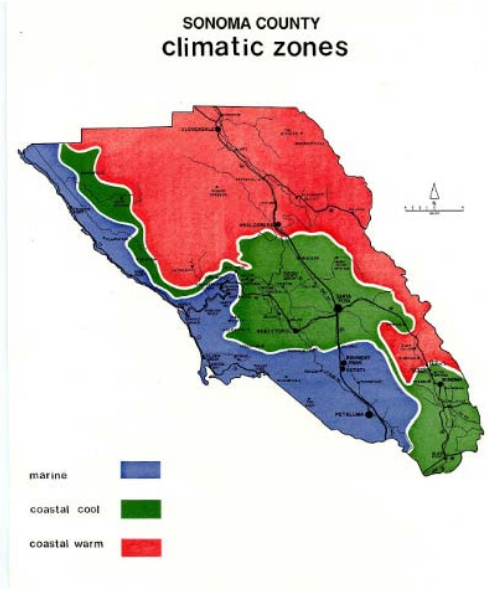
Farmland Feasibility Criteria

Key points in evaluating the potential profitability of farm lands for growing edible crops, by Paul Vossen

1. Climatic Zone



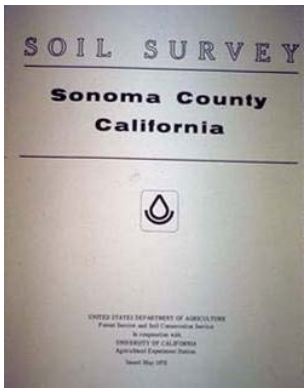
- There are three main climatic zones in Sonoma County and many microclimates within each zone . See: http://cesonoma.ucdavis.edu/files/27208.pdf .
- The ***Marine*** zone (ave. degree days of 2,185) is quite cool and only suitable for berries (raspberry, strawberry, blueberry, blackberry) and cool season vegetables (broccoli, beets, brussel sprouts, cabbage, cardoon, artichoke, chicory, lettuce, mustard greens, onions, garlic, peas, potatoes, radish, and turnips).
- The ***Coastal Cool*** zone (ave. degree days of 2,582) is intermediate in temperature which is excellent for berries, cool season vegetables, apples, pears, plums, cut flowers, and cool season vegetables (listed above). Cool season vegetables start and finish earlier than in the marine zone and warm season vegetables and all fruits start later and ripen later than they do in the coastal warm zone.
- The ***Coastal Warm*** zone (ave. degree days of 2,920) zone is excellent for berries, cool and warm season vegetables, and most fruit trees including mandarins and meyer lemon. The cool season vegetables do very well during the non summer months, berries and tree fruits ripen early, and warm season vegetables (tomato, pepper, asparagus, beans, sweet corn, eggplant, melons, pumpkins and squash) produce good yields in most years.

2. Slope and Surface Drainage

- ***Steep*** slopes > 35% are more difficult to manage, need more hand labor, are more expensive to manage, can't use some tractors, and there is a greater risk of soil erosion.
- ***Moderate*** slopes offer good surface drainage in heavy rainfall areas, are easier to manage, but must be designed to avoid soil erosion problems.
- ***Flat*** land is easy to manage with farm machinery, there is no threat of soil erosion, but the site must be evaluated for adequate surface drainage(the potential for flooding or standing water with saturated soils.

3. **Parcel Size**

- ***Small*** < 5 acres is limiting because of a lack of efficiency in the use of farm equipment and it is difficult to rotate crops appropriately.
- ***Medium*** 6-20 acres is ideal for managing intensive fruit and vegetable crops.
- ***Large*** > 20 acres may need to be divided up into smaller blocks, but offers more potential for rotation and wildlife buffer zones.



4. **Soil Characteristics – found in the Soil Survey**

- ***Soil Type*** can be found by locating the parcel on the aerial photo within the Sonoma County Soil Survey Map in hard copy (found at most libraries) or on line at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Once the soil type is identified, a description of the soil is provided by profile layers indicating color, texture, drainage characteristics, water holding capacity, and whether or not roots are present.
- ***Storie Index*** – this is a rating system on a scale of 0-100. Ratings of 0-20 are not suitable for crop production or must be managed very carefully at significantly higher costs. A Storie index of between 20-40 indicates soils that can be very good for growing most shallow rooted crops and some tree crops, but may have some limitations (shallow, heavy clay, too steep, etc.). Generally these soils would need to be managed with drip irrigation and require more intensive oversight. Soils rated above 40 are excellent for almost anything including crops that are sensitive to poor drainage.

- ***Rooting depth*** and internal drainage is primarily determined by where roots are actually located. The soil survey indicates where roots exist within each profile layer at specific depths. This should be verified at all locations where there is any notable change in soil color or slope – usually by digging several back hoe pits to about 6 ft in depth and observing the profile. Note on the profile where roots are located. Drainage can be improved somewhat by planting crops on raised bed or berms.
    - o ***A rooting depth of 1-18*** inches is not very good, but these soils can be managed in summer and left fallow in winter, or if on a gentle slope will have fewer drainage problems. Shallow soils will require more irrigation input usually with drip irrigation.
    - o ***A rooting depth of 18-36*** inches is acceptable for most crops if the land is sloped to improve surface drainage.
    - o ***A rooting depth of over 36 inches*** is excellent for growing anything and may be required for crops sensitive to wet feet.

- ***Available water*** (water holding capacity) – most soils hold about 2 in/ft of rooting depth. This indicates how much water is available to plants in the spring from winter rainfall.
    - o ***2-3 inches*** of water holding capacity indicates a shallow soil (12-18" deep)
    - o ***4-6 inches*** of water holding capacity indicates that the soil is moderately deep (24-36")
    - o ***7-10 inches*** of water holding capacity indicates a soils that is quite deep (42-60")

5. <u>Existing Vegetation (trees, shrubs, grasses)</u>

- Quite often the existence of certain native plants and their vigor can indicate some soil characteristics, drainage, and crop growth potential.
    - o ***Native oaks*** will grow almost anywhere, but very large trees require more rooting depth and good drainage.
    - o ***Resident annual grasses*** will grow almost anywhere, if however the grasses are extremely tall, thick, and lush – this might indicate a deeper and fertile soil.
    - o ***Manzanita*** and other very drought tolerant shrubs, can indicate shallow soils.
    - o ***Eucalyptus*** (non native) do not indicate very much, but again if the soil is deep the trees will be larger.
    - o ***Reeds, sedges*** and other wetland plants indicate poor drainage.

6. <u>Soil Nutrients and pH</u>

- If there are trees, shrubs and grasses growing normally on the property, this most likely indicates that there are no limitations from pH or excess or severely deficient soil nutrients. Where nutrients are deficient - they can normally be applied at a low to moderate cost.
- Serpentine soils often are associated with gray shale and appear light in color. These are not common, but do exist and can only be managed by applying very large quantities of calcium to offset the excess of magnesium.
- Soil pH should be between 5.0 to 7.5, but this can be modified with amendments
    - o ***High pH*** soils > 7.5 are rare in Sonoma County. They can be modified by adding sulfur.
    - o ***Low pH*** soils <5.0 are common and can be improved by applying lime.
- Some areas very near the coast (shoreline) or San Pablo Bay can have high salt contents, but otherwise our heavy winter rainfall leaches out most salts.
- Some areas have high levels of boron, sulfur, and heavy metals usually associated with hot springs. These soils could have severe limitations in growing crops. Soil nutrient levels should ideally be:
    - o ***Phosphorous*** > 10.0 ppm
    - o ***Potassium*** > 125.0 ppm
    - o ***Calcium*** at a ratio of about 4: 1 with magnesium
    - o ***Magnesium*** at a ratio about of 1:4 with calcium
    - o ***Boron*** < 1.0 ppm
    - o ***Chloride*** < 10.0-15.0 meq/l
    - o ***Sodium*** (SAR < 15.0)

7. <u>Water quantity</u>

- Total water demand depends on the climate (how hot it is), crop type, and how much water is stored in the soil from winter rainfall (rooting depth). That amount needs to be available from an irrigation source (well, spring, or reservoir). Note that some crops will use less water and deep soils in a cool climate may hold a significant amount of water available to deep rooted plants.

  - ***42.5 inches*** per season (April –Oct.) is the typical average water demand for most crops grown in the Coastal Warm climatic zone. This translates into 1,140,468 gallons/acre per season; or 4.2 gallons per minute/acre pumped continuously.
  - ***34.4 inches*** per season (April to Oct.) is the typical average water demand for most crops grown in the Coastal Cool climatic zone. That amount translates into 923,236 gallons per acre/season; or 3.5 gallons per minute /acre continuous flow.
  - ***21.2 inches*** per season (April to Oct.) is the typical average water demand for most crops grown in the Marine climatic zone. This translates into 543,080 gallons per acre/season; or 2.0 gallons per minute/acre continuous flow.

8. <u>Water quality</u>

- Well, surface, and spring water needs to be tested for potential problems.
- The following levels of pH and elements in water indicate potential problems:
  - ***pH*** < 6.5 or > 8.3
  - ***Boron*** > 1.0 ppm
  - ***Bicarbonate*** > 2.0 ppm
  - ***Total Salt*** > 1.5 dS/m EC – or – 250.0 ppm
  - ***Sodium*** > 3.0 meq/l - or – 9.0 SAR
  - ***Chloride*** > 3.0 ppm

9. <u>Existing structures</u>

- Structures such as: Storage sheds, animal housing, greenhouses, cold storage units, or buildings that can be used for produce sales areas offer a significant advantage.