



Cornell University
Cooperative Extension and
Department of Horticulture

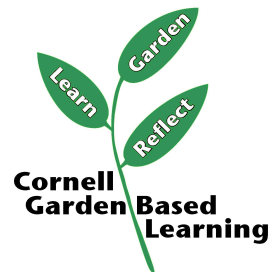
Ecology for Garden Design

Author: Steve Gabriel

This presentation was originally created for use in the fall of 2013 for the Cornell Garden-Based Learning Regional Training for Cornell Cooperative Extension educators and Master Gardener Volunteers. This training kicked off our CCE 2014 Growing Season Educational Campaign: Designing for Garden Ecosystems.

Garden design is critical for setting the stage for garden success and environmental stewardship. In this training we consider a **polycultures** approach to garden design. The concept embraces growing multiple crops in the same space, in imitation of the diversity of natural ecosystems.

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Ecology Defined

- Oikos = home
- Study of the relationship between organisms and their environment
- Study of the relationship between organisms, their environment, ***and each other***







PARADISE LOT

TWO PLANT GEEKS, ONE-TENTH OF AN ACRE

and

THE MAKING OF AN EDIBLE
GARDEN OASIS IN THE CITY

ERIC TOENSMEIER

WITH CONTRIBUTIONS FROM JONATHAN BATES



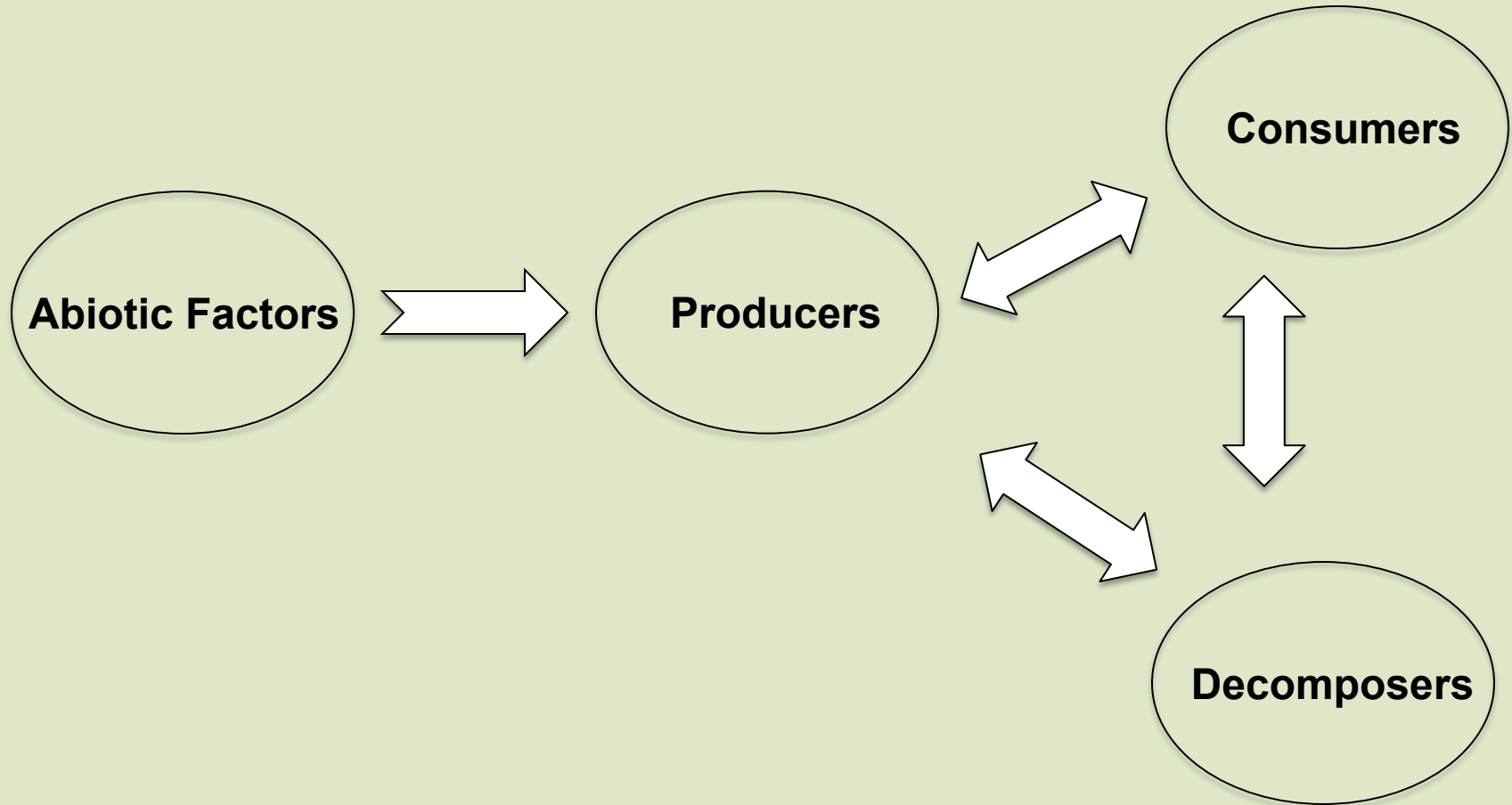


Ecology for Gardeners

STEVEN B. CARROLL and STEVEN D. SALT



Nature is a web



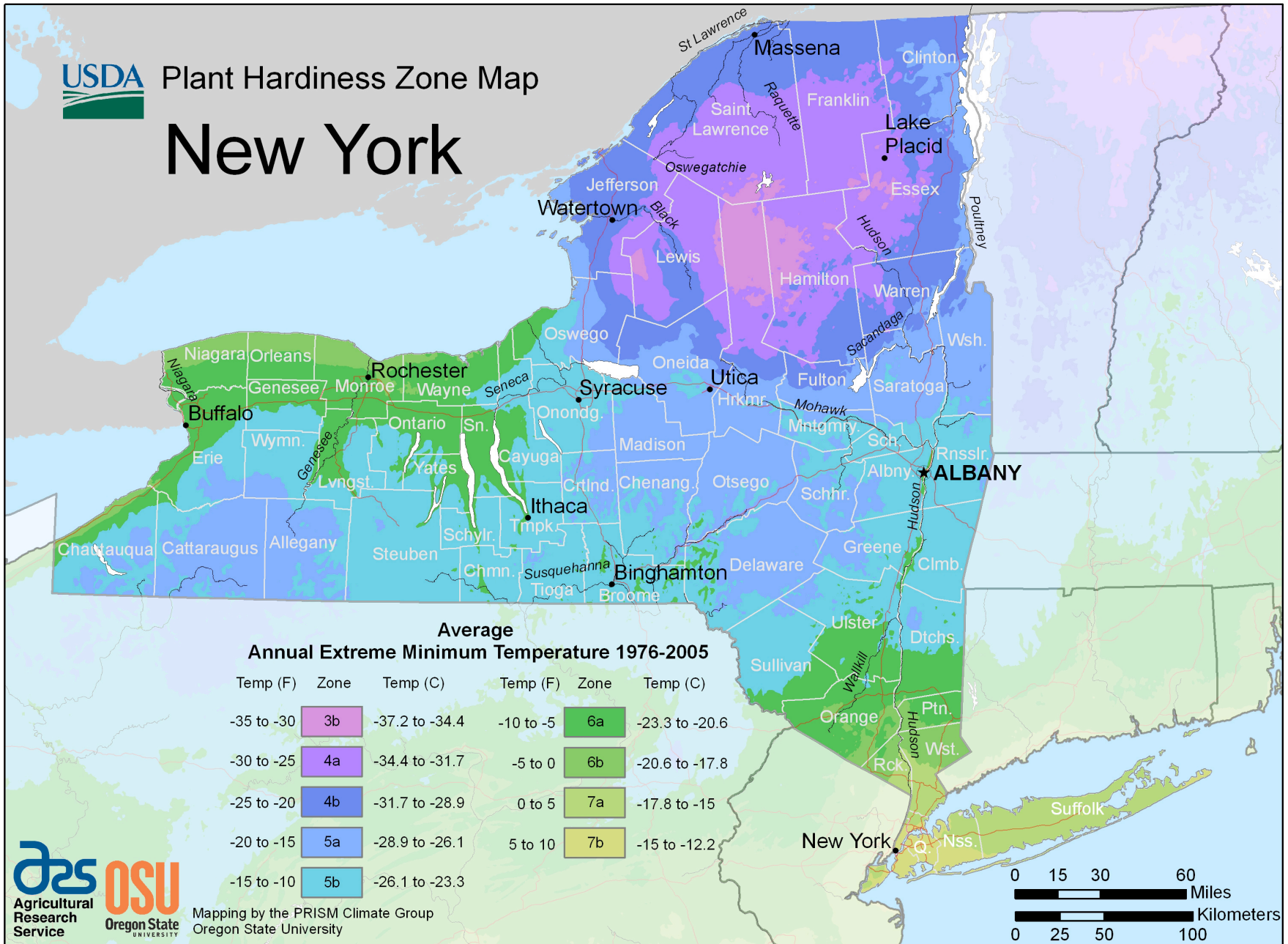
Abiotic Factors

- ***Non – living*** elements of the ecosystem
- *Precipitation, Landform, Sun, Soil, Geology, Climate, Microclimate, Wind, Water, etc*
- **“Limiting Factor”**
 - An environmental variable that limits or slows the growth of an organism/system:
 - ***Sets limits to what we can do!***



Plant Hardiness Zone Map

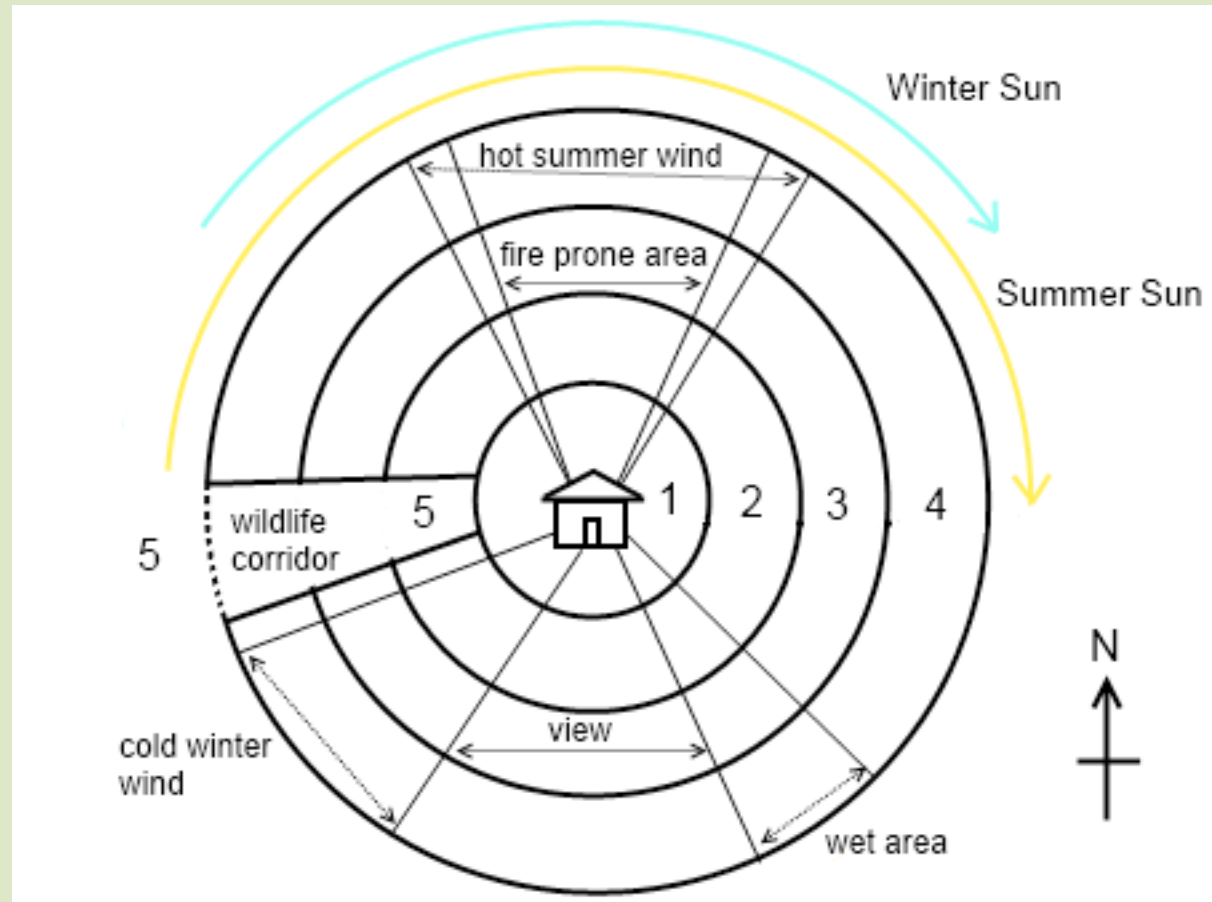
New York



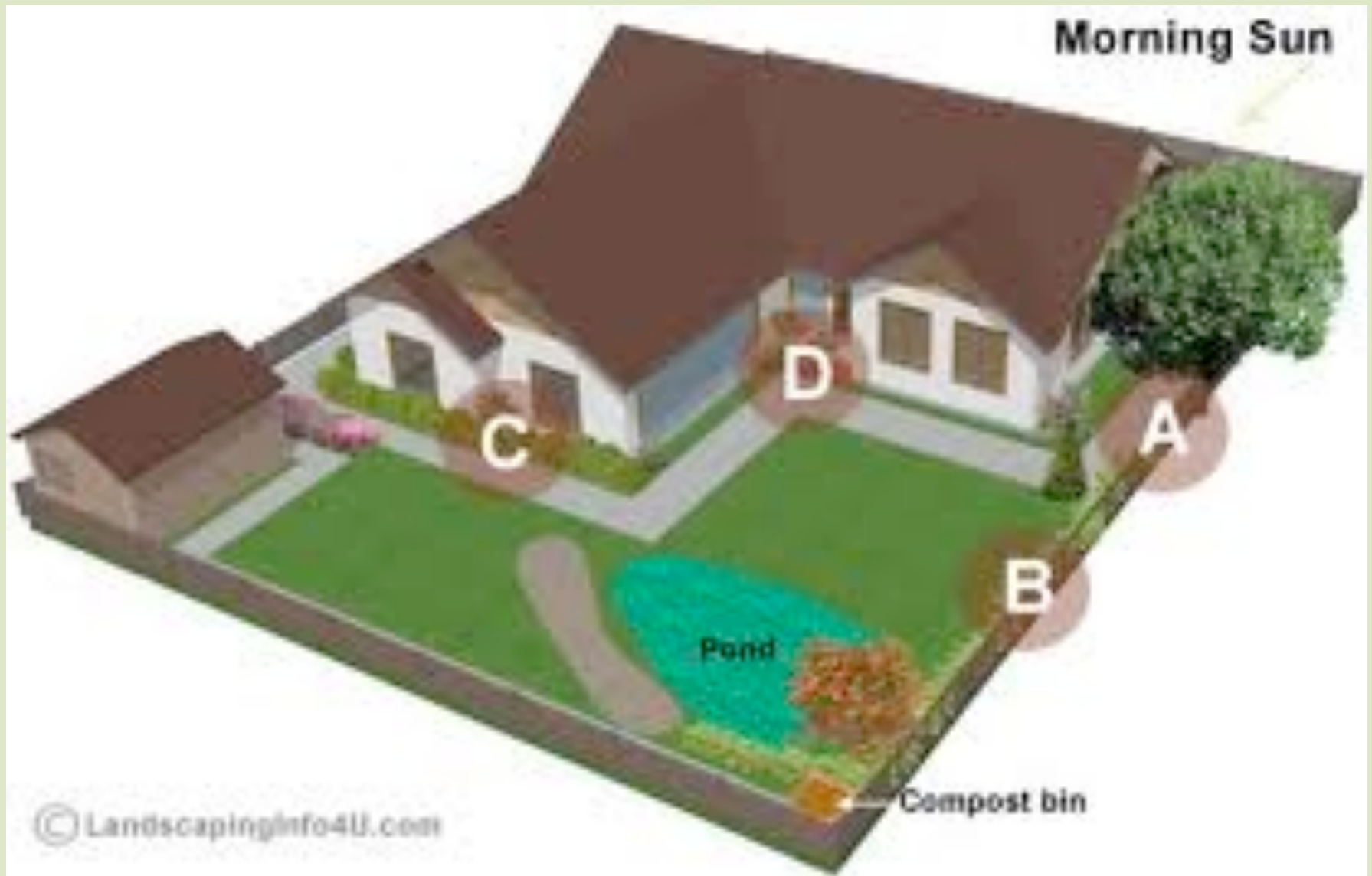


gardening.cornell.edu/sectors

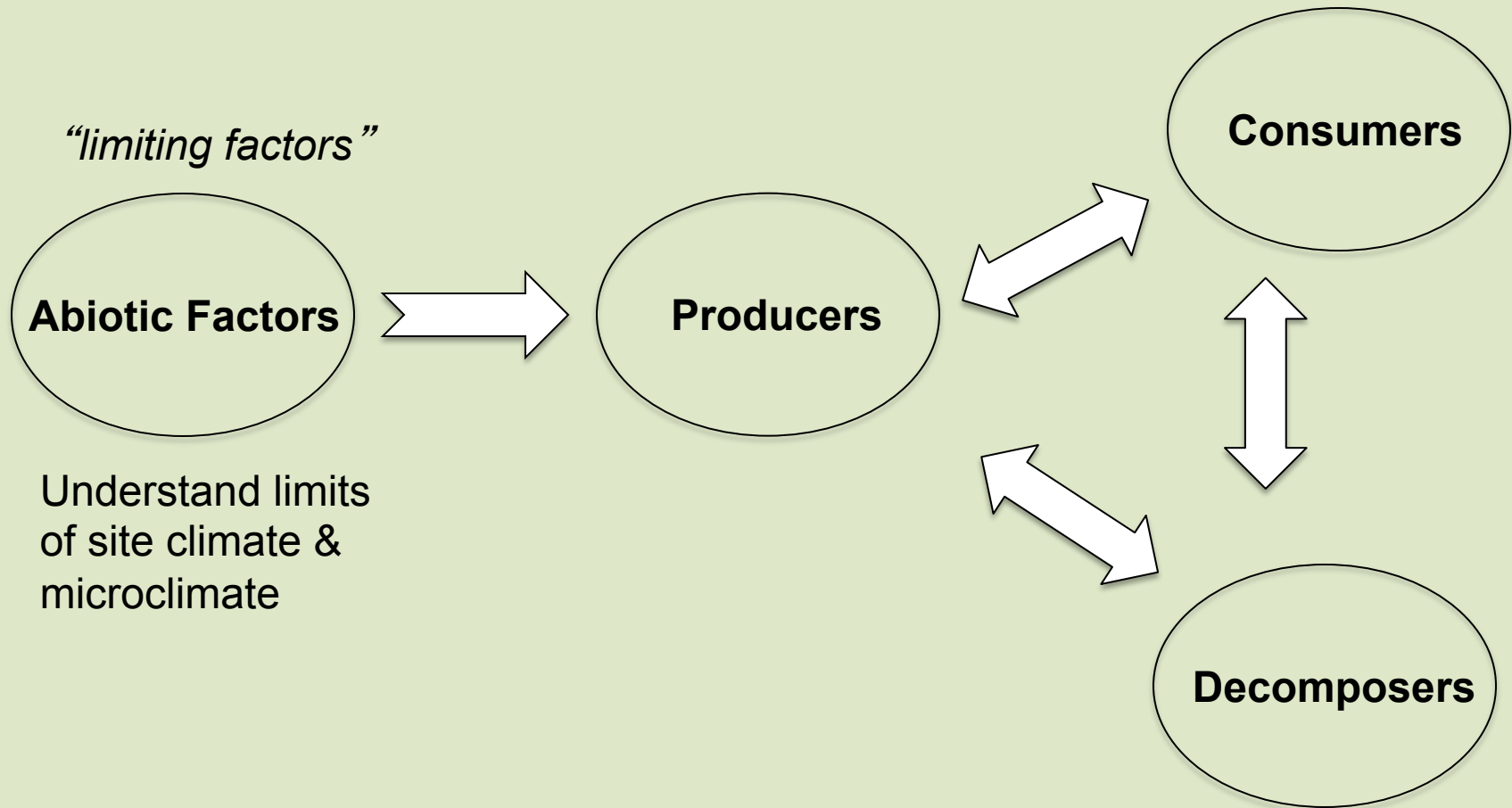
- Sun
- Shade
- Wind
- Water
- Noise
- Visual
- Wildlife
- Pollution
- Traffic



Microclimate



Basic Ecology



Producers = plants

Only organisms that can
Photosynthesize sunlight



Producers = plants

Only organisms that can
Photosynthesize sunlight

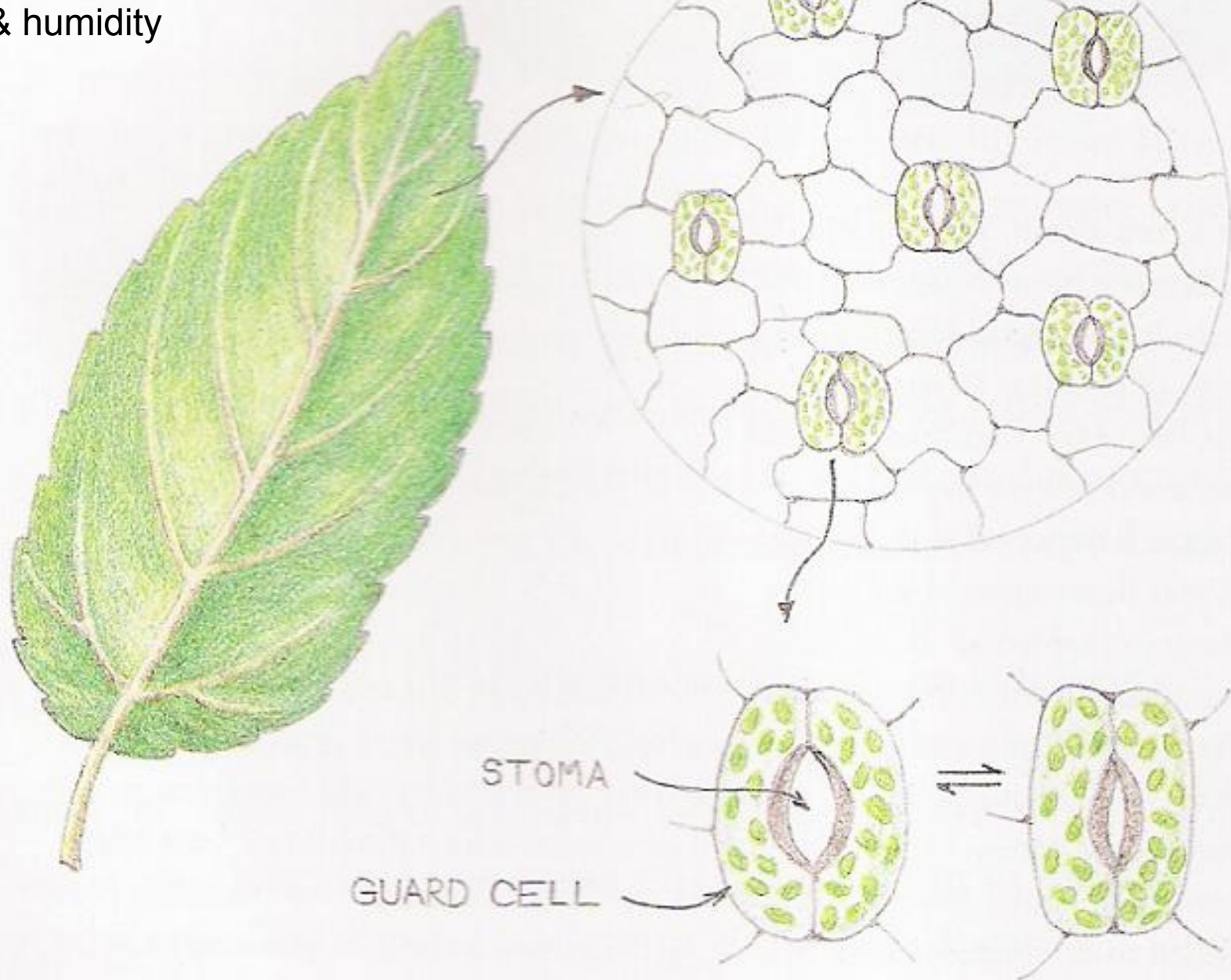
“Catch &
Store
Energy”



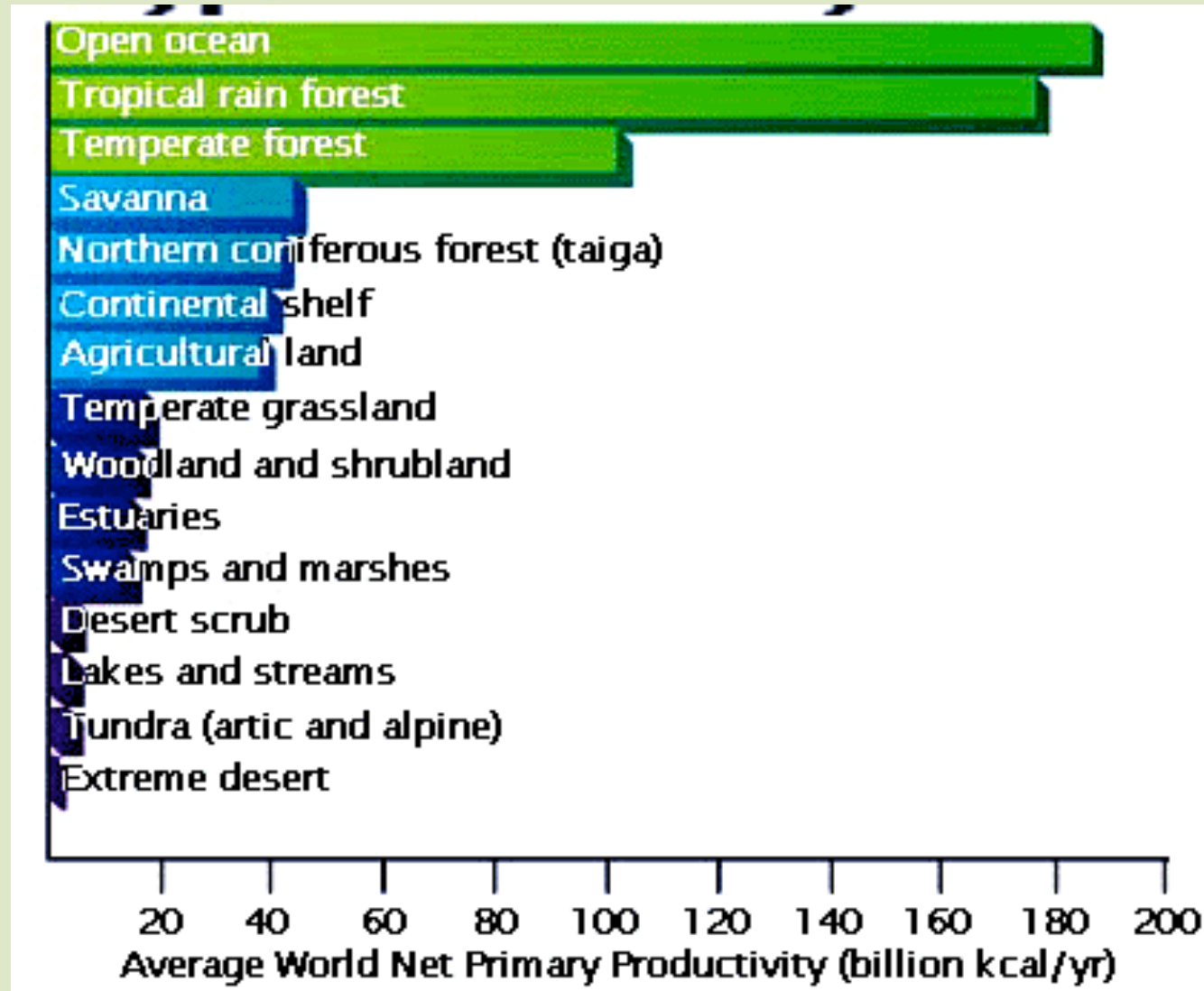
Plants transform sun energy to
wood, seeds, fruits, roots, & shoots



Trees and plants respire
water, modify temperature
& humidity

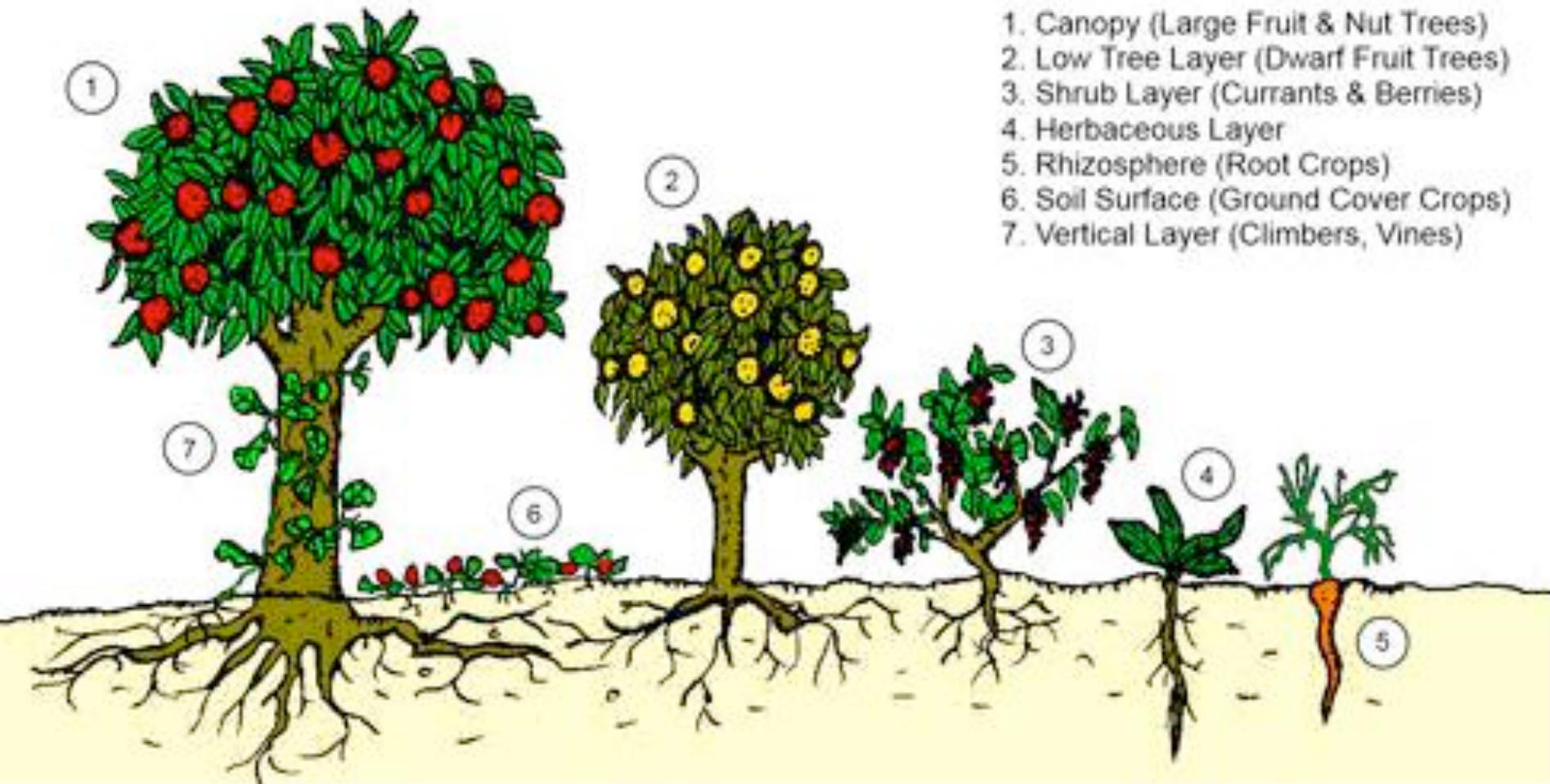


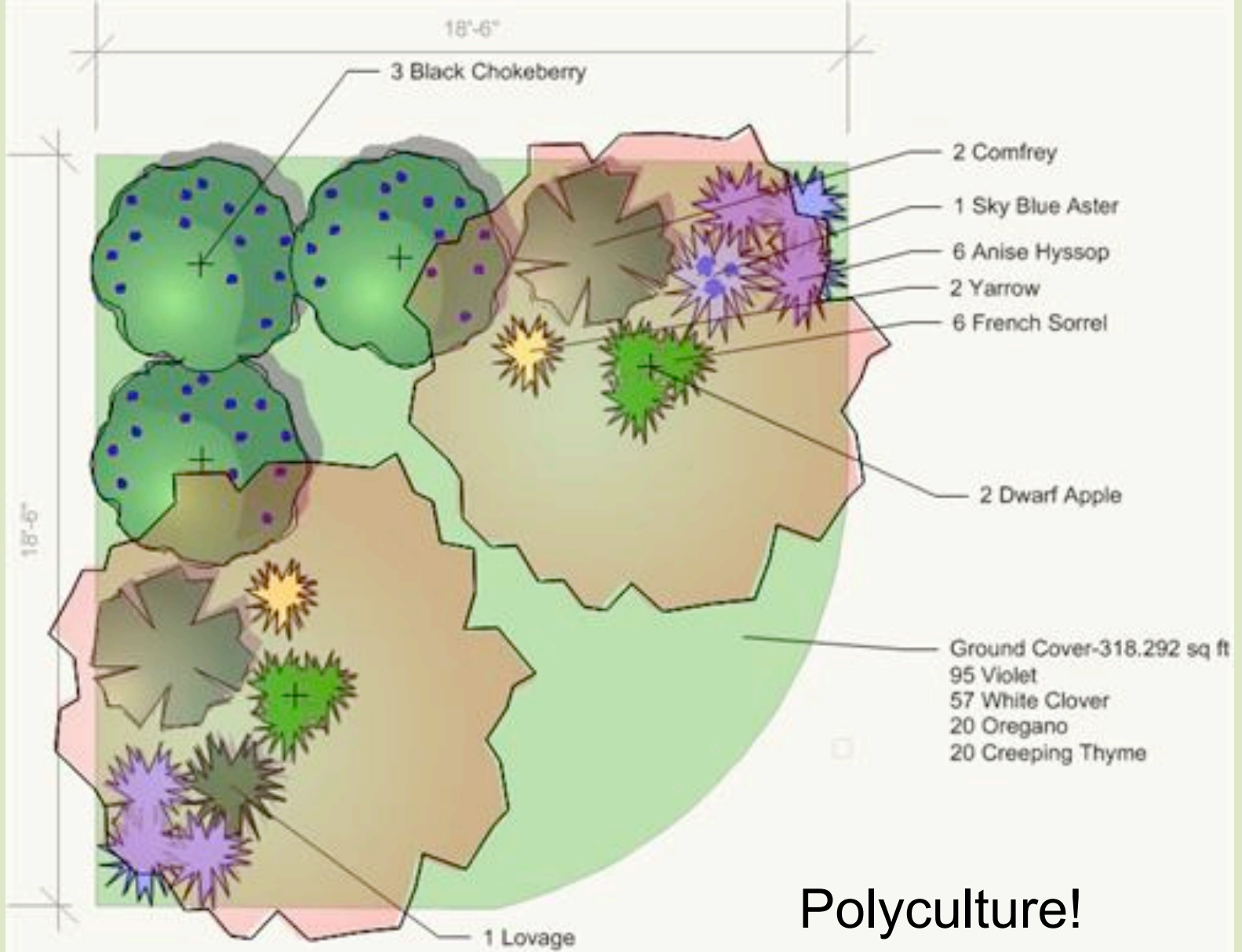
Biomass production – the *root of ecosystem wealth*



The forest as our model

The Seven Layers of a Forest Garden





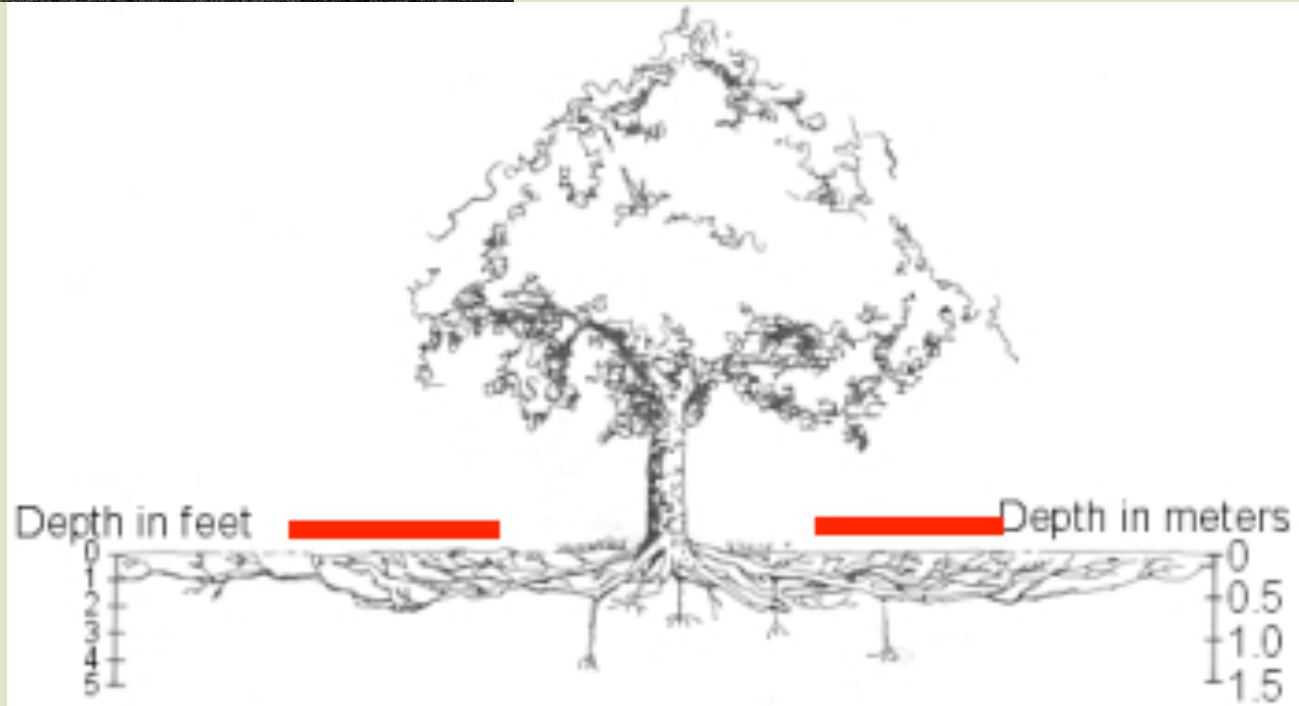
Polyculture!







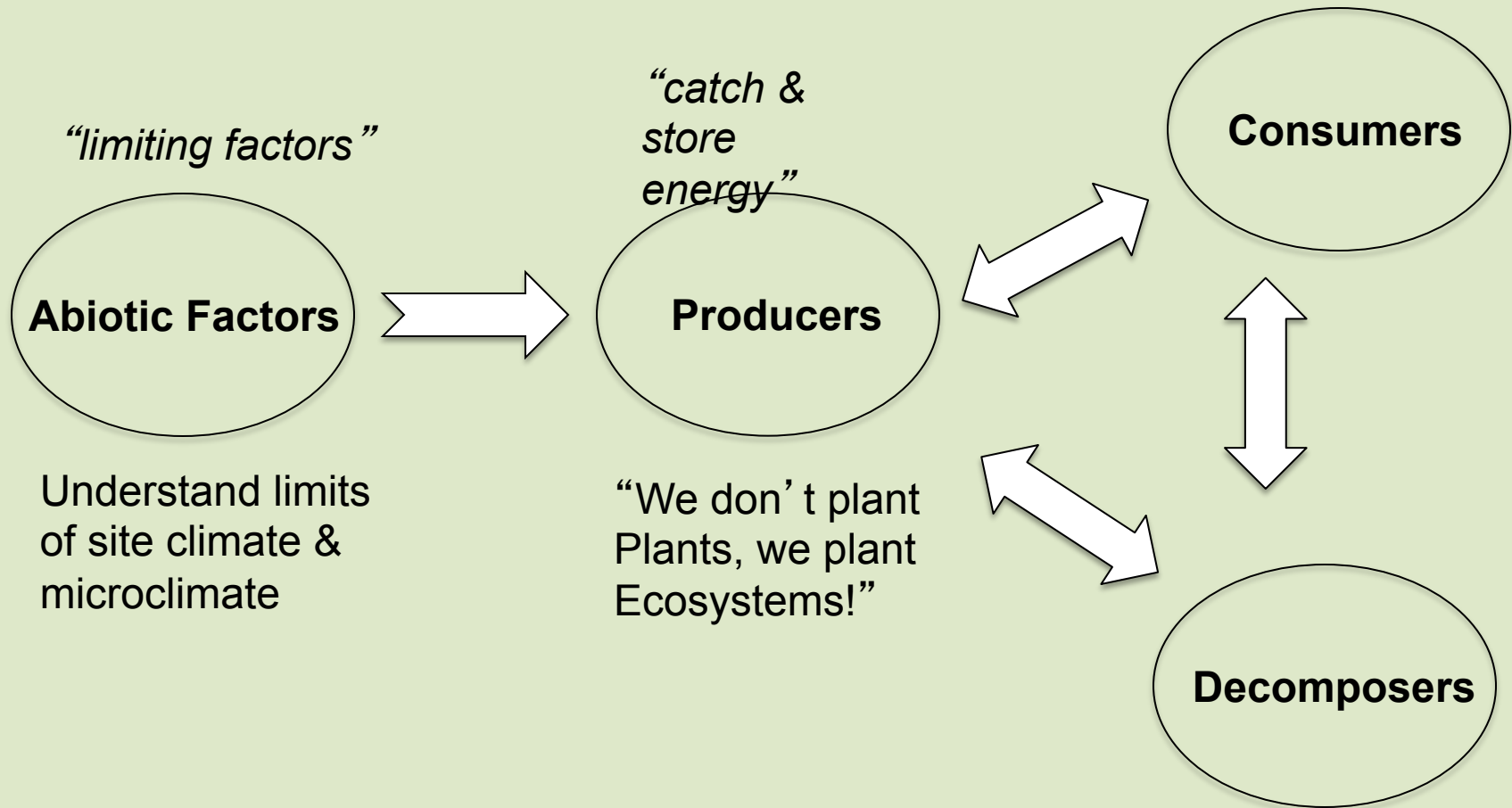
VS.





“We don’ t plant plants,
we plant ecosystems”

Basic Ecology



Consumers = Animals



- Move **fertility**, seed, pollen, materials

Pollination



Not just honey bees

Green Sweat Bee



Bumble Bee



Leaf Cutter Bee



THE XERCES SOCIETY GUIDE

Attracting NATIVE POLLINATORS

Protecting North America's Bees and Butterflies

Ensure pollination in your
garden, orchard, or farm



Identify the flower-visiting
insects of your region



Provide host plants and
nesting sites for bees and
butterflies



Create a landscape that is beautiful, diverse,
and pollinator friendly



FOREWORD BY DR. MARLA SPIVAK

Domestic animals cycle fertility



Importing fertility from offsite



“Importing” fertility

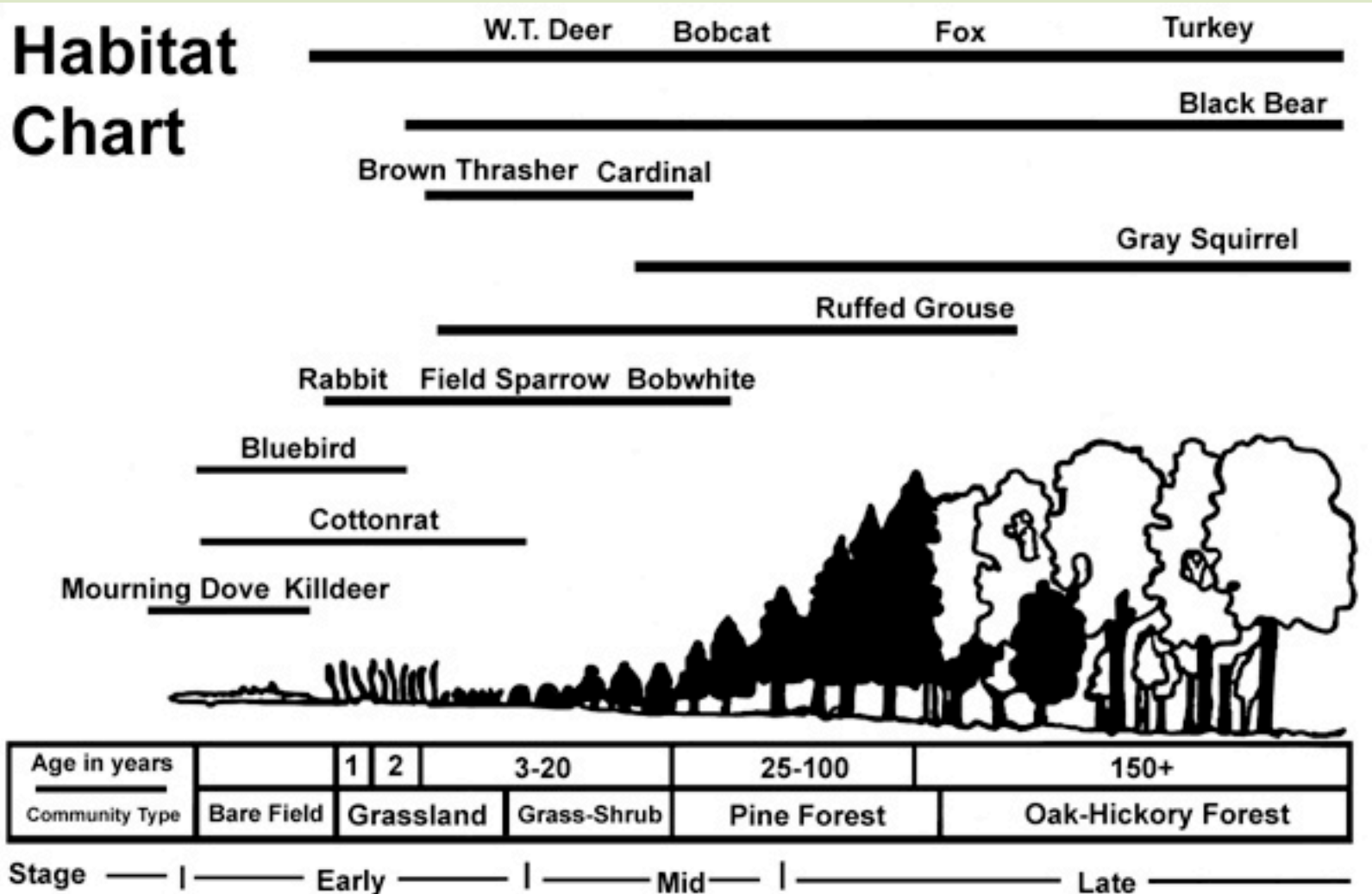
Winter food sources, diverse plantings & edges, nesting habitats

- Bluebirds
- Chickadee
- Nut Hatches
- Sparrows
- Swallows
- Woodpeckers

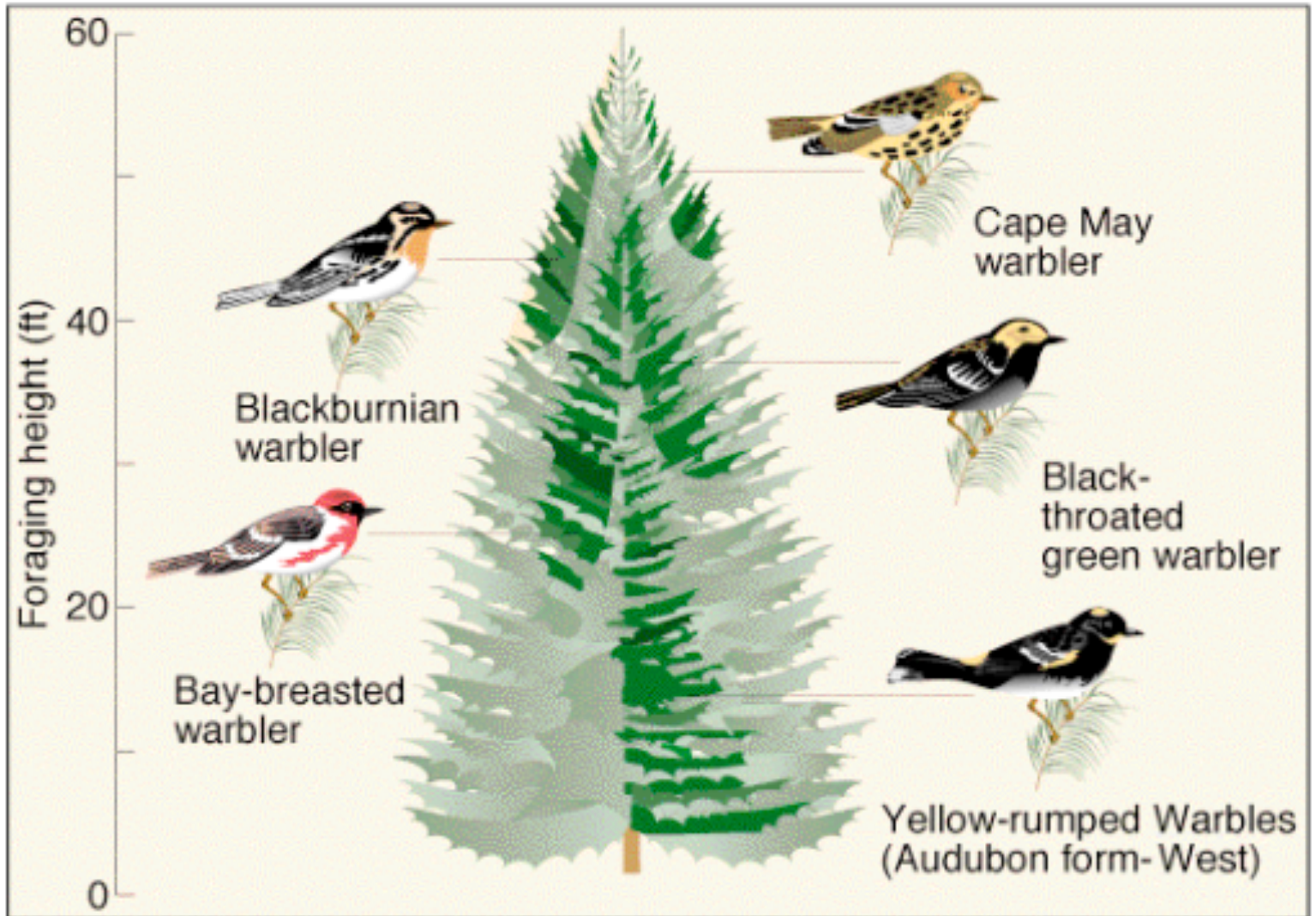


Edge, Structure, Texture is Key

Habitat Chart



Resource Partitioning



Gene Logsdon



Wildlife in the Garden



How to Live in Harmony
with Deer, Raccoons,
Rabbits, Crows,
and Other Pesky
Creatures

EXPANDED EDITION

Deerproofing Your Yard & Garden

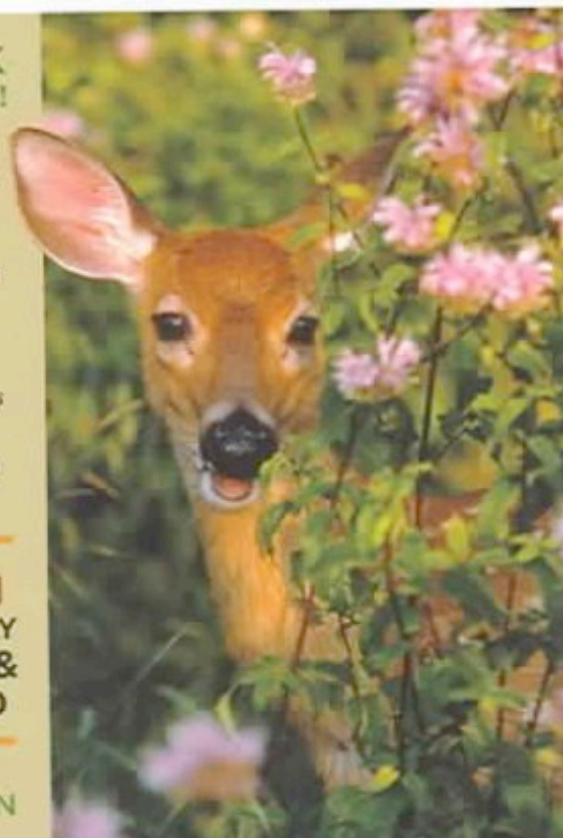
RHONDA MASSINGHAM HART

THE BUCK STOPS HERE!

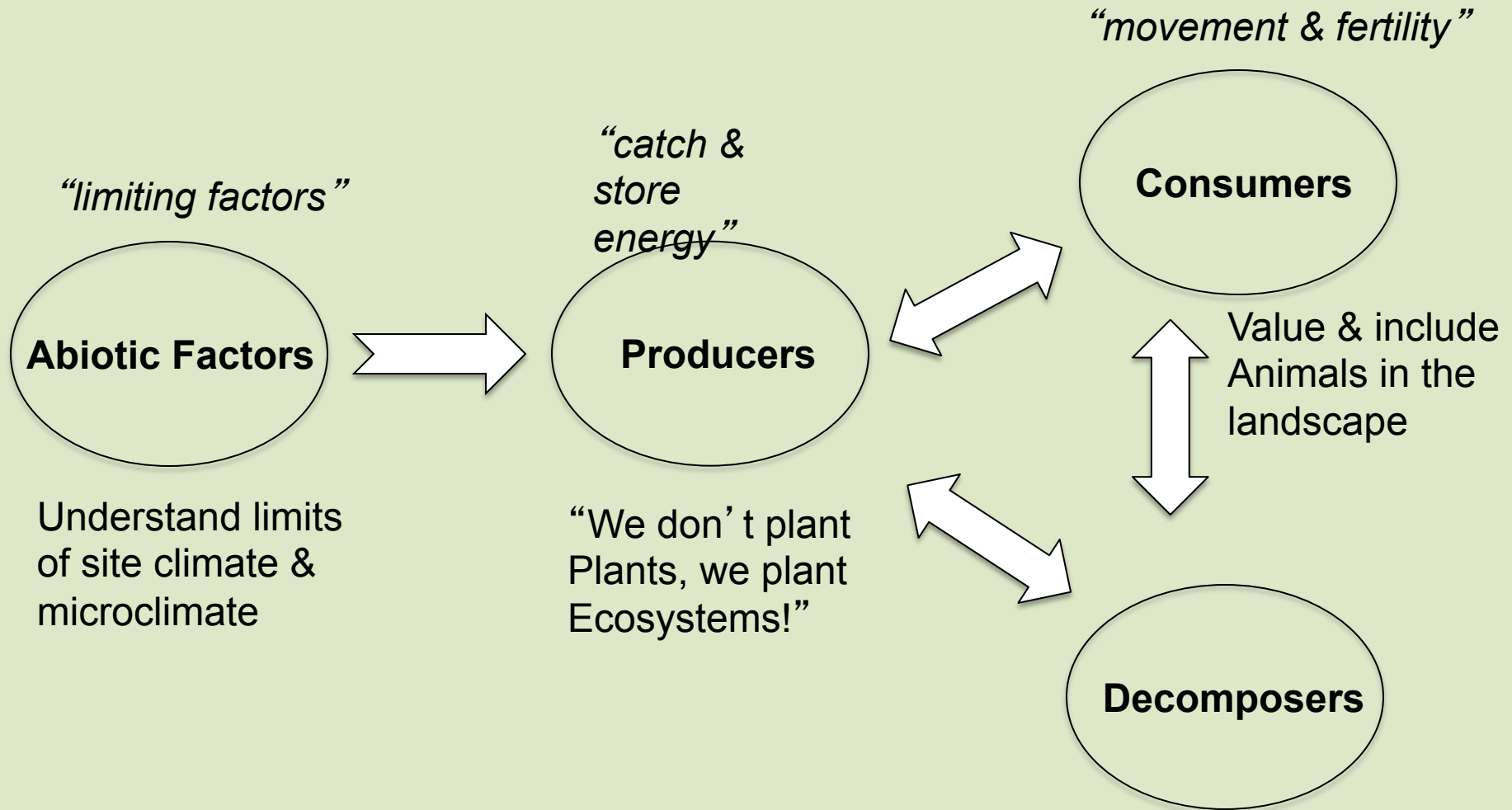
- ❶ Surefire plants deer truly hate
- ❷ Homemade & store-bought deterrents that really work
- ❸ Innovative fencing & netting options
- ❹ Up-to-date information on Lyme disease

2nd Edition
COMPLETELY
REVISED &
UPDATED

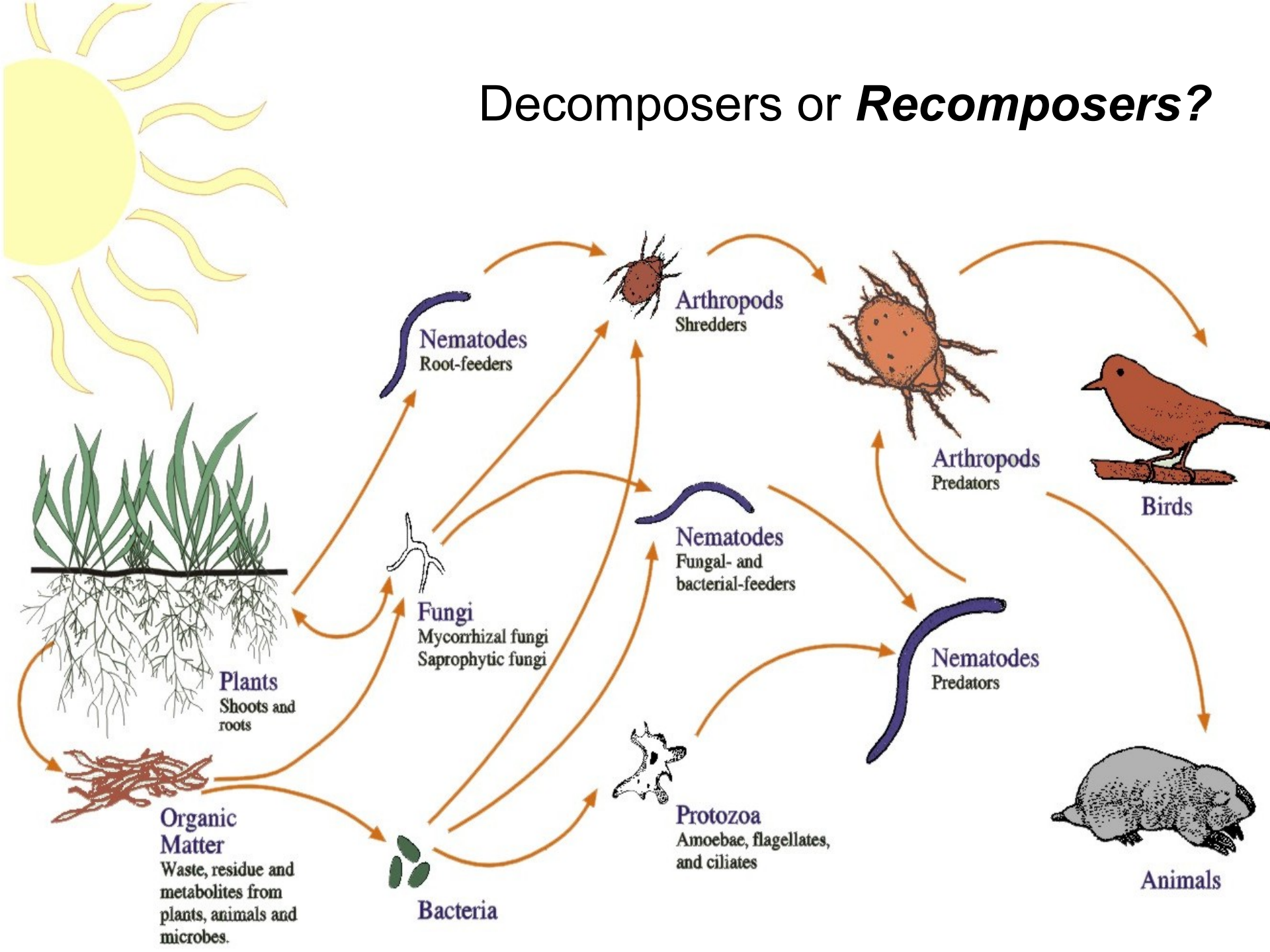
Foreword by
JIM WILSON



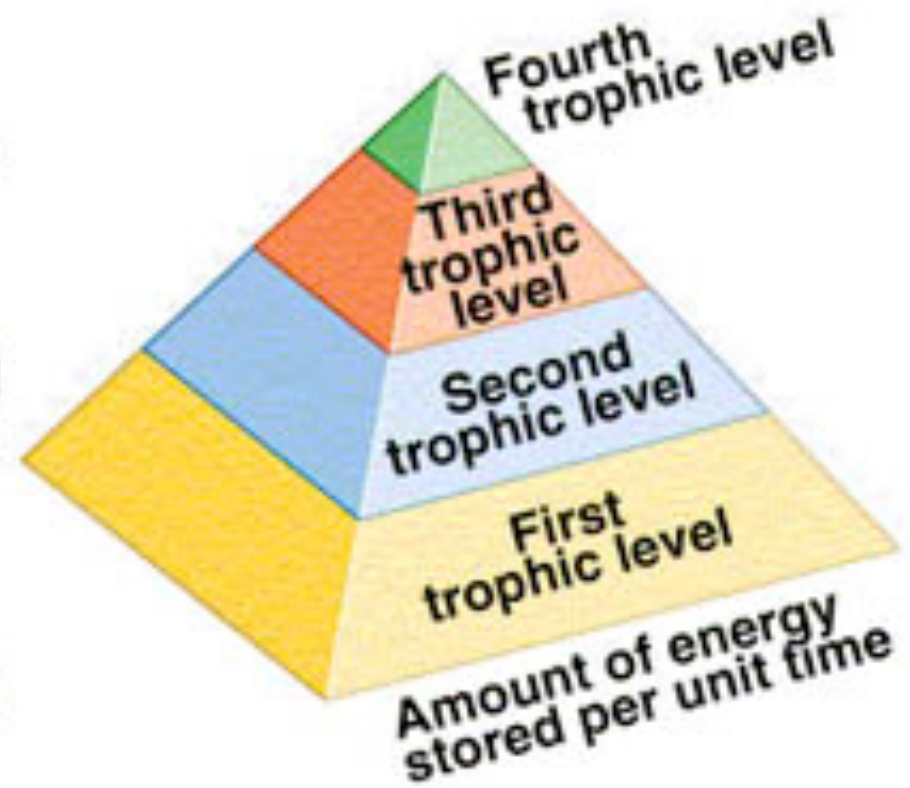
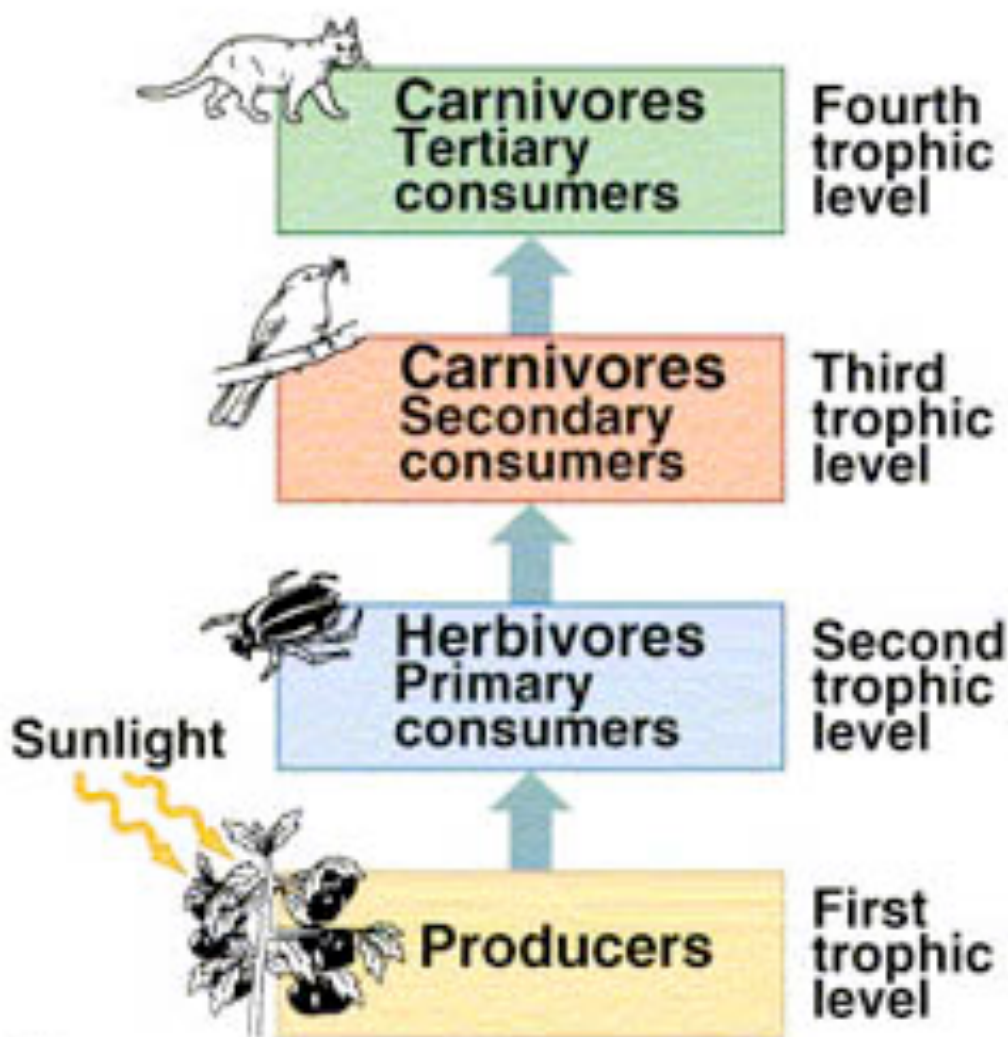
Basic Ecology



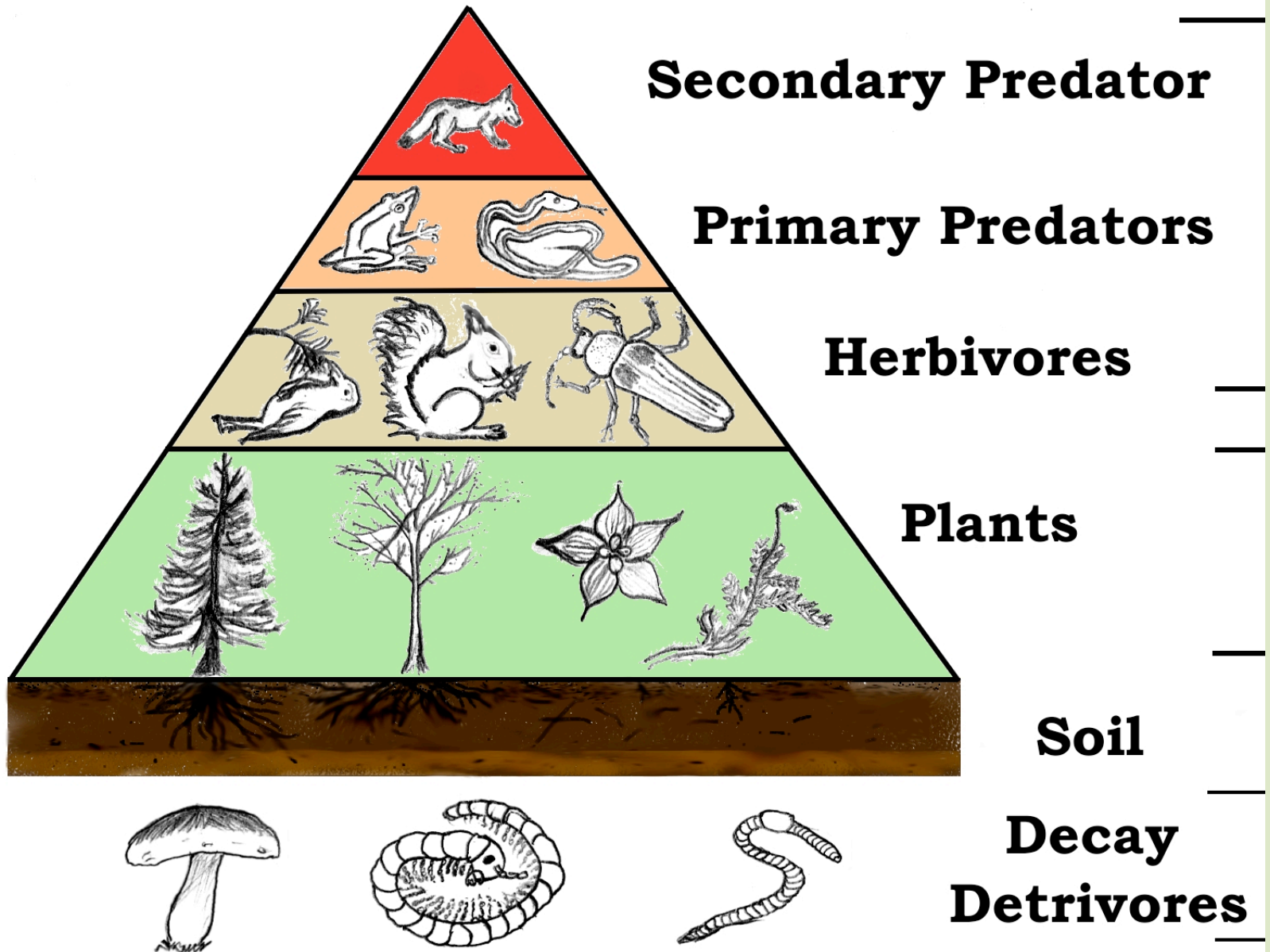
Decomposers or *Recomposers*?



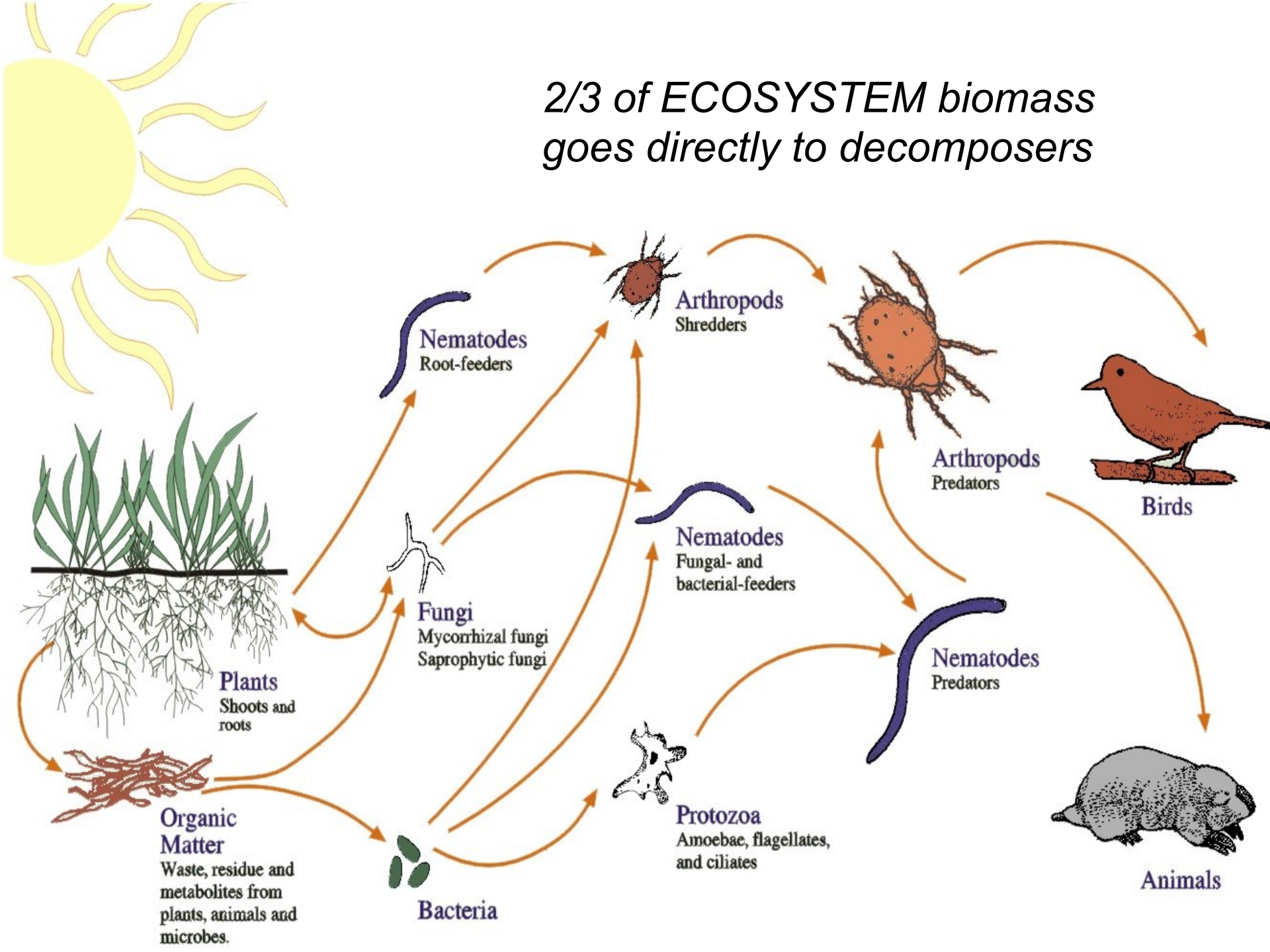
Ecosystem energy flow



a.



2/3 of ECOSYSTEM biomass goes directly to decomposers



Gardens & Farms need to be net
biomass producers!

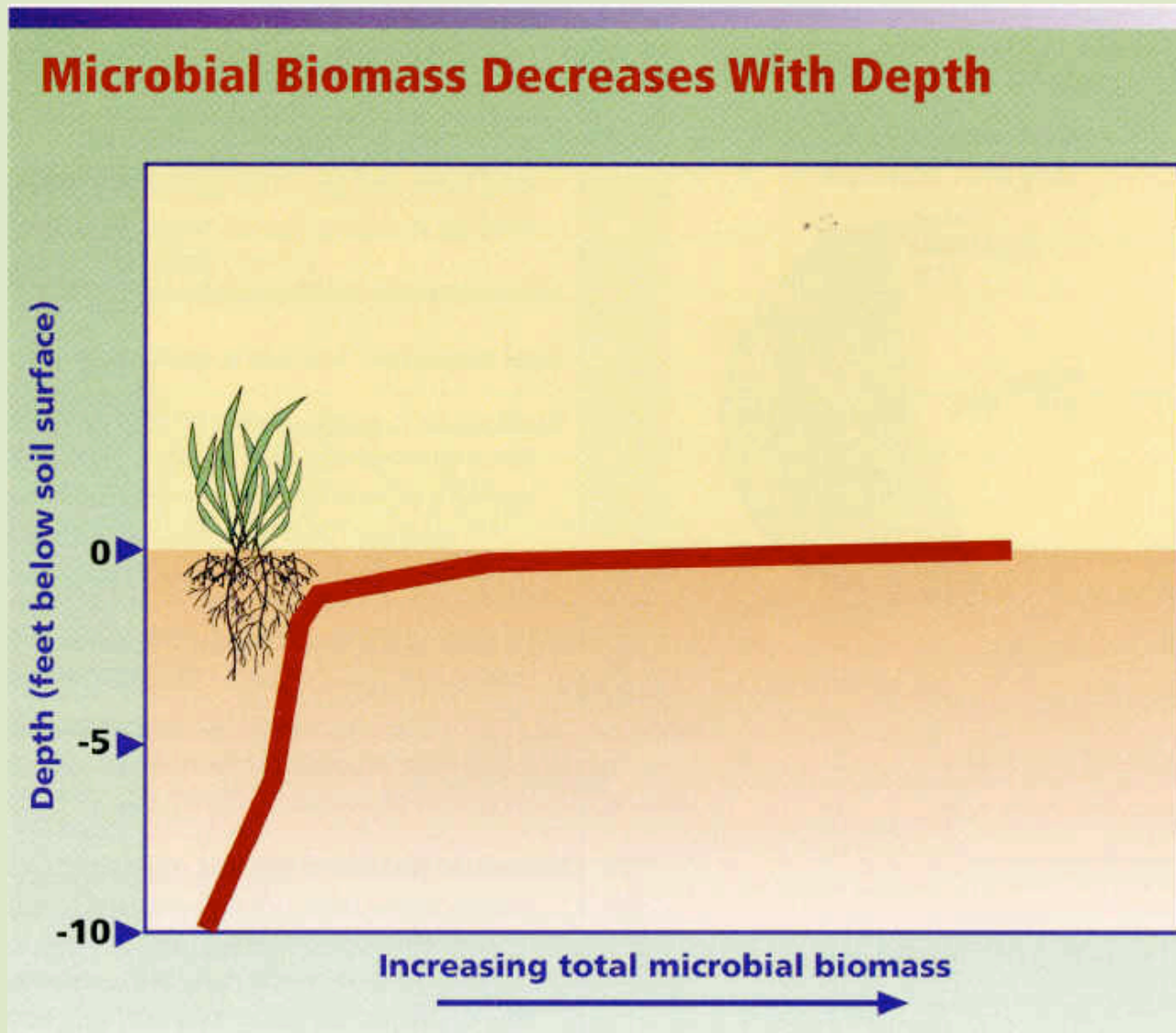
Diverse forms of Organic Matter,

Living and Dead,

Pulsing throughout the season

Living

Organisms Live in Rhizosphere





This image shows increased drought tolerance of a plant with a mycorrhizal relationship.

Fred T. Davies, Texas A&M Aggie Horticulture

Crop Residues



Sunchoke

*Helianthus
tuberosus*

Living Mulch: “Chop and Drop”



NUTRIENT ACCUMULATORS

Sorrels

Rumex spp.



Comfrey

*Symphytum X
uplandicum*





**Cover
Crops**

SOIL DECOMPACTORS





NITROGEN FIXATION

Dead









Wine Cap
Stropharia rugosa annulata

Putting it together:
“Pulsing throughout the seasons”

Wood Chips

Composted
For
2-3
months



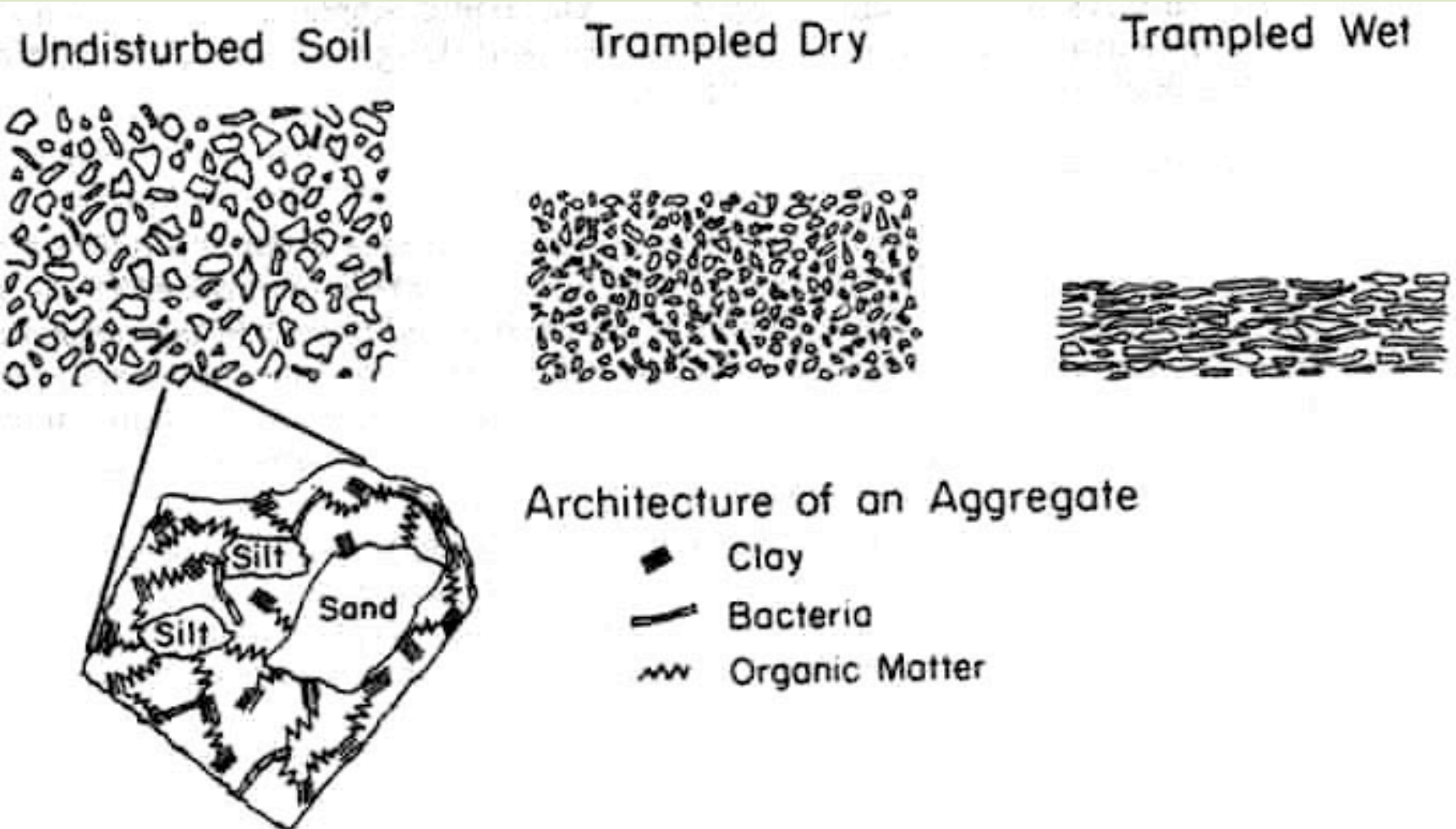








Structure & Aggregation in Soil



Bacteria glue together small aggregates (clumps of soil)

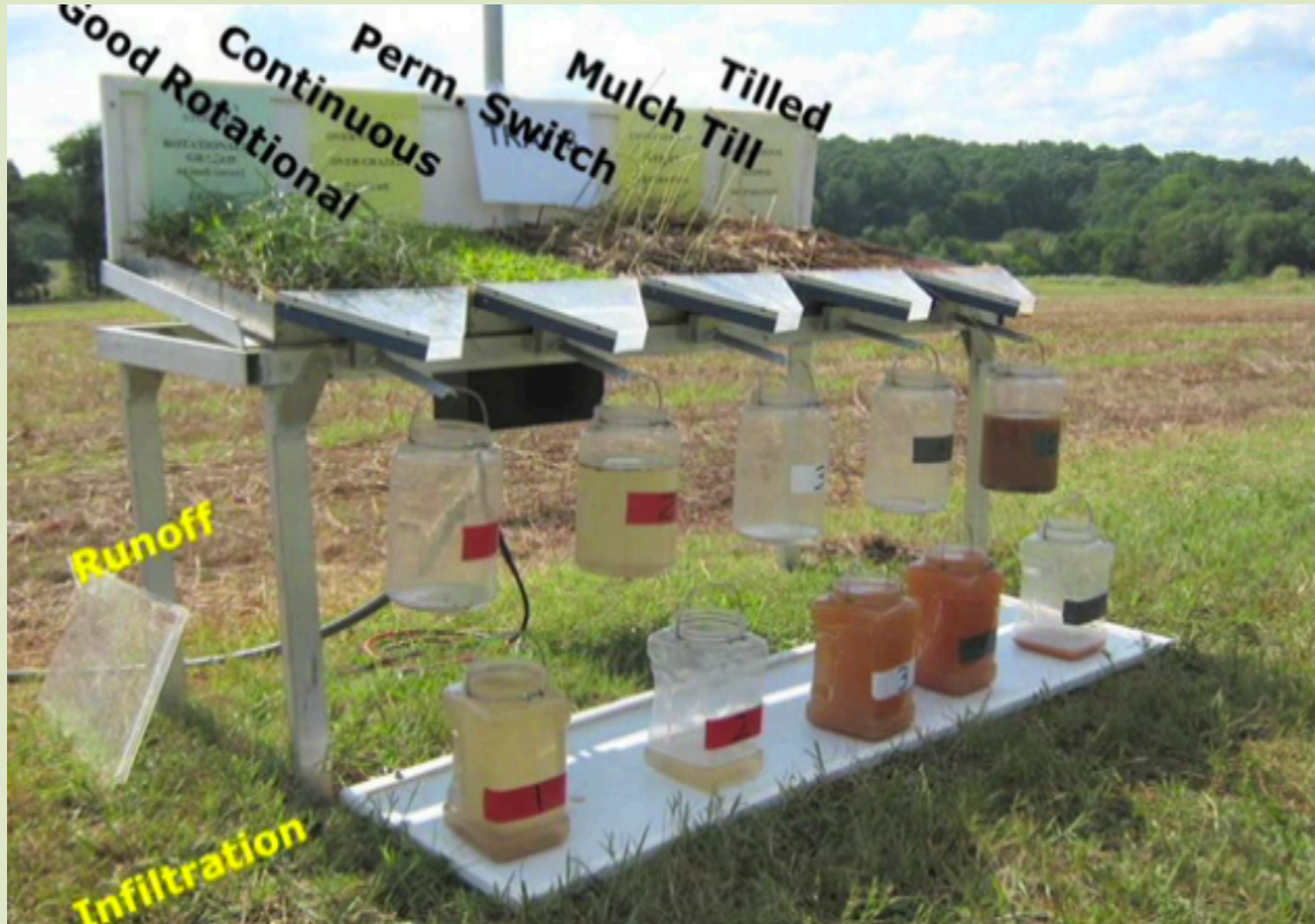
Fungi glue them into larger aggregates.

REDUCE TILLAGE FREQUENCY/DEPTH

Tilling breaks these aggregates apart and they have to start all over!



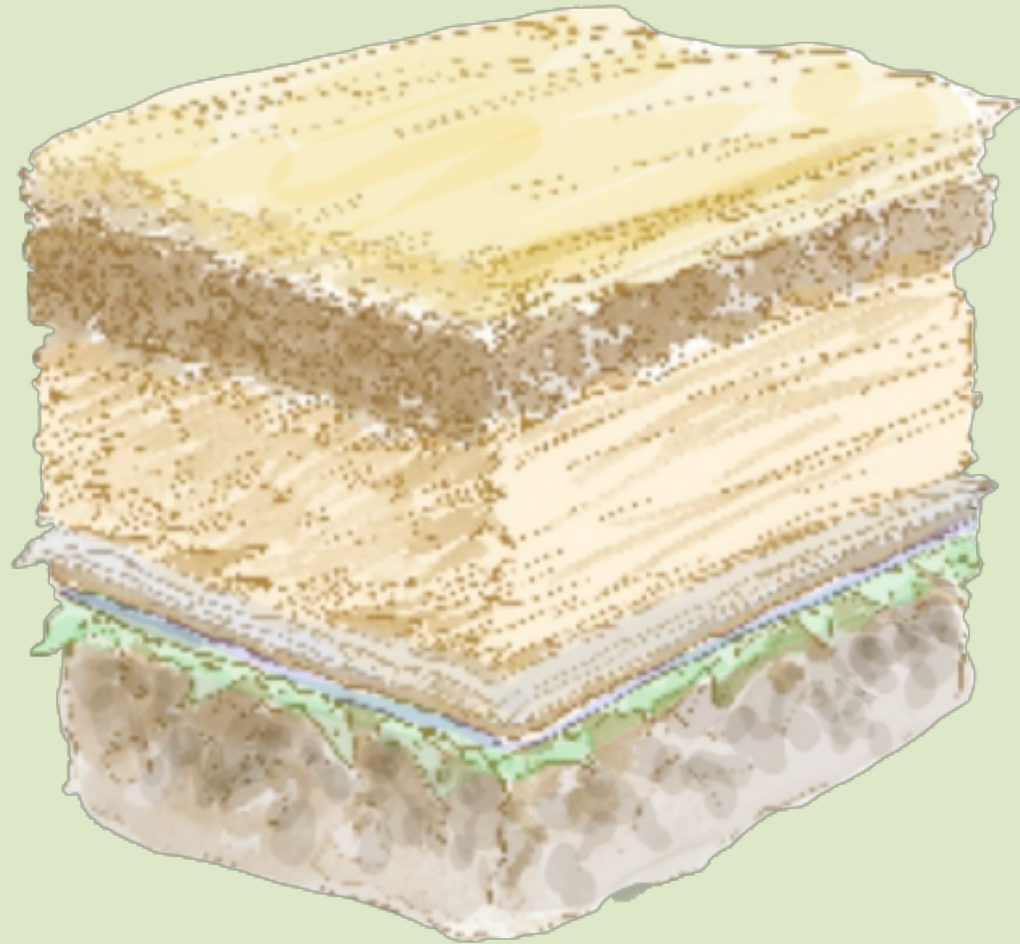
Tilling w/o cover crops leads to more erosion



Tilling stirs up weed seeds



SHEET MULCH: **mimicking how nature builds soil**

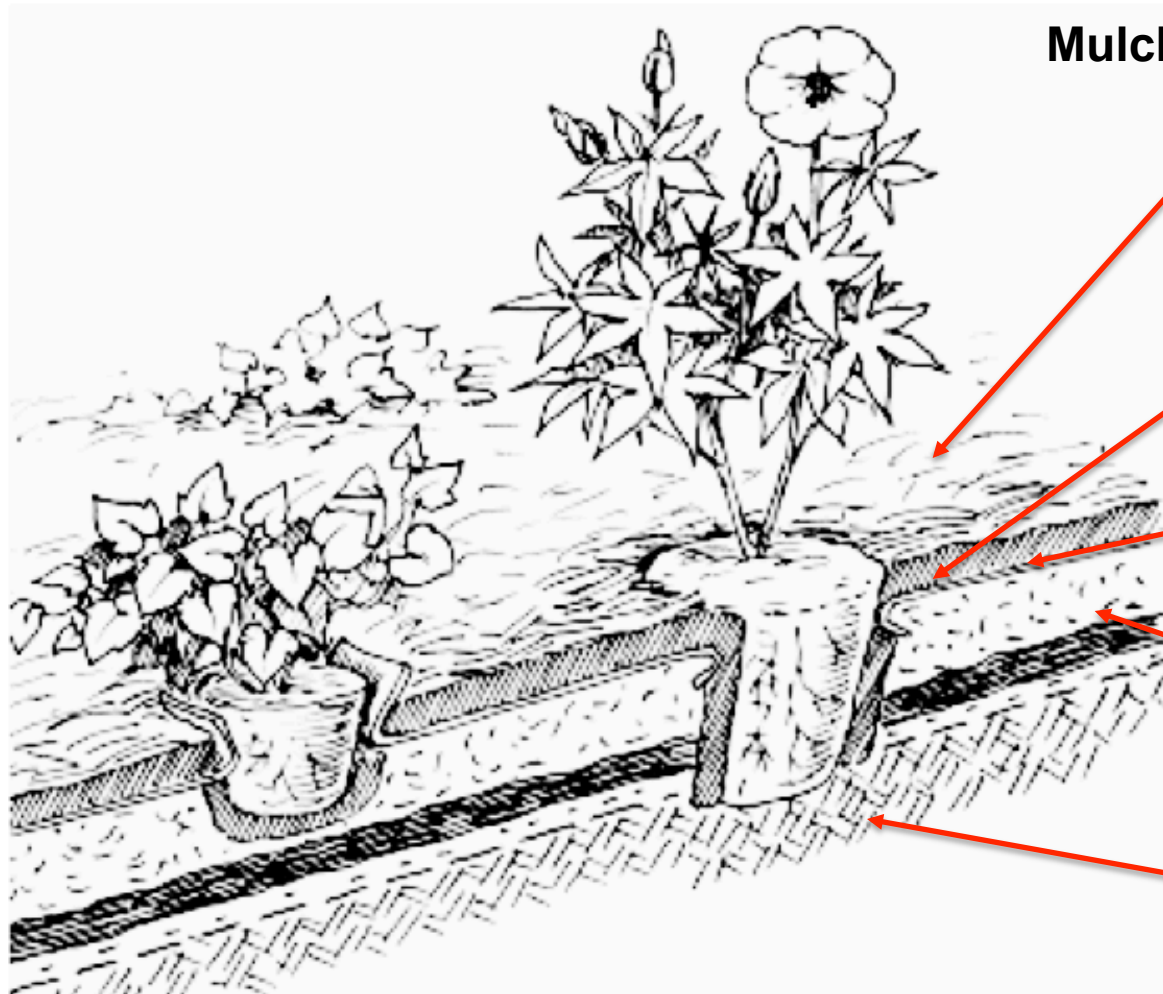


Let vegetation or cover crop grow first and slash down before you mulch



...Then Aerate with pitchfork or broadfork





Mulch (Straw, Woodchips)

Finished compost

WEED BARRIER
(newspaper or cardboard)

**Weedy compost,
manure, amendments
2 – 6"**

Existing Soil
(weed seed layer)

Planting in sheet mulch



Hori Hori

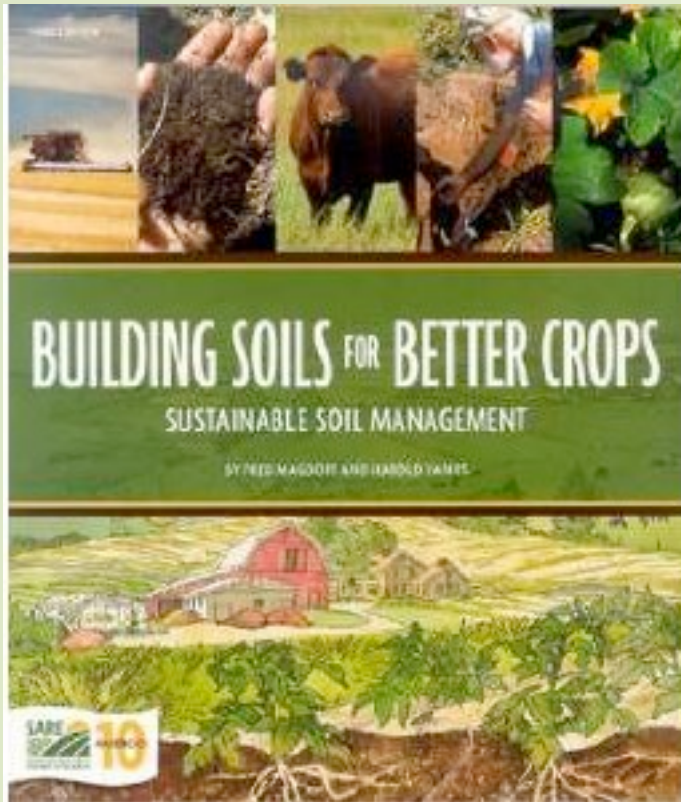
Does mulch “rob” nitrogen ?

“Carbon-rich woody wastes will not compete with plants for nitrogen if they are placed on the soil surface around plants. However, these materials should not be mixed into soil without extra nitrogen fertilizer Use wood chips and sawdust to mulch trees and shrubs where the soil is not tilled and the mulch stays on the surface. “

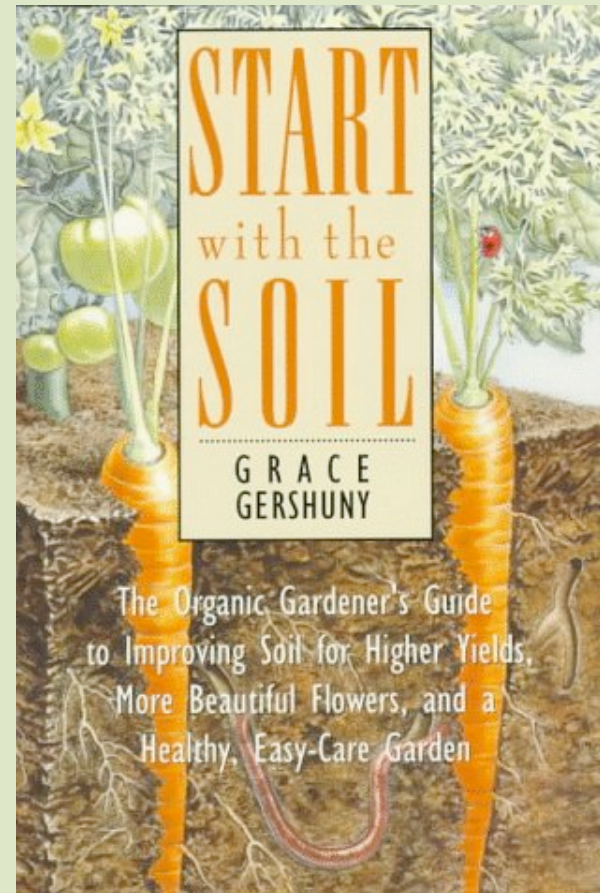
*ALL ECOSYSTEM DESIGN SHOULD BEGIN
WITH SOIL BUILDING.*

*THE PRIMARY YIELD IN YEAR ONE AND TWO
SHOULD BE HEALTHY, LIVING SOIL*





<http://tinyurl.com/bettersoilsbettercrops>



www.gardening.cornell.edu/soil
www.gardening.cornell.edu/soiltesting
www.gardening.cornell.edu/compost



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