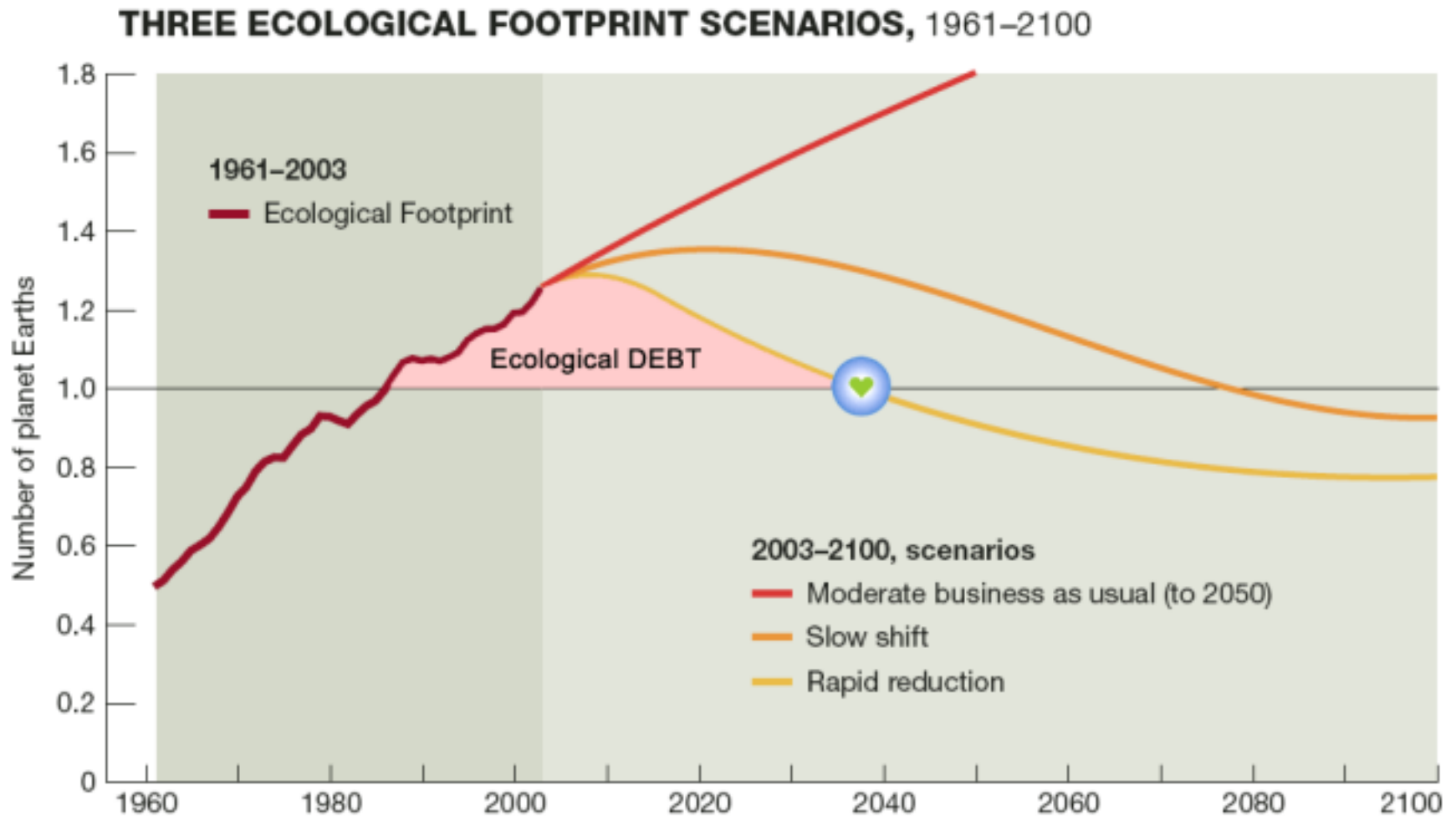


The Permaculture Design Process: Patterns, Principles, and Practice



Resource Degradation



Facts and Figures

- 1.2 trillion gallons of sewage, storm water and industrial waste is discharged into US waters each year.
- 73 types of pesticides have been found in groundwater which is where drinking water is usually taken from.
- 40% of America's rivers and 46% of America's lakes are too polluted for fishing , swimming or aquatic life.
- 2.1 million pounds of plastic pollution enters the world's oceans every hour.
- The USA releases one-quarter of the world's carbon dioxide emissions.
- 38 million acres of forest are destroyed every year worldwide.
- Cropland worldwide is shrinking 37,000 square miles a year due to soil erosion.





Permaculture (**permanent agriculture** or **permanent culture**) is the conscious design & maintenance of agriculturally productive systems. Sustainable human settlement design is its prime focus, where the concept strings the disciplines into a web of appropriate & productive development. Originally developed as a methodology in the early 1970's it is now practiced and applied in nearly every country, and works to sustainably promote low energy and solid state food and resource security.

Darren J. Doherty



ETHICS OF PERMACULTURE

CARE OF THE EARTH

The primary ethic

The earth is the primary client

CARE OF THE PEOPLE (CARE OF OURSELVES)

If we can provide for our own basic needs, then we can care for the earth

*RETURN OF SURPLUS -
CONTRIBUTE TIME, MONEY &
ENERGY TO ACHIEVE ETHICS
1&2.*

And setting limits to population and consumption



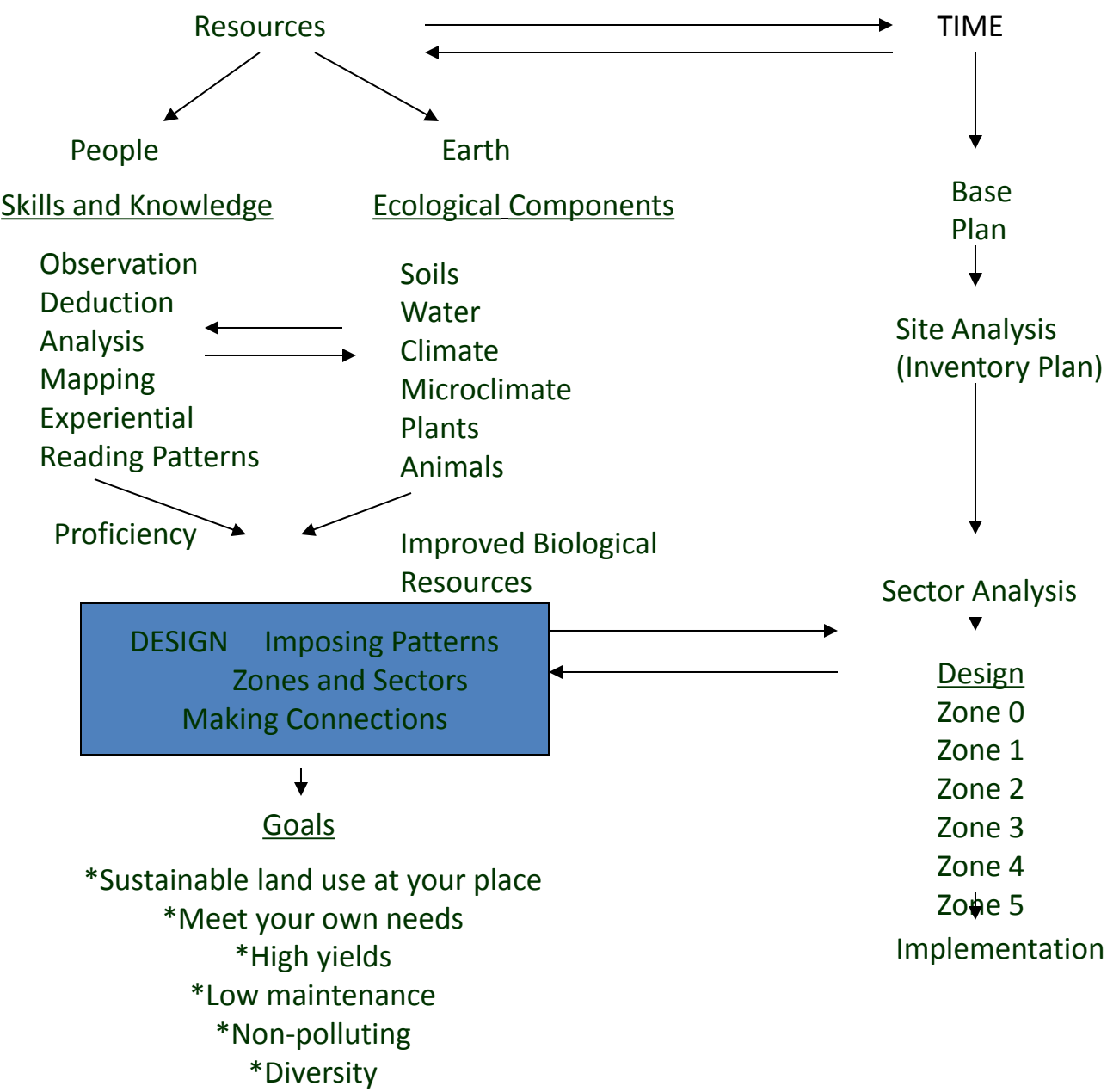
Oil is a Finite Resource

And it is the same with

- coal,
- natural gas
- and even uranium.







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The Permaculture Scale of

Permaculture

Climate

Landform

Water (in general)

Access and Circulation

Microclimate

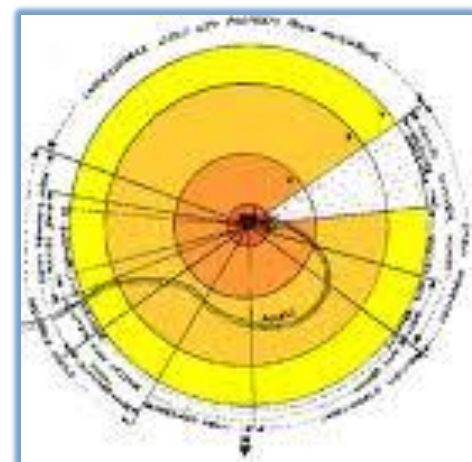
Vegetation and Wildlife

Buildings and Infrastructure

Zones of Use

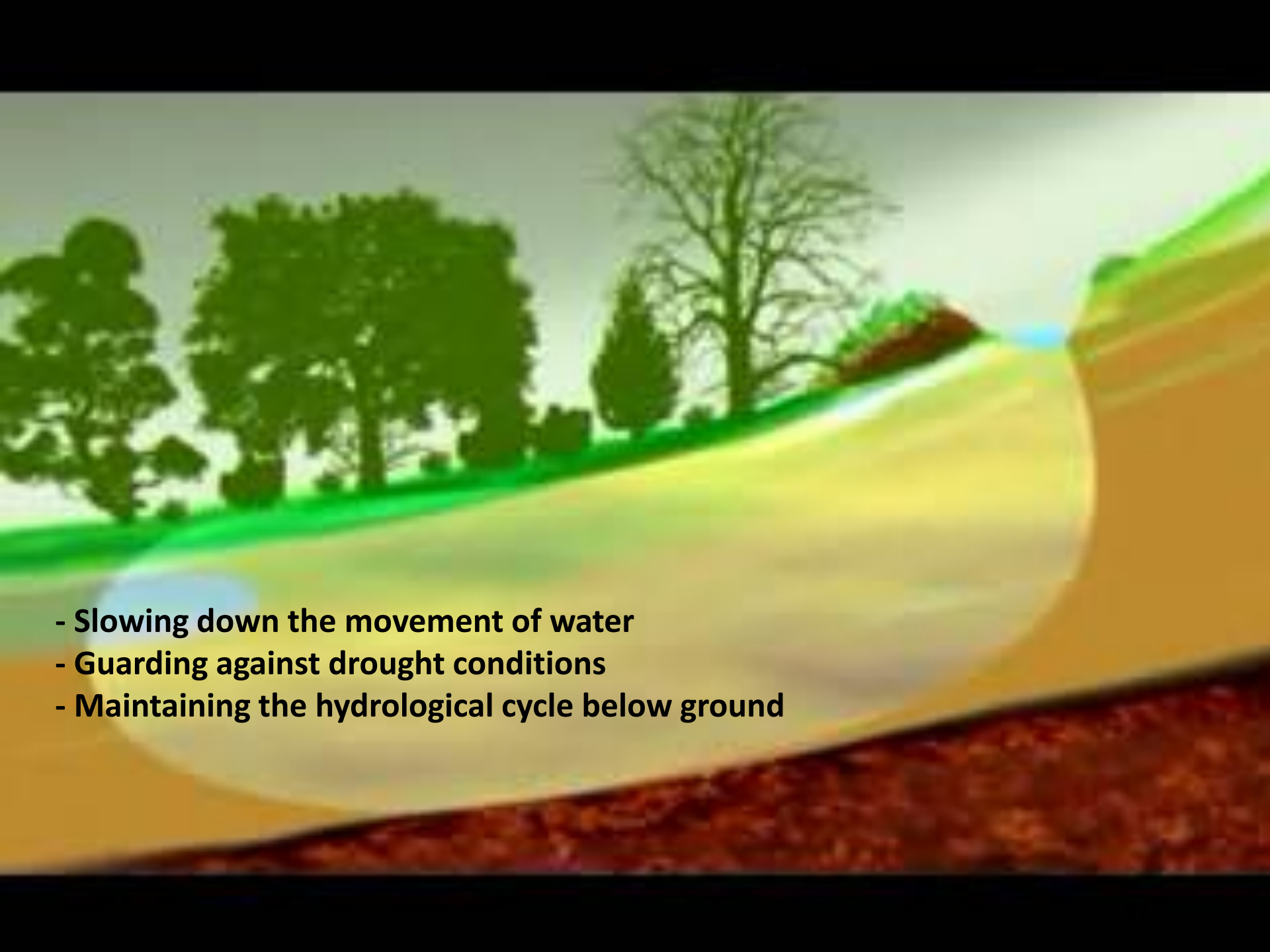
Soil (fertility and Management)

Aesthetics



Swale Holding Water on the Landscape





- Slowing down the movement of water
- Guarding against drought conditions
- Maintaining the hydrological cycle below ground



Series of Photos of China Reclamation Project

Documentary Video: Hope in a Changing Climate





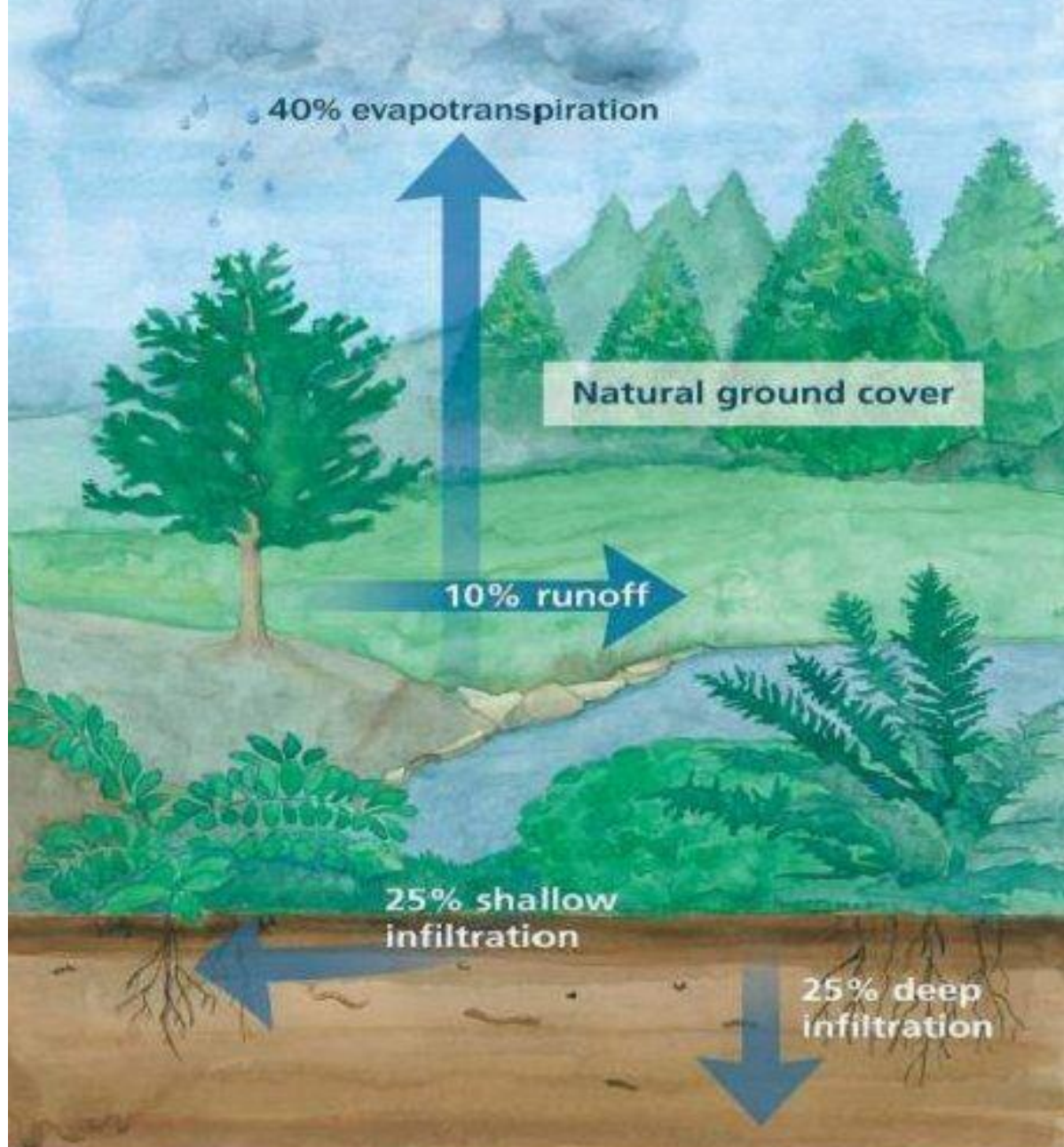








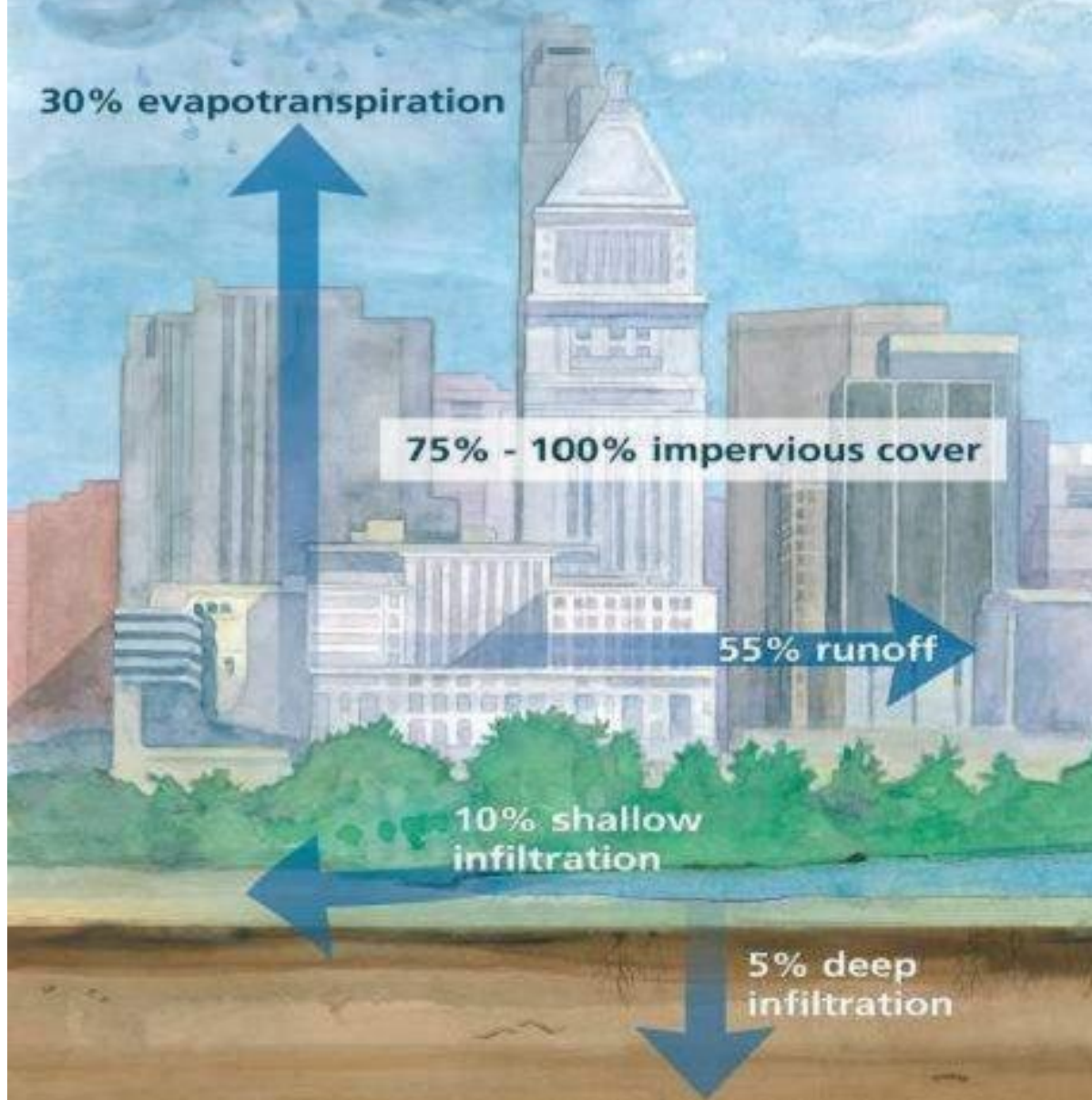
Typical water cycle in an undeveloped area



50%

50%

Typical water cycle in an urban area



30% evapotranspiration

75% - 100% impervious cover

55% runoff

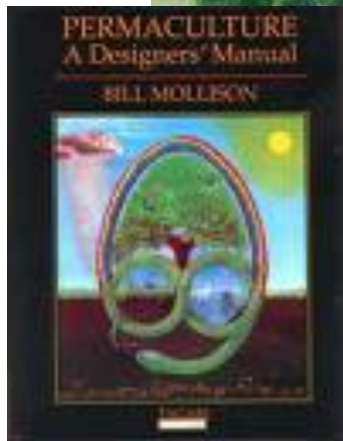
10% shallow infiltration

5% deep infiltration

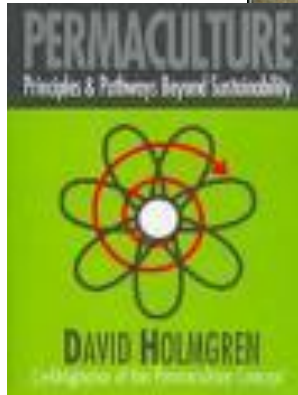
85%

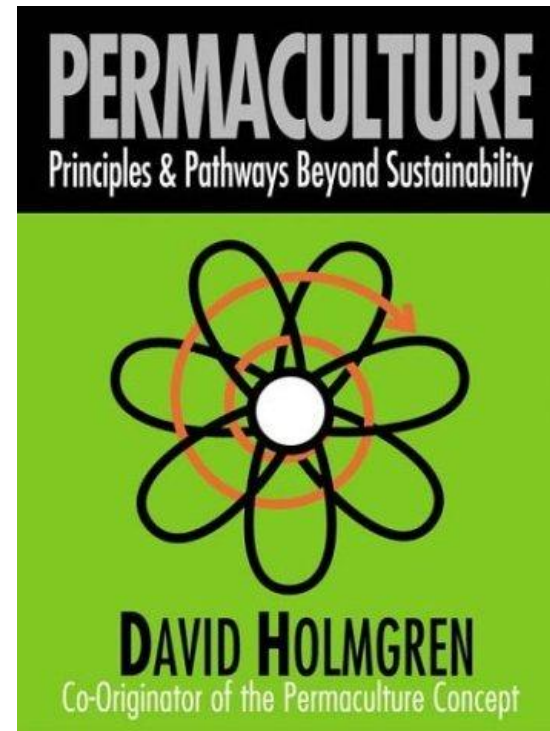
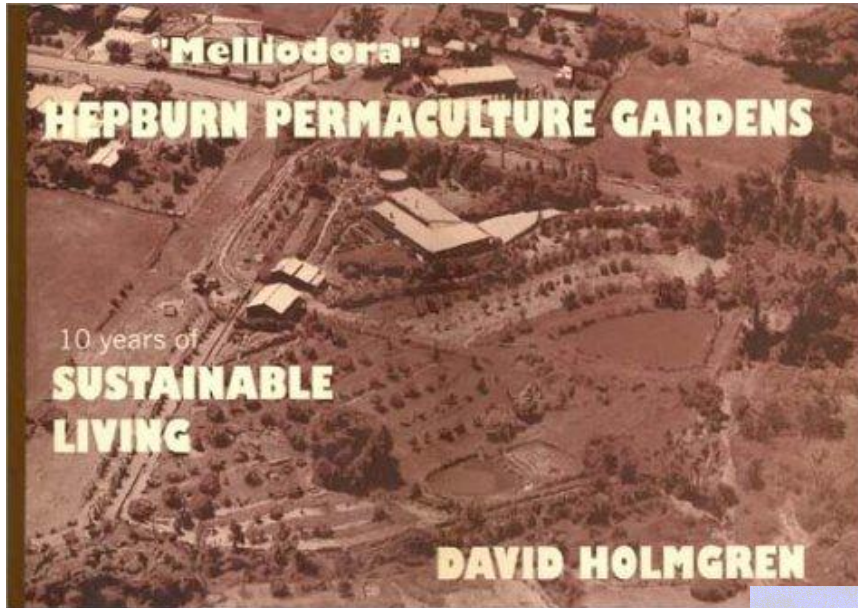
15%

Bill Mollison – Co-founder



David Holmgren – Co-founder





Holmgrenian Permaculture Principles

*The following principles of design
were developed by David Holmgren
and outlined in his book:
Permaculture – Principles & Pathways
Beyond Sustainability*



Observe. Use protracted and thoughtful observation rather than prolonged and thoughtless action. Observe the site and its elements in all seasons. Design for specific sites, clients, and climates.

Bill Mollison

Connect. Use relative location: Place elements in ways that create useful relationships and time-saving connections among all parts. The number of connections among elements creates a healthy, diverse ecosystem, not the number of elements.

Toby Hemenway



RELATIVE LOCATION...

Efficient function is achieved by careful placement of elements in relation to each other.



Each element performs multiple functions. Choose and place each element in a system to perform as many functions as possible. Increasing beneficial connections between diverse components creates a stable whole. Stack elements in both space and time.



EACH ELEMENT PERFORMS MANY FUNCTIONS...
Elements are chosen and placed to perform as many functions as possible.



Each function is supported by multiple elements. Use multiple methods to achieve important functions and to create synergies. Redundancy protects when one or more elements fail.

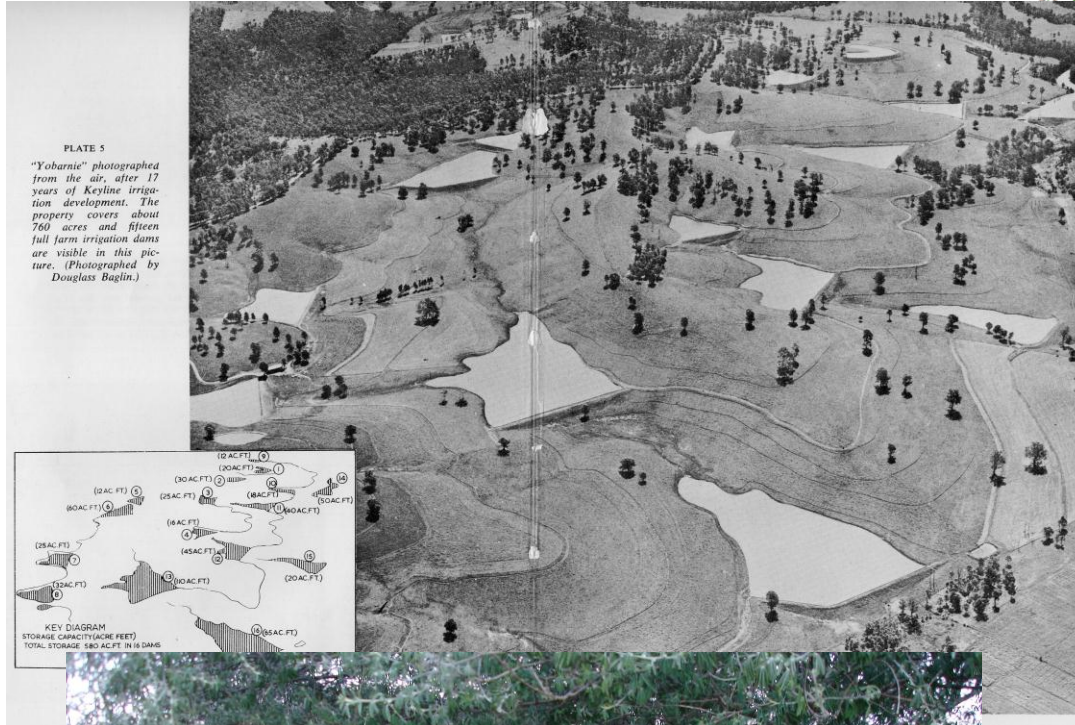
Toby Hemenway



EACH IMPORTANT FUNCTION IS SUPPORTED BY MANY ELEMENTS...

Important basic functions (such as water supply, fire protection and energy) are provided in more than one way

Make the least change for the greatest effect. Find the “leverage points” in the system and intervene there, where the least work accomplishes the most change.



ENERGY EFFICIENT PLANNING...

Energy efficiency is achieved through zoning (to conserve human energy), sector planning (to manage wild energies), slope planning (to utilise gravity) and by making the least change for the greatest possible effect.



USING BIOLOGICAL RESOURCES...
Use biological resources (5 Kingdoms of Nature) wherever possible to save energy and do the work of the site.



Catch and store energy and materials. Identify, collect, and hold the useful flows moving through the site. By saving and re-investing resources, we maintain the system and capture still more resources.

Recycle energy. Supply local and on-site needs with energy from the system, and reuse this energy as many times as possible. Every cycle is an opportunity for yield.



ENERGY CYCLING...

Nutrients and energies are stored, used close to their source and used repeatedly to avoid wastage before flowing off-site or to sinks.

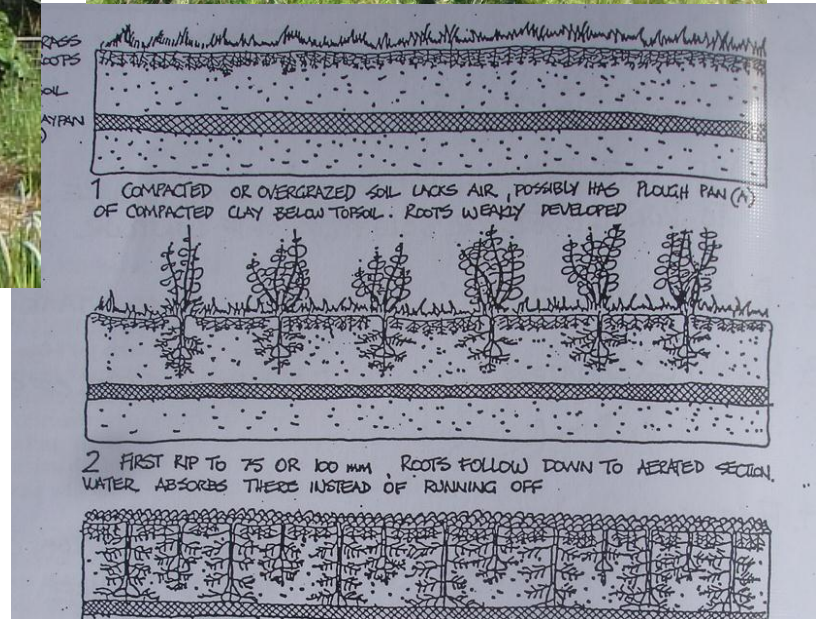
Use small scale, intensive systems. Start at your doorstep with the smallest systems that will do the job, and build on your successes, with variations. Grow by chunking.



SMALL SCALE INTENSIVE SYSTEMS...

Good design makes maximum use of minimal land; using productive human labour, hand tools and animals, rather than large machines and fossil fuels; and is multi-dimensional - utilising vertical space (plant stacking & trellising) and overlapping successional crops (time stacking).

Accelerate succession. Mature ecosystems are more diverse and productive than young ones, so use design to jump-start succession.



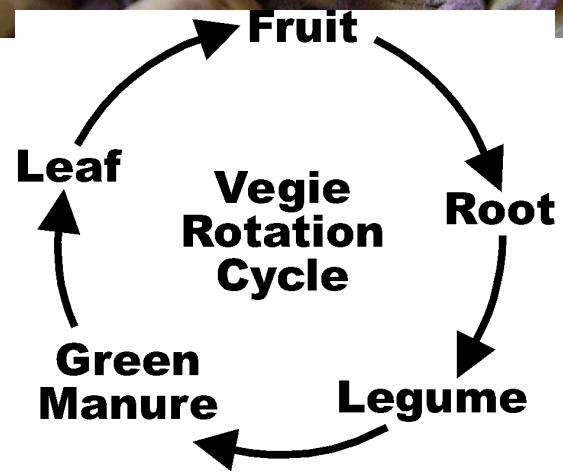
ACCELERATING SUCCESSION & EVOLUTION. Mature ecosystems are more diverse and productive than young ones, so use design to jump-start succession.

Use biological and renewable resources. Renewable resources (usually plants and animals) reproduce and build up over time, store energy, assist yield, and interact with other elements.



DIVERSITY...

Diversity increases productivity and stability, with polycultures, not monocultures; orderliness rather than tidiness; and guilds of elements that work harmoniously together.





Use the edge effect. The edge—the intersection of two environments—is the most diverse place in a system, and is where energies and materials accumulate. Optimize the amount of edge.



EDGE EFFECTS...

Extending and exaggerating the boundaries between adjoining systems provides additional contributions from the resources of both systems, increasing productivity.



Mistakes are tools for learning. Evaluate your trials. Making mistakes is a sign you're trying to do things better.

ATTITUDE...

Positivism is what drives Permaculture and the relationships that we develop as people working together toward our collective future.



Turn problems into solutions. Constraints can inspire creative design. "We are surrounded by insurmountable opportunities." — Bill Mollison



EVERYTHING WORKS BOTH WAYS...

Good design turns disadvantages into advantages; see solutions not problems.

Abundance is unlimited. The designer's imagination and skill is a bigger limit to yield than any physical limit.



Get a yield. Design for both immediate and long-term returns from your efforts: "You can't work on an empty stomach." Set up positive feedback loops to build the system and repay your investment.

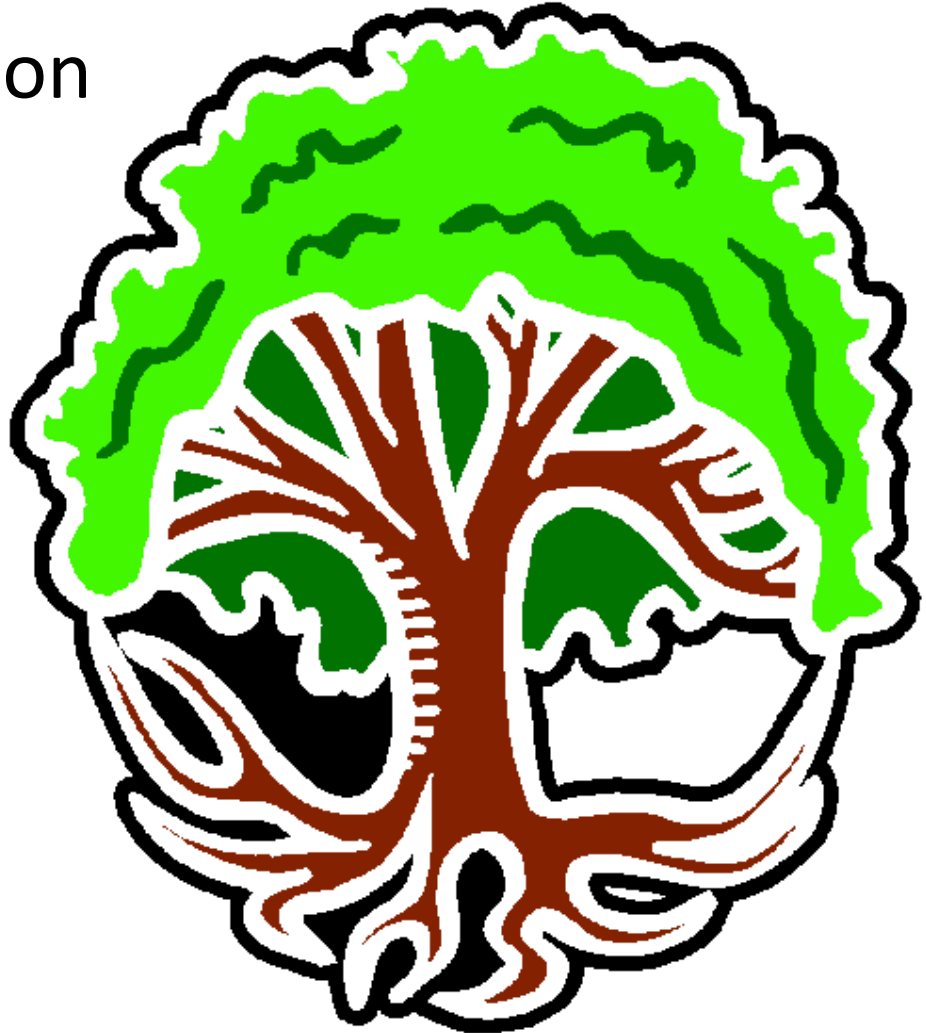


YIELDS ARE LIMITED ONLY BY INFORMATION AND IMAGINATION...

Permaculture uses creative design, rather than energy or capital, to increase productivity.

The Permaculture Process

- Pattern Observation
- Site Analysis
- Design
- Implementation
- Feedback



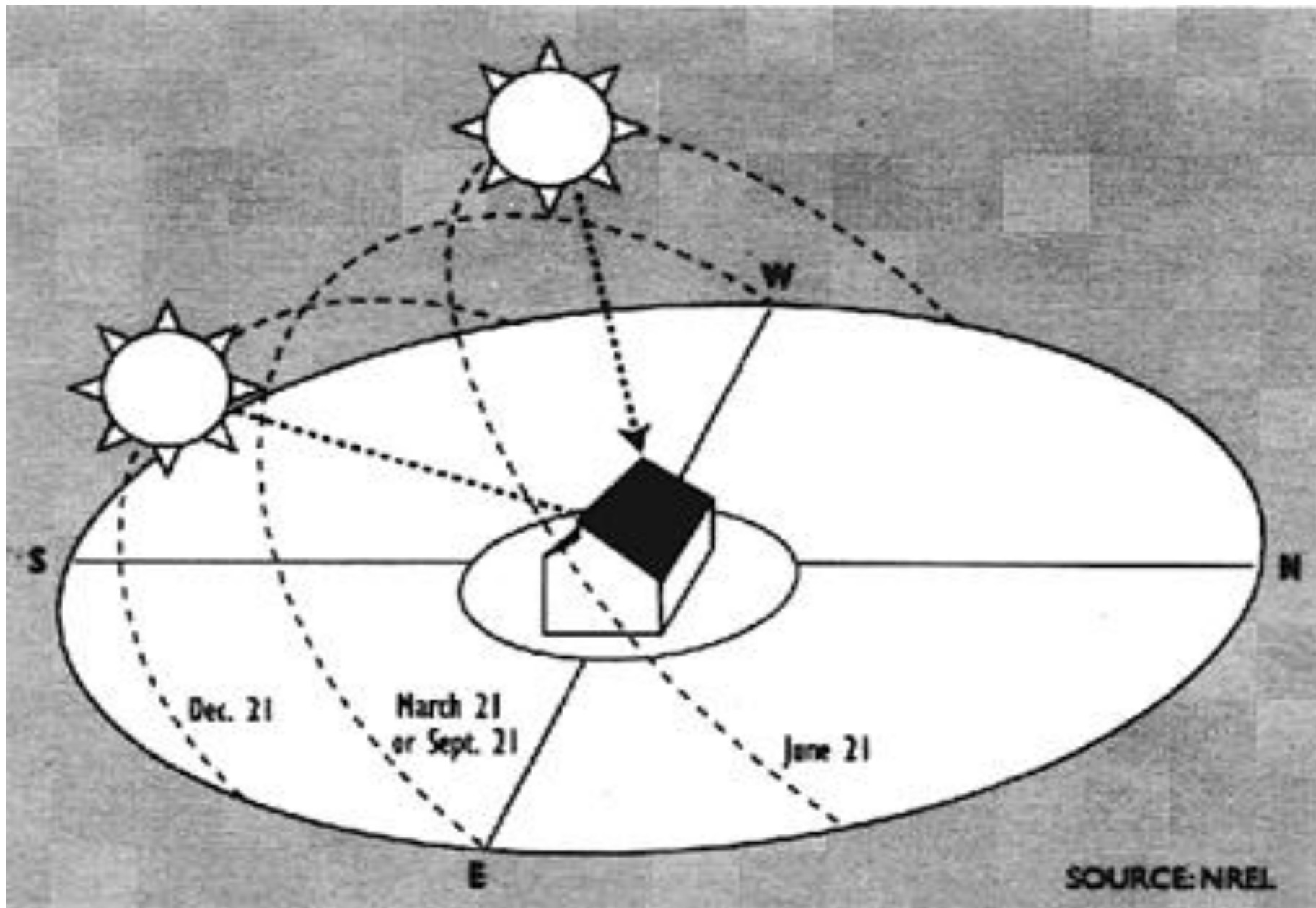
What is the Watershed in Your Area?

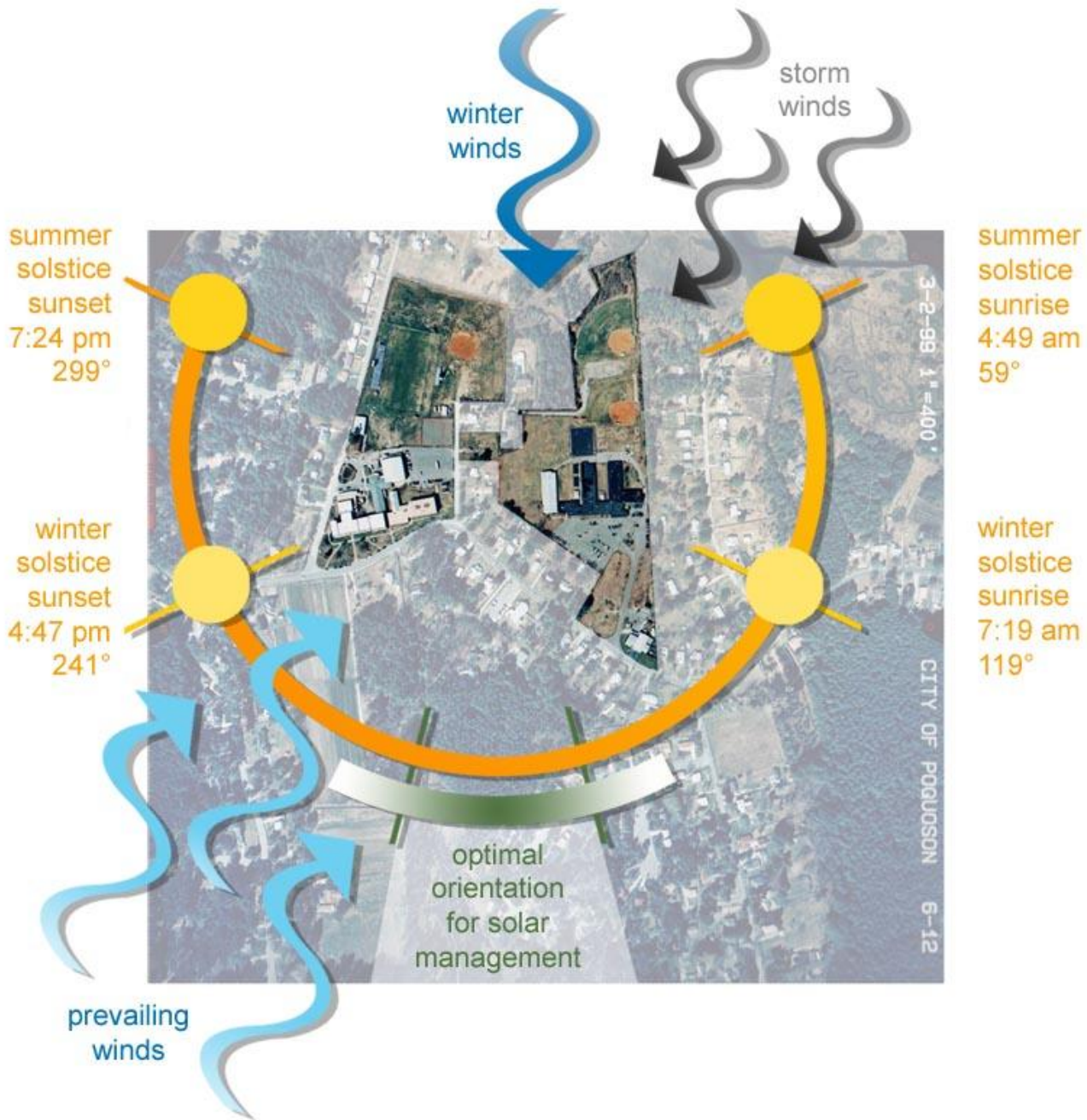


Where Does Water Flow?



How Does the Sun Move?

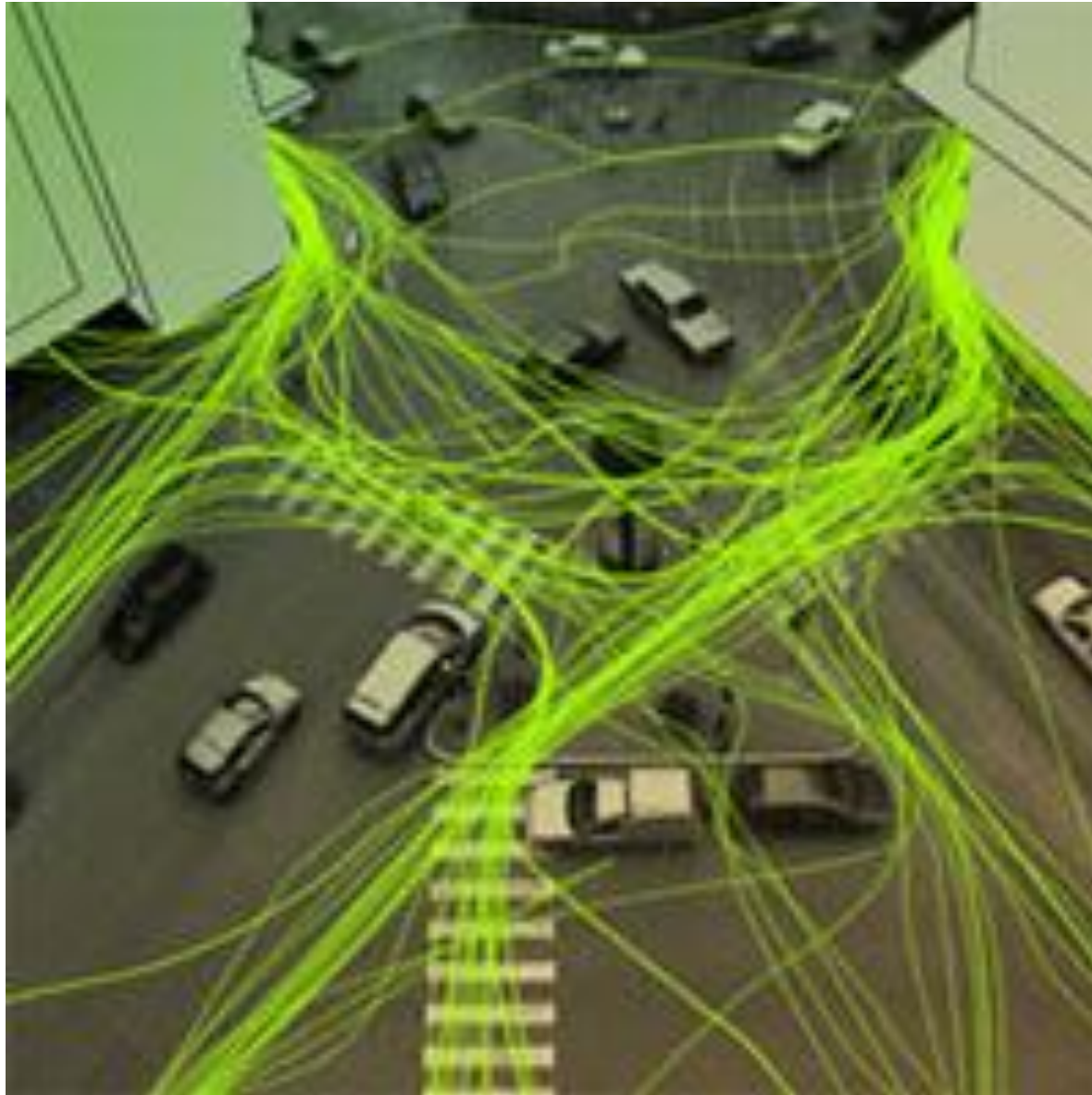




Solar Aspect and Microclimate



Flow Patterns



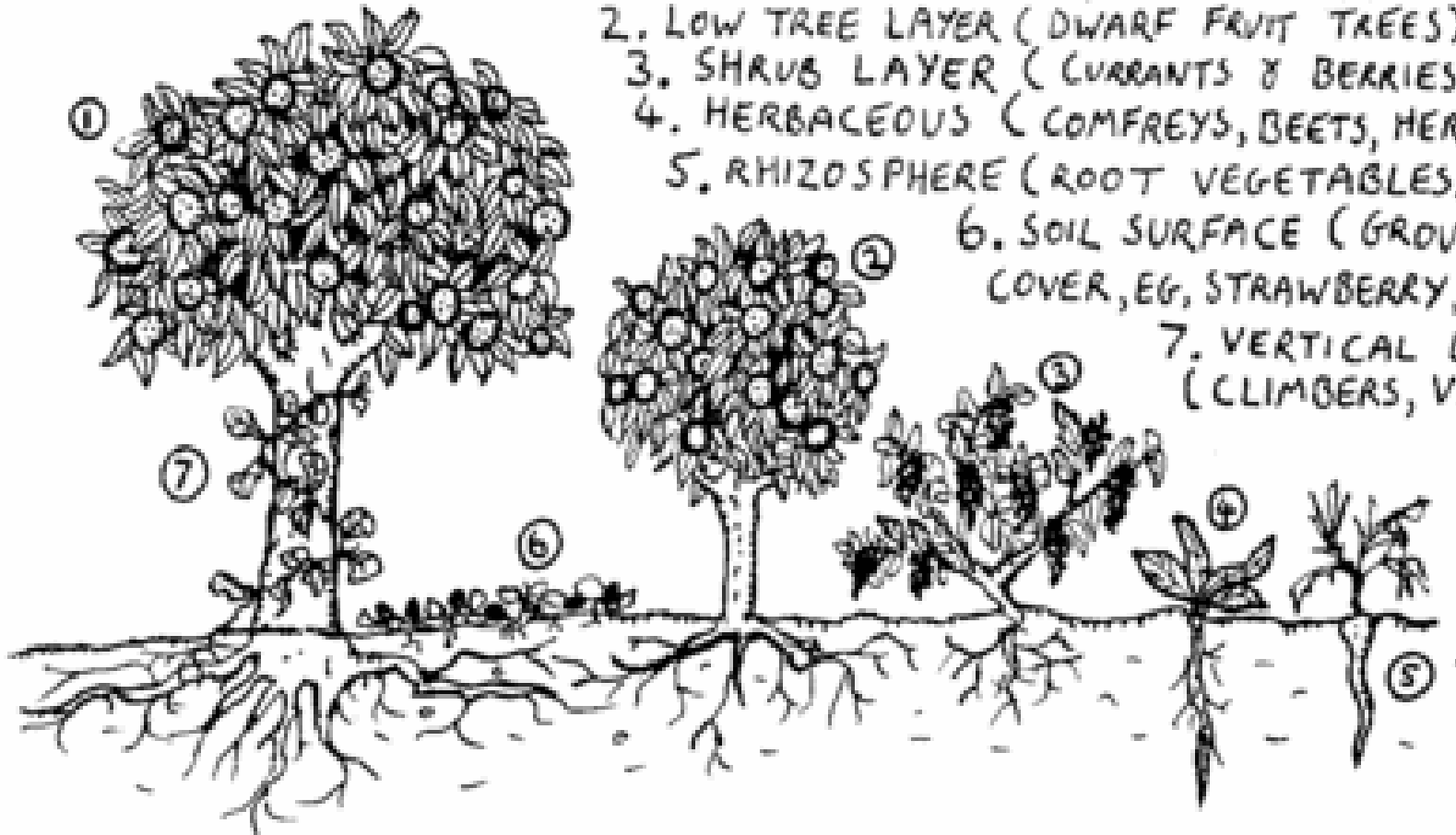
Some Types of Yields and Services:

- Food
- Fiber
- Medicine
- Fuel
- Nitrogen Fixation
- Beneficial Insect and Bird Attraction
- Nutrient Accumulation
- Pest Repellence and Soil Fumigation
- Soil Building/Mulch Accumulation/Weed Suppression



Forest Garden Pattern

1. CANOPY (LARGE FRUIT & NUT TREES)
2. LOW TREE LAYER (DWARF FRUIT TREES)
3. SHRUB LAYER (CURRANTS & BERRIES)
4. HERBACEOUS (COMFREYS, BEETS, HERBS)
5. RHIZOSPHERE (ROOT VEGETABLES)
6. SOIL SURFACE (GROUND COVER, EG, STRAWBERRY, ETC)
7. VERTICAL LAYER (CLIMBERS, VINES)



THE FOREST GARDEN: A SEVEN LEVEL BENEFICIAL GUILD

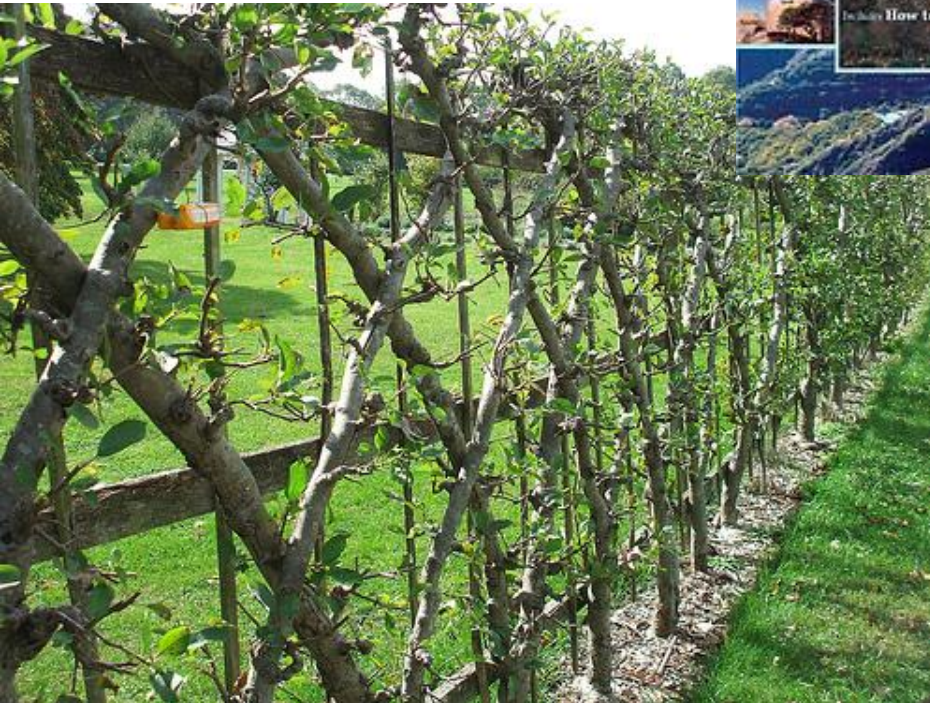
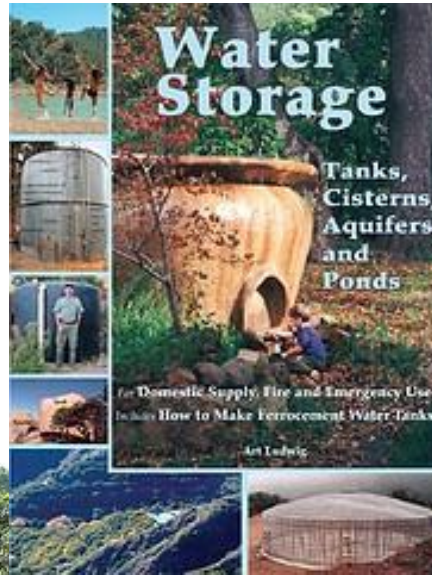
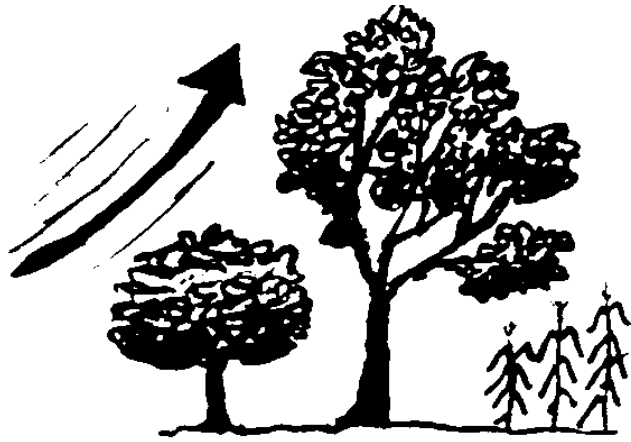


Strawberries under daylilies under currants
under bamboo under the canopy



A paw paw under the apple tree.

Each Element Performs Many Functions



insects

plant roots

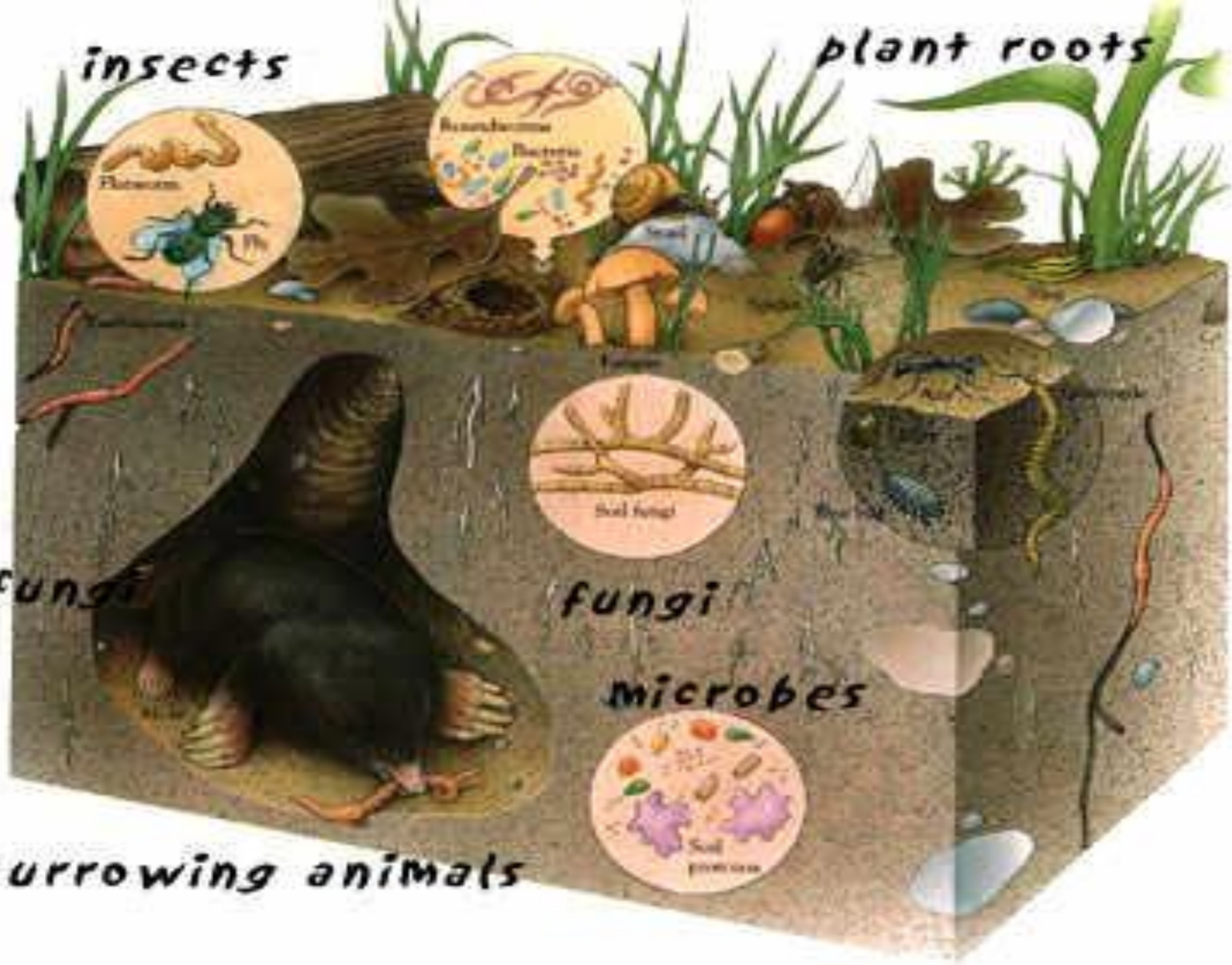


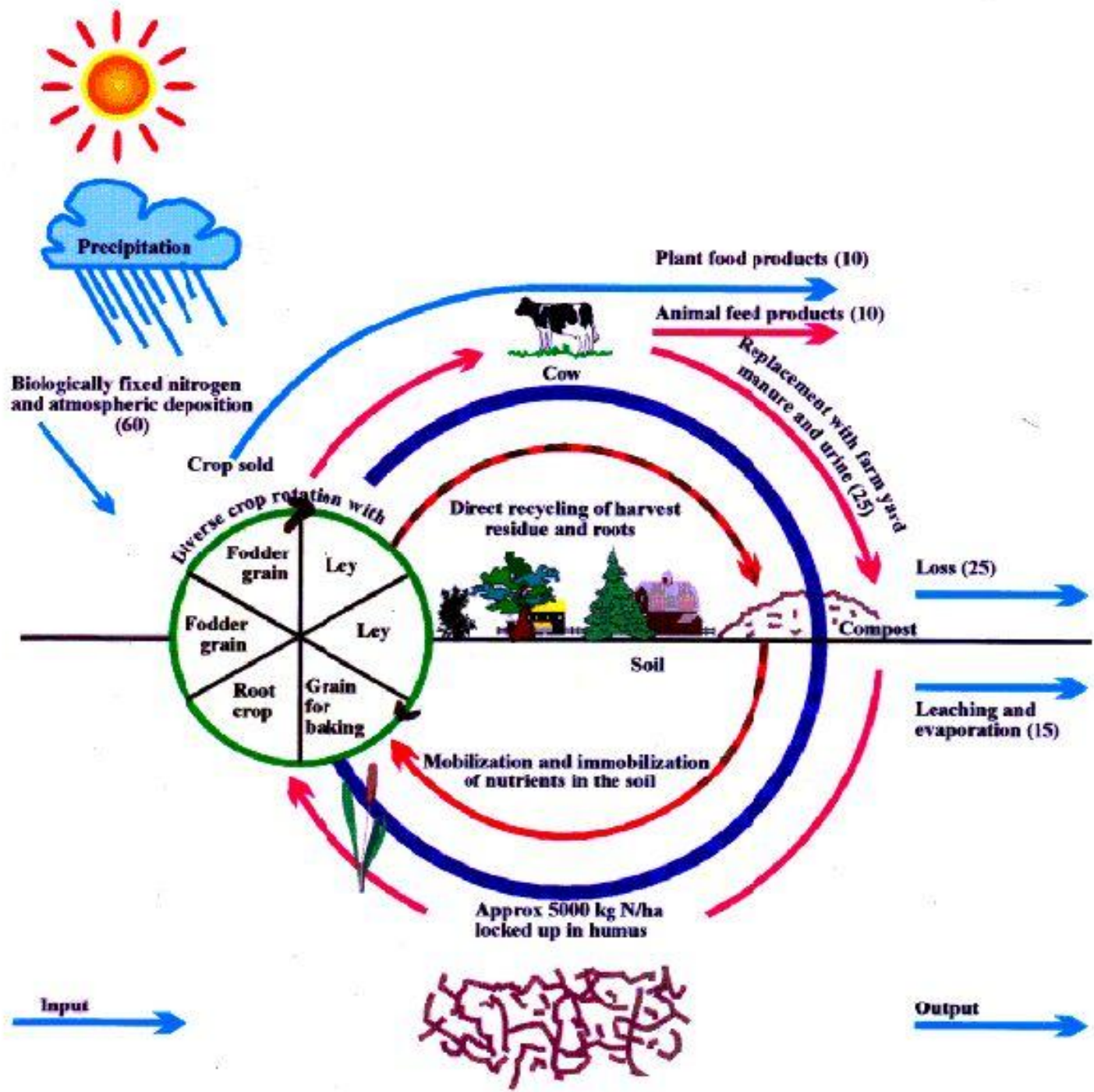
fungi

fungi

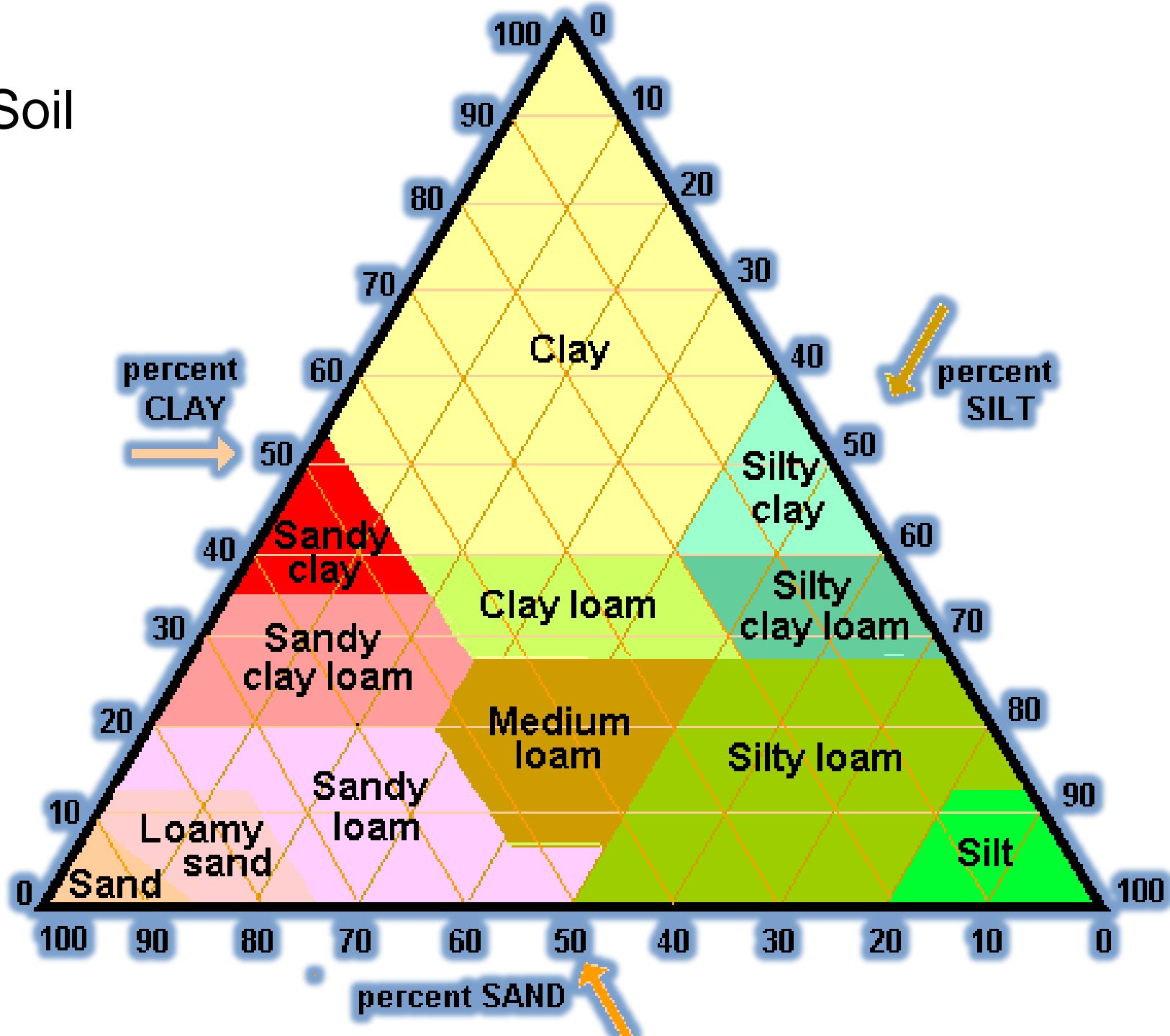
microbes

burrowing animals





Soil





Biodynamics



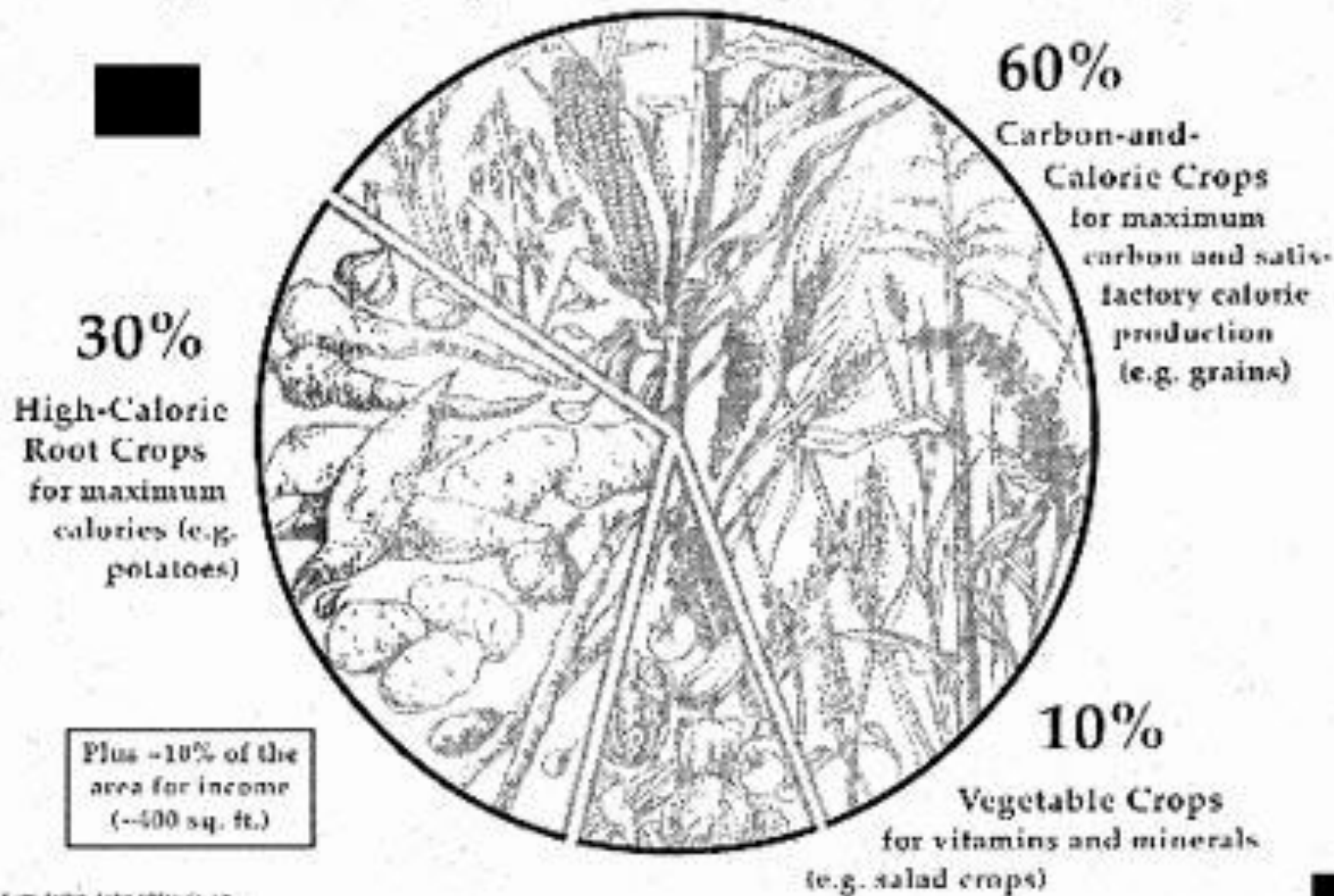
**CERTIFIED
BIODYNAMIC®**



Biointensive Farming and Gardening

"Grow Biointensive" Sustainable Mini-Farm ~ Approximately 4,000 sq. ft.

Approximate Crop Area Percentages for Sustainability



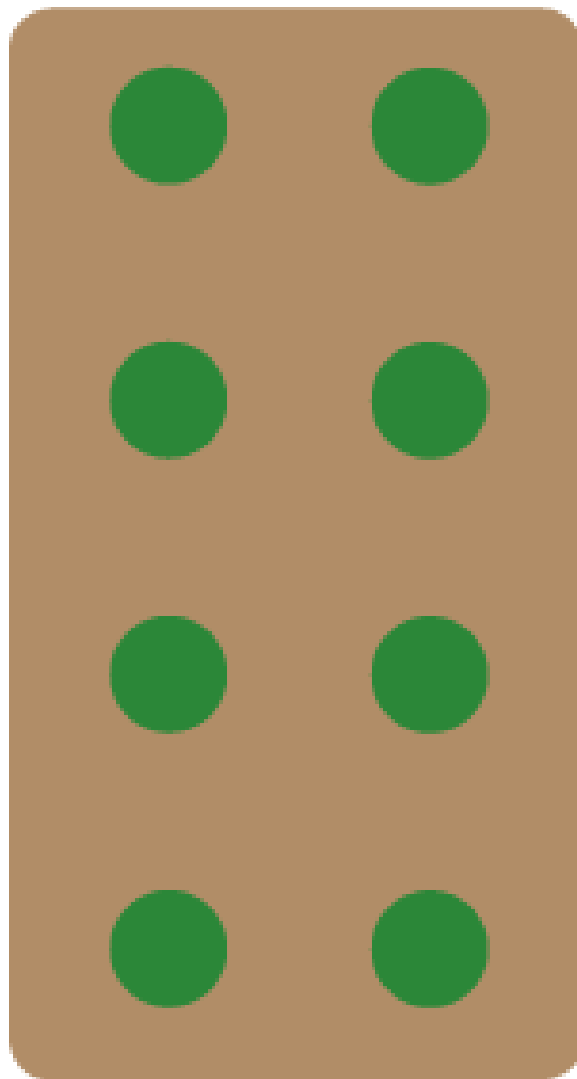
Bio-intensive Farming and Gardening Methods Yielding up to 10x's the food of industrial agriculture



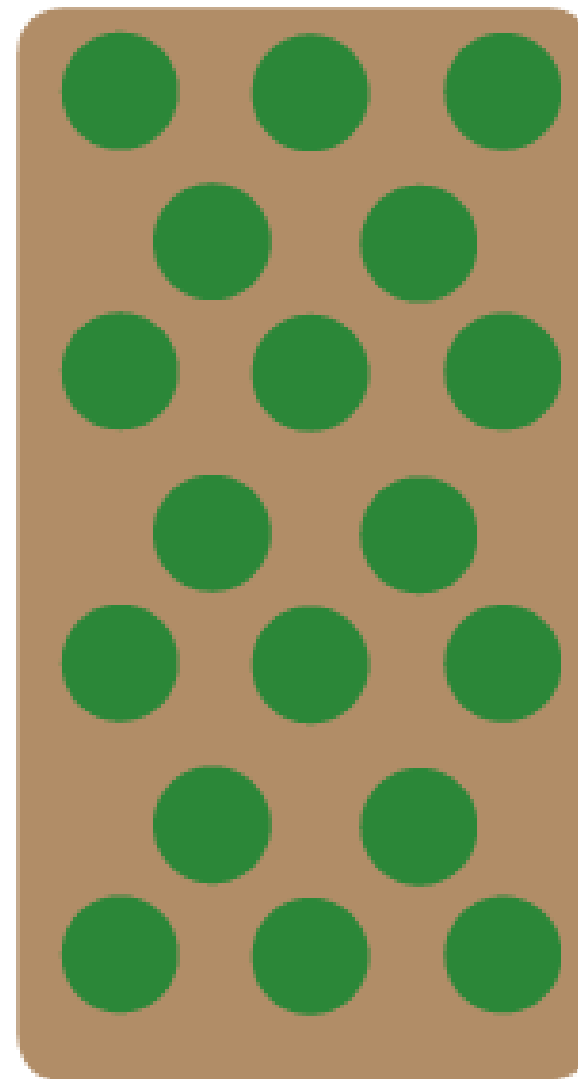
John Jeavons

“How To Grow More Vegetables Than You Ever Thought Possible on Less Land Than You Can Imagine”

Maximize your growing space and food production by using intensive (aka Biointensive) growing methods!

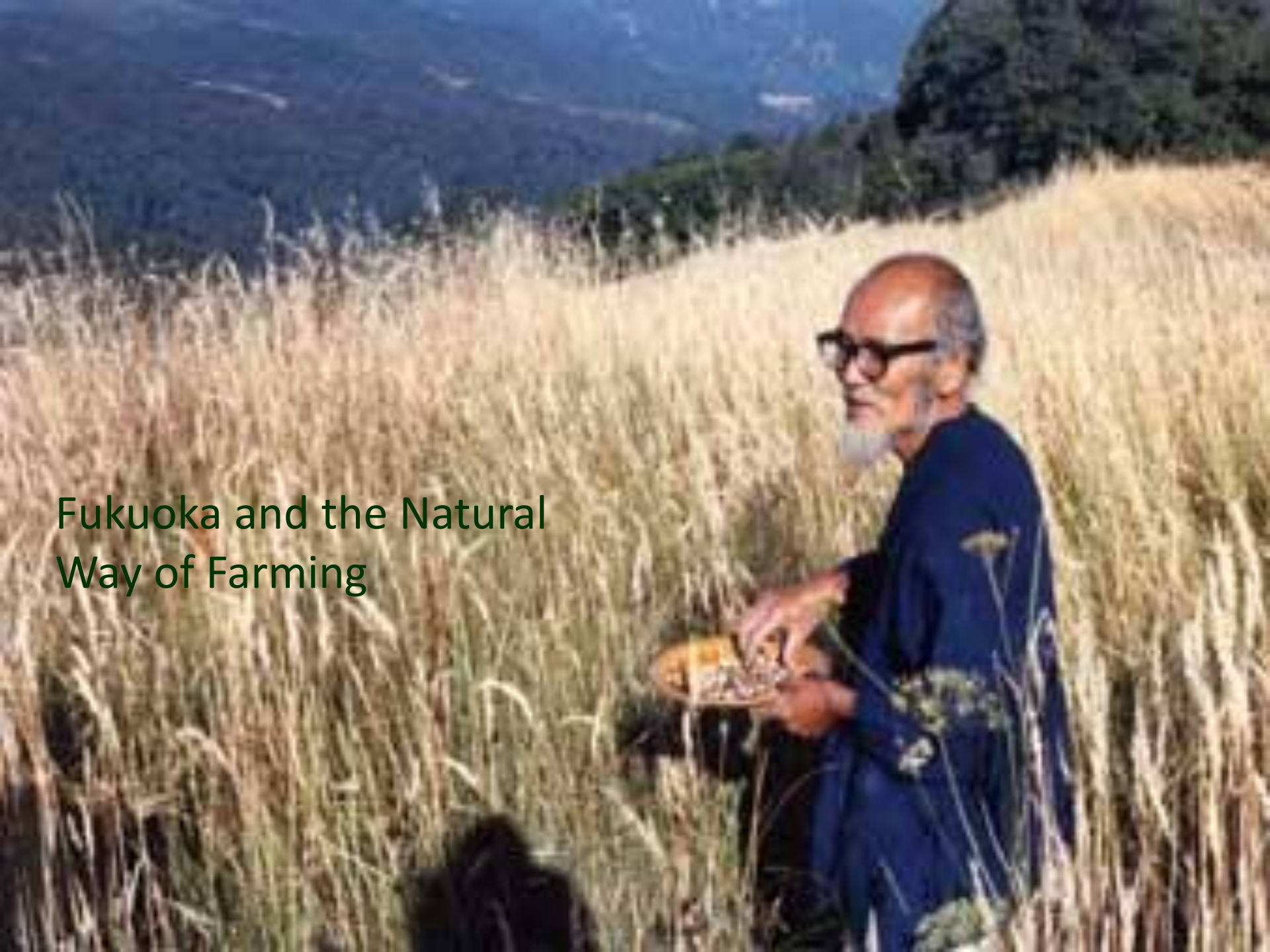


3 foot wide row with traditional planting.



Same 3 foot wide row with intensive/biointensive planting

Fukuoka and the Natural Way of Farming









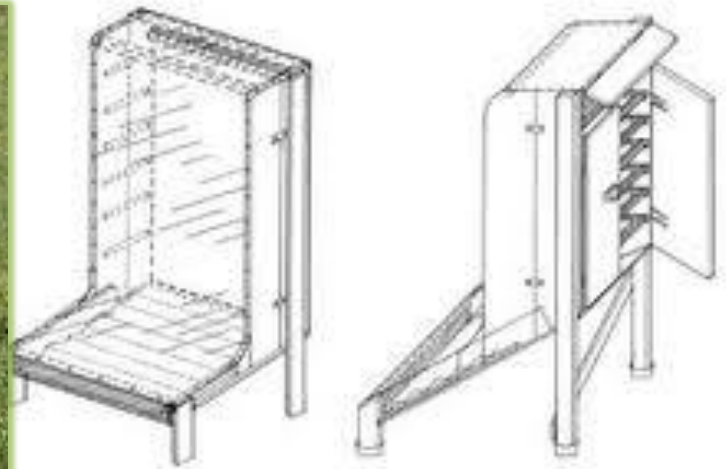
Greenhouse:
Season Extension



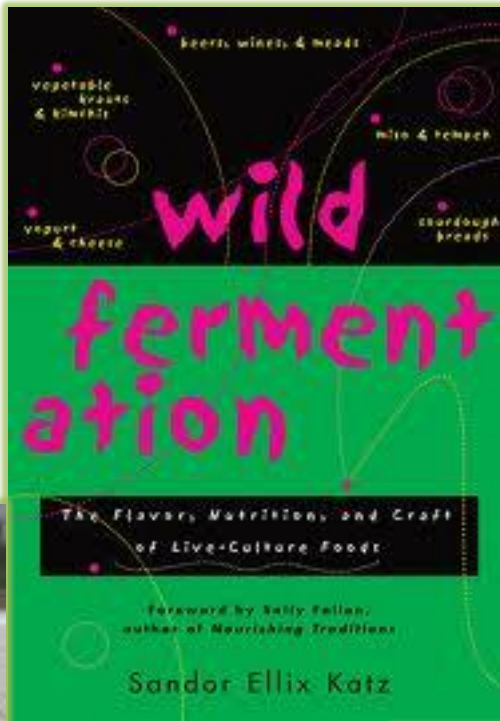
Cold Frame:
Season Extension



Floating Row Covers



Dehydration: Season Extension



Canning and Fermentation: Season Extension



Foraging



Wildcrafting



George Washington Carver

From peanuts, sweet potato and
soybeans:

Multiple food recipes,
dyes,
paints,
adhesives,
plastics,
and fuels.



Rubber from Goldenrod



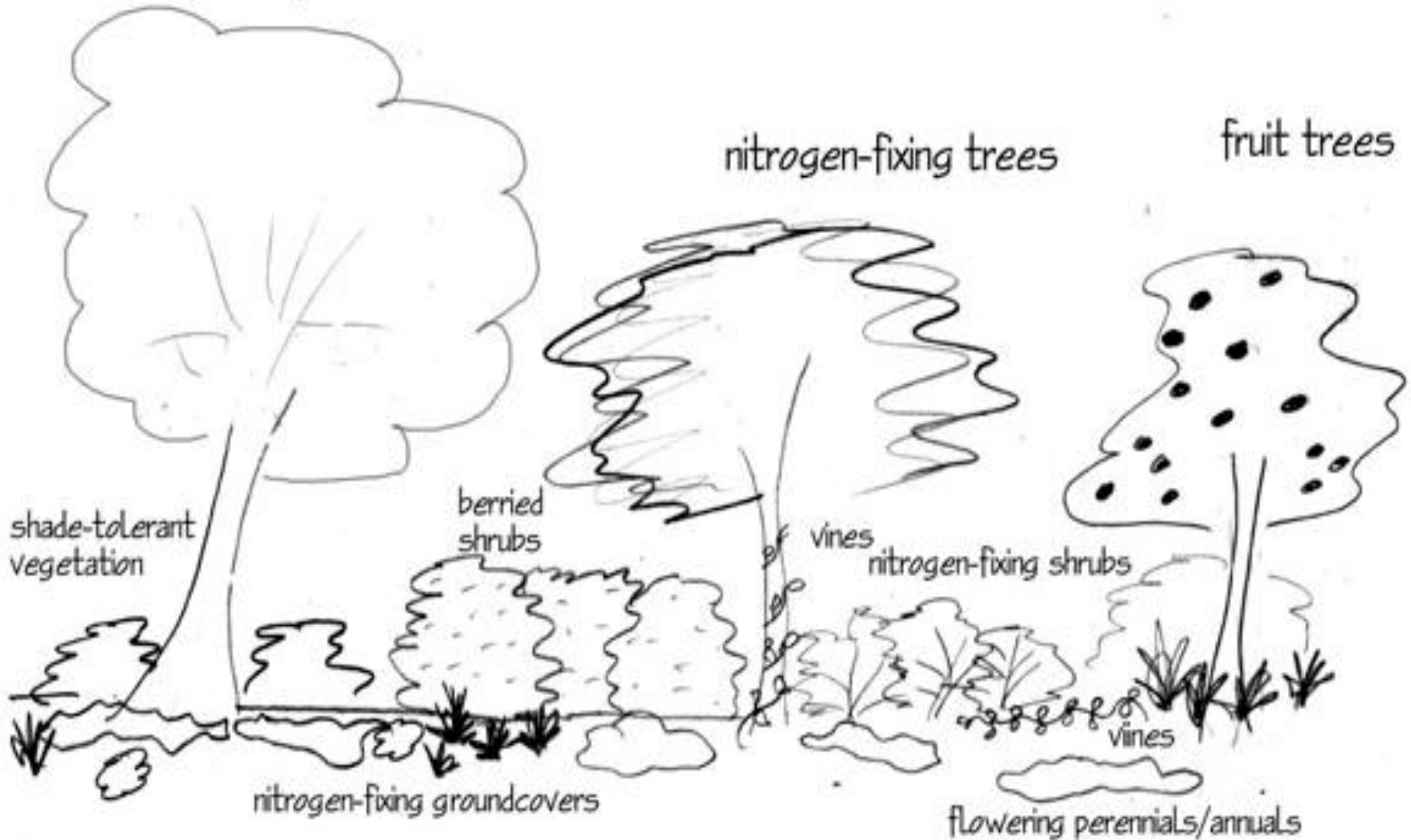
With Henry Ford

Plant Guilds

shade trees/windbreaks

nitrogen-fixing trees

fruit trees





Plant guilds are multi-functional groupings of plants that benefit each other in multiple ways



LAYERS of a FOOD FOREST

Kirsten Isakson

CANOPY

- locusts (N)
 - Pecan
 - Alder (N)
 - White Oak
 - Mulberry
 - Ginkgo
 - Chestnut
- Undwarfed/naturalized fruit trees
- apple
 - cherry
 - paw paw

SUBCANOPY: dwarf/semi-dwarf fruiting trees

- Apples
- Plums
- Apricots
- Olives
- Peaches
- Pears
- Quince
- Acacia (N)
- Mulberry
- persimmon
- Asian Pear
- Fig
- cherry

VINES

- Kiwi
- grape
- acaebia
- legumes (N)
- Schizandra

UNDERSTORY

- Blue berry
- High-bush cranberry
- Gogi Berry
- Aronia (N)
- Autumn Olive (N)
- Eleagnus (N)
- Rose
- Elder berry
- Asparagus

- Rubus (Black berry, Rasp., Marion-Y)
- Sea buck thorn (N)
- Beauty berry
- Camelia (tea)
- Oregon grape
- pomegranate

HERBACEOUS

- Sage
- Squash
- Brassicas
- Kale
- Broccoli
- Mustards
- Cauliflower
- Spinach
- Lettuce
- Basil
- Tomatoe
- Chard
- pepper
- Eggplant
- Borage
- Comfrey (N)
- Calendula
- Bergamot
- Day Lily
- Sun flower
- Jerusalem
- Artichoke
- Lavendar
- Legumes (N)
- peas
- beans
- lupine

FUNGI

- King Stropharia
- Oyster

ROOTS

- Carrots
- Beets
- Parsnips
- Turnips
- Potatoe
- Sweet Potatoe
- onion
- radishes
- garlic
- dandelion

GROUND COVER

- strawberry
- low growing mints (ie. thyme)
- Salal
- Kinnick Kinnik
- Wild Ginger
- Violet
- clover (N)







Permaculture Model

- **Holds water on the landscape**
- **Sequestering Carbon (CO₂)**
- **Builds topsoil, fertility and humus**
- **No herbicides, pesticides or artificial fertilizers**
- **Yields increase for 30 years then continue to produce for generations.**

Hold & Slow Water

Use the edge effect.

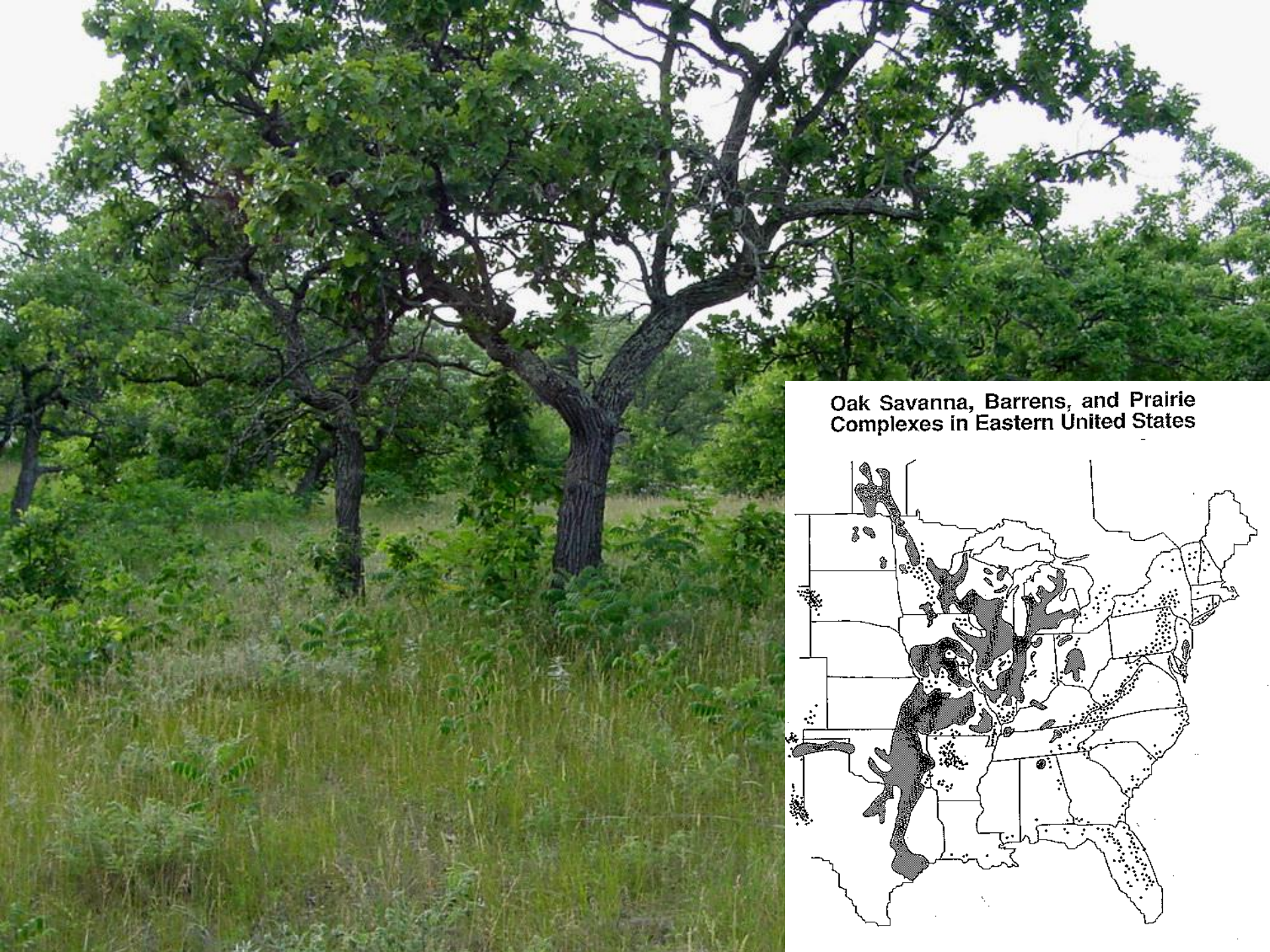
Stop tilling the soil.

Grow plants.

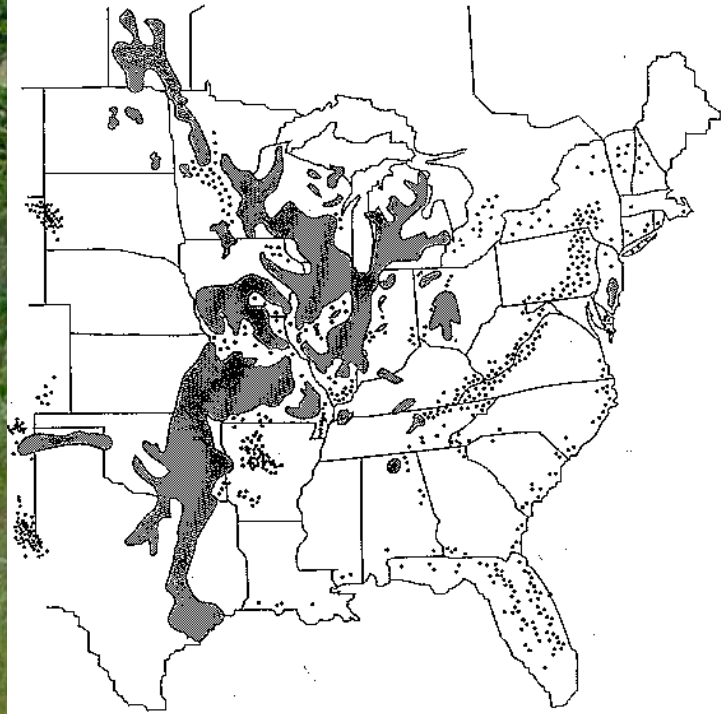
(especially trees)

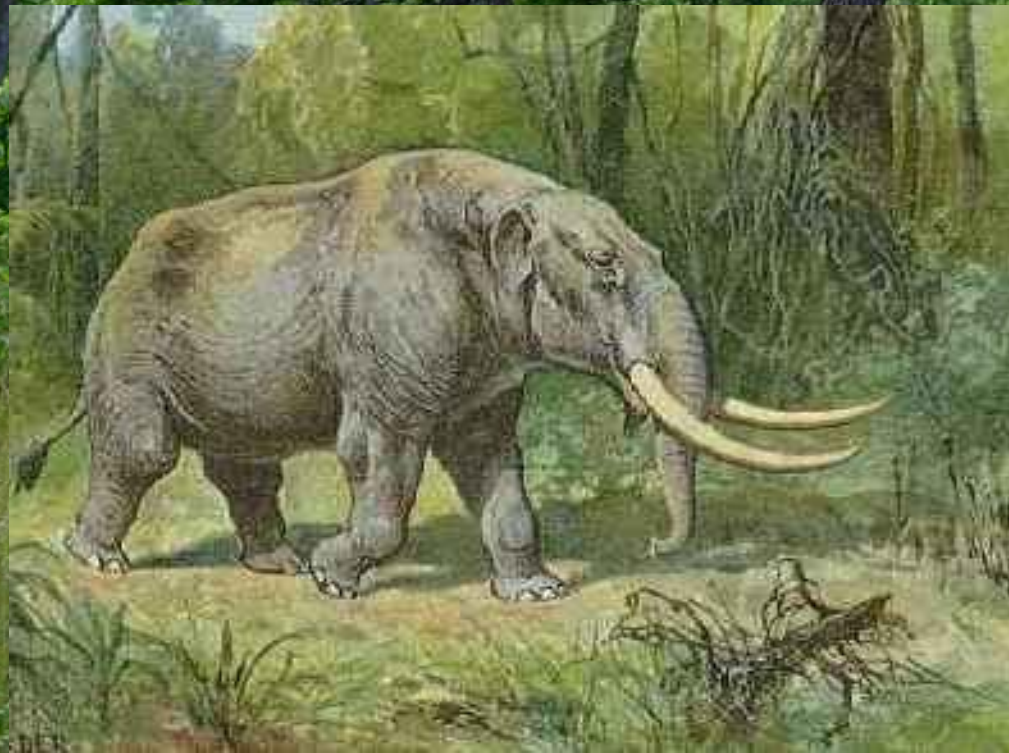
Use the Edge Effect





Oak Savanna, Barrens, and Prairie Complexes in Eastern United States





What services do trees provide?

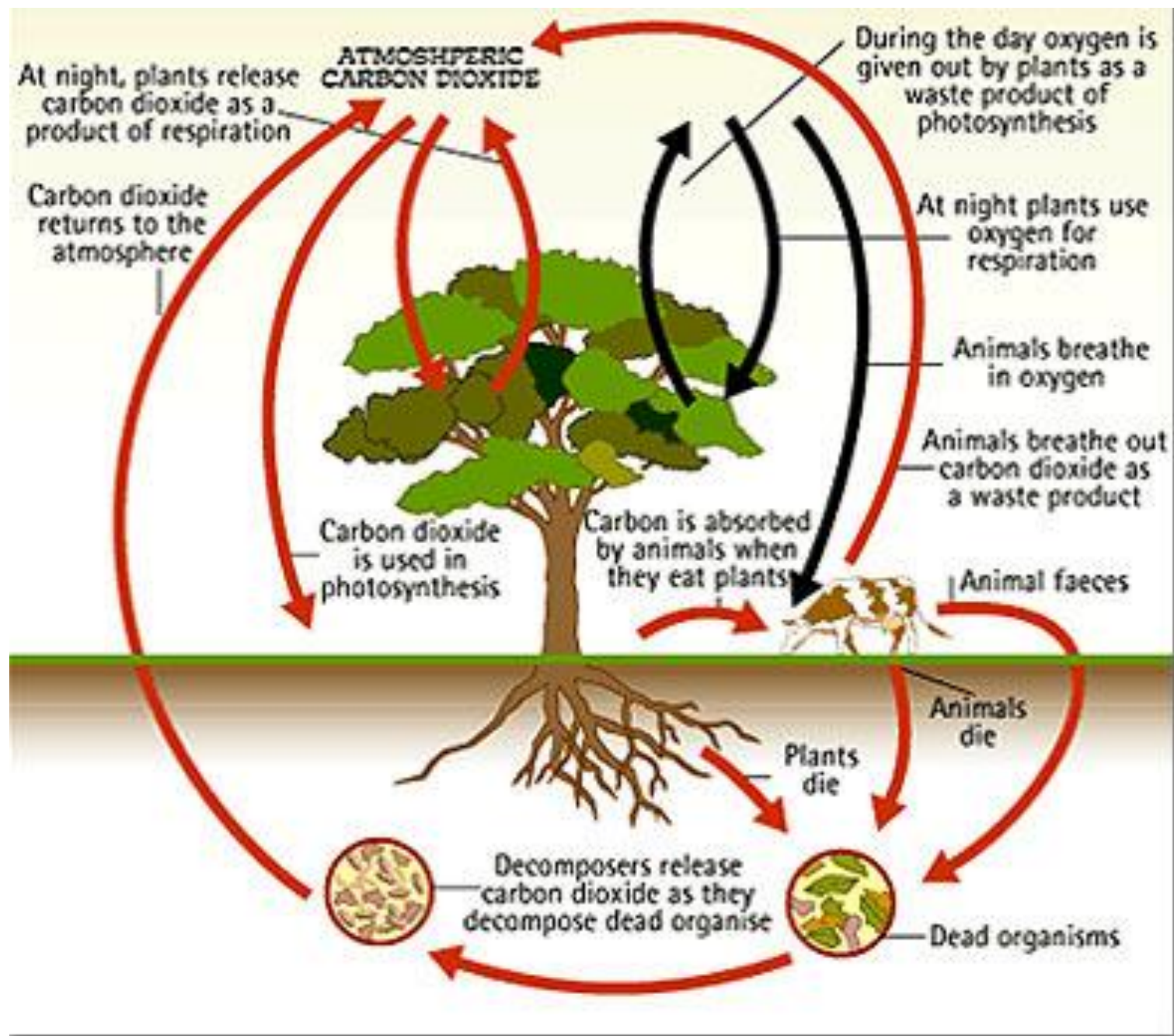
1. Pull carbon (CO₂) and nitrogen out of the air

2. Build fertility and soil

3. Hold moisture

4. Provide habitat for wildlife

**5. Produce useful & needed items for
a bountiful, human existence?**



Hazelnuts & Chestnuts



**How do we
transition from
this...**



...to This?



Alley Cropping





Silvopasture



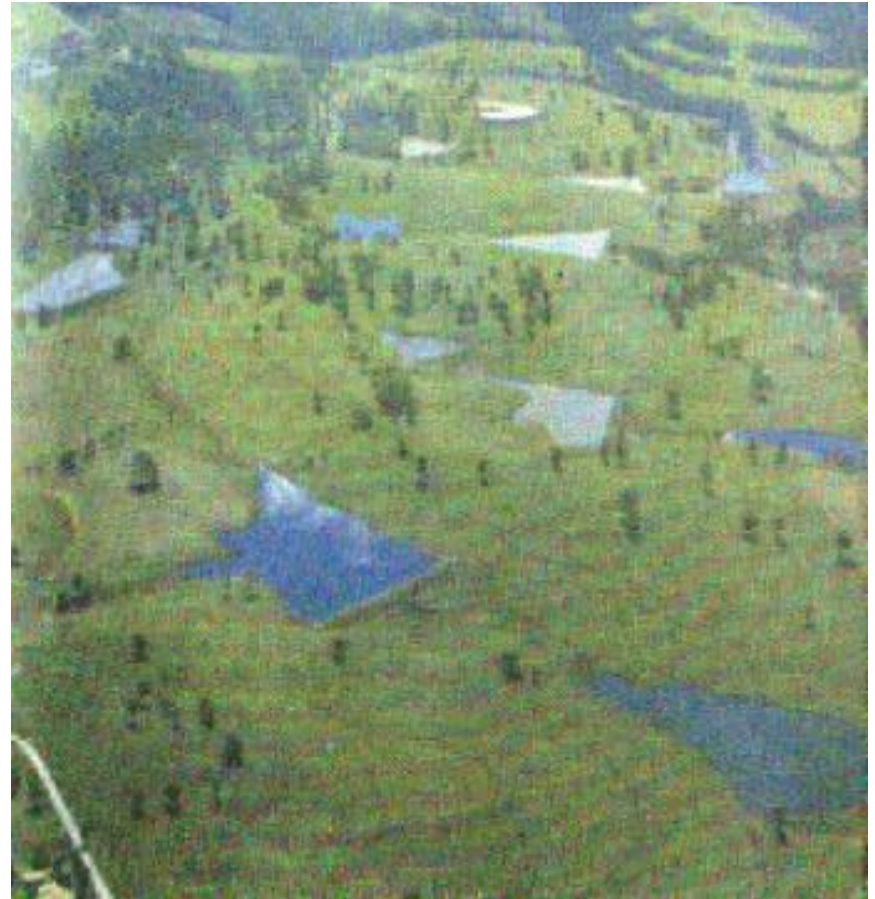




Harvest an average
of \$25,000 worth
of:

- Lambsquarter
 - Ramps
(wild leeks)
 - Wildflower Seed
 - Red Amaranth
(pigweed)
- ...each year.





Sustainable Agriculture
deepening living soil to absorb
Soil and CO2

Water for Every Farm

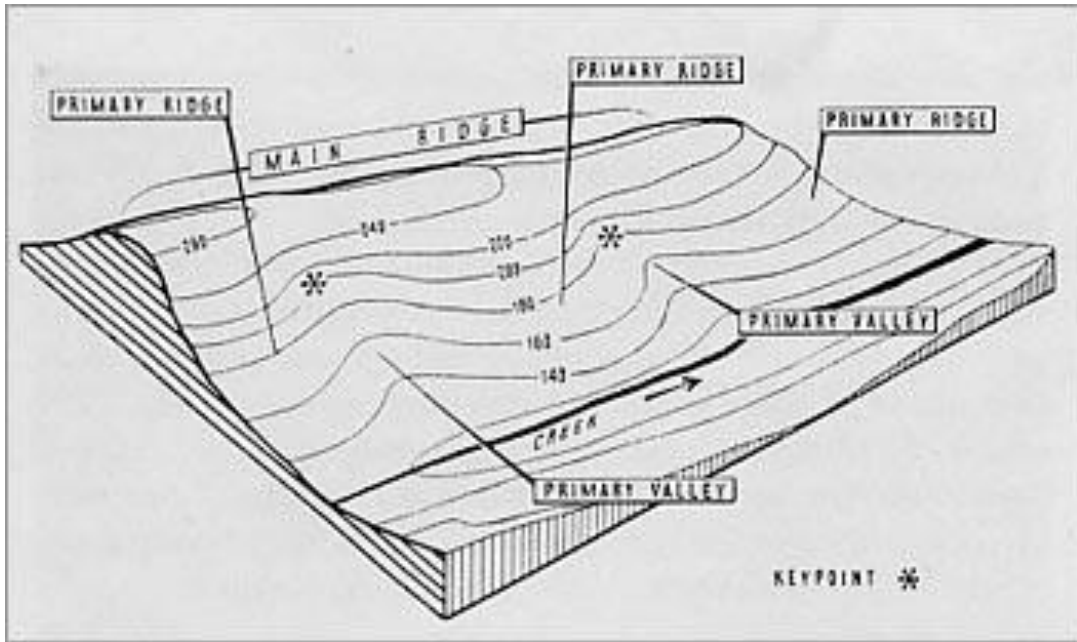
Yeomans Keyline Plan

www.keyline.com.au

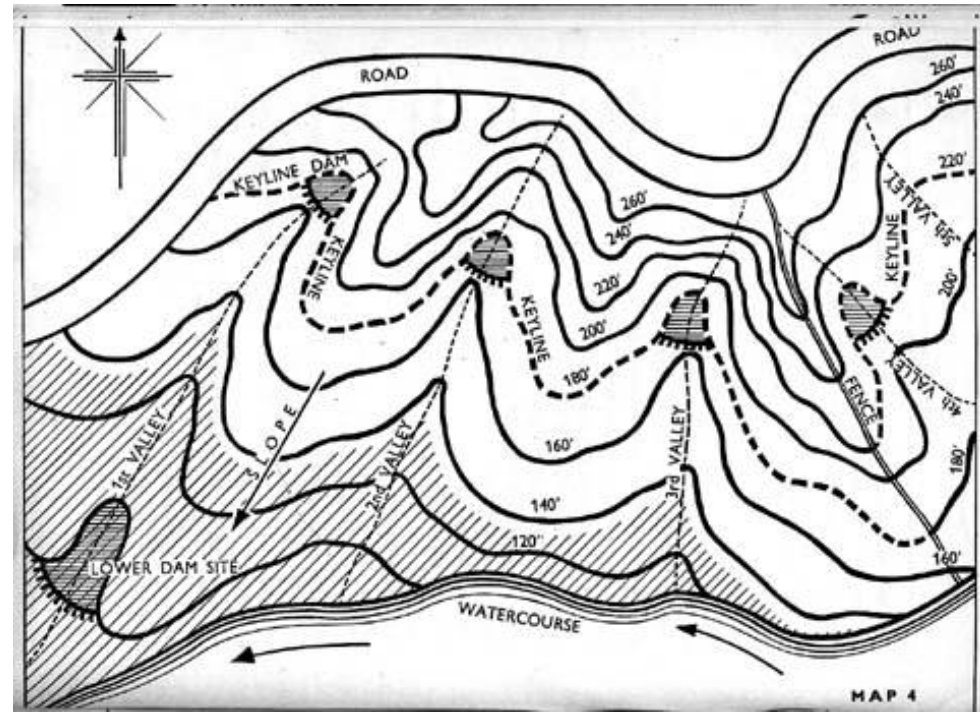
- Comprehensive Whole Farm Design
- Applied Contour Cultivation
- Water Storage in Farm Dams
- Low-cost Dams 1:500 Ready
- Quick-Ten-by Irrigation
- Custom Strip Farming
- Subdivision Design
- Hoading Process
- Soilring Salinity

Compiled, annotated and edited by
Ken B. Yeomans H.D.A.
from work and writings of the late

P.A. Yeomans

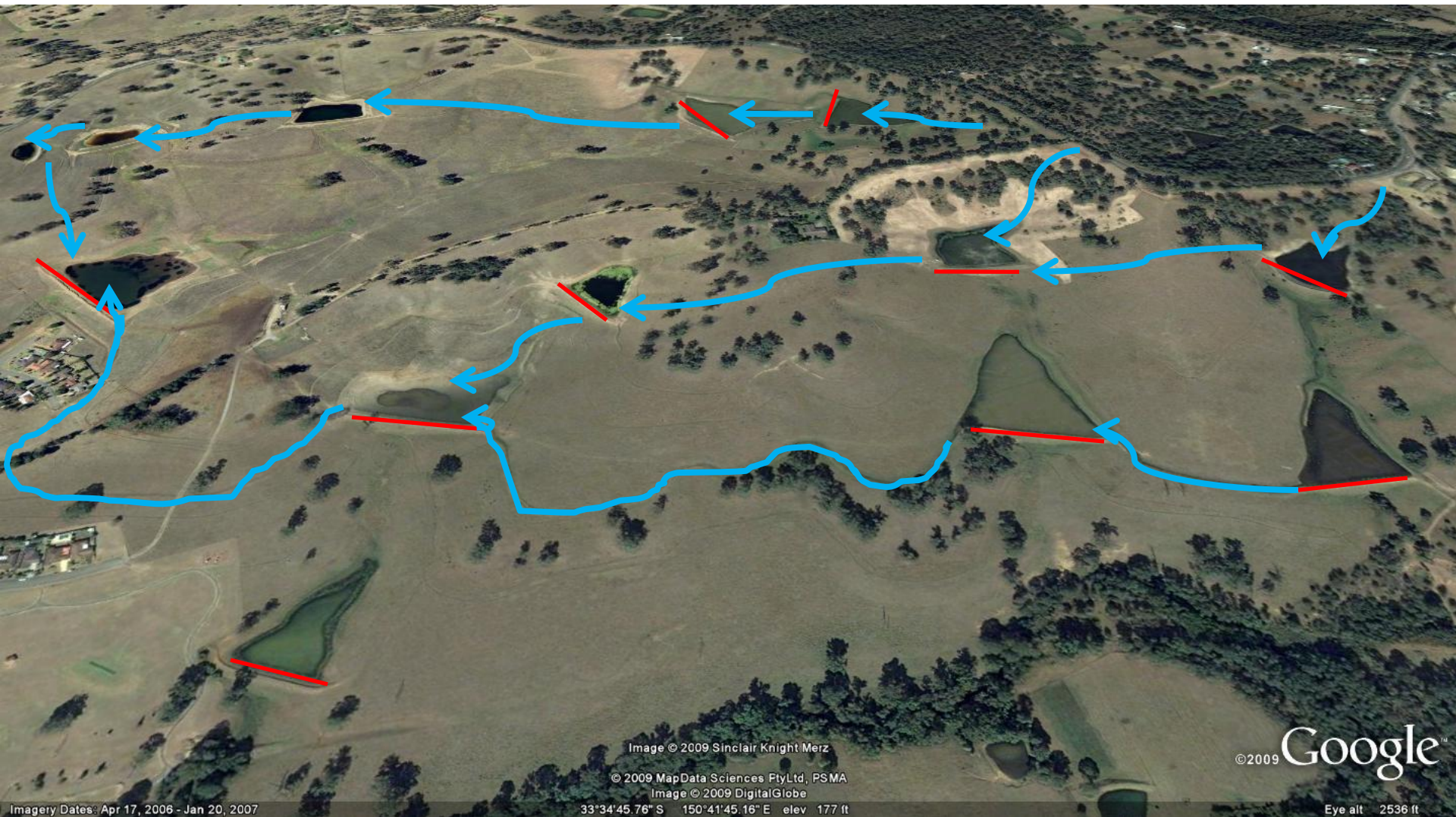


Siting Keyline Dams





Yobarnie Farm, Australia

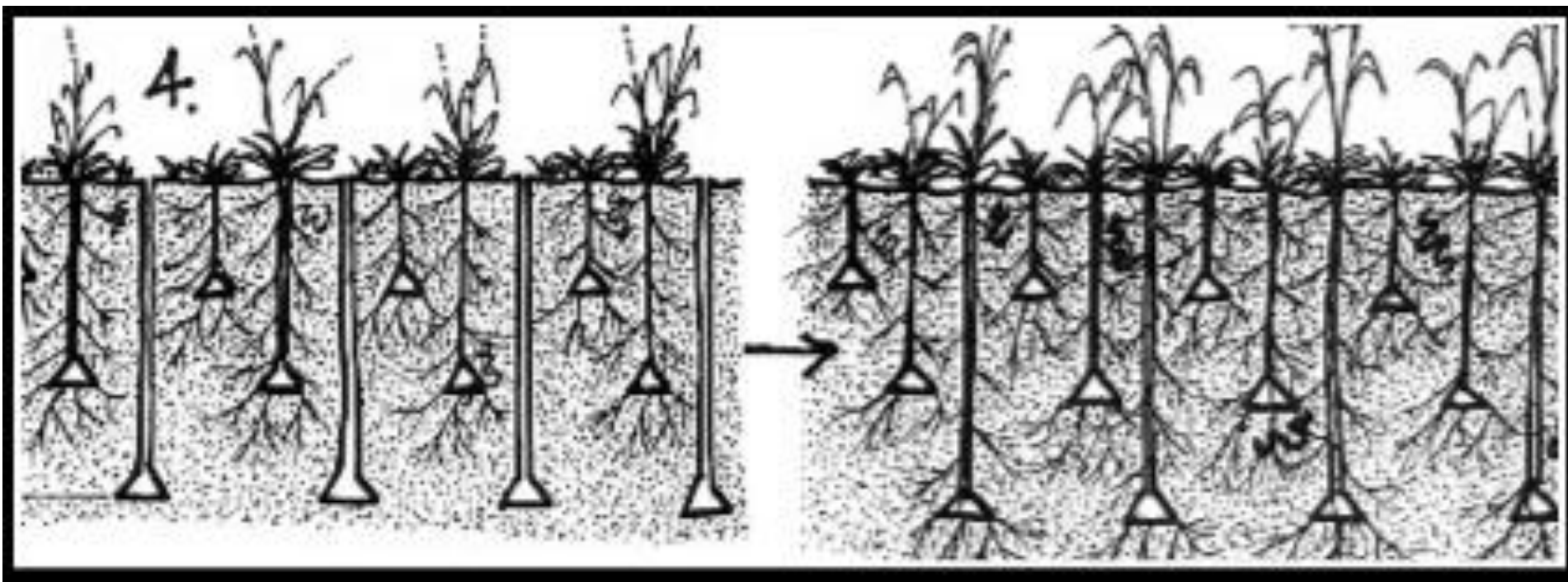


Established:

Image from April 17 , 2006 – Jan 20, 2007

Keyline Plow





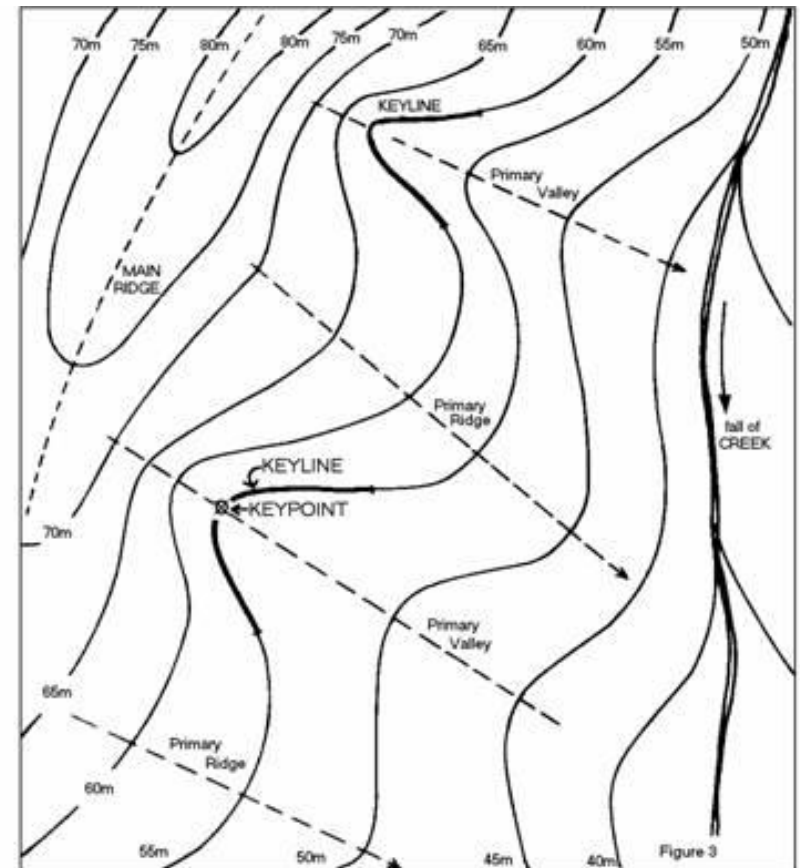
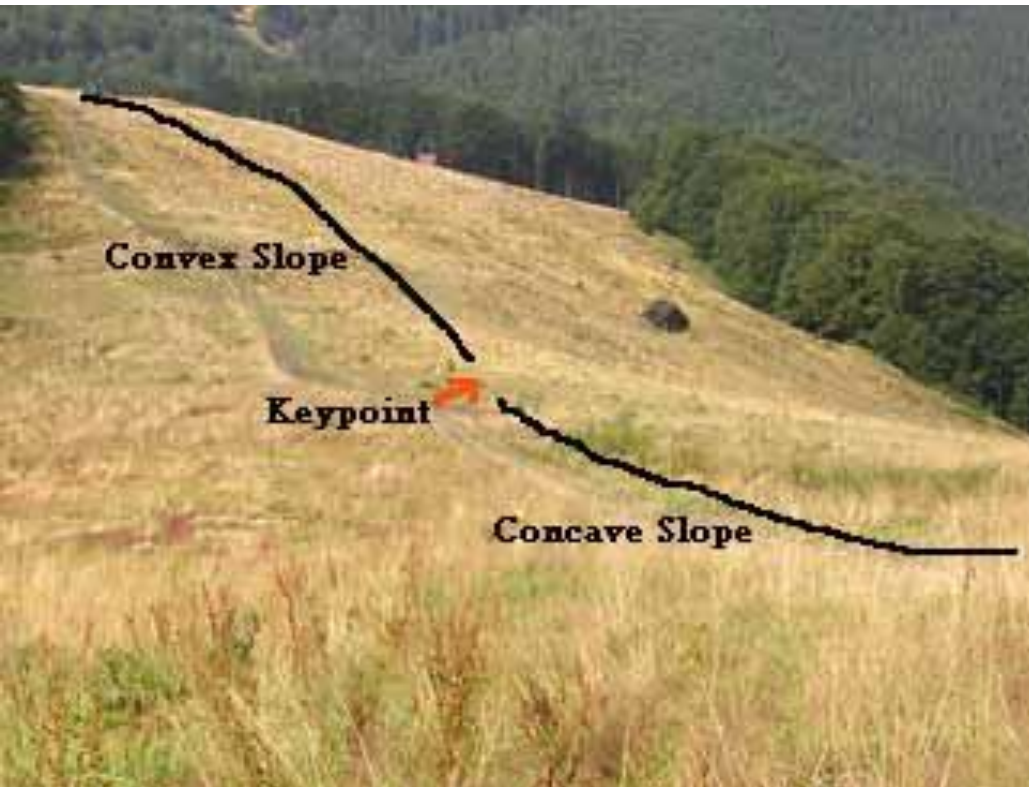


27804 C

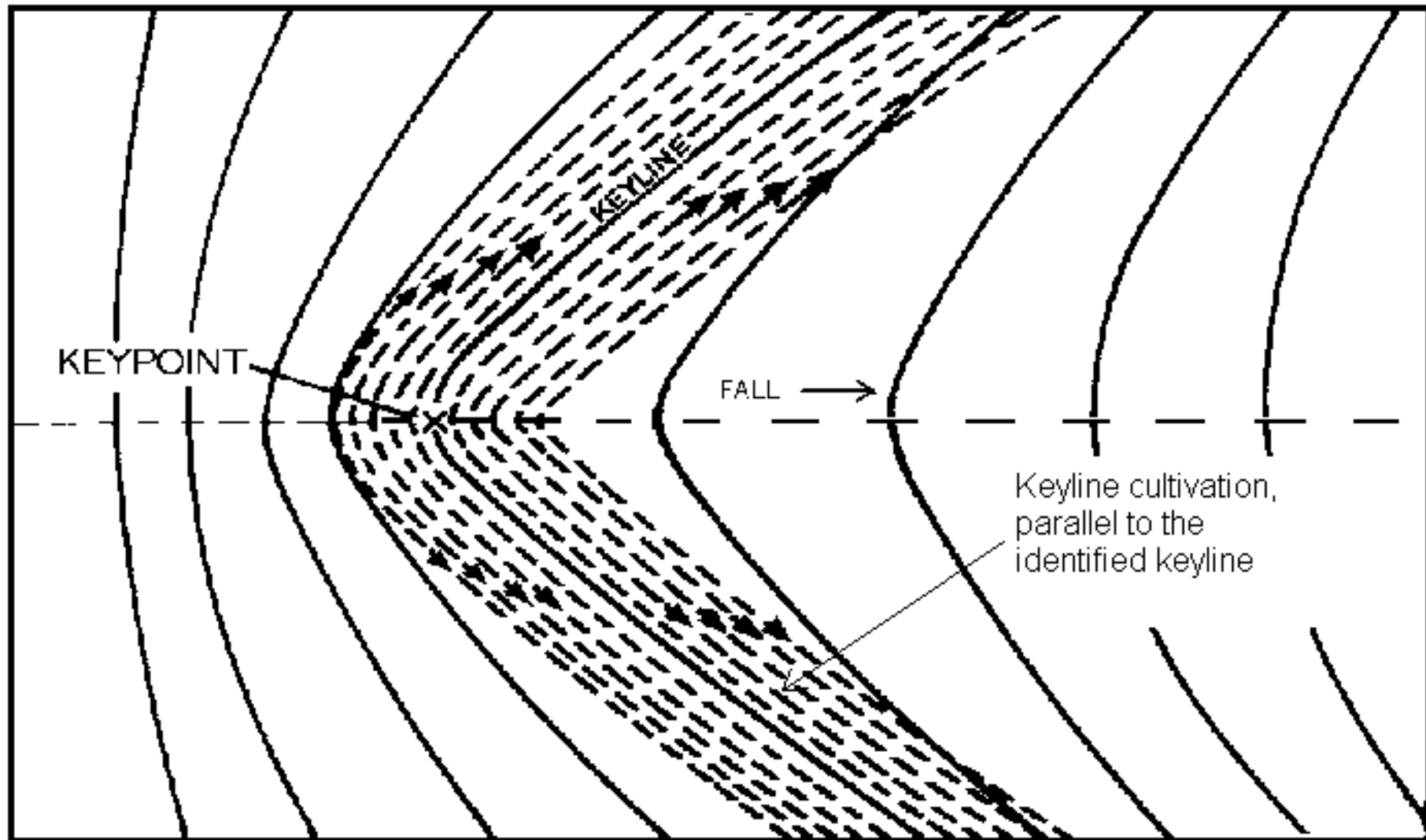
YEOMANS

PLOW CO.

Keyline Identified

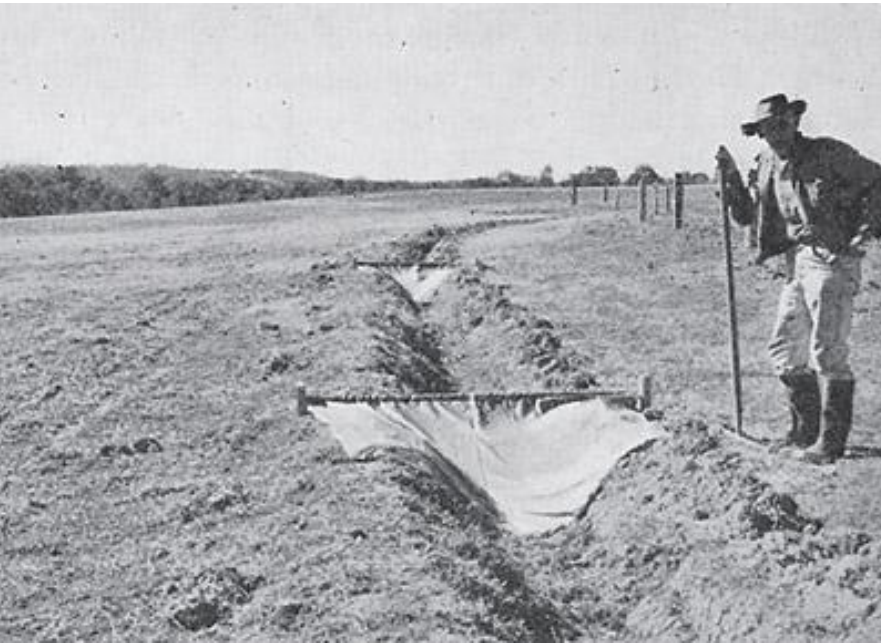


Keyline Pattern





Keyline Irrigation



Swales on Contour



Boomerang Basins: Nigeria



Two Frameworks for Decisions & Policies.

Holistic Management Framework.

- Work in 'wholes'
- Holistic goal ◀
- Nature's foundation.
- *Objectives – goals – mission - vision.*
- *Technology. Rest. Fire. Small organisms. Animal impact. Grazing.*
- *One or more factors:*
- Test questions. *
- Assume wrong -feedback loop – produce result.
- Proactive.

Conventional Framework.

- -----
- -----
- -----
- *Objectives- goals- mission -vision.*
- *Technology. Rest. Fire. Small organisms.*
- *One or more factors:*
- -----
- *Assume correct & monitor results*
- *Reactive – Adaptive.*

The Brittleness Scale

Non-brittle

1 2 3 4 5 6 7 8 9 10

Brittle

Jungle

Humidity year-round

Vegetation breaks down quickly

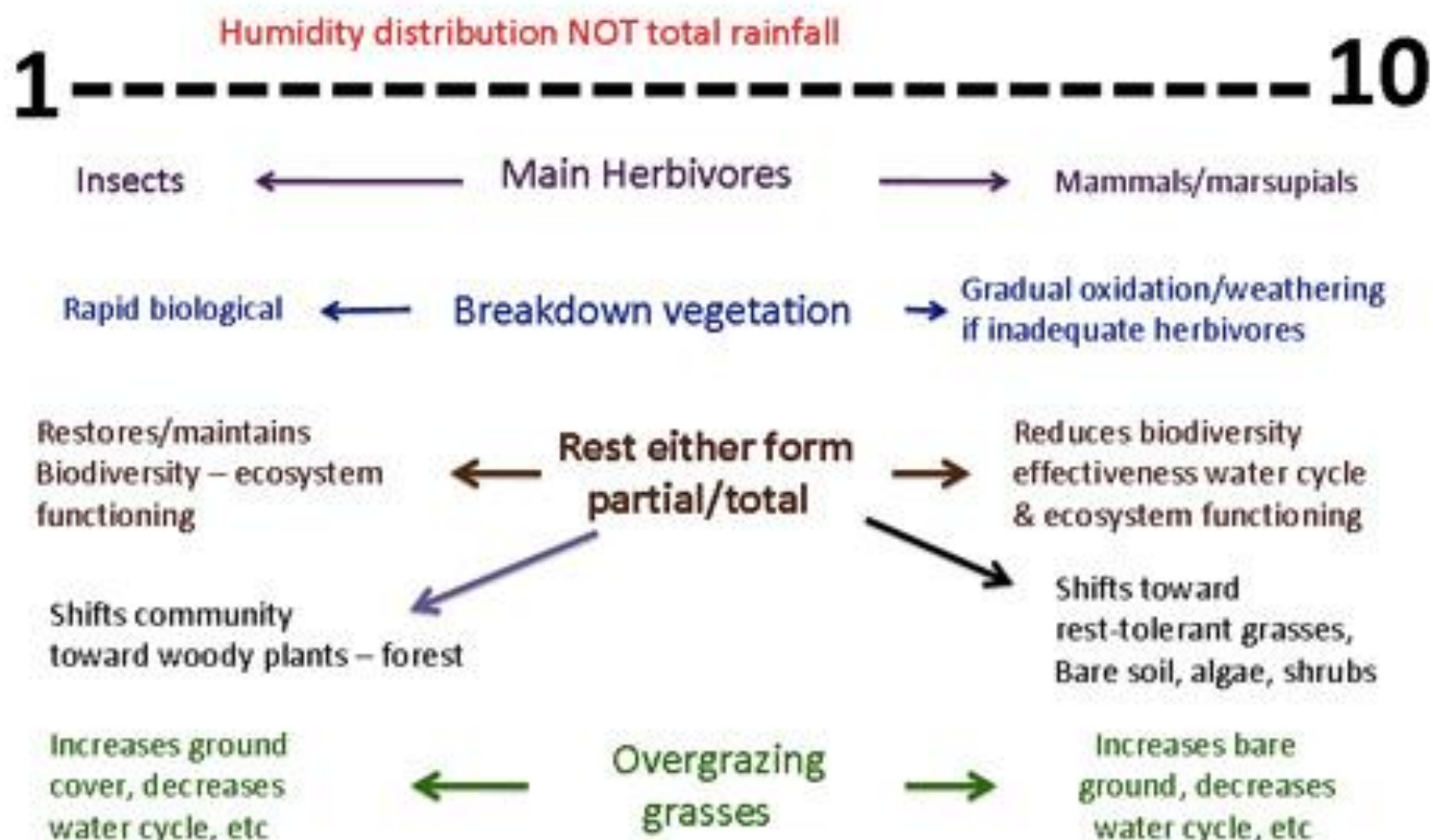
Desert

Humidity erratic

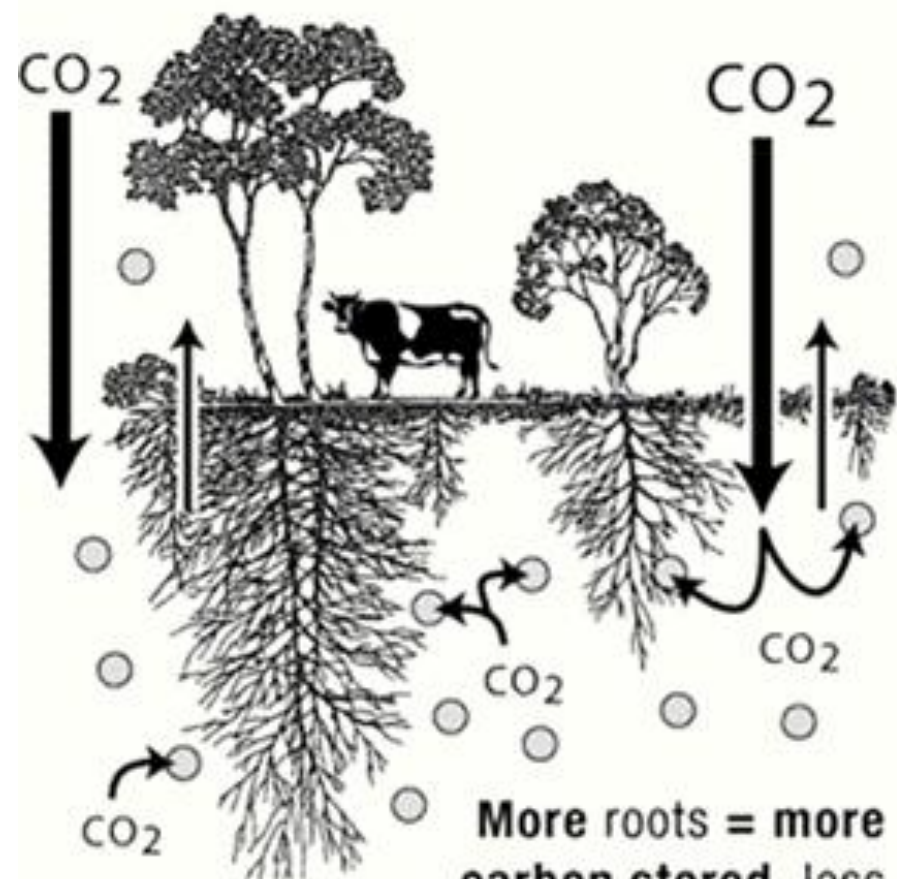
Vegetation lingers



Brittleness Scale & Tendencies Tools

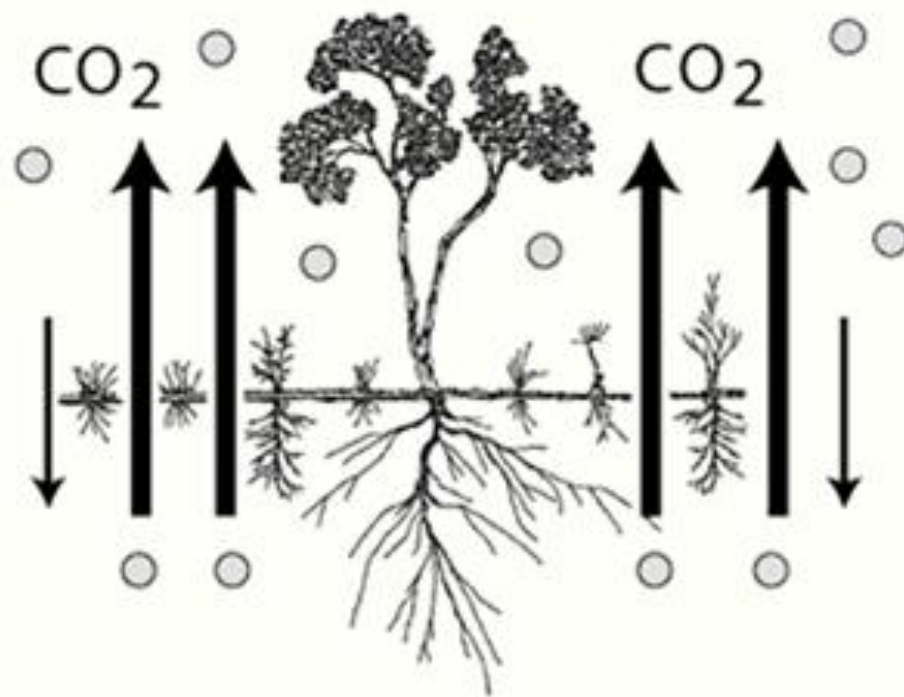


Holistically Managed Land



More roots = more carbon stored, less carbon in the atmosphere

Conventionally Managed Land



Less roots = less carbon stored, more carbon in the atmosphere



