An Overview of Agroforestry Practices

Ecological agriculture for America

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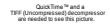
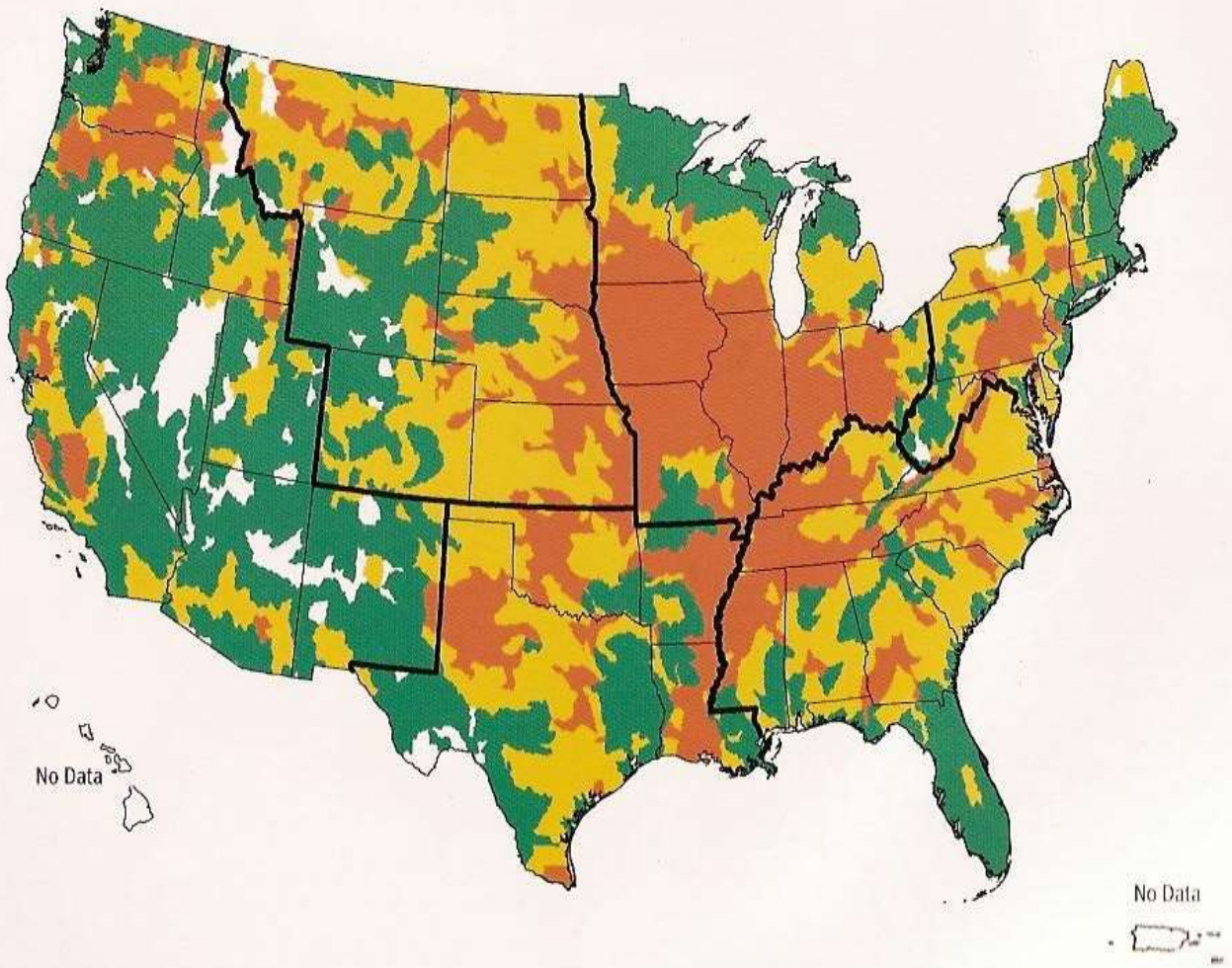
Forest Agriculture Enterprises LLC New Forest Farms LLC

www.forestag.com



Has anything REALLY changed?

Sediment Delivered to Rivers and Streams from Sheet & Rill Erosion



This map shows estimates of sediment delivered to rivers and streams for the approximately 2,150 watersheds comprising the contiguous United States. The Universal Soil Loss Equation was used to estimate sheet and rill erosion rates for the agricultural land in each watershed (other erosion processes are not included in this estimate). Erosion rates were converted to tons of sediment delivered to streams from agricultural land using a delivery ratio formula based on an empirical relationship between soil erosion rates and sediment loads in several U.S. river basins.

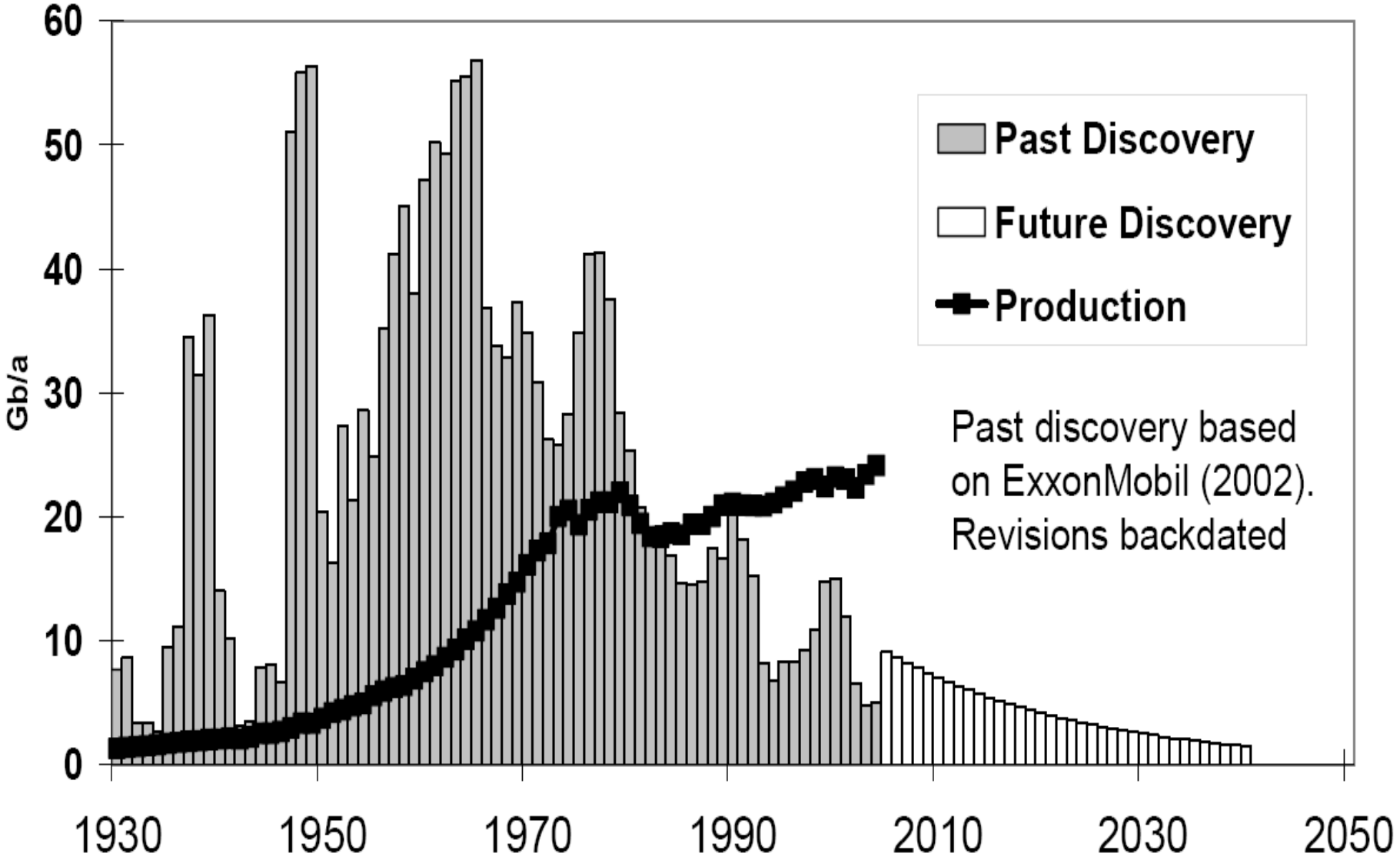
Sediment Delivered

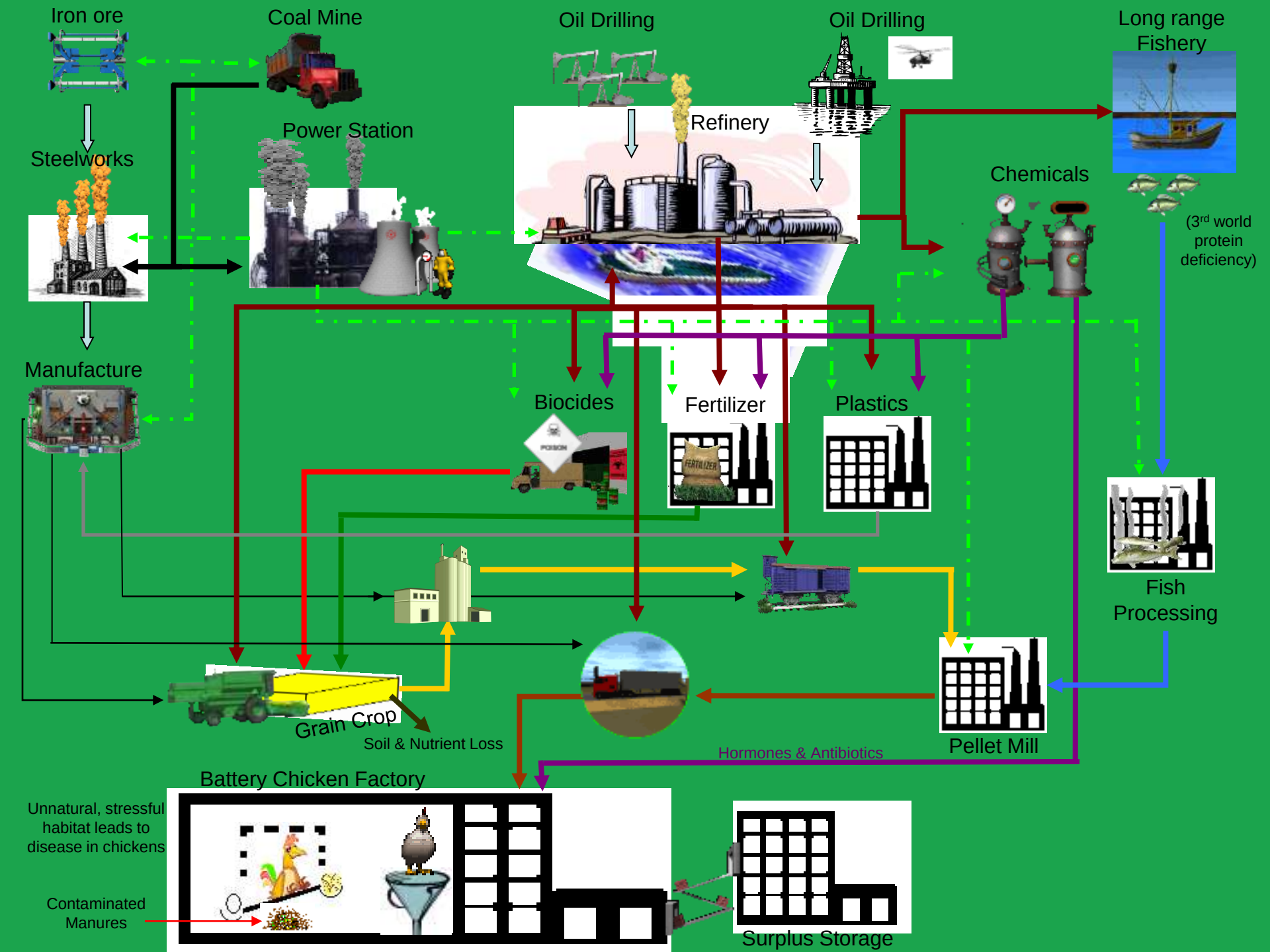
LEGEND

- High
- Medium
- Low
- None/No Data

Source:
USDA/NRCS based on data from R. Srinivasan and C. Walker, Texas Agricultural Experiment Station, 1996

THE GROWING GAP
Regular Oil



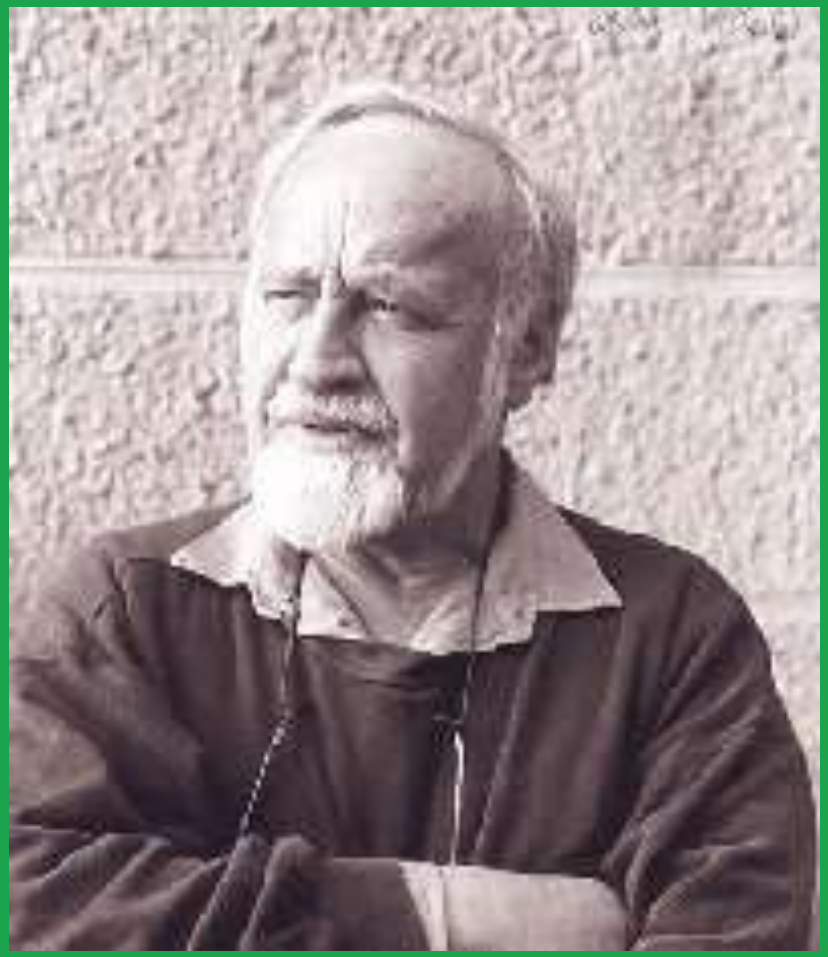

Iron ore
Coal Mine
Oil Drilling
Oil Drilling
Long range Fishery
Steelworks
Power Station
Refinery
Chemicals
(3rd world protein deficiency)
Manufacture
Biocides
Fertilizer
Plastics
Fish Processing
Grain Crop
Soil & Nutrient Loss
Hormones & Antibiotics
Pellet Mill
Battery Chicken Factory
Unnatural, stressful habitat leads to disease in chickens
Contaminated Manures
Surplus Storage

- Why does everyone seem to be working so hard to create and maintain something that doesn't seem to be working very well?

What is agroforestry?

- Agroforestry is the intentional combining of trees and livestock, crops or forest-grown products to achieve economic, conservation, and ecological goals.

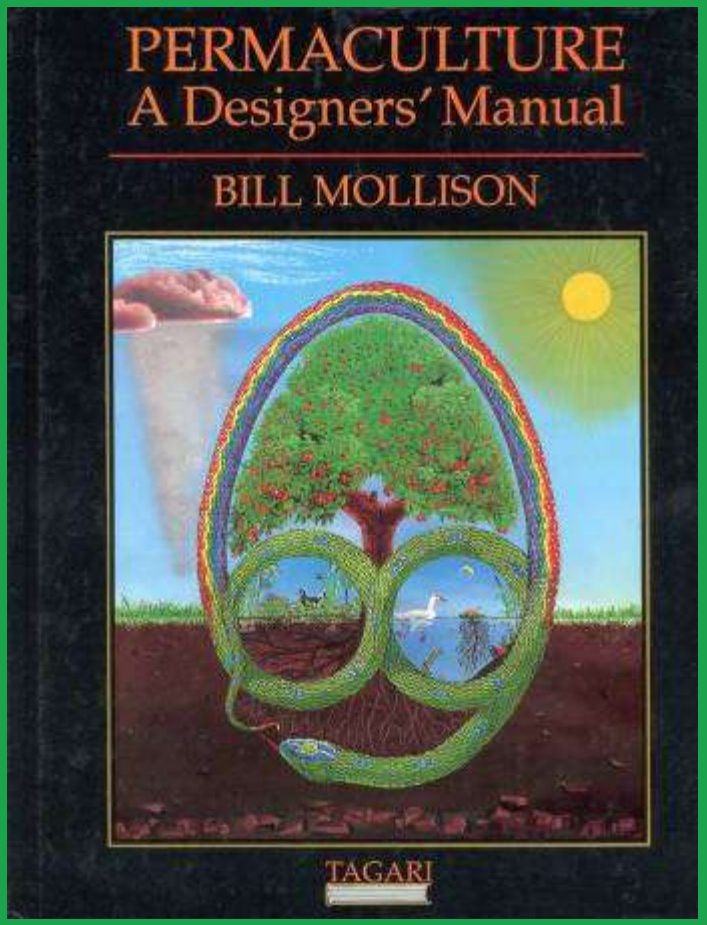
Permaculture



Bill Mollison

Wrote the book:

A Designers Manual



PERMA (permanent) CULTURE

- “Permaculture is about relationships that we can create between minerals, plants, animals and humans by the way we place them in the landscape. The **aim is to create systems that are ecologically sound and economically viable**, which provide for their own needs, do not exploit or pollute and are therefore sustainable in the long term.” (Bill Mollison)
- Permanent Agriculture = Permanent Culture
- (Permanent- Latin: per- throughout + manere- to remain; Culture- Middle English: cultivation, tillage; from Old French; from Latin: cultura, from cultus- cultivation, from Germanic: skel- to cut)

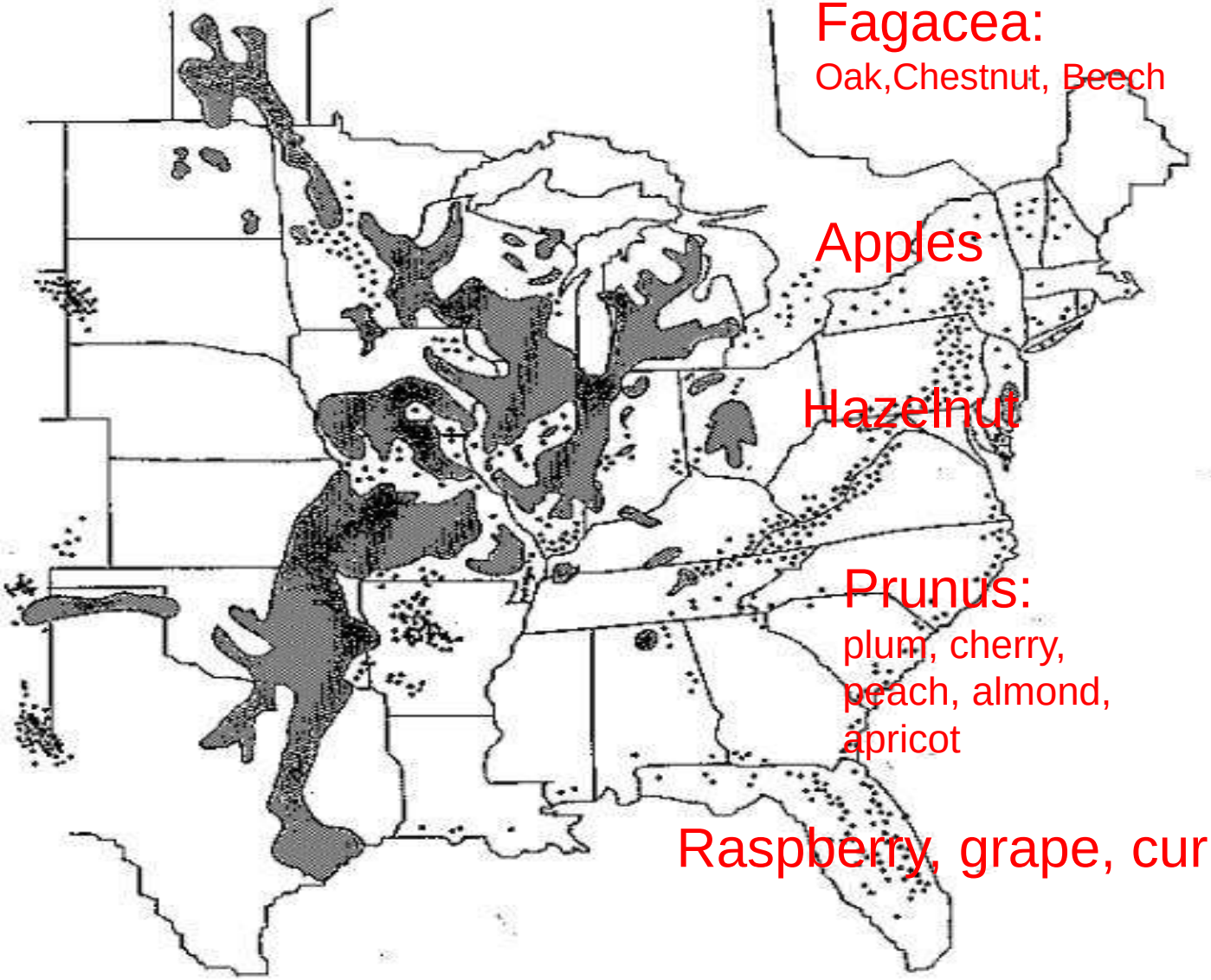
-The piece of planet where I live has been photosynthetically productive and has supported a rich variety of life for a bajillion years; all without the use of fossil fuels, commercial fertilizers, pesticides, herbicides, fungicides or even tillage!

-How do I design my farming system to operate this way?

-Can such a form of agriculture provide the staple foods (carbohydrates, ptoteins and oils) currently provided by annual crops?

-Can such a farm be economically viable according to the current economic system?

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



Fagacea:
Oak,Chestnut, Beech

Apples

Hazelnut

Prunus:
plum, cherry,
peach, almond,
apricot

Raspberry, grape, currant

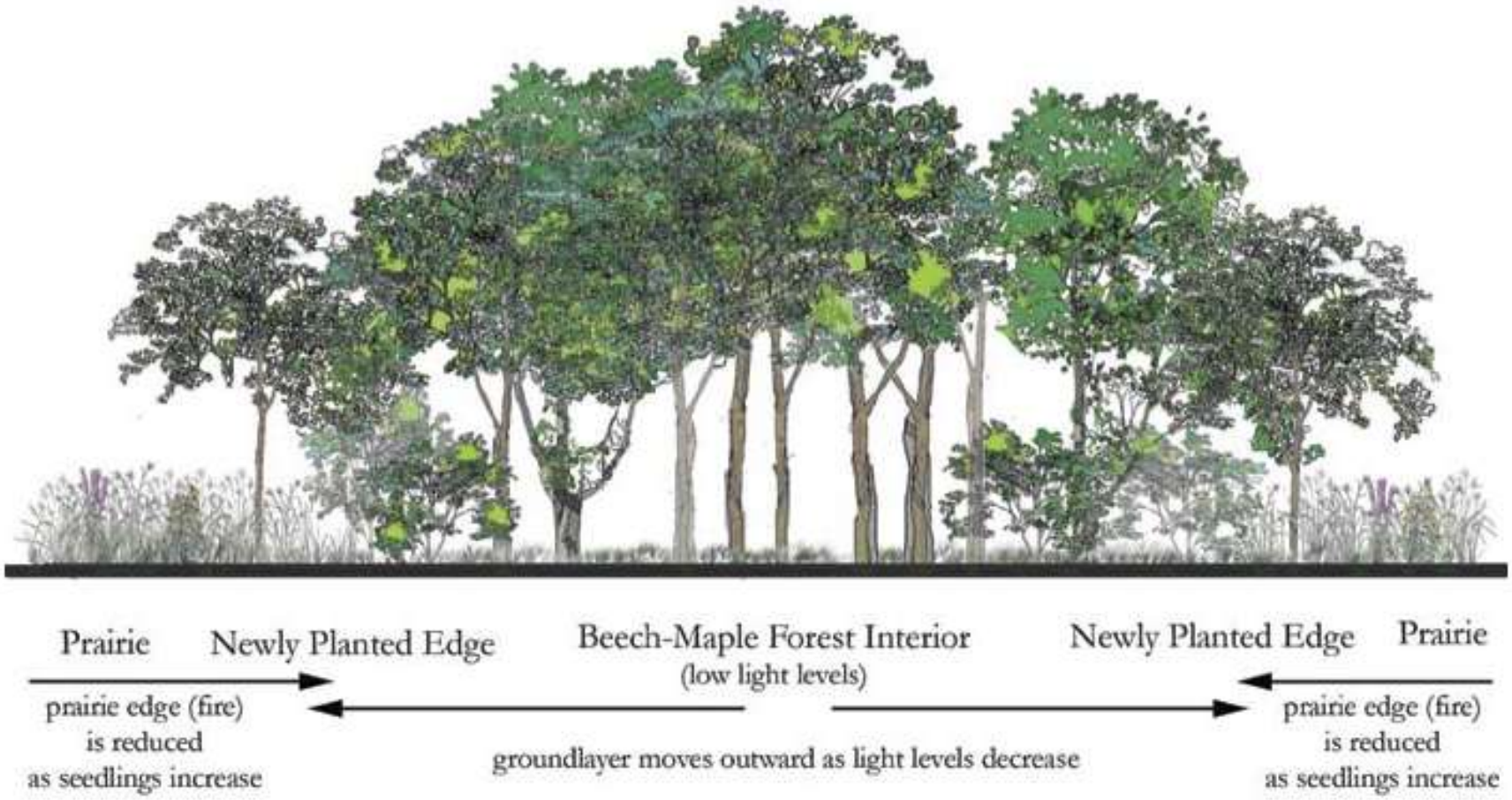
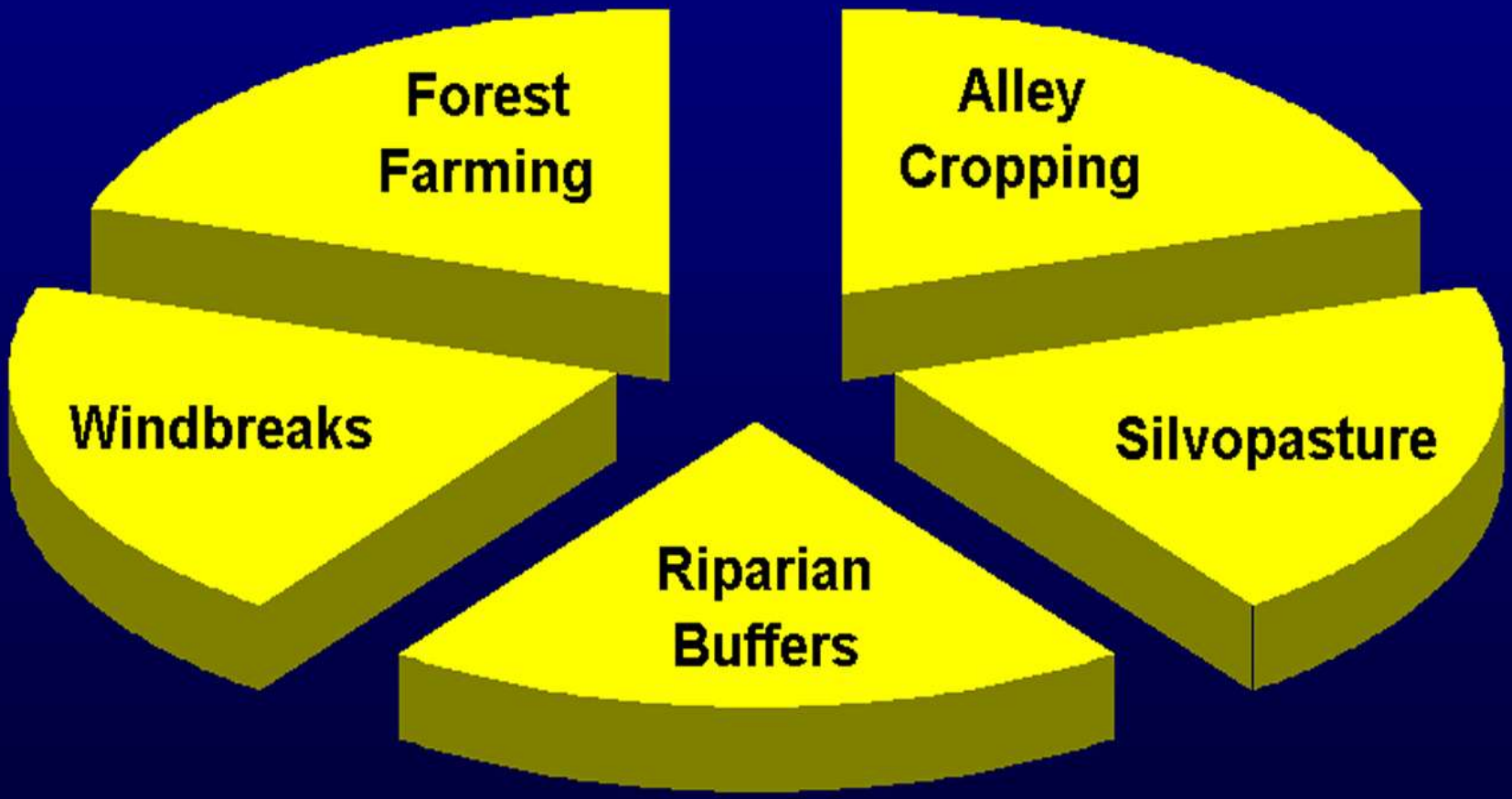


Illustration of Restoration Concept

Agroforestry Practices



Windbreak / Shelterbelt / Timberbelt

Definition

Plantings of single or multiple rows of trees or shrubs that are established for one or more purposes.

Planted and managed as part of a crop or livestock operation to enhance crop production, protect livestock, manage snow distribution, control soil erosion and create wildlife habitat.

How do Windbreaks provide these Benefits?

Windbreak function depends upon six key windbreak components:

- Height
- Density
- Orientation
- Length
- Width
- Continuity

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- Width
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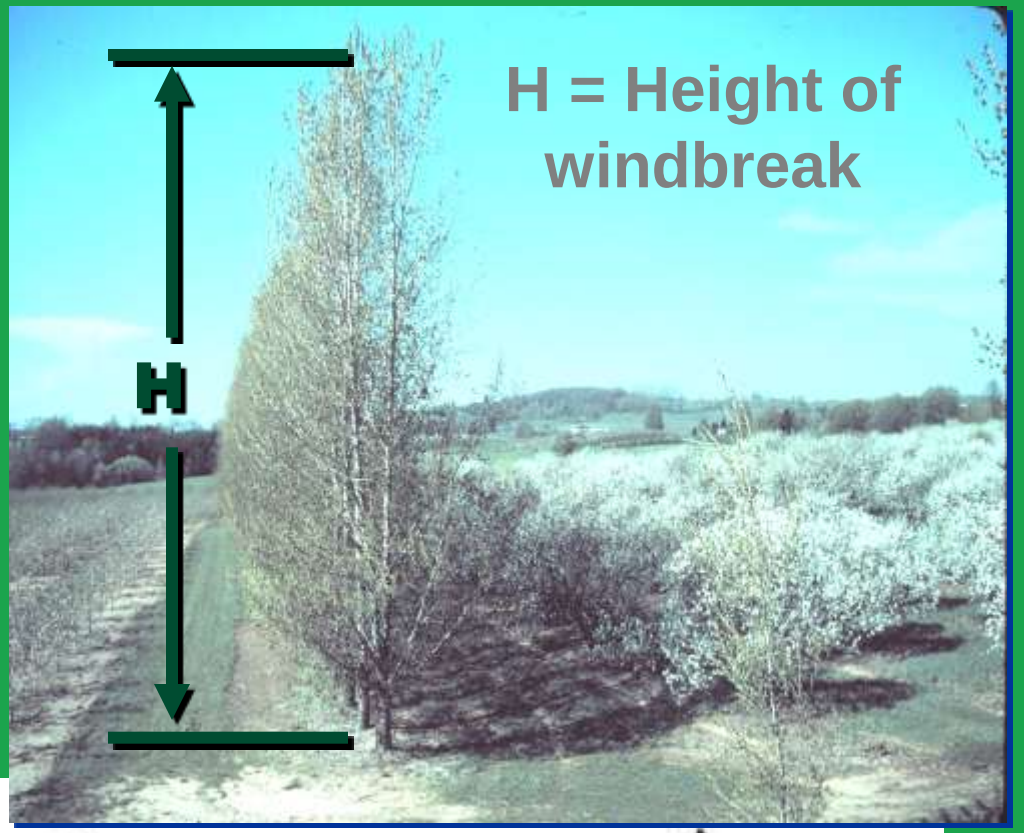
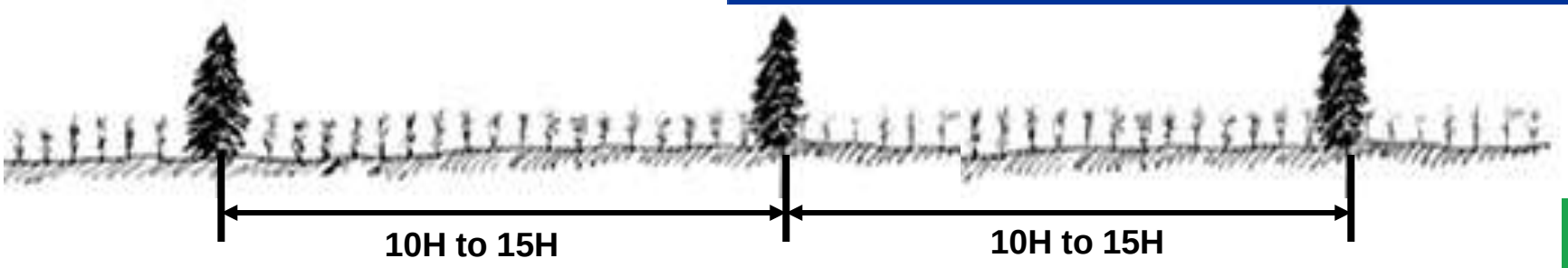
Why Is Windbreak Height Important?

Element: Height

Match height to achieve desired protected area

The height determines the distance of the sheltered zone. For example, select the tallest trees suited to the site for large fields and fewest windbreaks.

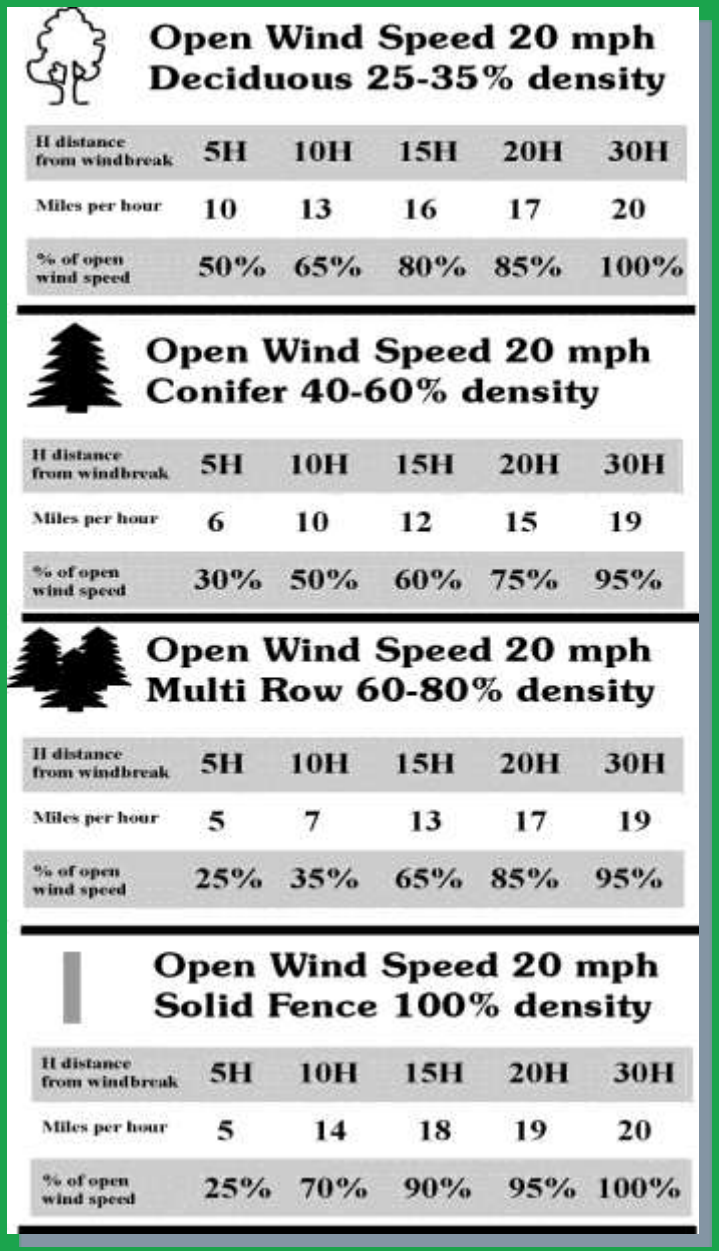




Windbreak Density

Dense =
Maximum wind reduction but short wind shadow

Moderately Dense =
Less wind reduction but longer wind shadow



Open Wind Speed 20 mph
Deciduous 25-35% density

H distance from windbreak	5H	10H	15H	20H	30H
Miles per hour	10	13	16	17	20
% of open wind speed	50%	65%	80%	85%	100%

Open Wind Speed 20 mph
Conifer 40-60% density

H distance from windbreak	5H	10H	15H	20H	30H
Miles per hour	6	10	12	15	19
% of open wind speed	30%	50%	60%	75%	95%

Open Wind Speed 20 mph
Multi Row 60-80% density

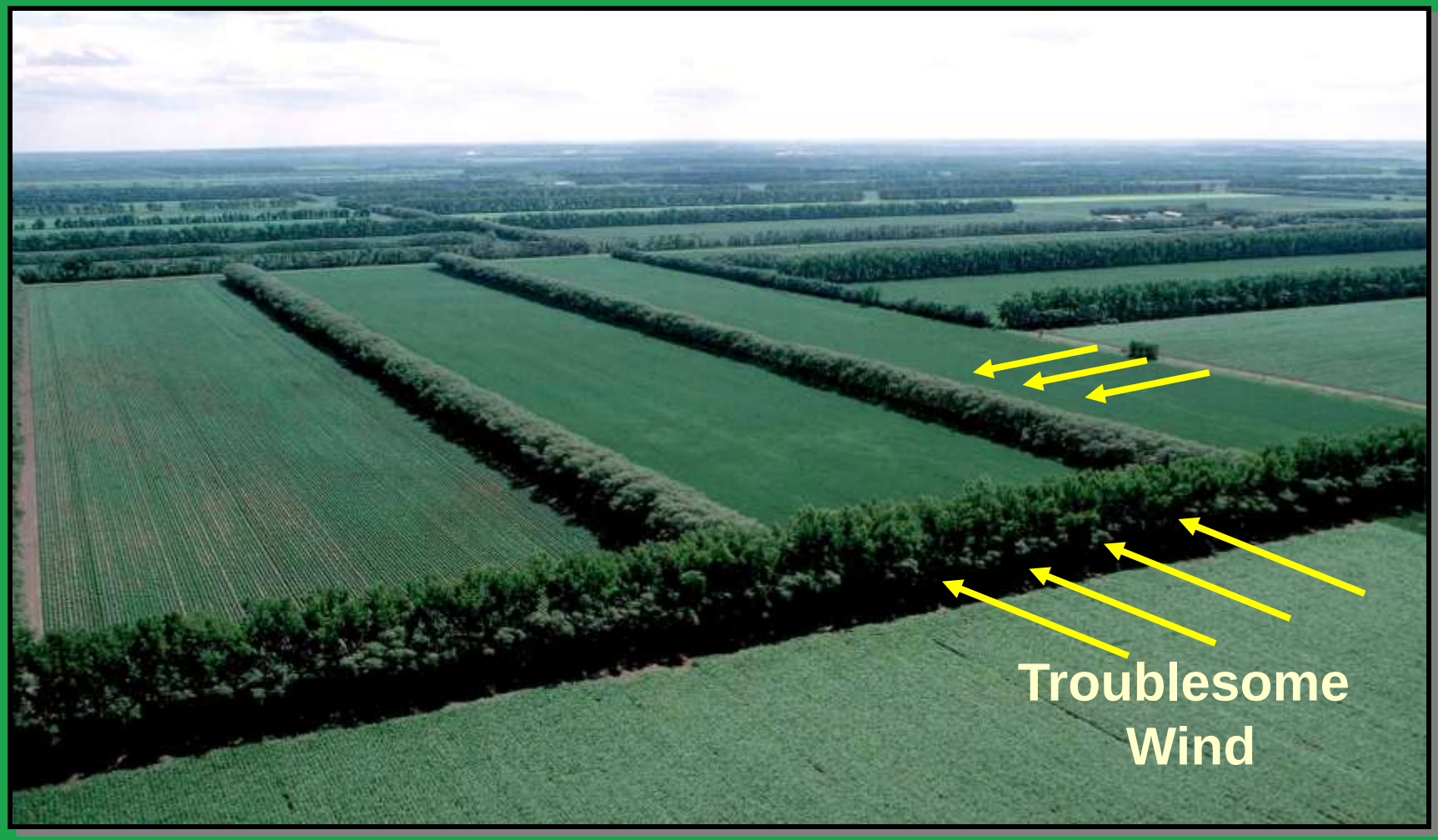
H distance from windbreak	5H	10H	15H	20H	30H
Miles per hour	5	7	13	17	19
% of open wind speed	25%	35%	65%	85%	95%

Open Wind Speed 20 mph
Solid Fence 100% density

H distance from windbreak	5H	10H	15H	20H	30H
Miles per hour	5	14	18	19	20
% of open wind speed	25%	70%	90%	95%	100%

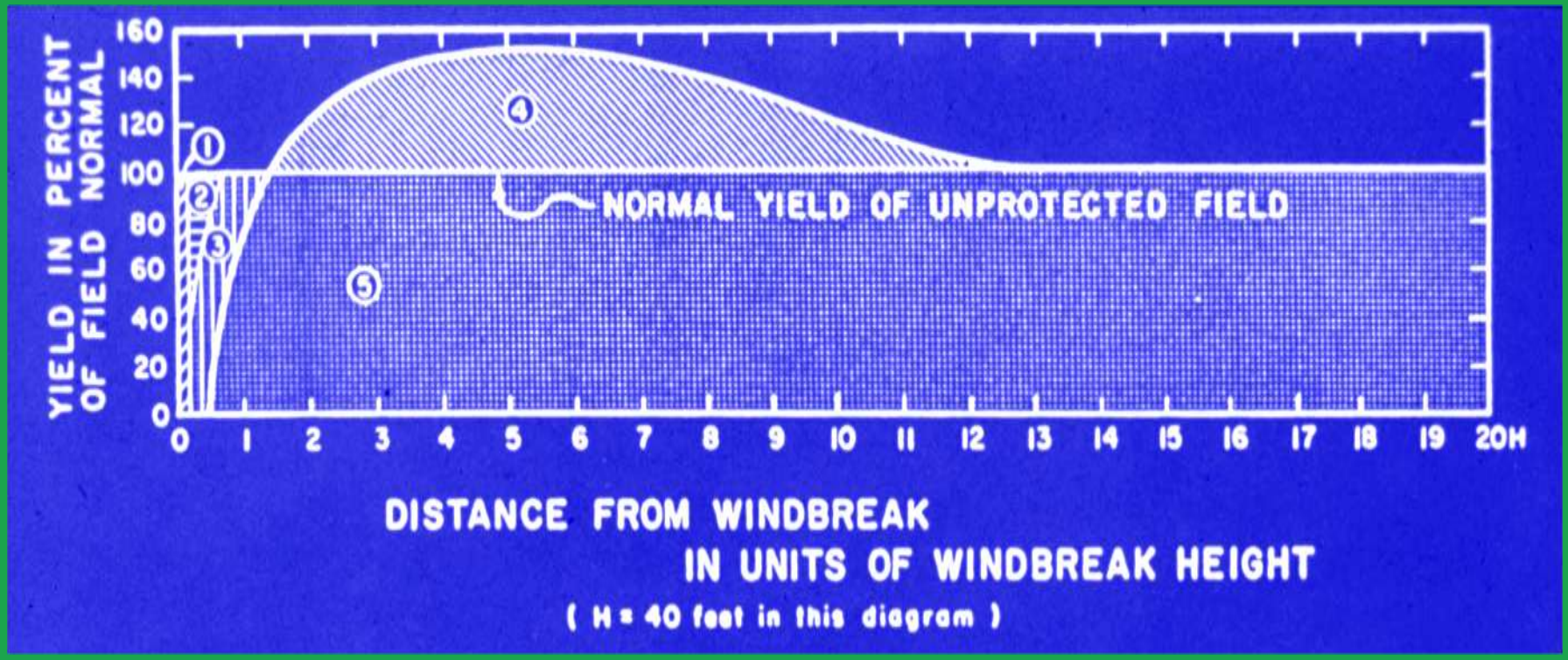
Windbreak Length

Windbreak Orientation



- Orient windbreaks perpendicular to troublesome winds
- Plan multiple windbreaks for whole field protection

Field Windbreak - Benefits



Weighted Average Crop Yield Increase:

Corn - 12%

Barley - 25%

Hay - 20%

Soybeans - 13%

Winter Wheat - 23%

Spring Wheat - 8%

(Kort, 1988)

Windbreaks

Windbreaks help prevent weight loss in cold weather and provide shelter for cattle

Riparian Forest Buffers

A combination of trees and other vegetative materials established on stream and river banks to regulate microenvironments and buffer these waterways from non-point source pollution from adjacent land use.

Because of watershed modifications *Riparian Forest Buffers* are needed

Often *no perennial riparian vegetation* is left & riparian buffers/filters have to start from scratch

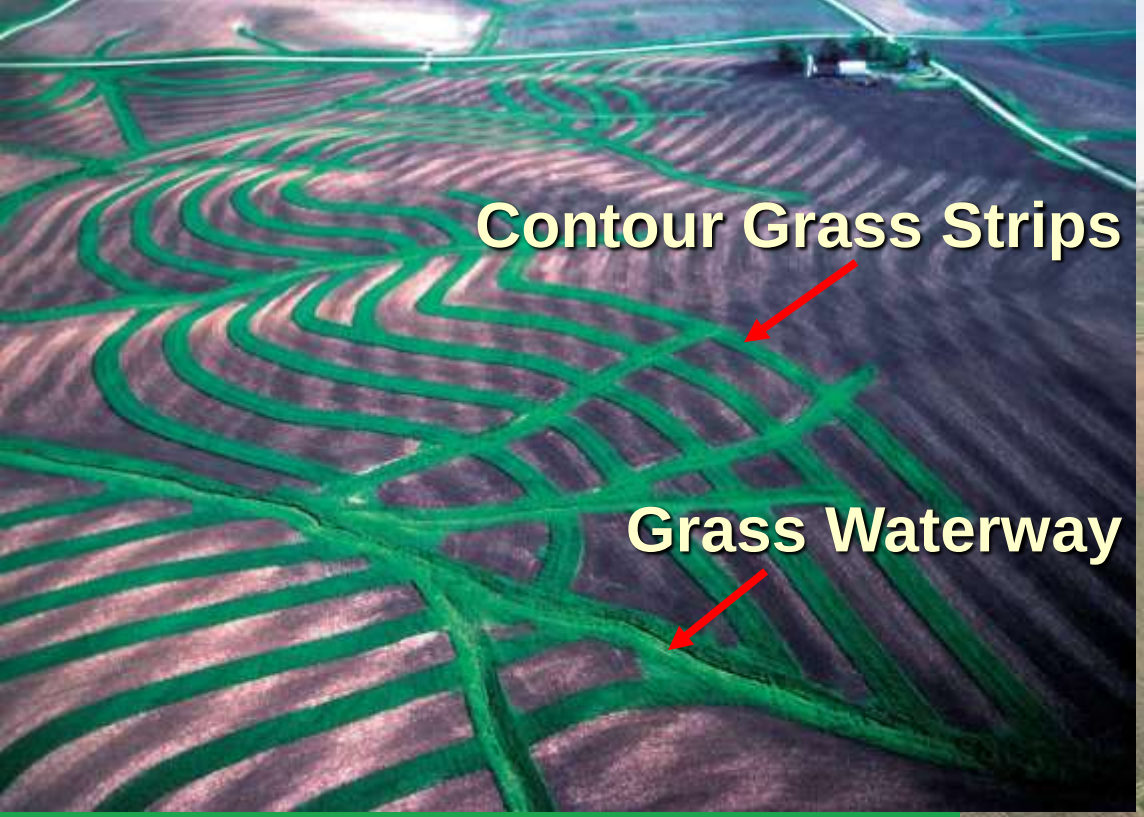
Riparian Forest Buffers

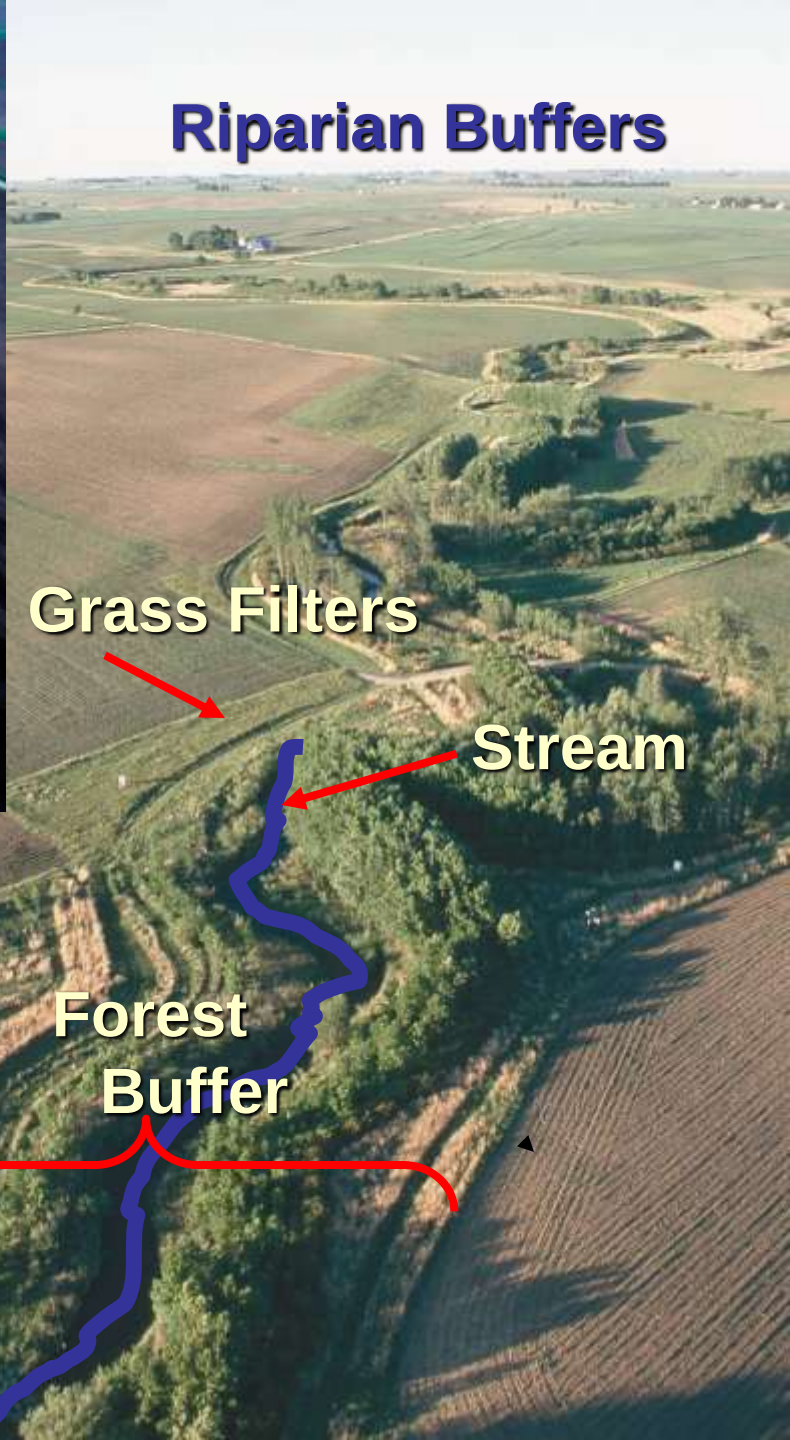
Year 5

Riparian Forest Buffers

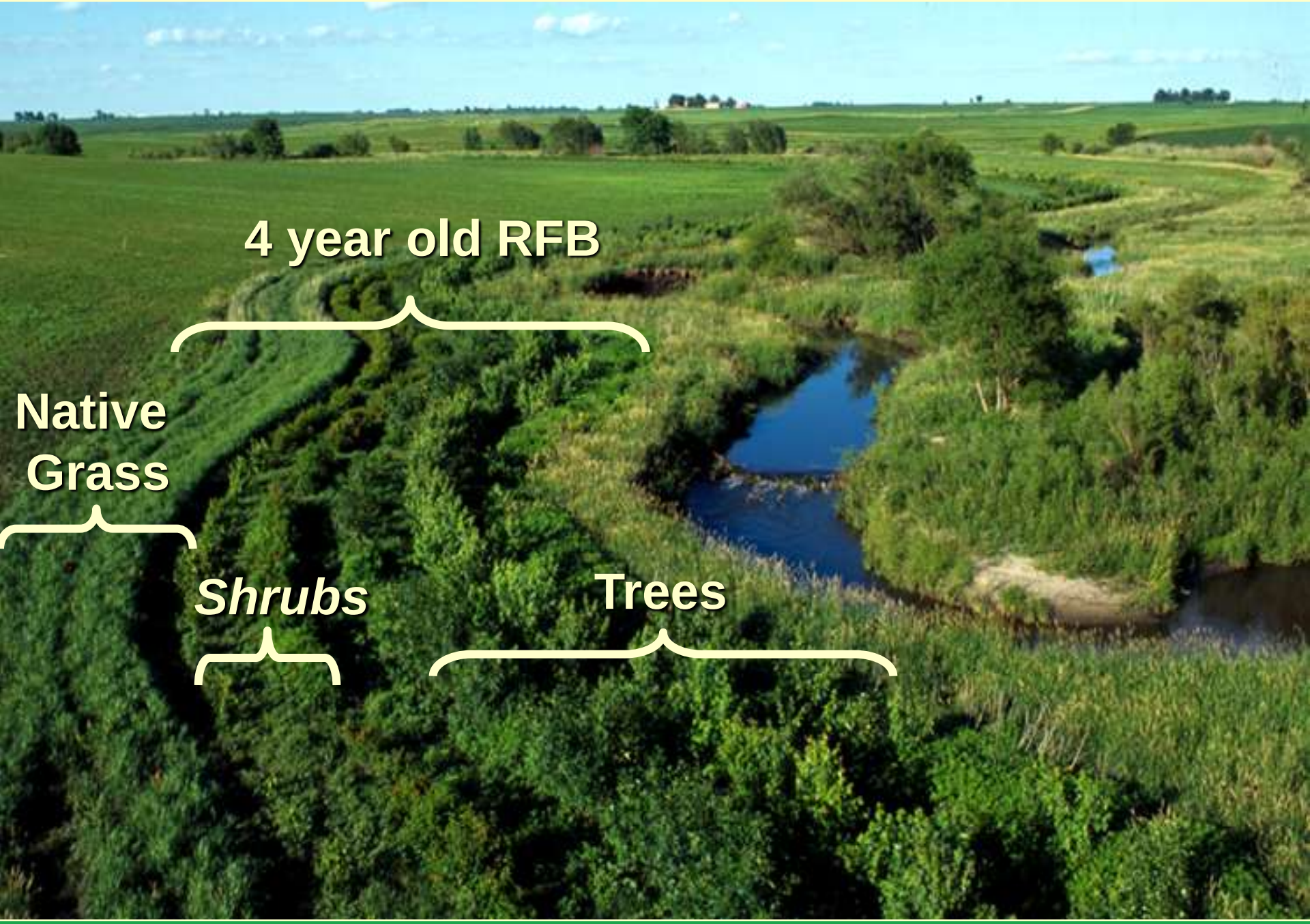
1990

1994

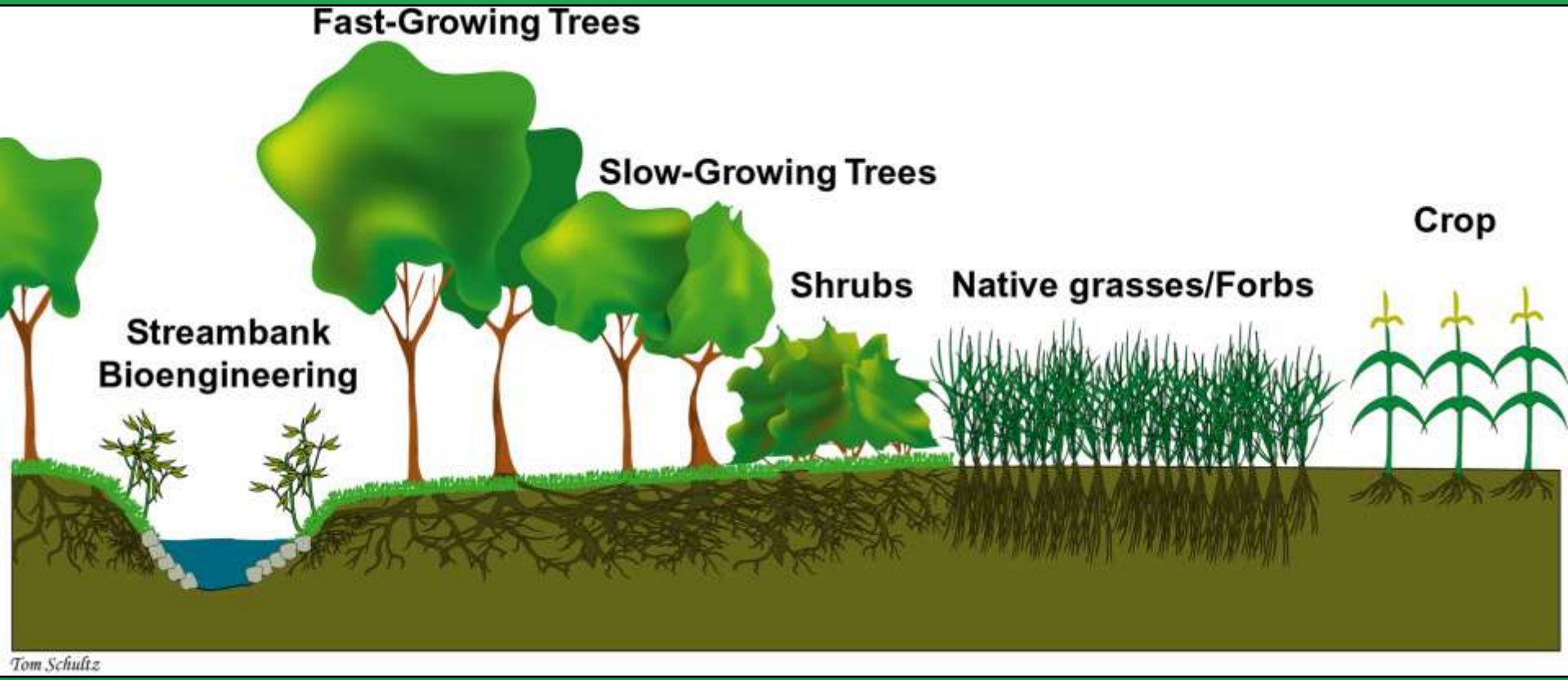




Riparian Forest Buffers
Only one
Conservation Practice
For Improving Stream Ecology


4 year old RFB
Native Grass
Shrubs
Trees

Riparian Forest Buffer



Planned combinations of trees, shrubs, grasses, forbs & bioengineered structures designed to mitigate the impact of land-use on a stream or lake.

Benefits of Forested Riparian Buffers

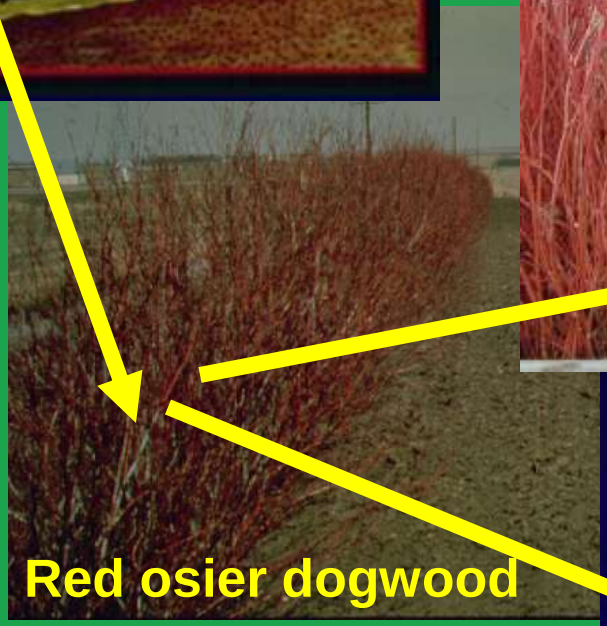
- Filter sediment, nutrients and pesticides
- Helps prevent stream bank erosion
- Provides income potential
- Develop and improve wildlife habitat
- Protects aquatic habitat
- Protects against flood damage

Riparian Forest Buffers and Income Generation

Woody florals

Shrubs with market value

$0.35 – $0.45 *per stem* wholesale



Red osier dogwood

Cornus stolonifera

Red Osier Dogwood and evergreen boughs

- **Alley Cropping**

Alley cropping is the growing of an annual or perennial crop between rows of high-value trees.

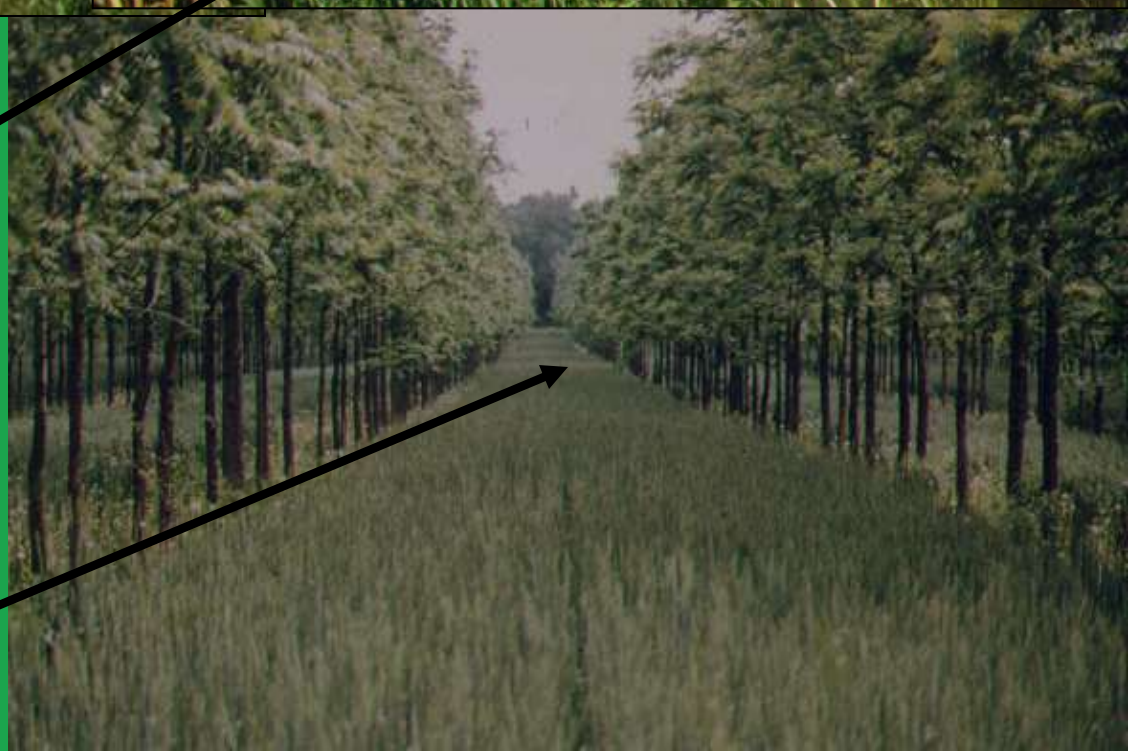
The agricultural crop generates an annual income while the longer-term tree crop matures.

Spacing Considerations

6 row corn planter,
tree rows on 22.5 foot centers,

5 feet between trees within the row

Age 3



Age 9, 35 ft. tall and time to thin


Row Orientation

Plant Materials - Trees

Species Selection

1. Trees matched to site conditions
2. Produce a light shade
3. Produce desired products
   -- Nuts, Timber, Honey …
4. High value
   -- grafted vs. nursery seedlings
   -- Black Walnut vs. White Oak
5. Deep rooted or minimal surface roots
6. Provides additional wildlife habitat to the site

Competitive interactions

•Spatially

•Temporally

•Above and below ground

Establishing Alley-Crops

Establishment phase

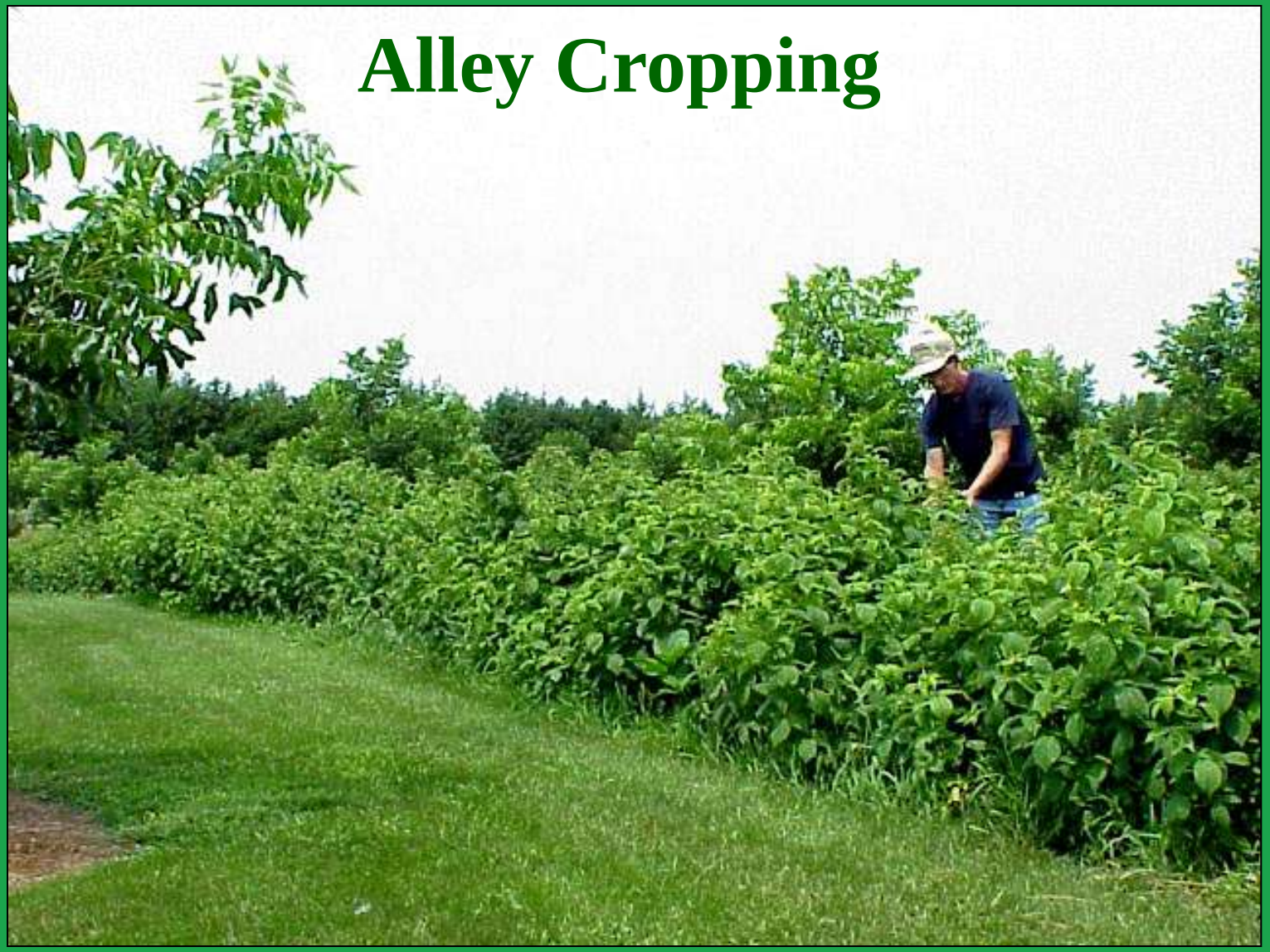
- Shade-intolerant species (annuals and/or perennials)
- Crop rotation according to light requirements as trees develop

Mature plantation

- Choose species according to light requirements
- Take advantage of micro-environments created in the system

Salad Greens alleycropped between tart cherries.

Alley Cropping



Raspberries (U-Pick) planted between rows of pecans

Corn, beans & alfalfa are all compatible with Walnut sp.

Asparagus between Chestnuts & Raspberries

Orchard Grass & Red Clover between Black Walnuts

Silvopasture

The Intentional combining of trees and/or shrubs, forage and livestock.

Allowing livestock to graze in a natural woodland area without any type of tree or forage management is ***not*** considered agroforestry.

Is this Silvopasture?

INTEGRATING TREES, FORAGES, AND ANIMALS

- The four variables in a silvopastoral practice that can be subjected to management are:

- Tree Species.
- Tree Density. (affects light vs shade and more!)
- Forage Species.
- Animal Maintenance.

Desirable Tree Species

- Loblolly Pine
- Slash Pine
- Black Walnut
- Pecan
- Bur Oak
- Red Oaks
- White Oaks
- Chestnut
- Hazelnut
- Hickories

The Effect of Light / Shade

(40 - 60% *shade* is *ideal*)

1. Yields can be maintained --
   Select the appropriate forage combination(s).

2. Improved quality

   a) Reduced lignin &
      improved digestibility

   b) Increased or no change in crude protein

   c) Improved N content

ANIMAL MAINTENANCE

- Maintain the proper stocking density (i.e., do not exceed carrying capacity of site).
- Use rotational grazing instead of continuous grazing.
- Remove livestock during excessively wet periods to minimize tree root damage and soil compaction.

TWO APPROACHES

Establish trees in pastures

Establish pastures in trees

Electric fence protects young trees, 40x10’ spacing, 108 trees/acre, trees planted into tall fescue pasture

Loblolly pine

Tree tubes protect young trees

Silvopasture

Cattle rotationally-grazed in a mature pecan stand


RC-100

Forest Farming

- …the intentional manipulation of the forest canopy to improve the forest stand and produce understory crops

FOOD - Edible Forest Mushrooms

- Shiitake
- Maitake
- Reishi
- Oyster

- Morels
- Chanterelles
- King Stropharia
- Honey Mushrooms
- Chicken-of-the-Woods
- Coral Mushrooms

Forest Grown Herbal Medicinals

A Landowner points out ginseng plants in a forest setting

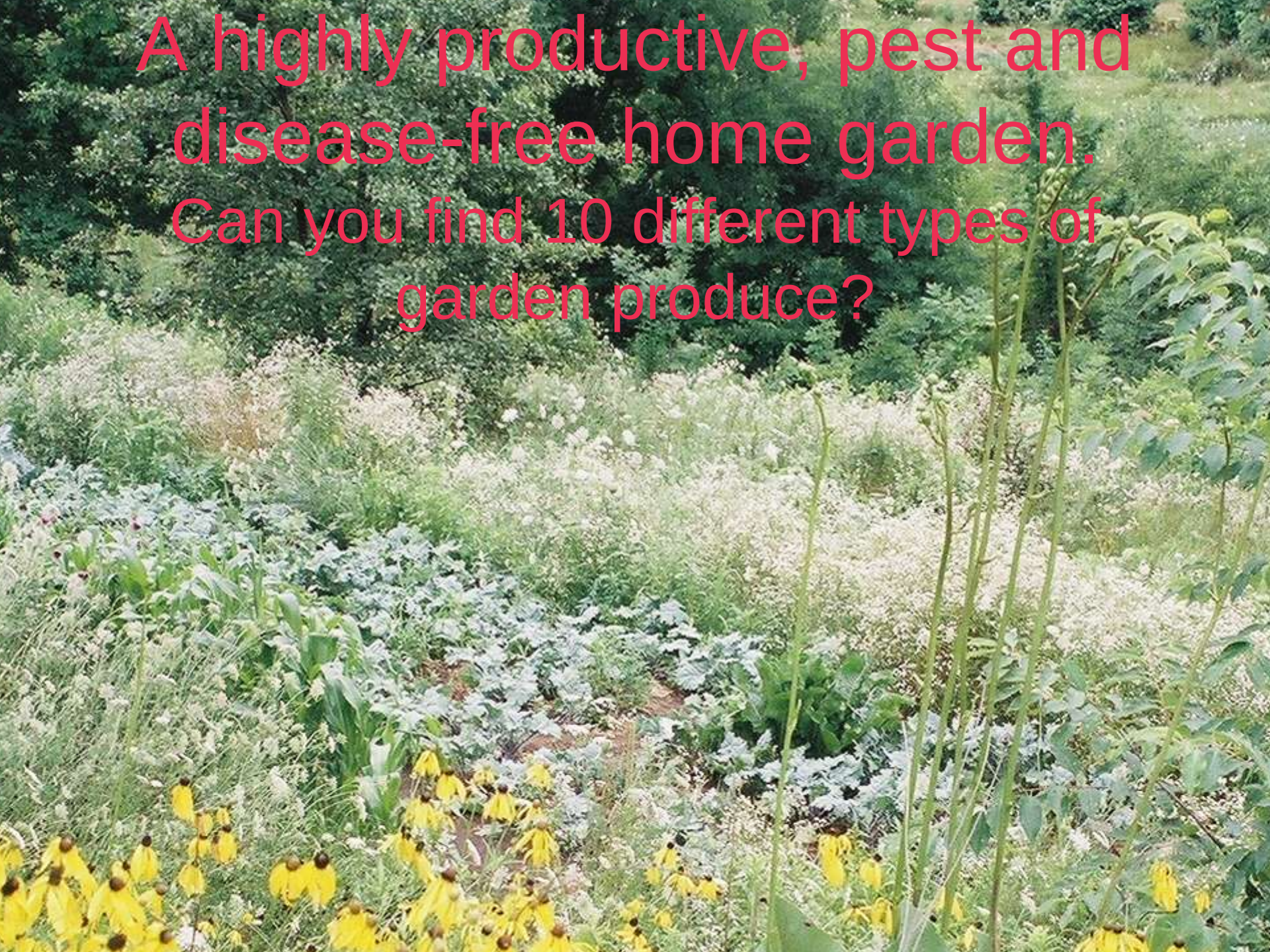
Edible Fruits

- **Brambles**
- **Elderberry**
- **Grapes**
- **Gooseberry**
- **Currants**
- **Serviceberry**
- **Mayhaw**
- **Mulberry**
- **Paw Paw**
- **Persimmon**
- **Wild Blueberry**

(Can you say winery?)

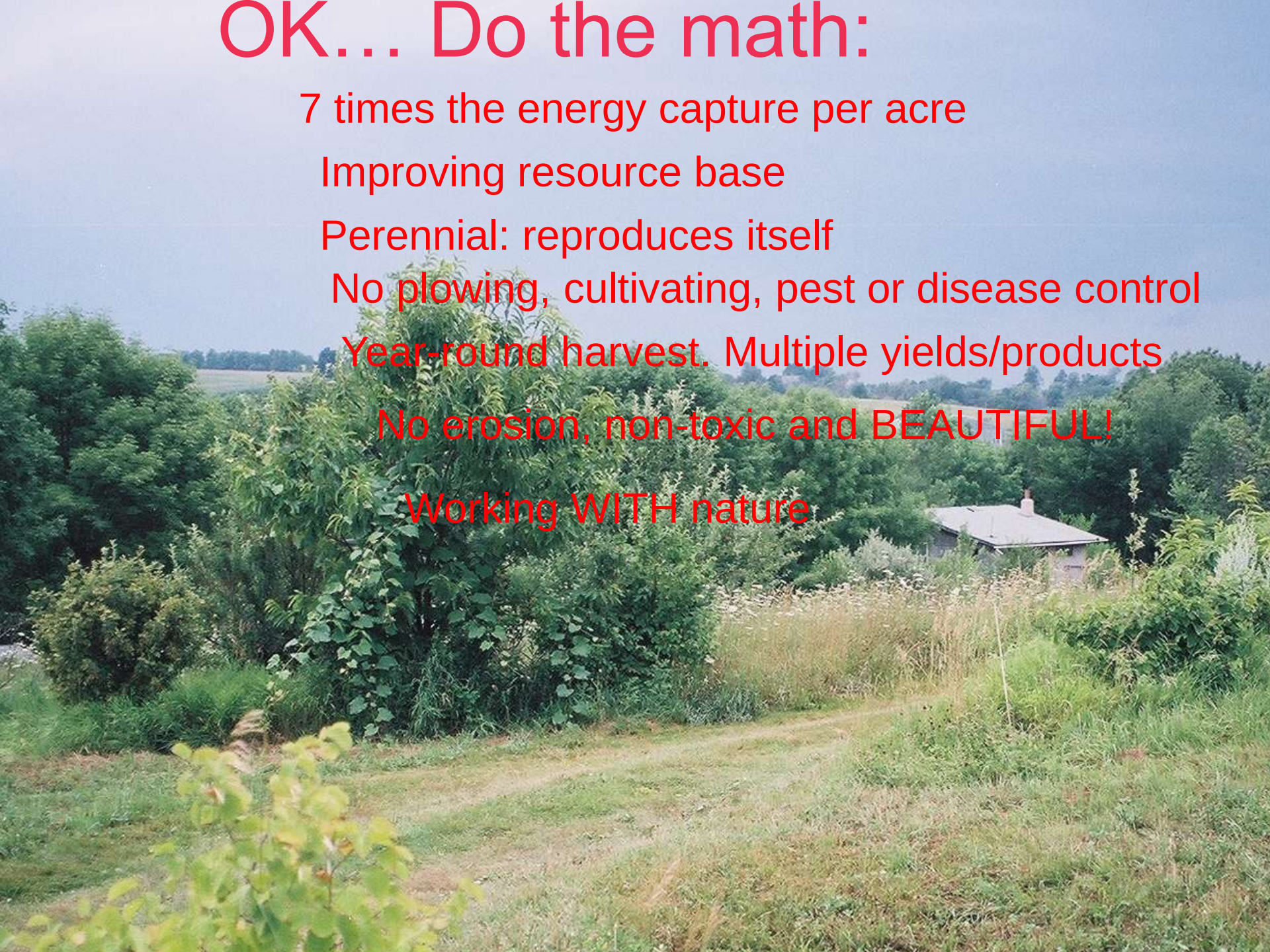

Some multi-story
polycultures…


The Apple “Orchard”:
Grapes on Chestnut over Hazelnut
next to Rose behind Apple over
Daffodil, Iris and Comfrey and
more…


A highly productive, pest and disease-free home garden.
Can you find 10 different types of garden produce?


Food, juice, vinegar, alcohol


Hazelnuts!
Protein & Oil
Oil + alcohol = Diesel Fuel!


OK… Do the math:
7 times the energy capture per acre
Improving resource base
Perennial: reproduces itself
No plowing, cultivating, pest or disease control
Year-round harvest. Multiple yields/products
No erosion, non-toxic and BEAUTIFUL!
Working WITH nature


ORGANIC
VALLEY


Thank you for Farming in Nature's Image!