Supporting soil health by using compost: benefits and potential drawbacks

(Charlotte Decock on behalf of)
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Supporting soil health by using compost: benefits and potential drawbacks

- What is soil health?
- Assessing soil health
- Management strategies to support soil health
- Compost: effects on soil health

What is soil health?

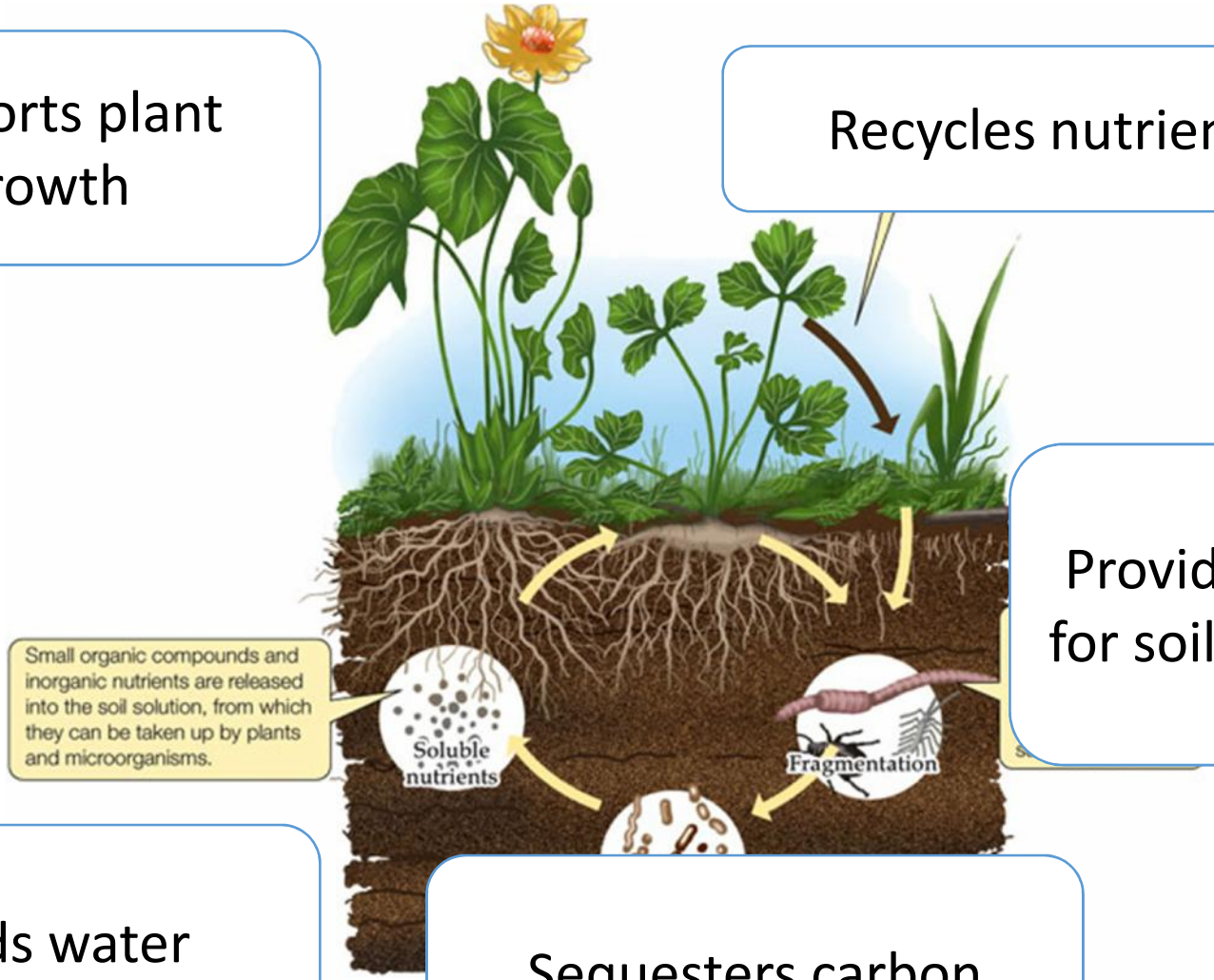
Soil health is **the continued capacity of soil to function as a vital living ecosystem** that sustains plants, animals, and humans (NRCS)-

A healthy soil is a soil that functions and provides services

What is soil health?

Supports plant growth

Recycles nutrients



Provides habitat for soil organisms

Holds water

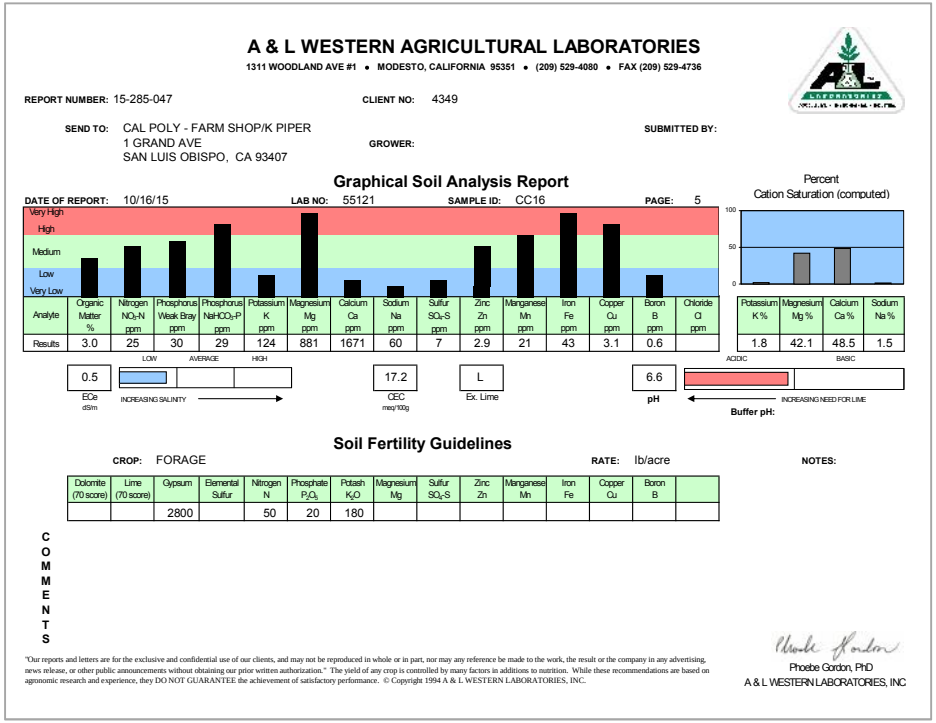
Sequesters carbon

ECOLOGY 2e, Figure 21.6

Assessing soil health

There are different things we can look at:

- Crop yields
- Soil health is well related to some soil **chemical**, **physical** and **biological** properties.



A & L WESTERN AGRICULTURAL LABORATORIES

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REPORT NUMBER: 15-285-047 CLIENT NO: 4349

SEND TO: CAL POLY - FARM SHOP/K PIPER
1 GRAND AVE
SAN LUIS OBISPO, CA 93407

GROWER: SUBMITTED BY:

Graphical Soil Analysis Report

DATE OF REPORT: 10/16/15 LAB NO: 55121 SAMPLE ID: CC16 PAGE: 5

Very High / High / Medium / Low / Very Low

Analyte	Organic Matter %	Nitrogen NO_3-N ppm	Phosphorus Weak Bray ppm	Phosphorus $NaHCO_3$-P ppm	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Chloride Cl ppm
Results	3.0	25	30	29	124	881	1671	60	7	2.9	21	43	3.1	0.6	

LOW AVERAGE HIGH

Percent Cation Saturation (computed)

Potassium K %	Magnesium Mg %	Calcium Ca %	Sodium Na %
1.8	42.1	48.5	1.5

ACIDIC BASIC

ECe dS/m	CEC meq/100g	Ex. Lime	pH
0.5	17.2	L	6.6

INCREASING SALINITY

INCREASING NEED FOR LIME

Buffer pH:

Soil Fertility Guidelines

CROP: FORAGE RATE: lb/acre NOTES:

Dolomite (70 score)	Lime (70 score)	Gypsum	Elemental Sulfur	Nitrogen N	Phosphate P_2O_5	Potash K_2O	Magnesium Mg	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B
		2800		50	20	180							

COMMENTS

Phoebe Gordon, PhD
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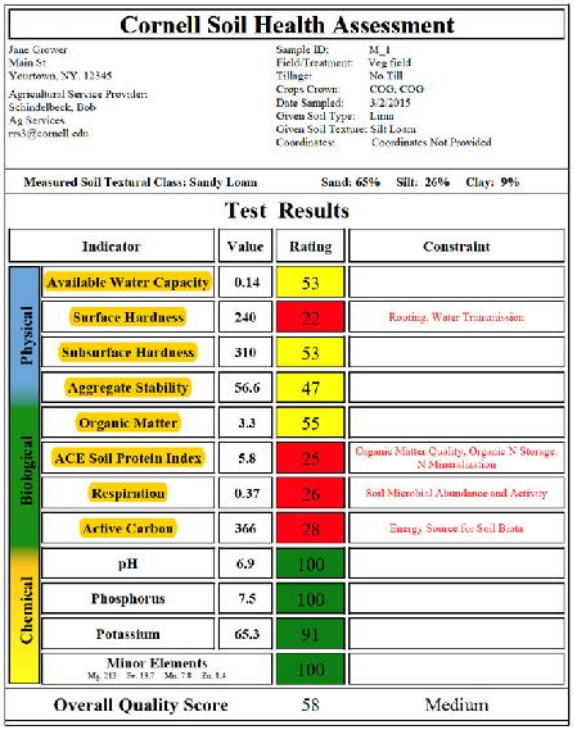

Cornell Soil Health Assessment

Jane Grower
Main St
Yeertown, NY, 12345

Agricultural Service Provider:
Schindelbeck, Bob
Ag Services
rrs3@cornell.edu

Sample ID: M_1
Field/Treatment: Veg field
Tillage: No Till
Crops Grown: COG, COG
Date Sampled: 3/2/2015
Given Soil Type: Luna
Given Soil Texture: Silt Loam
Coordinates: Coordinates Not Provided

Measured Soil Textural Class: Sandy Loam Sand: 65% Silt: 26% Clay: 9%

Test Results

	Indicator	Value	Rating	Constraint
Physical	Available Water Capacity	0.14	53	
	Surface Hardness	240	22	Rooting, Water Transmission
	Subsurface Hardness	310	53	
	Aggregate Stability	56.6	47	
Biological	Organic Matter	3.3	55	
	ACE Soil Protein Index	5.8	25	Organic Matter Quality, Organic N Storage, N Mineralization
	Respiration	0.37	26	Soil Microbial Abundance and Activity
	Active Carbon	366	28	Energy Source for Soil Biota
Chemical	pH	6.9	100	
	Phosphorus	7.5	100	
	Potassium	65.3	91	
	Minor Elements Mg, 283 Fe, 19.7 Mn, 7.8 Zn, 8.4		100	
	Overall Quality Score	58	Medium	

Assessing soil health: Soil chemical properties

Indicators: Soil organic matter, active carbon, Nutrient contents, pH, electrical conductivity and cation exchange capacity

Functions:

- Soil organisms
- Plant growth
- Carbon sequestration

Assessing soil health: Soil physical properties

Indicators: bulk density, infiltration, soil structure and porosity, soil depth, and water holding capacity

Functions:

- Retention and transport of water and nutrients
- Soil organisms
- Plant growth
- Soil workability

Assessing soil health: Soil biological properties

Indicators: Earthworms, microbial biomass C and N, soil enzymes, soil respiration, and total organic carbon

Functions:

- Nutrient cycling
- Plant growth
- Carbon sequestration

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Warning: absolute values or ranges of values for soil health are not applicable to all cases. Assessments of soil health should be done for each specific case and changes should be evaluated in relation to management practices

Management strategies to support soil health

Increase soil organic matter

Use of organic fertilizers (compost, manure, sewage sludge)

Cover crops

Incorporation of crop residues

Reduce disturbance

No-till or low till management

Management of vegetation cover through grazing or mowing

Increase diversity

Crop rotations

Cover crops

The CDFA Healthy Soils Program

- Objectives: to promote the use of conservation practices that:

Enhance soil health

Improved soil physical, chemical and biological properties

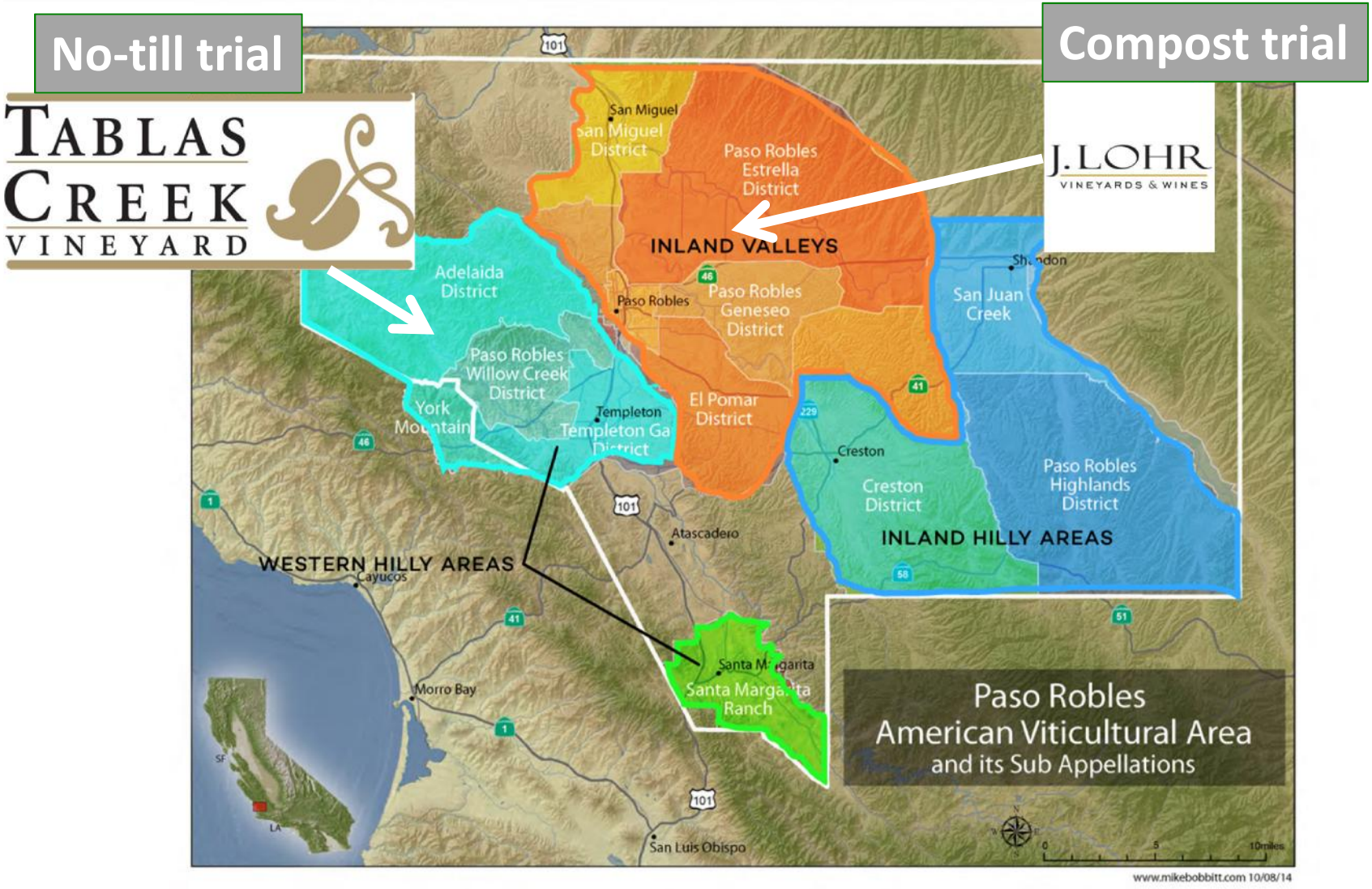
Reduce environmental impacts

- Higher C sequestration
- Lower GHG emissions (N_2O, CO_2, CH_4)

How do sustainable soil management practices affect soil health?

- Cover crops
- Organic fertilizers (compost)
- No till
- Grazing of cover crops

Assessment of no-till, compost and grazing on soil health, soil carbon and greenhouse gas emissions in wine grape production

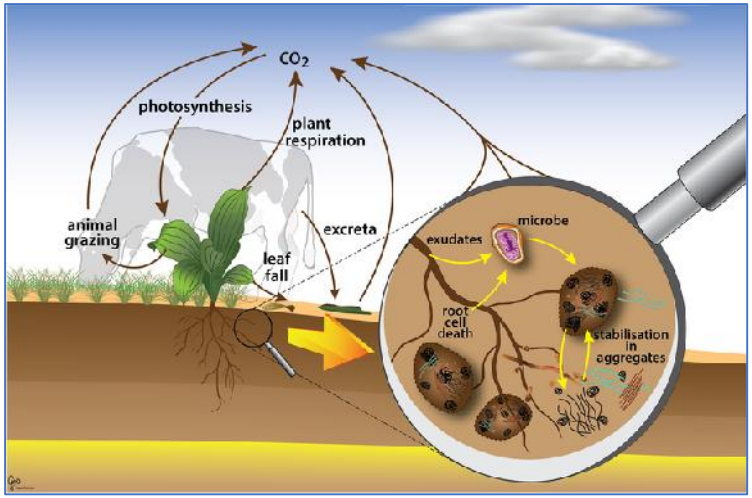


Compost provides a direct input of organic matter, therefore it directly improves soil health by providing plant nutrients and improving the physical, chemical and biological properties of soils.

Compost: potential drawbacks

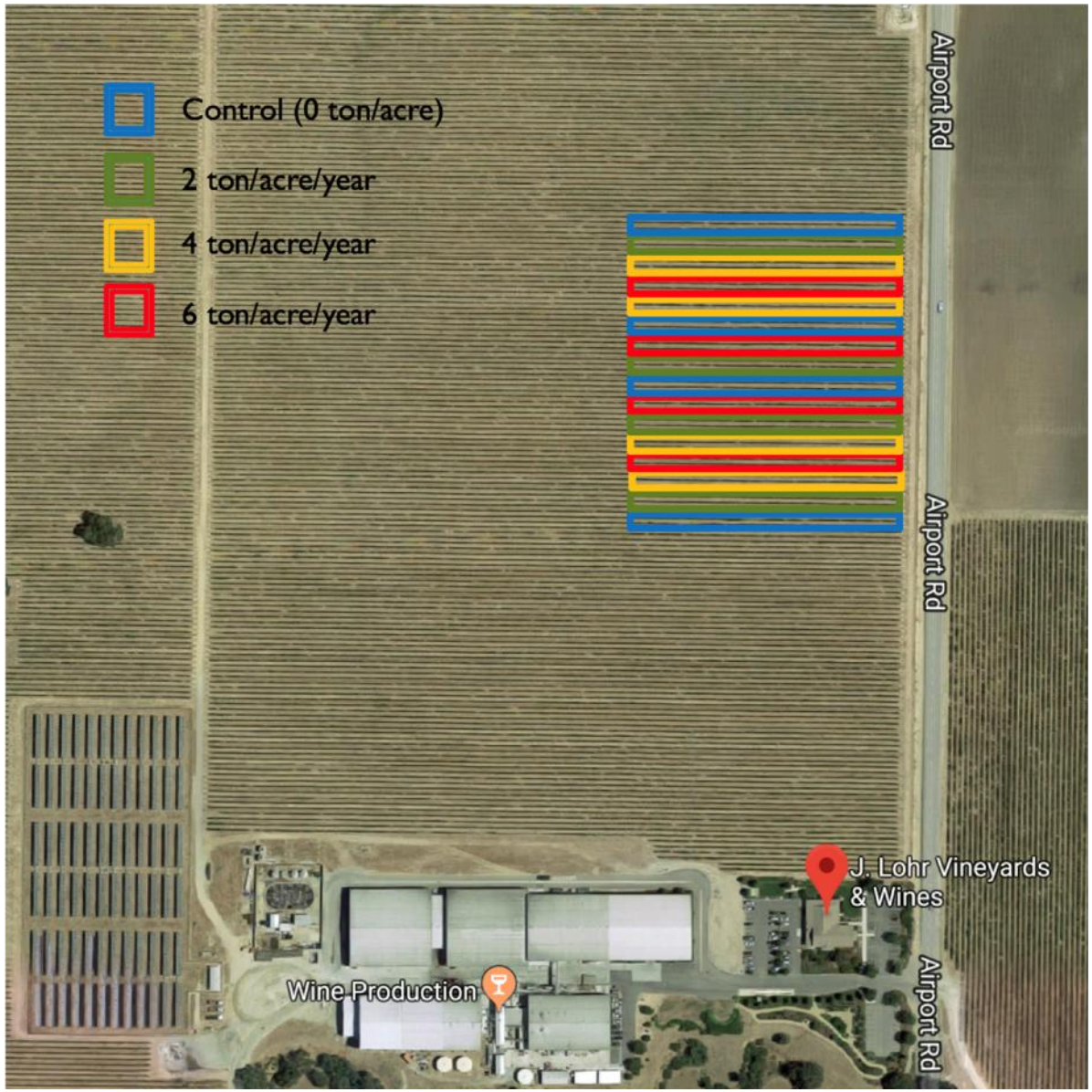
Increased nutrient cycling and microbial activity after compost application can also lead to the **increase in the emissions of greenhouse gasses such as (N_2O, CO_2 and CH_4)** and the loss of carbon from soils.

These gases are naturally produced by soil microorganisms but could offset the benefits of compost application.



There is a **cost** associated with applying compost

Aerial view of the compost trial at J. Lohr vineyards



Sample analysis

Soil samples

- Soil water retention
- Soil organic matter
- C and N content
- Carbon sequestration C distribution in aggregates

Gas samples

- Emissions of N_2O, CO_2 and CH_4

Plant samples

- Yields
- Quality: berry size, berry weight, soluble solids, pH, acidity, phenolics

Final goal

To select management strategies (compost application rates) that maximize benefits while reducing drawbacks

Questions?