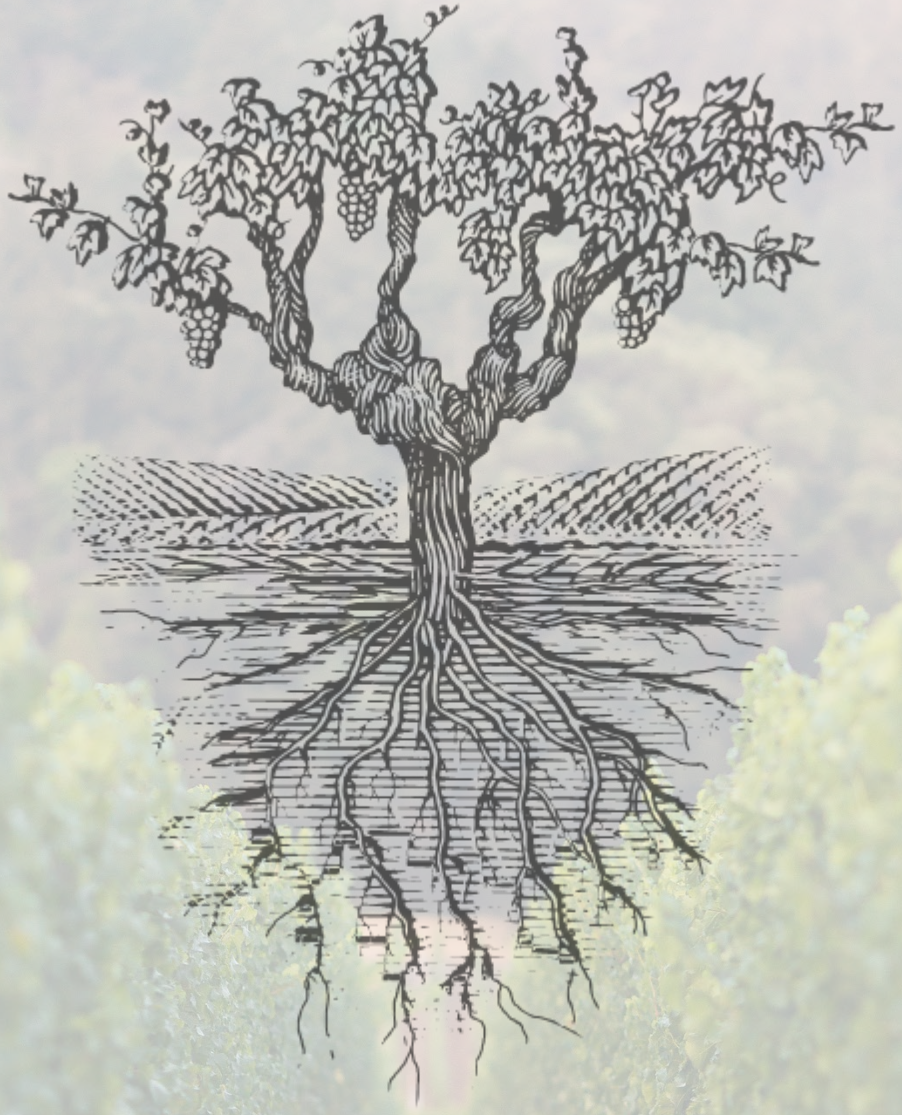

ELEMENT II

CARBON FARMING & REGENERATIVE AGRICULTURE

INTRODUCTION

What is Carbon Farming and Regenerative Agriculture?

Domestically, agriculture accounts for 10.5% of greenhouse gas emissions (GHGs). Carbon farming and regenerative agriculture refers to practices that not only reduce emissions but actually increase Soil Organic Matter (SOM) and store, or sequester, more carbon in the soil. Carbon is a core indicator of soil health, making it an essential part of ecosystem management in vineyards. Carbon farming practices can simultaneously improve:

- Soil health and quality
- Water retention and conservation
- On-farm habitat and biodiversity
- And yield higher quality grapes that can demand a price premium

Through carbon farming and regenerative agriculture growers can take climate action, build resiliency, and ultimately, profitability.

> *Agriculture is the ONE sector that has the ability to transform from a net emitter of CO_2 to a net sequesterer of CO_2 — there is no other human managed realm with this potential.*
>
> *-Carbon Cycle Institute*

The majority of winegrape growers already employ a number of carbon farming practices. Common vineyard carbon farming practices include compost and mulch application, expanding cover crops, conservation tillage, reducing the use of fertilizers, pesticides and herbicides, planting hedgerows and habitat preservation and restoration.

A 2018 study found that natural climate solutions could reduce net annual emissions in the United States by as much as 21%, with an estimated 63% of this potential coming from increased carbon sequestration in plant biomass, and 29% coming from increased carbon sequestration in soil. A more recent 2020 study on The role of soil carbon in natural climate solutions found that protecting and building soil carbon accounts for 25% of the global potential of natural climate solutions.

What is a Carbon Farm Plan?

In 2017, the Napa County RCD received a grant to work with growers to identify opportunities to store more carbon in the soil and quantify the climate benefits of implementing practices at the farm scale. The Carbon Farm planning process leverages the USDA and CDFA's COMET and COMPOST planners, which estimate the amounts of carbon that can be sequestered by implementing or expanding each of the opportunities on a property. The RCD provides growers with a custom Carbon Farm Plan (CFP) report for each of their vineyard properties. Growers can then use this data to pick and choose any and all strategies they want to implement on their properties.

The Carbon Cycle Institute also reviews these plans and provides feedback to the RCD to refine and continually improve the Carbon Farm Plan process.

Napa Green/RCD Memo on the Science Behind COMET and Carbon Farming

Developing a Carbon Farm Plan: To develop a Carbon Farm Plan (CFP) either the Napa Green or RCD climate and soil specialist will walk your property with you, baselining existing practices (including accounting for forested areas), noting vineyard and land areas and opportunities. The specialist then plugs this data into the COMET and COMPOST planners to estimate the carbon sequestration benefits of each potential carbon farming practice, and develops a CFP report for each of your properties. Using the CFP report you then pick and choose which strategies to implement based on your operations and goals.

The COMET and COMPOST Planners will be used to estimate carbon sequestration, and soil sampling will be used to validate on-the-ground results.

Example Carbon Farm Plans: **Viader Vineyard**; **Opus One Vineyard**

Science and Active Research

We acknowledge that soil science is complex and our understanding of carbon sequestration across different soil types and climatic conditions is still evolving. Carbon storage is site specific and tied to historic farming practices. The COMET tools provide qualitative guidance and quantitative carbon sequestration estimates. For this reason, annual soil testing and ongoing ecosystem monitoring will be used to cross-validate the COMET estimates.

Our certified members will contribute to scientific understanding of carbon storage in the Mediterranean climate and soils, which can aid in the optimization of the COMET tools. **As the science and quantification of sequestration evolves there is no downside to**

carbon farming given that the soil and ecosystem health benefits are well-established and proven.

Carbon Neutral and Climate Positive Targets

Napa Green Certified Vineyards must work to become **carbon neutral within two certification cycles (six years) and carbon negative (or climate positive) within three certification cycles (nine years).** The CFPs will be customized and updated every three years.

We recognize exceptions to the carbon neutral and negative targets may arise due to circumstances beyond grower control, as well as evolving scientific understanding of carbon sequestration in our specific climate and soils.

What will this accomplish? The RCD has already worked with Napa Green members to develop CFPs for >25 vineyard properties. The average size of these pilot properties was 75 acres, with an average carbon storage potential of 4.3 metric tons/acre. If Napa Green is ultimately able to certify 400 vineyards covering 30,000 acres, and there is an average of 3 metric tons/acre of additional carbon sequestration, that would be 90,000 metric tons of carbon storage, equivalent to more than 10 million gallons of gas consumed. And the sequestration benefit will continue to compound over time.

> *According to Marin Carbon Project research, sequestration of just one metric ton per hectare on half the rangeland area in California would offset 42 million metric tons of CO_2e, an amount equivalent to the annual greenhouse gas emissions from energy use for all commercial and residential sectors in California.*
>
> -Carbon Cycle Institute

Nitrous Oxide Emissions

Unfortunately, there is not yet a tool, including the COMET tools, which allows ready accounting for nitrous oxide emissions (N_2O) associated with the application of nitrogen fertilizers **(N_2O is 300 times more potent than carbon dioxide or CO_2).** Napa Green will be tracking fertilizer application and we will do our best to account for this in the vineyard emissions inventory.

It is essential to practice Integrated Nutrient Management, to identify when and if the vines need nutrients. **Growers should use both soil pH and petiole testing to help target fertilizer applications, recognizing that there can be discrepancies between soil and plant indicators.** The needed nutrients may be present in the soil but pH or other factors could be preventing plant nutrient availability. The goal is to maximize the efficiency of fertilizer use, and keep any fertilizer onsite and in the soil.

CARBON FARM PLAN – ONSITE OR DIY ASSESSMENT

In order get to signed up for a Carbon Farm Plan assessment please fill out and submit this **questionnaire** to **ben@napagreen.org**. Napa Green or the RCD will reach out with the rough timeline for scheduling.

For the Onsite Assessment:

- For the onsite assessment the Vineyard Manager will need to spend 2-3 hours with Napa Green/RCD staff providing a tour of the property and answering questions. There may be some follow-up questions and/or data that needs to be submitted.
- The Napa Green/RCD staff will use the COMET and COMPOST Planner tools to develop your Carbon Farm Plan(s).
- Once they provide you with these plans, they will schedule a time to review the results, answer questions, and discuss your preferred Carbon Farming actions for your first three-year certification cycle.
- As part of the interim annual "Desk Audits" at the start of years 2 and 3 vineyard managers will need to report on the progress in implementing/expanding carbon farming practices.

SOIL SAMPLING AND TESTING

Soil sampling is essential to effectively and efficiently manage soil health and vine nutrition. Soil testing establishes a baseline of Soil Organic Matter (SOM, including carbon) and other important soil health indicators, and tracks changes over time. Note that soil sampling is most effective when the soil is moist (February-April) so we recommend soil sampling in the winter/spring and sample at the same time of year each time. If it is later in the year this can be an Action Plan item.

Integrated Nutrient Management: Soil samples should also be used to identify when and if the vines need nutrients. Growers should use both soil tests and petiole testing to help target fertilizer applications, recognizing that there can be discrepancies between soil and plant indicators. While petiole samples can provide a snapshot of vine nutrient content, soil samples can help identify systemic nutrient and pH imbalances. This larger context can help target fertilizer application, reducing material use and cost.

- When you receive your Carbon Farm Plan onsite assessment the Napa Green/RCD staff will assist with soil sampling and testing of physical parameters.
- If you are in queue for a CFP onsite assessment you will need to reach out to **Ben Mackie,** Napa Green's Climate & Soil Specialist, to schedule a brief call to review your block map(s) and determine the best locations for soil sampling. Once you have identified where best to sample you will need to conduct your own soil sampling. **RCD Soil Sampling Guidance, Cornell Cooperative Extension: Soil Sampling in the Vineyard.**
- Download the **Soil Sampling Requirements PDF.**

We are requiring each vineyard to sample three blocks (6 soil samples) within their first year in the program and every following certification period (3 years). These samples will be 3 undervine and 3 in the alleys, with at least 10 subsamples from within a similar soil type.

For vineyards under 10 acres or several vineyard locations of similar soil types and management, contact **Ben Mackie.**

	Required	Recommended
Lab Test	Organic Matter, Macronutrients, CEC, pH (Most standard tests)	Micronutrients, texture, bulk density
On-site/ Physical test		Bulk density, aggregate stability, infiltration, compaction

Cost:

- **A&L Labs** (Modesto) will test required chemical parameters for $25/sample

- **Ward Labs (NE) has more holistic tests available such as the Haney test ($50/ sample)**
- **Dellavalle Labs**

For testing of physical parameters: You can either wait for your onsite assessment OR attend a Soil Sample Training (we will be organizing these trainings with the RCD) and complete these tests in-house.

Note on Compost: *It is essential to track the amount of nutrients being added to the soil relative to the amount you need. If you purchase compost any high-quality producer should provide compost nutrient data – be sure to review. If you make your own compost you should sample and send to a lab for testing.*

ACTION ITEMS – MARK IF COMPLETED/UPLOADED

☐	**Carbon Farm Plan Onsite Assessment & CFP Report**: Fill out questionnaire and email to Ben to schedule CFP on-site assessment.
☐	**Annual soil sampling & testing:** Results uploaded in online account.
☐	**Online Resource Calculator:** In online account use Resource Calculator to enter electricity use, fuel use, water use, fertilizer application, and annual yields. *Note: We can assist in accessing PG&E data.*
☐	**Review completed Carbon Farm Plan:** Select your preferred practices to implement over the next 3 years for the Action Plan.

ADDITIONAL RESOURCES

These resources and organizations are in addition to the resource links we have embedded throughout this element.

Organizations

- **Biome Makers:** https://biomemakers.com/
  Our technological platform helps farmers and agronomists to discover the whole microbial community impacting your crop. From there, we can help to determine how to improve production and maintain soil sustainability for many future harvests to come.

- **Bioneers**
  - Carbon Farming
  - Regenerative Agriculture

  For 30 years, Bioneers has acted as a fertile hub of game-changing social and scientific innovators with breakthrough solutions for the world's most pressing environmental and social challenges.

- **Carbon Cycle Institute – Carbon Farming:** https://www.carboncycle.org/carbon-farming/
  The Carbon Cycle Institute's mission is to stop and reverse climate change by advancing science-based solutions that reduce atmospheric carbon while promoting environmental stewardship, social equity and economic sustainability.

- **Napa County Resource Conservation District – Carbon Farm Plans:** https://naparcd.org/what-we-do/help-farmers-and-ranchers/carbon-farm-plans/
  Napa RCD empowers the community to voluntarily conserve, protect, and restore natural resources in a landscape that supports agriculture, urban areas, and wild lands.

- **North Coast Soil Hub:** http://soilhub.org/
  This network includes: farmer-to-farmer workshops, long-term experimental demonstrations, and this website as an information sharing platform.

- **UC Division of Agriculture and Natural Resources (UCANR)**
  - Climate Smart Agriculture
  - Webinars & Events

  True to the mission of the land grant universities, UC Agriculture and Natural Resources connects the power of UC research in agriculture, natural resources, nutrition and youth development with local communities to improve the lives of all Californians.

- **UC Statewide Integrated Pest Management Program:** http://ipm.ucanr.edu/PMG/selectnewpest.grapes.html
  UC ANR translates research into action — creating management strategies for a safer, more climate-resilient California.

Information, Articles & Studies

Compost

- Compost Tea: a Power Shake for the Vineyard
- Napa Recycling – Organic Compost
- Upper Valley Disposal & Recycling – Compost and Soil Amendments
- US Composting Council

Cover Crops

- Cover Cropping in Vineyards: A Grower's Handbook
- Cover Crops, Tillage and Lessons Learned from Ridge Vineyards
- UC Solution Center for Nutrient Management – Cover Crops
- SAREP Cover Crop Database
- Environmental and Operational Benefits of Conservation Tillage and Cover Cropping

Hedgerows

- Hedgerows and Farmscaping for California Agriculture
- Hedgerows: Benefits to Farmers, Benefits to Wildlife
- Hedgerows and Pollinator Habitat
- NRCS Hedgerow Plant List
- Planting Hedgerows on North Coast Vineyards
- Preston Farm – Thoughts on Hedgerows and Woodlots

Natural Climate Solutions

- Intergovernmental Panel on Climate Change: Special Report on Climate Change and Land
- Natural Climate Solutions for the United States
- The role of soil carbon in natural climate solutions