How Increasing Soil Health Can Help the Monterey Bay National Marine Sanctuary

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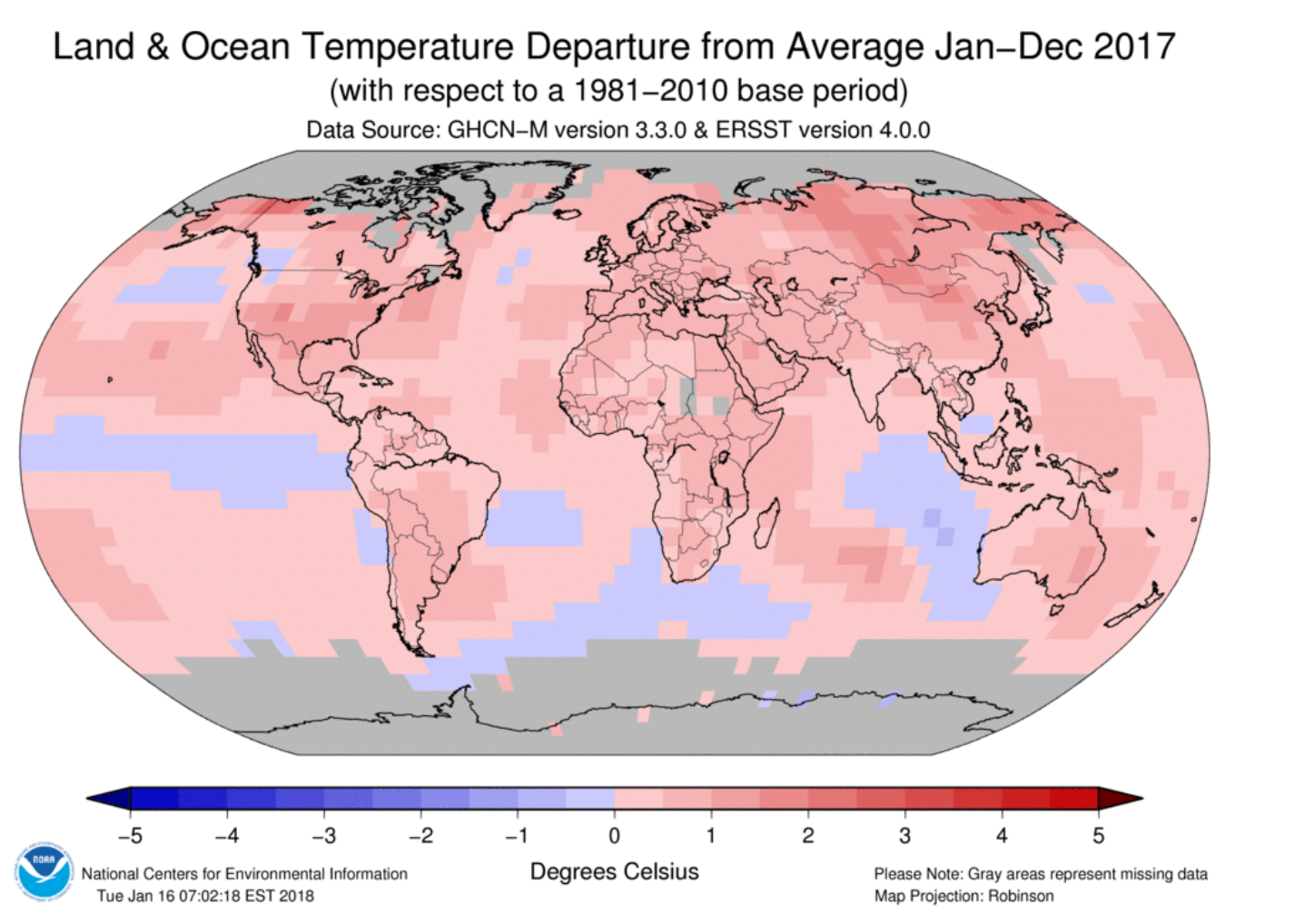
Storing CO2 in Soils can Help the Ocean



Oceans act as a planetary heat sink

Oceans stored > 80% of the excess heat energy from global warming.

Global ocean temperature in the upper 700 meters has increased by 1 deg F over the past 100 years.

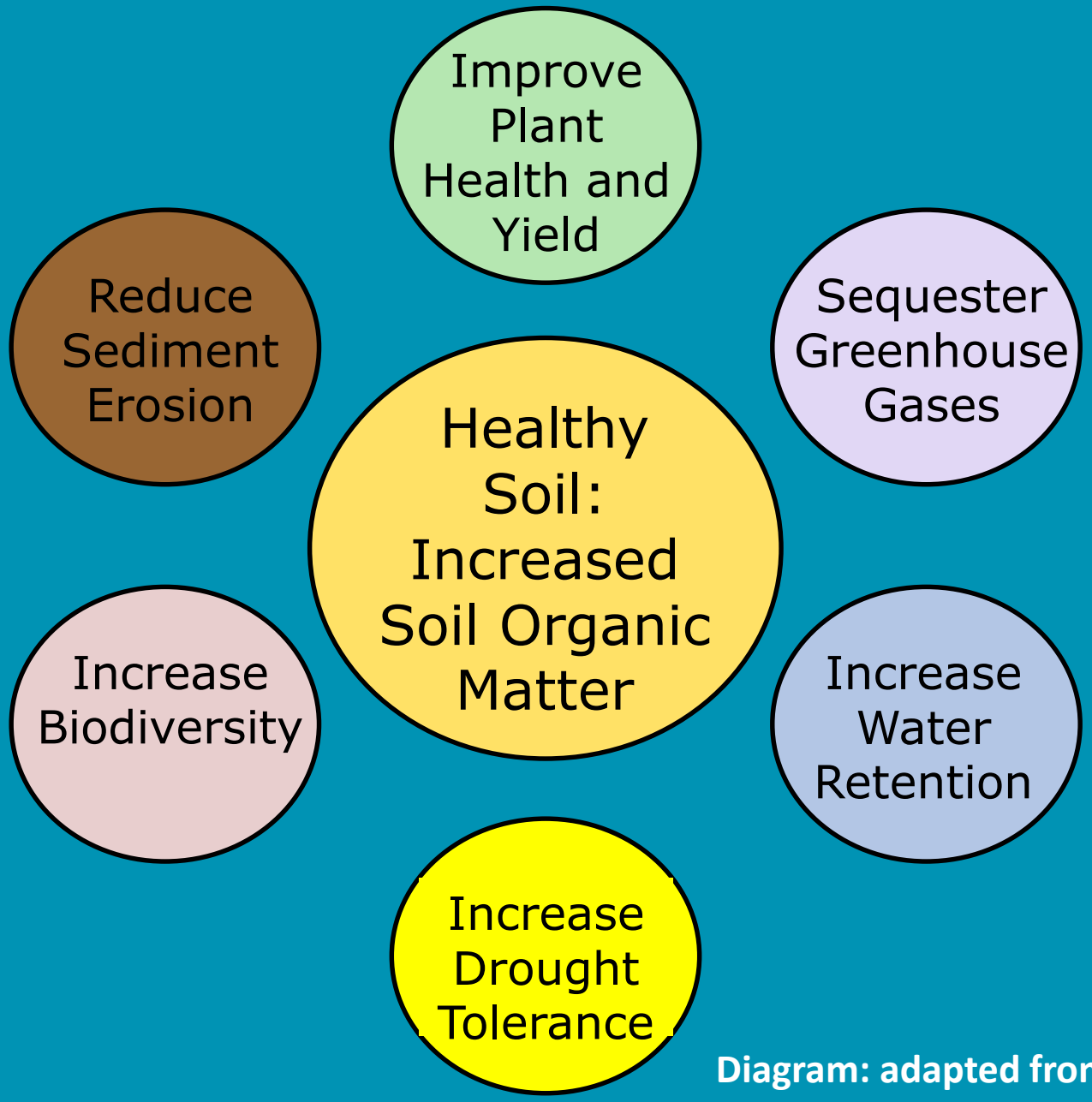
Ranching and Farming NRCS and CDFA Practices Proven to Sequester Carbon and Improve Soil Health

Cropland Management:
Reduced Tillage
Cover Crops
Mulching
Compost Application
Nutrient management
Strip cropping

Woody Cover:
Hedgerow Planting
Riparian Forest Buffer
Windbreak Establishment
Multi-Story Cropping

Grazing Land Practices:
Prescribed Grazing
Range Planting
Silvopasture
Nutrient Management
Compost Application

Herbaceous Cover:
Buffer Strips
Grassed waterway
Field border
Filter strip
Vegetative Barrier



How Soil Health Practices help the Rancher or Farmer

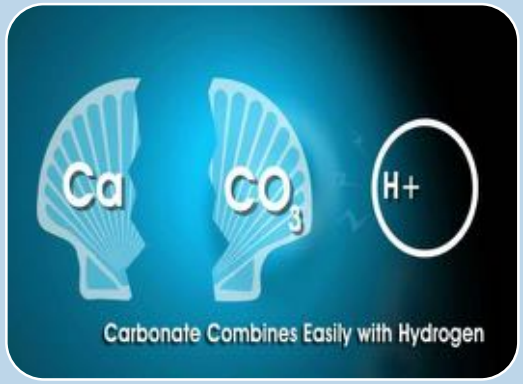
Diagram: adapted from CDFA California Healthy Soils Fact Sheet

How much can CO_2 Sequestration into Soils help?

Management Practice applied to 10% of CA's rangeland	**Sequestration Potential (Million Tons CO_2/ yr)**
Seeding forages to improve rangeland condition	2
Planting trees and shrubs on grazed grassland	4
Compost Application to Grazed Land	27

Equivalent to CA Residential GHG Production

Ocean Changes and Atmospheric Change



Physical:

Warming

Changing Currents

Sea Level Rise

Weather Extremes

Chemical

Acidification

Stratification

Hypoxia

Calcium Carbonate

Biological/ Ecosystem

Adaptation

Movement

Mortality

Ecosystem Change

Social/ Economic

Resources

Extreme Weather

Employment

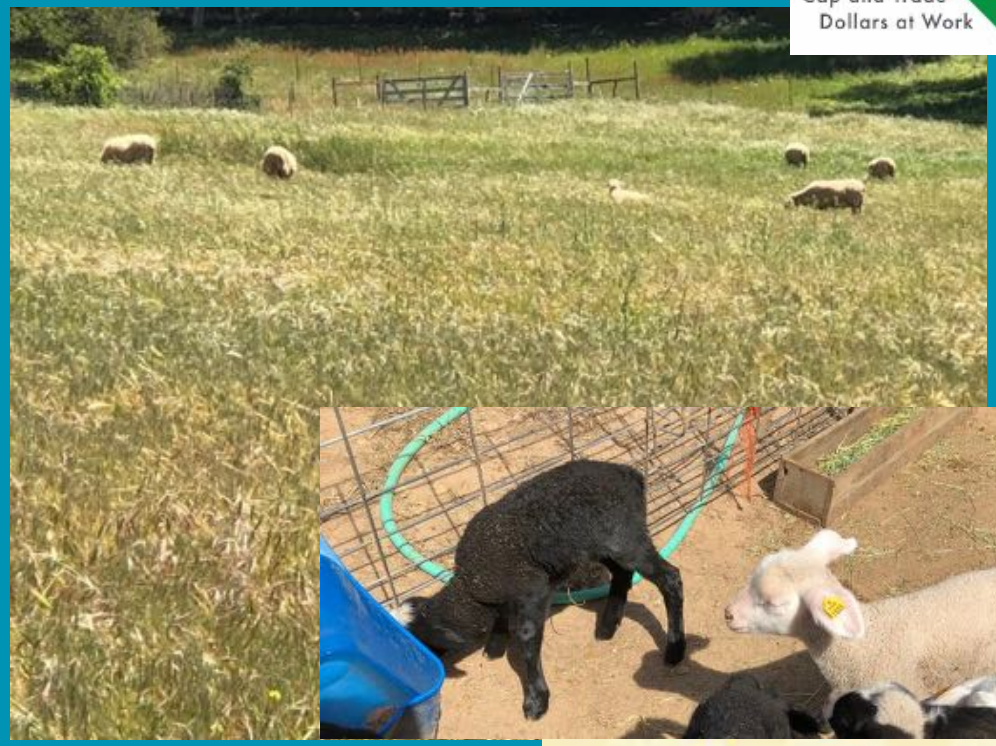
Health Risks

Shoreline Loss

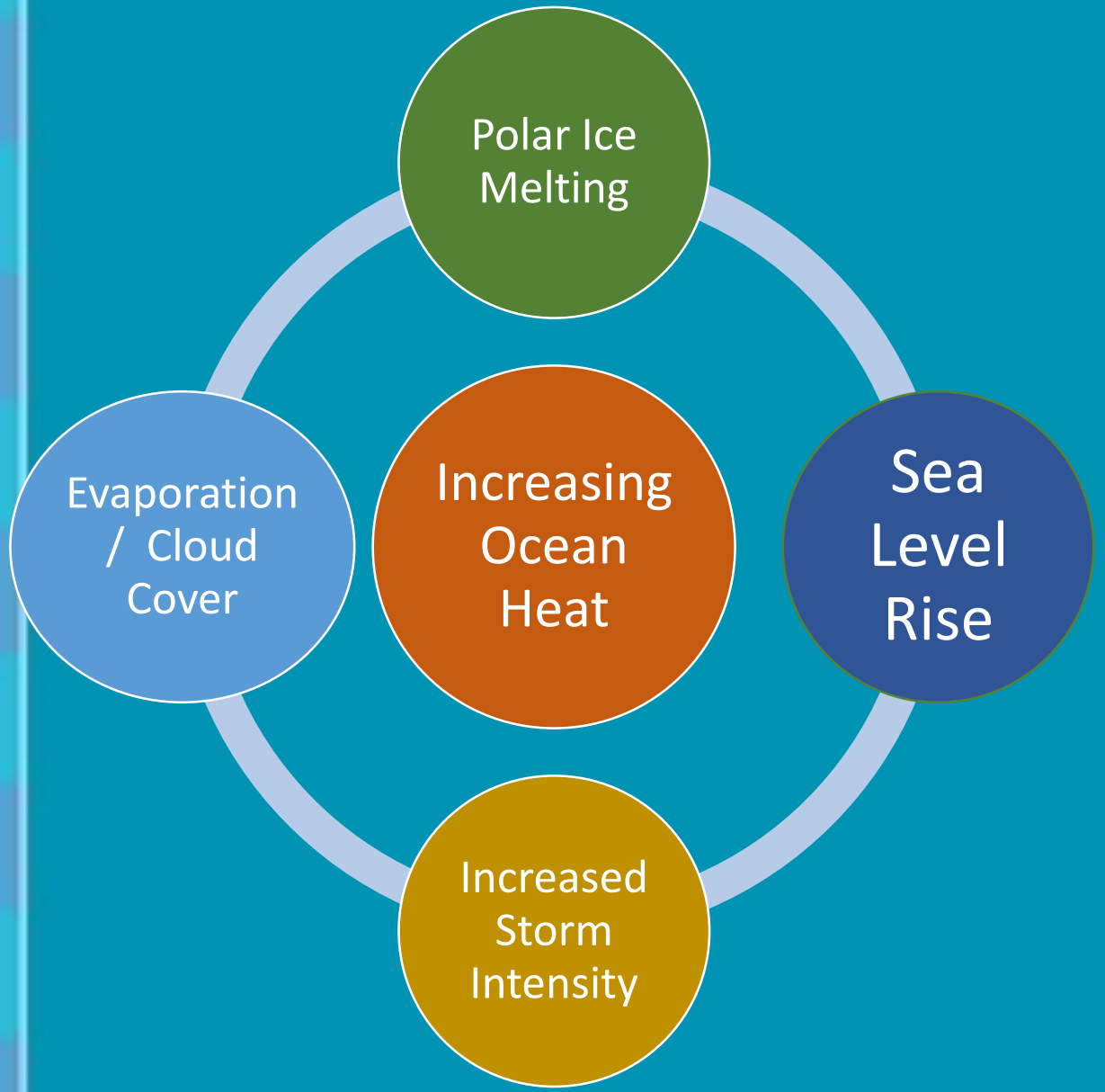
Two Small Ranches Helping the Ocean

Through Ranch Conservation Practices

FIESTA FARM
17 Acres
Goats, Chickens, Pigs
Adding Compost and Hedgerows



Monkeyflower Ranch
38 Acres
Sheep, Chickens, Pigs
Adding Compost and Hedgerows



Polar Ice Caps are melting including the Arctic, Greenland and Antarctica ice sheets.

Sea level has risen 6 inches and is predicted to raise another 3 feet by 2100 at current rates of CO2 increase.

GHG: water vapor.

Tropical storms are more frequent and more powerful.

Carbon Dioxide Absorption by Oceans

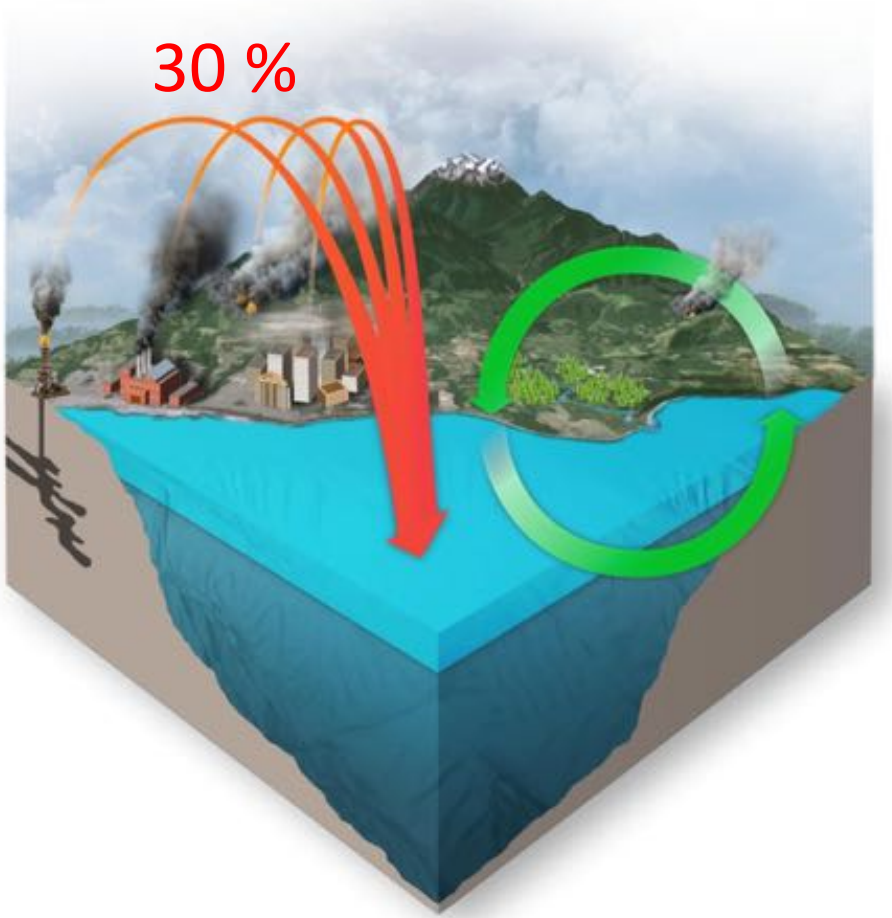


Figure: NOAA Marine Pacific Environmental Lab

About 30% of the anthropogenic CO2 has diffused into the ocean, which holds 50 times as much CO2 as the atmosphere.

The pace of CO2 storage in the oceans has slowed.

CO2 uptake by the ocean is temperature and pH dependent. At higher temperatures, less can be stored.

Ocean Acidification and Calcium Carbonate Solubility

Graphic: Chris Gobler, Stony Brook University

Shells are formed of Calcium Carbonate

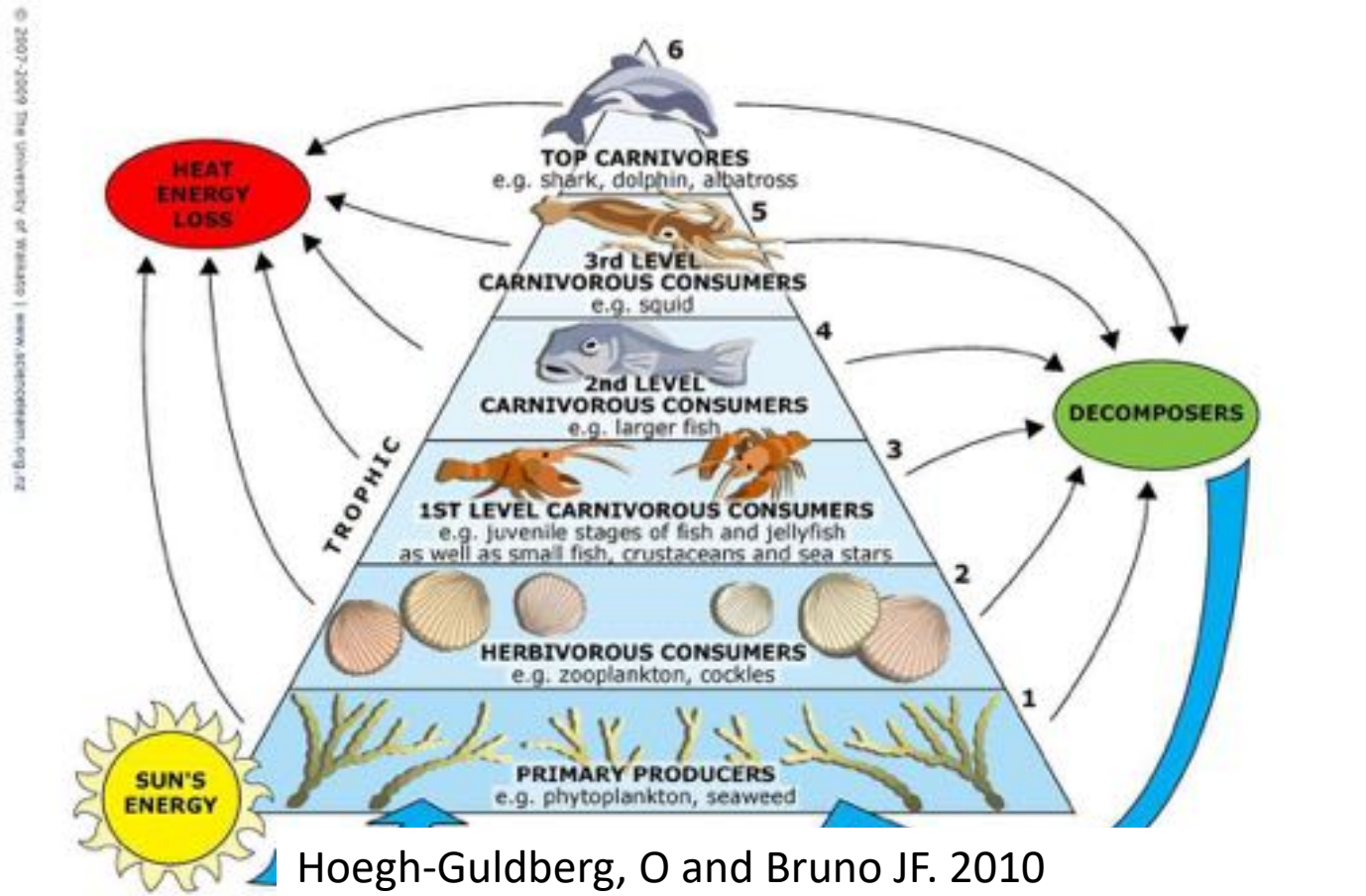
Acidification changes ocean chemistry and calcium carbonate is no longer as available

Crabs, mussels, clams and other shell forming organisms have difficulty, esp in their larval stage.

Adaptation may be possible.

Climate Change is Altering Marine Ecosystems

"The impacts of anthropogenic climate change so far include decreased ocean productivity, altered food web dynamics, reduced abundance of habitat-forming species, shifting species distributions, and a greater incidence of disease."



Hoegh-Guldberg, O and Bruno JF. 2010

Marine Ecosystems follow a trophic level food web as do terrestrial systems.

Not as much is known about marine : size complexity and inaccessibility..

Changes in populations of primary producers are carried up the web.

Response of marine life?

- Movement/ Migration
- Adaptation
- Δ Susceptibility
- Die Off
- Ecosystem Disturbance

Photos: Steve Lonhart

CO2 Sequestration into Soil

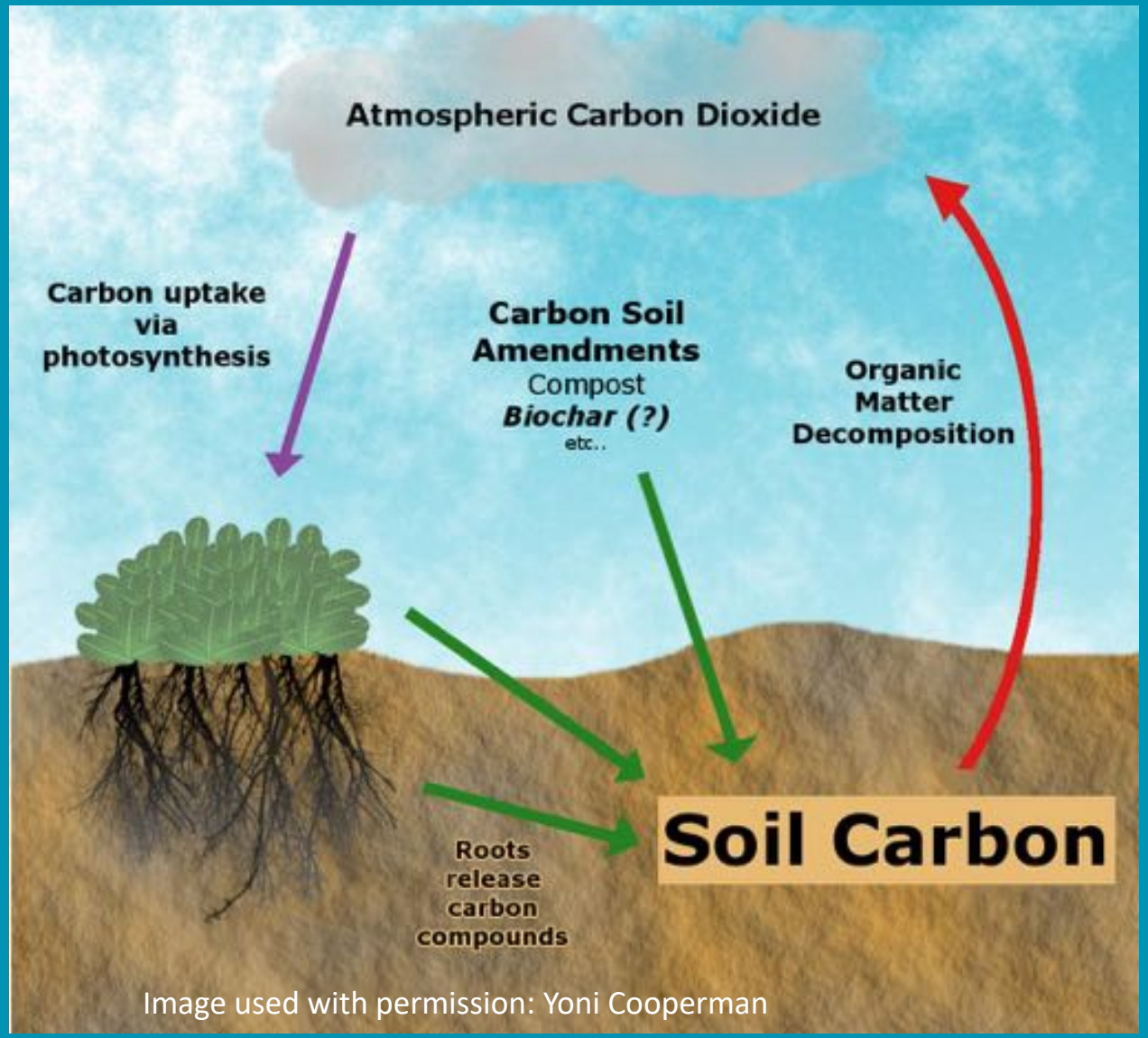


Image used with permission: Yoni Cooperman

Carbon is stored in the soil when compost and other amendments are added.

It can also be added through root structures.

Carbon is released from the soil when the soil is disturbed through physical or chemical processes.

Practices can also increase above ground carbon storage in plants.

Monkeyflower Ranch Oak Trees

Monkeyflower Ranch Hedge Row

We Are a Solutions Oriented People

Consumer Choices

- Buy from Ranchers and Farmers Using Healthy Soils Practices
- Find out by educating yourself and asking

Active Citizen Choices

- Follow climate agriculture legislative decisions
- Voice your opinion
- CalCAN: CA Climate and Agriculture Network

Visit Farms and Ranches – Attend Demonstration Events for Healthy Soils Projects. Invite a farmer/rancher to go with you.

Thank-you!
Questions??

PDF Sign Up Sheet: Legibly print your name and email address to Receive PDF documents on Ocean Change, Carbon Sequestration into Soil and Plants on Working Lands, or on Soil Health.

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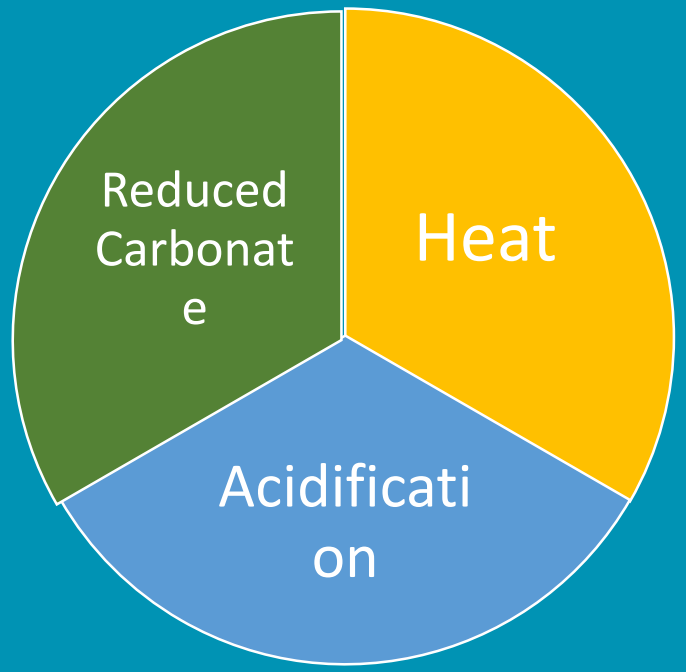
Effects on Biology and Ecology



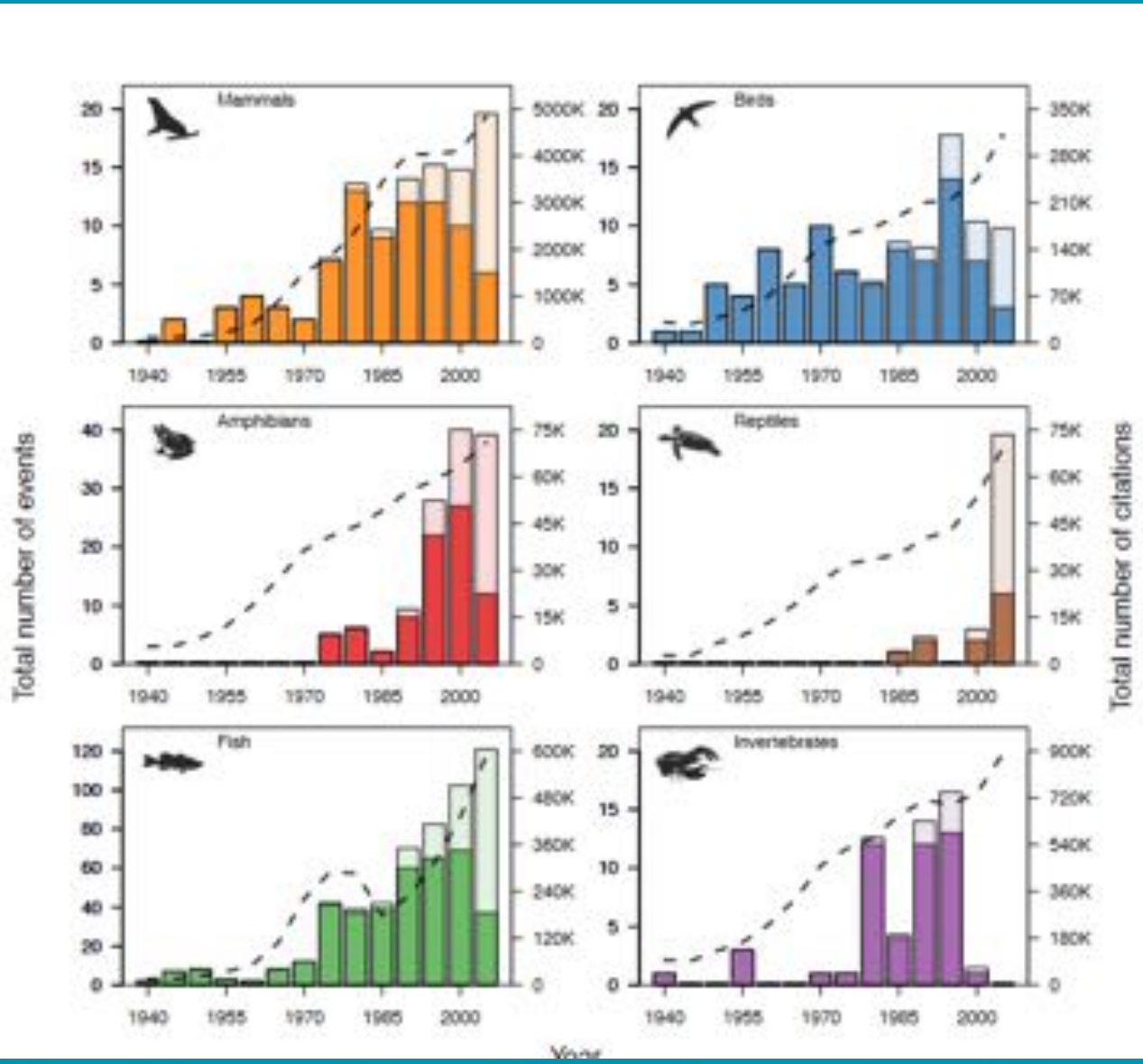
Lowering of Biodiversity as organisms and communities adapt to changing conditions

Primary production has decreased by 6% since the early 1980's, with more production lost at higher latitudes.

Habitat forming species are profoundly influenced, eg corals, sea grass, mangroves, salt marsh grass, and oysters.

Polar ice melting determines the timing of phytoplankton blooms and influences polar food web dynamics. Krill have reduced by 75% over the last 40 years.

Mass Mortaility Events



Cassin's Auklet mass die off in 2013-2015 due to ocean warming and a shift in zooplankton to lipid-poor species.

Figure: Frey et al. 2015. PNAS article