehicle) is reduced and alternative transportation is no longer alternative. Parking will actually decrease (by ratio) as Cal Poly grows, and more of the parking will be in structures. This will preserve agricultural land, decrease sprawl, and maintain Cal Poly as a compact residential / pedestrian campus. Vehicular traffic will be re-routed and the current North and South Perimeter will become pedestrian orientated malls. Cooperation with the city of San Luis Obispo will result in a connecting bike route along the railroad. Some segments south of the city are in place, and a 101 to Foothill link will begin soon, but the most challenging segment that involves creek, road, and freeway crossings remains.

2. Water [blue]

2A. A 24 inch line runs from the treatment plant, branches at the Poultry unit and passes through agricultural land under a service road to the Vet clinic. It continues down Mount Bishop road, under the Highland railroad crossing and along the railroad tracks down California Avenue. It branches off to feed Cal Poly at the pump station next to Highland

[2B] and again on the corner of California and Campus Way **[2C]**. Three campus pump stations deliver water to three 500,000-gallon concrete storage tanks on the "P" hill **[2D]**. The combined domestic, fire-fighting and core irrigation system is then gravity fed in three pressure zones. Current usage of potable water is 568 acre-feet/year at a cost in fiscal year 2000/2001 of $589,400.

Four hundred sixty acre-feet a year of untreated water from Whale Rock Reservoir is allocated to campus agricultural use at a cost of $261 per acre foot. This water is also used for irrigation at the Sports Complex. Additionally, in 2000 - 2001, five irrigation water wells produced 248 acre-feet of water with an electrical load of 349 KWH/acre-foot. This pumping is weather dependent and the wells can produce much more.

3. Electric Power [red]

Cal Poly gets most of its electricity from the 70Kv distribution line through Peterson Ranch. A branch splits off next to the Architecture Design Village **[3A]** and heads down Poly Canyon to the Mustang Substation **[3B]** located in front of the new residence complex. The capacity of this station is ten Mega volt-amperes with room to double. Power is distributed on the central campus at 12,000 volts and 4,160 volts switched through a looped computer-controlled system, underground in the core, overhead elsewhere. In 2000/2001, the University consumed 37 million KWH of electricity at a cost of $1,952,000.

4. Natural Gas, Heating and Cooling [yellow]

In 2000/2001 the campus used 1,737,000 therms of natural gas supplied by Southern California Gas Company at a cost of $2,010,000. This was up from $664,000 in the previous year. One medium pressure line enters at Highway 1 and Highland and feeds the Dairy and Poultry units. A second enters at Grand and Slack Streets to feed the Housing cogeneration facility and its back-up boiler. A third and fourth enter at California Street and Campus Way and feed the rest of the campus core and the central heating plant in building 40 **[4A]** across from the Rec Center. This plant contains three gas fired boilers and two electric chillers. Distribution of heating and cooling is via 10 inch (hot) and 8 inch (chilled) insulated supply and return lines within the mile-long Utilidor vault.

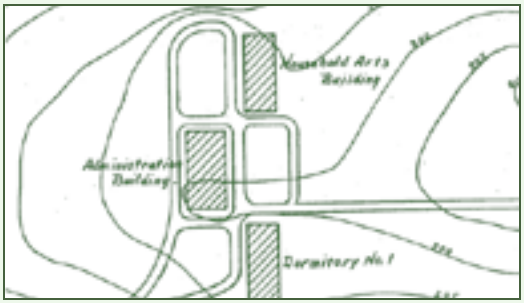
5.Sewers--Sanitary and Storm [tan]

All sanitary sewer lines converge and exit campus via a 15 inch line at the California Entrance **[5A]**. The wastewater is treated along

with San Luis Obispo city wastewater at the treatment plant at the south end of town. In fiscal year 2000/2001, Cal Poly's load was 320 acre-feet at a treatment cost of $291,000.

All storm sewer lines draining rooftops, roads, and parking lots lead to the creeks, primarily Brizzolara Creek to the north. Only recent construction projects, such as the Sports Complex and the Student Housing Complex, have sediment and pollutant retention basins. Upcoming federal regulations will soon require that surface water leaving Cal Poly be as clean as surface water entering Cal Poly.

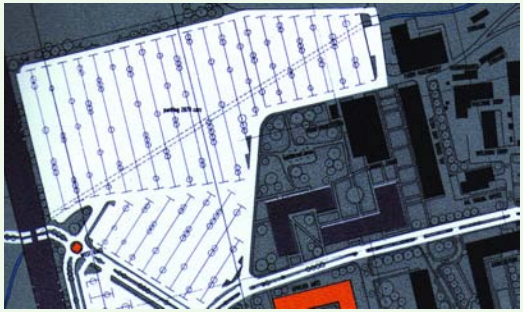
Technohistory: Under grounding Creeks



Detail from 1909 campus map. The dotted line to the north was a creek running through what is now Kennedy Library. The runoff is now carried underground in storm sewers. The building labeled "Power House" is not what we now call the "Old Power House" but an earlier structure now long gone. Map from University Archives, Cal Poly.

This creek in the top right picture is now carried in a 48 inch diameter storm sewer under the Grand Avenue Parking lot. The structures to the left were temporary post-war housing. Photo circa 1950.

The same fate was once planned for Brizzolara Creek. This is a detail from the 1963 Cal Poly Master Plan. The dashed line was to be Brizzolara under asphalt.

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Infrastructure Installations

An explorer of Cal Poly Land may often be mystified by peculiar protuberances in the landscape--a lunar-like probe in the middle of a meadow, a squat windowless hut by the side of a road, a huge circular pot lid halfway up a mountain. Depending on one's mood or prejudice, these infrastructure installations can either degrade or enhance the view. This map and legend decipher some of the mysteries.

1. PG&E Goldtree Substation. Two 12 kV lines branch off here from the 70Kv mainline. One feeds the Men's Colony, and one feeds northern San Luis Obispo city.

2. Mustang Substation. This University-owned substation built to replace a PG&E station in 1998 provides electricity for most of the campus. 12kV radial loops feed electricity as far out as the Swine and Poultry units. Housing is fed at 4160 volts.

3. A new water filtration plant was built in 1995 by the city of San Luis Obispo and was partially paid for by Cal Poly. The old plant **(3A)** is up Stenner Creek Road and used for storage of treated water.

4. Sewage Lift Stations use holding tanks and pumps to take sewage uphill from low points on campus to higher elevations where it can continue its gravity flow journey to the San Luis Obispo sewage treatment plant near Prado Road.

Today we can monitor the condition of the sewers with small video cameras. You are now in a Sanitary Sewer under Poly Grove.

5. GPS Monitoring Station was placed by the USGS to study plate tectonic movement of the San Andreas Fault. Information gathered is fed to the library by radio waves and then by modem to JPL labs in Pasadena. For more information, go to this website: http://pasadena.wr.usgs.gov/scign/gps.html

6. Radio Hill is used as a transmitter by local stations KVEC-AM and Cal Poly's KCPR and as a cell site by the campus and private companies.

7. A small (350kW) cogeneration facility in Sierra Madre residence hall burns natural gas to create electricity and make steam for heating at the same time. Excess heat from electrical generation is normally wasted.

8. Two 500,000-gallon storage tanks above the R1 parking lot (rectangular) and an additional 500,000-gallon tank farther up the hill under the Poly P **(8A)** supply potable water under gravity pressure and reserves for fire protection.

9. Methane turbine designed by Dr. Douglas Williams from Ag Engineering to reduce air and water pollution and to create electricity. Effluent from the dairy is stored in a covered pond and broken down anaerobically. A 30kW generator burns the methane byproduct collected by the cover, and the cleaned water is recycled for dairy farm uses.

10. Stenner Creek Pump Station boosts pressure on the city water line. A branch goes from here to Cheda Ranch

11. Stenner Creek Diversion takes water from the creek to the Middlecamp Reservoir to be used for irrigation.

12. Air vent and valve manhole for State Water Line

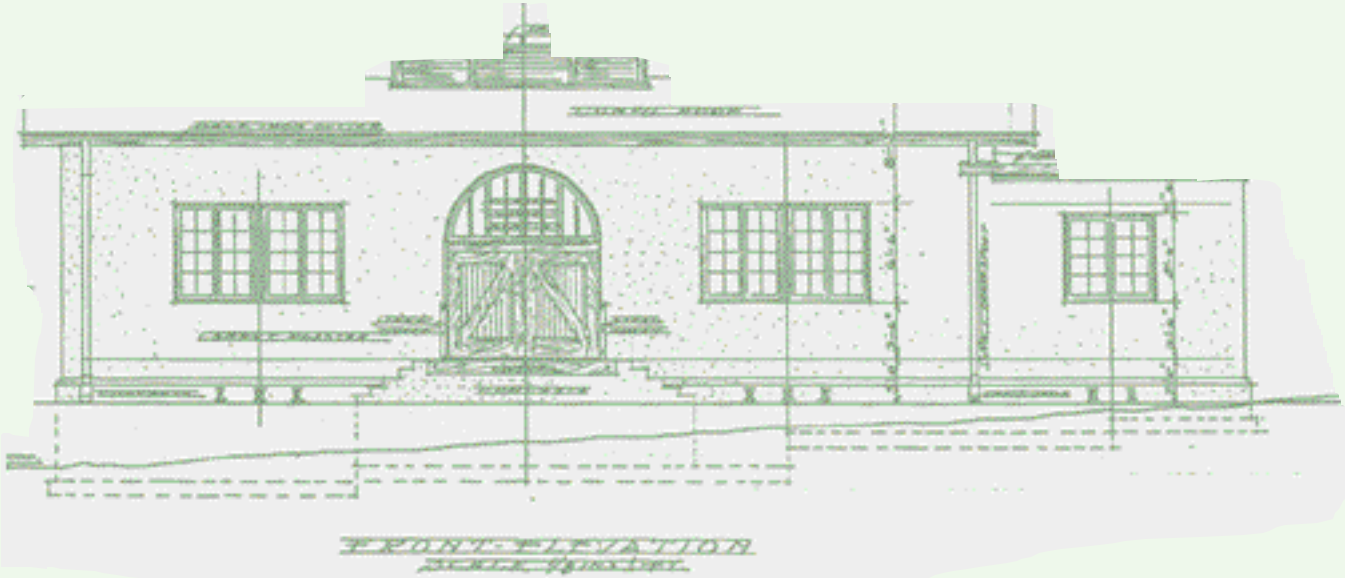
13. Water level tester at top of Poly Canyon by bridge

14. Cal Poly has five ground-water pumps for agricultural irrigation. Two are shown, the remaining three are at the Chorro Creek Watershed Ranches.

15. Fish ladder at Brizzolara railroad crossing. The 1901 RR bridge was built originally to only cross the creek; now Highland Drive passes beneath. A fish ladder for steelhead trout was installed as part of major widening and realigning of Highland Drive during the 1970s.

16. Decommissioned Poly Canyon landfill, current gravel quarry. Soil fill, construction debris, and green waste were deposited here in the 1950s and 1960s. Today "red-rock" is quarried for maintenance of Cal Poly farm roads.

17. Settling ponds at Sports Complex. Designed to reduce sedimentation in Brizzolara Creek and nutrient pollution to the watershed. The ponds hold runoff after rainstorms.



Technohistory: The Powerhouse

Architectural plans from 1909 for what we now call the "Old Power House" —number two in a series of four central heating plants that served Cal Poly. This structure is on the national registry of historic places.

The Old Power House is shown in green; in red is the building that houses Cal Poly's heating and cooling plant #4 (Engineering South, #40). The Utilidor, a mile-long vault under sidewalks that delivers hot water, chilled water, and drinking water, is shown in orange.

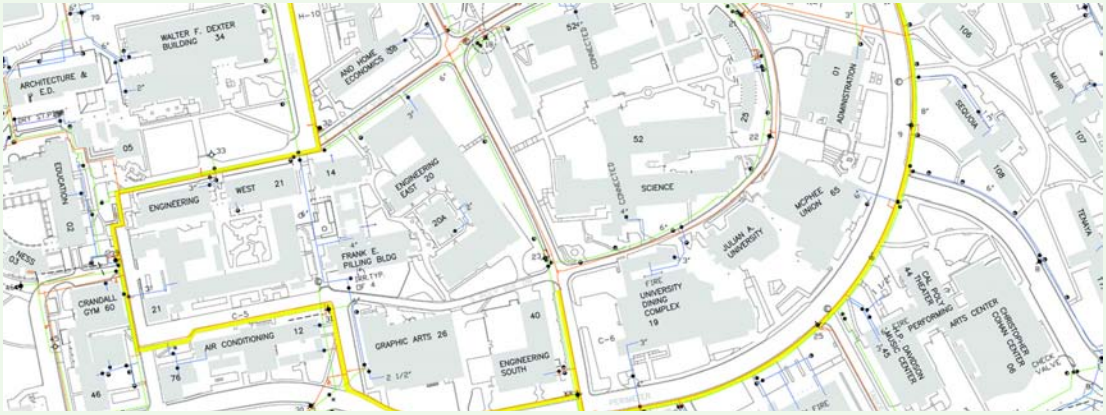
Powerhouse today

Mapping the Technological Landscape

The letters "USA" are often seen spray-painted on the ground prior to an excavation project. They stand for "Underground Service Alert," a statewide GIS database that indicates what utility lines may be in the vicinity. The owner of the utility is contacted – the gas company, for example – and a worker comes to the site and locates the gas lines, usually with remote sensing devices. Here at Cal Poly we own most campus utility distribution systems and a call to USA will lead the digger to the Cal Poly Facilities Department to locate Cal Poly utilities. Cal Poly relies on our Utility Atlas and department folklore to document underground systems.

Mapping the technological landscape has taken many forms, from early railroad surveys to hand-drawn utility atlases to modern day computer databases.

The first known Utility Atlas of Cal Poly from 1943. This detail shows water lines in the vicinity of what we now call Dexter Lawn. These maps were a senior project by John Westfall from the Mechanical Industries Department.



Current computer database, Atlas A. Atlas A shows utility systems one-at-a-time. This detail shows water with the colors representing different water systems and pressure zones.

Current computer database, Atlas B. Atlas B shows it all, useful for digging and avoiding unpleasant surprises. Here the colors are simplified. Blue indicates water. Purple indicates storm drains. Cyan indicates chilled water.

The Arts

No place is a place until it has had a poet.

– Wallace Stegner

Cal Poly Land consists of 10,000 acres located between 35 and 37 degrees latitude and 120 and 122 degrees longitude. But "Polyland" is also a territory of the imagination—a place for poets and painters, philosophers and photographers, dreamers, dancers and designers. This chapter showcases some of the University's outdoor teaching and learning activities in the arts, activities that bring professors and students closer to the land and that allow the land to enrich their creative and spiritual lives.

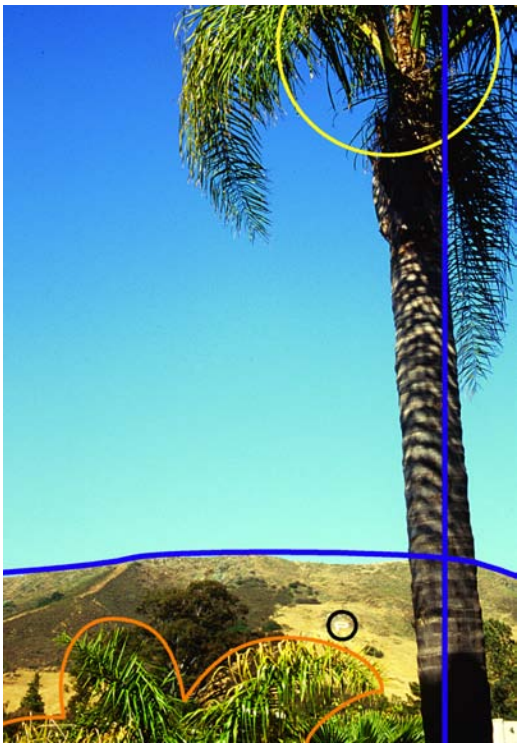
- A professor of Landscape Architecture provides techniques and terms for analyzing the landscape used by professionals in his field.
- The Architectural Study Area in Poly Canyon memorializes experiments of the 1960s to '80s and inspires reflections by a wandering writer.
- Students in English classes take to the woods to read and write poetry.
- Students in Art and Design travel to Swanton Ranch to create site-specific sculptures with natural materials.
- Dance students practice movement in tune with wind and light; photography students make pictures of what happens.
- A novelist and teacher writes a short story inspired by the historic stone corral in Pennington Canyon.

Dance class on design village dome – Poly Canyon.

The Visual Experience of Cal Poly Land

Dale A. Sutliff, Landscape Architecture Department

The landscape we see is the synthesis of natural and cultural processes. The most pronounced sensory experience people have is visual. What we see provides roughly 85 percent of our sensory information. Cal Poly Land can be used as a valuable setting for practicing seeing, for training the eye, and for influencing campus visual land management practices.



The view we experience from the center of campus looking towards the 'P' can be organized using visual analysis terms. *Foreground* consists of tropical trees, *middle-ground* consists of Australian and Eastern U.S. trees and buildings, and *background* consists of native chaparral plants and mixed grasslands. These layers of the scene provide perspective and depth. Foreground shows specific visual information. Middle-ground gives information about major scene elements and the relationships from front to back of the view. Background provides context and contains the whole scene.

Our eye travels back and forth between these layers, resting, exploring, and allowing mental interpretations that end with decisions and actions that direct our movement and cause us to pause or to contemplate and judge what we see.

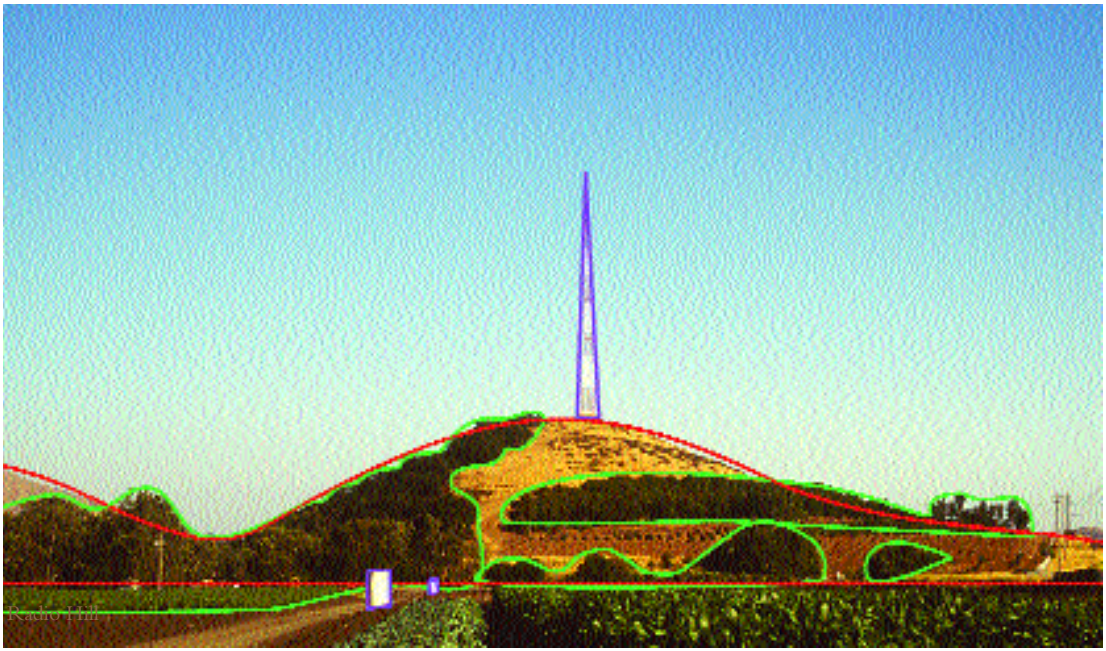
Poly mountain from Dexter Hall

Dexter Lawn

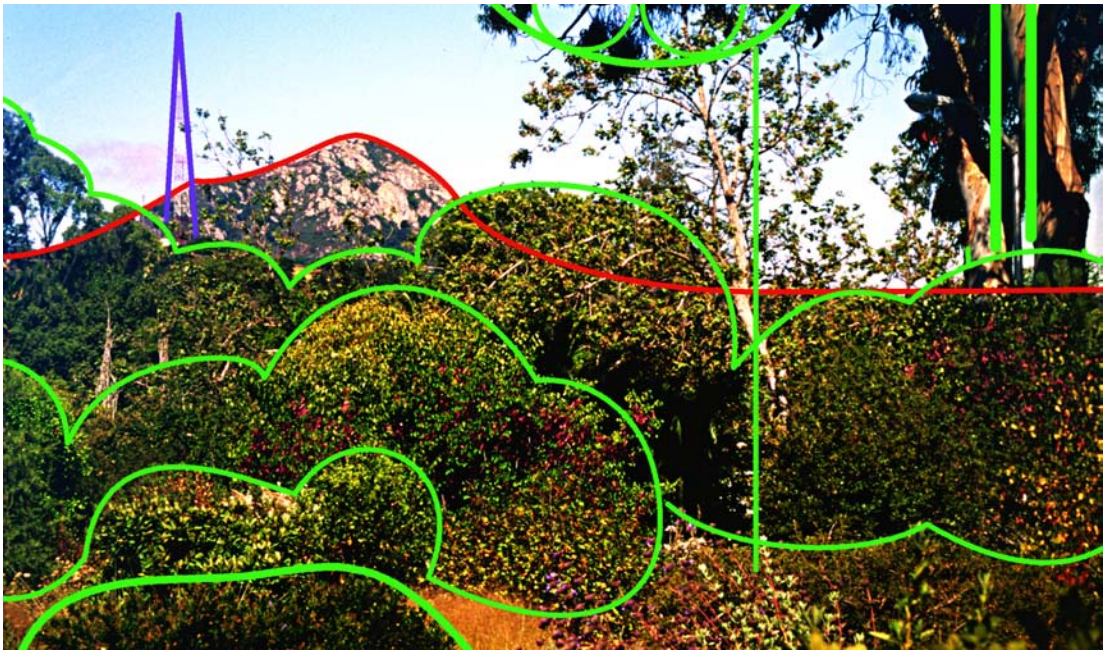
Using a diagram we can break down the compositional parts of the scene for better understanding. The elements that define what we see in composition are termed: *form* (shape), *line* (edge), *texture* (grain), *color* (hue), plus *contrast* (distinction). These elements are modified by *light* (tone and value of shading) and *scale* (size.)

In a view from Dexter Lawn towards the Cal Poly 'P' one can identify the compositional elements. Forms are represented in plants, buildings, and other features. "Points" are places where the focus is drawn. "Planes" such as *lateral* (ground), *vertical* (walls), or *overhead* (sky, ceiling, or canopy) direct the visual experience.

The view is composed of a simple foreground (lawn and paving), a complicated mix of visual elements in the middle-ground, and a loosely patterned background that provides closure for the entire scene while also drawing the eye upward.



At Radio Hill assorted visual elements and layers combine singular and collective properties that resolve into larger forms and patterns. This gives an overall structure to the view. The view can be broken down into combinations of forms, patterns, textures, colors and tones that create contrast, balance, line and focus: an informal harmony of the parts. This is the result of *built*, *land*, and *plant* forms assembled in a particular relationship. The transmission tower accentuates the hill, yet the hills' form provides a dramatic pedestal for the tower. The combined plant forms, as masses, cause the eye to move about through the scene. Plant forms that are closer to the viewer create more distinct shapes while those farther away blend together as texture. By re-arranging the elements, the scene's focus, balance, and rhythm could be altered to achieve a different experience.



Bishop's Peak from Henry's Border

This view of Henry's Border—named after the gardener—includes an eclectic mix of native plants backed by eucalyptus and Bishop's Peak. In contrast to the simple composition of Radio Hill, this view displays a complex layering of plant-forms, builtform and landform. The smaller, rounded plant forms that possess varied properties of color and texture make a loose arrangement, while the strong verticle of the gum tree, complemented by a verticle built form, anchors the landscape composition. The foreground interest in visual detail remains as you move throughout the scene.

Any landscape is composed not only of what lies before our eyes, but also what lies within our heads.

– D.W. Meining

Architectural Study Area

Shell House

Emerging from the deep-shadowed grove of Poly Canyon, one comes suddenly upon a bright open vista: to the right rises the serpentine mass of Poly Mountain viewed from the back. Straight ahead sits a complex of old buildings and corrals—the Peterson Ranch. And up on the hillside to the left, under the rugged escarpment of Rockslide Ridge, one spies a smattering of fanciful structures tucked into a landscape reminiscent of Tolkien's Shire.

This is the Architectural Study Area, a facility of the College of Architecture and Environmental Design. From the 1960s to the 1980s, faculty encouraged use of the expansive space, dramatic settings and freedom from code restrictions afforded by this site for experiments with unconventional designs, techniques, and materials. Architecture and construction management students built large-scale sculptures, infrastructure facilities, and residences as senior projects. These include the Underground House, the Passive Solar

Cantilever Bridge

Greenhouse, the Poly Pavilion, the Stick-Built Structure, Earth-Formed Concrete Restrooms, a ferro cement Water Tower, the Bridge House, the Shell House, the Geodesic Dome, and the Modular House. Some were completed and some remained unfinished or fell apart, adding a feel of romantic ruins to the place. Others are still under construction and provide housing for resident caretakers. Present day classes are guided through the Area to learn about the aspirations and the styles of a previous generation and to study examples of structural failure and success.

In keeping with new ideas about preservation of open space and agricultural resources, the Architectural Area is used today to promote low impact development in the landscape.

Design Village is an annual design competition for students held on the Cal Poly campus during the Open House weekend at the end of April college, community college and high school students from around the state spend the weekend "camping" in structures they design and build as part of the competition. Contest guidelines specify that the structures must be dismantled before students leave and that the site must be left completely undisturbed.

Architectural Area from Caballo Peak

Designs in the Land: Meandering Through the Nature/Culture Divide

Jacalyn Pauer, Graduate Student in English 513: Ecoliterature

Just as I was drifting into sleep, a vivid image sprang to mind, a memory of something from my nature walk: I saw before me an improbable arch of ruddy-colored stone that lifted from the dust of Poly Canyon Road. It was fifteen or so feet tall and shaped the way an exuberant child might draw a rainbow to cover the entire sky on a whole sheet of paper. It smiled and opened onto a path bordered with the same glowing stone, welcoming me into the heart of a rolling meadow dotted with strange, barely discernible structures. In the dark of my room, the image presented a fantastic, magic realist vision—a landscape made lively with unknown possibilities. The arch shimmered in my memory like the entrance to the Emerald City.

I had just finished reading Henry David Thoreau's famous essay, "Walking," in which he proclaims his "wish to speak a word for Nature."

A cry for absolute Freedom and Wildness, as contrasted with a freedom and Culture merely civil, to regard man as an inhabitant, or a part and parcel of Nature, rather than a member of society, . . . for there are enough champions of civilization; the minister, and the school committee, and every one of you will take care of that.

My interest in art and architecture placed me potentially in opposition to Thoreau and linked me to his minister's camp, a place where I have never felt comfortable. But I agreed with him on one point: the human is part of the natural world—not just the individual human on his solitary walk, but all of humanity—the varying social orders and all of their processes and products.

We go to walk in nature and marvel at the cleverness of birds and bees, treasuring the designs of their nests and hives, while simultaneously we disparage human designs as intrusions on the landscape. It seems inconsistent to me. Humans are makers and, like all animals, we use raw materials from our natural surroundings as means to reach our own ends. The beaver cuts down trees to make its dam, and the mud-dauber wasp hauls materials from puddles to construct a nest. To call them carpenters and masons is not simply metaphoric, nor is it necessarily anthropocentric; it is a true connection in a continuous network of interconnections. We humans, however, because

of our self-reflective consciousness, have many more choices than the beaver or the wasp. We strive well beyond the animal drive for survival, and frequently we misuse materials and waste energy. Yet, our particular consciousness and drive to create are as intrinsic to our species as the complex shape of the seed cone is to the pine.

On my first free day, I returned to Poly Canyon at dawn. The marine layer hung thick among the trees and softened the landscape. The canyon gets its name from the California Polytechnic State University, which holds stewardship over the land and includes it in teaching programs. The Greek root of the word *poly*, meaning "much" or "many," suits the history of how humans have used the canyon for the last 9,000 years. Seasonally, the Chumash and their precursors gathered, dried, and ground acorns there. Because their mortars were carved into existing boulders, we can conclude that they stayed for weeks, possibly months at a time until the laborious task of preparing acorn meal for winter storage was complete. Rock paintings from the period suggest that they also felt the need to leave a permanent mark on the land that was not simply utilitarian, one that would serve as a sign to whomever followed, perhaps indicating the tribe's relationship to the land or fulfilling a more ephemeral aesthetic or spiritual purpose. We cannot read the intentions in these signs; we can only guess. But we do know that the earliest humans who came to this place knew themselves as intentional makers in the landscape.

Arch at Architectural Area

When Spanish settlers arrived, they used the land more intensively, raising sheep, cattle, and horses and growing wheat, fresh vegetables, and grapes for wine. They began to clear meadows for grazing and planting, and to harvest ancient trees to build shelters and ships. The mission with its massive carved beams and altar may be the most important sign they left on the land—a sign both of aesthetic pleasure and spiritual striving, but primarily a sign of dominion. Ranchers followed, and the fence became one of the most important structures. It served a utilitarian purpose, keeping domestic animals in, but often failing to keep wilder animals out. For

the landowner, the fence was a sign of refuge, of security, and responsibility. For the newcomer and the outsider, though, the sign said "No Trespassing, Private Property." But the fence could also evoke an aesthetic response, a direct experience of the beautiful interrelationships within the common space we share. Where fields and fences run with the contours of the land, they enhance human pleasure, accentuating the original spatial forms developed over time.

I walked up the canyon in a reverie of names and pleasurable associations: Ceanothus with its bouquet. California Laurel for the taste in a stew. Toyon with its red berries woven with mistletoe and draped in a holiday swag. A blue jay feather made a beautiful bookmark. In his "Marshland Elegy" from *A Sand County Almanac*, Aldo Leopold writes that the ability to perceive quality in nature begins, as in art, with the pretty, moving through successive stages of the beautiful to values as yet uncaptured by language. This idea that land ethics grow from aesthetic values rather than from economic concerns struck a deep chord in me. As I came around a bend, I caught a glimpse of the stone arch. Seen from that angle and distance, it made a radical parabola against the backdrop of mountains and trees. As I got closer, the narrow arch seemed to grow wider and I sensed that it was opening the meadow so that I might perceive the land more clearly.

The stone wall that bordered the path grew out of the arch's wide base and narrowed to make an S-shape funnel into the landscape. But, rather than rushing me through, the sinuous shape of this funnel slowed my passage, forcing me to turn right first, then left, then right again, before I could enter the meadow. When I had made the final turn, I could see three sculpted faces placed on the interior wall like watchers at the gate. Of these, only one was fully intact, and it seemed more powerful somehow in relation to the crumbling, degraded faces of the others. The dark beard made it a distinct representation of a male. The eyes, which had been glazed with a cerulean blue, caught morning light that came though the oak trees, so that the face appeared to gaze directly at me, eyes shining with a kind of messianic fervor. The stone arch held itself in place to mark my passage through an otherwise porous border, and the watchers asked me to pay attention.

My spirits sank, however, as I made my way up the mountain. A feeling of disintegration pervaded the place. Handrails on bridges were either missing or patched together out of misbegotten materials. Whole sections were missing from the large concrete sculpture named "Flower." The fanciful block chairs and wooden benches around the barbeque area had not been properly preserved so that mortar crumbled and wood rotted in the elements. Plastic bags, half-burned boxes,

and rotting plywood were strewn around the shelter that housed the barbeque. Although I felt discouraged, I was drawn across the meadow to the structural frame of a geodesic dome that spanned an area where the creek went underground. I was delighted to find a small amphitheater within it—an ideal place for Ecoliterature and Environmental Design classes or for poetry readings—complete with a wooden stage and concrete seats. But the dome felt like a temple defiled. Chunks of concrete with rusting rebar protruded from the ground. There were horse droppings in the middle as if barbarian hordes had recently conquered and sacked the place. Dock, thistle, and datura sprang up through the seats—plant species that were hardier and more determined than the humans who had constructed this space.

And yet, the dome was beautiful. The morning sky, which had seemed so still before, moved dramatically when seen through its meshed web of triangles. The dome's shapely intervention helped me to truly see the sky. Buckminster Fuller had been right to call its minimal architecture an "ephemeralization," a structure whose existence seemed brief and fleeting, but was in fact enmeshed with the universal, the eternal. Its canopy echoed the arched canopies of surrounding laurel and oak trees, the rise of the mountains, the dome of the heavens, the bony crest of my own skull. It harmonized with the arched gateway as if all together, the land and the artwork and the updraft that lifted a hawk in flight presented a symphonic movement, asking me to listen.

A spray of chamomile offered its white blossom, and I squeezed one bud gently to release its sweet smell of fallen apples. I sat on the concrete risers and ate the two peaches I'd brought with me for breakfast, then carefully wrapped the pits in a piece of paper from my notebook, and put them into my backpack. There was no one else around, and so I stood on the stage, reciting a few of my own poems, and then adding some Yeats for good measure. This was a place I would have brought my own children to watch clouds pass, where I would have brought my Freshman Composition class to write descriptive paragraphs, where I would have returned again and again to spend the night naming stars and constellations as they interlaced with the dome's finely attenuated geometry.

Who had designed this site? Why would such a jewel be abandoned? How could I begin to tell the community here of the potential for locating and developing land ethics through the shared aesthetic experience that Design Village potentially offered?

Look at the arches, the domes, I wanted to say. Feel the capability of your own hands. Look at the land.

Reading and Writing the Landscape

English classes in "Ecoliterature" analyze great works of nature writing, study local natural history, produce journals, poems and essays, and explore Cal Poly Land on weekly hikes. Environmental Literature or Nature Writing is a vital new field of study in the Liberal Arts.

Journal entry, April 27, 2001

Once again, Mother Nature has cooperated with our tribe. A beautiful, sunny, hot Friday afternoon on the Central Coast. We began our ascent of the foothills which backdrop the Poly campus. The first thought that struck me as we marched through the crunchy, golden grasses was how quickly the ground has dried out. Only a week of dry weather after seemingly months of rain, and the soil looks and feels parched.

Halfway up the hill we came to an area dominated by reeds, a small marsh. Oozing, grimy mud-thick and viscous. Crossing this, we continued up the hill to a small plateau. Pausing to check the view of San Luis Obispo, I was amazed by the beauty of it all. Out on the coastline sat an ominous, foreboding fog bank--extending from Morro Bay down past Avila to Pismo. It appeared to be moving slowly closer, rolling over hill and dale to engulf us.

Looking down on San Luis, I noticed the sprawl of the city. Only 45,000 people, yet covering so much terrain. The most prominent natural feature of the landscape from this perspective would have to be the "Seven Sisters" chain—a series of peaks extending northward which dominate the horizon.

Continuing our journey up the hill, we came upon a shady area and a huge oak tree. Its limbs extended in every direction, gnarled and twisted, supremely functional. This would be the site of our reading of Thoreau. Fitting. The temperature difference between the exposed hillside and the shade beneath the tree was substantial—probably a twenty degree spread. I envisioned native American Indians pausing from their daily chores and taking a respite in this very place years ago. A spiritual feeling prevailed.

Onward and upward. I stumbled upon a still-intact deer leg minus the rest of the body. It looked like a recent kill. I tried to imagine the scene which led to this carnage—a deer casually graz-

ing, unaware that a silent predator lurked nearby. Possibly a mountain lion or coyote. Above us extended a sparse landscape. Yucca plants dotted the hill, giving it the appearance of a Mexican desert. Only a few were coming into bloom this early in the season.

Time to head back down the hill. Running down the rocky trail on the verge of being out of control. At the bottom I looked back and felt a twinge of envy—several members of my tribe were camping out there tonight as I returned to my self-contained urban unit.

– Todd Marshall

Journal entry April 13 2001

Further, seeing how familiar Professor Holland was with the landscape—knowing the names and characteristics of all the plants — showed me the value of connecting to our surroundings scientifically as well as spiritually and morally. The former enhances the latter. It is the difference of being in a crowded room where you know no one's name, or finding yourself among intimates. In the spirit of Thoreau and Emerson I must say that a knowledge of nature's material aspects leads to a more complete understanding of her as far as her philosophical, invisible aspects are concerned. "In Nature I am not alone and unacknowledged. They [trees] nod to me, and I to them. The waving of the boughs is new to me and old… Its effect is like that of a higher thought or a better emotion coming over me." (Emerson)

– Brad Parker

Journal entry 4:32 A.M. April 28 2001

Awakening in darkness

I'm welcomed by the night
To a resplendent roofless hall
Too grand for my poor sight.

The handle of the dipper
Goes swiveling overhead
A warm wind gusts across my face
And grasses sweep my bed.

The silence of the valley
Breaks with a coyote's sound
That's followed by responses
From all the hills around.

The stars look down from heaven
The owl gives a hoot
The earth supports my body
My pillow is my boot.

– Steven Marx

Journal entry July 12 2001

words and leaves...i have started pasting leaves into my journal… . i want to remember this summer at San Luis Obsipo when the natural found its way into my writing--when the way i "saw" changed forever and i am marked by that even though this experience will end… i have always valued myself an observer, but never in such as way as to be apart and moved by the quality of life that exists separate from man and totally self-sufficent.

The earth makes noises we don't hear--even when our ears are glued to ground. i saw a trumpet vine today, identified a eucalyptus, stretched myself on freshly cut grass aware of everything and unafraid. The air here is crisp and breathable (unlike smog-layered L.A., whose fine lines are coated in brown residue). The opposite is true here. i can name myself pod or sapling or green chaos. i understand i am fuel here--destructive as i walk on grass and pick leaves. if intention really does matter, i should hope to be forgiven.

– Alene Terzian

Pennington Canyon exploration

Art Projects at Swanton Ranch

George Jercich, Art and Design Department

Professor Jercich working with clay

In the Winter quarters of 2000 and 2001, some 30+ Studio Art students and faculty participated in retreats at Swanton Ranch. Originating from the inspiration and popularity of the artwork of British artist Andy Goldsworthy, the idea was to work on temporary, site-specific projects in this remote and unusual natural setting.

Jim Elniski, an artist and psychotherapist, was re-cruited to lead the retreats. He teaches at Northland College in Wisconsin, a campus that focuses on environmentally-oriented disciplines,

Site-specific installation workshop with Jim Elniski

Site-specific installation and artist

including Art and Natural Resource Management.

Jim showed his own slides of collaborative art work in Africa at the Red House and then set up individual and group projects and critiques. One emphasis of the retreat was group participation which allowed the Art students to get to know each other and members of the Art faculty in a natural setting.

In Spring Quarter of 2002, Art & Design students organized the Swanton Ranch retreat as puppet-making workshop. This activity was inspired by the work of Theater Department professor "Doc" Malkin. The result was a night of entertainment. Groups performed original puppet stories combining visual art, performance art and live musical accompaniment. All of this resounded in the red wood forest setting of northern Santa Cruz County.

Dance class
above Sycamore Glen

Photography and Dance

Maria Junco, Theatre and Dance Department

In the studio environment, dancers all too often become sidetracked from inspiration, concentrating on technique at the expense of expression. Taking dance out of its ordinary surroundings and back to its source is an extraordinary experience, opening up new possibilities. Instead of a relationship with a mirror, the sky, sun, trees and hills become new partners. The feel of the wind on skin informs movement, and allows the dancer to fill the space with a sense of expanded dimension. The changing light and the clouds tumbling overhead create a constantly shifting landscape that the dancer responds to. The endless sky on top of Cuesta Ridge pulls the focus and energy outward, while deep in the canyon by the stream, energy becomes more internal under a passing cloud bank. The dancer learns to respond. Back in the studio, these experiences can be referenced, and the wholeness of expression recaptured through memory.

I wondered what the day would be like when I awoke to stormy skies the morning of the shoot. As we hiked around the curve into Poly canyon, the clouds started to break up and patches of blue scattered across the sky. While we snapped away, the shifting light accentuated the different forms and features of the dancers. It was a magical and inspiring experience.

– *Mackenzie Newman*

"Peaking Face"

A foot rises
A hand extends
Chiffon is wrapped around a body
The sun shines
Shadows of dance
Mountains mixed with motion
A foot falls
A hand withdraws
Chiffon is blowing in the wind
The sun sets
Memories of dance
Mountains mixed with motion

– *Anonymous*

My experience with the on-site choreography involved leaping barefoot on rocks near a pond. As our group of three concluded with a pose, I lay back on the boulder with my arms stretched down to the pond and my eyes toward the sky thinking, "this is pure....this is dance.

– *Maggie O'Malley*

I felt immediately inspired by the natural surroundings. We were hanging from trees and laying in flower beds; everything could be used as a prop. It was such a creative and stretching experience since we couldn't rely on mirrors, music, or the smooth dance floor.

– *Robyn Wood*

Above Sycamore Glen

A Meditation on Sheep and Those Who Tend Them

Paula Huston, English Department

The stone sheep corral on upper Pennington Creek looks ancient, even mythological, though it is probably no more than 130 years old: a jumbled, wavering line of serpentine rock, laid down by hand sometime after the great drought of 1862-1864 when sheepmen first arrived in the county. This one sits near the site of the J. Pennington homestead and is the only trace, except for the olive trees, of the hardy folk who once lived there. I've seen walls like this before, thousands of years old, in both Greece and Israel, walls of piled rock meandering over the lion-colored hills, walls dividing one man's flock from another.

For sheep are serious business--you can see this at the Pennington corral. Somebody sweated for months to dig out these stones and carry them to the site, to feel

out their flat planes and their protuberances, to fit them together like an immense and ungainly puzzle, somehow meant to stay vertical in spite of winter freezes, spring gusts, the baking heat of summer. Not to mention a crowding mob of woolies, spooked by a bobcat or a moonlit coyote songfest. Whoever worked on this wall had good leather gloves or wound up missing skin. And--no doubt about it--this long project carved itself into the base of his spine forever.

But where were the sheep when he was building? Not necessarily staying out of trouble. For these peaceful ruminants are as difficult as goats to keep confined, yet once loose, utterly defenseless. A determined dog can tear a ewe to shreds; a pack can decimate a flock, just for the fun of it. Nor do sheep make good decisions. The lost sheep has in fact become a universal symbol for foolish helplessness. I imagine their bony skulls and what lies beneath: does an animal so limited in intellectual ability have the capacity for dread? Yet what else could it feel, given the circumstances?

Much love is thus required of the shepherd. I've known people who raised sheep--my uncle, a Norwegian bachelor farmer in Minnesota, kept a good-sized flock for many years--but he was not a shepherd in the old, venerable sense of the word. His ram, a yellow-eyed monster with curling horns, he kept locked in a stall in the barn; the ewes, confined by sturdy fences, grazed quietly among crabapple trees. When the temperature plummeted and the snow fell, he drove them all inside where mutual desire--ram and ewes--kept them warm. Only once a year did my uncle know the shepherd's heart, and this was during lambing season. It was then he laid aside his other chores to focus on his flock, to think like a sheep, to inhabit that dark, uneasy psyche. It was then that his natural tenderness, so rarely called out during his hard days of labor on the farm, came forth.

Real shepherds, those loners who tend thousands of animals on the open range, are harder to find. I met one once, a Basque man on a high Sierra plateau with his trailer, his dogs and his gun. The sheep were everywhere, 2,500 of them, cropping grass in the thin alpine air. They'd come from the Valley, he told me, and he would take them down again, a 10,000-foot descent, when the cold days began. We'd stumbled onto his pasturelands, my young husband and I, while hunting for arrowheads along an icy river. The battered pink trailer had been there for years--in fact, we'd seen another one a mile back, empty, with words in a strange language scrawled on the inside walls, as though without telephone or mail some anguished shepherd had had no other way to court the girl he'd left behind. Our own shepherd explained this to me in his few words of English: young men from his country, he said, came to

Sheep Corral: Pennington Canyon

America for work and work alone. When they saved enough to marry, they went back to their towns at the base of the Pyrenees.

I wanted to know more. What did he do, for example, about mountain lions? What happened during lightning storms? Did the sheep go crazy? My husband, his mind on the arrowheads, wandered off along the riverbank while the shepherd and I talked on and on. He was a small man about my size, younger, I was sure, than he looked. His face was seamed, his fingernails black, his front teeth rotted. Something had chewed on one ear and a persistent fly hung near the crusted-over wound. His dog, a border collie mix, lay close by, keeping both master and flock in her steady gaze. We were standing near the pink trailer with the rifle propped against it. His brown eyes moved off to the east in the direction my husband had headed, and I followed his look. Nothing but green meadow and the backs of grazing sheep.

He turned back to me and cleared his throat, then asked, very courteously, if I would mind stepping inside the trailer, for he had something to show me, something he was sure I'd like to see. A profound silence fell upon us, broken by the distant scream of a wheeling hawk. No thank you, I said carefully, already starting to move off. I've got to be going now. I need to catch up with my . . .

No, please, he said, I think you would like this. I looked at the door of the tiny trailer, which was ajar, and tried to imagine its impoverished interior. A water bucket, perhaps, and a tin pot, bags of rice and beans, a cot and a ragged sleeping bag. Were there love poems on the walls?

No, I said. I'm sorry. I really need to go now. I smiled reassuringly into the soft brown eyes and thought that I would kill my oblivious husband if I got out of this one alive.

Then wait, he said. One moment only. He turned and slipped through the door and I contemplated just bolting, darting to the side and running blindly until whatever was going to happen to me happened. Beyond the trailer, the flock moved slowly through the grass like an immense living body. All was peace, except perhaps in the heart of this lonely shepherd.

But then he was back, holding out one closed fist for my inspection. The hawk screamed again, further off, and I said, What is it? Slowly, he rotated his hand and opened his palm. On it lay a perfect obsidian ax head. For you, he said. Do you like?

The noon sun struck light from the razored edges. It belonged in a museum, or back in the cave he'd found it in. My husband, I thought, would go crazy for this, the find of the day. I

reached out and touched it, then shook my head. Thank you, I said, but I can't take it. It's too beautiful, do you understand?

Please, he began, but I shook my head again, firmly this time.

He pulled a filthy handkerchief from his back pocket and wrapped it around the ax head, sliding it into his jeans. Then he put out his hand once more, and I wondered if he wanted me to shake it. Instead, he placed two delicate, filthy fingers against my sweatered breast. Before I could even startle, he'd withdrawn them. Look, he said. Between his fingers was a single white hair. He nodded at the dog, smiling and exposing those pathetic teeth of his.

I swallowed, flushed, and walked off with as brisk a dignity as I could muster. What had just happened? I didn't know--only that I'd been embarrassingly naïve, that my husband had been worse, and that this isolated shepherd with the crusted wound on his ear had somehow read both of us with the penetrating accuracy of a psychologist or priest. When I was a long way off, I looked back for just a moment. He was still standing by the steps of the pink trailer, watching me, and when he saw that I was looking, he lifted his hand in a wave.

Years later, I wondered what else he'd read about us. I wondered if he'd seen that the marriage wouldn't last, that we were both too young and ignorant to sustain a genuine partnership. I wondered whether he'd seen through to my dark sheep's mind, which, during the tumultuous time of the divorce, suddenly panicked, stampeding me nearly to the edge. Maybe he'd had the best of intentions after all. Maybe his shepherd's heart had seen what my husband in his youth could not possibly know: that I was in serious need of some loving guidance.

The Pennington rock corral is a monument to the strange and lonely tenderness of the shepherd. Who else could have hefted those stones? Who else would devote himself to such creatures? Who else would have the patience for such passive ignorance, such terrible, dumb dread?

Recreation

Recreation derives from the latin word *recreare*, meaning to restore, refresh, invest with vigor or strength. Cal Poly Land provides unparalleled resources for recreation. In its canyons, fields, creeks and mountains, thousands of people find peace and excitement, solitude and companionship, relaxation and challenge. They range from earthbound hikers, joggers, bikers, and equestrians to high flying paragliders, trapeze artists and model airplane enthusiasts.

These intense recreational activities need not have high negative impacts upon the landscape and upon one another if those who enjoy them are considerate and if the land owner can provide appropriate management services. This chapter includes the statement of a Land Ethic for recreational users and an outline of custodial responsibilities for the University formulated by Professor of Recreation Management, John Harris. It concludes with a collecion of trail maps and itineraries.

Mountain Biking

Cal Poly Land is a well-known venue for mountain bikers. *Fat Tire Fun*, a best-selling local guide by Gwen Dawkins and Dirk Franklin, maps two favorite routes, which are identical with the "Poly Canyon Loop" and "The Great Loop," described later in this chapter. These dirt roads and trails are shared with hikers, joggers, horseback riders, cattle and wildlife.

Biking the Poly Canyon Loop

My vicinity affords many good walks, and though I have walked almost every day for so many years, and sometimes for several days together, I have not yet exhausted them. …There is in fact a sort of harmony discoverable between the capabilities of the landscape within a circle of ten miles' radius, or the limits of an afternoon walk, and the three-score-years and ten of human life. It will never become quite familiar to you.

– H.D. Thoreau "Walking"

Rusty

I hop on my trusted steed. His spokes rusted from the salty sea air. This is a city horse, no mountains. In Hermosa only the long cement strand that separates the houses from the beach. Up, up I go.

There's digging in the street...the lines of a new dorm. A couple ahead of me disappears and reappears with each slight curve. I try to identify what we've been taught about the flora of SLO: Good for Wiping, Danger Beware.

At the small farm, the horses are gone. No one for Rusty to play with. The sweet blackberries are inviting. The sun is intense in the great open. I worry about my solar panel, the skin above my eyebrows and below my creeping hair. Did I use enough sunblock? Curses I didn't bring a hat.

But it is the space. The color of this grass Van Gogh never captured. The contrast with the blue. It hits me in the stomach. Words, never. Only sight.

The road is sandy, less maintained. I give Rusty a rest and begin to walk alongside him. The road climbs through the grass. At the top I follow it with my eye, a pleasing curve fast sleek, then it disappears a gray snake sliding beyond the hill. The road follows some unseen energy, nothing the engineers can look up in a chart. The streets of New England are paved cow paths. The roads of my youth are designed by cows.

I coast. At a bottoming out, shade from good-for-wiping. A still flowing creek. A sunburnt tree, its skin peeling. The road is a washout. An imp, I play in the mud. Through the mud, back in the sun. A cows skull, the toll taker, sits on the side of the road. I want to see a snake slither through its eye socket. I reach the base of the bowl. The boundaries of time and gravity pull me back to the library.

– Peter Marcoux, summer student

The authors of *Fat Tire Fun* ask riders to respect users and the land to avoid closure of the trails to bikers. These are some of their rules of the road for cyclists:

- *Allow pedestrians and equestrians the right of way*
- *Maintain safe speeds and don't "bomb" other users of the trail.*
- *Respect private property.*
- *Don't litter; pack out whatever you bring in.*
- *Don't stop in the middle of the trail where you can be a hazard to approaching cyclists.*

Other rules to consider while riding on Cal Poly Land:

- Stay out of "no bicycling areas" posted for good reason by Cal Poly farm staff.
- Close all farm gates to prevent livestock from straying. This is especially important under new grazing regimes that keep cattle out of creeks and riparian areas and in small enclosed areas for short periods.

The agricultural use of this land takes priority over recreational use.

- Stay on existing trails. Going off them will create new trails that others will follow and that will encourage still others to create yet more. It's not hard to do, especially when the ground is wet, but each new trail damages plants, many of which are rare and sensitive species, and it contributes to erosion, destabilizing the land and clouding the creeks, thereby harming fish.

Hiking and Jogging

Hikers on serpentinite hillside

Cal Poly Land offers a multitude of paths through a landscape of extraordinary variety. The geological, biological, agricultural, technological, and artistic resources catalogued in earlier chapters can all be accessed by foot within an afternoon's saunter. For comfort and safety carry plenty of water on any of these hikes and learn to identify and stay clear of poison oak alongside roads and trails.

A Land Ethic for Recreation and A Program for Recreation Management on Cal Poly Land

John Harris, Recreation Administration

There are many outdoor recreation opportunities here at Cal Poly. Your behavior can either enhance or detract from this place, from your future experience, and from the outdoor experience of others. Please make this a "heart" issue as you enjoy the land of Cal Poly. Your WISE enjoyment of the land will enable future visitors to have an enjoyable experience also.

Please make a concerted effort to do the following in your outdoor recreation activities at Cal Poly:

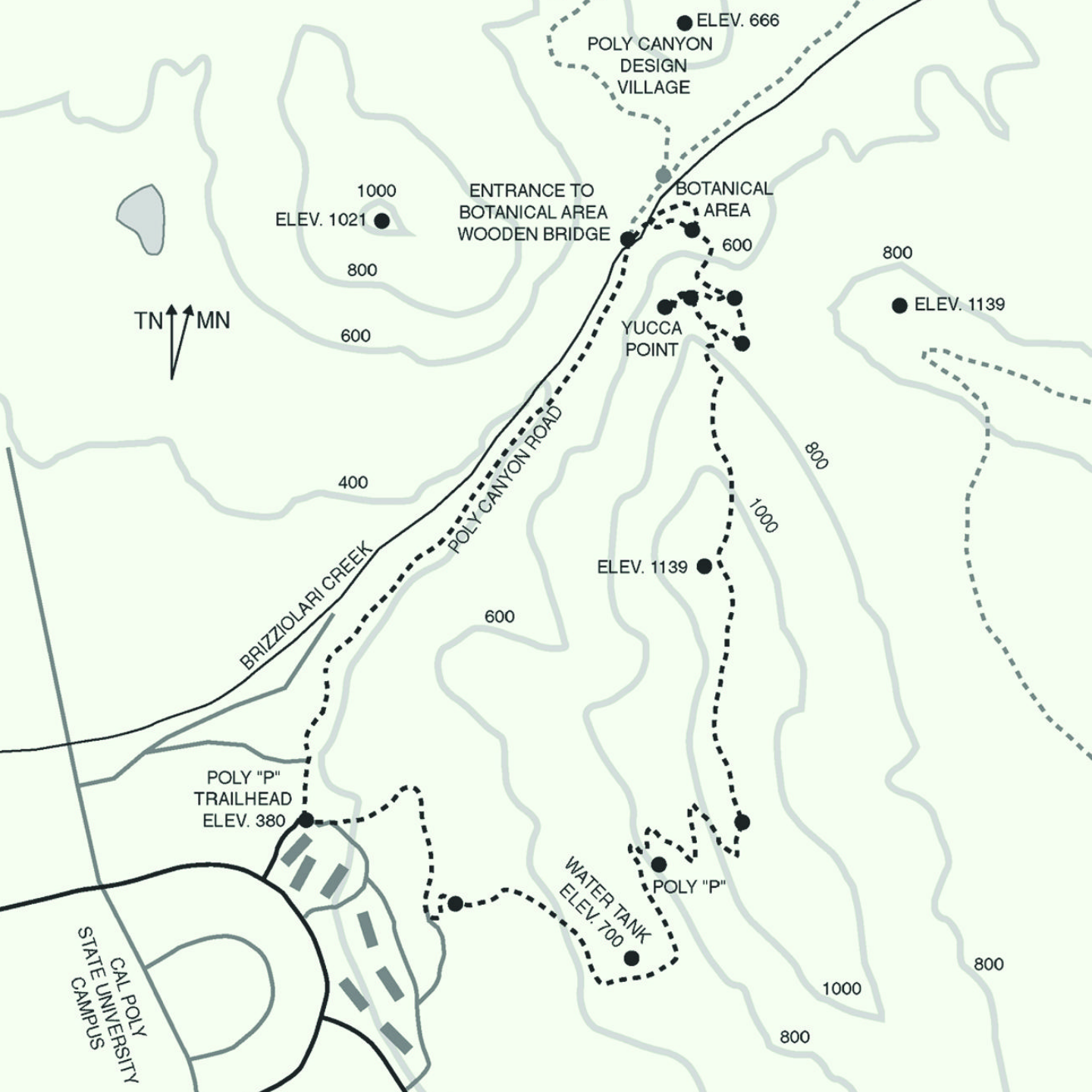
- Respect your activity by being a model ambassador
- Respect the land and its living and nonliving parts
- Respect other outdoor recreation visitors
- Respect the land owner and efforts to conserve and protect the land
- Leave natural and cultural objects so others may enjoy them
- Pack out your trash and that of others
- Reduce your impact by being aware of it: stay on trails and roads, avoid areas and behaviors that make impact, reduce your group size
- Report negative outdoor recreation behavior to officials

1. Cal Poly will employ a permanent natural resource management professional to ensure the protection of the land.
2. The Cal Poly Master Plan will be modified to provide quality outdoor recreation areas and facilities.
3. "Special" areas such as Brizzolara Creek will be given the highest protection status by campus administration and appropriate restoration work will take place.
4. The outdoor recreation visitors to Cal Poly Land will develop a moral commitment to the "wise" use of the land and consideration for their fellow outdoor recreation visitors.
5. Proper outdoor recreation facilities (trails, paths, etc.) will be developed to both protect the land and to provide quality outdoor recreation experiences.
6. Programmed outdoor recreation activities, such as walks, talks, demonstrations, overnights, will increasingly take place.
7. Meaningful volunteerism will take place for both development and maintenance of outdoor recreation facilities and for programmed educational activities.

Footbridge over Brizzolara Creek

8. Educational materials will be developed to increase the maturity level of outdoor recreation visitors to Cal Poly Land.

9. A quality publicity plan to promote Cal Poly's outdoor recreation areas, facilities, and activities will be developed.

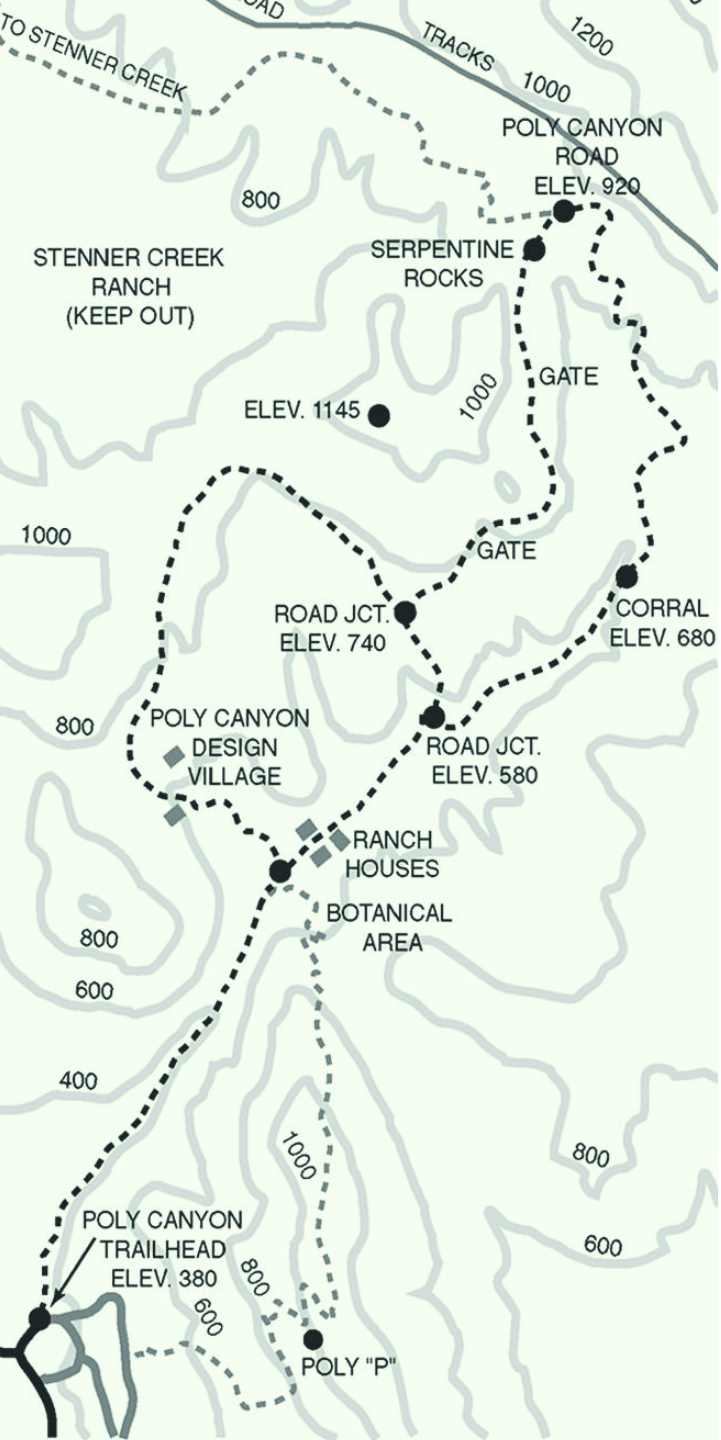

ELEV. 666
POLY CANYON
DESIGN
VILLAGE
1000
ELEV. 1021
ENTRANCE TO
BOTANICAL AREA
WOODEN BRIDGE
BOTANICAL
AREA
600
800
800
ELEV. 1139
TN
MN
600
YUCCA
POINT
400
POLY CANYON ROAD
800
1000
ELEV. 1139
BRIZZIOLARI CREEK
600
POLY "P"
TRAILHEAD
ELEV. 380
WATER TANK
ELEV. 700
POLY "P"
CAL POLY
STATE UNIVERSITY
CAMPUS
800
1000
800

Poly "P" Loop

Trail Overview: This is a good year-round trail. With a moderate amount of effort, the hiker will be treated to some of the best views of San Luis Obispo, Cuesta Ridge and the Poly and Reservoir Canyons. Wildflowers flourish here in spring. This trail was partially built in the late 1980s by the California Conservation Corps (CCC). The trail on the face of the "P" was built in 1998 by the local chapter of the Sierra Club. The addition makes this an enjoyable loop trail.

Poison oak

Poly Canyon Trailhead Description: From the parking lot we pass through an open gate surrounded by eucalyptus trees. The road quickly turns to dirt as it passes above the cattle unit and starts to wind its way into the canyon. We again enter a grove of eucalyptus with a road to our right leading to the Poly dump. Just ahead is a short trail to our left leading down to Brizzolara Creek. If you cross the creek, you can take a less-used trail to the wooden bridge. We will continue along the road, reaching a wooden bridge. The trail crosses the creek and enters the Cal Poly Botanical Area. Go right at the fork just past the bridge. The trail starts a steady and sometimes steep climb over rocky ground. It first comes to East Canyon Trail Junction. You can turn right here if you wish and rejoin the trail just ahead. We take the left fork, climbing to Bob's Trail Junction. Turn right here, and walk about 100 yards to the South Boundary Trail. Turn left here and continue up the hill. The trail, still climbing steeply, eventually comes to a rocky outcropping leading to the Yucca Viewpoint Junction. Continue to the left, climbing to the top of the ridge at 1100 feet. Make sure to take in the fine views along this ridge from San Luis Obispo to Morro Bay. The trail now heads south along the ridge for 0.3 mile to a cairn or large rock on the left as the trail swings right, then left, down a set of well-graded switchbacks. If you are going straight downhill, you missed the left turn. The trail continues its descent to a small open meadow, then switches again to the base of the Poly "P." From the "P," the trail traverses the hill and reaches the buried water tank. Follow the access road to a locked gate. Just beyond the gate, follow the road left to the parking area, then make a right turn over a small rise before descending the final 100 feet and returning to the Poly Canyon Trailhead.

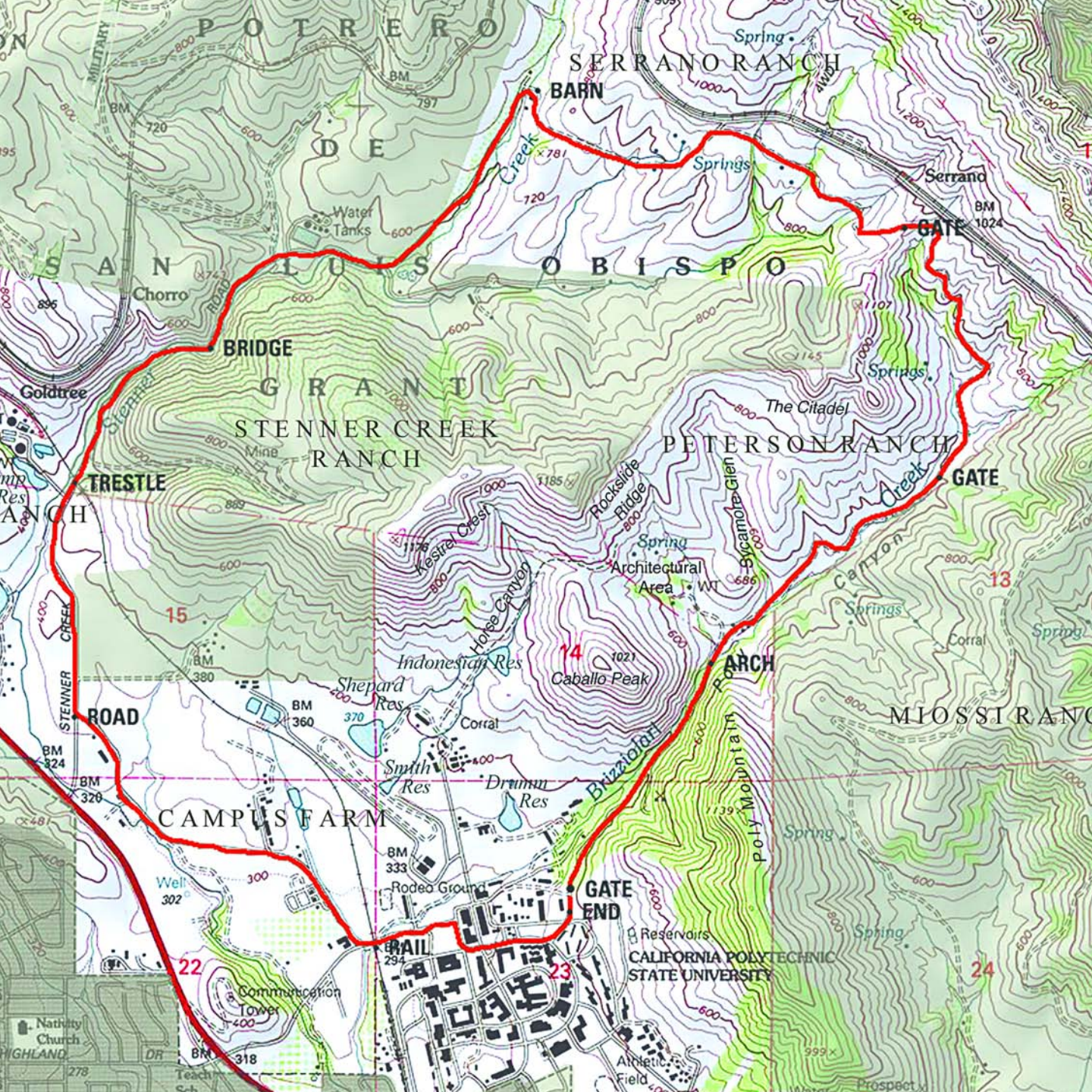


Poly Canyon Loop

Trail Overview: This loop goes mostly along a farm road with a short section of actual trail. It starts with pleasant walk along Brizzolara Creek, explores the bottom of Poly Canyon, and finally climbs to a saddle dividing Poly Canyon and Stenner Creek Canyon. West Cuesta Ridge is the prominent backdrop for this hike.

Poly Canyon Trailhead Description: From the parking lot we pass through an open gate surrounded by eucalyptus trees. The road quickly turns to dirt as it passes above the cattle unit and starts to wind its way into the canyon. We again enter a grove of eucalyptus with a road to the right leading to the Poly Quarry. Just ahead is a short trail to our left leading down to Brizzolara Creek. If you cross the creek, you can take a less used trail to the wooden bridge. We will continue along the road passing a wooden bridge spanning Brizzolara Creek. On the left is a rock arch leading into Poly Canyon architectural area. This trail goes up to the ridge and rejoins the main trail. Our route continues along the road to the Ranch Houses ahead and a gate. Pass through this gate then descend a short distance to another gate shaded by a large sycamore tree. A side trip here heads up a trail to the left, following the

tributary to Brizzolara Creek through a rich riparian grove into a secluded hollow called Sycamore Glen. The road continues straight, then rounds a bend to the right to reach a road to the left. Turn left and climb 160 feet up the hill to another road junction. Turn right here. At this point we are on the trail that is part of the "Geological Tour of Poly Canyon" described earlier. The trail starts to narrow as it contours the hill known as "The Citadel" and passes through a gate. A short climb offers us views of West Cuesta Ridge and Poly Canyon. The trail narrows and descends to a wire gate beneath the oaks. From here, the trail starts its final climb to the saddle overlooking both Poly and Stenner Canyons. On top of the saddle, there is a cluster of serpentine rocks, a good spot for a lunch or rest stop. Owls often leave pellets on this rock and just below it is evidence of a recent landslide in the unstable Franciscan melange. Leaving the rocks behind, the trail continues along the fence line rejoining Poly Canyon road and passing new livestock watering troughs fed by a pipeline transporting water from springs above the railroad tracks. At the junction you may turn left and continue a longer hike through Stenner Canyon—see "The Great Loop." Our route turns right revealing views of Lower Poly Canyon, the Miossi Ranch, Poly Mountain, High School Hill, and glimpses of the city of San Luis Obispo as we head downhill, rounding many bends before reaching a gate with a corral. Continue along the road again through one more gate to reach the road junction at which we turned earlier. From this point retrace your steps along the road to the entrance of Poly Canyon trailhead.


BARN
GATE
BRIDGE
TRESTLE
ROAD
GATE
ARCH
GATE
END
RAIL
SERRANO RANCH
SAN LUIS OBISPO
GRANT
STENNER CREEK RANCH
PETERSON RANCH
CAMPUS FARM
MIOSSI RANCH
Water Tanks
Chorro
Goldtree
Mine
Serrano
Springs
Spring
The Citadel
Rockslide Ridge
Sycamore Glen
Canyon Creek
Horse Canyon
Kestrel Crest
Indonesian Res
Shepard Res
Smith Res
Drumm Res
Caballo Peak
Architectural Area
Corral
Rodeo Ground
Well
Reservoirs
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
Communication Tower
Nativity Church
Athletic Field
Prospect
Brizziolari
Poly Mountain
Stenner Creek
Stenner Creek Road
Military
13
14
15
22
23
24

The Great Loop

The Great Loop is the prime route for hikers, runners, bikers, and equestrians. A 7.5 mile grand tour of all regions of the 3000 acre San Luis Obispo Creek Watershed campus, it includes an elevation gain of 650 feet and splendid views of both Brizzolara and Stenner Creek drainages, stretches along two streams in parallel canyons, goes by picturesque old farm buildings, and alternates between sun and shade, ascent and descent.

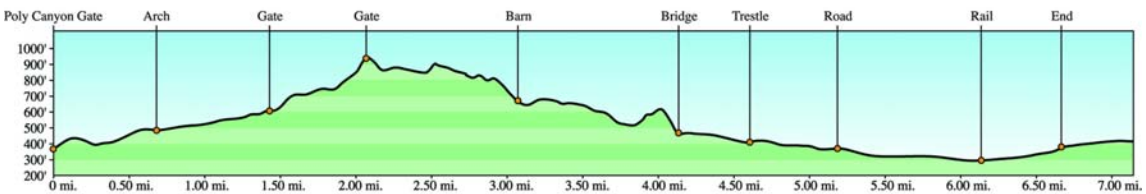
1. Start at the gate that restricts vehicular access and ascend through the canyon between Poly Mountain and Caballo Peak. Pass the Arch at the Architectural area, Peterson Ranch buildings, and big trees at the mouth of Sycamore Glen. You'll see the State Water pipeline crossing, and a gate by an old cattle loading chute.

2. Begin the long climb toward the divide, crossing tributaries of Brizzolara Creek that originate in springs above the railroad tracks. At the crest, pass through a gate and hairpin down the back of The Citadel. Climb up to the tracks and continue down and up and down to Serrano Ranch.

3. Cross Stenner Creek at the old barn and take the road past Chumash Challenge, exiting Poly property at the gate. Follow the creek as it finds its way downhill along the back of Rockslide Ridge and Kestrel Crest. Walk through the twisting canyon until Bishops Peak comes into view under the railroad trestle, and re-enter Cal Poly Land at Cheda ranch.

4. Leave Stenner Creek behind, heading uphill toward the junction with Mt. Bishop Road at the Poultry Unit. Turn left keeping the railroad now on the left. After the Beef Cattle Evaluation Center, see Parker Barn and Stenner Creek return on the right. Pass by the pungent dairy lagoon, the crop fields and orchards and hang a left at the busy intersection with Highland Drive.

5. Use the underpass marked "1900" to cross under the railroad again. Brizzolara creek flows below it through a culvert with a fishladder. Watch for traffic on the way back to the starting gate.




The Citadel
PETERSON RANG
Rockslide Ridge
Sycamore Glen
MORTARS
Spring
Architectural Area
SADDLE
Kestrel Crest
Horse Canyon
Canyon
Springs
ARCH BRIDGE
Indonesian Res
GATE
GATE
Corral
Shepard Res
Caballo Peak
1021
ARBORETUM
Smith Res
START
Drumm Res
Brizziolari
CROSSING
Poly Mountain
Spring
BARN
BRIDGE
BM 333
Rodeo Ground
FEEDMILL GATE
Reservoirs
BM 294
CALIFORNIA POLYTECHNIC STATE UNIVERSITY

Horse Canyon Loop

This hike circling Caballo Peak is somewhat strenuous at the start. It affords splendid views of campus, city, and back country.

1. Begin at parking lot below Environmental Horticulture (EHS) and Horse Units and make a side trip to Arboretum.

2. Weave through the Horse Unit, pass arenas and corrals, go uphill through two gates to Indonesian Reservoir. Always close gates.

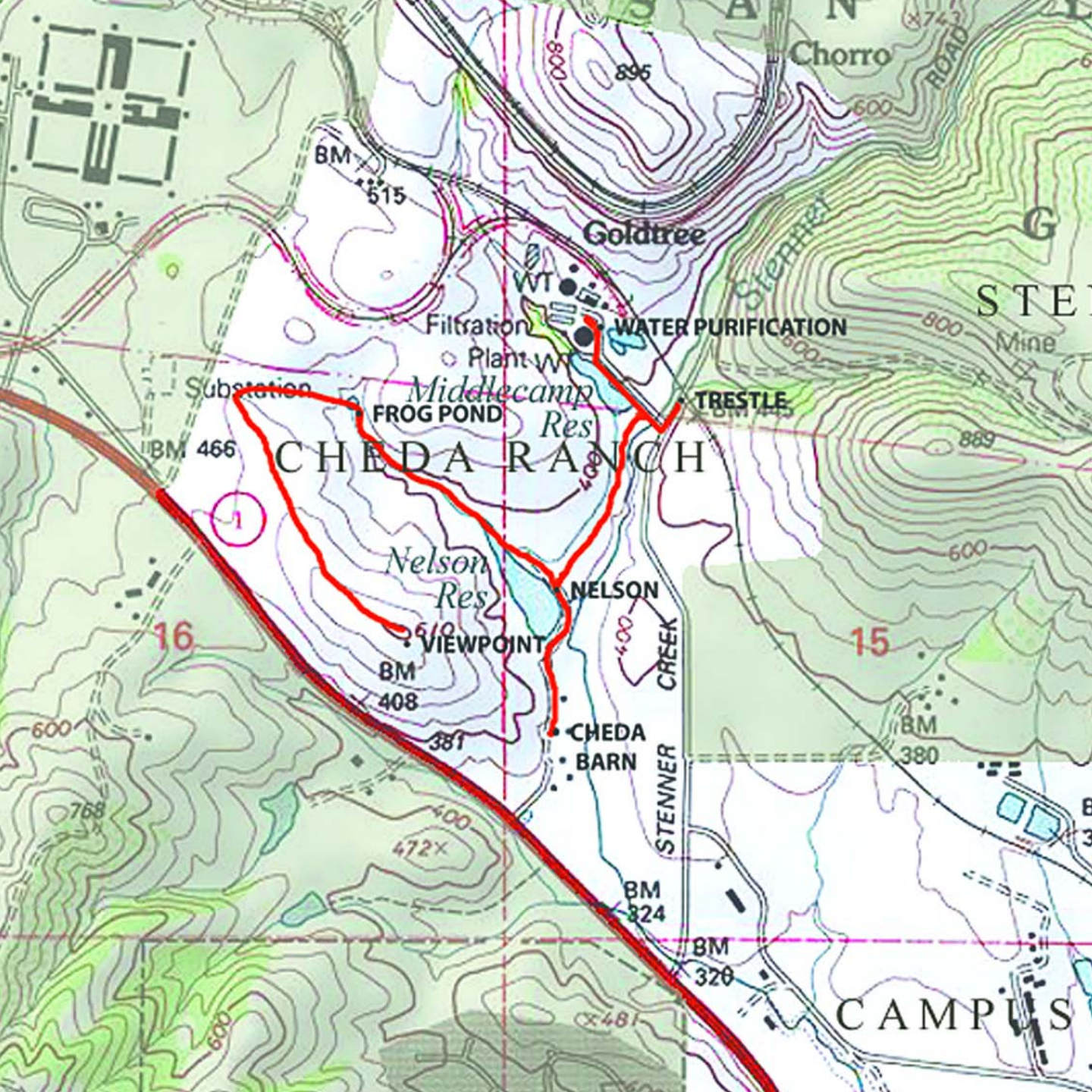
3. Pass bedrock mortars under the California Bay grove to the left of the path, head up through Horse Canyon to a saddle.

4. Follow the path below Rockslide Ridge and above the Architectural Area to a trail on right and head toward the ridge top sloping down toward Poly Canyon. Check out more bedrock mortars surrounding the lone clump of bay trees and follow the path down toward Peterson Ranch buildings, ending at a metal gate converging with Poly Canyon road.

5. Follow the road briefly past the stone arch and take the trail on the right opposite the footbridge on the left and before the road crosses Brizzolara Creek. Negotiate the precarious trail along the creek through the canyon and bear left down steps to cross the creek in a eucalyptus grove. Ascend the steps to Poly Canyon Road.

6. Walk to the junction with Feed Mill road, turn right and wind through the feedmill to a bridge crossing Brizzolara Creek. Dogleg right toward the Bull Test area, then left past Drumm Reservoir toward the barns, and end at the parking lot below EHS and Horse Units.

Lone clump of bay trees


Chorro
ROAD
BM
515
Goldtree
WT
Filtration
Plant WT
WATER PURIFICATION
Substation
FROG POND
Middlecamp
Res
TRESTLE
BM 466
CHEDA RANCH
Nelson
Res
NELSON
VIEWPOINT
BM
408
381
CHEDA
BARN
CREEK
STENNER
BM
380
BM
324
BM
320
CAMPUS
16
15
Stenner
Mine
895
800
600
400
768
472×
481

Cheda Ranch Hike

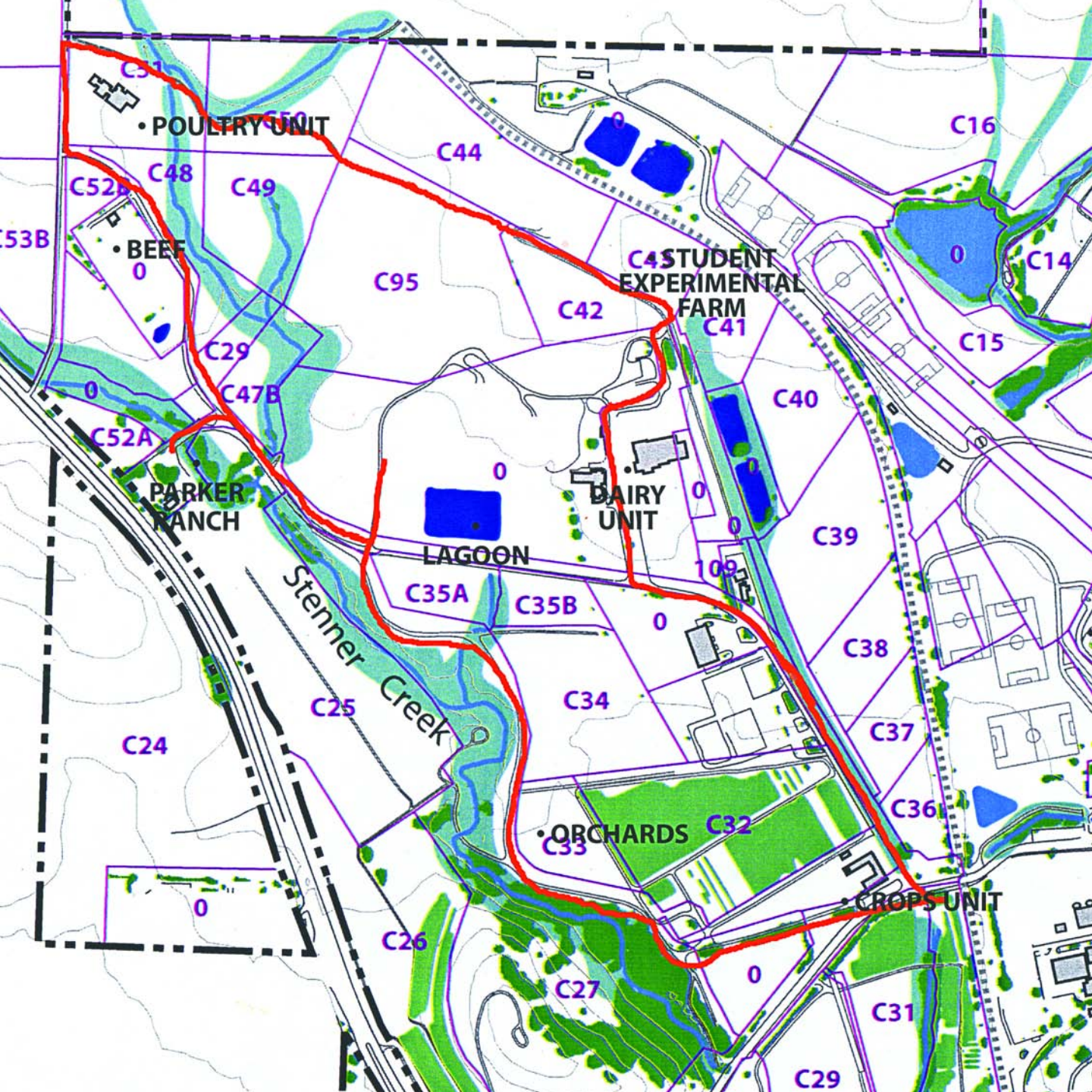
This easy hike passes technological landmarks, rich riparian areas, impressive views, and historic agricultural facilities.

1. Start at the trestle over Stenner Canyon. Check out the City Water Purification Plant if open, then walk back down to Middlecamp Reservoir through the gate to the right, passing below the vineyard to Nelson Reservoir. Both feature excellent bird-watching.

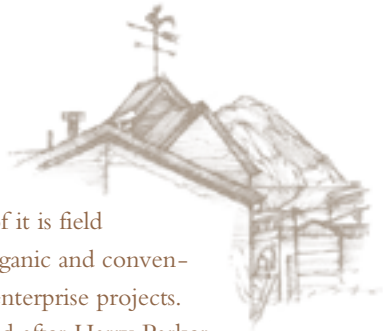
2. Turn right and head up a drainage, passing Frog Pond, host to much wildlife. Facing the State Prison, follow the road to left through a gate and back toward campus as it rises to a viewpoint of campus and the Morros.

3. Head back down to Nelson Reservoir and turn right following the road to Cheda Ranch buildings to see the Sheep Unit, Stenner Creek restoration area, antique barn and farmhouse, and striking olive and black walnut trees.

Exterior and interior views of Cheda Barn


POULTRY UNIT
BEEF
PARKER RANCH
LAGOON
DAIRY UNIT
STUDENT EXPERIMENTAL FARM
ORCHARDS
CROPS UNIT
Stenner Creek
C51
C50
C44
C48
C49
C52B
C53B
C95
C45
C42
C41
C16
C14
C15
C40
C29
C47B
C52A
C35A
C35B
C39
C38
C37
C36
C34
C25
C24
C32
C33
C26
C27
C31
C29
109

Farm Walk 1

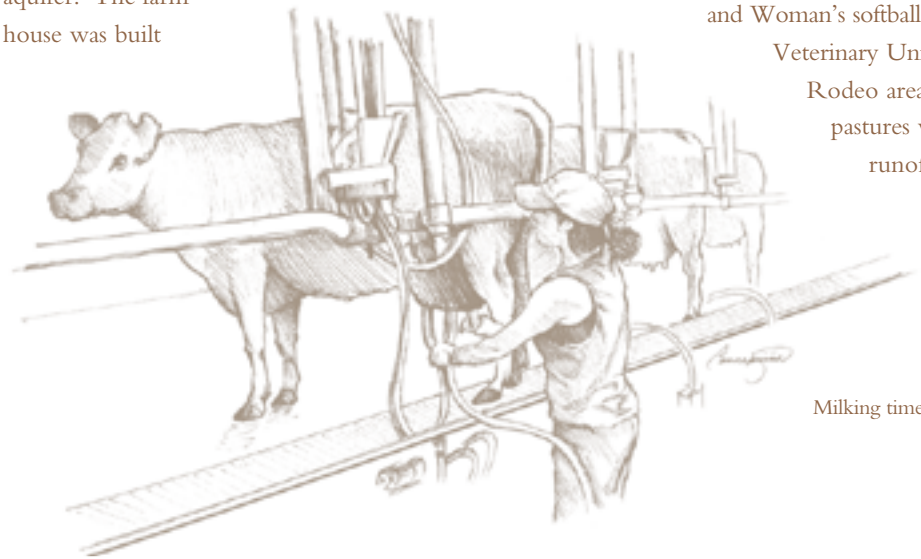


This is an easy walk along farm and university roads. Light traffic may be encountered in some sections.

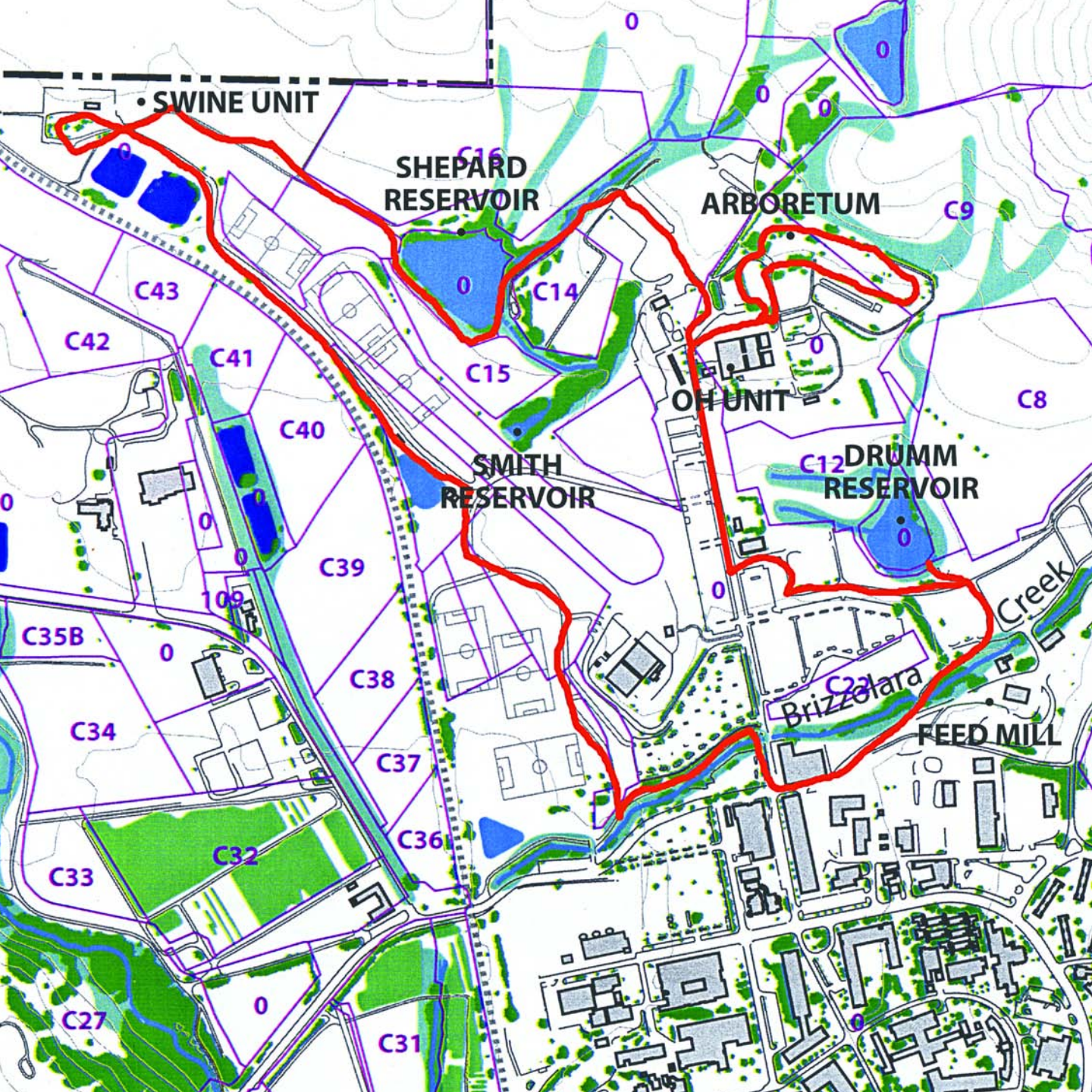
1. Start at the Crops Unit and head toward Radio Hill under the cover of trees. Following Stenner Creek, the road passes through orchards and crop fields.

2. Cross Mt. Bishop Rd. and take the dirt road for a look at dairy darns and the lagoon. Return to Mt. Bishop Road and follow the creek to Parker Ranch. This is the site of what was called "The Old Chorro Dairy" operated by the Fiscalini family from 1920 to 1928. Cal Poly acquired it in 1929 primarily for the excellent wells which dip into the Stenner creek aquifer. The farmhouse was built about 1910. Just south of it is field 25, which grows both organic and conventional crops for student enterprise projects. The Parker barn is named after Harry Parker who lived here and served as beef herdsman and instructor from 1936-56. Continue past Beef Evaluation corrals and turn right on Stenner Road. Enter gate behind Poultry Unit, walk parallel to railroad tracks and visit Student Experimental Organic Farm.

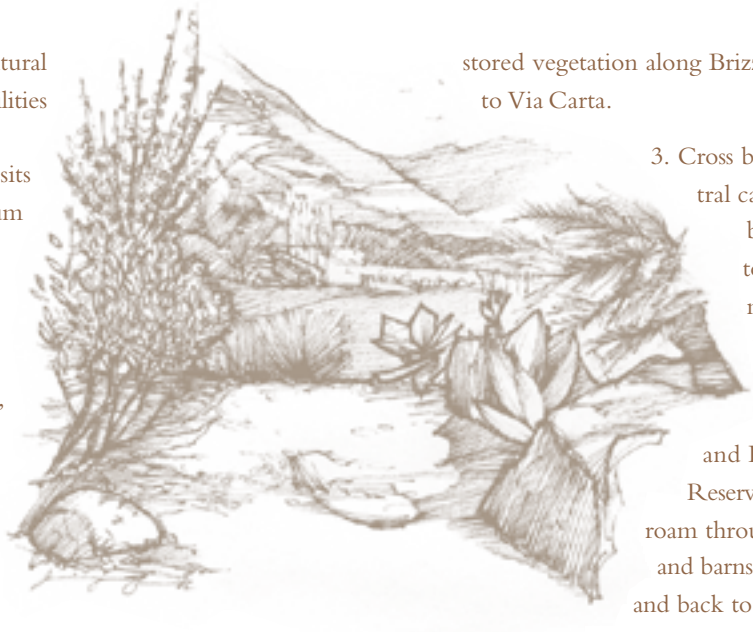
3. Wind through the Dairy Unit and tour a state-of-the art milking parlor and across the parking lot, an advanced milk processing facility. Often calves are found tethered nearby, eager to play with visitors. Continue south down to Mt. Bishop Road, turning left above the Warehouse and Woman's softball field. Pass the Veterinary Unit and new Rodeo area on the left and pastures watered with runoff from the Dairy Lagoon, and return to the Crops Unit.



Milking time at the Dairy Unit


SWINE UNIT
SHEPARD RESERVOIR
ARBORETUM
C16
C9
C43
C14
C42
C41
C15
OH UNIT
C8
C40
SMITH RESERVOIR
C12
DRUMM RESERVOIR
C39
109
C35B
C38
C22
Brizzolara
Creek
FEED MILL
C34
C37
C36
C32
C33
C27
C31
0

Farm Walk 2



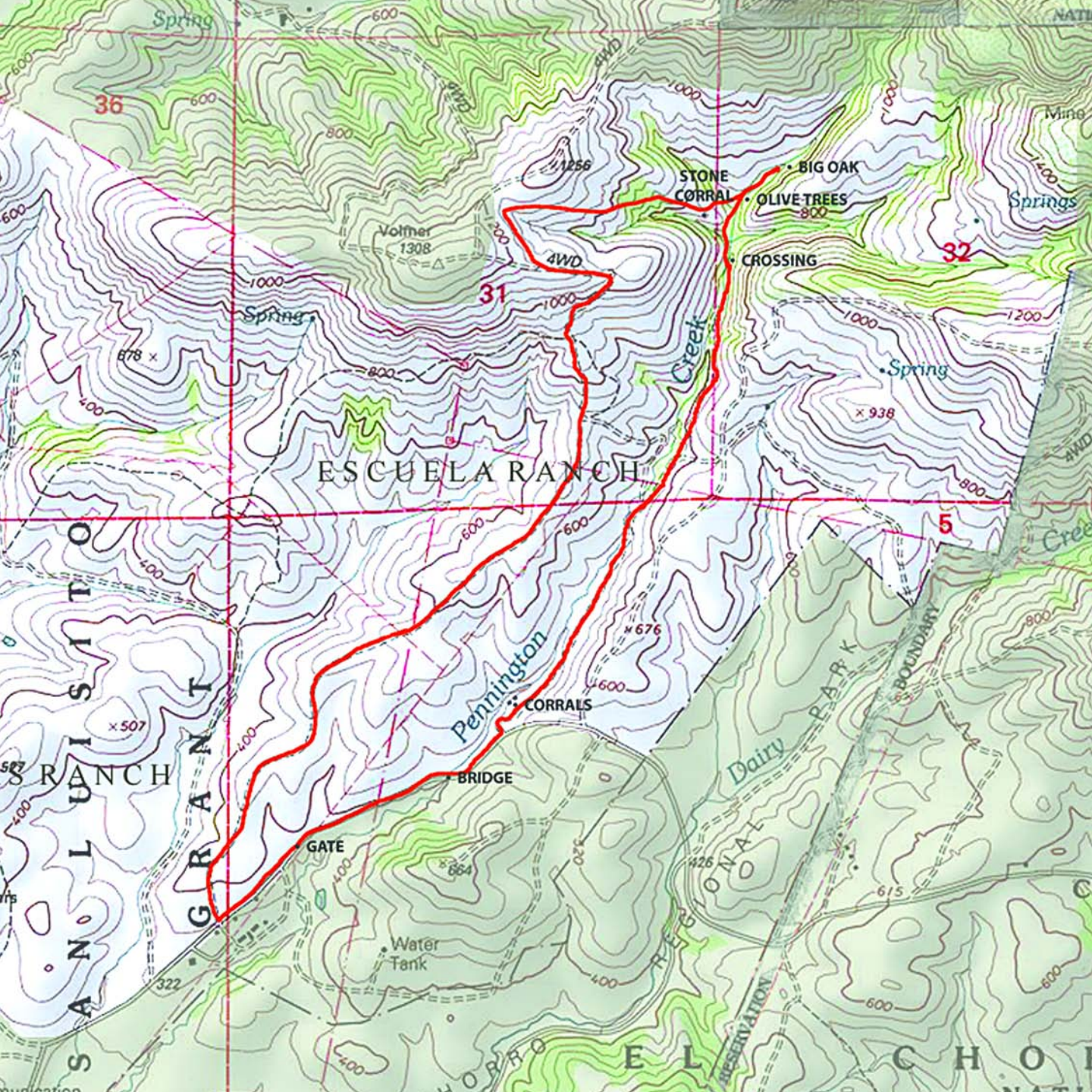
California Collection
at Arboretum

This tour of agricultural and recreational facilities of the Extended Campus includes visits to peerless Arboretum gardens, horses, riparian wildlife sanctuaries, pigs, a state-of-the-art recreation complex, restored creekside paths, aging industrial facilities, and a high-tech irrigation training facility. It's an especially entertaining walk for children.

1. Start at the Environmental Horticulture Unit. Go through the green houses and instructional plots and turn uphill to discover formal gardens on the left and a variety of native and exotic vegetation communities on the right.

2. Walk through the horse unit and through the gate by the creekbed. Head down to Shepard Reservoir and circle it on the dike, go through gate to the Swine Unit and head back through the recreation complex to a shaded path of restored vegetation along Brizzolara Creek to Via Carta.

3. Cross bridge to central campus and go behind garages toward feed mill. Re-cross the creek and visit the Bull Test Area and Drumm Reservoir, then roam through corrals and barns to Via Carta and back to the start.


BIG OAK
STONE CORRAL
OLIVE TREES
CROSSING
ESCUELA RANCH
CORRALS
BRIDGE
GATE
Water Tank
Pennington Creek
Dairy Park
BOUNDARY
SAN LUIS OBISPO
GRANT
RANCH
EL CHORRO
REGIONAL
RESERVATION
Volmer
1308
Springs
Spring
4WD
36
31
32
5

Pennington Canyon Hike

This is a strenuous hike to a remote area. It leads to historical landmarks located near the dramatic convergence of five tributaries of Pennington Creek.

1. Start at Cal Poly gate just beyond Rancho El Chorro County Environmental Education Center. Continue up the road crossing the bridge over Pennington Creek, enter the gate at left going toward Escuela Ranch buildings and corrals.

2. Pass through corrals, always locking gates, and follow the dirt road through the valley and up the canyon, keeping the creek on left below.

3.Where a bay tree stands in a narrow canyon, cross the creek to the left. Fenced off to the right is the Cal Poly Biological preserve of 211 acres.

4. Continue upstream along the base of Mt. Vollmer and emerge from the canyon into a grove of olive trees that mark the location of an old homestead. West Cuesta Ridge appears to the North, above the ring of surrounding grass-covered hills.

5. Walk up the road keeping the north fork of the Creek to the right until reaching a huge oak tree standing alone.

6. Return to olive trees, head down across the northwest fork to the right and up the shoulder of the hill to an ancient sheep corral providing views of all five Pennington creek tributaries and of Chorro Valley. There is no trail. Step lightly to avoid wildflowers.

7. Still off trail, follow the shoulder up toward the summit of Mt. Vollmer. Contour left to intersect the jeep road heading back toward Pennington Creek and Rancho El Chorro. Follow it down to where it meets the road below the gate at the start of the hike.

Sheep corral


BRIDGE
VINEYARD
BM 138
Pumping Sta
4 LANE
BM 184
Walters
505
Communication Tower
GATE
SHOP
CHORRO CREEK RANCH
CUESTA COLLEGE
AIRSTRIP
VINEYARD
Well
Spring
Creek
BOUNDARY
Sewage Disposal
O' SULLIVAN AIRFIELD
Chorro
Spring

Chorro Creek Ranch Walk

This is a walk on traffic-free roads over mostly flat land. Little shade is available on the way. It offers splendid views of Hollister Peak, Chorro Peak and Chorro Valley plus a chance to see waterfowl in its two reservoirs.

1. Start at the gate at the west end of Cuesta College. Pass the residence of the Cal Poly Farm manager. Turn right at the first intersection and follow the road to top reservoir and adjacent model airplane airstrip.

2. Continue toward Chorro Creek passing through one area of new vineyards planted by Gallo Company and walk nortl

the creek and the ridge of unnamed Morros.

3. Continue to the road crossing the creek which leads left to private property and a striking rock outcrop. Cross the bridge to a second Gallo vineyard plantation. If gate is open it is possible to follow the road eastward to the lookout above the valley.

4. Retrace your steps to a junction at the farm machinery warehouse. Turn left and continue back to start.

Chumash Challenge

Chumash Challenge is an outdoor recreation program with a serious educational mission. Built by the Associated Students following the inspiration and leadership of ASI staff employee Rod Neubert, the nature playground and ropes course is one of the largest and most advanced of its kind in America. Since it opened in 1993, more than 25,000 people, most of them Cal Poly students, have taken advantage of the program, which develops self-esteem and self-knowledge in individuals, and trust, communication, problem solving, and team effectiveness in groups.

This program and the constructed facilities that house it are grounded in their secluded natural setting along Stenner Creek on the Serrano ranch. The broad vistas of mountain and valley

Team-building at Stenner Creek

the protective shade of ancient oaks, the undisturbed sounds of wind and water, and the conspicuous absence of electricity and telephone provide a secure retreat where traditional roles fall away, people allow themselves to take risks, and unimagined potential can be realized.

Chumash Challenge ropes course

Model Airplane Flight Range

The Model Airplane Flight Range [EFR] at Chorro Creek Ranch provides the home for another form of recreation, this one combining technological experimentation with educational training. Built and operated by a collaboration of Cal Pol
the Ass
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craft pr
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Accord
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Model airplane maintenance at Chorro Creek Ranch

Stewardship

Without a complex knowledge of one's place, and without the faithfulness to one's place on which such knowledge depends, it is inevitable that the place will be used carelessly, and eventully destroyed.

– Wendell Berry

The preceding chapters of this book have introduced "a complex knowledge" of our place. This concluding chapter outlines some efforts to use this place carefully and assure that it will be preserved as Cal Poly enters its second century.

Restoration and Enhancement Projects

Brizzolara Creek Project

As part of the Campus Master Plan process between 1999 and 2001, the Biology Advisory Committee produced a set of general guidelines for creek management. These will shape the Brizzolara Creek Restoration Project. Brizzolara Creek drains Poly Canyon and runs through the middle of the campus. In the past, much of the riparian area along the creek was paved and used for a slaughterhouse, a junkyard, and a truck and heavy equipment maintenance facility where pollutants were flushed directly into the stream. The first draft of the Master

Revegetated creekbed with drainage pipe

Plan proposed moving all these facilities out of the creek's floodplain and replacing them with residence halls. Input from the Biology Advisory Committee and other interested parties led to a revised plan which will restore the Creek to a natural wetland.

College of Agriculture Water Quality Enhancement Program

Brad Parker, graduate student

With so much livestock on its lands, Cal Poly faces the responsibility of making sure that soil erosion due to overgrazing around creeks, as well as excessive amounts of animal waste, do not pollute its waterways.

To address potential sources of water pollution, in 2000 Cal Poly enacted a campus-wide comprehensive water management plan. The water management plan articulates the water quality goals of everything from agricultural practices to construction projects.

Animal Science Professor Michael Hall studies how certain cattle grazing practices can preserve water quality. He conducts his study in the upper San Luis Creek watershed area east of the Central Campus. Hall said his objective is "to show the benefits of raising livestock and to show it in a scientific way."

According to Hall's research proposal, the primary threat cattle pose to water quality is grazing too close to creeks, which removes protective vegetation along the banks. This accelerates erosion and leads to sediment pollution.

Hall proposes that rotational grazing can prevent soil erosion and preserve water quality. In rotational grazing, cattle are fenced off from habitats surrounding creeks. This permits vegetation to grow along the banks of the creek, keeping the banks stable and preventing erosion.

Hall said that rotational grazing also protects water quality by keeping rangelands that surround fresh water habitats stable by reducing the amount of potential fuel for a fire.

"Rotational grazing," said Hall, "is an example of how animals can be manipulated as biological resources."

The waste lagoons of the dairy and swine units are another potential source of water contamination. Their nitrate-rich concoction may somehow find its way into Brizzolara or Stenner creek. This is most likely to occur during the rainy season.

If the levels of the lagoons are not low enough to support the rain runoff from the hills during the wet season, the contents of the lagoon will need to be pumped into pasture lands already saturated with rainwater and thus unable to absorb the

waste. Consequently, that waste could potentially run off into the nearest creek.

According to Mark Shelton, in the recent past the College of Agriculture has made a conscious effort to anticipate and prepare for the rainy season. They make sure to discharge the waste of the lagoons periodically during the dry season while the pastures are able to absorb it. This ensures that the lagoons will not need to be pumped during the rainy season as well as fertilizes the fields.

Also, Cal Poly has installed monitoring wells, around the pastures to measure the nitrate levels of ground water. They are checked quarterly to make sure that the waste from the lagoons does not contaminate the ground water.

Sorrel Marks, a sanitation engineer at the Regional Water Quality Control Board, said that Cal Poly's Water Management Plan has been effective because it makes people aware of what to do to prevent water pollution. Referring to the University's recent track record on preventing water pollution, Marks commented, "I wouldn't say there are any chronic problems at Cal Poly."

Stenner Creek Restoration

Poly's Animal Science Department partners with the San Luis Obispo Land Conservancy to combine creek restoration with holistic grazing. After many years of dairy cattle grazing at Cheda Ranch, Stenner Creek was stripped of the protective vegetation that had stabilized banks and shaded the watercourse. Brian Stark of the Land Conservancy of San Luis Obispo led a group of California Conservation Corps workers and Cal Poly students in planting and watering of appropriate species in 1999. Professor Rob Rutherford and his students cut weeds to allow the new natives to get established. Through controlled, high-intensity sheep grazing for brief periods, they continued weed control and stimulated vigorous regrowth of the desired species. Now the stream flows cool and deep enough to provide habitat for speckled dace, steelhead salmon, two bobcats, and hawks.

Steward sheep at Stenner Creek

Cal Poly Master Plan

Chris Clark, City and Regional Planning Department and Master Plan co-author

Cal Poly 's natural environment may be viewed as several "landscapes," each with qualities meriting conservation and offering numerous academic assets.

This statement in Cal Poly's Master Plan (October 2000) addresses two important concepts in understanding the lands of Cal Poly; there is a great deal of land, and it all serves the academic mission of the university. Cal Poly is large, 6,000 acres in San Luis Obispo County and another 3,200 acres in Santa Cruz County. Only a small portion of that land comprises the urbanized component of the campus. A larger amount is in intensive agriculture. Most of the land is relatively untouched, either used as grazing land in San Luis Obispo or as forest management resources in Santa Cruz.

Approaches like those found in county or city regulations, which would categorize much of the land as "open space" or for preservation, are not applicable to Cal Poly. In the Master Plan, all land has been given a specific designation. Every square foot of Cal Poly is recognized as embodying an "academic asset."

The two largest total acreages are designated as "Natural Environment" and "Outdoor Teaching and Learning." Natural Environment is an "overlay" designation. The overlay identifies lands that are especially sensitive because of geological, hydrological, and biological factors. They are generally not suitable for buildings and hardscape. They will continue to function as valuable teaching resources in the fields of geology, soil science, biology, natural resource management, agriculture, and liberal arts endeavors that prosper from immersion in the natural landscape.

Outdoor Teaching and Learning lands are classrooms and laboratories. These consist primarily of agricultural fields but also include forestry research stations and biological preserves. The land use designation recognizes the variety of departments and classes that use these assets. For example:

- Below the Environmental Horticultural unit a large field with markers in precise locations is used by surveying students for closed loop traverses.
- Soil scientists can sample different soil types from numerous pits
- Near the Sports Complex a facility that houses a jet engine is used once a year for test firings.
- On Escuela Ranch two large riparian areas are used for a "paired watershed" study conducted by Landscape Architecture and Natural

Resource Management and funded in part by the EPA.

Part of the Master Plan's vision is to ensure that these lands remain operational and protected. When conflicts over land use arise, Cal Poly, through its Campus Planning Committee, will provide a resolution that best represents the mission of the University as a whole.

Development will occur at Cal Poly. The Master Plan was updated comprehensively in part to carefully plan for the accommodation of an additional 3,000 students. Providing housing, transportation, administrative and academic services to these students, in addition to improving the quality of instruction campus-wide, was the objective of the update.

Master Plan Buildout Drawing 2001

Environmental Education

Many University departments utilize the Outdoor Teaching and Learning Resources of Cal Poly Land to instruct students about environmental stewardship both for career preparation and general education.

Natural Resource Management

Cal Poly's Natural Resource Management Department offers forestry classes at Swanton Ranch, where sustainable silviculture and timber harvesting are taught in theory and practice within the redwood forests of the Scott Creek watershed. The subject of one of the Department's capstone courses, Ecosystem Management, must, in the words of Professor Rich Thompson, "be viewed simultaneously as a philosophical and implementable approach to natural resource management. The philosophical dimension is important to reshape the attitudes of individuals to enable them to focus on the system itself and less on our usual attention to outputs. At the same time, for Ecosystem Management to have value and relevance, it must meet people's needs and thus must promote the sustainable flow of goods and services. Therefore, it is through the principle of sustainability that these two often conflicting perspectives on the purpose of natural resources management reach a practical nexus."

Forest Inventory at Swanton Ranch

Environmental Education Center

Swanton Ranch is the future site of an Environmental Education Center which will prepare students for professional careers in conservation and sustainable agriculture and will host conferences on land management, sponsor specialized programs for students from other California State University campuses, and provide a West Coast training resource for such national organizations as the American Farmland Trust and the Land Trust Alliance. The Education Center will blend scientific knowledge with cooperative partnerships, environmental sensitivity, and economic pragmatism.

Students and the public will learn about conservation in an extraordinary site of natural beauty and environmental importance. According to Joe Jen, former Dean of the College of Agriculture, "Every effort has been made to maximize the natural characteristics of the area. The buildings' design will contribute to a cost efficient and energy conserving operation, as well as being an integral part of the Swanton education program. Solar energy will provide passive space and water heating."

Earth Sciences Major

A new interdepartmental program focusing on the the land is being offered as the Earth Sciences major. It "provides a strong foundation for understanding and improvement of the use of land, water, and atmospheric resources [and] emphasizes a wide range of disciplines in natural resources and in the cultures that use and modify them.

- It encompasses climatic change, food production, and population questions.
- It focuses on means of minimizing human impact on a fragile ecosystem that nurtures all human cultures.
- It demonstrates the interrelationships among geography, soil science, and geology.
- It demonstrates the linkages among environment, resources, and people.

Sustainability

Stewardship of Cal Poly Land is an application of the larger principle of sustainability. Sustainability has been defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainability promotes "life that uses nature without bringing harm to it." A commitment to Sustainability has been adopted by many University constituencies.

The Renewable Energy Institute

(REI) is a non-profit organization established to promote teaching, research, development, and community service in solar and renewable energy technologies and sustainable community infrastructure involving students, faculty, staff and off-campus persons from the fields of Agriculture, Architecture, Science, and Engineering. Projects include:

- Hay Fund grant opportunity for solar energy research
- Alternative Uses of Rice Straw Report, a document prepared for the California Air Resources Board outlining the diverse uses of straw that can replace waste disposal.
- Hands-on learning and demonstration of straw bale construction techniques
- E2R2, a technical and economic feasibility study of a biological solid waste and wastewater treatment facility for Cal Poly that reclaims valuable nutrients, energy, and water.
- Development of a sustainable campus master plan for the recent Fort Ord Military Base Conversion into a California State University campus at Monterey Bay.

Academic Senate Resolution

In June 2001, the Cal Poly Academic Senate adopted a "Resolution on the Environment" accepted by the University President that contains the following provisions:

- That Cal Poly place a high priority on the preservation and enhancement of the environment;
- That a University Environmental Committee be established…to promote policies and activities that support a sustainable environment and educate the campus community
- That Cal Poly shall purchase goods and services that are produced using environmentally sustainable practices
- That environmental sustainability shall be con-

sidered for any construction project, [which] shall be designed for long-term energy efficiency

- That Cal Poly shall strive to recycle materials and use recycled material and materials that have a high recycled value.

Cal Poly Campus Sustainability Initiative

In October 2001, Student Body President Angie Hacker called together a group of students, faculty, management, and staff to found an organization called Cal Poly Sustainability Initiative (CSI). Its vision statement proclaims:

"It is our intention that with the University's polytechnic emphasis, Cal Poly will play a leadership role in California's sustainability movement. This will be achieved through practicing sustainable development and instilling sustainable values in our graduates, employees, and throughout the campus in teaching, operations, and research."

Within its first few months of existence, CSI has developed a website[csicalpoly.org] and a grant proposal to a major foundation. It also organized a Centennial History Day event on March 8, 2002 entitled "Sustainability and the Future of the Polytechnic University," which drew 550 people to attend a presentation by Amory Lovins, author of *Natural Capitalism: Creating the Next Industrial Revolution* and CEO of Rocky Mountain Institute.

Campus Sustainability Worldwide

These initiatives mirror that of the California State Student Association which passed a resolution that "requests the Trustees of the California State University to adopt sustainable design policies for all new buildings in the CSU system that include definitive standards for sustainability in resource use, life-cycle cost analysis, as well as use of environmentally friendly building materials."

In recent years, the movement for sustainability has grown into a worldwide phenomenon fostered by a number of coordinating organizations:

- University Leaders for a Sustainable Future www.ulsf.org/about.html

"serves as the Secretariat for signatories of the Talloires Declaration, a ten-point action plan committing institutions to sustainability and environmental literacy in teaching and practice. Over 340 university presidents and chancellors in more than 40 countries have signed the declaration."

- Campus Ecology, a subsidiary of the National Wildlife Foundation www.nwf.org/campusecology/index.cfm

"is helping to transform the nation's college campuses into living models of an ecologically sustainable society; train a new generation of environmental leaders; and ensure a strong future for

America's environmental movement."

- Second Nature
  www.secondnature.org/home.html

"is dedicated to accelerating a process of transformation in higher education. We guide and nurture these institutions in their quest to make sustainability an integral part of the institution and to help expand their efforts to make human activity sustainable."

Stewardship, Accounting and Management

Kate Lancaster, Orfalea College of Business

Previous chapters have described the vast array of resources that Cal Poly's officials oversee. As students, educators and others in the surrounding community continue to use Cal Poly Land and surrounding areas, the ecological system and its capacity to recover become strained. In order to ensure that in 100 years students (and other Cal Poly stakeholders) will be able to have the same opportunities to benefit from the land resources, Cal Poly's stakeholders need to develop the mindset and tools to help us maintain and enhance these resources. This section describes several approaches available to help us.

It is difficult to place a value on something that has an intrinsic value to some yet is not considered valuable by others. For example, how are the benefits of having a healthy riparian and creek ecosystem quantified and how does the Cal Poly community agree on the steps necessary to accomplish this? Up till now, individuals whose activities harm the ecosystem have not had to consider any of the costs, so these costs have not been included in their decisions. In economic terms, such intrinsic things that have perceived value which is not factored in as part of the "true cost," are called externalities.

Three techniques are commonly used to ensure that organizations include externalities (and in particular, their impact on the environment) in their decision process. The first is to have environmental organizations provide oversight and guidance and act as a voice for concerned constituents. For example, the Land Conservancy has worked with Cal Poly to enhance the creek ecosystem and the Coastal Resources Institute has also been involved in monitoring and enhancing water quality. Another method is to impose governmental regulations that either tax or fine those that damage the environment. The Clean Water Act, with its focus on restoring and maintaining the integrity of the nation's waters, is one example of such a regulation. An economic approach is to encourage consumers to "vote" with their pocketbooks and support organizations that conserve, reduce toxic waste, and minimize their impact on natural resources.

A number of authors offer guidance on sustainable economics. These approaches may be loosely classified as sustainable development models. While not primarily used to measure environmental performance, in response to some inadequacies of traditional accounting methods, Robert

Kaplan and David Norton designed a Balanced Scorecard (BSC). The "triple bottom line" was developed by John Elkington as a way for organizations to communicate their economic, environmental, and social performance. Allan Savory, founder and director of the Center for Holistic Management and author of *Holistic Management: A New Framework for Decision Making* (1999) offers a decision model that captures many externalities. Paul Hawken, Amory Lovins, and L. Hunter Lovins illustrate how many organizations consider and minimize their environmental impact in their book *Natural Capitalism: Creating the Next Industrial Revolution* (1999).

A BSC is a metric of performance measures that support an organization's strategy. In addition to financial measures, a BSC includes long-term, forward-looking perspectives (i.e. customer and business processes, employee learning and growth, and environmental protection) that are necessary to ensure a healthy and profitable future. Businesses use a BSC to evaluate their ability to provide quality output with fewer resources, eliminate non-value added efforts, align products or services provided with customer priorities and expectations, track progress, evaluate process changes, and continually improve accountability. Other entities or individuals can easily adapt the BSC concept. As an exercise, participants in the Cal Poly Land Seminar developed a BSC for the Cal Poly Center for the Environment at Swanton Pacific Ranch. This BSC includes perspectives (educational, environmental, economical, and societal) that encourage Center planners to develop and then monitor holistic goals. The next step would be to develop targets and initiatives for each objective.

Allan Savory outlines the complexity of a decision model that considers environmental impact. Sam Bingham describes a ranch community's effort to implement the Holistic Management Model in Colorado's high deserts in his book, *The Last Ranch*. They employ six steps to validate any decision:

1. Honor the ecosystem as a whole
2. Strengthen the weak link in the operation
3. Address causes, not symptoms
4. Give the best marginal reaction per dollar
5. Represent a conscientious use of energy and nonrenewable wealth
6. Respect society and culture

The first step in the Holistic Management model is to identify the "whole" under management– those affected and the resources (both monetary and natural) involved. The second step is to develop a value-based holistic goal, which is used for the basis of all decisions. If we refer to our previ-

ous example, all parties that affect the health of the riparian ecosystem on Cal Poly Land and those that are working to restore that ecosystem would work together to identify what they value about a healthy ecosystem. Their holistic goals might be that native fish again migrate up the creeks, that the banks be restored with native plants, and that the surrounding lands serve as a water catchment. After considering all the ecosystem processes (in our example, the riparian ecosystem and the surrounding water catchment) and the tools that are available for managing the ecosystem (what we can do to restore the riparian ecosystem), each recommendation is evaluated using guidelines that consider economic, social, and ecological impacts, which reflect the emphasis of the "triple bottom line." The feedback loop is an important component in that any implemented solution must be revisited to see if the anticipated results occur.

Hawken, Lovins, and Lovins describe many companies that have successfully integrated their economic, environmental, and social goals. They propose redesigning our production and consumption cycles so they are based on "a new perception of value, a shift from the acquisition of goods as a measure of affluence to an economy where the continuous receipt of quality, utility, and performance promotes well-being."

Hawken, Lovins, and Lovins identify four types of capital that are interconnected in a properly functioning economy: human, financial, physical or manufactured, and natural. A company's financial and physical capital is easy to quantify, but its human and natural capital—i.e. its "soft assets"—are harder to assign value and are therefore normally not included in financial statements. Hawken, Lovins, and Lovins conclude that "the true bottom line is this: a society that wastes its resources wastes its people and vice versa. And both kinds of waste are expensive."

Visionaries like Savory and Hawken, Lovins, and Lovins offer tools to evaluate the impact of our decisions on the environment. Cal Poly's substantial land holdings require the University to educate people who are conscious of holistic consequences. For example, the proposed business research park at Cal Poly should be designed as a closed-loop system in which all waste products are recycled. Any new buildings should be energy and resource efficient. Crop and livestock management classes should instruct students on ecologically sustainable methods. Business classes should incorporate holistic management tools into the curriculum. We have an opportunity to lead by example, and there are indications that our students, faculty, and administrators are beginning to do just that.

Stenner Creek restored

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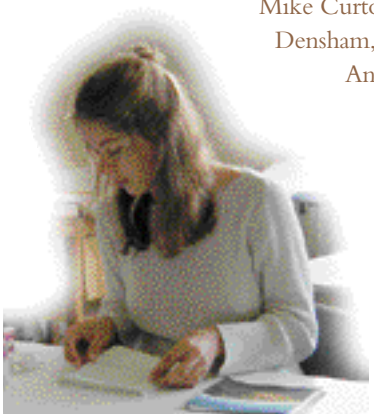

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