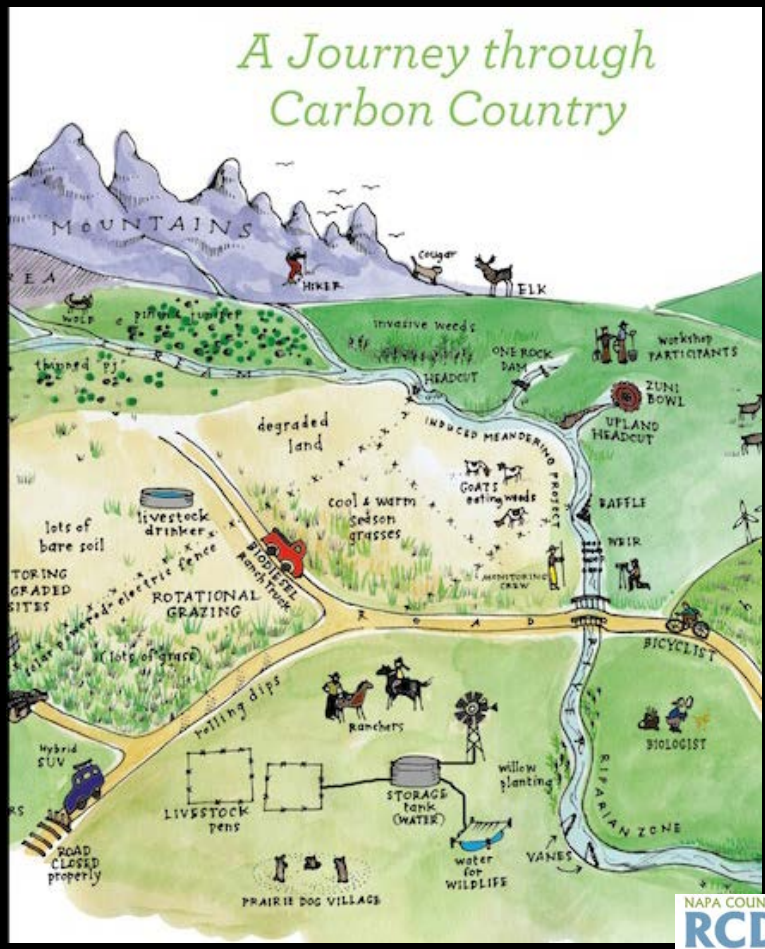
Carbon Farm Plans for Vineyards

Charles Schembre
Vineyard Conservation Coordinator
November 4, 2016

What is Carbon Farm PLANNING?

Planning on-farm CONSERVATION practices to:

- *Increase biological carbon*
- *Reduce GHG emissions*
- *Quantify carbon benefits of conservation practices relative to current condition*



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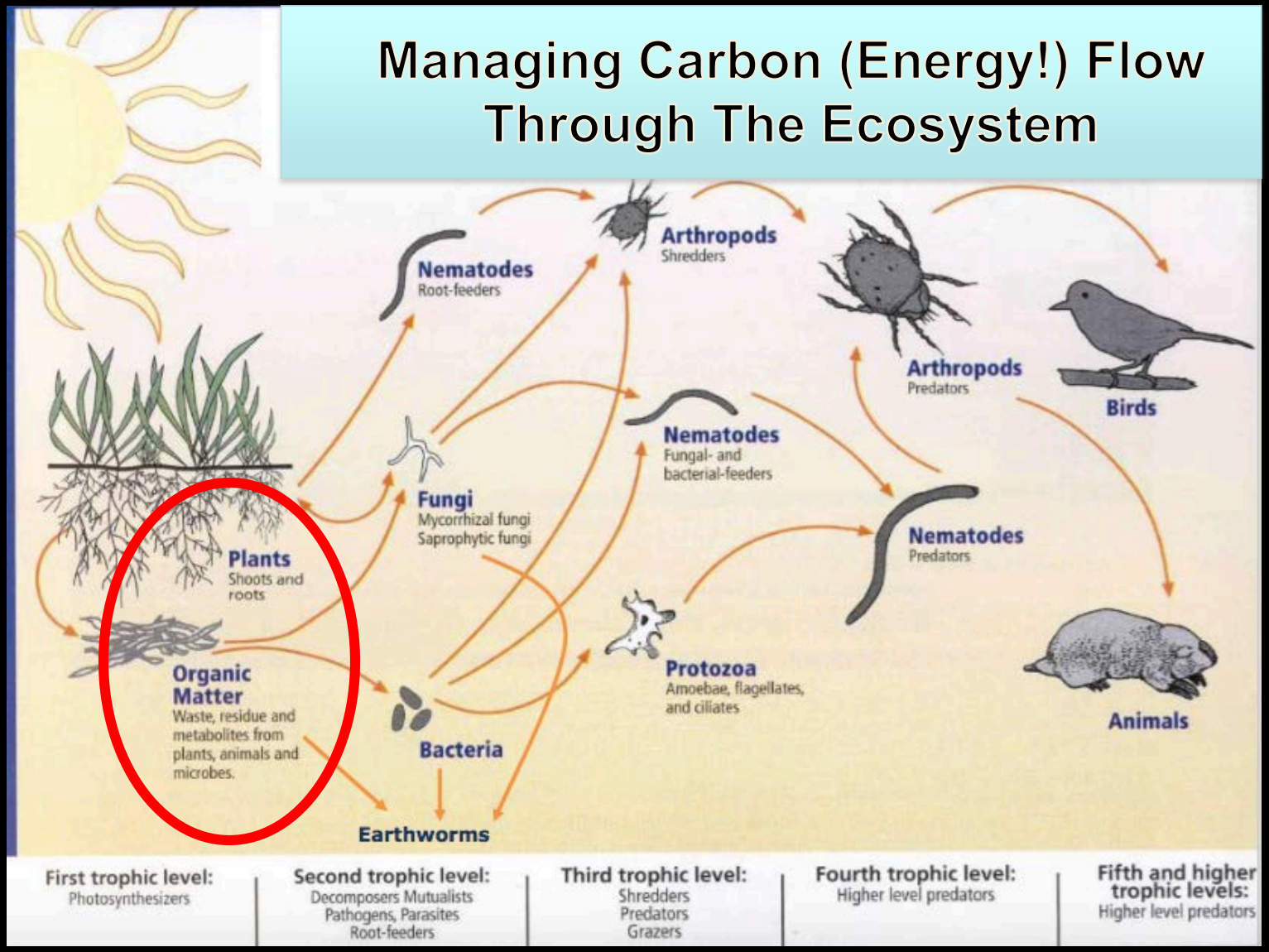
What is Carbon Farm PLANNING?



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Why Carbon Farm PLANNING?

- Carbon can be beneficially stored long-term in soils and vegetation through biological carbon sequestration

- Agriculture can provide solutions to climate change

- Increasing global soil OM by 0.4% annually would offset *all* global CO2 emissions

(4‰ Initiative: Ministry of Agriculture, Agrifood and Forestry, France: http://agriculture.gouv.fr/agriculture-et-foret/environnement-et-climat)

Creating a Carbon Farm Plan

1. Farm Assessment
2. Document farming options
3. Prioritize options into a working Plan

Creating a Carbon Farm Plan

1. Farm Assessment

- Producer's objectives
- Producer's operations
- Producer's interest
- Producer's landscape

Creating a Carbon Farm Plan

2. Document farming options

Explore with the **Carbon Lens**!

- Is there potential for Seq-C Soil AND Seq- C Vegetation?
- NRCS - 34 climate beneficial practices
- Site analysis
- Maps: Google Earth, GIS, Soil Survey, other plans

Creating a Carbon Farm Plan

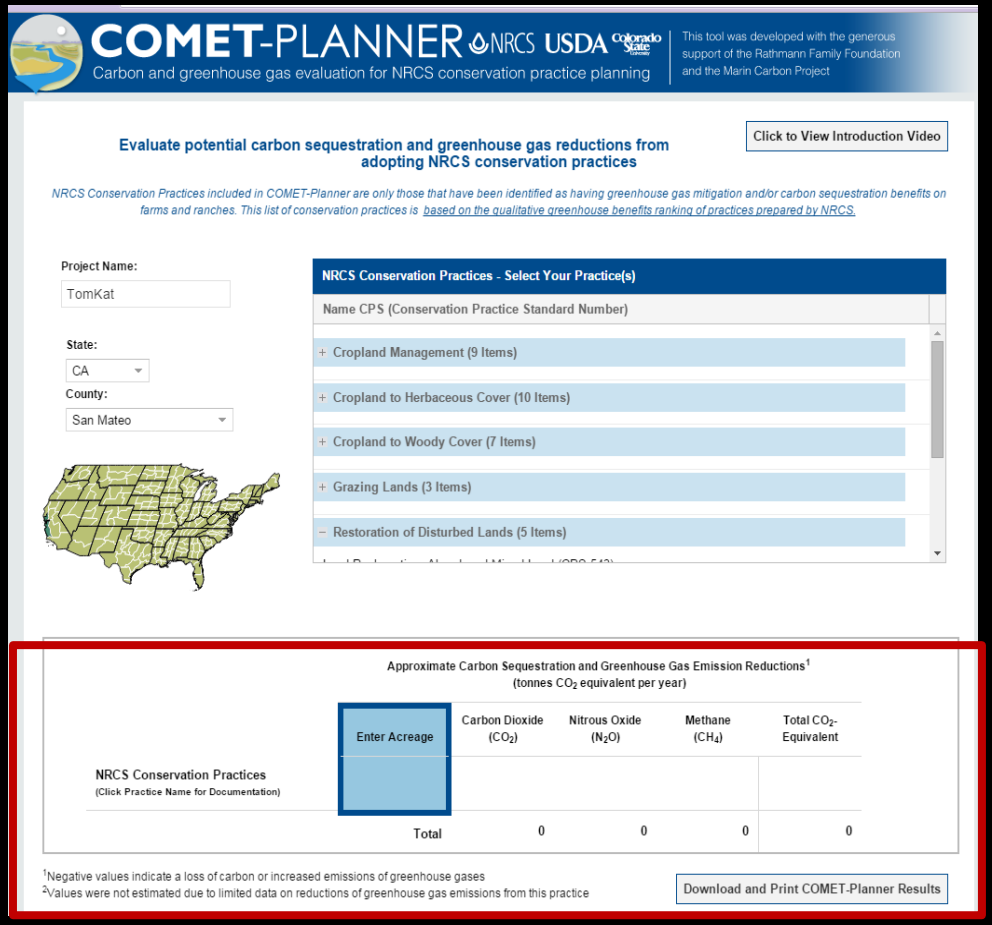
3. Prioritize options into a working Plan

Compatibility of practices with:

- Grower's priorities
- Crop production
- Farm ecology
- Costs
- Quantitative impacts of practices

Goal is IMPLEMENTATION

Calculating Carbon Potential



NRCS

LOCAL DATA; other sources

COMPOST: R.Ryals et al 2013; M.DeLonge et al 2013

CREEK CARBON: D.Lewis et al 2015

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*.

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Carbon Sequestration Potential Over Time is Significant!

Example Ranch:

Potential terrestrial carbon sequestration through implementing conservation practices identified through a Carbon Farm Planning Process

CO2e reduction at Maturity = 708,270 Metric Tons =

149,109 Passenger vehicles driven for one year!

Practice	Average Annual CO2e Reduction	20 yr CO2e Reduction	CO2e Reduction at Maturity
Rangeland Compost	638 Mg	98,847 Mg	162,619 Mg (30 years)
Cropland Compost (590)	2,060 Mg.	23,200 Mg	43,374 Mg at 5% SOM
Shelterbelts (380)	98 Mg CO2e;	1,960 Mg	7,840-19,260 Mg at 80 years.
Hedgerows (422)	6 Mg CO2e	120 Mg	120 Mg CO2e
Prescribed Grazing (528)	1,460 Mg	29,200	29,200
Riparian Restoration	410 to 1,725 Mg	6,144-25,867 Mg at 15 years	18,431-188,117 Mg at 45 years.
No Till (329)	39 Mg	780 Mg	780 Mg
Minimum-Tillage (345)	100 Mg	2,000 Mg	2,000 Mg
Silvopasture (381)	660 Mg	13,200 Mg	214,000 Mg
Nutrient Management (590)	610 Mg	12,200 Mg	48,800
Totals	**6,081- 7,396 Mg**	**187,651 - 207,374 Mg**	**527,164- 708,270 Mg**

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Components of a Successful Carbon Farm Plan

- Evolving and dynamic
- Reflects priorities of producer
- Collaborative product
- Implementation schedule & strategies
- Can complement other Farm Plans
- Multi-benefit

Carbon Farm Planning and LandSmart

MARIN CARBON PROJECT

Carbon Cycle Institute

MARIN RESOURCE CONSERVATION DISTRICT

LandSmart®
Productive lands. Thriving streams.

A program of
Resource Conservation District (RCD)
and Natural Resources Conservation Service (NRCS)

Sonoma RCD, Gold Ridge RCD,
Mendocino RCD, Napa RCD, Marin RCD

By March 2017:

- Vineyard Carbon Farm Plan Template (already complete)
- Orchard Template
- Rangeland Template
- Forestry Template

Coastal Conservancy

NRCS

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Vineyard Carbon Farm Plan Template

- Site Description
- Assessment of Potential Carbon Beneficial Practices
  - **WATER-RELATED ENERGY**
  - **VINEYARD VEHICLES**
  - **VINEYARD FARMING PRACTICES**
  - **VINEYARD MANAGEMENT**
  - **VEGETATION IN AND AROUND THE VINEYARD**
- Monitoring Soil Carbon
- Carbon Farm Plan Summary & Map

Assessment of Carbon Beneficial Practices

C16. Tillage is minimized or no-tillage is practiced in efforts to promote a healthy soil ecosystem for maximizing soil carbon sequestration potential.

☐ Yes – Describe current practice:

_____

☐ No (Consider practice # 2 in Table C4 below)

Opportunities and farming practices to reduce tillage:

E.g. use alternative equipment, reduce depth, reduce frequency

Planned (NRCS) Practices are Assembled in Tables

Conservation Practice	*NRCS Practice Title*	*Current Practice*	*Planned Implementation Date*	*Location*
1. Conduct soil analysis for organic matter		☐		
2. Reduce tillage (permanent perennial or no-till annual cover crop is ideal for reducing GHG emissions and improving soil health and carbon sequestration).	Residue and Tillage Management (329, 345), Conservation Cover (327), Cover Crop (340)	☐		
3. Incorporate grazing animals into vineyard management to reduce equipment needs, increase nutrient cycling and enhance cover crop performance.	Prescribed Grazing (528)	☐		
4. Utilize organic contact herbicide, hand hoe, mow or graze to control vegetation under the vines.	Integrated Pest Management (595)	☐		
5. Apply ≥ 4 inches of mulch under vine rows to suppress weed growth, conserve water and increase soil organic matter.	Mulching (484)	☐		
6. Apply ½" – 1" of compost in alleys and 1"-2" in vine rows to increase soil organic matter, conserve water and improve soil				

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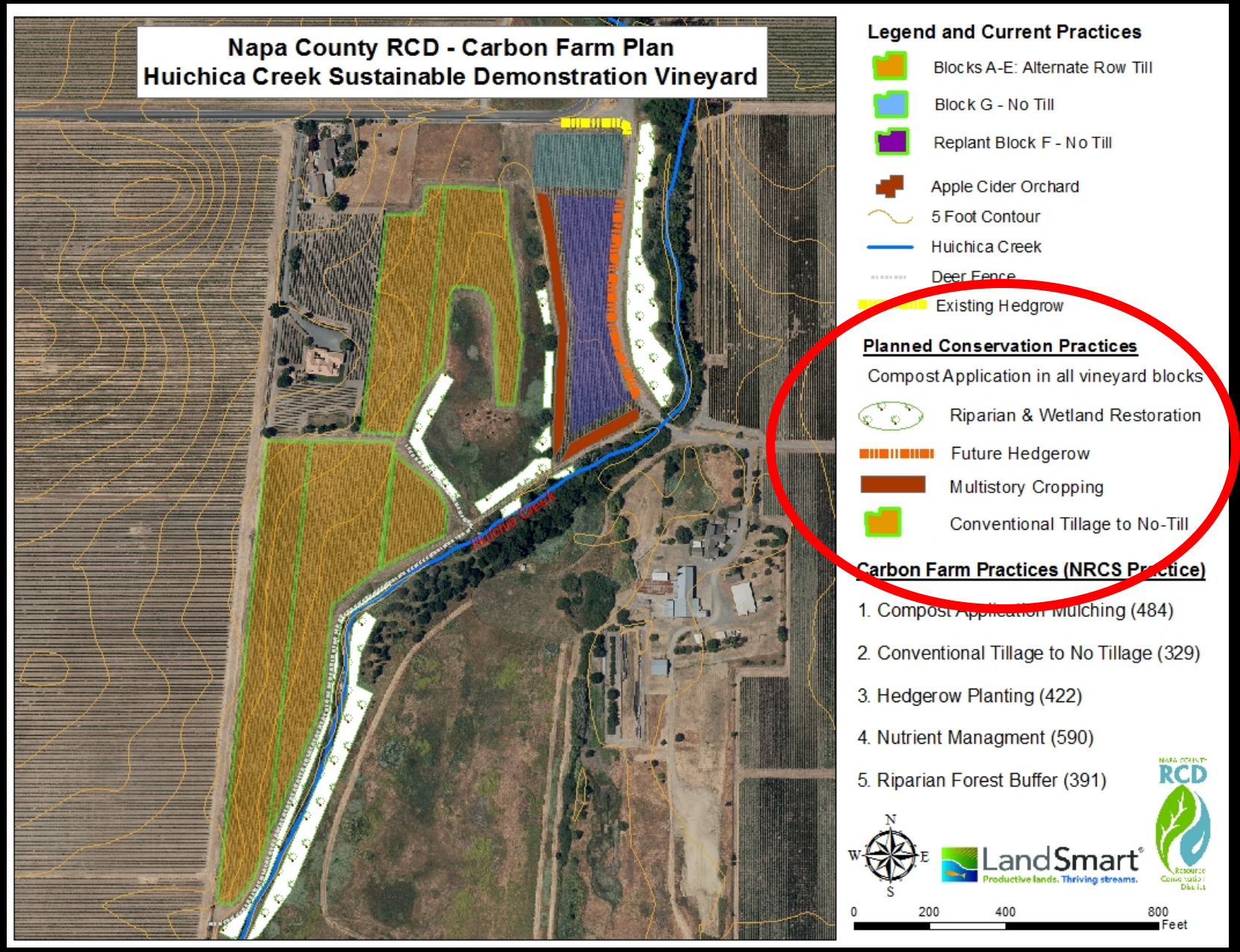
Map



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Tracking Implementation

Carbon Farm Plan Summary

	Ranch/ Property ID	XXXXX						
NRCS CPS	Practice Description	Field Location	Acres	Current Practice	Proposed Practice	Implementation Date	CO2e per acre per year	CO2e Annual Total
329	Coventional Tillage to No Tillage	Blocks A,B,C,D,E	4	Alternate row tillage. Alternate no till & alternate till	Full no tillage. Very minimal tillage may be incorporated from time to time for breaking up tractor compaction and for soil ammendments	2017-2010	0.74	2.96
391	Riparian Forest Buffer Establishment							
379	Multistory Cropping							
422	Hedgerow Plant							
590	Nutrient Management/Compost Application							
340	Cover Crop establishment							
380	Windbreak /Shelterbelt Establishment							
657	Wetland Restoration							
	Monitor and Evaluate fuel and electricity usage							
							TOTAL =	

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RCD
Resource
Conservation
District
Huichica Creek Vineyard
Sustainable Agriculture Demonstration
Made possible by a grant from the
California State Coastal Conservatory
www.naparcd.org

Huichica Creek Vineyard

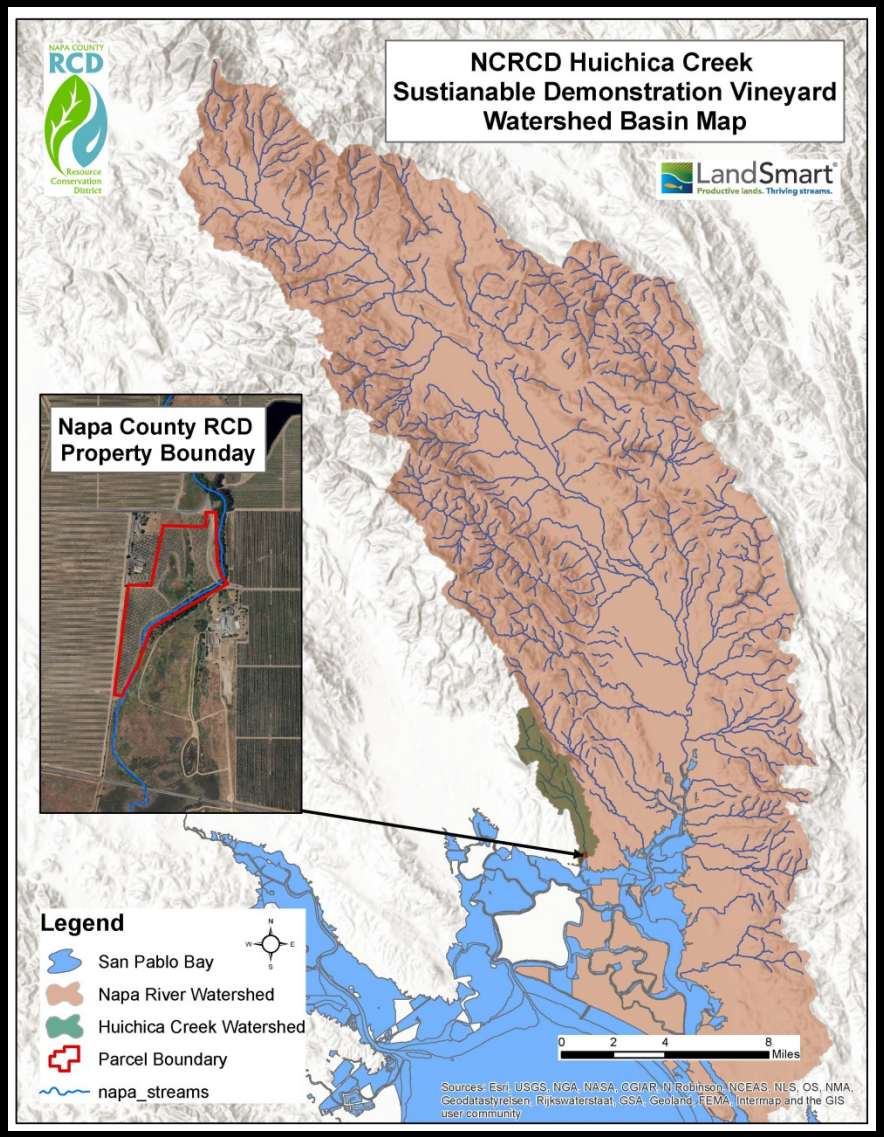
1. Farm Assessment




1. Farm Assessment

   - Producer's objectives
   - Producer's operations
   - Producer's interest
   - Producer's landscape

Huichica Creek
Sustainable Demonstration Vineyard



- 21 Acres, 13 Acres Chardonnay & Pinot, 1 Acre cider apples
- 4 acres Wetland
- Huichica Creek frontage

- 26 years of site restoration: oak trees, creeping wild rye, hedgerows
- Recent grant funding to
  - Improve water management (DWR)
  - Redevelop 3-acre block with climate beneficial farming practices (NRCS CIG)

Huchica Creek Vineyard

2. Farming Options

CPS 329
Conventional Tillage
to No Tillage

CPS 391
Riparian Buffer

CPS 380/ 657
Wetland Restoration
Wind Break

Huchica Creek Vineyard

2. Farming Options

CPS 590 Nutrient Management / Compost

CPS 379 Multistory Cropping/ Diversifying

CPS 340 Cover Crop Establishment

CPS 422 Hedgerow Planting

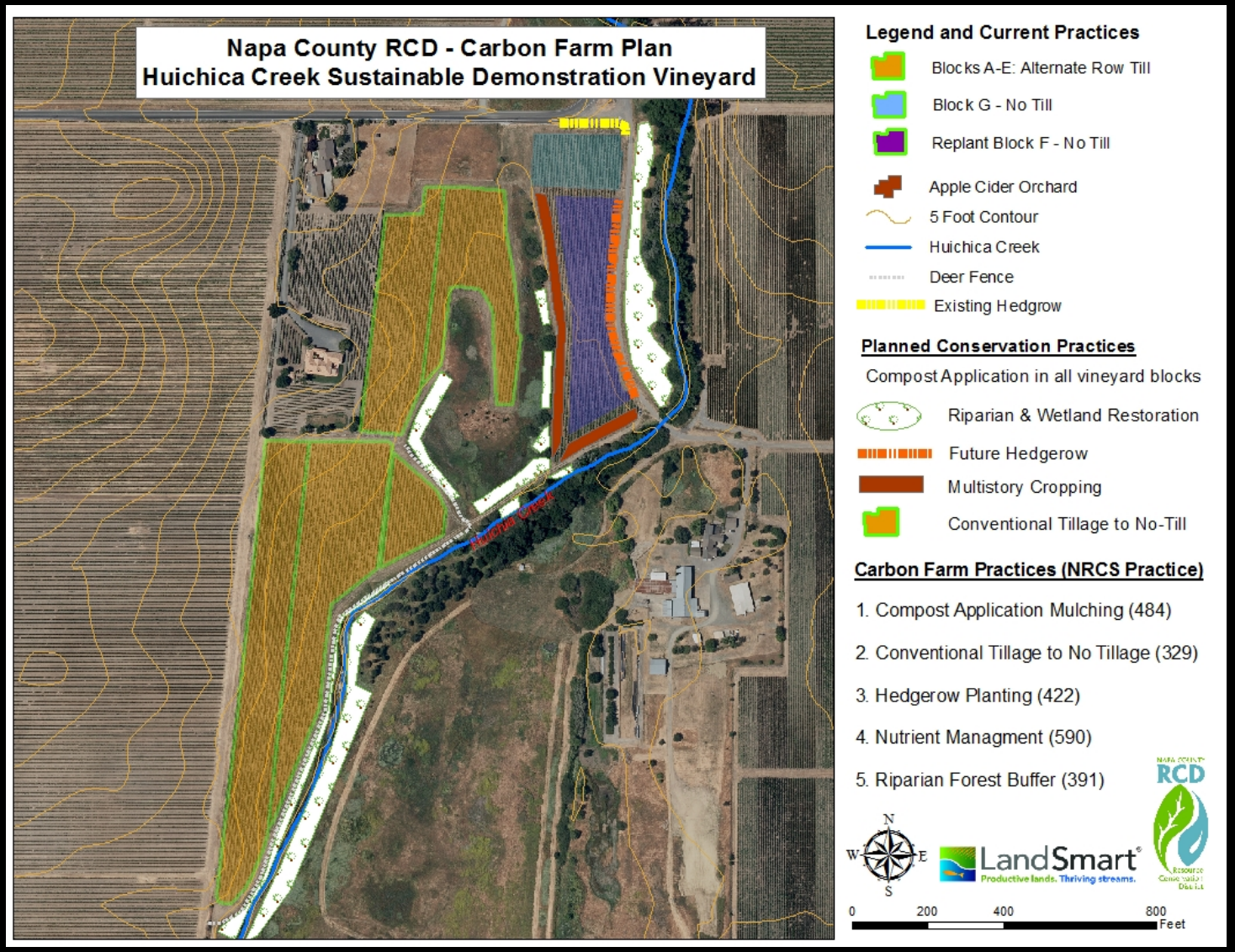
Huichica Creek Vineyard

Farming Options to quantify for the Future

- Fuel and Energy Usage
- Graze Livestock for weed management and soil fertility
- More Multistory cropping and Diversification
- Biochar application as tool to promote carbon sequestration and soil fertility.

Huchica Creek Vineyard

3. Prioritize options into a Plan



Carbon and GHG Reduction Summary Table

NRCS CPS	Practice Desciption	Field Location	Acres	Current Practice	Proposed Practice	Implementation Date	CO2e per acre per year	CO2e Annual Total	CO2e 20yr Reduction
329	Coventional Tillage to No Tillage	Blocks A,B,C,D,E	4	Alternate row tillage. Alternate no till & alternate till	Full no tillage. Very minimal tillage may be incorporated from time to time for breaking up tractor compaction and for soil ammendments	2017-2010	0.74	2.96	59.20
391	Riparian Forest Buffer Establishment	Huichica Creek top of banks	2.76	Restoration plantings and volunteers have re-vegetated the creek	Restore areas that with native plantings where noxious weeds have populated or where there open areas.	2016-2025	16.34	45.10	901.97
379	Multistory Cropping	Block F - Apple Orchard	0.75	Vineyard	Plant cider apples on standard rootstock. Establish a diverse grassland understory.	2016	1.63	1.22	24.45
422	Hedgerow Plant	Along access road and Block F	0.15	grasses	Plant native flowering shrubs	2017-2018	1.32	0.20	3.96
590	Nutrient Management/Compost Application	All blocks	14	No compost application	Apply 10-15 tons compost per acre, every 2-3 years.	2015-Lifetime of vineyard	0.44	6.16	123.20
340	Cover Crop establishment	Blocks A,B,C,D,E	4	Alternate row tillage. Alternate no till & alternate till	Maintain annual and/or perennial soil cover. Very minimal tillage may be incorporated from time to time for breaking up tractor compaction and for soil ammendments	2017-2018	0.37	1.48	29.60
380	Windbreak /Shelterbelt Establishment	Block A	0.5	No windbreak/shelterbelt	Replace one row vines in replant. Establish shelterbelt at windward fenceline	2018-2020	2.09	1.05	20.90
657	Wetland Restoration	Season Wetland	4	Some intentional restoration. Majority is natural rehabilitation	Using windbreak metrics. Plant shrubs, small trees, and wetland grasses.	2020-Future	2.09	8.36	167.20
	Monitor and Evaluate fuel and electricity usage	Entire Vineyard Operation			Planning			*	*
							TOTAL	66.52	1330.48

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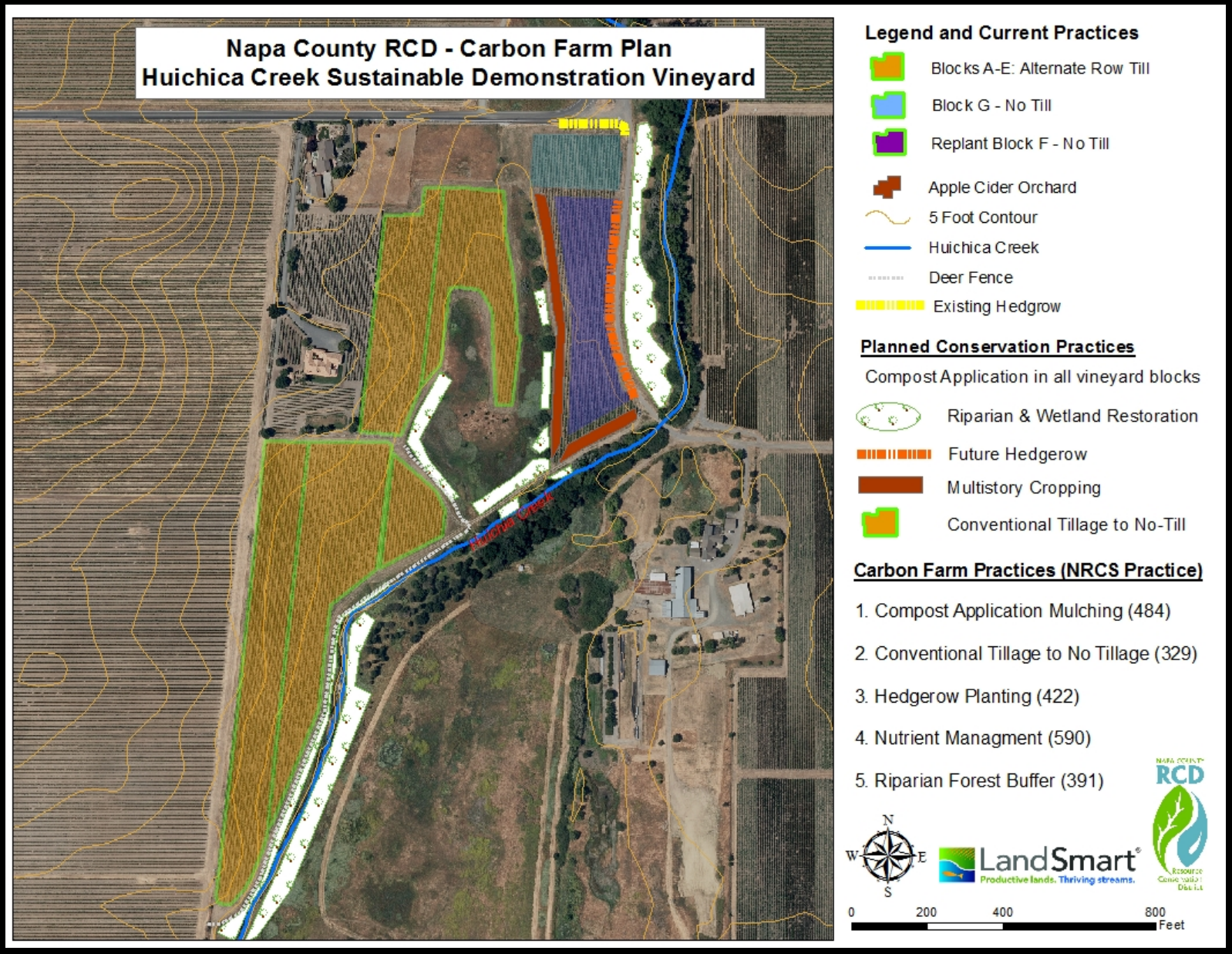
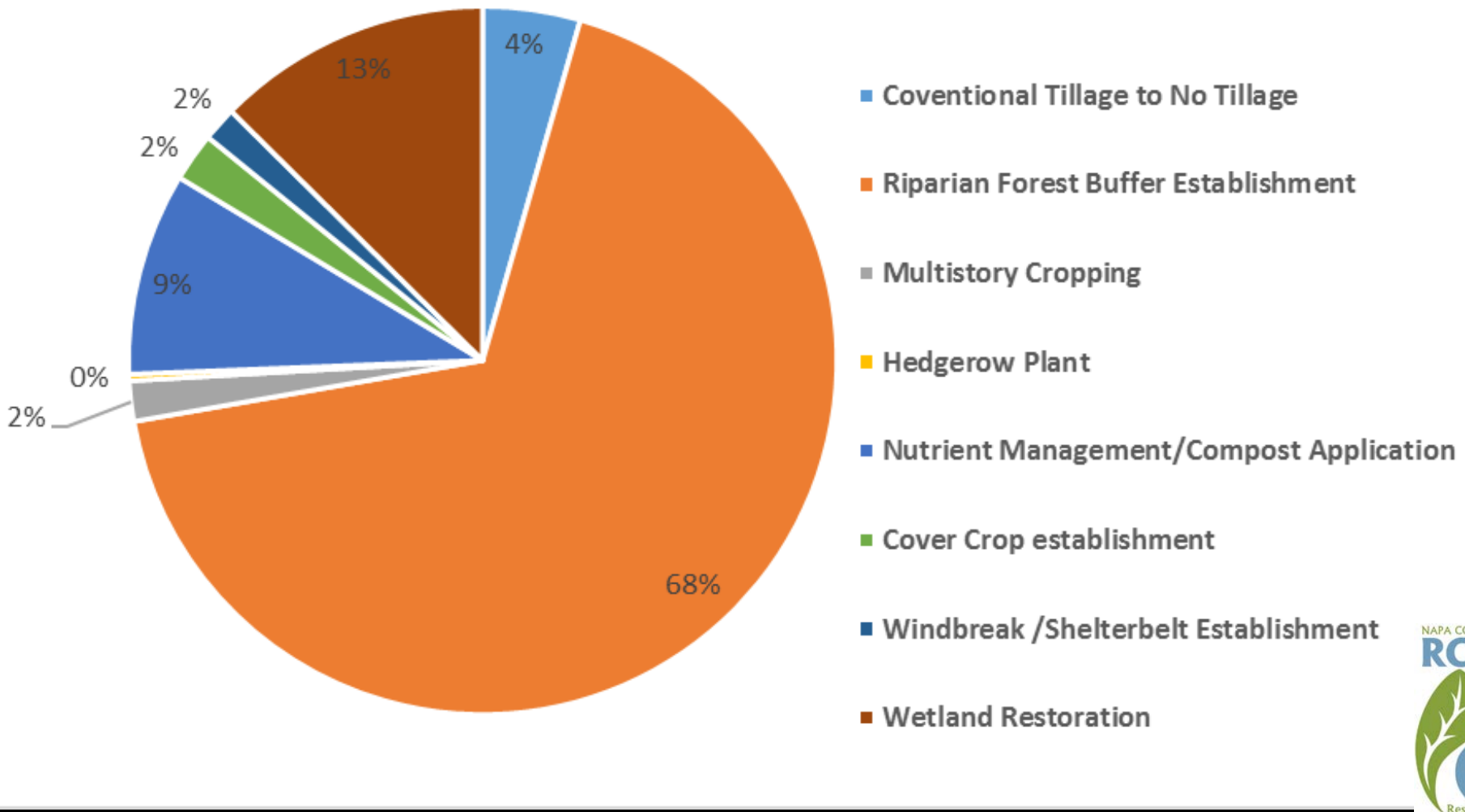
Practice map shows planned and implemented practices



Relative Impact of Practices



Take Home Message:

Carbon Farm Planning is a possible Climate Change Solution for Growers

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QUESTIONS?

Charles Schembre
Charles@NapaRCD.org
707-252-4189 x3112

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Carbon-Soil-Water-Climate Connection

IF

CA's vineyards (~ 500,000 acres) increase SOC by 1 % (1% to 2%) in the plow layer

THEN

- Water holding capacity increase by ~41,667 acre feet
- CO2e sequestered > 16 million metric tons (MMg).

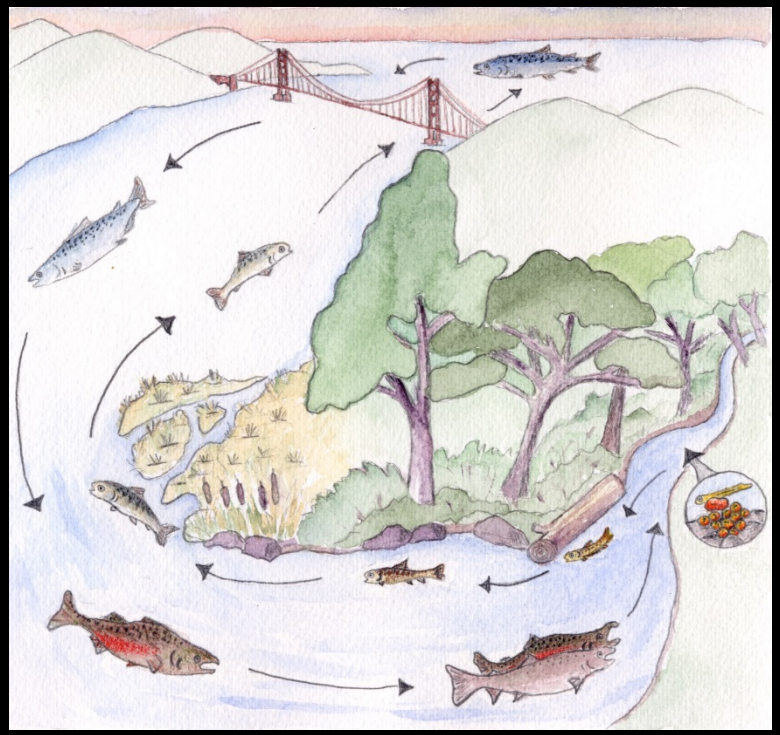
WHICH MEANS

- 25% reduction in CA's annual vineyard water use (1.7 million AF)
- 38% of the CA's annual Commercial/Residential energy emissions offset (~ 42 MMg CO_2e) OR CA's annual livestock emissions

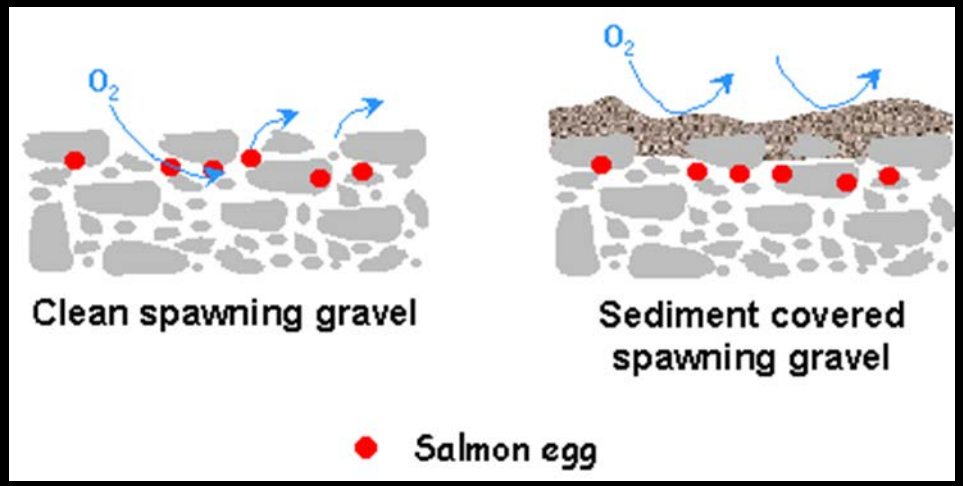
ASSUMPTIONS

- Based on plow layer (top 6.7") only; including deeper soil strata increases potential
- 1% increase in SOM results in 1 acre-inch increase in soil water holding capacity per acre;
- 1% increase in SOC represents 2% increase in SOM;
- 1 metric ton (2,200 lbs) of soil C represents 3.67 metric tons of CO2e;
- 1% increase in (plow layer only) SOC is about 10 short tons or 9 metric tons SOC/acre.

Excess sedimentation impairs aquatic habitat



- Suffocates fish eggs in spawning beds
- Loss of aquatic habitat

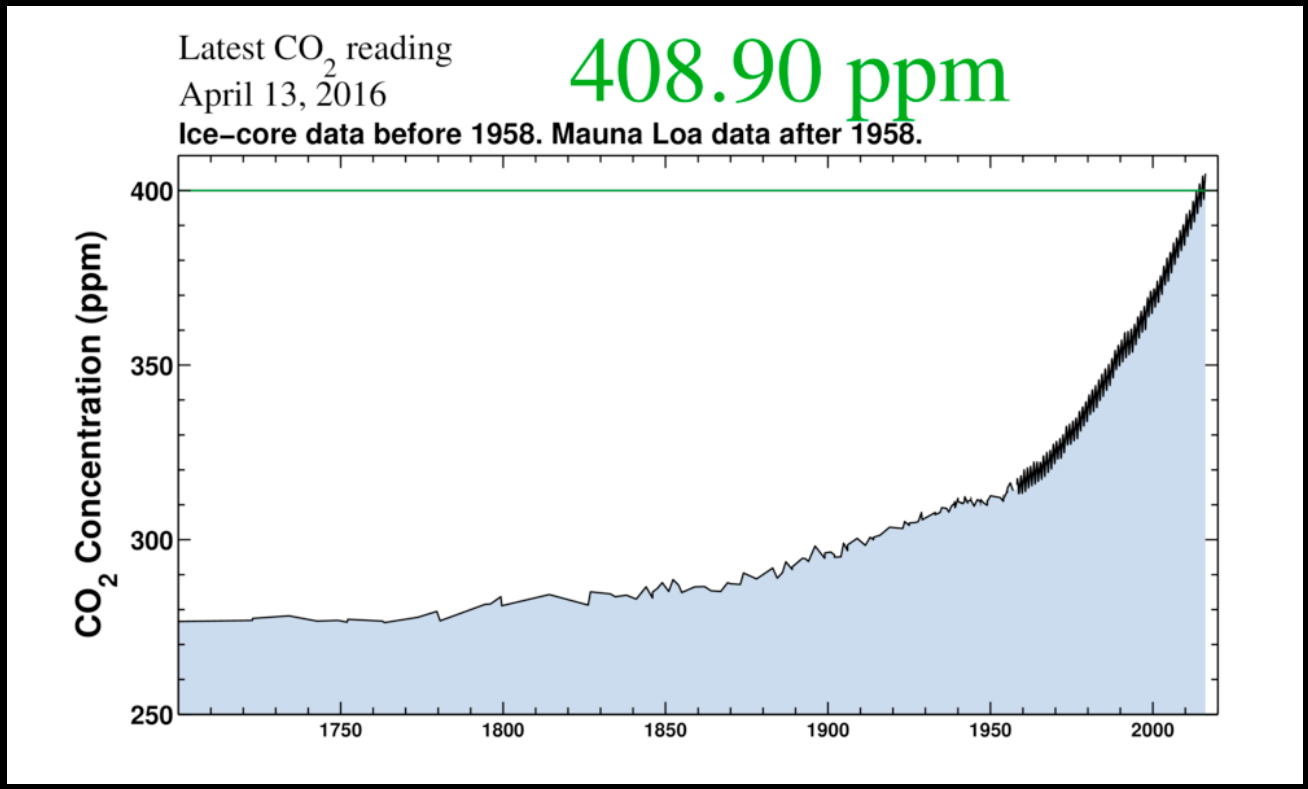


Key Elements of Carbon Farm Plan

- Evolving and dynamic
- Reflects priorities of producer
- Provide recommendations
- Implementation schedule
- Implementation strategies

Why Carbon Farm PLANNING?

- Assess whole farm
- Track progress towards goals
- Use limited resources efficiently
- Develop a farmer who has documented options for the future



CARBON FARM PLAN

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Short Term Impacts of Practices are Significant as Well

December 2013

*Photos from **Marin Carbon Project***

Soil Monitoring

- RCDs and NRCS have a standard protocol (thank you Josh!)

4. MONITORING SOIL CARBON

Background: Use this table to monitor and track soil health over time.

Date	Sample Location (show on map if possible)	Bulk Density	Total Organic Carbon		Active Carbon		Notes
		gm/cm^3	%	Tons per acre	%	Tons per acre	

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