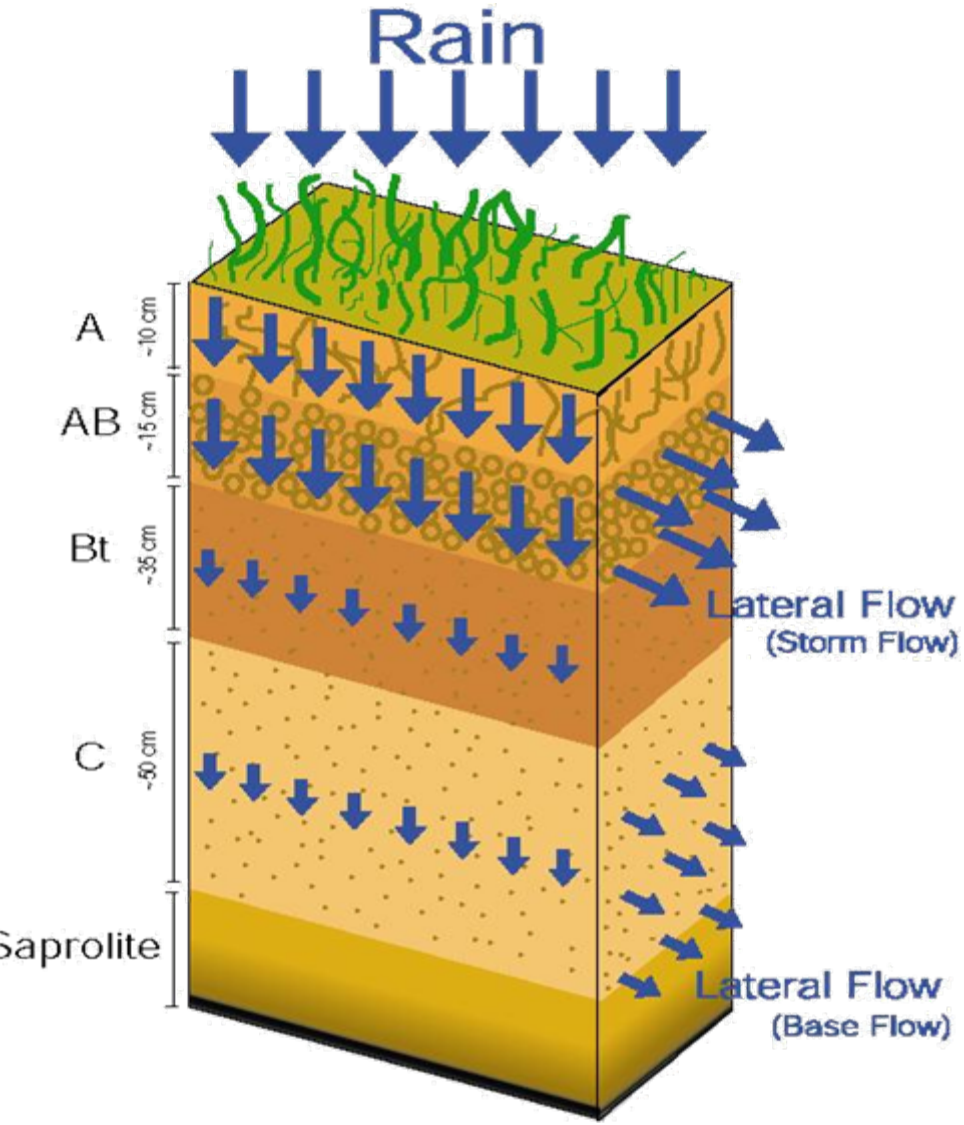
# Considering Soil Properties for Livestock Production

**Toby O'Geen**
**Department of Land, Air and Water Resources**
**University of California, Davis**

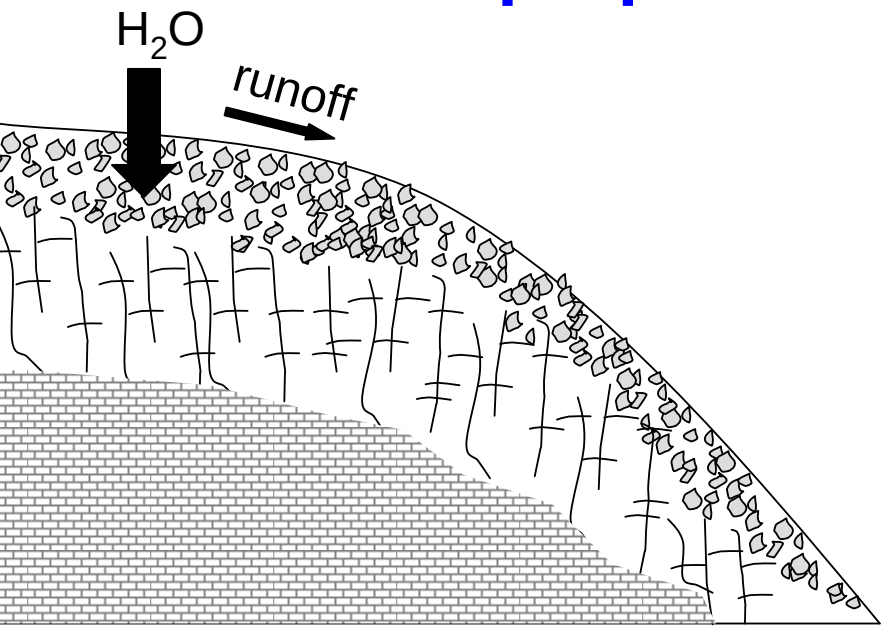
# Soil properties and landscape patterns influence productivity & surface water quality




**Surface runoff/Infiltration: texture, structure, aggregate stability, organic matter, compacted layers, slope**

**Sub-surface lateral flow: restrictive layers (bedrock, clay, cemented layers), slope, landscape curvature**

# Soil properties influence surface runoff



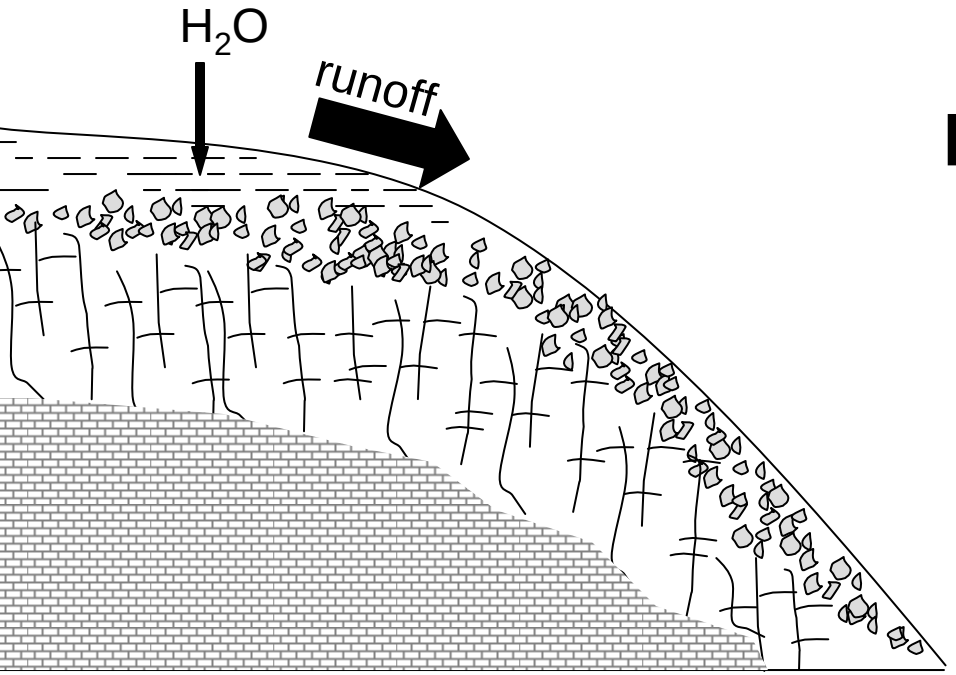

**Infiltration capacity exceeds rainfall intensity**

**Low runoff:**

***Good structure***

***Sandy or loamy textures***

***High porosity***




**Rainfall intensity exceeds infiltration capacity**

**High runoff:**

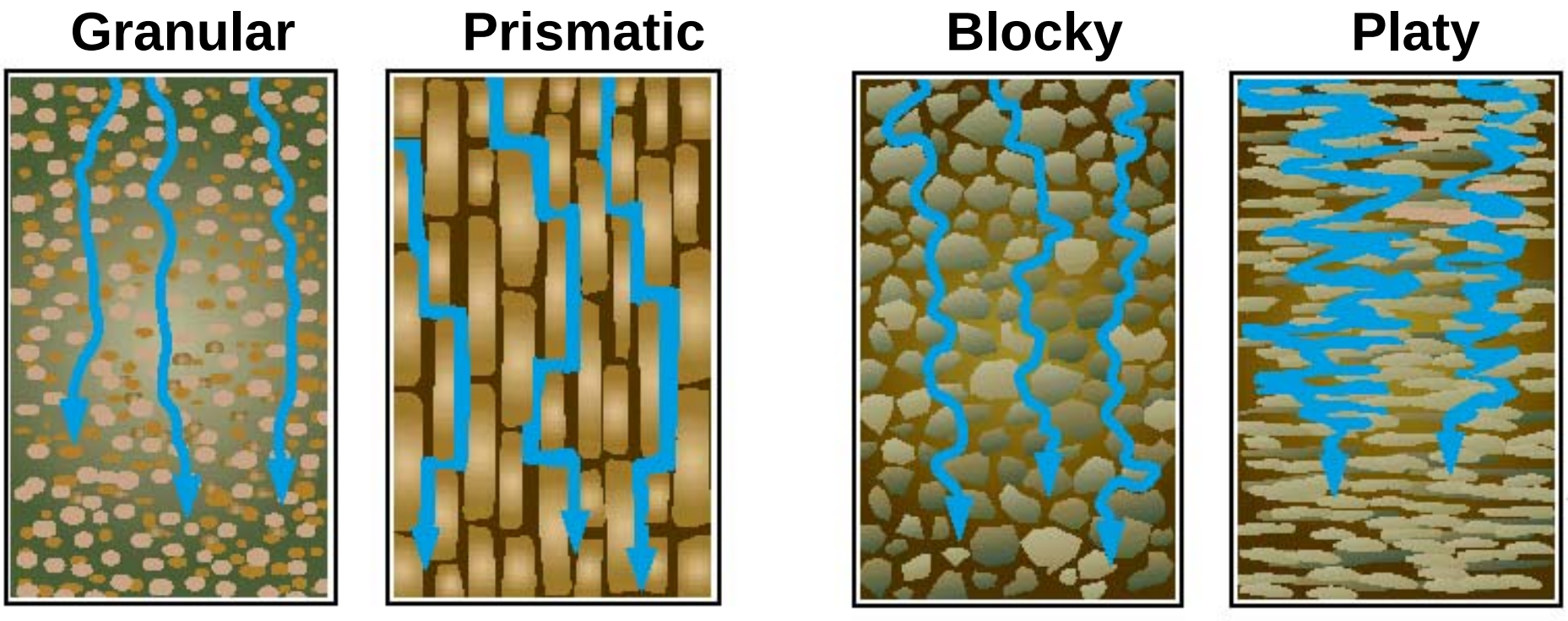
***Poor structure***

***Compaction***

***Clayey textures***

***Low porosity***

# Effects of soil structure (aggregation) on water infiltration




USDA-NRCS

# Rangeland soil with good soil structure

# Compacted rangeland soil

# Evidence of poor drainage in compacted soil horizon “cow pan”

# Evidence of poor drainage in compacted soil horizon “cow pan” in Coast Range

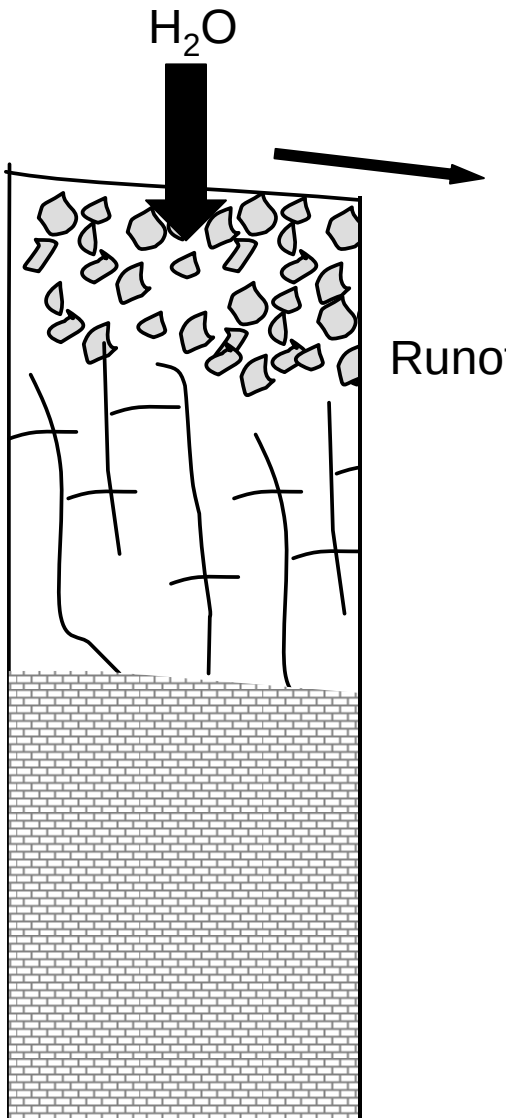
# Effects of soil moisture storage on runoff

## Saturated soil


Runoff > infiltration

**Observations: texture, depth to restrictive layer, landscape patterns**

## Unsaturated soil




Runoff < infiltration

# “Redoximorphic features” evidence of seasonal saturation

# Soil moisture storage

**depth to bedrock**
**or restrictive layer**


# Saturated soils can be unstable especially when combined with tree removal

# http://casoilresource.lawr.ucdavis.edu/soilsurvey

California Soil Resource Lab

Home Links Online Soil Survey People Projects Software Site Map

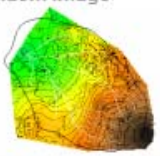
SoilWeb: An Online Soil Survey Browser

- Dynamic Export of Soil Survey Data to KML through Soil-Web
- Major updates to CA, AZ, NV online soil survey system
- Migrating to Ka-Map! Online Soil Survey for AZ, CA and NV
- SoilWeb for the iPhone
- Streaming Soil Survey Data in Google Earth (updates)
- Two New Soils-Related KMZ Demos
- Updates to SoilWeb
- Who is Using our Online Soil Survey?

Navigation

- blogs
- books
- Recent posts
- search
- News aggregator

Random image



User login

Username: *

Password: *

Log in

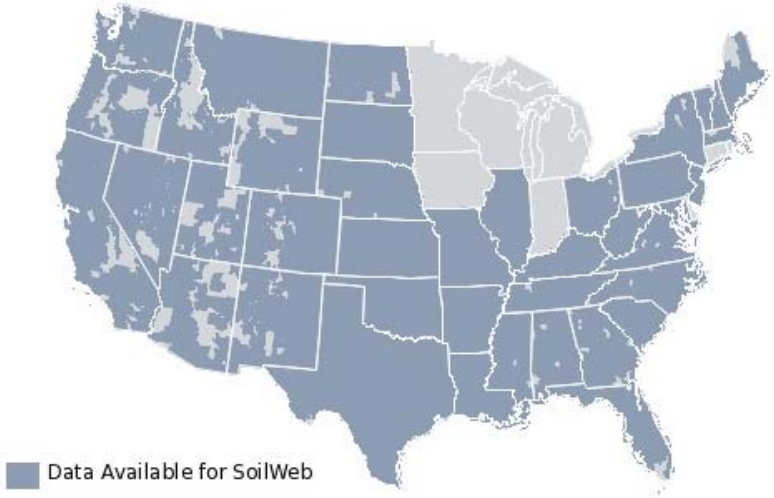
## SoilWeb: An Online Soil Survey Browser

Submitted by dylan on Fri, 2010-02-26 16:13.

Our online soil survey can be used to access NRCS-NCSS 1:24,000 scale detailed soil survey data (SSURGO) in many parts of the lower 48 states. Where this data is not yet available, 1:250,000 scale generalized soils data (STATSGO) can be accessed instead (AZ, CA, NV only). An interactive map interface allows for panning and zooming, with highways, streets, and aerial photos to assist navigation (Figure 1). Soil polygons become visible near a scale of 1:30,000. Alternatively, a GPS point, CA Zip code, or a street address can be used to zoom in on a specific location. General usage notes and information on how our online soil survey work can be found here. Statistics on who is using our online soil survey can be found here. Technical details on SoilWeb can be found in this publication.

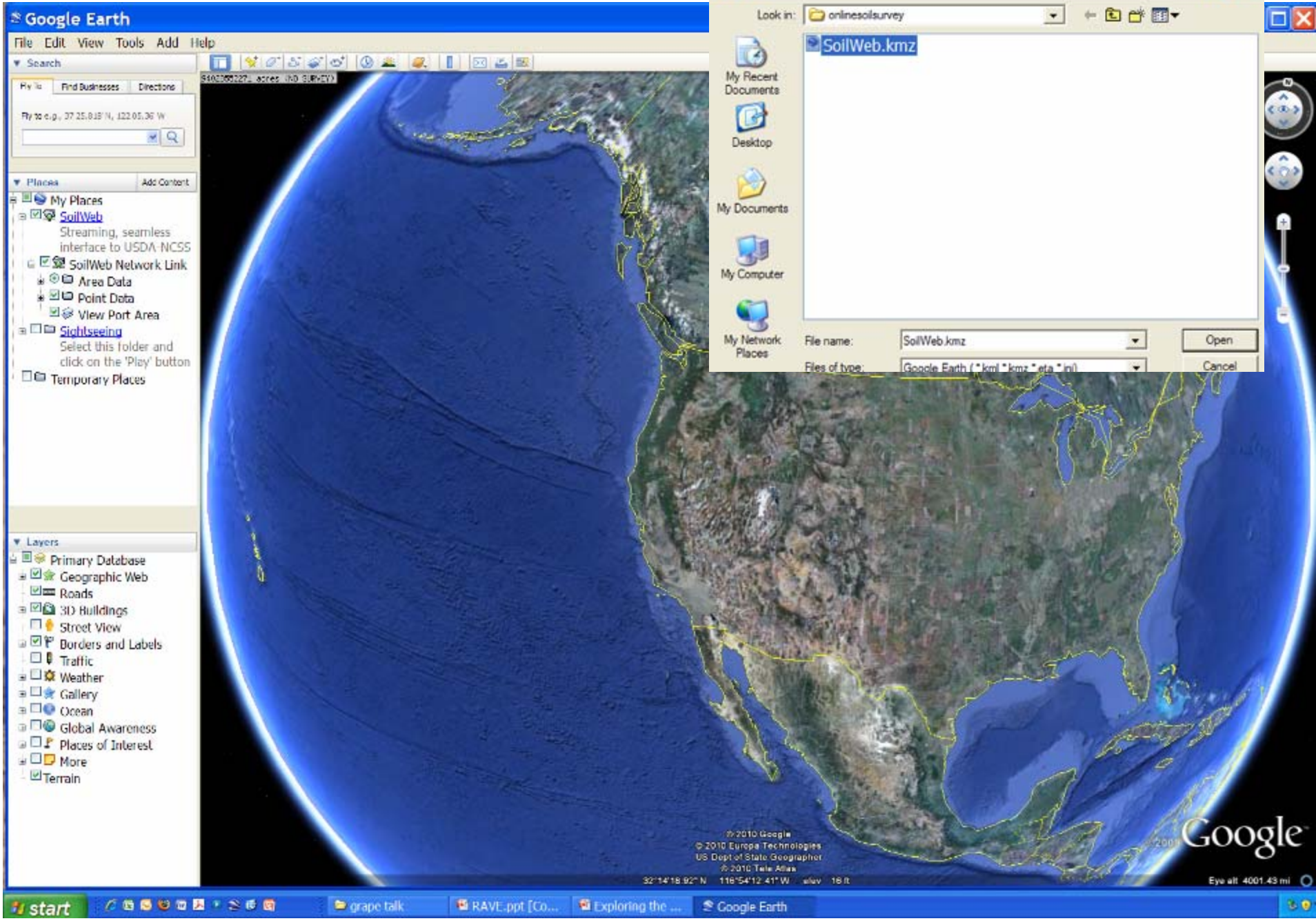

SSURGO Map Units

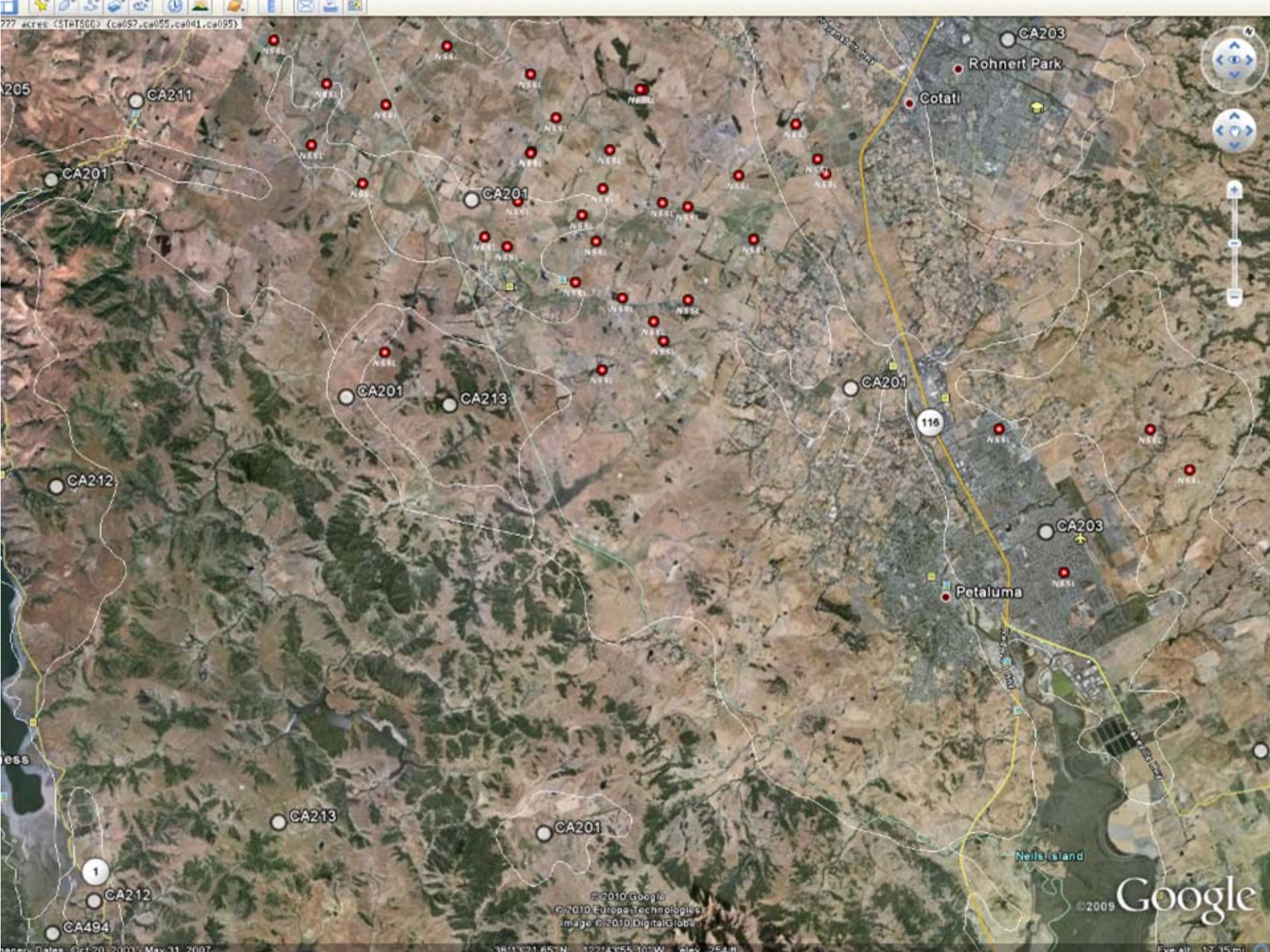
STATSGO Map Units




**Select an Interface to SoilWeb**

- An iPhone App for real-time, location-based soil queries!
- Google Maps interface
- Google Earth Interface
- A Text-only interface to SSURGO
- Original Interface

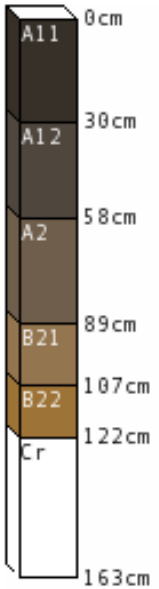

Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Places
Add Content
My Places
SoilWeb
Streaming, seamless interface to USDA-NCSS
SoilWeb Network Link
Area Data
Point Data
View Port Area
Sightseeing
Select this folder and click on the 'Play' button
Temporary Places
Layers
Primary Database
Geographic Web
Roads
3D Buildings
Street View
Borders and Labels
Traffic
Weather
Gallery
Ocean
Global Awareness
Places of Interest
More
Terrain
Open
Look in: onlinesoilsurvey
SoilWeb.kmz
My Recent Documents
Desktop
My Documents
My Computer
My Network Places
File name: SoilWeb.kmz
Files of type: Google Earth (*.kml *.kmz *.eta *.ini)
Open
Cancel
© 2010 Google
© 2010 Europa Technologies
US Dept of State Geographer
© 2010 Tele Atlas
Google
Eye alt 4001.43 mi
start
grape talk
RAVE.ppt [Co...
Exploring the ...
Google Earth


777 acres (STATSGO) (ca097,ca055,ca041,ca095)
CA203
Rohnert Park
Cotati
CA211
CA201
CA201
CA201
CA213
CA201
116
CA212
CA203
Petaluma
CA213
CA201
Nails Island
CA212
CA494
© 2010 Google
© 2010 Europa Technologies
Image © 2010 DigitalGlobe
©2009 Google

## STEINBECK LOAM, 15 TO 30 PERCENT SLOPES

Major Component List:

Steinbeck (85%)
Ultic Haplustalfs




*STEINBECK LOAM, 15 TO 30 PERCENT SLOPES*
*terraces / Backslope*


38°17'33.93" N 122°48'38.79" W elev 287 ft
Eye alt 5923 ft

# STEINBECK SERIES

The Steinbeck series consists of deep, well drained soils that formed in material weathered from soft sand-stone. Steinbeck soils are on smooth rolling hills and have slopes of 2 to 50 percent. The mean annual precipitation is about 30 inches and the mean annual temperature is about 55 degrees F.

**TAXONOMIC CLASS:** Fine-loamy, mixed, superactive, mesic Ultic Haplustalfs

**TYPICAL PEDON:** Steinbeck loam, on a SW facing convex slope of 5 percent under sub-clover, ryegrass, wild barley, Italian thistle, velvet grass and soft chess at 320 feet elevation. (Colors are for dry soil unless otherwise stated. When described (1/20/76) the soil was moist throughout.)

**A11**--0 to 12 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak fine subangular blocky structure parting to moderate medium granular; hard, very friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine interstitial and vesicular pores; moderately acid (pH 6.0); gradual wavy boundary. (10 to 15 inches thick)

**A12**--12 to 23 inches; grayish brown (10YR 5/2) loam, very dark gray (10YR 3/1) moist; weak fine subangular blocky structure parting to weak medium granular; hard, very friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine interstitial and vesicular, common fine tubular pores; slightly acid (pH 6.3); clear wavy boundary. (10 to 15 inches thick)

**A2**--23 to 35 inches; variegated very pale brown and pale brown (10YR 7/4, 10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine interstitial and common very fine tubular pores; slightly acid (pH 6.3); abrupt wavy boundary. (10 to 15 inches thick)

**B21t**--35 to 42 inches; variegated grayish brown and light yellowish brown (10YR 5/2, 10YR 6/4) light clay loam, yellowish brown (10YR 5/4) moist; common medium prominent yellowish red and dark grayish brown (5YR 5/8, 10YR 4/2) mottles; massive; slightly hard, firm, sticky and plastic; few very fine roots; common very fine interstitial and few very fine tubular pores; few thin clay films on peds and in pores; slightly acid (pH 6.3); gradual wavy boundary. (5 to 10 inches thick)

**B22t**--42 to 48 inches; variegated light yellowish brown and brownish yellow (10YR 6/4, 10YR 6/8) light clay loam, yellowish brown (10YR 5/6, 10YR 5/4) moist; common medium prominent dark yellowish brown (10YR 3/6) and brownish yellow (10YR 6/8) mottles; massive; hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores; few thin dark yellowish brown (10YR 3/6) clay films on peds and in pores; slightly acid (pH 6.5); gradual irregular boundary. (5 to 10 inches thick)

**Cr**--48 to 64 inches; strongly weathered soft sandstone; moderately acid (pH 6.0).

**TYPE LOCATION:** Marin County, California; 0.9 miles north of intersection of Highway 1 and Tomales-Dillon Beach Road and 0.5 miles east of Highway 1; 122 degrees 54' 40" W latitude and 38 degrees 15' 28" N longitude

# California Soil Resource Lab

## Map Unit Composition

Map units consist of 1 or more soil types, commonly referred to as "components".

| Component Name | Geomorphic Position | Area Fraction | Component Type | Horizon Data |
|---|---|---|---|---|
| Soil Type 1 **Steinbeck** | terraces / Backslope | 85% | Major Soil Type | YES |
| Soil Type 2 **Cotati** | | 5% | Inclusion | Similar Data [1] * |
| Soil Type 3 **Goldridge** | | 5% | Inclusion | Similar Data [2] * |
| Soil Type 4 **Los Osos** | | 5% | Inclusion | Similar Data [3] * |

*Note: links to horizon data marked with an * are approximate.*

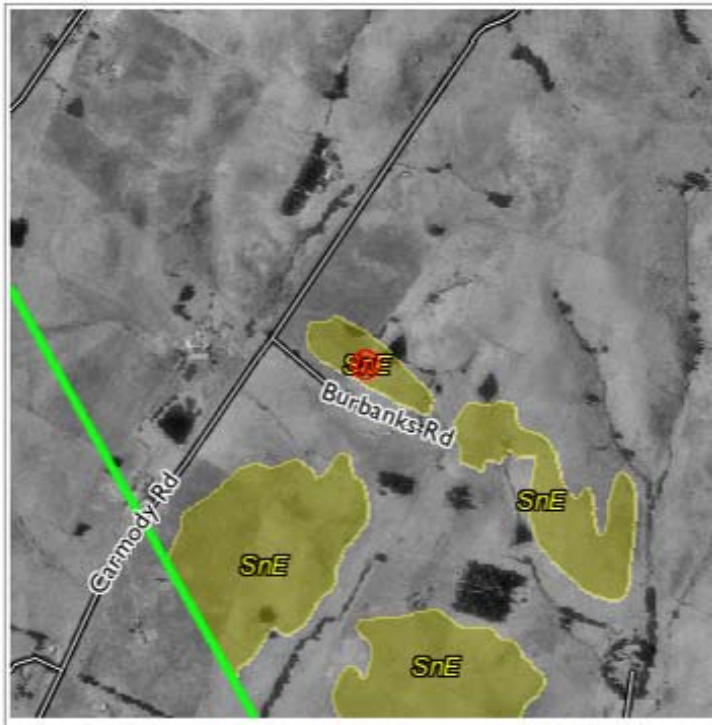
## Map Unit Data *What is a Map Unit?*

Cartographic information about this map unit.

| | |
|---|---|
| **Map Unit Name:** | STEINBECK LOAM, 15 TO 30 PERCENT SLOPES |
| **Map Unit Type:** | Consociation |
| **Map Unit Symbol:** | SnE |
| **Map Unit Acres:** | 15 acres (5168ac. total in survey area) |

Raw Map Unit Data

Raw Component Data (All Components)




Queried map unit polygons in yellow, queried point in red.

## Map Unit Aggregated Data

Generalized soils information within this map unit.

| | |
|---|---|
| **Farmland Class:** | Not prime farmland |
| **Available Water Storage (0-100cm):** | 12.26 cm |
| **Max Flood Freq:** | None |
| **Drainage Class (Dominant Condition):** | Moderately well drained |
| **Drainage Class (Wettest Component):** | Moderately well drained |
| **Hydric Conditions:** | Not hydric |
| **Min Water Table Depth:** | n/a |
| **Min Bedrock Depth:** | n/a |

Raw Aggregated Map Unit Data

## Map Unit Notes

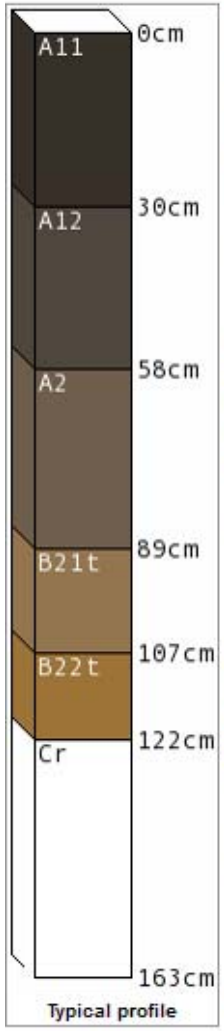
Miscellaneous notes recorded by NRCS staff about this map unit.

## Associated Point Data

Links to any NSSL point data within this map unit.

1 Lab Data for NSSL Pedon CA097SnE-S27

# California Soil Resource Lab



Typical profile

## Soil Taxonomy

| | |
|---|---|
| **Order:** | *Alfisols* |
| **Suborder:** | *Ustalfs* [Map of Suborders] |
| **Greatgroup:** | *Haplustalfs* |
| **Subgroup:** | *Ultic Haplustalfs* |
| **Family:** | *Fine-loamy, mixed, mesic Ultic Haplustalfs* |
| **Soil Series:** | *Steinbeck* (Link to OSD) (Link to SM Tool) |
| | |
| **Data:** | [Lab Data] [Nitrate Groundwater Pollution Hazard Index] |
| **Raw Data** | Component All Horizons |

## Land Classification

| | |
|---|---|
| Storie Index | *48* |
| Land Capability Class **[non-irrigated]** | *6-e* |
| Land Capability Class **[irrigated]** | - |
| Ecological Site Description | *LOAMY UPLAND* |

## Soil Suitability Ratings

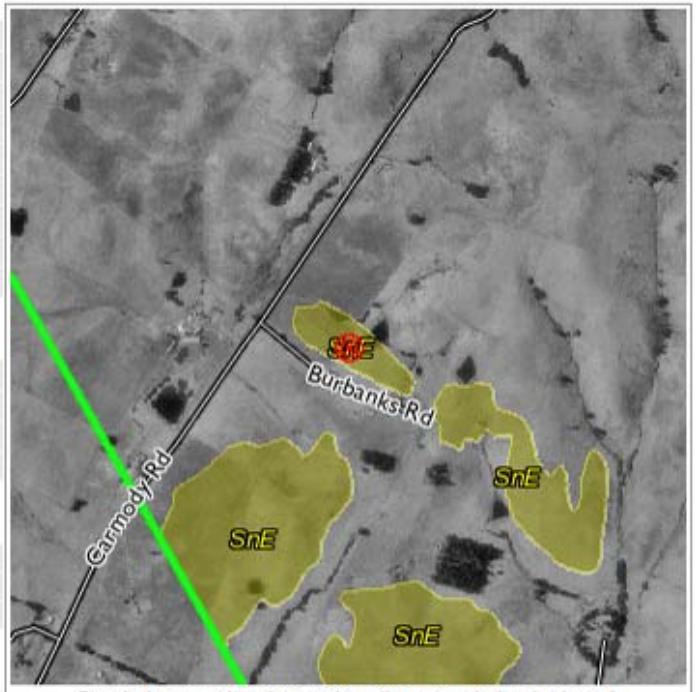
| | |
|---|---|
| Waste Related | Engineering |
| Urban/Recreational | Irrigation |
| Wildlife | Runoff |

## Hydraulic and Erosion Ratings

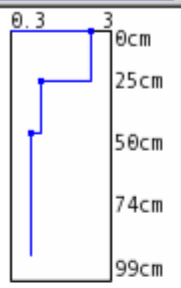
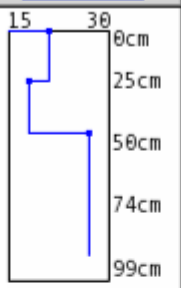
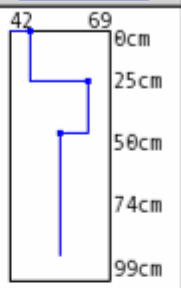
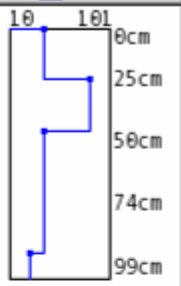
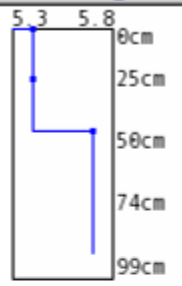
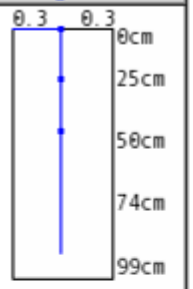
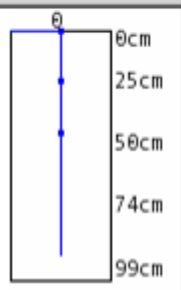
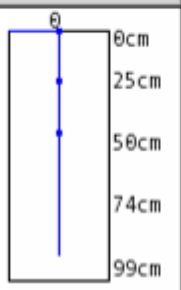
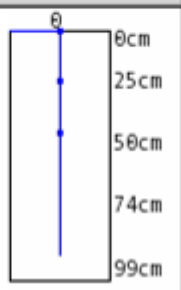
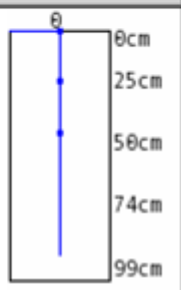
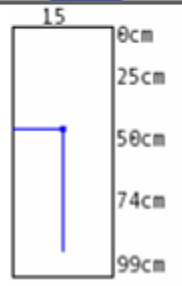
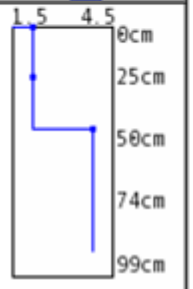
| | |
|---|---|
| Wind Erodibility Group | *6* |
| Wind Erodibility Index | *48* |
| T Erosion Factor | *3* |
| **Runoff** | *High* |
| **Drainage** | *Moderately well drained* |
| **Hydric Rating** / Hydrologic Group | *No* [Group B] |
| **Parent Material:** | *residuum weathered from sandstone* |
| **Profile Water Storage (cm):** | *14.3* |

## Geomorphology

| | | |
|---|---|---|
| **Landform** | *terraces* [Backslope] | |
| **Landscape** | *uplands* | |

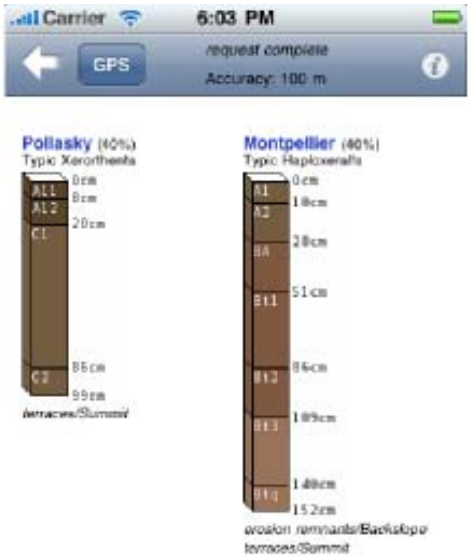


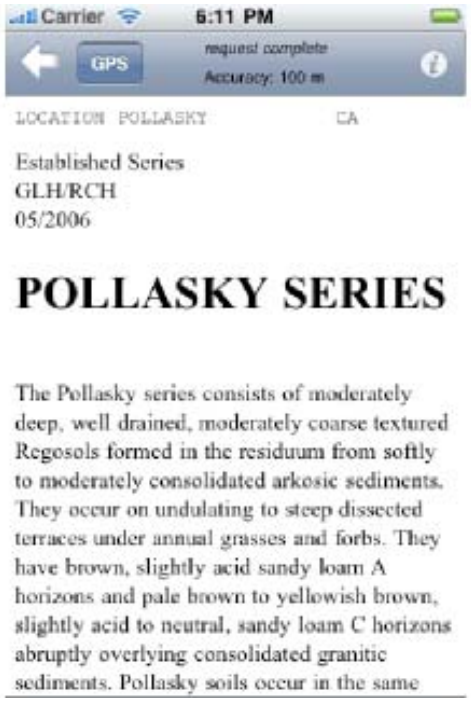
Queried map unit polygons in yellow, queried point in red.

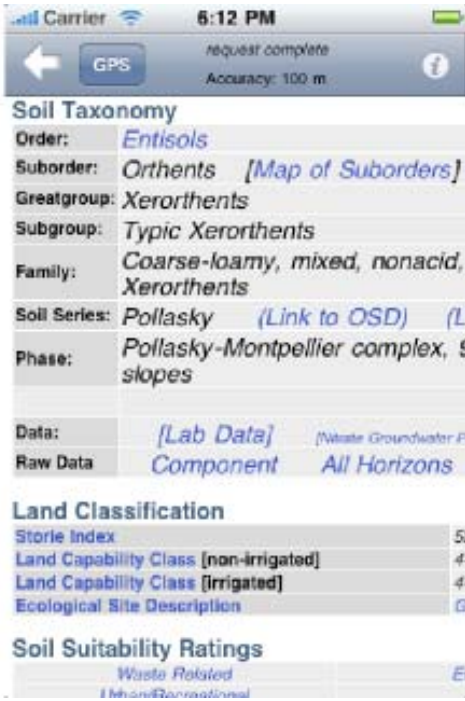
| Organic Matter (%) | Percent Clay | Percent Sand | $K_{sat}$ (mm/hr) | pH (1:1 $H_2O$) | $K_f$ Factor |
|---|---|---|---|---|---|
|   |   |   |   |   |   |
| EC (dS/m) | SAR | $CaCO_3$ (%) | Gypsum (%) | CEC at pH7 (cmol + /kg soil) | Linear Extensibility (%) |
|   |   |   |   |   |   |

| | Waste Related | |
|---|---|---|
| **AWM - Manure and Food Processing Waste** | **Very limited** | |
| | 1. Slope | *(Slope 8 to > 15%)* |
| | 2. Depth to bedrock | *(Shallow to Bedrock 50 - 100 cm)* |
| | 3. Too acid | *(Surface Reaction (pH 3.5 to 6.5))* |
| | 4. Droughty | *(Droughty, AWC 0 to 150cm)* |
| **AWM - Land Application of Municipal Sewage Sludge** | **Very limited** | |
| | 1. Low adsorption | *(Adsorption Capacity, Clay Activity Ratio 0-50cm)* |
| | 2. Slope | *(Slope 8 to > 15%)* |
| | 3. Too acid | *(Surface Reaction (pH 5 to 6.5))* |
| | 4. Depth to bedrock | *(Shallow to Bedrock 50 - 100 cm)* |
| | 5. Droughty | *(Droughty, AWC 0 to 150cm)* |
| **AWM - Rapid Infiltration Disposal of Wastewater** | **Very limited** | |
| | 1. Slope | *(Sloping 3.9 to > 8%)* |
| | 2. Depth to bedrock | *(Shallow to Bedrock < 200cm)* |
| | 3. Slow water movement | *(Percolation (10 - 40 um/sec) 0 to 60 inches)* |
| **AWM - Slow Rate Process Treatment of Wastewater** | **Very limited** | |
| | 1. Too steep for surface application | *(Slope 2.9 to > 8% surface)* |
| | 2. Too steep for sprinkler irrigation | *(Slope 5.9 to > 12% sprinkler)* |
| | 3. Depth to bedrock | *(Shallow to Bedrock 100 - 150 cm)* |
| | 4. Too acid | *(Surface Reaction (pH 5 to 6.5))* |
| **AWM - Overland Flow Process Treatment of Wastewater** | **Very limited** | |
| | 1. Too steep for surface application | *(Slope 5.9 to > 12% surface)* |
| | 2. Seepage | *(Seepage Limitation (4 - 1 um/sec) Surface Layer)* |

# SoilWeb a Smartphone Soil App

# Consider the systematic variation of soil properties in your operation

# Thank You

**http://casoilresource.lawr.ucdavis.edu/soilsurvey**

**Thank you: Dylan Beaudette, Alex Swarowsky, Jiayou Deng, Donna Dutra, Tony Orozco, Dustin Flavell, Martin Beaton, Jeannie Evatt and SFREC Crew.**