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SEMINAR SERIES

CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

Soil Health and CDFA Healthy Soils Program

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California Department of Food and Agriculture

Outline

- Soil Health and Principles to Improve Soil Health
  - ✓ Soil Health and Soil Organic Matter
  - ✓ Four Principles to Build Healthy Soils
- CDFA Healthy Soils Initiative and Healthy Soils Program
  - ✓ Healthy Soils Initiative
  - ✓ CDFA Healthy Soils Program (HSP)
  - ✓ Eligible HSP Management Practices
- CDFA Healthy Soils Program Current Status
  - ✓ 2017 HSP First Solicitation - Summary
  - ✓ 2017 HSP Second Solicitation
  - ✓ Future Plan

Why Soil Health Matters?

Healthy soil promotes healthy tree growth and increases fruit yield.

Healthy shoot growth and higher yield

↑

More soil water and nutrients taken up
Stronger resistance to pathogens and diseases

↑

Healthy root system

↑

Healthy soil

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Functions of Soil and Soil Health

- **Soil Functions:**
  - ✓ Providing physical stability and support
  - ✓ Regulating water through controlling, infiltration and retention
  - ✓ Cycling nutrients
  - ✓ Filtering and buffering potential pollutants
  - ✓ Sustaining plants and animal life
- **Soil Health**: the **continued capacity** of soil to function as a vital living ecosystem that **sustains** plants, animals, and humans.

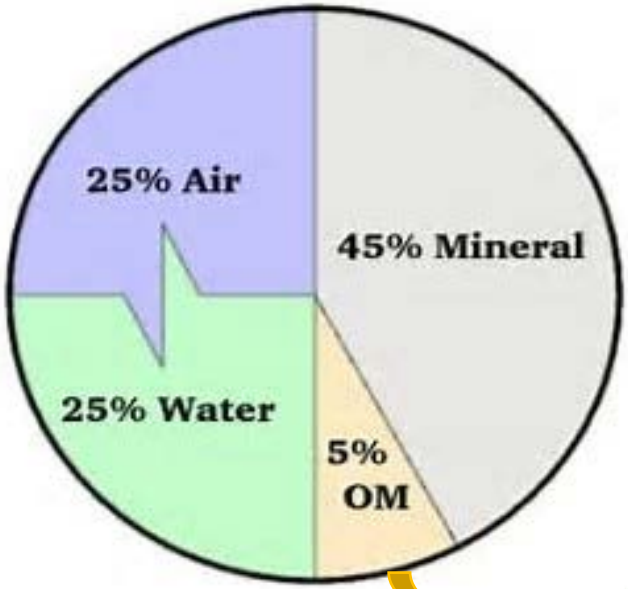
Soil – A Living and Life Giving Natural Resource

- An estimated 25% of all living species in the soil
- A square meter of soil contains billion of individual organisms and millions of species
- A myriad of living organisms not visible with naked eyes
  - ✓ Micro-organisms (e.g. bacteria, fungi, protozoa and nematodes)
  - ✓ Meso-fauna (e.g. acari and springtails)
  - ✓ Macro-fauna (e.g. earthworms and termites)
- 90% of soil function is attributed to soil microbes

  Fungi and bacteria break down organic matter making nutrients available to plants

Healthy Soil – Structure and Composition

Ideal soil condition by volume



Soil organic matter composition

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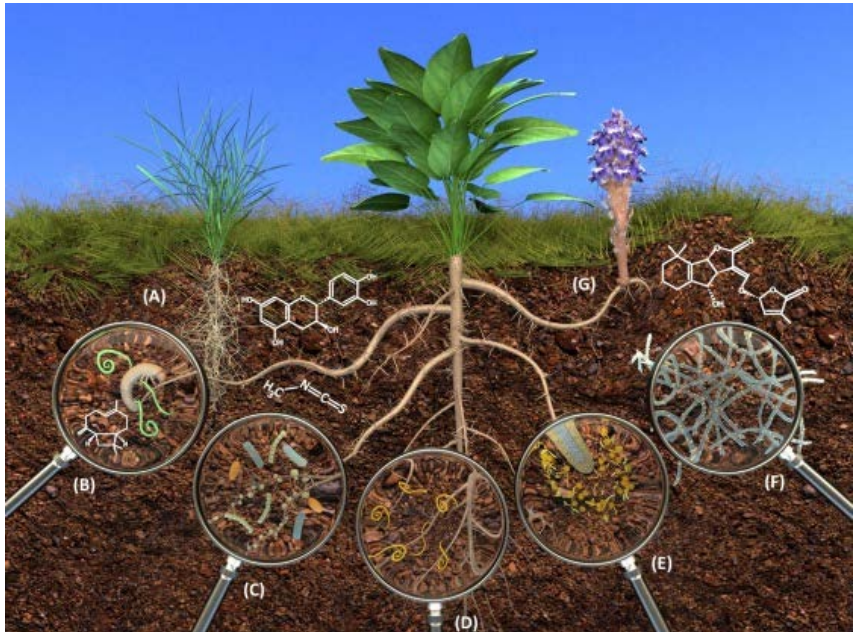
Important of Soil Organic Matter

Important of Soil Organic Matter

- Improves **soil aggregate formation** and **structure**
  - ✓ Reducing soil erosion and compaction
  - ✓ Improving water drainage and root growth
  - ✓ Increasing water infiltration and retention
  - ✓ Increasing water holding capacity
- Improves **soil chemical properties**
  - ✓ Increasing soil cation exchange capacity
  - ✓ Adding nutrients in soil and increase nutrient holding capacity
  - ✓ Increasing pH buffering capacity
- Increases **soil microbial activity and biodiversity**
  - ✓ Stimulating soil biological activity and nutrient release
  - ✓ Lowering pest and disease damages to crops

Four Principles to Improve Soil Health-1

1. Keeping Living Roots in the Soil Throughout the Year



Root exudates stimulate and feed soil biology

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Four Principles to Improve Soil Health-2

2. Maximizing Soil Diversity through Plant Diversity

Crop Rotation

Mixture Plantings

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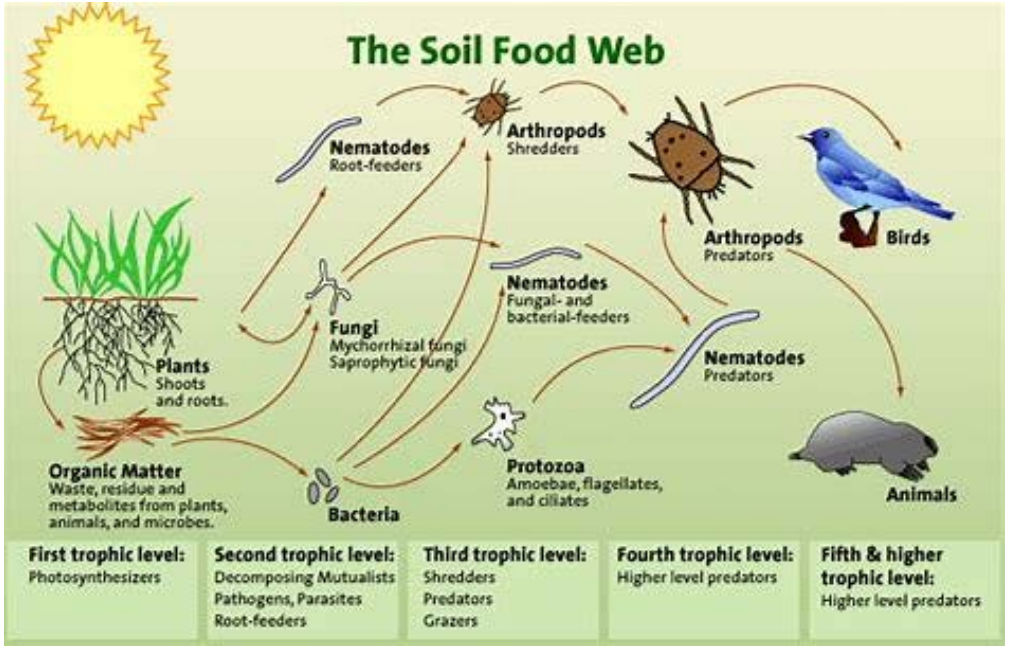
Four Principles to Improve Soil Health-3

2. Maximizing Soil Diversity through Plant Diversity – cont'd



– Diversifying soil organisms and reducing soil pests

Four Principles to Improve Soil Health-3

3. Minimizing Soil Disturbance – Conservation Tillage

No-Till

Strip-Till

Reduced-Till

- Maintaining living root system and soil organic matter
- Increasing soil aggregate stability and structure
- Reducing soil erosion

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Four Principles to Improve Soil Health-4

4. Keeping Soil Covered

by residue, mulch and live plants

- Returning nutrients and organic matter to soils
- Improving water infiltration and reducing soil erosion
- Regulating soil temperature and conserving soil moisture

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  - ✓ **CDFA Healthy Soils Program (HSP)**
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Actions for the Healthy Soils Initiative: Interagency and State-Federal Partnerships

- Protect and restore soil organic matter on California soils
- Identify sustainable and integrated financial opportunities to facilitate healthy soils
- Provide for research, education and technical support to facilitate healthy soils
- Increase governmental efficiencies to enhance soil health on public and private lands
- Promote interagency coordination and collaboration to support soil health and state goals

Partnerships for State Healthy Soils Initiative

Healthy Soils Program (HSP): Objective and Funding

Objective: To Build soil carbon and reduce agricultural greenhouse gas (GHG) emissions through incentives.

CDFA received $7.5 million in FY 2016-17 to develop and administer a new incentives and demonstration program on the CA Healthy Soils Initiative from the Greenhouse Gas Reduction Fund.

Two Components of HSP:

- ✓ Incentives Program ($3.75 M) On-farm implementation
- ✓ Demonstration Projects ($3.0 M): Implementation and outreach to other farmers and ranchers.

HSP Incentives Program

- **Eligibility**

  California farmers, ranchers, native American Indian tribes

- **Up to $50,000 per project**
- **Standard payment rates**
- **Project verification**
- **2017 HSP Incentives program**
  - ✓ CDFA funds in year 1 and 2
  - ✓ Awardees provide cost sharing in Year 3

HSP Demonstration Projects

- **Eligibility**

  Non-profits, University Cooperative Extension Services, Federal/University Experimental Stations, Native American Tribes, Growers in partnership with Resource Conservation Districts (RCDs) or one of the aforementioned entities.

- **Project Types:**

  ✓ Type A: implement practice, measure GHG data and conduct outreach, Up to $250,000

  ✓ Type B: implement practice and conduct outreach: Up to $100,000

- **Outreach:**

  Awarded projects to invite 40 different individual growers/ranchers per year to site to showcase and share information on practice implementation.

- **2017 HSP Demonstration Projects**

  ✓ CDFA funds in year 1 and 2

  ✓ Awardees provide cost sharing in Year 3

2017 HSP Agricultural Management Practices

I. Soil Management Practices

- Cropland Management Practices

  Must follow NRCS conservation practice standards and associated site specific requirements during implementation.

  - ✓ Cover crop (USDA NRCS CPS 340)
  - ✓ Mulching (USDA NRCS CPS 484)
  - ✓ Residue and Tillage Management – No-Till (USDA NRCS CPS 329)
  - ✓ Residue and Tillage Management – Reduced Till (USDA NRCS CPS 345)

- Compost Application Practices

  Must follow guidance in CDFA Compost Application White Paper.

  - ✓ Compost Application to Annual Crops (CDFA)
  - ✓ Compost Application to Perennials, Orchards and Vineyards (CDFA)
  - ✓ Compost Application to Grassland (CDFA)

2017 HSP Agricultural Management Practices

II. Herbaceous Cover Planting Practices

Must follow NRCS conservation practice standards and associated site specific requirements during implementation.

- Herbaceous Wind Barrier (USDA NRCS CPS 603)
- Vegetative Barriers (USDA NRCS CPS 601)
- Riparian Herbaceous Cover (USDA NRCS CPS 390)
- Contour Buffer Strips (USDA NRCS CPS 332)
- Field Border (USDA NRCS CPS 386)
- Filter Strip (USDA NRCS CPS 393)

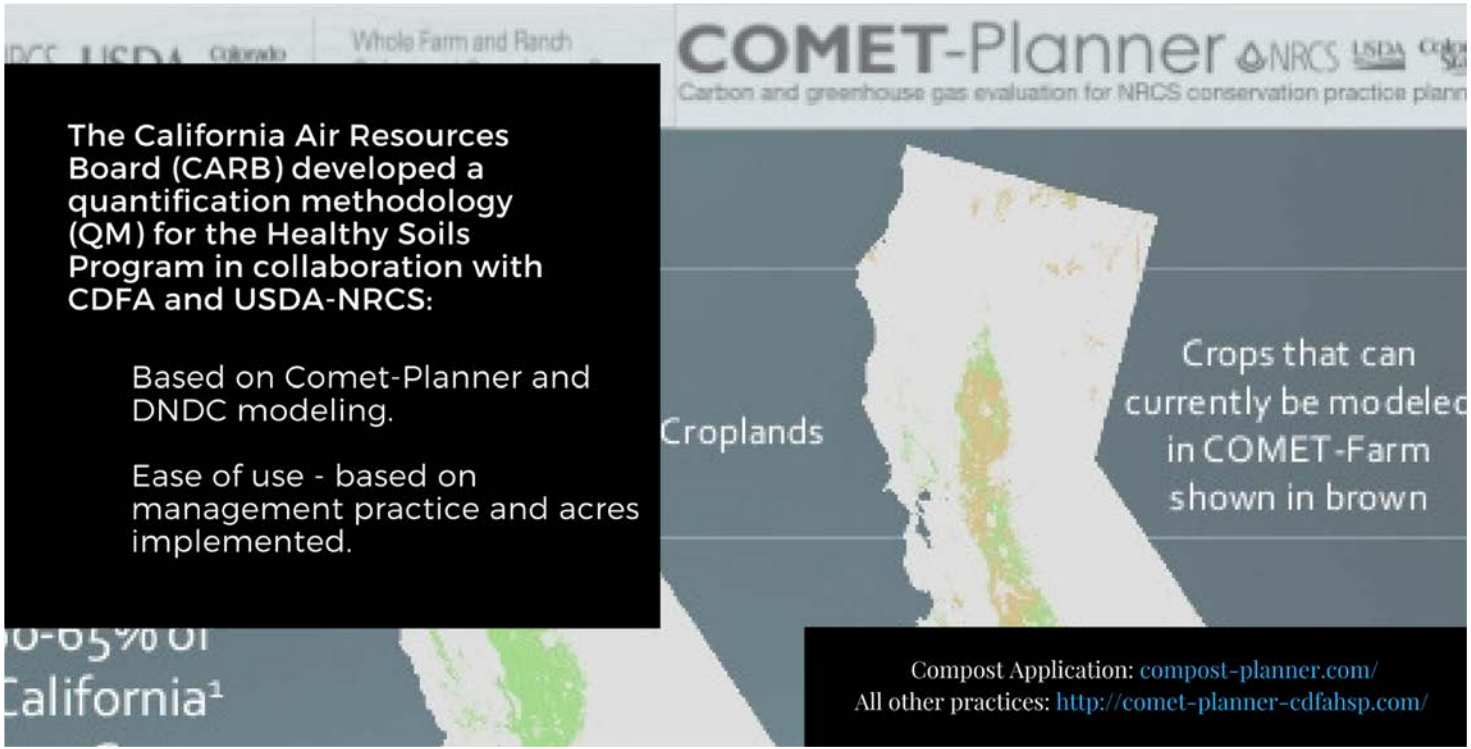
2017 HSP Agricultural Management Practices

III. Establishment of Woody Cover Practices

(1) Must follow NRCS conservation practice standards and associated site specific requirements during implementation.
(2) Expected life of practice is 10 years.

- **Woody Plantings Practices**
  - ✓ Windbreak/Shelterbelt Establishment (USDA NRCS CPS 380)
  - ✓ Riparian Forest Buffer (USDA NRCS CPS 391)
  - ✓ Hedgerow Planting (USDA NRCS CPS 422)
- **Grazing Lands Practices**
  - ✓ Silvopasture (USDA NRCS CPS 381)

Quantification Methodology for GHG Emission Reductions



Soil Management Practices: - Cover Crop

- **Definition:**
  Crops including grasses, legumes, and forbs for seasonal cover and other conservation purposes.
- **Purpose (Benefits) of Cover Crop:**
  - ✓ Reduce soil erosion
  - ✓ Build and improve soil fertility and health
  - ✓ Suppress weeds, and
  - ✓ Control diseases and pests.

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Soil Management Practices: - Cover Crop

Cover crops Help Build Mycorrhizal Networks:
- connecting plants intra- and inter- specifically

Plants growing in close proximity are often connected underground by mycorrhizal hyphal interconnections.

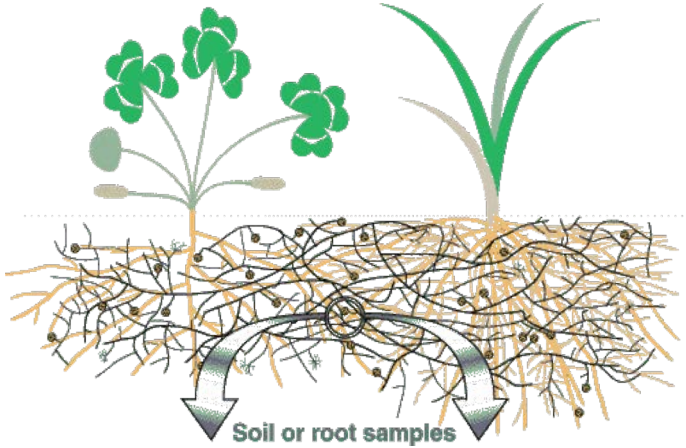

Illustration by Mark Brundrett, Ecologist, Univ. of Western Australia

AM fungi bridges cover crop to subsequent crop

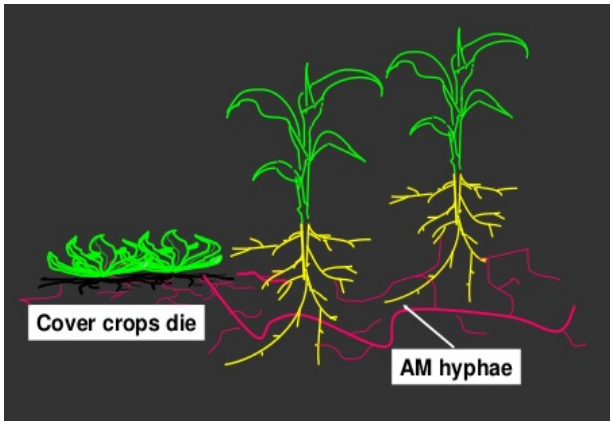

Illustration by Joel Gruver, associate professor, WIU Agriculture

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Soil Management Practices: - Mulching

- Definition:

  Applying plant residue or other natural materials produced off-site to the land surface.

- Purpose (benefits) of Mulching:
  - ✓ Conserve moisture
  - ✓ Reduce erosion
  - ✓ Suppress weeds
  - ✓ Regulate soil temperature, and
  - ✓ Improve soil Health.

INDEX FRESH

Soil Management Practices:
- Residue and Tillage Management – No-Till

INDEX FRESH

- **Definition:**

  Managing the amount, orientation and distribution of crop and other plant residue on the soil surface year around, limiting soil-disturbing activities to those necessary to place nutrients, condition residue and plant crops.

- **Purpose (benefits) of No-Till:**

  - ✓ Reduce soil erosion and dust
  - ✓ Reduce energy use and greenhouse gas emissions
  - ✓ Improve soil organic matter content
  - ✓ Increase plant available moisture
  - ✓ Improve soil structure.

Soil Management Practices:
- Residue and Tillage Management – Reduced-Till

INDEX FRESH

- **Definition:**

Managing the amount, orientation and distribution of crop and other plant residue on the soil surface year around while limiting soil-disturbing activities used to grow and harvest crops in systems where field surface is tilled prior to planting.

- **Purpose (benefits) of Reduced-Till:**
  - ✓ Reduce soil erosion and dust
  - ✓ Reduce energy use and greenhouse gas emissions
  - ✓ Improve soil organic matter content
  - ✓ Increase plant available moisture
  - ✓ Improve soil structure.

Soil Management Practices: - Compost application

Crop Type	Compost Type	Dry Tons/Acre
Annual Crops	Higher N (C:N ≤ 11)	2.2 – 3.6
	Lower N (C:N > 11)	4.0 – 5.3
Tree / Perennial	Higher N (C:N ≤ 11)	2.2 – 3.6
	Lower N (C:N > 11)	4.0 – 5.3
Pasture/ Rangeland	Higher N (C:N ≤ 11)	4.0 – 5.3
	Lower N (C:N > 11)	4.0 – 5.3

- ✓ Compost application rates eligible for funding through the program
- ✓ Compost must be produced by a facility permitted or otherwise authorized by state and local authorities that can demonstrate compliance with all state regulations.
- ✓ STA (US Composting Council's Seal of Testing Assurance Program) or CDFA-OIM (Organic Input Material) Program certified compost is recommended.

INDEX FRESH

2017 HSP Incentives Program Payment Rates

Soil Management Practices	Practice implementation Name (COMET –Planner)	Scenario Name	Payment Unit	Payment Rate ($)
Cover Crop (CPS 340)	*Add Seasonal Cover Crop to Irrigated Cropland*	General purpose	Ac	123.82
Mulching (CPS 484)	*Add High Carbon Mulch to Croplands*	Natural materials	Ac	376.56
No-till (CPS 329)	*Intensive Till to No Till or Strip Till on Irrigated Cropland*	No-till	Ac	29.40
Reduced-till (CPS 345)	*Intensive Till to No Till or Strip Till on Irrigated Cropland*	High residue	Ac	31.24
Compost Application (CDFA)	*Compost (C:N ≤ 11)* *Compost (C:N > 11)*	CDFA Application rate Range	Dry ton	35.00

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  - ✓ **Future Fund**

Healthy Soils Program Application Process

Competitive Application Process

Application Review & Evaluation

Multiple Levels of Review:

- Administrative Review: Internal - Conducted by CDFA.
- Technical Review: External - Conducted by Technical Reviewers (University experts).

Scoring Criteria for 2017 HSP Incentives program	Points
Project Feasibility	30
Project Sustainability	10
GHG Emission Reduction Benefits	20
Soil Health and Environmental Co-Benefits	10
Conservation Plan	10
Disadvantaged Communities	10
Additional Considerations	10
Total	100

THE OFFICE OF ENVIRONMENTAL FARMING & INNOVATION
healthy soils program

CDFA Healthy Soils Program – First Solicitation

2017 HSP Awarded Projects

★ Incentives Program

51 projects

22 counties

8,992 tons CO2e/yr GHG Reduction

$1.4 Million requested in grants
$1.6 million in Year 3 cost sharing
$1.62 million in matching funds

★ Demonstration Projects

22 projects

20 counties

1,642 tons CO2e/yr GHG Reduction

$3.2 Million requested in grants
$2.5 Million in matching funds

Note: Final grant awards subject to change pending CDFA budget evaluations.

2017 HSP - Awarded Projects

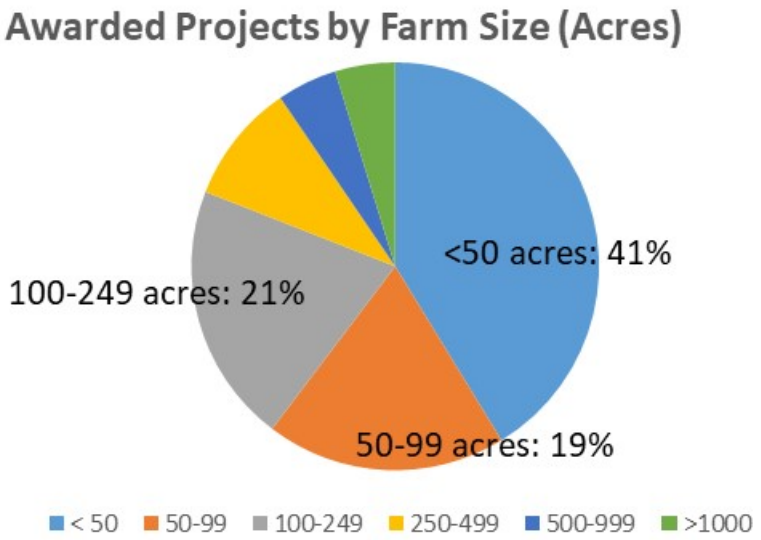
Reducing Greenhouse Gases Per Year

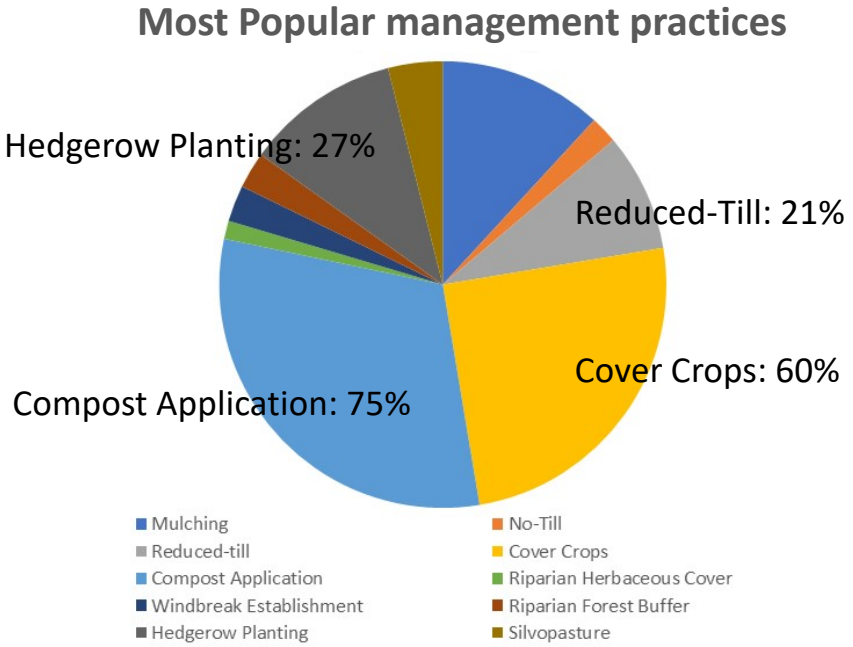
10,634 tons of CO_2e =

Source: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

Majority (~92%) of GHG reductions achieved through Compost Application - high acreage of adoption

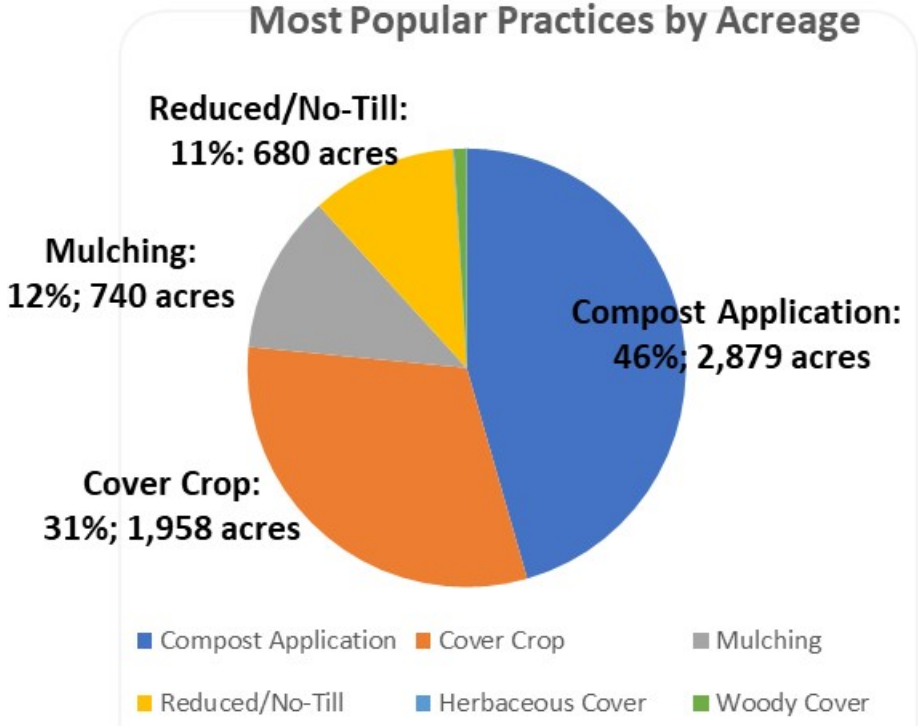
2017 HSP Incentives Program - Awarded Projects





73% of the awarded projects implement more than one practice.

2017 HSP Incentives Program - Awarded Projects



2017 HSP Incentives Program –First Solicitation Technical Assistance

TECHNICAL ASSISTANCE

Workshops conducted by CDFA and 3rd-party Technical Assistance Providers (TAPs) funded by CDFA:

- Resource Conservation Districts
- University Cooperative Extension
- Non-profit organizations.

32 workshops in 19 counties

295 in-person attendees, 101 remote attendees.

149 received additional assistance from TAPs.

Feedback provided by TAPs and applicants informs future process improvements.

2017 Healthy Soils Program – Second Solicitation

- **Fund Amount: $1.6 million**
  - ✓ Up to $500,000 for Demonstration Type B Projects
  - ✓ $1.1 million for Incentives Program
- **Funds must be expended/liquidated by June 30, 2020.**
- **Program duration and cost sharing:**
  - ✓ Program duration: May 1, 2018 – Dec. 31, 2020.
  - ✓ HSP funds cover Project Years 1 and 2: May 1, 2018 – Dec 31, 2019.
  - ✓ Cost sharing covers Project Year 3: Jan1, 2020 – Dec 31, 2020.

2017 Healthy Soils Program – Second Solicitation

- **Grant Application Duration: March 6 – April 13, 2018**

  Application Technical Assistance provided by

  - ✓ CDFA (workshops and webinars)
  - ✓ RCDs and non-profit organizations funded by CDFA (workshops and one-to-one on-demand application assistance)
- **Review Period: April – May, 2018**
- **Award Announcement: May, 2018**
- **Applications Received by April 13, 2018**
  - ✓ HSP Incentives Program: 43 applications, total funds requested: $1.15 million
  - ✓ HSP Demonstration Projects: 11 applications, total funds requested: $957,000

CDFA Healthy Soils Program - Future Fund

Potential Future Fund:

$ 10 million

SB-5 California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018

$ 5 million

2018-19 Governor's Budget (proposed)

CDFA Healthy Soils Program -
Expanding the Suite of Management Practices

- Public call for proposals: November 6 – December 18, 2017.
- 11 proposals, listing 31 practices received.
- CDFA evaluation process:
  - Publicly available research data in support of demonstrated C-sequestration through a proposed practice.
  - Ability to incorporate into GHG quantification tools (e.g., already an NRCS Standard Conservation Practice).
- Examples of practices being evaluated: nutrient management, prescribed grazing, conservation cover, alley cropping and more…

https://www.cdfa.ca.gov/oefi/efasap/docs/AgendaEFASAPMeeting-03152018.pdf

CDFA Healthy Soils Program Team & Acknowledgments

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Reference Links:

Healthy Soils Initiative:
www.cdfa.ca.gov/healthysoils/

First California Healthy Soils Week: 2017
https://www.cdfa.ca.gov/healthysoils/soilsweek.html

CDFA Healthy Soils Program:
https://www.cdfa.ca.gov/oefi/healthysoils/

Examples of practices being evaluated for addition into HSP:
https://www.cdfa.ca.gov/oefi/efasap/docs/AgendaEFASAPMeeting-03152018.pdf

GHG quantification for compost application:
http://www.compost-planner.com/

GHG quantification for all other practices:
http://comet-planner-cdfahsp.com

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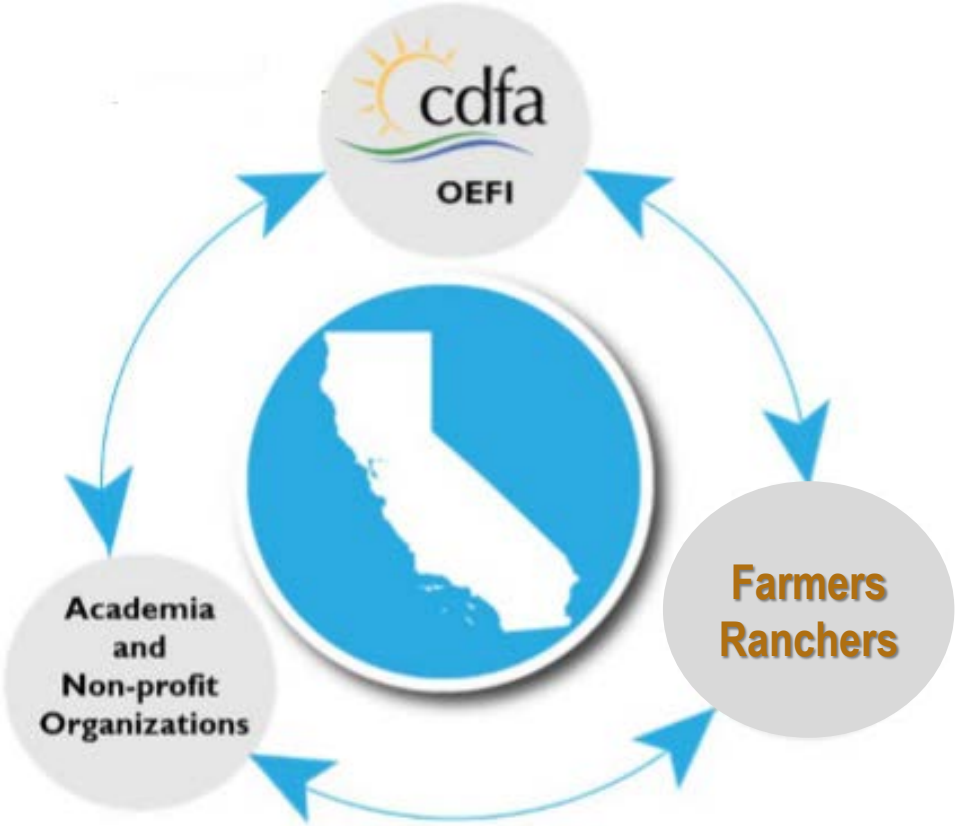
Partnerships for Soil Health



Take Home Messages

1. What we have learned about Soil

1) Soil is a living natural resource
2) Soil organic matter is the key to soil health
3) Soil biodiversity is important for plant resistance to pests, disease and pathogens.

2. How we should do to improve our soil health

1) Follow the four principles
2) Implement conservation management practices
3) Apply for CDFA Healthy Soils Program when next funding is available

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