Climate Smart Agriculture and Carbon Farm Planning

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Napa County Resource Conservation District

NAPA COUNTY RCD Resource Conservation District

NRCS

Carbon Cycle Institute

LandSmart® Productive lands. Thriving streams.

Regional RCD Programs

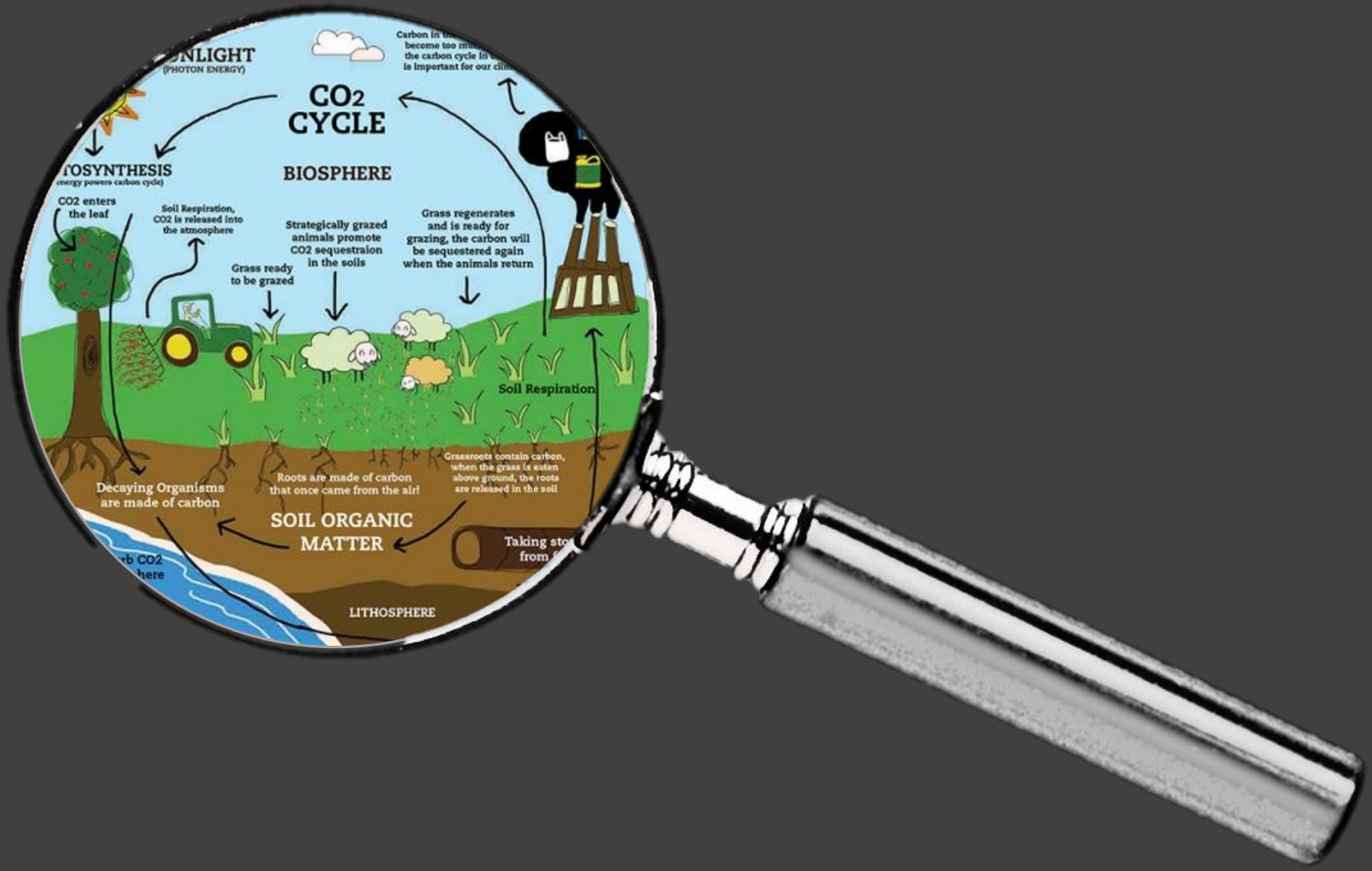
- Soil Health Assessments for Vineyards
- Carbon Farm Planning for Vineyards, Orchards, and Grazing Lands

Climate-smart agriculture

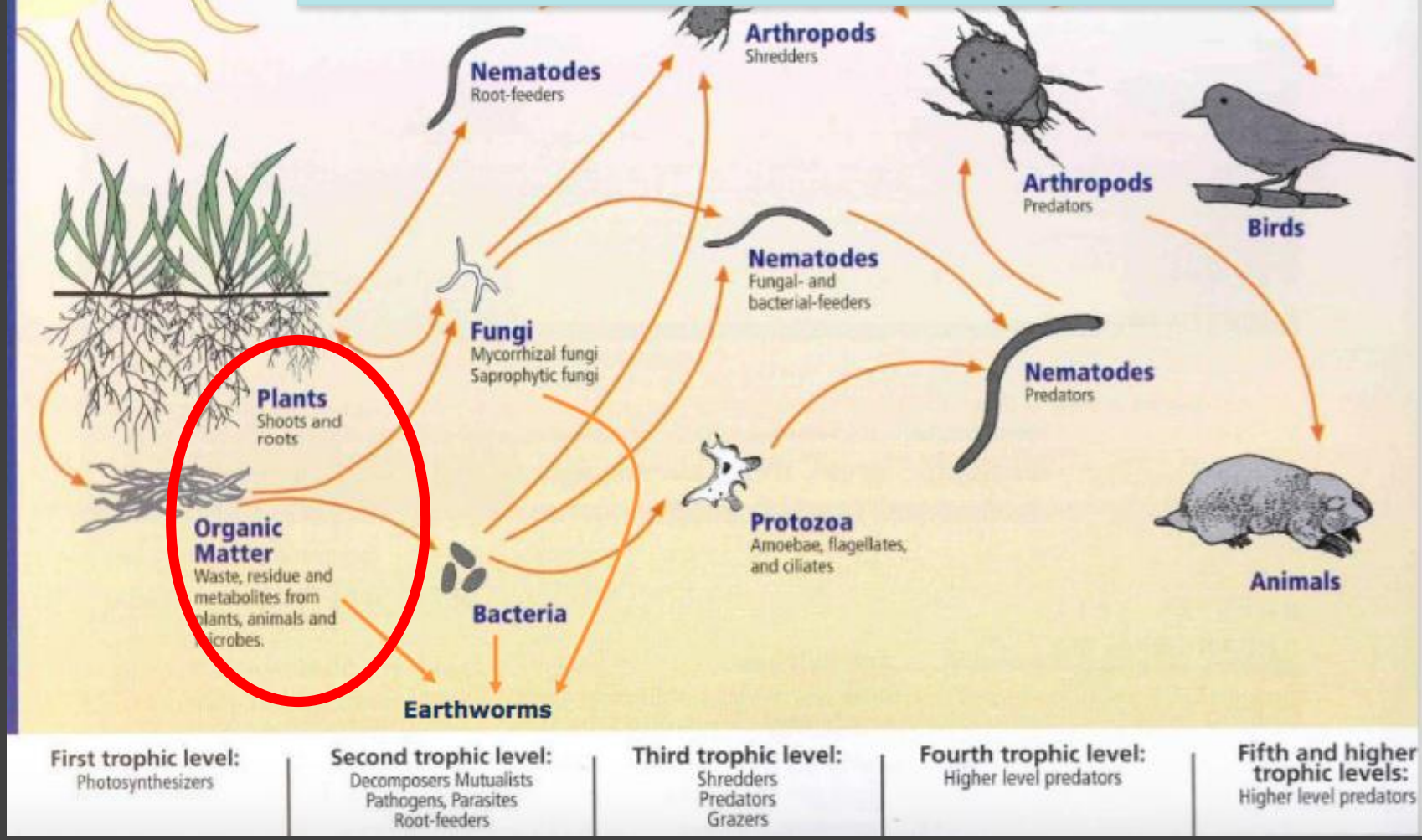
Definition from the Food and Agricultural Organisation of the United Nations (FAO),

“agriculture that sustainably increases productivity, enhances resilience, reduces/removes GHGs (mitigation) where possible, and enhances achievement of national food security and development goals”.

Mitigation is a human intervention to reduce or prevent emission of greenhouse gases or to protect (e.g. forests and oceans) or **create carbon sinks** (e.g. through conservation agriculture or agroforestry).


NLIGHT
(PHOTON ENERGY)
CO2 CYCLE
TOSYNTHESIS
energy powers carbon cycle)
BIOSPHERE
CO2 enters the leaf
Soil Respiration, CO2 is released into the atmosphere
Strategically grazed animals promote CO2 sequestraion in the soils
Grass regenerates and is ready for grazing, the carbon will be sequestered again when the animals return
Grass ready to be grazed
Soil Respiration
Grassroots contain carbon, when the grass is eaten above ground, the roots are released in the soil
Roots are made of carbon that once came from the air!
Decaying Organisms are made of carbon
SOIL ORGANIC MATTER
LITHOSPHERE

Managing Carbon (Energy!) Flow Through The Ecosystem Increasing Soil Health and Quality

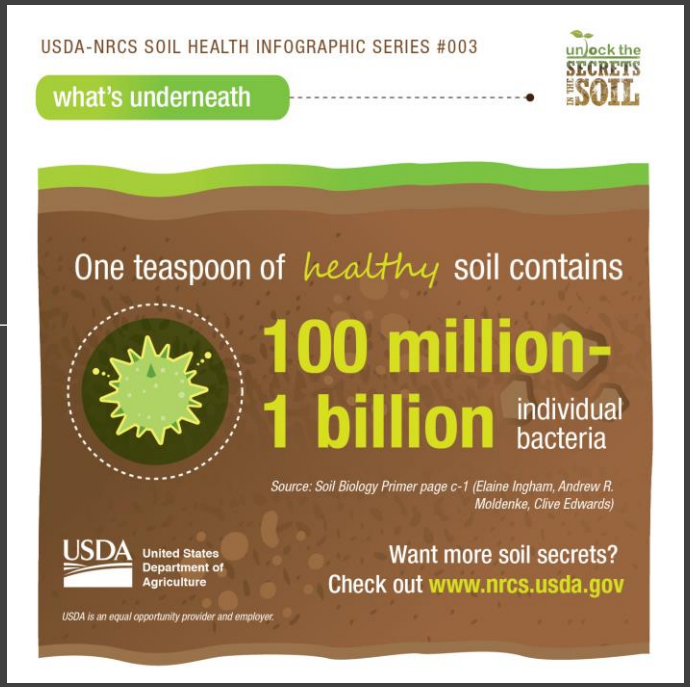



Keep Soil Covered - Minimize Soil Disturbance - Maximize Living Roots - Energize with Diversity -
unlock the
SECRETS
IN THE
SOIL

Soil Health

Soil health - also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans.

Soil Health



Attributes of a Healthy Soil

- Nutrient Cycling
- Water Infiltration and Storage
- Filtering and Buffering
- Physical Stability and Structure
- Habitat

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Soil Carbon and Soil Health Connection

Soil Organic Matter – key indicator for agricultural soil productivity, environmental resilience, and soil ecosystem functioning

50-60% of soil organic matter is organic carbon

Soil – The earths greatest carbon sink and greatest carbon emitter?

North Coast Soil Health Hub
Soil Health Assessments

Soil Health Measurements

- Biological
- Chemical
- Physical

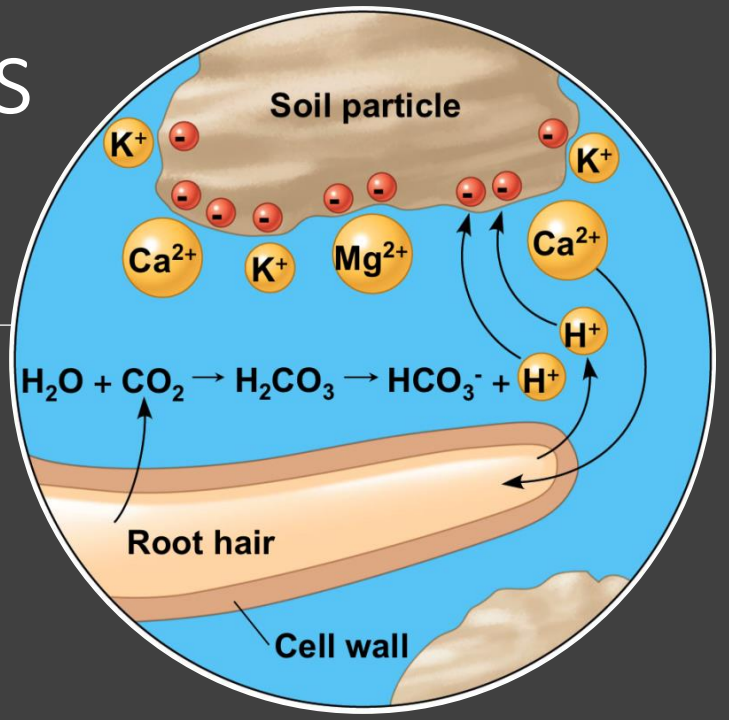
Lab Analysis at Oregon State University Analytical Lab – Soil Health Assessment Package

Soil Health Assessments
Biological Properties

Microbial Biomass

- Active Organic Carbon
- Potentially Mineralizable Nitrogen
- Microbial Respiration
  - C02 Respiration

Soil Health Assessments
Chemical Properties



- pH
- Phosphorus
- Potassium, Calcium, Magnesium
- Cation Exchange Capacity (CEC)
- Total Organic Carbon
- Total Nitrogen

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Soil Health Assessments
Physical Properties

- Texture
- Aggregate Stability
- Bulk Density
- Water Infiltration
- Soil Penetrometer - Compaction

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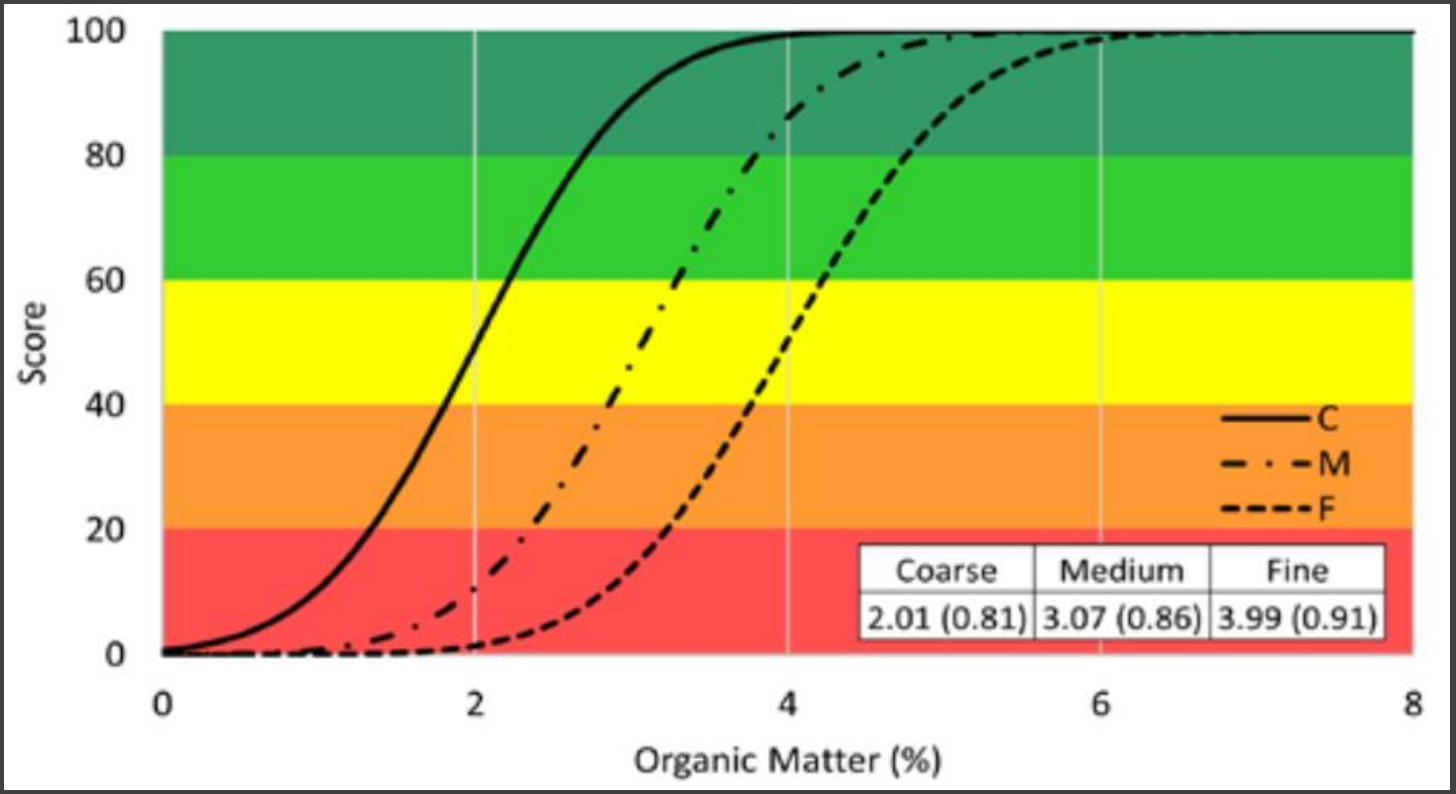
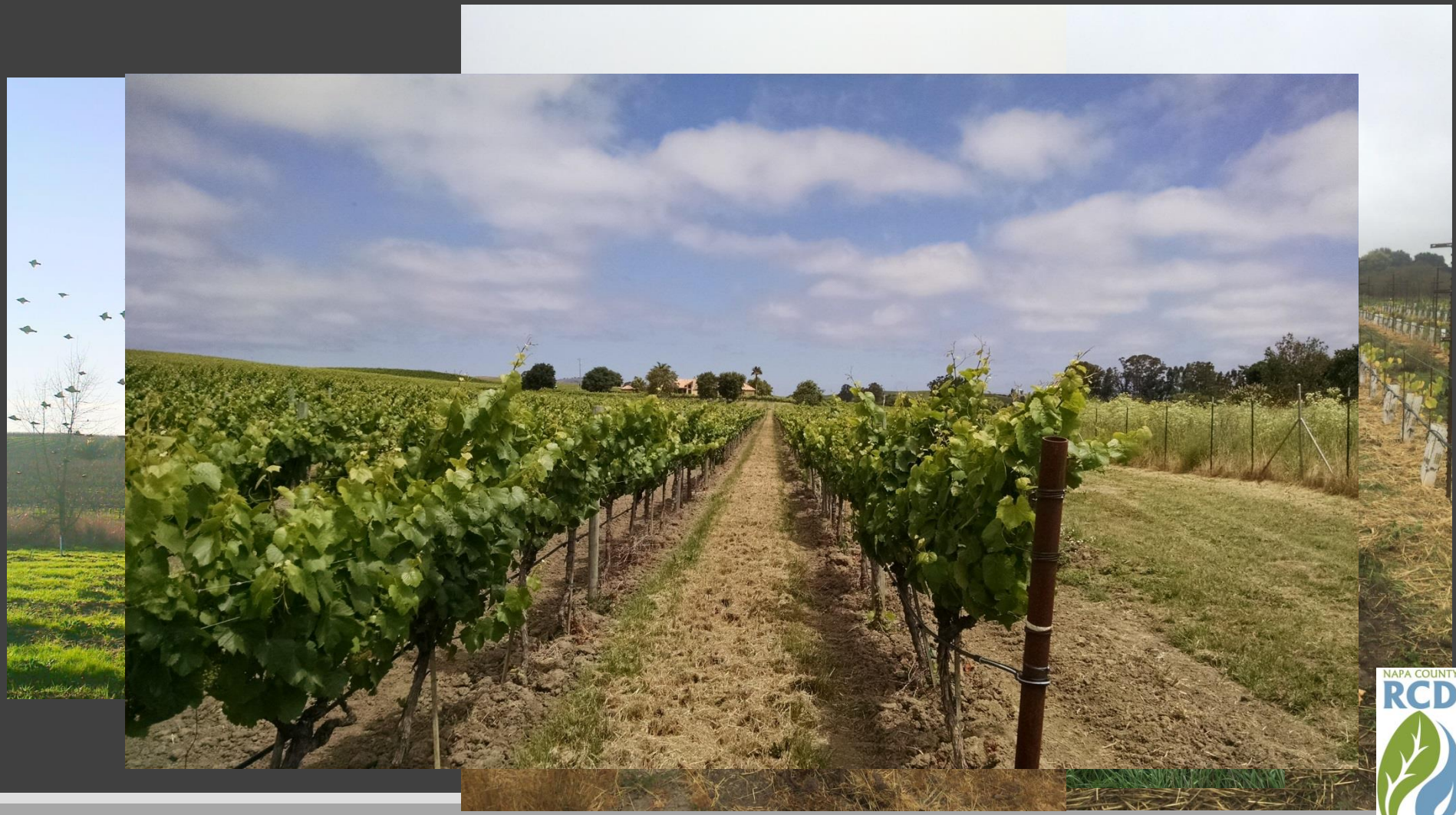
Cornell Framework Manual – Comprehensive Assessment of Soil Health

Soil Organic Matter (SOM%) – Soil Health scoring function based on soil texture



Huichica Creek
Sustainable Demonstration Vineyard



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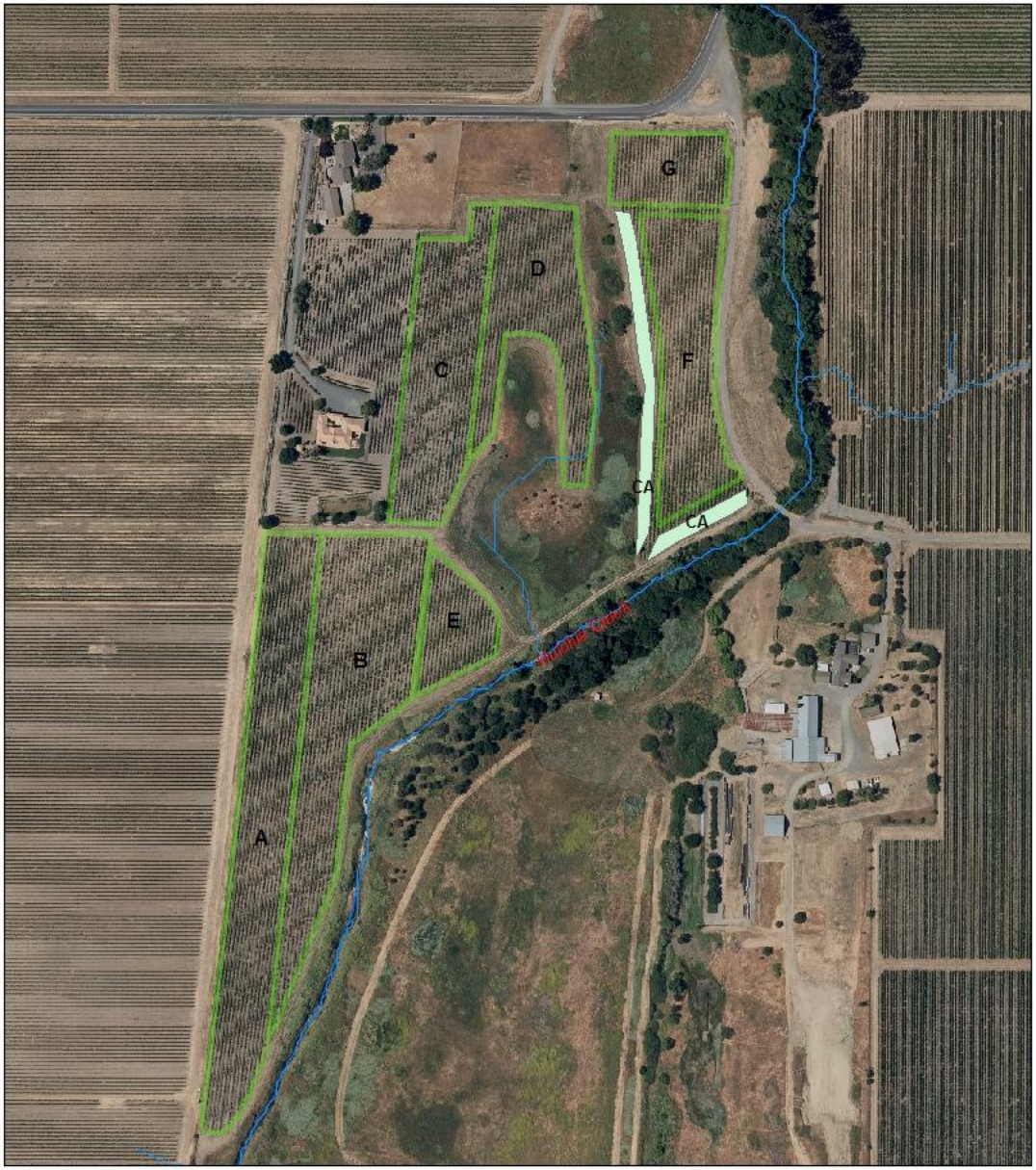

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Huichica Creek Sustainable Demonstration Vineyard

LandSmart
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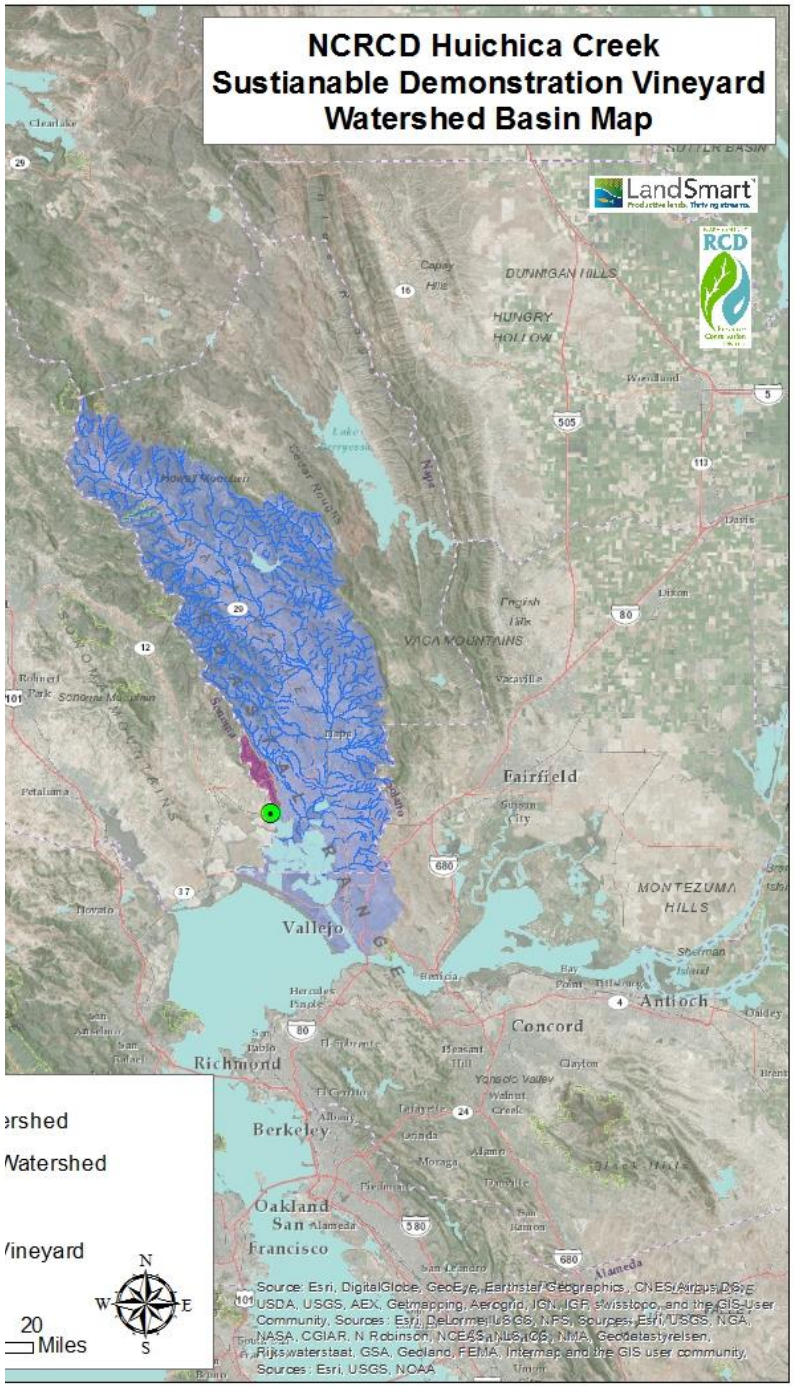
0 250 500 1,000 Feet

N
W E
S



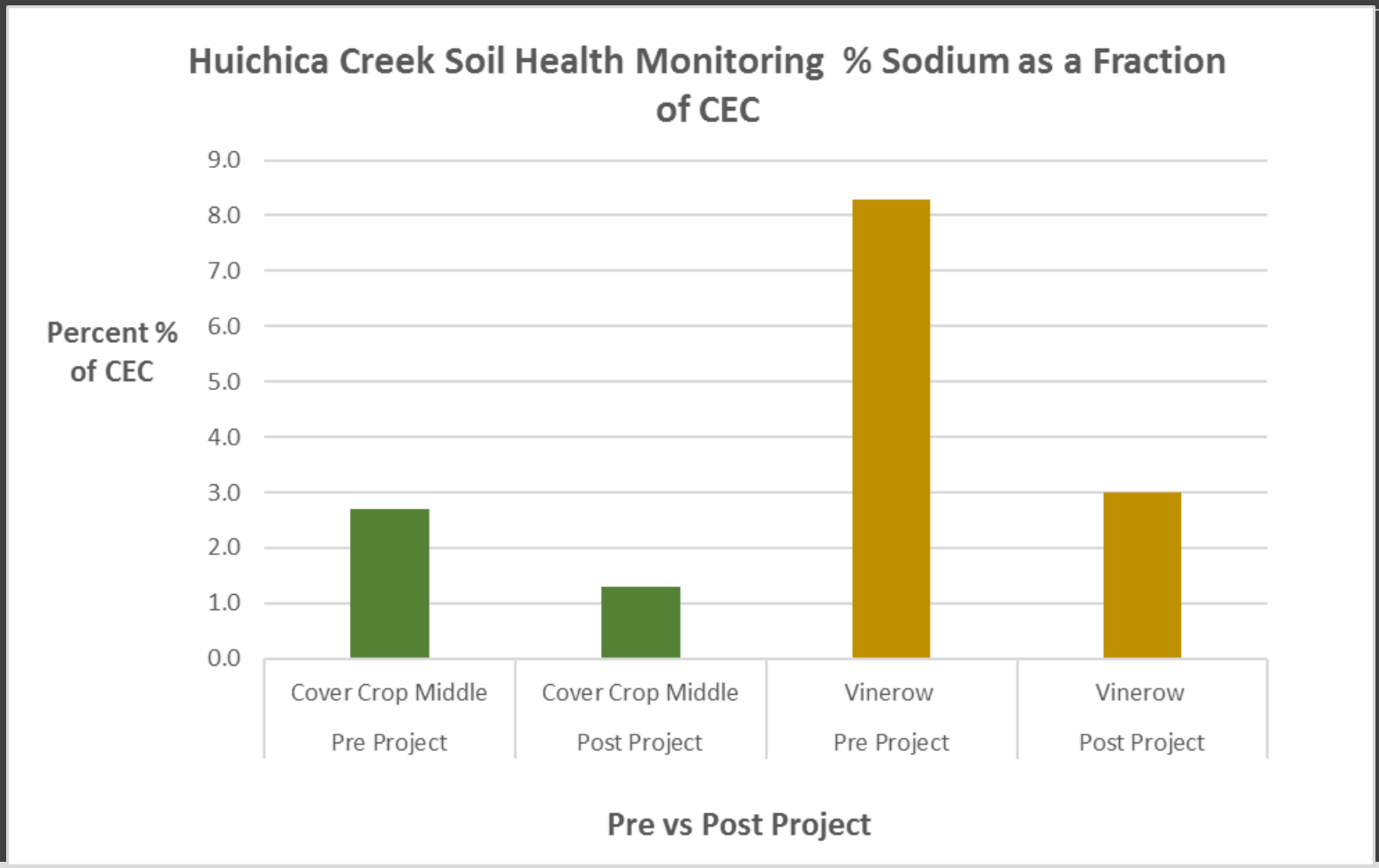
Huichica Creek Sustainable Demonstration Vineyard Soil Health Monitoring

1% SOM increase = 1 acre inches increase in AWHC

0.6 % Increase in Soil Organic

Water Holding Capacity Increased by 0.46 acre inches per acre per year in top 6 inches

Huichica Creek Sustainable Demonstration Vineyard Soil Health Monitoring



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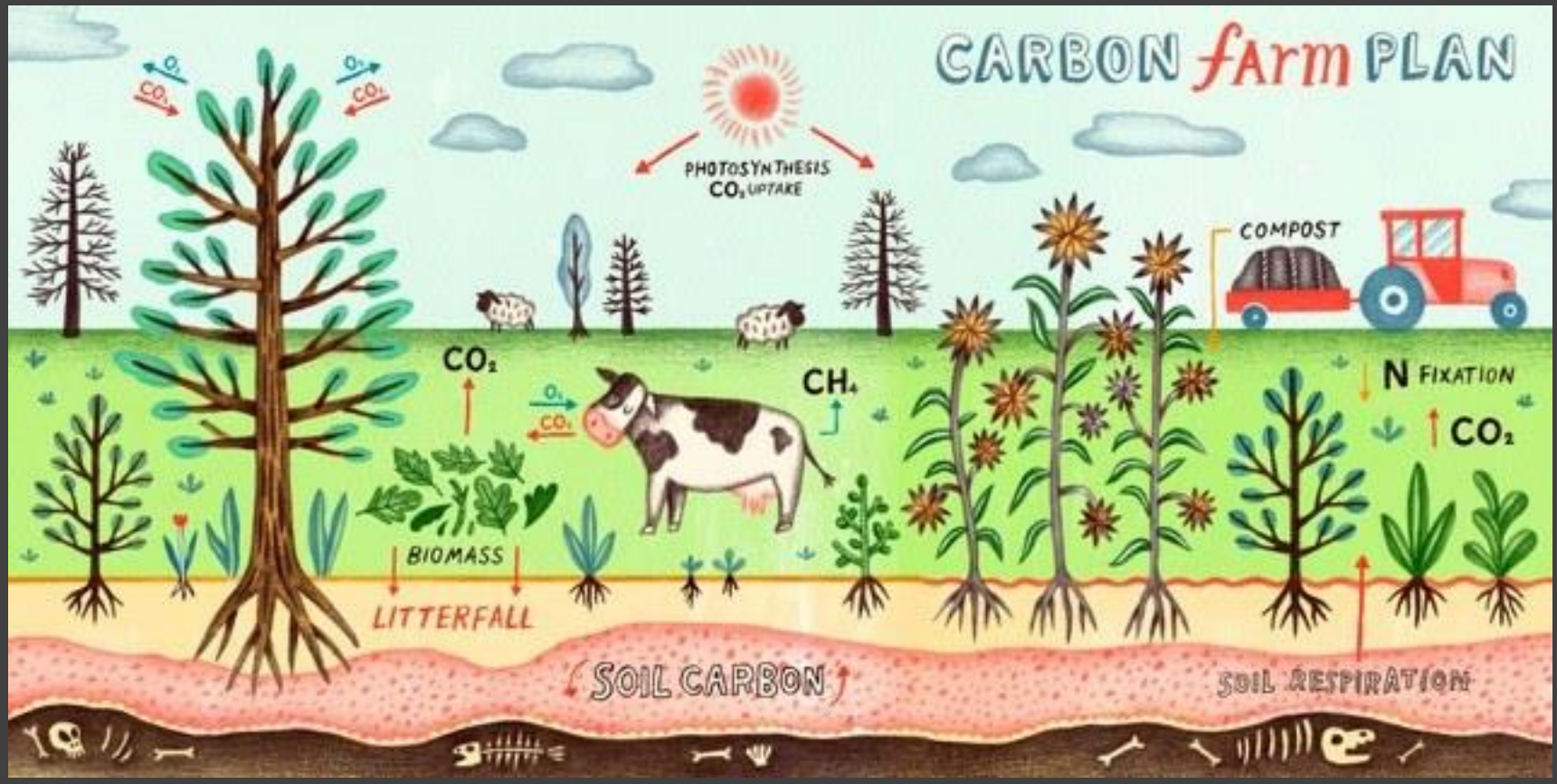
Carbon Farm Planning



Creating a Carbon Farm Plan

Conservation and Natural Resources Planning through the Carbon Sequestration Lens

1. Farm Assessment
2. Document farming options
3. Prioritize options into a working Plan
4. Quantify the carbon benefits

Primary Carbon Farm Practices – NRCS Conservation Practices

- Mulching/compost application
- Residue and Tillage Management,
- No Till
- Reduce Till
- Anaerobic Digester
- Multi-Story Cropping
- Windbreak/Shelterbelt Establishment
- Silvopasture Establishment
- Forage and Biomass Planting
- Nutrient Management
- Tree/Shrub Establishment
- Forest Stand Improvement
- Contour Buffer Strips
- Riparian Restoration
- Riparian Forest Buffer
- Vegetative Barrier
- Windbreak/Shelterbelt Renovation
- Alley Cropping
- Riparian Herbaceous Cover
- Range Planting
- Herbaceous Wind Barriers
- Critical Area Planting
- Residue and Tillage Management
- Forest Slash Treatment
- Field Border
- Filter Strip
- Grassed Waterway
- Hedgerow Planting
- Land Reclamation Abandoned Mined Land
- Cross Wind Trap Strips
- Conservation Cover
- Wetland Restoration

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Napa County RCD - Carbon Farm Plan
Huichica Creek Sustainable Demonstration Vineyard

Current Practices

- Blocks A-E: Alternate Row Till
- Block G - No Till
- Replant Block F - No Till
- 5 Foot Contour
- Huichica Creek

Planned Conservation Practices

Compost Application in all vineyard blocks

- Riparian, Wetland, and Windbreak Planting
- Alternate-Row Tillage to No-Till
- Multistory Cropping

Carbon Farm Practices (NRCS Practice)

1. Riparian Restoration (390
2. Hedgerow Planting (422)
3. Conventional Tillage to No Tillage (329)
4. Compost Application Mulching (484)
5. Cover Crop Establishment (340)
6. Multistory Cropping (379)
7. Windbreak Establishment (380)
8. Wetland Restoration (657)

N W E S

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0 230 460 920 Feet

Quantify Carbon Benefits

+ Local Data

+ Other sources:

DNDC Model (CSWGA)

R.Ryals et al 2013; M.DeLonge et al 2013 (compost on rangeland)

D.Lewis et al 2015 (riparian vegetation)

US EPA, 2011. Market Opportunities for Biogas Recovery Systems at U.S. Livestock Facilities

USDA 2014. Quantifying Greenhouse Gas Fluxes in Agriculture and Forestry: Methods for Entity-Scale Inventory.

Carbon Calculations by weight

NRCS Conservation Practice Standards

CPS 329
Conventional Tillage
to No Tillage

CPS 391
Riparian Buffer

CPS 380/ 657
Wetland Restoration
Wind Break

Conservation Practices Standards

CPS 484 Compost/Mulch Application

CPS 327 Permanent Cover Crop Establishment

Conservation Practices Standards

CPS 379 Multistory Cropping/ Diversifying

CPS 484 Mulch Application

CPS 422 Hedgerow Planting

Huichica Creek Sustainable Demonstration Vineyard Approximate Carbon Sequestration and Greenhouse Gas Emission Reductions 2016 - Future (tons CO2 equivalent per year)

NRCS Conservation Practice	Acres	1yr - Metric tons CO_2e Reduction	20yrs - Metric Tons of $C0_2e$ Reduction
Riparian Restoration (CPS 390)	2.76	45.1	902.0
Hedgerow Planting (CPS 422)	0.15	0.3	5.1
Conventional Tillage to No Tillage (CPS 329)	4.00	1.2	24.8
Permanent Cover Crop Establishment (CPS 340)	4.00	5.0	100.8
Compost Application (CPS 484)	14.00	218.4	1310.4
Mulching (CPS 484)	4.00	1.28	25.60
Multistory Cropping (CPS 379)	0.75	1.3	26.1
Windbreak/ Shelterbreak Establishment (CPS 380)	0.50	1.0	20.9

Equivalent offset - 550 Passenger Vehicles!

- EPA, 2014, "Greenhouse Gas Emission from a Typical Passenger Vehicle" = 4.7 MT C02e/yr

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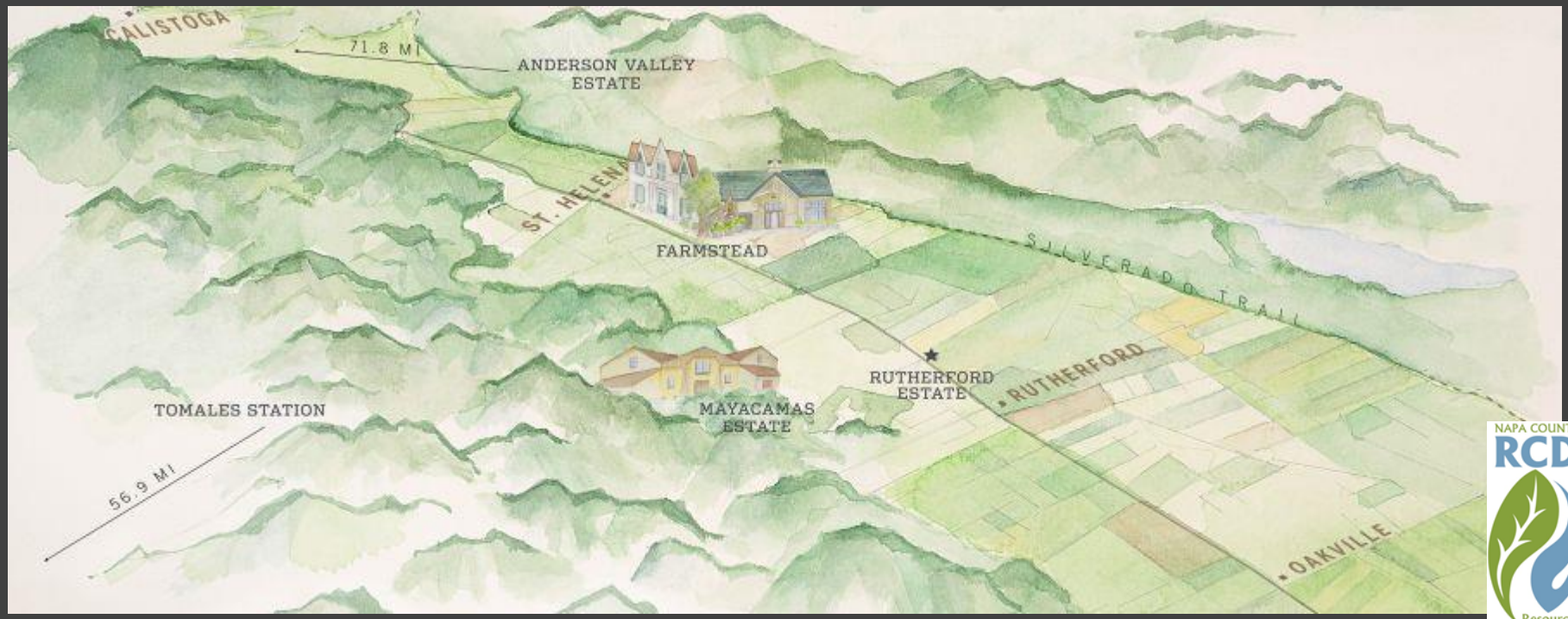
LONG MEADOW RANCH



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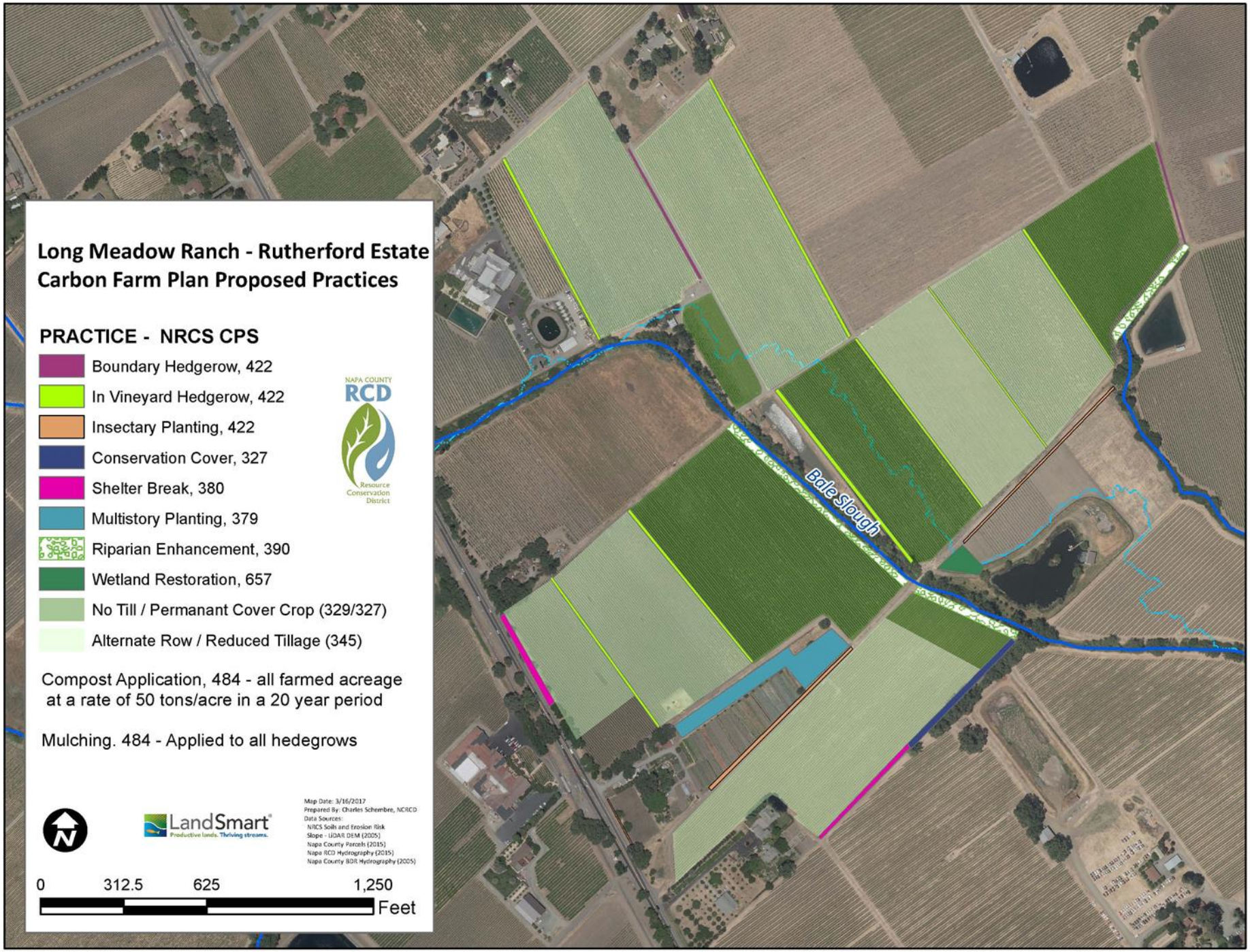
Long Meadow Ranch - Rutherford Estate
Carbon Farm Plan Proposed Practices
PRACTICE - NRCS CPS
Boundary Hedgerow, 422
In Vineyard Hedgerow, 422
Insectary Planting, 422
Conservation Cover, 327
Shelter Break, 380
Multistory Planting, 379
Riparian Enhancement, 390
Wetland Restoration, 657
No Till / Permanant Cover Crop (329/327)
Alternate Row / Reduced Tillage (345)
Compost Application, 484 - all farmed acreage at a rate of 50 tons/acre in a 20 year period
Mulching. 484 - Applied to all hedegrows
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Map Date: 3/16/2017
Prepared By: Charles Schembre, NCRCD
Data Sources:
NRCS Soils and Erosion Risk
Slope - LIDAR DEM (2005)
Napa County Parcels (2015)
Napa RCD Hydrography (2015)
Napa County BOR Hydrography (2005)
0
312.5
625
1,250
Feet
Bale Slough

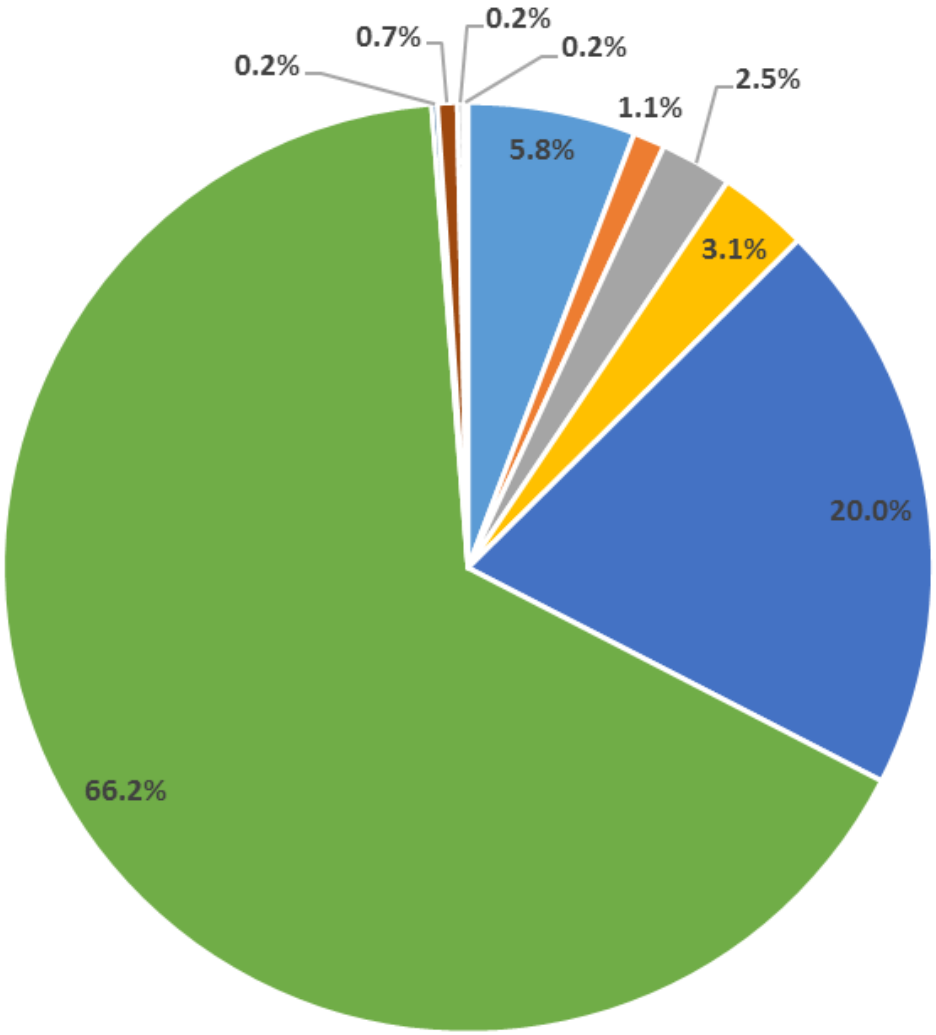
LongMeadow Ranch - Rutherford Estate

Carbon Sequestration and Greenhouse Gas Emission Reductions Potential (tons CO2 equivalent per year)

NRCS Conservation Practice	Acres	Carbon Dioxide (CO_2)	Nitrous Oxide (N_2O) Per Acre Per Year	Methane (CH_4)	1yr - Metric tons CO_2e Reduction	20yrs - Metric Tons of CO_2e Reduction
* Riparian Restoration (CPS 390)	1.1	*n/a	*n/a	0.00	18.0	359.5
Hedgerow Planting (CPS 422)	2.0	1.42	0.28	0.00	3.4	68.0
Conventional Tillage to No Tillage (CPS 329)	24.9	0.42	-0.11	0.00	7.7	154.1
Coventional Tillage to Reduced Tillage (CPS 345)	48.5	0.13	0.07	0.00	9.7	194.0
Permenant Cove						1,234.8
**Compost Appl						4,085.1
Mulching (CPS 484)	2.0	0.32	n/a	n/a	0.6	12.8
Multistory Cropping (CPS 379)	1.2	1.71	0.03	0.00	2.1	42.1
Windbreak/ Shelterbreak Establishment (CPS 380)	0.3	1.81	0.28	n/a	0.6	12.5
Wetland Restoration (CPS 657)	0.2	1.81	0.28	n/a	0.5	10.0
				Totals	**308.6**	**6,172.9**

Equivalent offset - 1313 Passenger Vehicles!

- EPA, 2014, "Greenhouse Gas Emission from a Typical Passenger Vehicle" = 4.7 MT C02e/yr



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Carbon-Soil-Water-Climate Connection

The Natural Resource Conservation Service suggests that a 1% increase in soil organic matter (SOM) results in an increase in soil water holding capacity of approximately 1-acre inch, or 27,152 gallons of increased soil water storage capacity per acre. A 1% increase in SOM represents roughly 20,000 pounds of organic matter, or 5 short tons of organic carbon.

Proposal:

Increase SOM% in the plow layer (6.7 inches) by an additional 1.5% in 20 years or less

LMR increase Available Water Holding Capacity on a Ranch Scale =

11.1 acre feet per year or 3,624,792 gallons

This equates to **40,728 gallons per acre** of additional soil water holding capacity

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