Chapter 2
The Benefits of the Soil Food Web

Lecture 10 – Structure (Part 2)

A Healthy Food Web Will:

- Make nutrients Available at rates plants require (eliminate fertilizer) leading to flavor and nutrition for animals and humans
- Retain Nutrients (stop run-off, leaching)
- Suppress Disease (competition, inhibition, consumption; no more pesticides!)
- Build Soil Structure (reduce water use, increase water holding capacity, increase rooting depth, create aerobic conditions)
- Decompose Toxins

Building Structure in Clay Soils

1. Much of the chemical basis of soil structure lies in how the clays bind to each other in the soil.

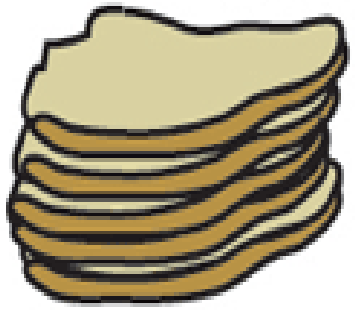
2. To get air and water to move into the soil, and then be held in the soil structure, clays must be flocculated.

3. To flocculate the clays, the exchangeable Ca:Mg ratio must be correct, given the type of clay.

Collapsed vs Well-Structured Clays

Adapted from. J. Walworth. Soil Structure: The Roles of Sodium and Salts. University of AZ

Collapsed



Increase
Ca+

More than
Mg+

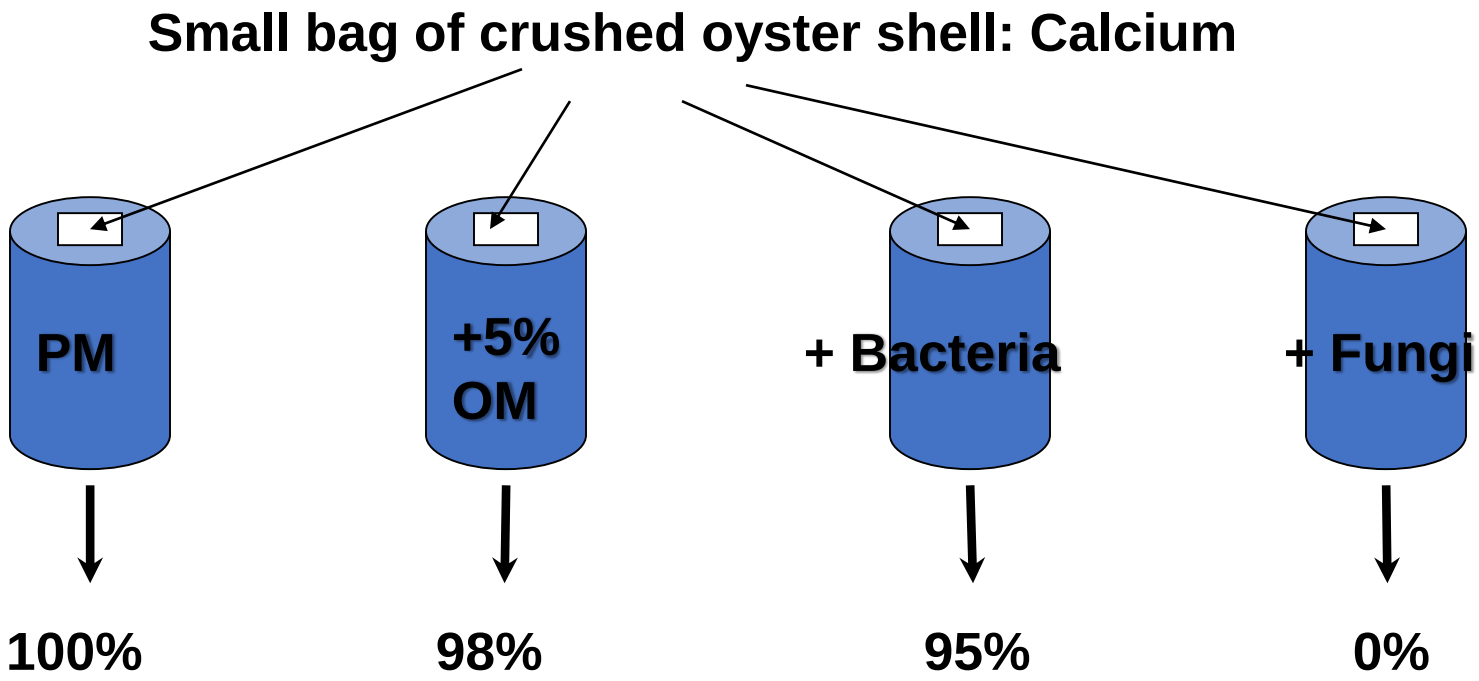
Flocculated

Ca:Mg Range 5:1 to 7:1

Victorian Resources Online: Soil Structure

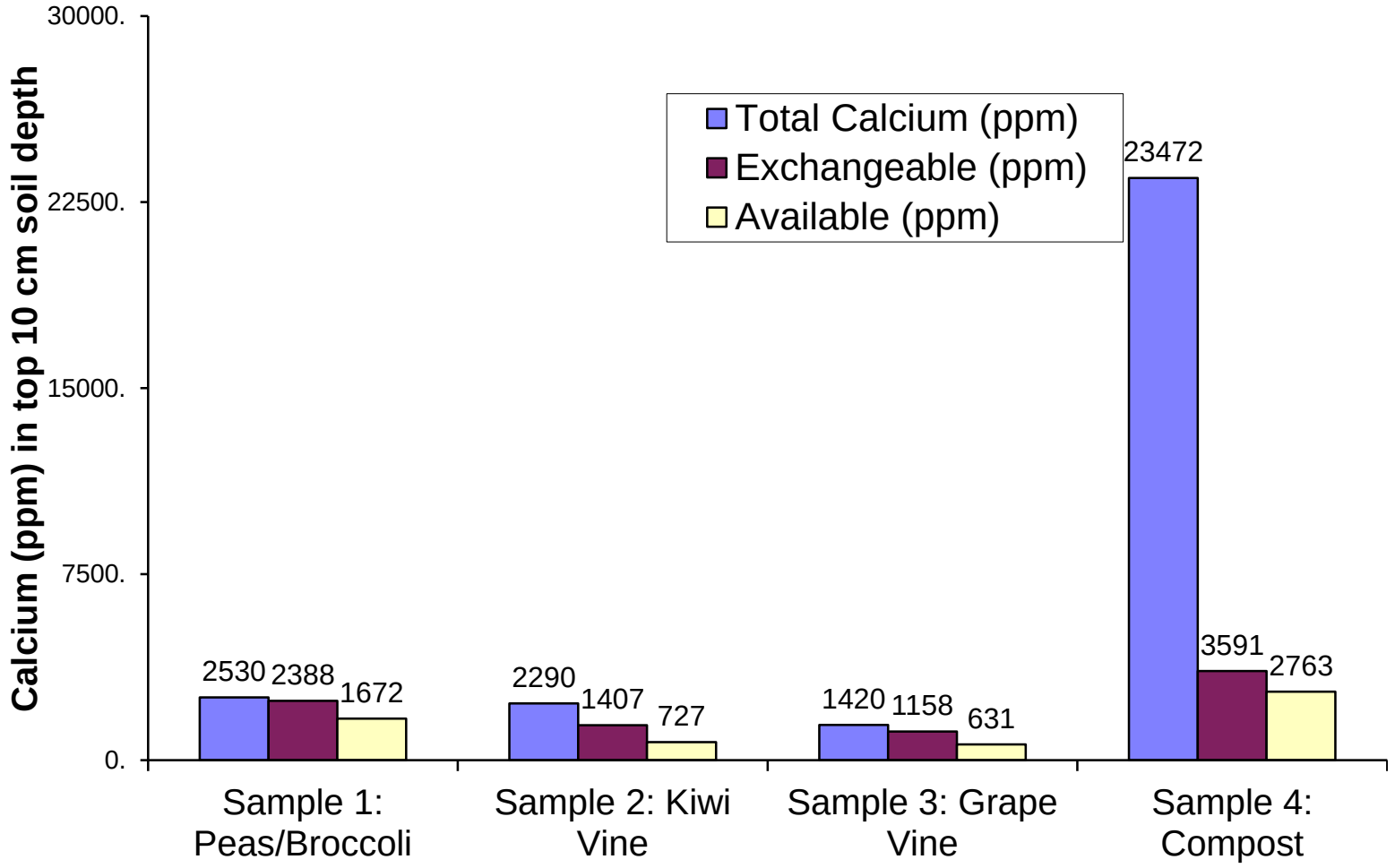
Where Are Nutrients Retained?

Parent material held no Ca. Sterile OM held only 2% of the leachable Ca, bacteria and OM held 5% of Ca, when fungi present, **ALL CALCIUM held**.



Percentage of the 300µg Ca leached from the oyster shell

Nutrient Levels in BioComplete™ Compost



Environmental Analysis Lab, SCU, NSW, AU

Biology and chemistry working together properly build soil physical structure

What comes first?

1. Clays (if present) must be flocculated.
2. Microaggregates must be built.
3. Macroaggregates must be built.
4. Air passageways and hallways must be present.

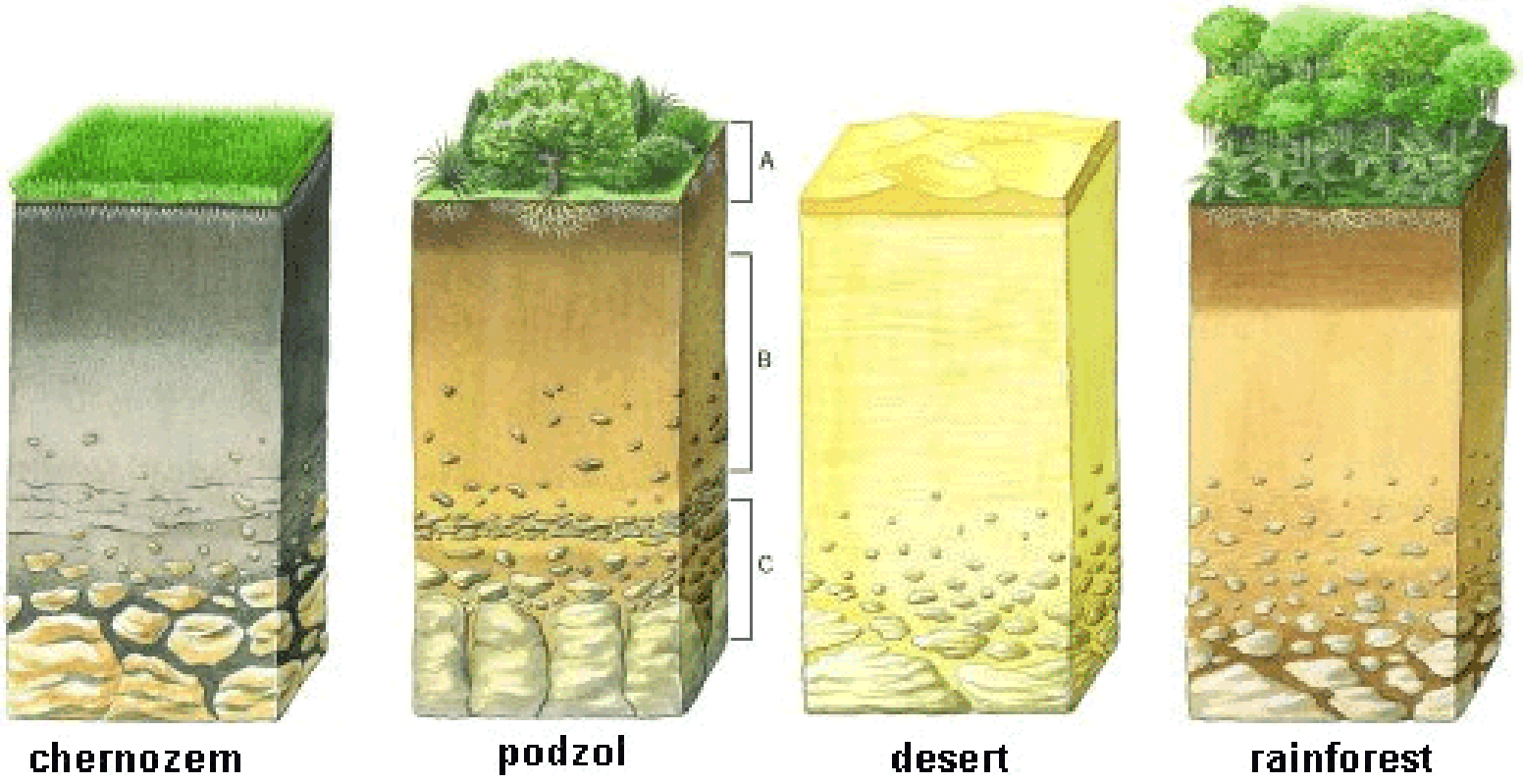
If passageways and hallways and pores are present and stable, then…….

- Water infiltrates easily into the soil and moves into the medium evenly
- Air moves freely through the soil
- Nutrient cycling occurs normally
  - Aerobic bacteria and fungi can grow normally
  - Protozoa, nematodes and microarthropods consume bacteria and fungi and release plant-available nutrients
- Roots grow deep

Soil Profiles

Soil profiles, or horizons (O, A, B, C) are slightly different in different climates, but all require soil life to develop.

Note incorrect root depths in all pictures.



Large Scale Erosion

Collateral damage on soil life is far-reaching.

Erosion and run-off.

Compaction (heavy equipment) and burning (few foods left to feed the organisms), prevented soil life from holding nutrients and soil in place, so all systems downstream were harmed.

Adding Biology

Swiss Chard in Petaluma, California

- Front area sprayed with one BioComplete ™ Liquid application
- Back area, normal organic practices
- From Daniel and Caitlin McLeod

An example from Hendrikus Schraven

- The engineering approach has been used.
- Need to use biology to solve problems.
- Using biology requires education and knowledge.
- Organisms are NOT inert chemicals, can’t treat them as such.
- Organisms need air, water, food and housing (soil structure).
- Even dormant, organisms have to be treated right, or they won’t work for you.

How do you fix this?

Greater than
1:1 slope

Jan 2000
soildynamics.com

Steps to Fix Food Web

- **Measure** soil biology and soil chemistry
- **Determine** soil nutrients and biology needed
- **Biology:** Use BioComplete™ Compost and/or BioComplete™ Liquids to add an INOCULUM of the desired organisms (diversity!)
- **Chemistry:** N, P, K, Ca:Mg, micronutrients etc. added as BioComplete™ Soil Amendment and/or organic fertilizer in "Essential Soil"
- **Foliar** BioComplete™ Tea applied through summer
- **Pesticide** residue prevented full recovery
- **BioComplete™ Soil Amendments** added in fall to balance required nutrients

Biological Analysis Through the Year

1. Initial soil biology
2. Add BioComplete™ Soil Amendments with fish, Ca, nutrients
3. Assess soil again after six months

AB	**Active Bacteria**
TB	**Total Bacteria**
AF	**Active Fungi**
TF	**Total Fungi**
F	**Flagellate**
A	**Amoebae**
C	**Ciliate**

Sample	AB	TB	AF	TF	F	A	C	Nematode
Soil (Dec)	2	135	1	25	0	0	0	21
BioComplete™ Soil Amendments	41	850	5	800	36,000		3,700	17
Soil (July)	13	317	8	139	20,000		2,600	14
Desired Range	**25**	**300**	**25**	**300**	**20,000**		**5,000**	**30**

Same Slope – July 2000

Getting the right biology back in the soil

- Tie up nutrients that otherwise leach, run-off, erode
- Make nutrients available at rates plants need, when plants need them
- Compete with, inhibit, consume diseases, pests
- Build soil structure so air and water can go deep into soil, so roots can follow
- Move non-plant-available nutrients into plant-available forms

Before work by Hendrikus Schraven Landscaping
January 2000

Before work by Hendrikus Schraven Landscaping January 2000

This tree did not take swimming lessons!

Soil Improved by Adding Biology

BioComplete™ Soil Amendments were used to improve the soil over a 7 month period.

AB	**Active Bacteria**
TB	**Total Bacteria**
AF	**Active Fungi**
TF	**Total Fungi**
F	**Flagellate**
A	**Amoebae**
C	**Ciliate**

Sample	AB	TB	AF	TF	F	A	C	Nematode
Soil (Dec)	0.3	75	0	3	0	0	1,300	113
BioComplete™ Soil Amendments	41	850	5	800	36,000		3,700	17
Lawn	3	215	13	197	25,000		1,300	7
Garden	22	117	21	293	75,000		4,300	14
Desired Range	**25**	**300**	**25**	**300**	**20,000**		**5,000**	**30**

Great Results Within 7 months

Hendrikus Schraven Landscaping

If you cut the top, do the roots fall off?

Hendrikus Schraven holding ryegrass planted July 15, 2002

Harvested Nov 6, 2002

Mowed twice to ½ inch

70% Essential Soil,

30% BioComplete™ Compost/organic fertilizer

BioComplete™ Tea added once

No weeds, no disease

www.soildynamics.com

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