Property Purchase Assessment

Prepared for: Sarah [redacted]

Property: [redacted]

Montecito, CA 93108

Prepared by:

7th Generation Design

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Executive Summary

7th Generation Design was invited by Sarah [redacted] to conduct a property purchase assessment of the 84 acre [redacted] Property (ORP) located in Montecito, CA. The [redacted] family has communicated a desire to rehabilitate a degraded plot of land and develop regenerative land-based systems that are supported by the climate, with the following major goals:

- improving the health of the land,
- carbon capture (or other positive environmental impact),
- a beautiful setting to relocate to in 5-10 years, and
- development of land-based income.

The predominant land and climate features at [redacted] include:

- A secondary ridge, extending from the spine of the primary ridge (which [redacted] Road bordering the property to the NW follows) nearly to the primary valley at its toe (which [redacted] Rd follows) along its length in a NW x SE direction and spanning the two secondary valleys that define the ridge across its width ([redacted] Ave, which borders the property, follows the western secondary valley bottom).
- Temperatures with typical highs between 60-80℉ and lows that only very rarely drop below freezing, with an average of 300-500 chilling hours (<45℉) per year.
- Average rainfall of 17.73 inches per year, with approximately 40.44 million gallons of water landing on the property per average rain year.
- High solar exposure, with an average solar insolation level of 6.1 kWh/m^2/day (compared to that of Death Valley, CA at 6.4 kWh/m2/day, and Fairbanks, AK at 3.1 kWh/m2/day).
- Monthly average winds that range from 5 to 8 mph, blowing predominantly from the southwest during the spring and summer and from the northeast during the fall and winter.
- Clay and clay-loam soils with moderate to high fragility, low to moderate permeability, moderate to rapid runoff potential, and 30-50" effective rooting depth.

The property has fairly fertile soils, a warm climate, good sun exposure, and generally low to moderate slopes - all highly supportive qualities for human habitation. While the property at [redacted] has immense potential for the [redacted] family's goals to be realized, there are some issues that will pose significant ongoing challenges to meeting these goals unless they are rectified. These issues include:

- The diverse array of native, climate-appropriate trees and shrubs that existed prior to human use and settlement of the property have largely been replaced/displaced with monocropped avocado and citrus trees and what is assumed to be shallow-rooted annual grasses of European origin (if 7GD's experience in other nearby areas is any indication). This poses several issues:
  - The water requirements of the avocado trees are prohibitively high in such a drought-prone climate, and will result in increasing costs and contribute to greater water insecurity for the property and in the region.

  - The monocropped nature of these systems results in increased susceptibility to disease, fluctuations in market demand, and other environmental conditions, and thus ongoing maintenance challenges and financial instability.
  - The likely abundance of annual grasses coupled with fire-unadapted trees in a fairly open canopy and an absence of property-managed livestock present major fire concerns that can only be somewhat-alleviated by an intensive maintenance regimen.
- Several major erosion issues are evident from satellite imagery. These have likely resulted from an increased flow of water over the intrinsically low-moderately permeable, fragile soils on significant slopes. This increased water flow has likely resulted since human use and settlement of the property began with the removal of closed-canopy vegetation, overgrazing of soils, and channelization of water from access routes, structures, and other property elements. Erosion and its root causes will only continue to worsen if left unchecked, resulting in greater energy expenditure to eventually repair (if even possible) and negative downslope impacts.
- The site currently lacks private access to water in the form of a spring, well, or other replenishable water body. Water is currently provided by the Montecito Water District, and the future reliability and costs of this supply are unknown.

Initial considerations for rectifying these issues, all of which should be investigated further as part of a detailed site assessment and design process, are:

- Non-erosive drainage elements and energy-dissipation structures (geological and/or organic) should be considered wherever water is currently channelized and resulting in erosion.
- Passive water harvesting earthworks designed to slow the estimated minimum of 8-20 millions gallons of surface runoff during every average rain year, spread it out along the drier ridges, and infiltrate as much of it in the soils as possible should be considered wherever the topography safely permits.
- Replacing the mono-cropped avocado and citrus orchards with a diverse assembly of climate appropriate (temperature- and drought-tolerant, fire-resistant) plants of varying size and root depth (trees, shrubs, perennial grasses) will be among the most effective way to prevent further erosion, rehydrate the landscape, prevent devastation from natural fire cycles, and minimize water use and maintenance requirements. Agroforestry systems integrate economically-productive and climate-appropriate vegetative elements with intensively-managed livestock to create financially viable systems that also regenerative the landscape as time goes on.

1. Site Work Up

1.1 General Site Information

Client(s): Sarah [redacted]

Address: [redacted], Montecito, CA 93108

Parcel Number: [redacted]

Area: 84 acres

Latitude: 34° [redacted]

Longitude: -119° [redacted]

Altitude: ~200'-450' above sea level

Proximity to Ocean: 0.75 miles

Figure 1.1.1
Satellite image of [redacted] Property

Figure 1.1.2

raPlecraPPar [redacted] Property [redacted]
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1.2 Topography

Topography describes the variation in elevation across a landscape. Topographic maps use contour lines to show the shape of the earth's surface in addition to the geographic features included on typical maps, including roads, railroads, rivers, streams, lakes, buildings, built-up areas, boundaries, place or feature names, mountains, elevations, survey control points, vegetation types, and much more.

A contour line joins points of equal height. Contours make it possible to show the height and shape of mountains, depths of the ocean bottom, and steepness of slopes. Basically, contours are imaginary lines that join points of equal elevation on the surface of the land above or below a reference surface, usually mean sea level.

[1] https://sbcassessor.com/assessor/maps_pdfs/00508.pdf

Figure 1.2.1 presents the topographical map for [redacted] Property and the surrounding areas in the [redacted] Creek Watershed.

Figure 1.2.1
High-level topographical map of [redacted] Property and surrounding properties.

This image has been removed from the sample report to preserve owner privacy.

The [redacted] Property property is located on a secondary ridge, extending from the spine of the primary ridge (which [redacted] Road bordering the property to the NW follows) nearly to the primary valley at its toe (which [redacted] Rd follows) along its length in a NW x SE direction and spanning the two secondary valleys that define the ridge across its width ([redacted] Ave, which borders the property, follows the western secondary valley bottom).

1.3 Climate

Temperature Data

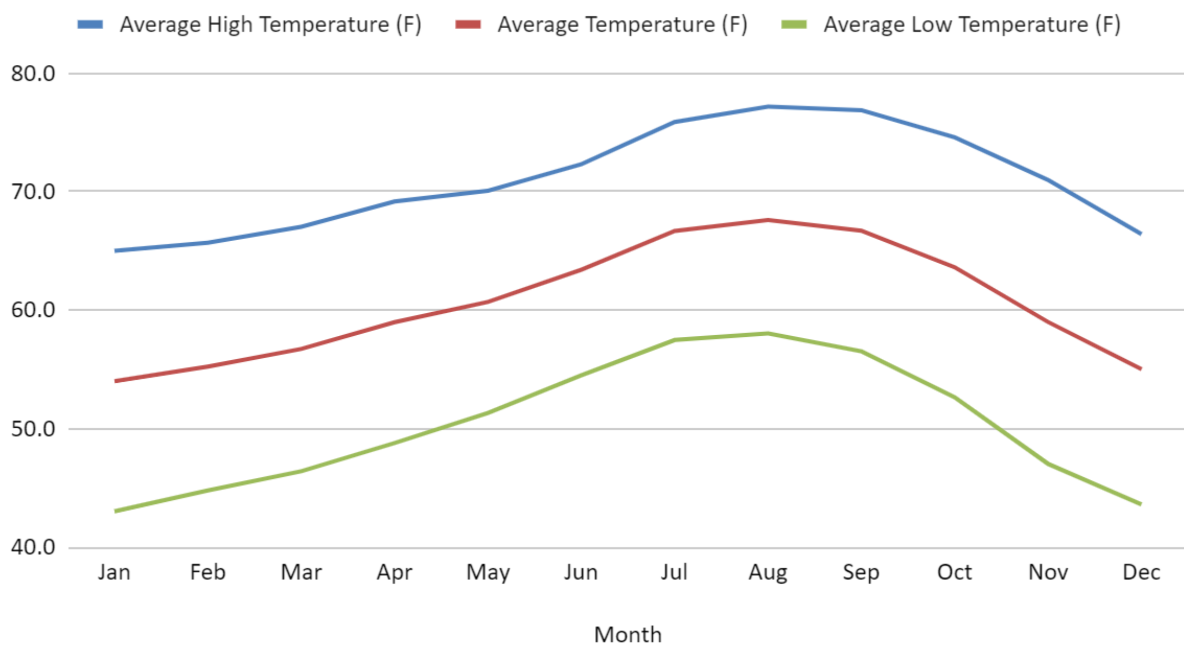
The closest weather station to ORP with real-time weather data is KCASANTA125[2], located approximately **0.9 miles** away.

The closest weather station with historical data is at the **WRCC Station 047902**[3], located **6.2 miles** away from ORP. Annual temperature data for a typical meteorological year at the WRCC Station 047902 Santa Barbara is shown in Figure 1.3.1. The coldest months of the year are December

[2] https://www.wunderground.com/dashboard/pws/KCASANTA125
[3] https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca7902

through February; the warmest months are July through September. The extreme high temperature on record is 115℉, recorded on June 17th, 1917 ; the extreme low temperature on record is 20℉, recorded on January 4th, 1949.

Figure 1.3.1
Average monthly temperature data for WRCC Station 047902 Santa Barbara

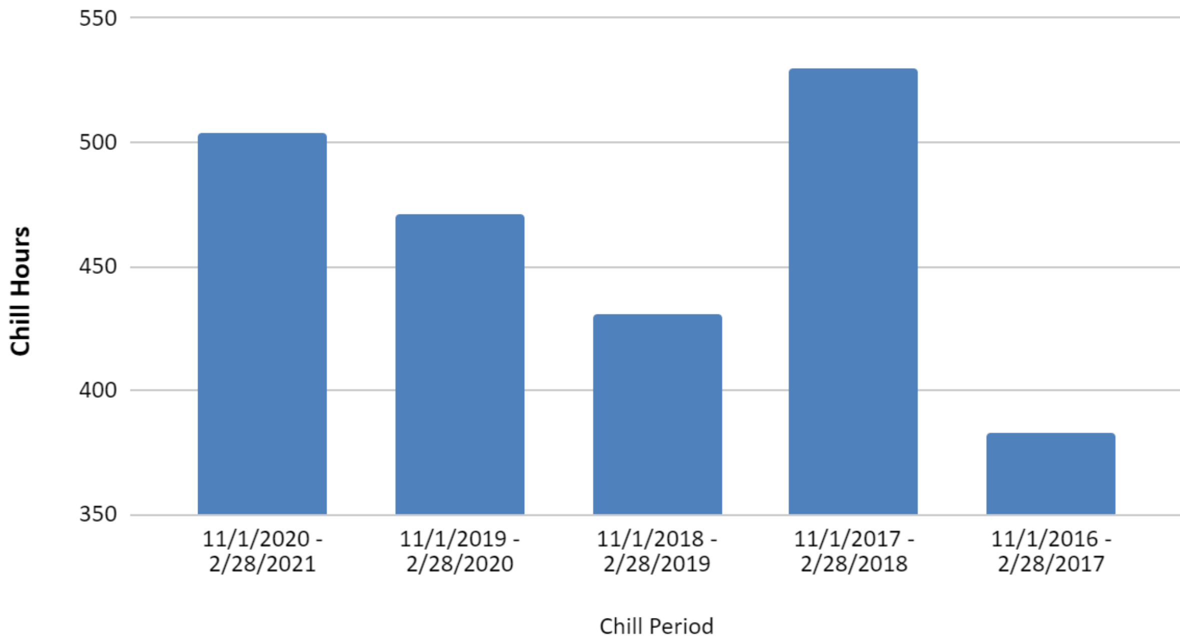


Chilling Hours

Deciduous fruit trees, which lose their leaves in the fall and are dormant throughout the winter, need to accumulate a minimum number of hours below 45℉ during their dormancy in order to set fruit the following year. Knowing the approximate amount of chilling hours an area experiences throughout the cold season enables better selection of fruit trees that are likely to do well in that area.

In what is called the *Below 45℉ Model*, chilling hours are the total number of hours below 45℉ accumulated each year while the tree is dormant. The Santa Barbara Airport weather station, located approximately 13 miles away from [redacted], has seen an average of **464 hours** below 45℉ over the past 5 years. Figure 1.3.2 below presents the cumulative chill hours for each of the past 5 years of dormant seasons at the Santa Barbara Airport weather station (KSBA), useful in comparing the range of chilling hours and trend in recent years.

Figure 1.3.2
Five-year cumulative chilling hour data for the Santa Barbara Airport weather station, located approximately 13 miles away from [redacted].



While the Santa Barbara Airport is located in a similar area geographically and topographically as the property at [redacted], the chill hours may nonetheless vary. Chilling hours can vary significantly even across the same piece of land; low spots, frost pockets, slopes and wind tunnels or wind buffered areas will all experience different chill hours. The best way to know for a specific site, especially before undertaking any capital-intensive agroforestry project, is to install temperature data loggers on-site and record hourly data during a winter season. However, on cold days and nights valuable information can be gained simply by walking up and down slopes with some bare skin exposed so that you can sense where a thermocline - a thin but distinct layer in the atmosphere in which temperature changes more rapidly with depth than it does in the layers above or below - might persist. Often, the difference in 10 feet of vertical elevation will make the difference between a citrus tree thriving or dying. Knowing these invisible lines in the landscape will inform better decisions about which types of plants will do best where.

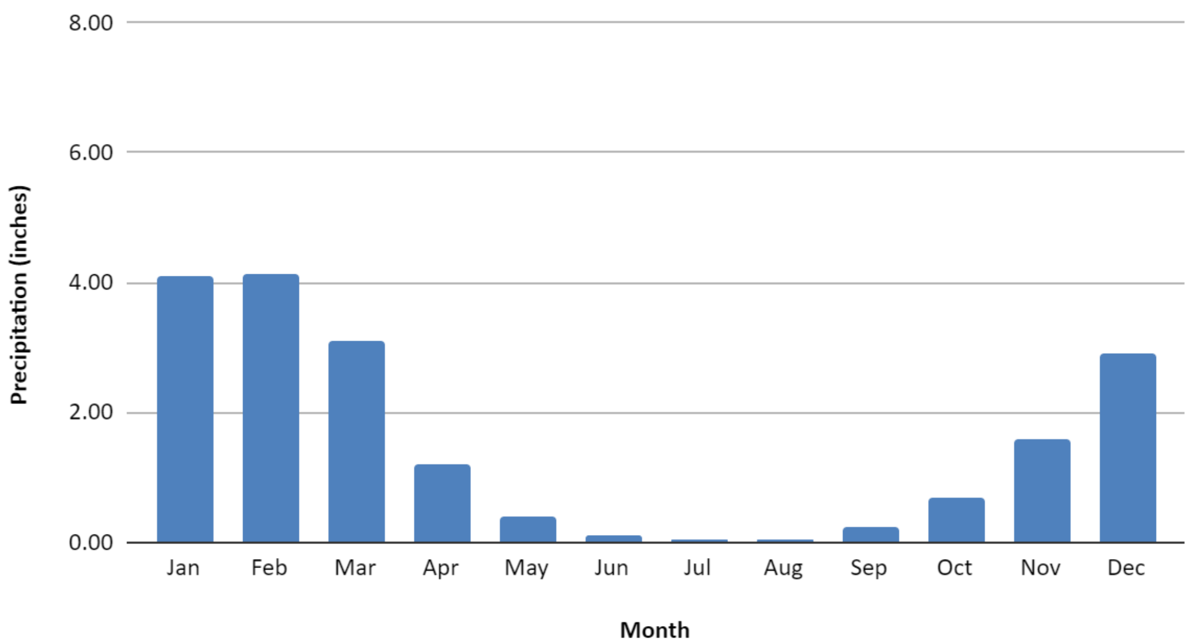
When it comes to fruit tree selection, making selections for staple tree crops with a chilling hours buffer is suggested. For this site, trees that require **300** chilling hours or less are recommended. While it can be fun to push the boundaries for select plantings, for your staple tree crops, staying within this range will create the greatest chance for successful harvests year after year.

Precipitation and Groundwater Data

Annual Precipitation Totals

The annual average amount of rainfall recorded at WRCC Station 047902 Santa Barbara, located 6.2 miles away from [redacted], is 17.73 inches. The record high annual total during that period was 41.48 inches in 1941; the record low total was 3.99 inches in 1947.

Figure 1.3.3
Average monthly rainfall for Montecito.



During an average rain year of 17.73 inches, the total volume of rainfall that lands within ORP property lines is 40.44 million gallons.

Approximately 65% of precipitation (~26 million gallons during an average rain year) falls on the 55-acre southwest-facing side of the ridge that the property sits on, with any water that doesn't infiltrate the soils of the property during rain events (runoff) descending to bordering [redacted] Ave and ultimately to the ocean. The runoff from this portion of the property is estimated to be between 5 and 13 million gallons of water per average rain year.

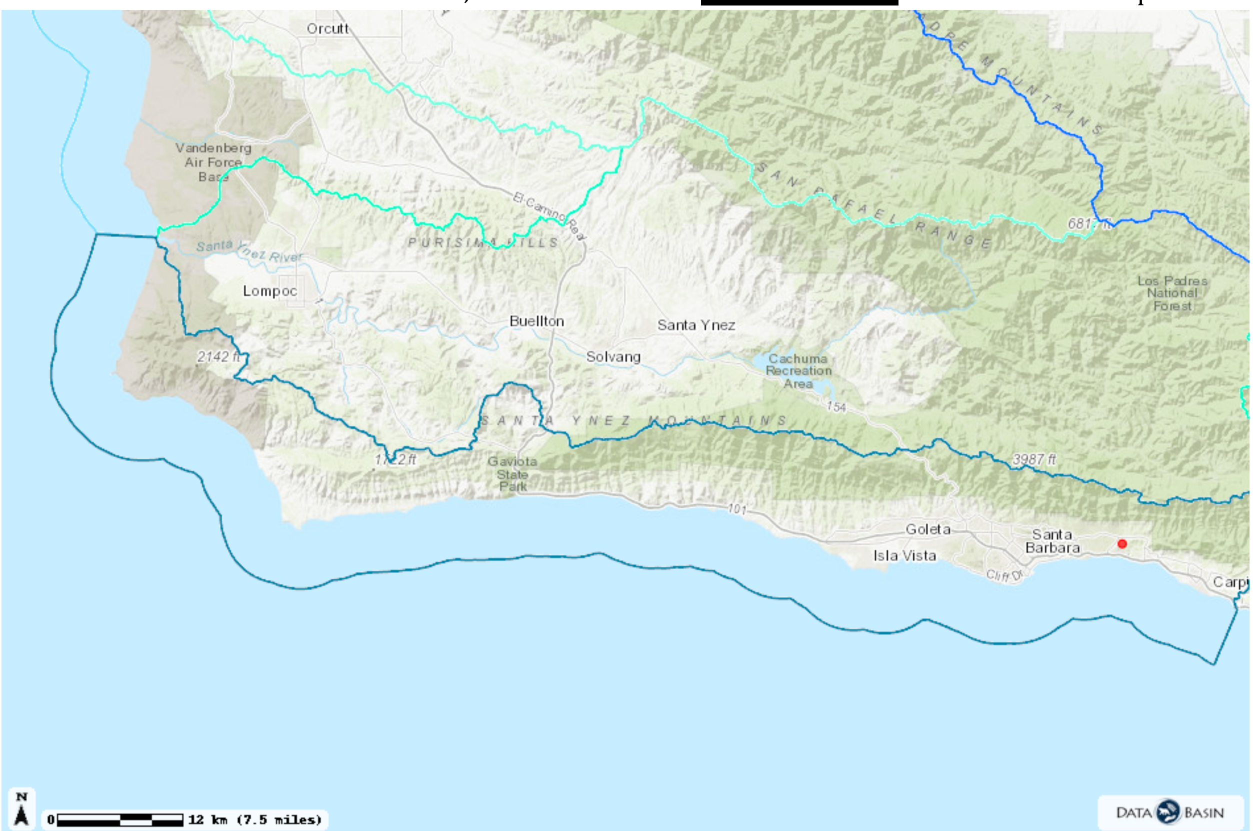
Approximately 30% of the precipitation (14 million gallons during an average rain year) falls on the northeast-facing side of the ridge that the property sits on, with any water that doesn't infiltrate the soils of the property during rain events (runoff) descending into a drainage just outside property lines and ultimately to the ocean. This runoff from this portion of the property is estimated to be between 3 and 7 million gallons per year.

Detailed calculations on total on-property catchment and estimated runoff are available in the ORP Water Catchment Calculator spreadsheet.

A watershed, also known as a drainage basin or catchment, is an area bounded by hills and ridges where any rainfall and runoff leads to a single outlet. Watersheds can be as small as a footprint or large enough to encompass all of the land that drains water into rivers that drain into the ocean. It all depends on the outflow point; all of the land that drains water to the outflow point is the watershed for that outflow location.

[redacted] lies entirely within the Santa Barbara Coastal Watershed, which spans from the main traverse (east-to-west) ridge of the southernmost portion of the Santa Ynez mountains to the Santa Barbara coastline. This watershed is shown in Figure 1.3.4, with the location of [redacted] identified as the red point.

Figure 1.3.4
The Santa Barbara Coastal watershed, with the location of [redacted] identified as the red point.



Annual Distribution of Precipitation

There are an average of 36 rainy days (>.1 inch) per year. Typically 80 - 90% of total annual rainfall falls between November and April, making this a brittle climate (see “Climate Brittleness”, below).

Rainfall Intensity and Recurrence Interval

Table 1.3.1 below lists rainfall intensity and the recurrence interval for the Montecito area. Water harvesting earthworks design is typically informed by the 500 or 1,000-year recurrence interval event - a rainfall event of certain intensity and magnitude that has a 0.2 - .1% probability of occurring during any given year. In this case, the table below shows the 1,000-year recurrence interval event to be 8.0 inches of rain in a 12-hour period, and 10.6 inches of rain in a 24-hour period. We use this information to size spillways, drains, catchment basins and overflows to ensure that the system can endure such an event, and any of lesser intensity and magnitude, without damage.

Table 1.3.1

Rainfall intensity and recurrence interval for [redacted] Property

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.157 (0.134-0.185)	0.199 (0.170-0.235)	0.254 (0.216-0.301)	0.297 (0.251-0.356)	0.356 (0.288-0.444)	0.400 (0.316-0.511)	0.444 (0.340-0.585)	0.488 (0.362-0.666)	0.548 (0.386-0.784)	0.593 (0.401-0.885)
10-min	0.225 (0.192-0.265)	0.285 (0.244-0.337)	0.364 (0.310-0.431)	0.426 (0.360-0.510)	0.510 (0.413-0.636)	0.573 (0.453-0.733)	0.636 (0.488-0.838)	0.700 (0.519-0.954)	0.785 (0.554-1.12)	0.850 (0.575-1.27)
15-min	0.272 (0.233-0.320)	0.345 (0.295-0.408)	0.440 (0.375-0.521)	0.516 (0.435-0.617)	0.617 (0.500-0.769)	0.693 (0.547-0.887)	0.769 (0.590-1.01)	0.847 (0.627-1.15)	0.949 (0.669-1.36)	1.03 (0.695-1.53)
30-min	0.421 (0.360-0.496)	0.535 (0.457-0.632)	0.682 (0.581-0.808)	0.799 (0.674-0.956)	0.956 (0.774-1.19)	1.07 (0.848-1.37)	1.19 (0.914-1.57)	1.31 (0.972-1.79)	1.47 (1.04-2.11)	1.59 (1.08-2.38)
60-min	0.632 (0.541-0.745)	0.803 (0.687-0.948)	1.02 (0.872-1.21)	1.20 (1.01-1.44)	1.43 (1.16-1.79)	1.61 (1.27-2.06)	1.79 (1.37-2.36)	1.97 (1.46-2.68)	2.21 (1.56-3.16)	2.39 (1.62-3.57)
2-hr	0.929 (0.796-1.10)	1.18 (1.01-1.39)	1.50 (1.28-1.78)	1.76 (1.49-2.11)	2.10 (1.70-2.62)	2.36 (1.86-3.02)	2.62 (2.01-3.45)	2.88 (2.13-3.92)	3.22 (2.27-4.62)	3.48 (2.36-5.20)
3-hr	1.15 (0.986-1.36)	1.46 (1.25-1.73)	1.86 (1.59-2.20)	2.18 (1.84-2.61)	2.60 (2.11-3.24)	2.92 (2.30-3.73)	3.23 (2.48-4.26)	3.55 (2.63-4.84)	3.97 (2.80-5.69)	4.29 (2.91-6.41)
6-hr	1.67 (1.43-1.97)	2.12 (1.81-2.50)	2.69 (2.30-3.19)	3.15 (2.66-3.77)	3.75 (3.04-4.68)	4.21 (3.32-5.38)	4.65 (3.57-6.13)	5.11 (3.78-6.96)	5.70 (4.02-8.17)	6.15 (4.16-9.18)
12-hr	2.19 (1.87-2.58)	2.79 (2.38-3.29)	3.54 (3.02-4.20)	4.14 (3.49-4.95)	4.92 (3.99-6.14)	5.51 (4.35-7.04)	6.08 (4.66-8.01)	6.65 (4.93-9.07)	7.41 (5.22-10.6)	7.97 (5.40-11.9)
24-hr	2.84 (2.47-3.32)	3.64 (3.17-4.27)	4.66 (4.04-5.47)	5.46 (4.70-6.46)	6.50 (5.44-7.94)	7.28 (5.97-9.06)	8.05 (6.45-10.2)	8.81 (6.88-11.5)	9.81 (7.38-13.3)	10.6 (7.69-14.8)

**PDS: precipitation data server; PF: precipitation frequency*

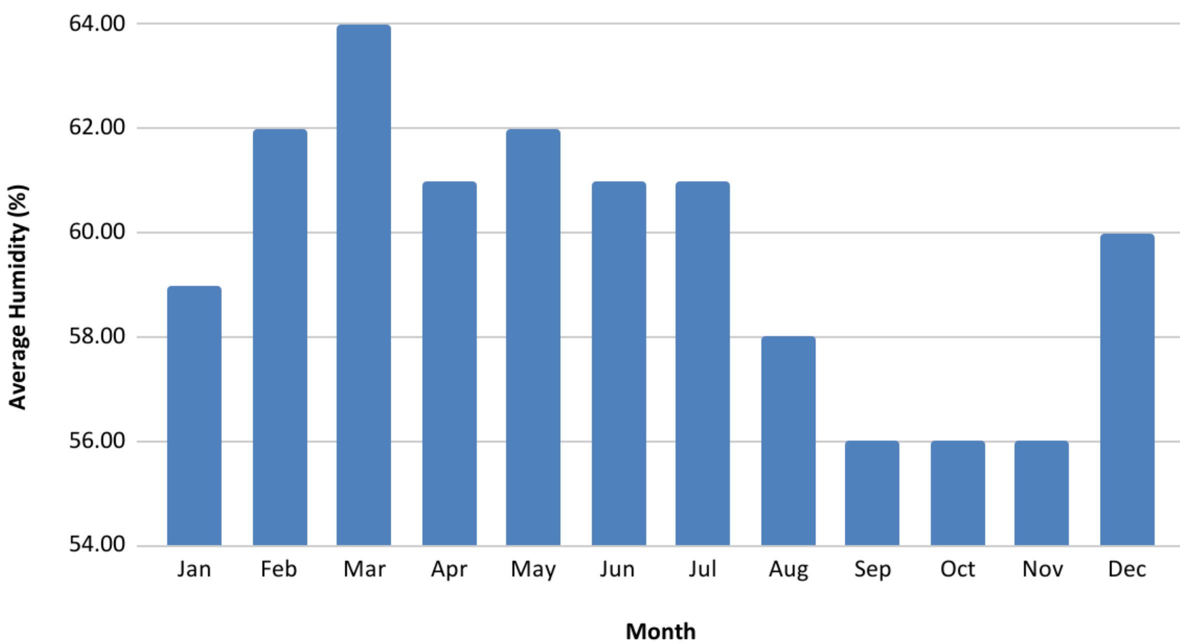
Humidity

The closest weather station with humidity data is WRCC Station 047902 Santa Barbara (6.2 miles). The humidity does not vary much in that location throughout the year; it is highest in the winter, spring, and early summer, with monthly averages ranging from 58-64%, and lowest in the late summer and fall, with monthly averages at 56%.

The average monthly relative humidity over the course of a typical meteorological year at WRCC Station 047902 Santa Barbara (6.2 miles away) is shown in Figure 1.3.5.

Figure 1.3.5

Average monthly relative humidity for a typical meteorological year at WRCC Station 047902 Santa Barbara (6.2 miles away from [redacted]).



Fog

Coastal fog banks in the Santa Barbara channel exert a cooling and humidifying effect on the area when present. These fog banks are more frequent during spring and summer, and contribute to the higher humidity levels during that period.

Aquifer

The [redacted] Property sits atop the Montecito Groundwater Basin, which has a surface area of 6,270 acres. According to the California Department of Water Resources, "this basin is bounded on the north by the Santa Ynez Mountains and the Arroyo Parida fault, on the east by consolidated rocks, on the southeast by the Fernald fault, and on the northeast by a surface drainage divide that separates the Montecito and Carpinteria Groundwater Basins (DWR 1999). The offshore Rincon Creek fault and the Pacific Ocean bound the basin on the south. An administrative boundary on the west separates the Montecito Groundwater Basin from the Santa Barbara Groundwater Basin."

According to a 2020 Groundwater Data Report[4] prepared by the County of Santa Barbara, approximately 9,667 residents utilize the groundwater basin for domestic water, and its water is

4 https://www.countyofsb.org/uploadedFiles/pwd/Content/Water/WaterAgency/GW%20Data%20Report%202020.pdf

used to irrigate approximately 706 acres of agricultural land. Current draw is estimated at 45% of its supply.

According to the 2020 Groundwater Data Report, the basin's water levels have been observed to drop during extended years of drought (1945-1951, 1984-1990, and 2012-2018), and have not rebounded to pre-drought levels. General trends indicate increased storage following above average precipitation in 2017 and following above average precipitation in 2019.

The following information is from [California's Groundwater Bulletin 118](https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/3_049_Montecito.pdf)[5], written in 2003:

> **Groundwater Storage:** The storage capacity above sea level is estimated at 14,490 acre-feet [6] (af, Montecito Water 1998). The total storage capacity of the basin has been estimated at 281,000 af (Muir 1968; DWR 1975). The amount of groundwater in storage is estimated at 14,400 af (SBCWA 2001).
>
> **Groundwater Budget:** Montecito Water District pumps about 700 af/yr of groundwater (Montecito Water 2001). However, the amount pumped by private well owners is unknown. Annual natural recharge is approximately 1,614 af/yr (Montecito Water 1998). The average annual stream seepage rate is estimated at 764 af/yr, and the average annual infiltration of rainfall is estimated at 500 af/yr (Montecito Water 1998). The long-term average subsurface inflow is approximately 250 af/yr. The long-term average deep percolation of irrigation water is estimated at 100 af/yr (Montecito Water 1998).
>
> **Characterization:** The groundwater in the Montecito Basin is of two chemical types. South of the Arroyo Parida fault, groundwater has calcium bicarbonate character, however, north of the fault it has sodium sulfate character. TDS concentration ranges from 600 to 1,100 mg/L (Montecito Water 1998). Analyses of data from four public supply wells show an average TDS of 698 mg/L in the basin with a range from 526 to 778 mg/L.
>
> **Impairments**: Iron and manganese concentrations in wells exceed Federal standards (Montecito Water 1998). During 1990, some wells yielded groundwater samples containing high chloride concentrations that exceeded State limits. However, no wells are confirmed to be affected by seawater intrusion (Montecito Water 1998).

The Sustainable Groundwater Management Act (SGMA) was passed in 2014 to create a framework for groundwater sustainability throughout California. Groundwater basins that are designated as high or medium priority by the DWR must form a Groundwater Sustainability Agency (GSA). Each GSA is responsible for the development, implementation, and oversight of a Groundwater Sustainability Plan (GSP). GSPs must achieve groundwater sustainability within 20 years of GSP adoption. GSP objectives require that future groundwater use does not cause undesirable results,

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[5] https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Bulletin-118/Files/2003-Basin-Descriptions/3_049_Montecito.pdf

[6] 1af = 325,851 gallons

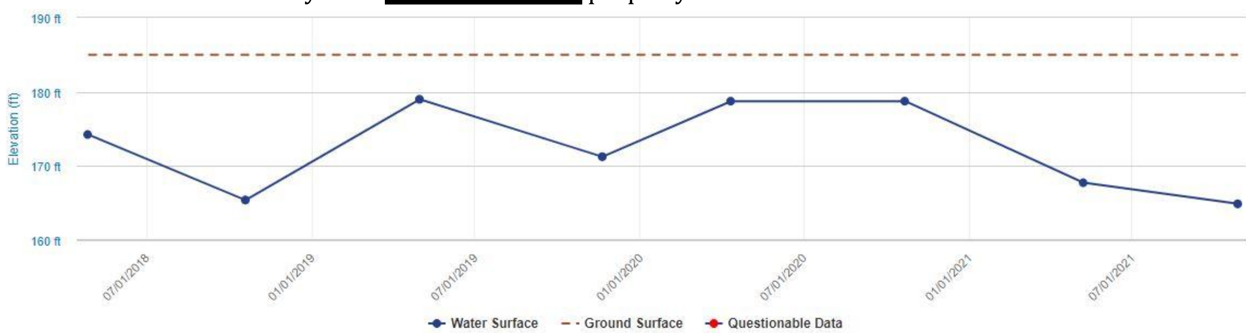
which include the following: declining water levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletion of interconnected surface water.

The GSP for the Montecito Groundwater Basin is due in 2024, and will be made publicly available at the Montecito Groundwater Sustainability Agency's website[7].

The closest monitored well with publicly available data is EVR 3[8], located in the Birnam Wood Golf Club approximately 0.4 miles away at an elevation of 185 feet. The water surface at the well has varied between 165ft and 179ft over the past 3 years of data recording, as illustrated below.

Figure 1.3.6

Measured water surface depth for well EVR 3, located in the Birnam Wood Golf Club approximately 0.4 miles away from [redacted] property at an elevation of 185 feet.



Climate Brittleness

Brittleness gauges climate vulnerability to desertification. The brittleness scale is subjective and has no formula for calculation, but can be thought of as a continuum, ranging from a 1 - very humid with moisture distributed throughout the year (tropical rainforest) to a 10 - very arid with long dry periods(desert). We use brittleness to inform management decisions for a given property or bioregion.

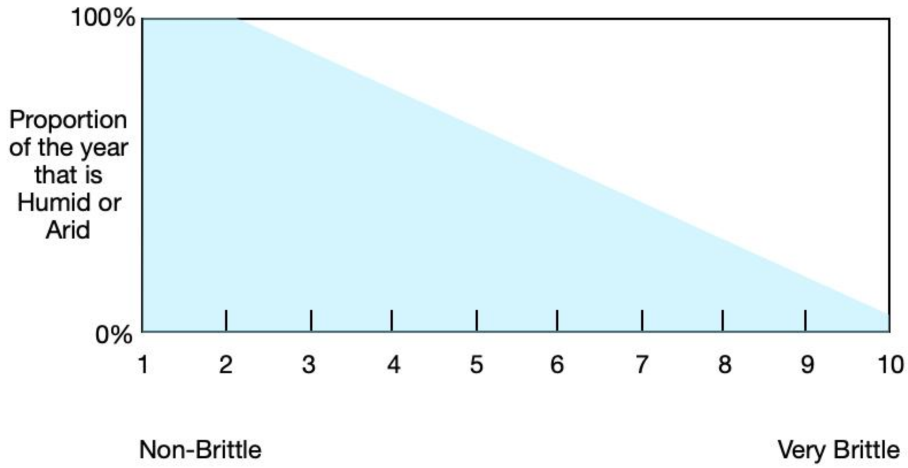
Where any given climate falls on the brittleness scale is determined not so much by total rainfall, but rather by the distribution of precipitation and humidity throughout the year. This pattern determines the degree of brittleness. Very brittle environments typically have a long period of non-growth (often due to long periods without precipitation and low humidity) and can be very arid. Brittle environments also tend to accumulate more dead plant material as biological breakdown of carbon-based plant tissues by insects, microbes and fungi all but cease during the long dry season. This can have a negative effect on the health and resilience of the vegetation due to increased risk of catastrophic fire (due to built up fuel levels) and decreased light penetration to young growing tips (blocked by dead, standing vegetation).

[7] https://montecitogsa.com/

[8] https://wdl.water.ca.gov/WaterDataLibrary/GroundwaterBrowseData.aspx?LocalWellNumber=&SelectedCounties=&StationId=51950&StateWellNumber=&SelectedGWBasins=&SiteCode=344312N1196068W002

Figure 1.3.7

Climate Brittleness Scale



The climate at [redacted] Property tends towards being **brittle**. Long summer dry seasons and fairly short winter wet seasons predominate. There is a significant maritime influence on the property, which brings with it exposure to a fog cycle and some intermittent moisture through dew set.

Increasing the amount of perennial vegetation on property will have the greatest effect in moderating climate extremes and creating soil that can retain more moisture for longer. Use of ruminant grazing animals should be carefully planned and attentively managed to ensure they are benefiting the larger processes of soil creation and establishment of perennial cover across the property.

Evapotranspiration

Evapotranspiration (ET_o - the amount of water released to the atmosphere through plant and soil respiration from mowed, perennial grass cover) was approximately **49.61** inches from 12/2020-11/2021, as measured from CIMIS[9] Station **107**.

Solar Data

Solar aspect describes the way that the sun moves across the sky at your location during the various seasons. Having an understanding of the sun's seasonal path is critical for properly siting various elements in the property design, designing housing and other structures for passive heating/cooling, and situating solar panels.

[9] California Irrigation Management Information System: https://cimis.water.ca.gov/WSNReportCriteria.aspx

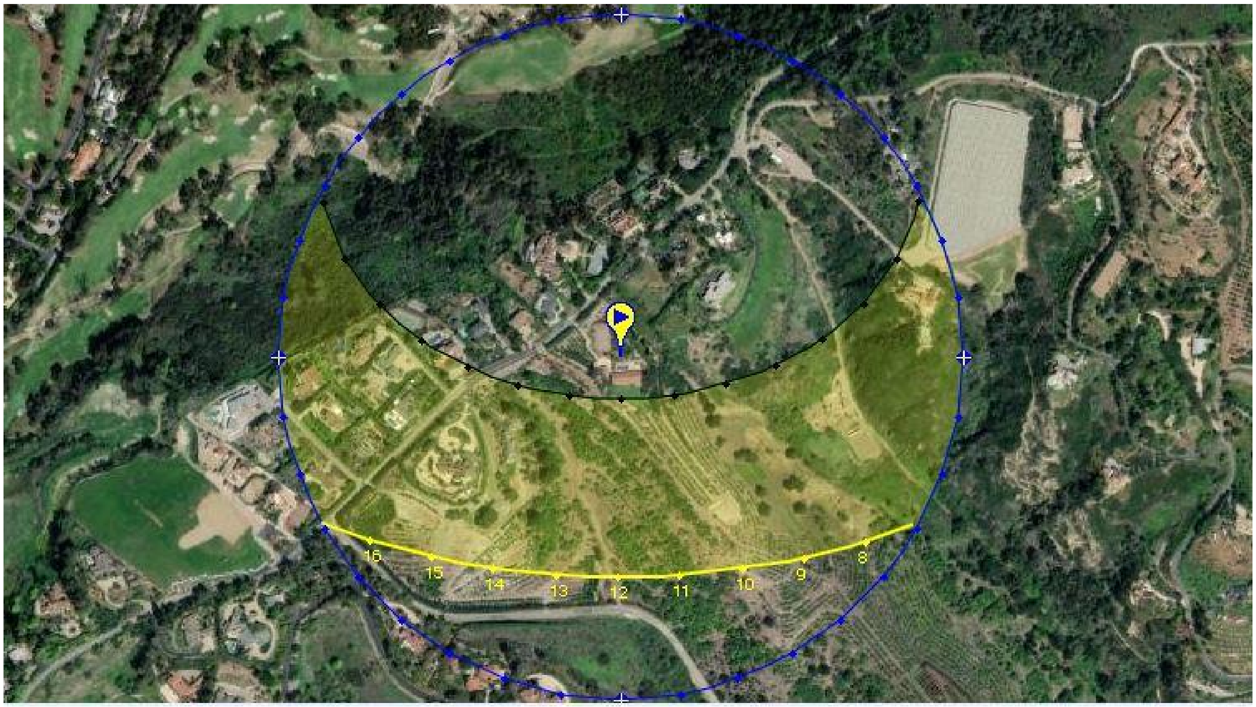


Table 1.3.2
Solar aspect information for each season at ORP.

Season Change	Sun Angle* (deg)	Shadow Length**	Sunrise Location*** (deg)	Sunset Location*** (deg)
Winter Solstice	32.16º	1.59	118.46º	241.78º
Spring Equinox	55.75º	0.68	89.27º	270.84º
Summer Solstice	79.01º	0.19	60.33º	299.50º
Fall Equinox	55.57º	0.69	89.22º	270.36º

** Sun angle from horizontal plane at culmination (highest in sky)*
*** Shadow length expressed as multiple of object height, taken at culmination*
**** Exact locations of sunrise/sunset on the horizon from suncalc.org - visit mooncalc.org to get similar data for lunar cycles.*

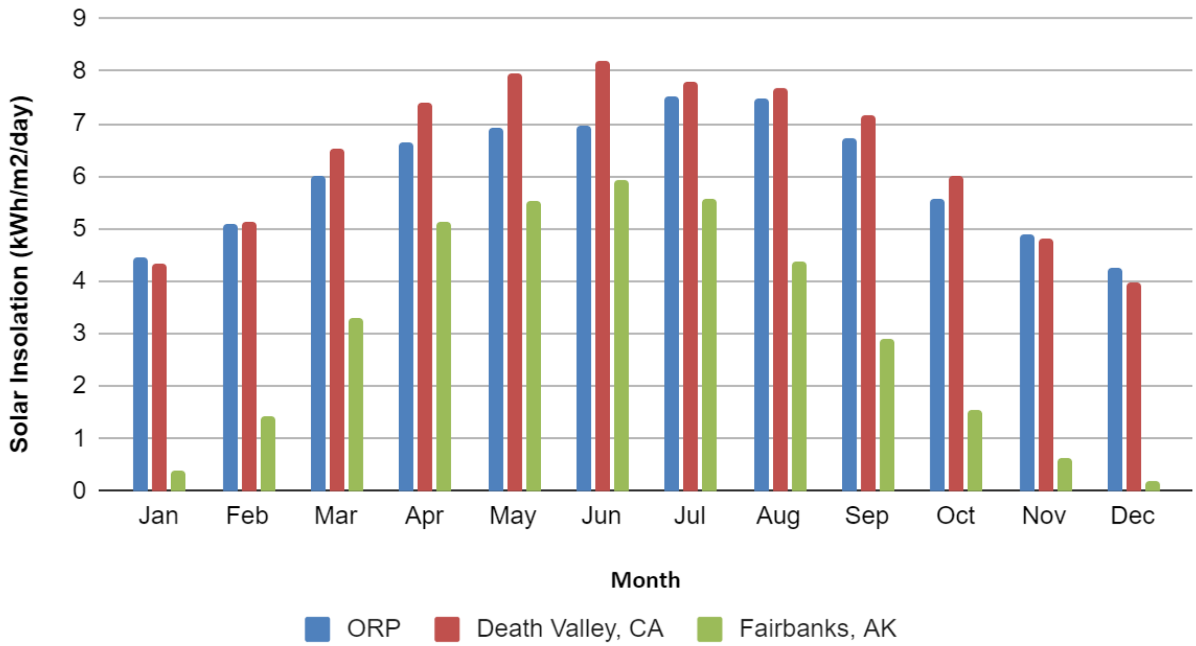
There are approximately **307** days of sun per year in Santa Barbara.

The longest day length is **14h28m** on the Summer Solstice, and the shortest day length is **9h52m** on the Winter Solstice.

The average annual solar insolation (used to measure energy production of solar PV systems, in kWh/m2/day) at ORP is 6.1 kWh/m^2/day, compared to that of Death Valley, CA at 6.4 kWh/m2/day, and Fairbanks, AK at 3.1 kWh/m2/day- considered to be among the sunniest and least sunny places in the US, respectively. The monthly average solar insolation at ORP is presented in Figure 1.3.8, and also compared with Death Valley, CA and Fairbanks, AK. It is clear from the data that ORP is ideally located for solar PV electricity generation.

Figure 1.3.8

Solar insolation for a typical meteorological year at ORP, as compared to that of Death Valley, CA and Fairbanks, AK *(data compiled from [NREL's PVwatts Calculator](https://pvwatts.nrel.gov/)[10])*

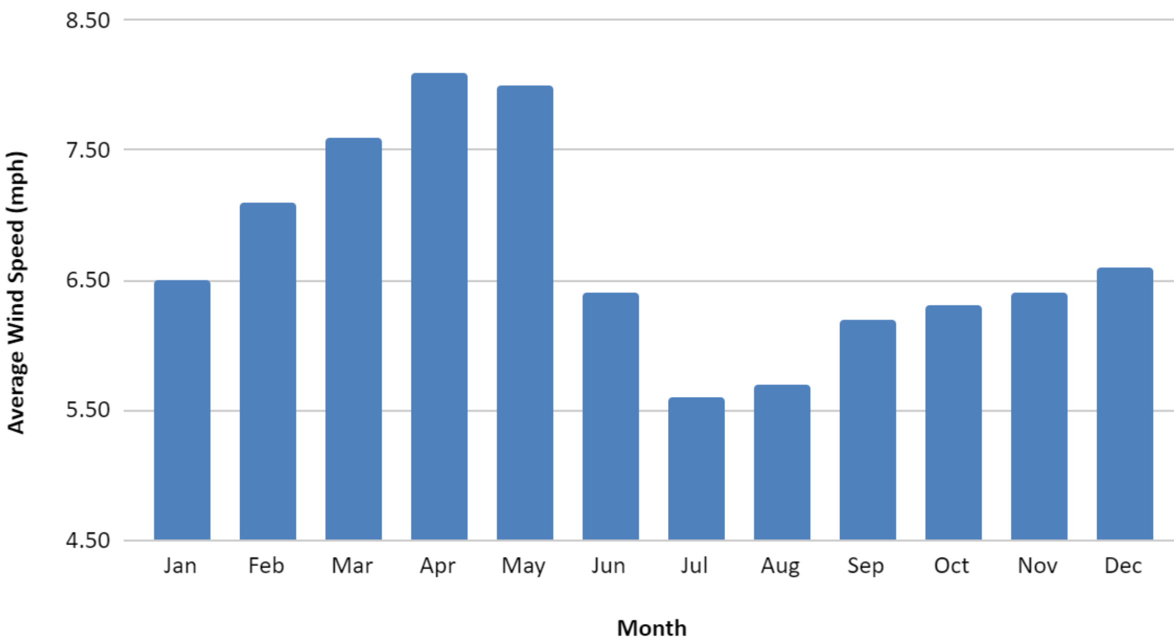


Wind Data

The closest weather station with recorded wind speed data is located at WRCC Station 047902 Santa Barbara (6.2 miles). There, the annual average wind speed is 6.7 mph. The monthly average wind speed over the course of a typical meteorological year is shown in Figure 1.3.9. Average wind speeds are highest during the late spring and summer months, the highest being 10.1 mph during the month of June. The lowest monthly average wind speed of 4.4 mph occurs during December.

[10] https://pvwatts.nrel.gov/

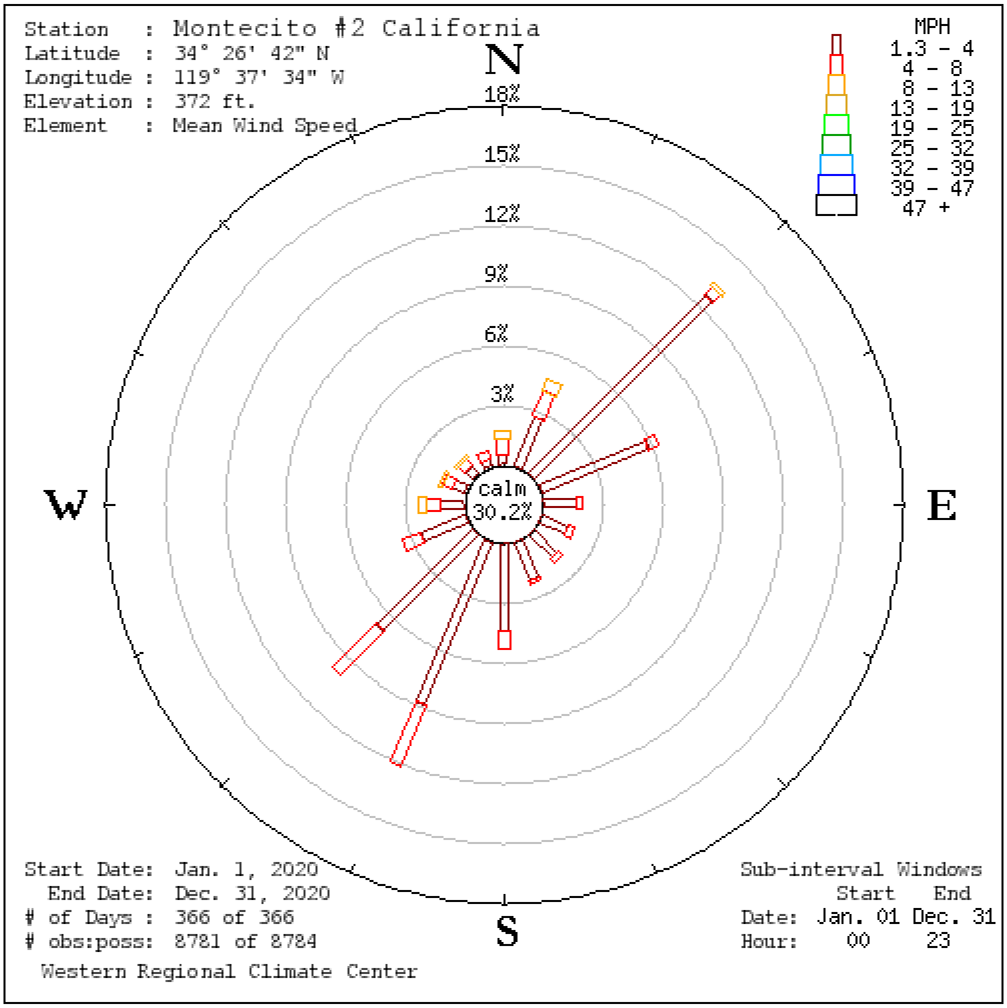
Figure 1.3.9
Daily average wind speed recorded at a station located 1.8 miles away from [redacted] near San Ysidro Canyon in Montecito.



A wind rose showing the speed, direction, and distribution of hourly wind data for 2020 recorded at a station located 1.8 miles away from [redacted] near San Ysidro Canyon in Montecito is shown in Figure 1.3.11. The prevailing wind directions are from the northeast and southwest.

Figure 1.3.10

Windrose[11] for a station located 1.8 miles away from [redacted] near San Ysidro Canyon in Montecito.



The prevailing wind blows onshore from the southwest, over the ocean and towards the Santa Lucia range. These prevailing winds are most present during the spring and summer months. Fall days see frequent warmer offshore wind events from the northeast. Winter sees a mix of onshore and offshore winds during clear days and winds from south to north during the passage of storms.

As with the other climatic sectors, wind speeds and directions can vary significantly over a small area, even on the same property. The information above is a good approximation of the wind conditions at ORP to use as a starting point for plantings, windbreak siting, etc; however, on-site observation- simply walking around throughout the year, noting wind direction and relative strength at different locations - will provide more refined information. If capital-intensive projects that are heavily influenced by the wind sector are ever considered (such as wind turbines), a detailed study should certainly be performed on-site.

[11] https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCMN2

Climate Zones

USDA Hardiness Zone

USDA Hardiness Zones gives an approximation of the lowest temperatures a site will experience in a given year. It is a helpful, if somewhat limited tool in determining what will survive (but not necessarily *thrive*) in an area. Hardiness zones can be determined for a given zip code at https://planthardiness.ars.usda.gov/. Microclimates and site specific characteristics will vary.

The USDA Hardiness Zone for ORP is **10a**. This zone is characterized by cold-season low temperatures that do not generally fall lower than **30-35**ºF, typically occurring between November and February.

Sunset Climate Zone(s)

Sunset climate zones take into account length of growing season, timing and amount of rainfall, winter lows, summer highs, wind and humidity. They provide a more detailed climate description than the USDA model, helpful in selecting which plants will not only survive but thrive with local climate variability. List of maps and climate zone descriptions[12].

The Sunset Climate Zone(s) for [redacted] Property are likely a combination of **Zones 23** (likely in the upper portion of the property) and **24** (potentially at the bottom of the property)**.** They are described on the Sunset Western Garden Collection website as:

> **ZONE 23: Thermal belts of Southern California**
>
> One of the most favored areas in North America for growing subtropical plants, Zone 23 has always been Southern California's best zone for avocados. Frosts don't amount to much here, because 85 percent of the time, Pacific Ocean weather dominates; interior air rules only 15 percent of the time. A notorious portion of this 15 percent consists of those days when hot, dry Santa Ana winds blow. Zone 23 lacks either the summer heat or the winter cold necessary to grow pears,most apples, and most peaches. But it enjoys considerably more heat than Zone 24—enough to put the sweetness in 'Valencia' oranges, for example—but not enough for 'Washington' navel oranges, which are grown farther inland. Temperatures are mild here, but severe winters descend at times. Average lows range from 43 to 48°F (6 to 9°C), while extreme lows average from 34 to 27°F (1 to –3°C).
>
> **ZONE 24: Marine influence along the Southern California coast**
>
> Stretched along Southern California's beaches, this climate zone is almost completely dominated by the ocean. Where the beach runs along high cliffs or palisades, Zone 24 extends only to that barrier. But where hills are low or nonexistent, it runs inland several miles.

[12] http://sunsetwesterngardencollection.com/climate-zones

This zone has a mild marine climate (milder than Northern California's maritime Zone 17) because south of Point Conception, the Pacific is comparatively warm. The winters are mild, the summers cool, and the air is seldom really dry. On many days in spring and early summer, the sun doesn't break through the high overcast until afternoon.

Zone 24 is coldest at the mouths of canyons that channel cold air down from the mountains on clear winter nights.Partly because of the unusually low temperatures created by this canyon action, there is a broad range of winter lows in Zone 24. Winter lows average from 42°F (5°C) in Santa Barbara to 48°F (9°C) in San Diego. Extreme cold averages from 35° to 28°F (2 to –2°C), with all-time lows in the coldest stations at about 20°F (–6°C).

The all-time high temperatures aren't greatly significant in terms of plant growth. The average all-time high of weather stations in Zone 24 is 105°F (41°C). Record heat usually comes in early October, carried to the coast by Santa Ana winds. The wind's power and dryness usually causes more problems than the heat itself—but you can ameliorate scorching with frequent sprinkling.

Koppen Geiger Climate Classification

The Koppen Geiger Climate Classification System is a widely used climate classification system, useful in tracking large scale climate changes over time. Helpful visualizations are available as .kmz files in Google Earth[13]. Knowing your KGCC rating can be especially helpful in quickly finding climate analogues around the world as a starting place for researching biological systems, management practices and species that will have a high likelihood of success at your location. The Koppen Geiger Climate Classification System map, viewable by county, is available at http://koeppen-geiger.vu-wien.ac.at/.

The Koppen Geiger Climate Classification for Montecito is **Csb.**

- Csb: The C stands for warm temperate, the lower case s for precipitation mode of 'summer dry' and the lower case b for a temperature rating of 'warm summer'. This is generally considered a Mediterranean climate. Expanded definitions for each letter within the code are available here[14].

Growing Season

Late February - Early June. Growing season for climate-adapted native plants typically occurs during and immediately following the rainy season (December through March) and tapers by the end of spring, entering some sort of stasis come the hot, dry months of summer. For non-native, food producing, or other plant varietals the growing season is quite long with Montecito's average of 307 sunny days per year.

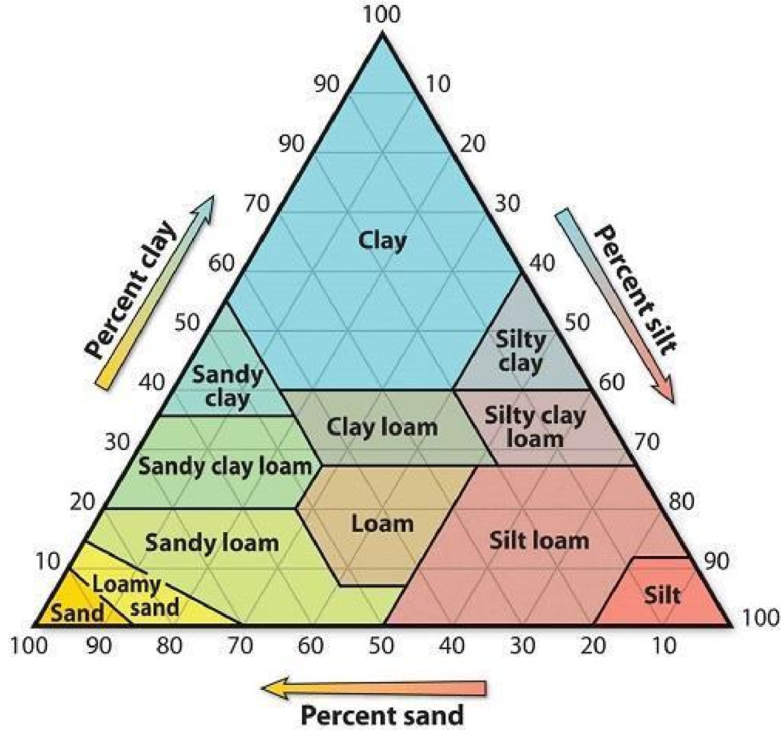
[13] http://koeppen-geiger.vu-wien.ac.at/present.htm#GoogleEarth
[14] https://www.britannica.com/science/Koppen-climate-classification

1.4 Soil Data

Fertile soil is the foundation for a healthy landscape. Soil data provides information for the landowner of what actions will be required to facilitate healthy development of the landscape. This information can be used to determine the best methods to organically build soil to optimal levels.

The soil texture classification triangle is shown in Figure 1.4.1, depicting the different proportions that occur between the three main particles that comprise soil: sand, silt, and clay. The percentages of each of these result in soil classifications such as "loam", "sandy loam", etc.

Figure 1.4.1
Soil texture classification triangle.



Soil Condition Summary

The Natural Resources Conservation Service (NRCS) map for the [redacted] property is provided in Figure 1.4.2. Detailed descriptions of the soil classifications shown on the map follow.

Figure 1.4.2

NRCS Web Soil Survey Data for [redacted] Property and surrounding areas.

Table 1.4.1

Summary of soil types for [redacted]

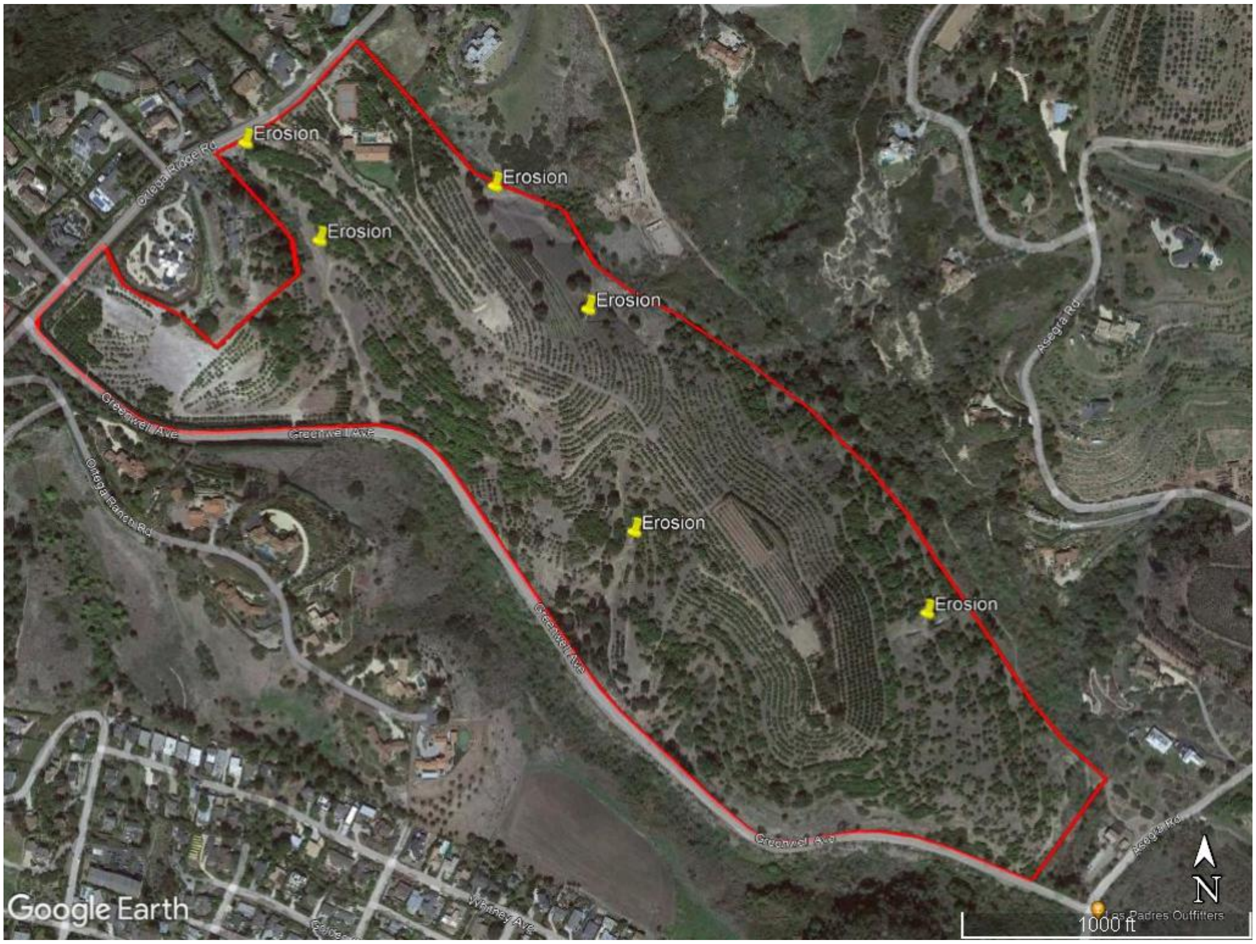
Soil Series	Soil Type	Defining Slope	Property Area	Key Characteristics
Todos	TbE2	15-30%	31%	• Predominant soil texture: Clay-loam • Depth to shale or mudstone <45” • Medium runoff • Moderate erosion hazard • Effective rooting depth 40-60”
Diablo	DaD	9-15%	26%	• Predominant soil texture: clay • Depth to shale or mudstone <50” • Medium runoff • Moderate erosion hazard • Effective rooting depth 45-60”

	DaE2	15-30%	17%	● Predominant soil texture:clay ● Depth to shale or mudstone <40-45” ● Rapid runoff ● High erosion hazard ● Effective rooting depth 40-55”
	DaF2	30-50%	12%	● Predominant soil texture: clay ● Depth to shale or mudstone <35-45” ● Rapid runoff ● High erosion hazard ● Effective rooting depth 40-50”
Zaca	ZaD2	9-15%	2%	● Predominant soil texture: clay ● Depth to shale or mudstone <30” ● Medium runoff ● Moderate erosion hazard ● Effective rooting depth 40-50”
	ZaE2	15-30%	11%	● Predominant soil texture: clay ● Depth to shale or mudstone <20” ● Rapid runoff ● High erosion hazard ● Effective rooting depth 40-55”

All NRCS soil layer data indicates that the predominant soil types present on-property contain significant amounts of clay and are prone to expansion and shrinkage with annual precipitation and soil hydration cycles, are either fragile or moderately fragile, meaning they are quite susceptible to erosion and loss of pore space via compaction, and have low to moderate permeability.

Satellite imagery indicates that several areas on the [redacted] property are actively eroding. These locations visible with satellite imagery are highlighted in the image below - there are others that exist.

Figure 1.4.3
Areas where erosion has been identified from satellite imagery of the property at [redacted].



A written summary information on each soil type is provided below, and further detailed information can be found in the [NRCS Santa Barbara County Soils Report](https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA673/0/ca_SB_Coastal.pdf)[15].

Todos clay loam soils

Approximately one-third of the property (the upper portion of the ridge) is dominated by Todos clay loam (TbE2), formed in weathered sandstone and shale bedrock. In a representative profile the surface layer is dark reddish brown clay loam about 18 inches thick. The subsoil is dusky red and dark reddish brown about 26 inches thick. The substratum is reddish brown highly fractured soft shale. These soils are typically neutral or slightly acidic. Runoff is medium, permeability is slow, and the hazard of erosion is moderate. Gullies and rills are common in most areas as a result of cultivation. Available water capacity is 6 to 10 inches. Effective rooting depth is 40 to 60 inches.

Todos clay-loam soils are well-suited for the cultivation of fruit and nut trees, perennial grasses for grazing livestock, or most ideally, agroforestry systems that combine both.

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[15] https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/california/CA673/0/ca_SB_Coastal.pdf

Diablo clay soils

A little over a half of the property (the lower portion of the ridge) is dominated by Diablo clay, formed in soft shale and mudstone. In a representative profile, the surface layer is very dark gray clay about 37 inches thick. The next layer is mixed very dark gray and light yellowish-brown clay about 13 inches thick. The substratum is light yellowish brown mudstone to a depth of 60 inches and more. These soils are typically neutral in the upper part of the surface layer and moderately alkaline below. Permeability is slow. High shrinking and swelling is probably during dehydration/rehydration cycles. Satellite imagery indicates areas with these soil types on property that have already seen substantial erosion issues, specifically in tertiary valleys on the steeper sides of the main ridge where runoff from the orchard and access roads becomes channelized as it makes its way down to the secondary valleys bordering the property.

Diablo clay soils are well-suited for the cultivation of fruit and nut trees, perennial grasses for grazing livestock, or most ideally, agroforestry systems that combine both.

Zaca clay soils

Approximately one-tenth of the property (the western-most portions above [redacted] Road) consists of Zaca clay soils, formed in material weathered from calcareous shale and mudstone. In a representative profile, the surface layer is dark gray and very dark gray clay about 39 inches thick. The next layer is gray clay about 9 inches thick. The substratum is soft marly mudstone. The soils are moderately alkaline and calcareous (containing significant levels of calcium carbonate) throughout. Runoff is medium and permeability is slow. These soils are prone to erosion when vegetative coverage is removed and surface flow is channelized.

1.5 Legal and Utilities

Zoning

The property is zoned AG-I-20:

> The AG-I-20 zone is applied to properties with a minimum lot size of 20 acres that are appropriate for agricultural uses within Urban, Inner Rural, Rural (Coastal Zone only) and Existing Developed Rural Neighborhood areas that are shown on the Santa Barbara County Comprehensive Plan land use maps. The intent of the AG-I zone is to provide standards that will support agriculture as a viable land use and encourage maximum agricultural productivity.
>
> Within the Coastal Zone, the AG-I zone is intended to designate and protect lands appropriate for long term agricultural use within or adjacent to urbanized areas and to preserve prime agricultural soils

AG-I is a hybrid zone that represents an intermediate land use — partly residential, partly agricultural. Residentially, AG-I allows for various dwellings if provided with land use permits by the county of Santa Barbara. Agriculturally, AG-I zoning allows rural uses prohibited in residential zones, such as the keeping of livestock and farm animals including horses, alpacas and roosters. In addition, it may allow — but only with conditional-use permits, to ensure neighborhood compatibility — certain commercial agricultural operations that are allowed by right in the larger parcel AG-II zones.

Notable disallowed uses include:

- Extensive on-site agricultural processing
- Processing of off-site agricultural products
- Aquaculture
- Aquaponics
- Mining
- Composting
- Fertilizer Manufacturing
- Firewood processing
- Lumber processing

Further information is available in the Santa Barbara County Land Use and Development Code for Agricultural Zones[16].

The property has Williamson Act[17] status.

Utilities

- Domestic water and sewer is provided to the residential portion of the property by Montecito Water[18].
- Property listings indicate that the property has access to an agricultural water supply, however no additional information on this water supply was found.

1.6 Land History

The Chumash, a tribe of Native American hunter-gatherers especially known for their canoes ("tomol") and beautiful woven baskets, are thought to have lived in the site of present-day Montecito, along with the entire south coast of Santa Barbara County, for over 10,000 years. They called the area Salaguas. There is evidence of a fairly permanent settlement in the Montecito area, which was linked with other sites with an extensive trail network, including many that still exist, such as the San Ysidro Trail which connected the village situated in Montecito to smaller encampments in the hills and to the waterfall and beyond, and the Hot Springs Trail which led to the hot springs that were used by the Chumash well before world-travelers trekked to its healing sulfur waters.

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[16] https://images1.loopnet.com/d2/0WglQlTOUKHRCM3xzNHTIeRcRyHBGXNV0E__qi74SOg/document.pdf
[17] https://www.conservation.ca.gov/dlrp/wa
[18] https://www.montecitowater.com/

The Spanish arrived in the 18th century. In the spring of 1769, while Spanish soldiers were busy erecting a Royal Presidio on the site of Santa Barbara, their spiritual leader, Padre Junipero Serra OFM, was scouting for a place to put his tenth California mission. He selected a spot in present day Montecito's beautiful East Valley, where a Chumash trail snaked up a canyon. That trail is known today as Hot Springs Road. But Father Serra died shortly thereafter, and in 1786 it was his successor, Fermin Lasuen, who arrived to establish Mission Santa Barbara. Fr. Lasuen rejected Montecito, (which they called Rancheria de San Bernardino) as a mission site, believing it to be too far removed from the protection of the presidio. The roundabout oak groves – later named Montecito, which means "little woods" in Spanish – swarmed with grizzly bears, wolf packs, and human renegades. Prudently, Lasuen located Santa Barbara Mission four miles west. Considered a wilderness, it only became populated when retiring soldiers of the Presidio, in lieu of pensions, were given land in this hinterland far from the center of town. By then, the small Indian village by the sea, called Salaguas by the native Chumash and Rancheria de San Bernardino by the Spanish, had ceased to exist.

As the Spanish population increased, clusters of dwellings grew, and a small aldea became established along today's East Valley Road near Montecito Creek. Complete with rooming houses, an inn, grocery stores, dance halls, and saloons, the village served the needs of residents.

Spain yielded to Mexico in 1821, and Mexico yielded to the United States in 1848. A trickle of American farmers looking for inexpensive arable land joined a trickle of land speculators to take up grants offered by the Common Council of Santa Barbara for a few dollars an acre. Many of the Spanish families living in El Montecito added to their holdings at this time.

In 1855 an ailing '49er named Wilbur Curtiss came to Santa Barbara with a life expectancy of six months. A 100-year-old Chumash Indian led Curtiss up Hot Springs Canyon to the ancient spa. The "miracle waters" restored Curtiss to such robust health that in 1862 he filed a homestead claim on the Hot Springs and thus became Montecito's first American settler. He built the first of four wooden hotels at the springs, each destroyed by the periodic forest fires which swept the mountains. The last Montecito Hot Springs Resort hotel was lost in the Coyote Fire of 1964. Still privately owned, the springs remain today an important water source, although no longer exploited for their therapeutic value.

When the first Americans began arriving, in the middle of the 19th century, the area was known as a haven for bandits and highway robbers, who hid in the oak groves and canyons, preying on traffic on the coastal route between the towns that developed around the missions. California grizzly bears, now extinct, were so numerous in Montecito that as recently as 1869 a 550 bounty was offered for every beast slain inside the community. One specimen weighed over 1,000 pounds.

The first American farmer in Montecito is thought to be Newton M. Coates. His farm would later become a ranch named Las Fuentes (the springs) owned by William H. Crocker. William was the son of Charles Crocker, one member of the partnership known as the Big Four, the group that built the western end of the first transcontinental railroad. William's partner was his mother-in-law, Caroline Sperry, matriarch of a flour empire in Stockton. Crocker planned to develop the ranch as 33 ranchette home sites, but when the real estate boom of 1885-86 went spectacularly bust in 1887, he shifted gears and established a citrus ranch. It would be more than 80 years before the property became a gated residential community and golf club named Birnamwood.

By 1890, Montecito had been discovered by well-to-do Easterners who built elegant Victorian-style homes and estates, mainly as winter residences. The old Spanish families and American farmers found themselves sharing the land with an increasing number of these part-time residents. Over the years, however, many of them would eventually make El Montecito their permanent address.

Land speculation and subdivision increased, and by 1920, a second wave of newcomers had succumbed to the charms of the area. They favored a new style of architecture, Mediterranean and Spanish Revival, which came to dominate the architectural landscape. The old adobe homes of the Spanish settlers and the Victorians and wooden farmhouses of the previous wave of Americans began to disappear.

Increased population led to increased infrastructure needs. Prone to drought, fire, and flood, Montecito has a history of struggling to find a reliable water supply. Early on wells were dug, creeks tapped, and water adits drilled, Water supply problems have plagued Southern California's semi-arid climate from earliest times, and Montecito was no exception. In 1924 it became necessary to bore Doulton Tunnel into the mountain wall. This horizontal well met Montecito's increasing water needs until Juncal Dam was completed in 1930 at the 2,224-foot elevation of the watershed of the upper Santa Ynez River. This concrete arch structure, 160 feet high by 350 feet wide, impounded 7,050 acre feet of water in Jameson Lake. During the nearly half century that has followed, siltation and debris from run-off have reduced the lake's capacity to 6,000 acre feet. Montecito Water District water reaches its consumers via 2.2-mile-long Doulton Tunnel and a system of pipelines terminating in ten foothill reservoirs. Solving the water problem encouraged new growth; new growth required additional water, and the water problem arose again.