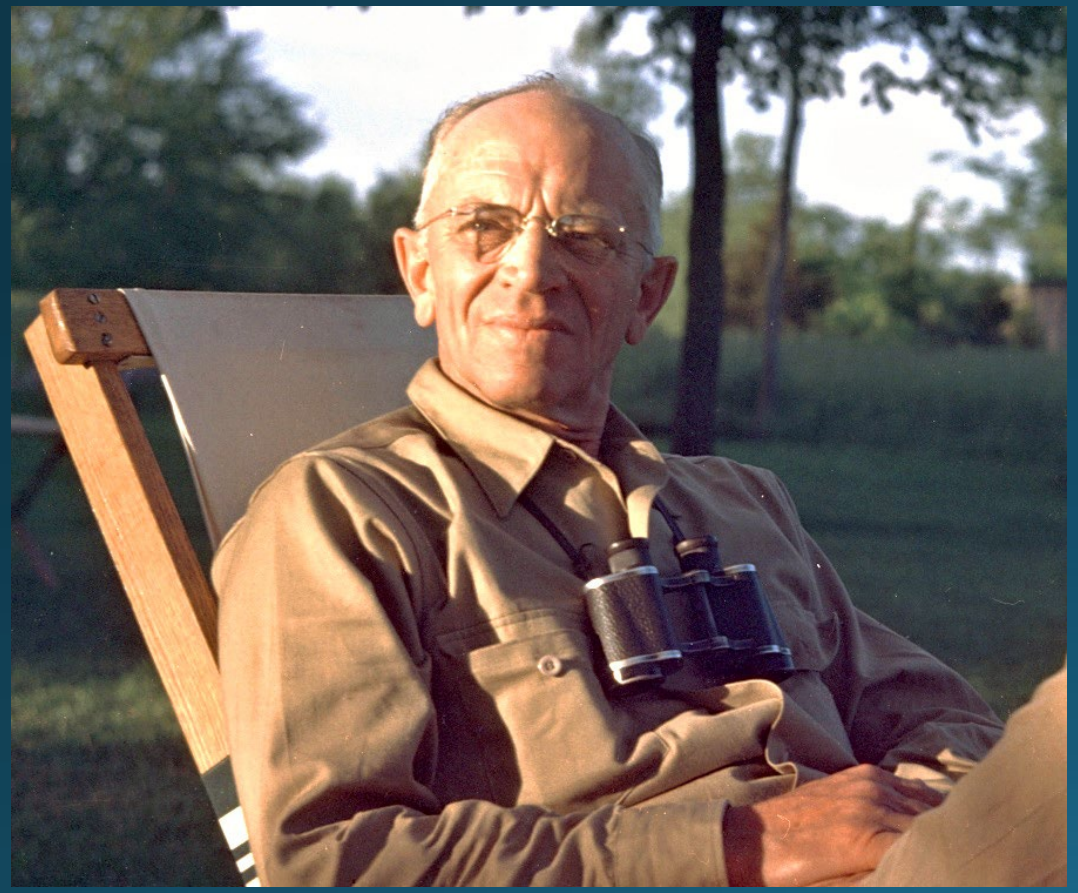
Soils, Agriculture, & Food

Modern Dream – Return to a lost land ethic

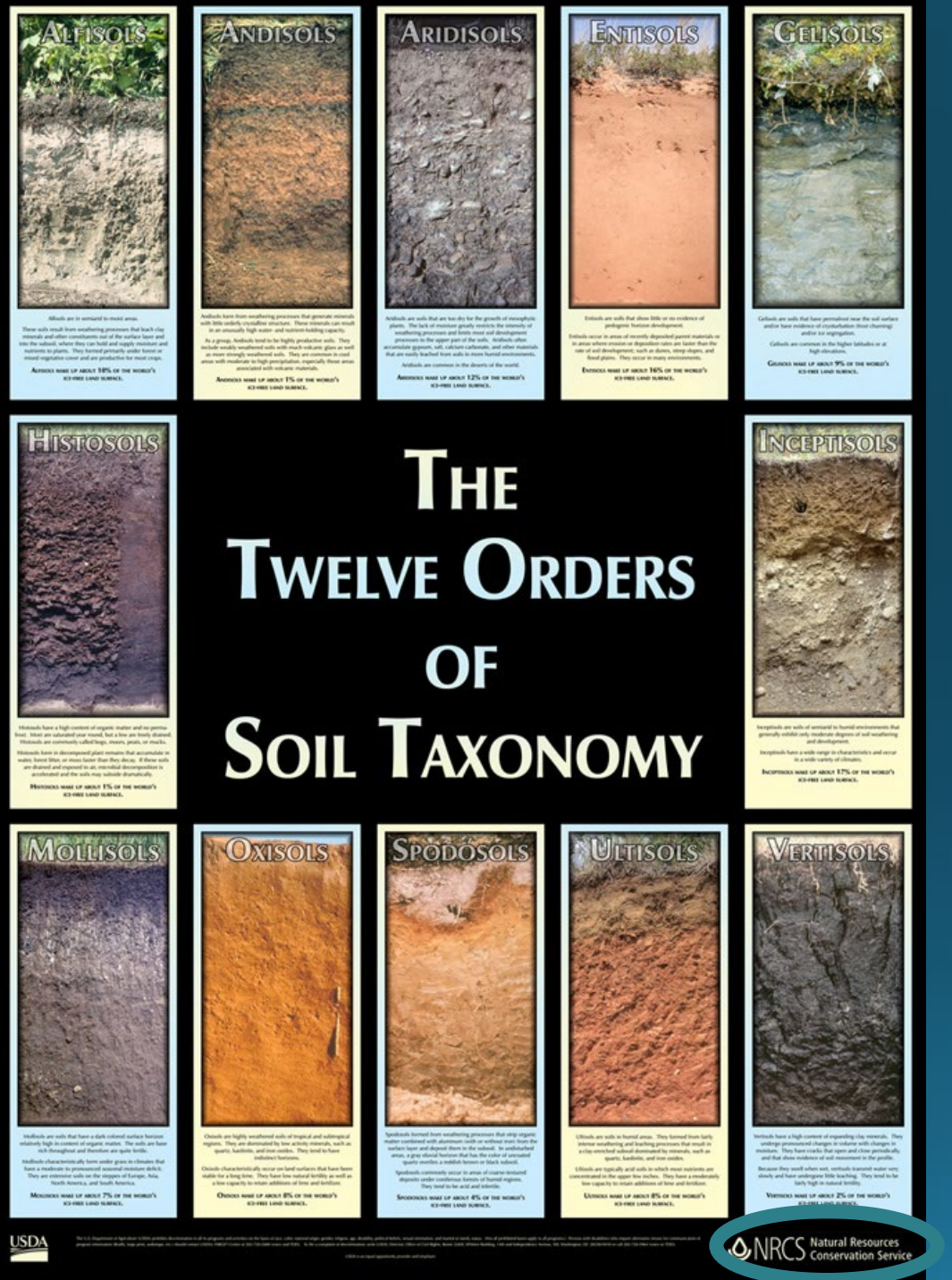
Buffalo Bird Woman

Aldo Leopold



"A land ethic … Reflects the existence of an ecological conscience, and this in turn reflects a conviction of individual responsibility for the health of the land. Health is the capacity of the land for self-renewal. Conservation is our effort to understand and preserve this capacity."


Canon
ULTRASONIC



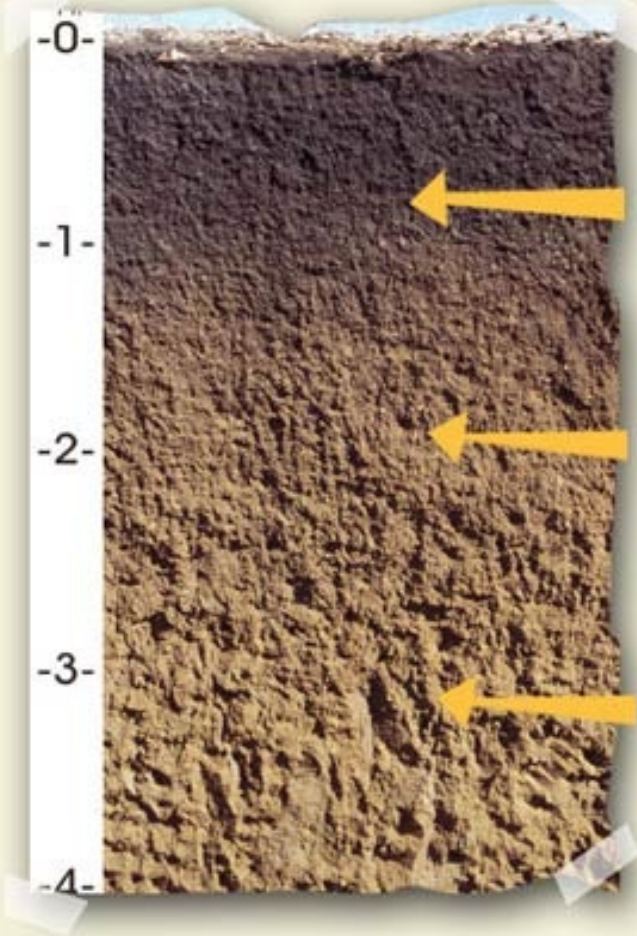
Natural Resources Conservation Service (NRCS)

Iowa's State Soil

Tama Series - Mollisol

Official State Soil: Tama

What's in it?



TAMA
Grassland Soils

A very, very deep soil surface rich in decaying plant matter.

Clays washed down by seeping rainwater accumulate in this layer.

The roots of the native prairie grasses that help build this soil were this deep-and deeper!

Official State Soil: Tama

Where is it?

Tama soils make up about 825,000 acres in east-central and eastern Iowa. They occur in 26 Iowa counties, but these soils were first identified in Black Hawk County, Iowa, in 1917.

Soil development variables

Hans Jenny (1941)

Cl, o, r, p, t

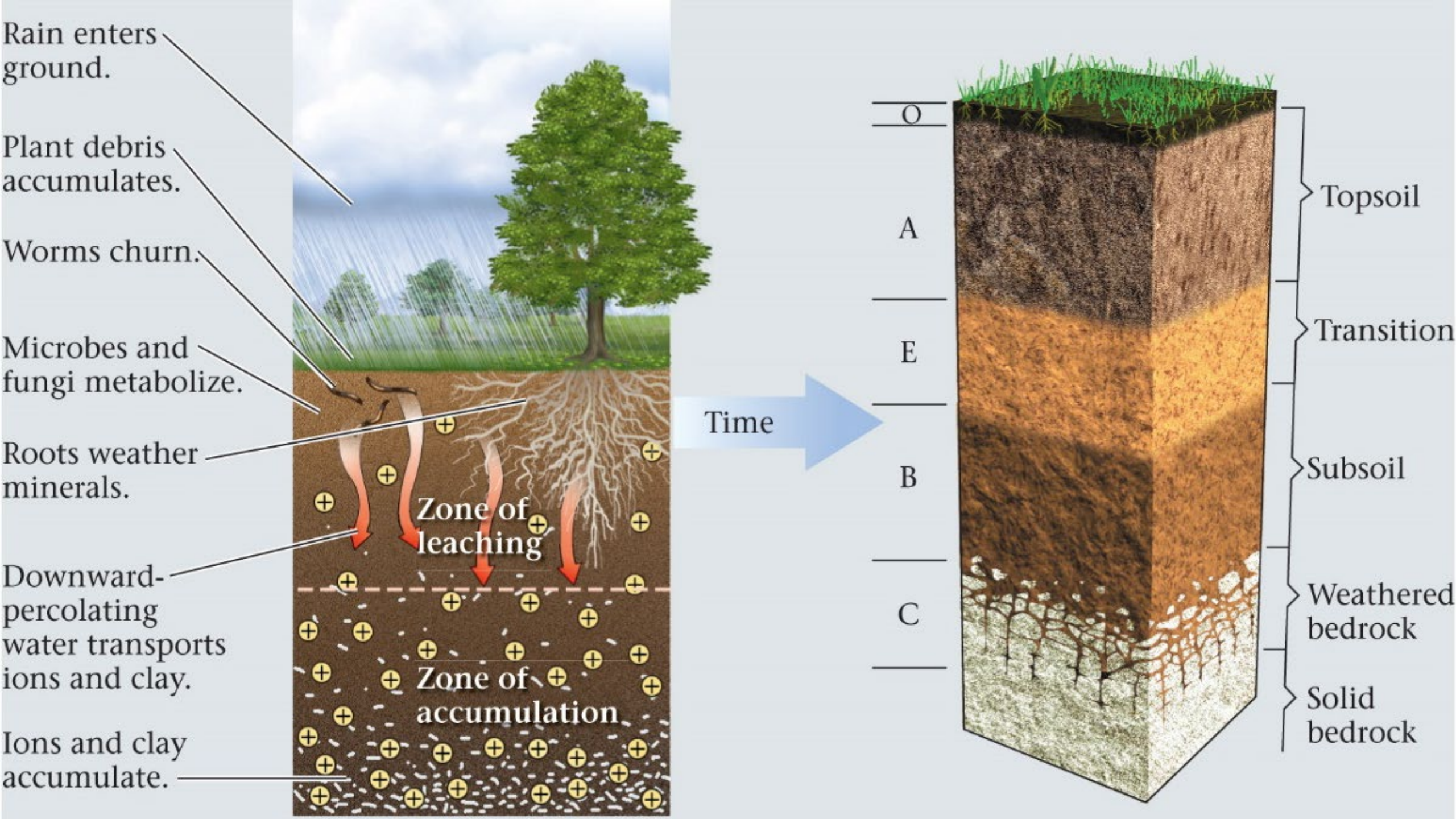
- cl, climate
- o, biology
- r, topography
- p, parent material
- t, time

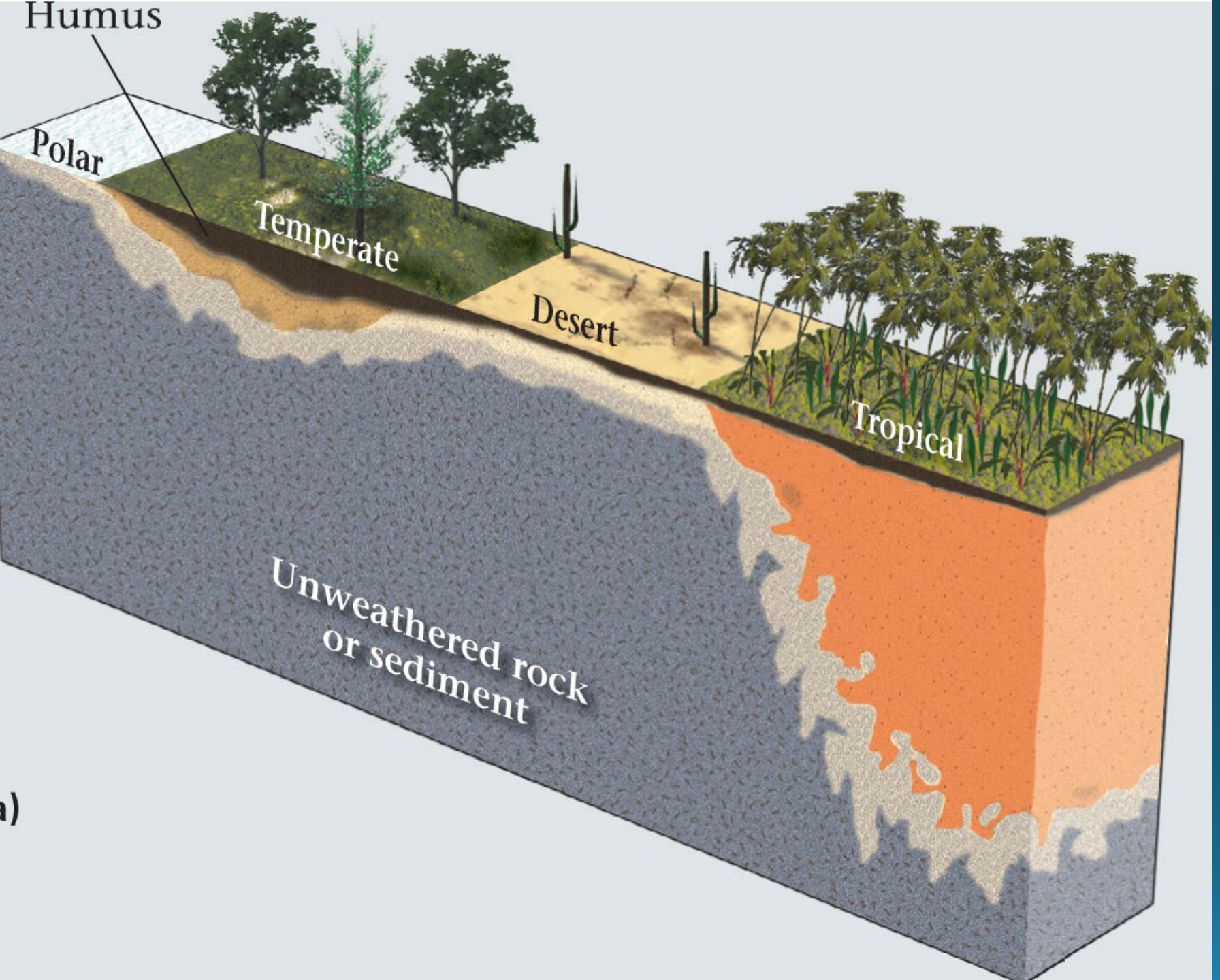
Landscape Stability

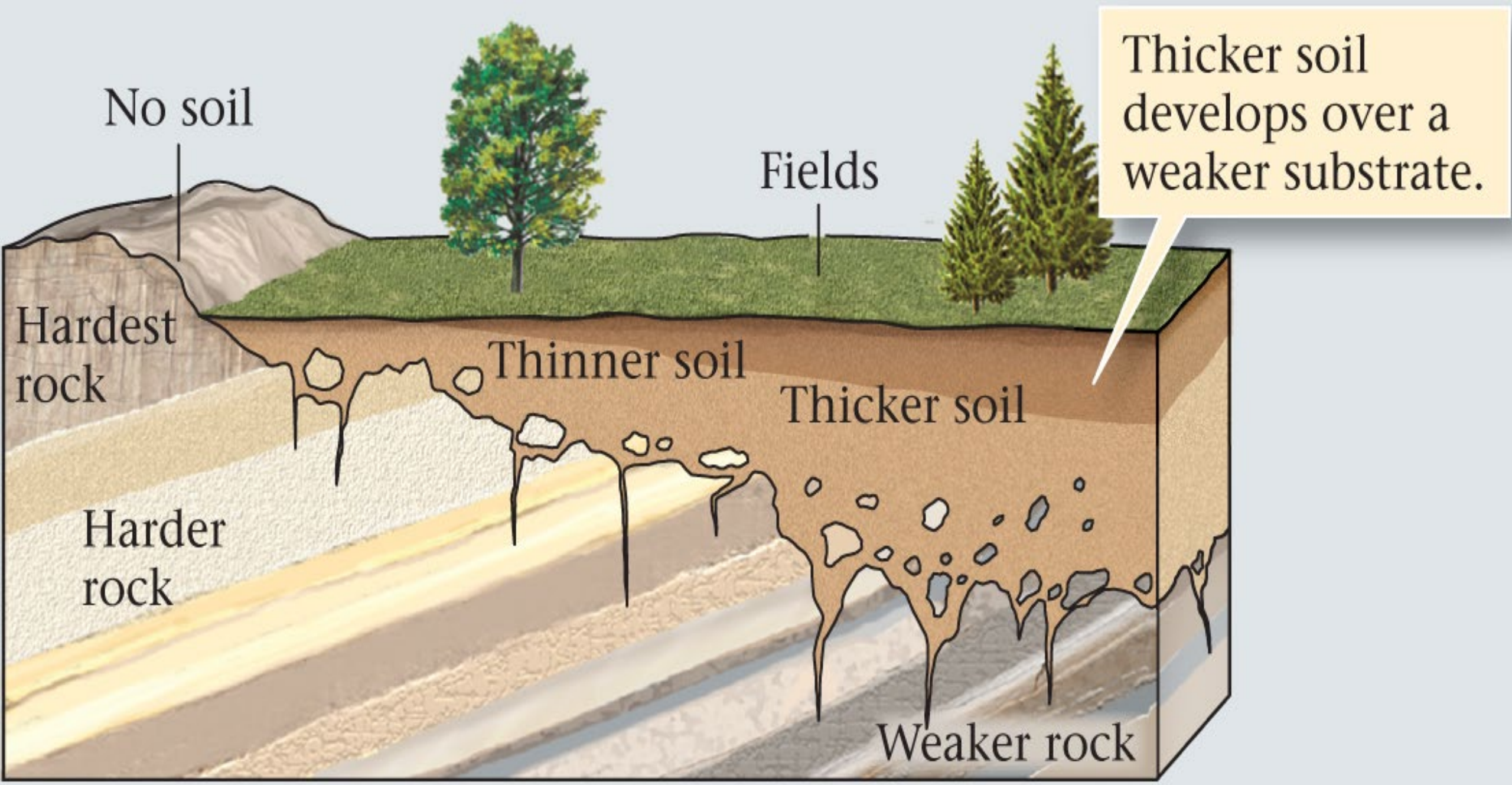
- Soils
  - Are a product of weathering
  - Texture – sand, silt and clay
  - Amazing interface

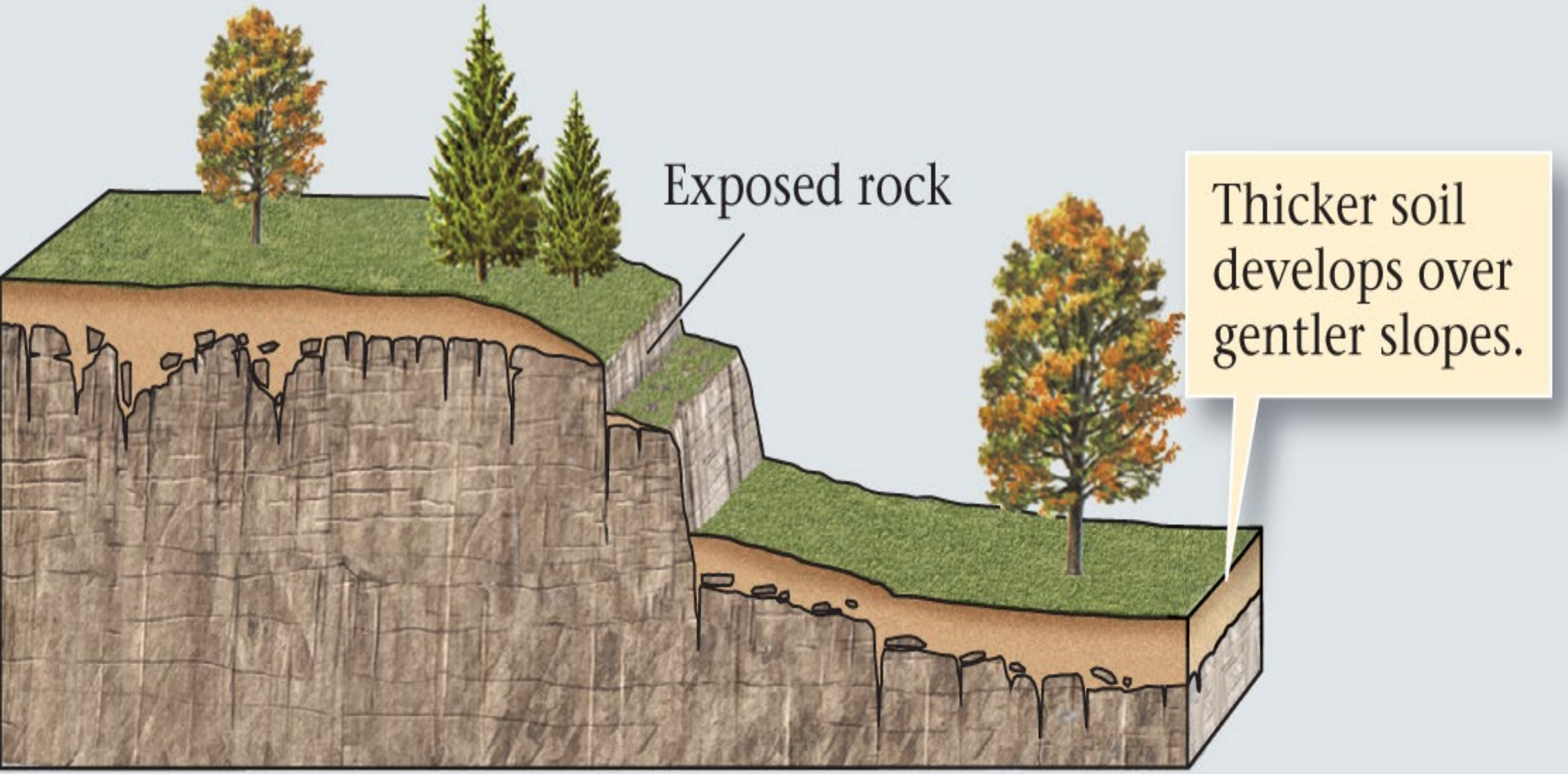
Biology

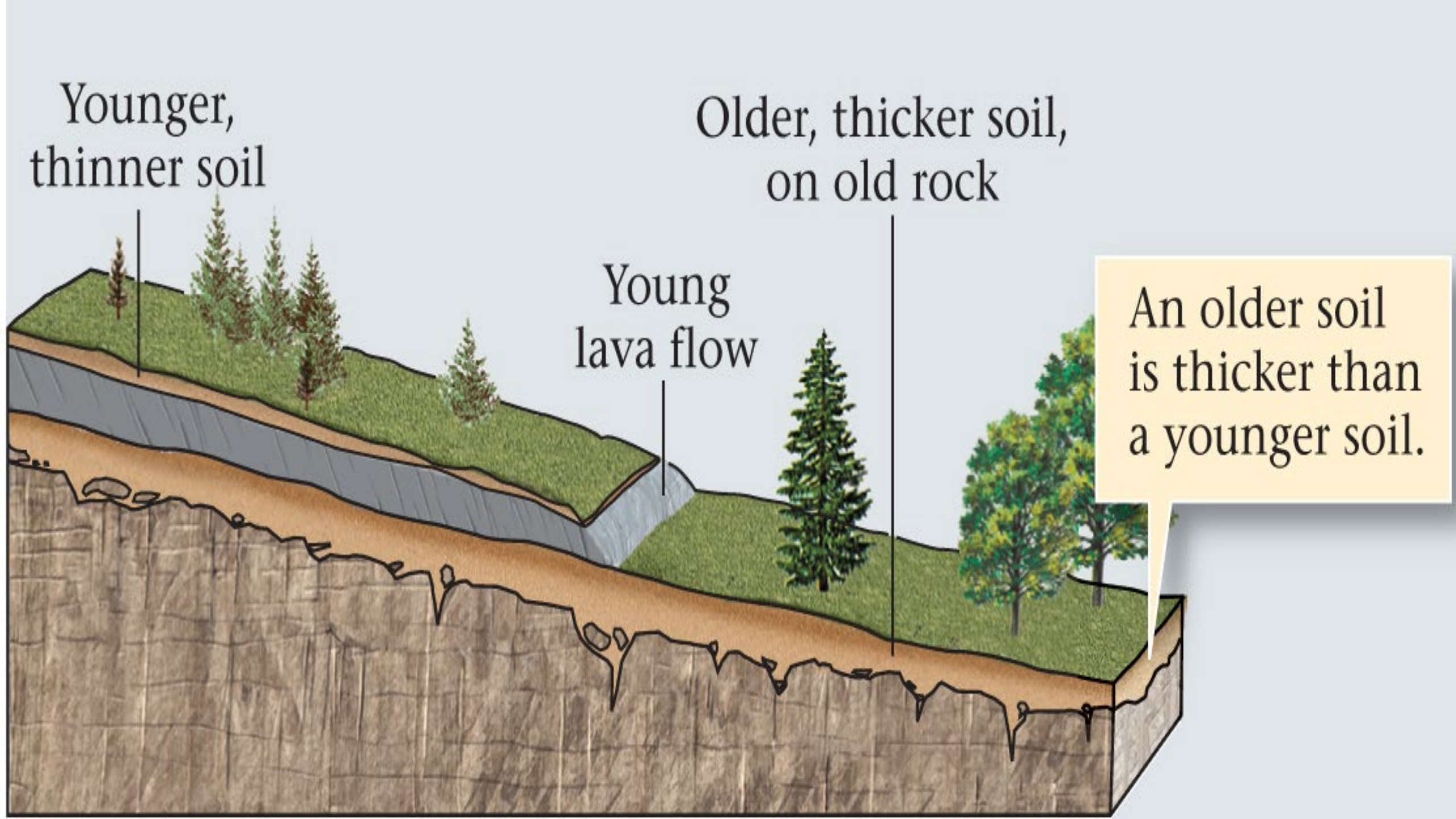
Geology

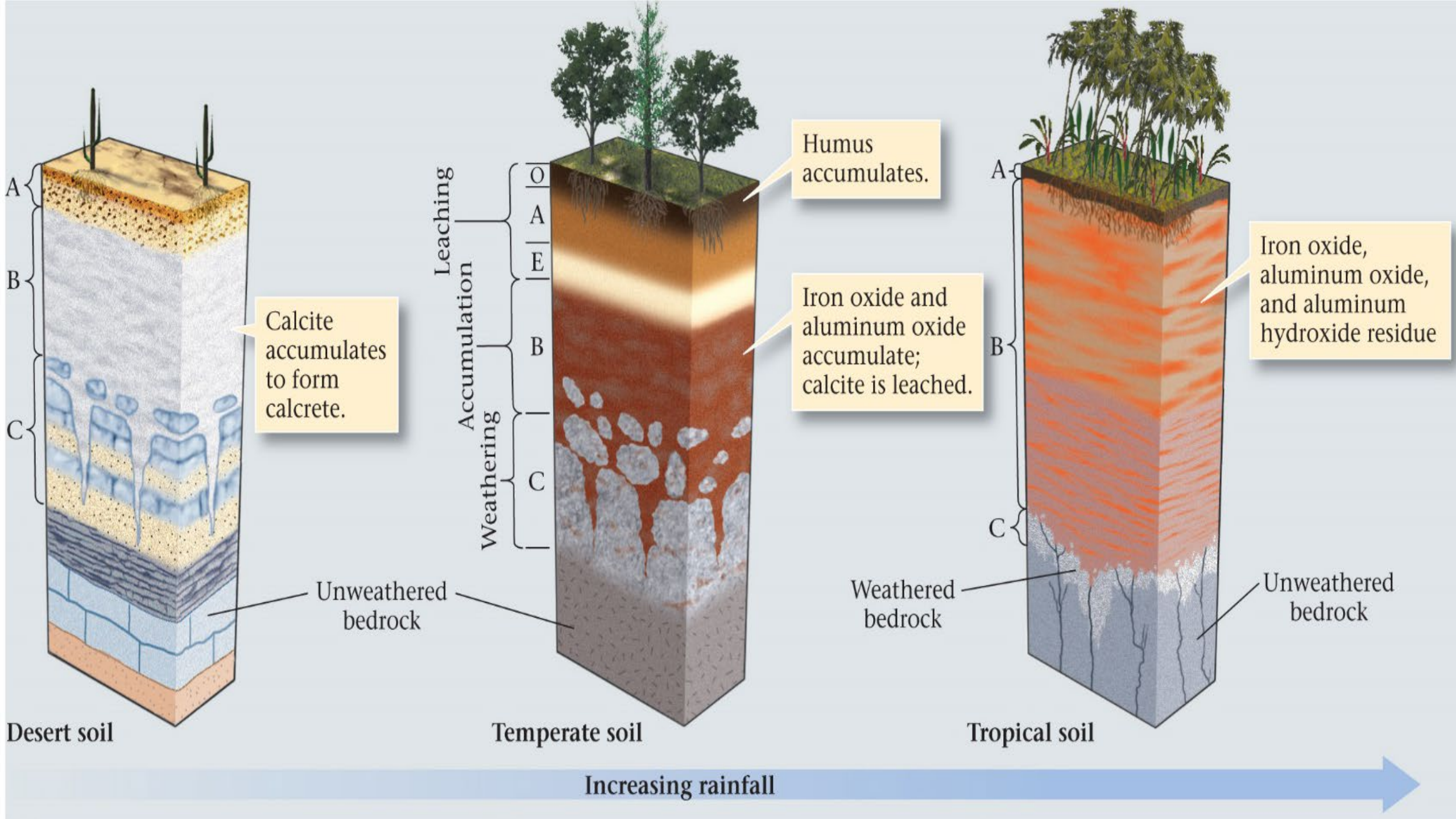

Rain enters ground.
Plant debris accumulates.
Worms churn.
Microbes and fungi metabolize.
Roots weather minerals.
Downward-percolating water transports ions and clay.
Ions and clay accumulate.
Zone of leaching
Zone of accumulation
Time
O
A
E
B
C
Topsoil
Transition
Subsoil
Weathered bedrock
Solid bedrock


Humus
Polar
Temperate
Desert
Tropical
Unweathered rock
or sediment


No soil
Fields
Thicker soil develops over a weaker substrate.
Hardest rock
Thinner soil
Thicker soil
Harder rock
Weaker rock


Exposed rock
Thicker soil develops over gentler slopes.


Younger, thinner soil
Young lava flow
Older, thicker soil, on old rock
An older soil is thicker than a younger soil.

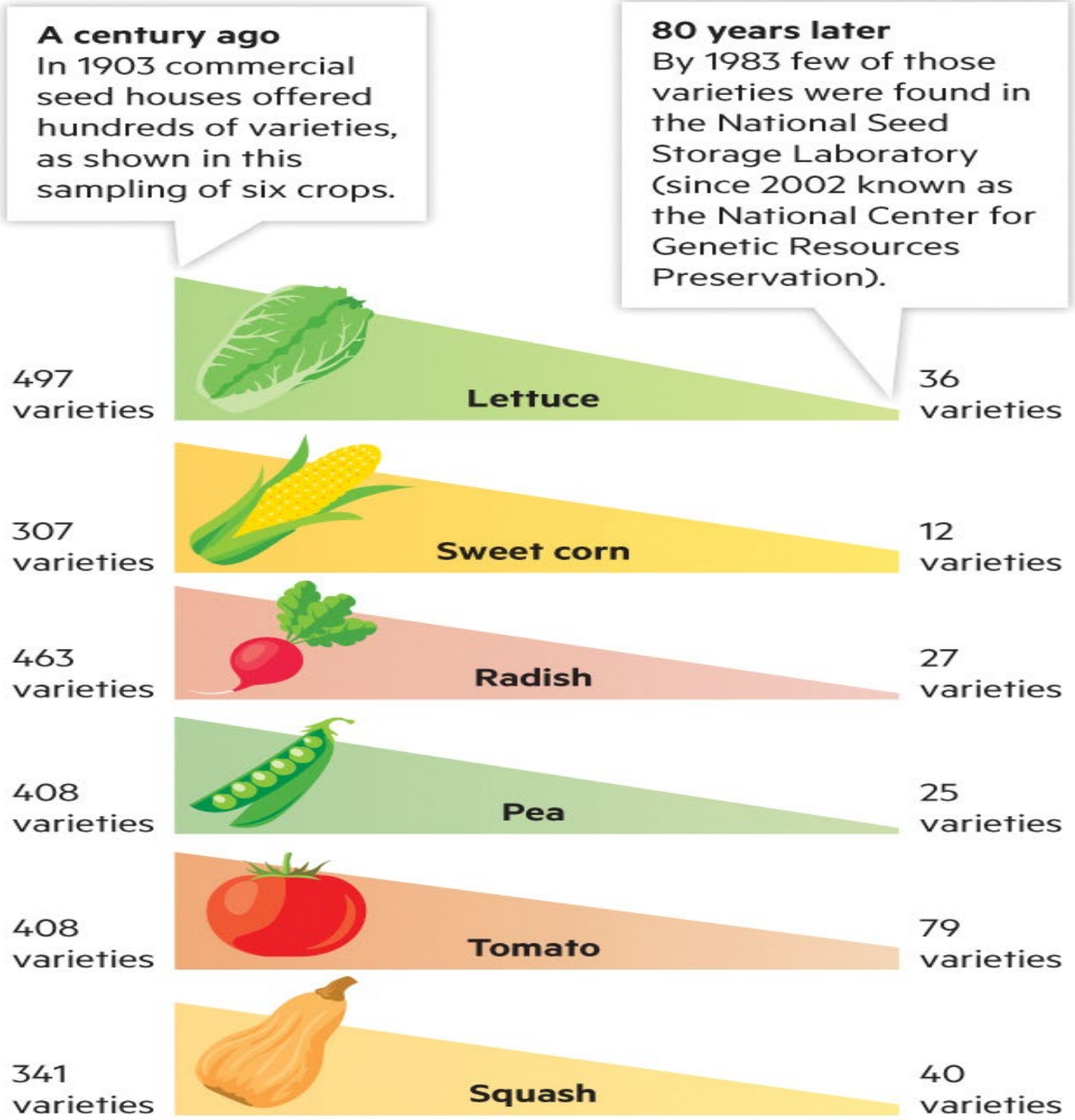

A
B
C
Calcite accumulates to form calcrete.
Unweathered bedrock
Desert soil
Leaching
Accumulation
Weathering
O
A
E
B
C
Humus accumulates.
Iron oxide and aluminum oxide accumulate; calcite is leached.
Temperate soil
A
B
C
Iron oxide, aluminum oxide, and aluminum hydroxide residue
Weathered bedrock
Unweathered bedrock
Tropical soil
Increasing rainfall

Soil's Purpose ?

- 45 different species Vs 1 or 2 species

1903

1983



Adapted from Rural Advancement Foundation International (n.d.)

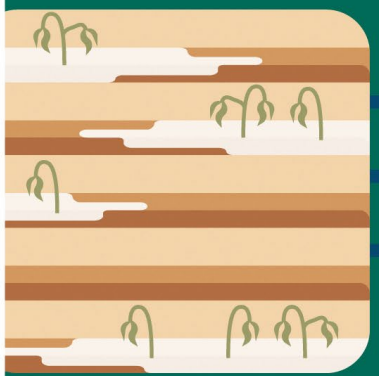
Biodiversity?

AT A GLANCE

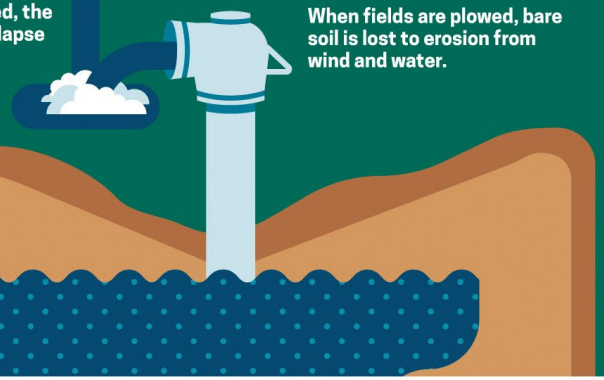
Environmental Impacts of Conventional Agriculture

Many practices of conventional agriculture have impacts on the environment. Finding solutions to these problems while feeding a growing population is a significant challenge.

Overirrigating crops can lead to degradation by both leaching nutrients away from the surface and concentrating minerals through evaporation in a process known as salinization.



When water for irrigation is pumped from groundwater sources more quickly than it can be replenished, the formerly water-filled spaces collapse and the ground surface sinks.



(PM)

Synthetic fertilizers affect both air and water quality. They emit ammonia (NH_3) into the atmosphere, where it combines with other compounds to make particulate matter (PM). On land, the nitrate and phosphorus in fertilizer can cause eutrophication when carried in runoff to bodies of water.

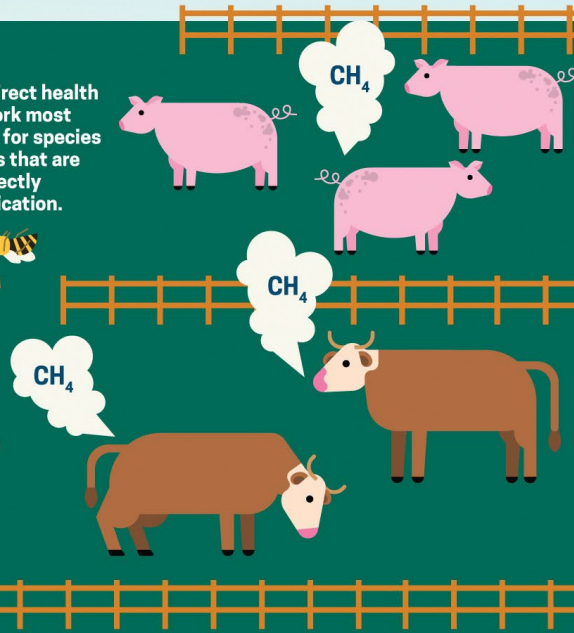
(NH_3)

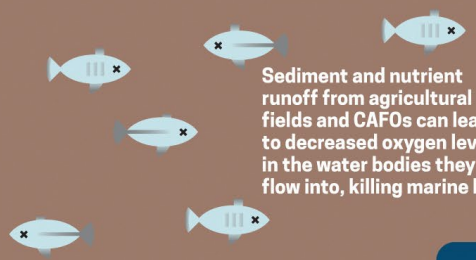
When fields are plowed, bare soil is lost to erosion from wind and water.

Runoff from rainfall and irrigation onto tilled fields can contribute to soil erosion.

Pesticides can pose direct health risks for those who work most closely with them and for species such as bees and birds that are either directly or indirectly affected by their application.

Reliance on monoculture (raising just a single crop in a given area) can lead to declining genetic diversity in our food crops—a loss of agrobiodiversity.





Sediment and nutrient runoff from agricultural fields and CAFOs can lead to decreased oxygen levels in the water bodies they flow into, killing marine life.

Concentrated animal feeding operations (CAFOs) collect large volumes of animal waste into manure lagoons that can pollute the water. Livestock, especially cattle, are also large emitters of the greenhouse gas methane (CH_4).

U.S. CORN USAGE

ETHANOL & FUEL
27%

FEED
39%

EXPORTS
16%

FOOD & INDUSTRIAL
9%

RESIDUAL
9%

80%
MEAL
The primary component of soybeans is meal.

20% OIL
The other soybean component is oil.

97%
ANIMAL FEED


97% of U.S. soybean meal is used to feed poultry and livestock.

3%
FOOD PRODUCTS


3% of soybean meal is used in food products like protein alternatives and soy milk.

68% FOOD


68% of soybean oil is used for frying and baking food, as a vegetable oil and as an ingredient in foods like salad dressings and margarines.

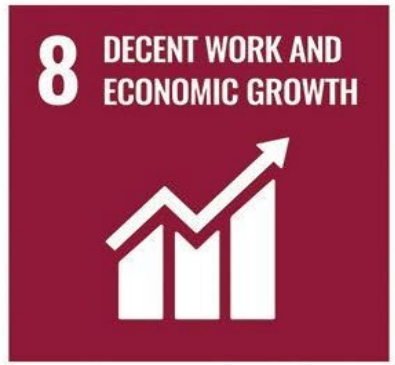
25% BIODIESEL & BIOHEAT®


25% of soybean oil is used for biodiesel and Bioheat.

7% INDUSTRIAL USES


Less than 7% of soybean oil is converted into industrial uses like paints, plastics and cleaners.

SUSTAINABLE DEVELOPMENT GOALS



Apply critical thinking to be wise consumers

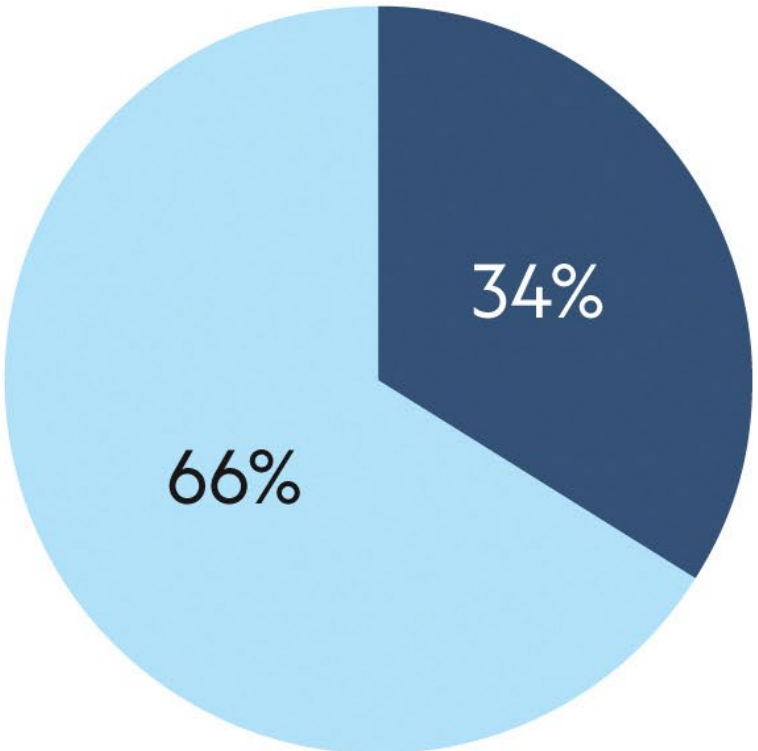
Our Food System

Food security vs Food Sovereignty

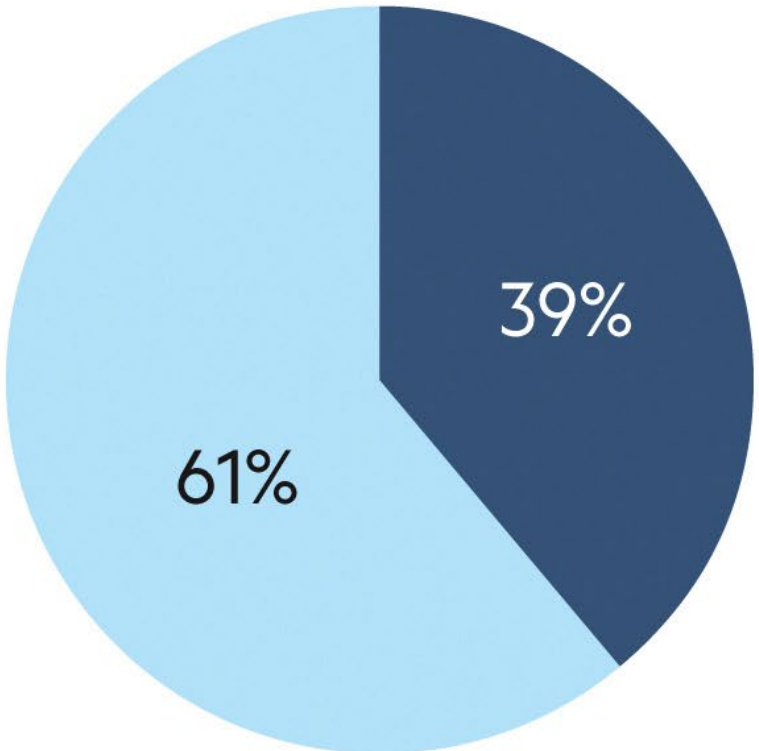
- **Food security** is concerned with the protection **and** distribution of existing **food** systems.

- **Food sovereignty** is rooted in grassroots **food** movements. **Food sovereignty** highlights the need for a democratic **food** system, one that involves inputs from citizens as well as producers.

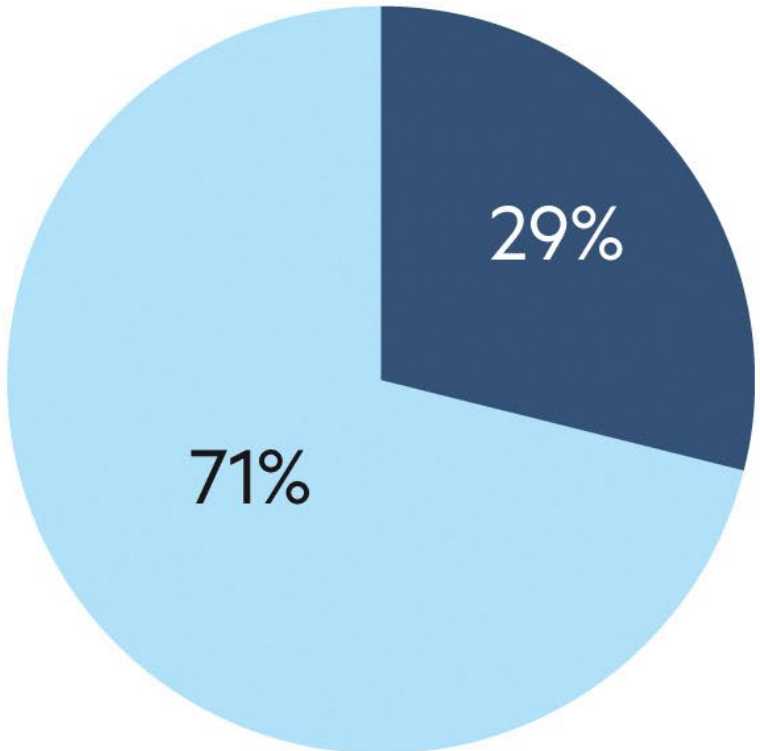
Overall



Two-year colleges



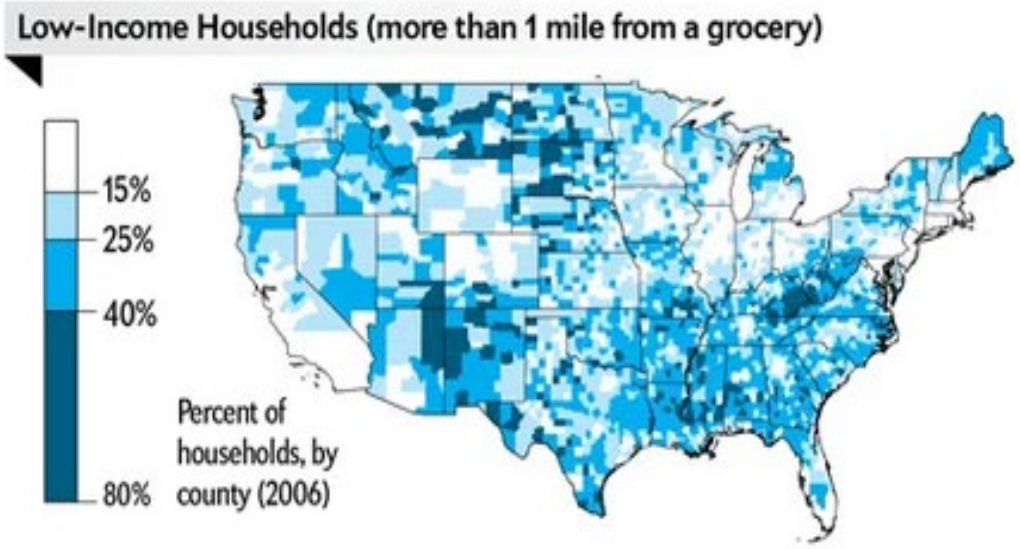
Four-year colleges

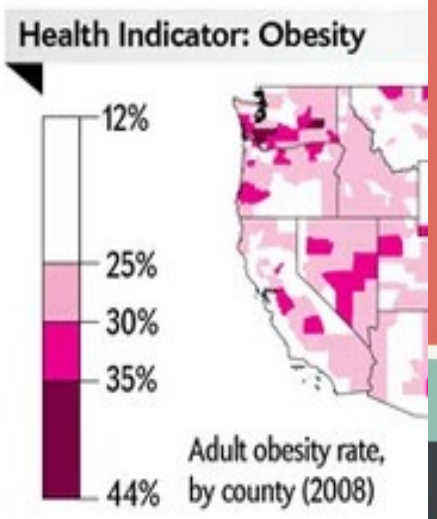


Food insecure

Adapted from The Hope Center for College, Community, and Justice (2021)

PANTHER PANTRY





Source: Food Environment Atlas, U.S. Department of Agriculture, Economic Research Service

FOOD DESERTS

Food Deserts are defined as...

Urban neighborhoods and rural towns without ready access to fresh, healthy, and affordable food.

Food deserts are most commonly found in communities of color and low-income areas, where many people don't have cars.

Studies have found that urban residents who purchase groceries at small neighborhood stores pay between

3 and 37

percent more than suburbanites buying the same products at supermarkets.

First Lady Michelle Obama has spearheaded the "Let's Move" campaign to combat childhood obesity, which includes a goal of eradicating food deserts by 2017 with a

$400 million

investment from the government focused on providing tax breaks to supermarkets that open in food deserts.

http://www.fooddispower.org/food-deserts/
http://apps.ams.usda.gov/fooddeserts/fooddeserts.aspx
https://www.dosomething.org/facts/11-facts-about-food-deserts

ABOUT THE AUTHOR

Jordan Burrows

Environmental Intern

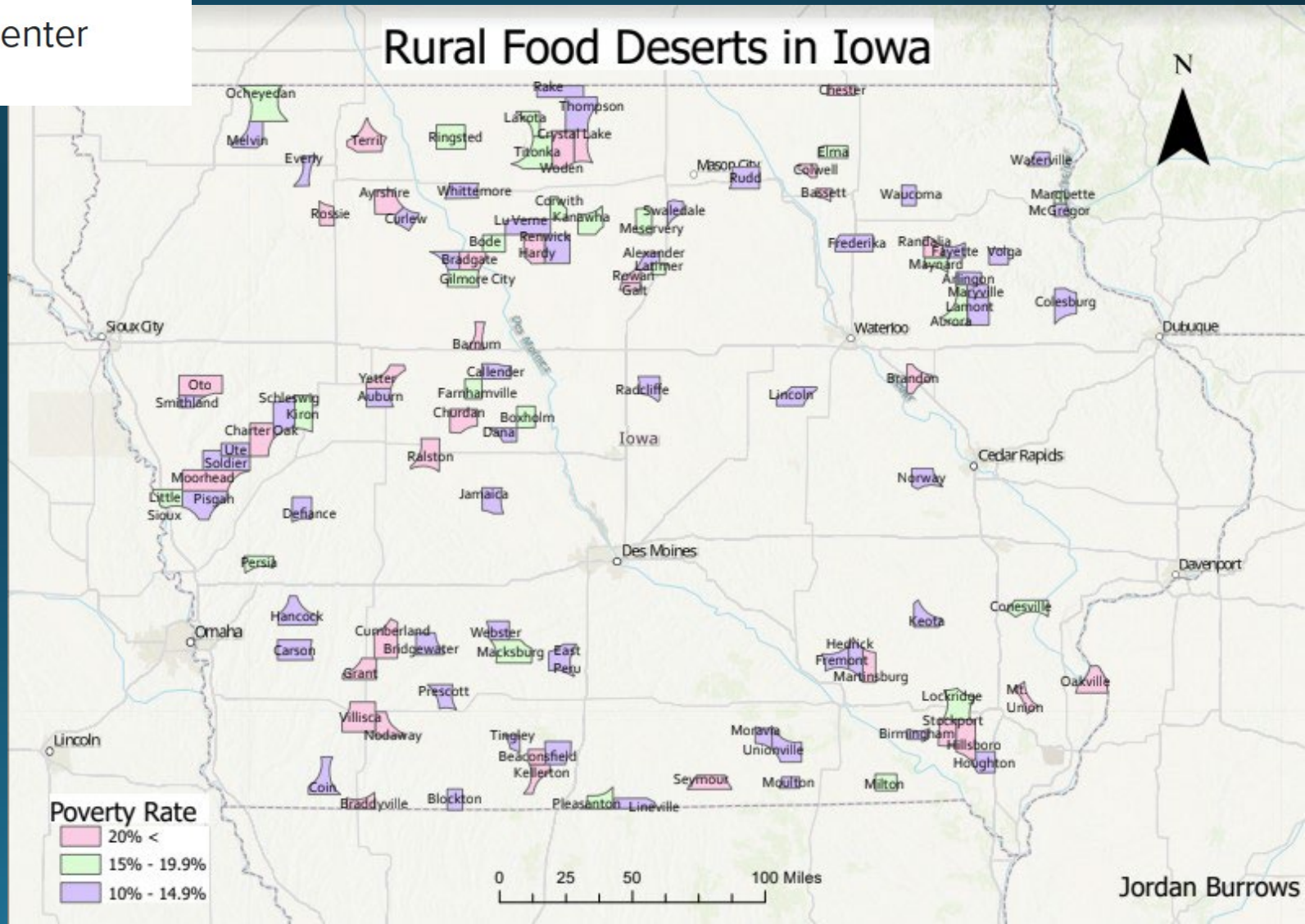
Iowa Waste Reduction Center

Iowa Waste Reduction Center (IWRC)

The results revealed:

111 total Iowa communities meet the criteria of a rural food desert.

Over 41,500 Iowans are living where there is no local access to wholesome food options.




100% natural
MILK
*from cows not treated with rBST
Made With Real Honey
Heart Healthy
GMO FREE
No High Fructose Corn Syrup
Made with Organic Wheat
USDA
Excellent Source of Calcium, Vitamin D & Riboflavin. Good Source of Vitamin A
35mg ISOFLAVONES PER SERVING
NON GMO Project VERIFIED
EXCELLENT SOURCE OF 10 VITAMINS & MINERALS
100% WHOLE GRAIN
31g or more per serving
WholeGrainsCouncil.org
REAL Fruit
FAT FREE
NO NITRATES OR NITRITES ADDED*
* EXCEPT FOR THE NATURALLY OCCURRING NITRATES IN CELERY & CHERRY POWDER
SUGAR FREE
100% Vitamin C DV Per Serving
25% Vitamins A & E
immune support
VITAMINS A, C & E TO HELP SUPPORT A HEALTHY IMMUNE SYSTEM

Fair Trade Products

When you see a product with the Fair Trade Certified seal, you can be sure it *meets rigorous social, environmental, and economic standards*. That means:

- Safe working conditions
- Environmental protection
- Sustainable livelihoods
- Community Development Funds

https://www.fairtradecertified.org/

'Organic'

Lodi Rules

Low Input Viticulture & Enology (LIVE)

Demeter Certified Biodynamic

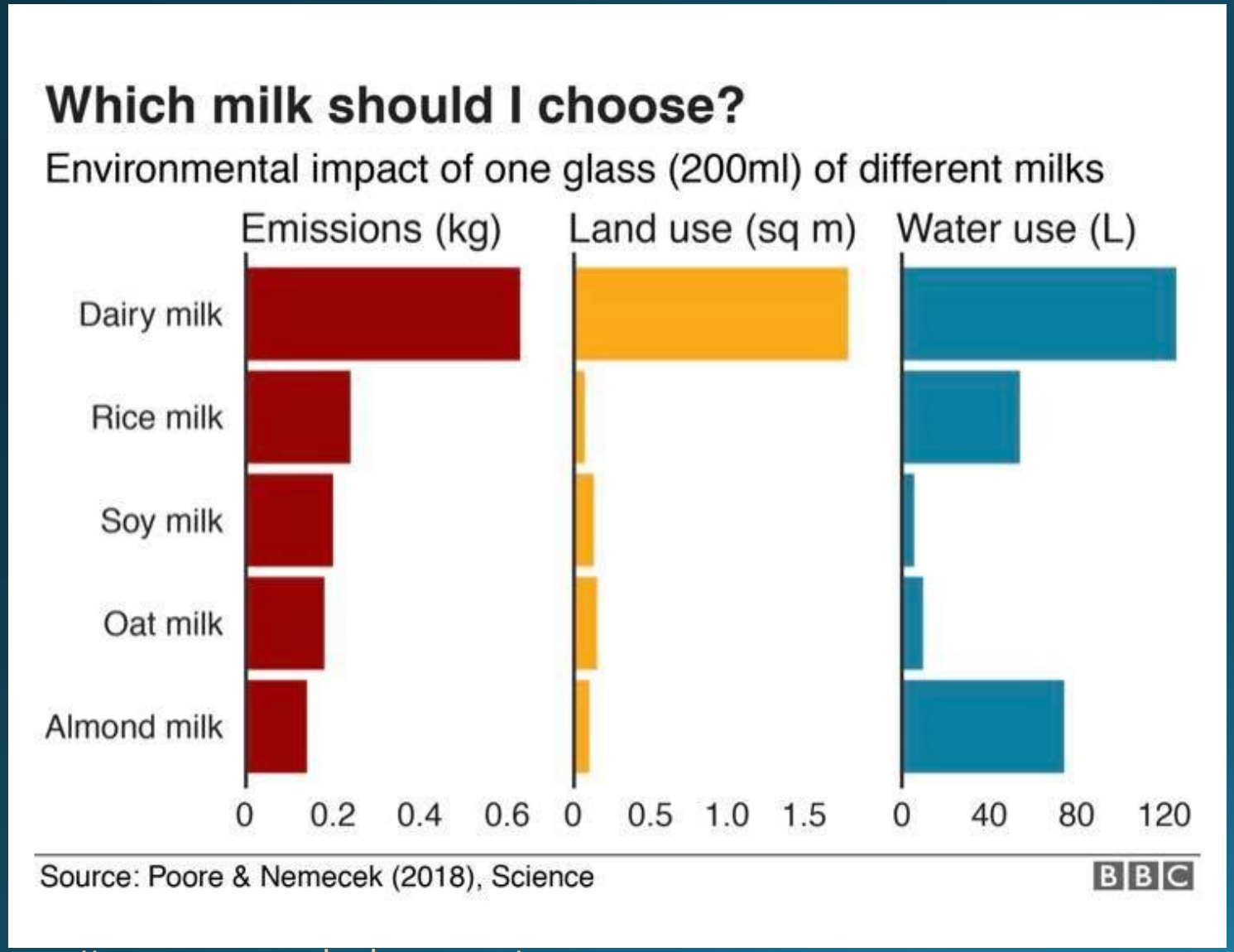
Sustainability in Practice (SIP)

Certified California Sustainable Winegrowing

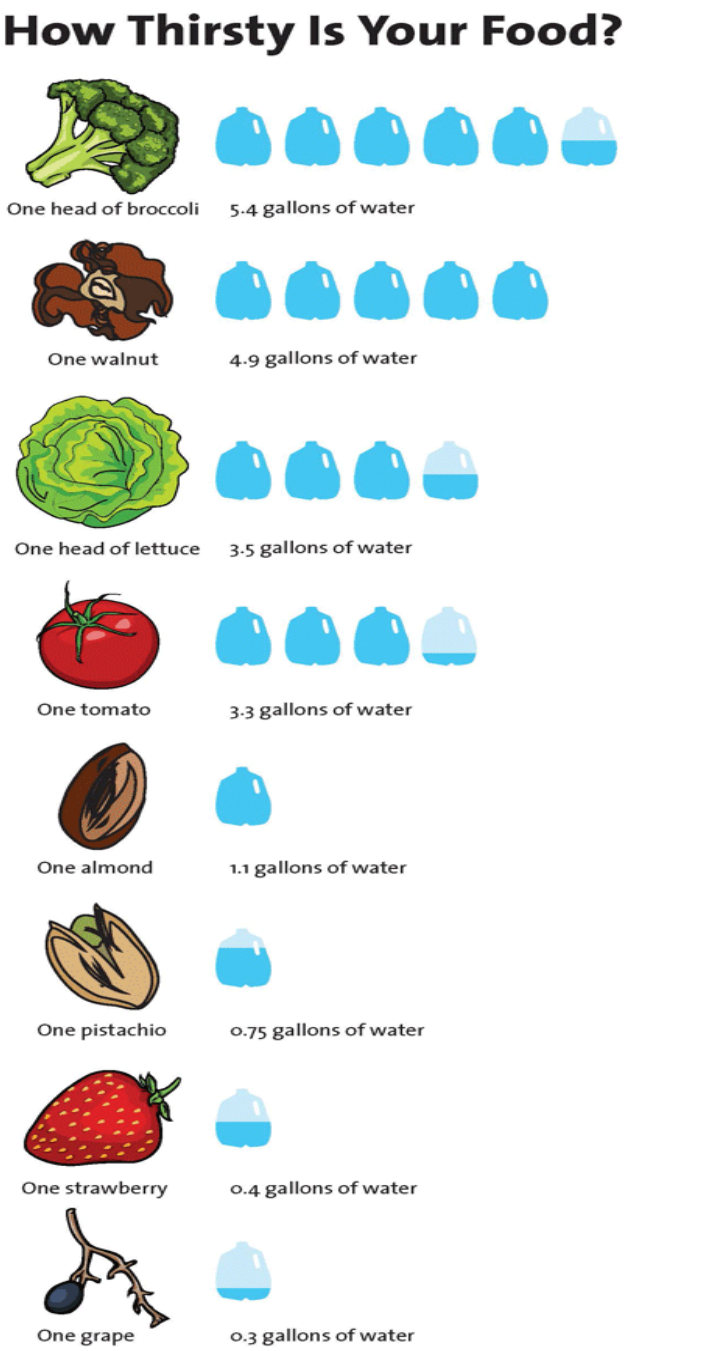
Certified Organic

Leadership in Energy & Environmental Design (LEED)

Energy, Water and Food



https://www.watercalculator.org/



Water and Food

1 Apple

70 Litres

1 Cup of Coffee

140 Litres

1 Cup of Tea

35 Litres

1 Slice of Bread

40 Litres

1 Pork Steak

1440 Litres

Virtual Water Usage

exchange of water that's embedded in the production of goods and services.

1 Chicken Breast

1170 Litres

1 Hamburger

2400 Litres

1 Beef Steak

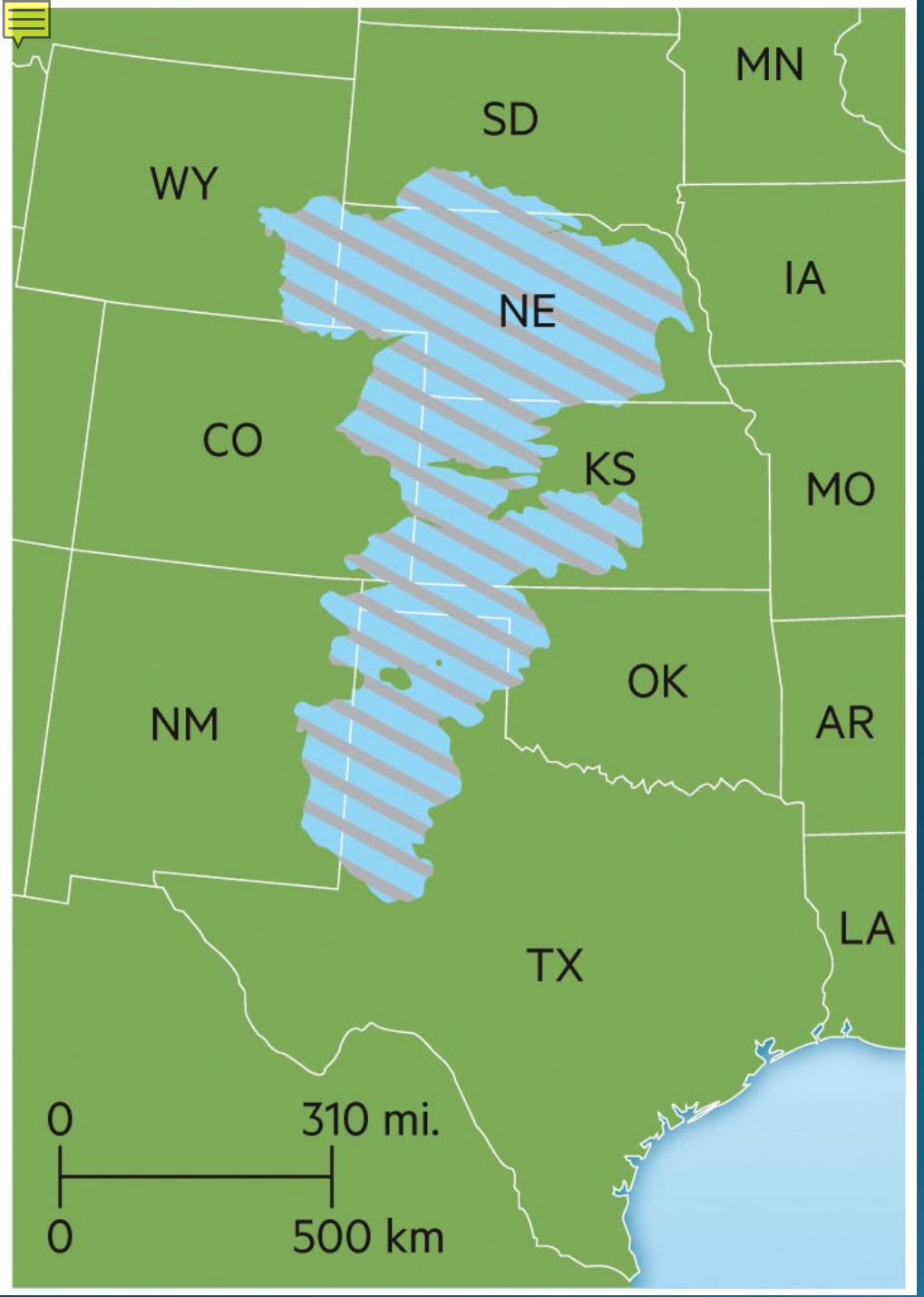
4650 Litres

1 Big Piece of Cheese

2500 Litres

1 Glass of Milk

200 Litres



Aquifer Type?

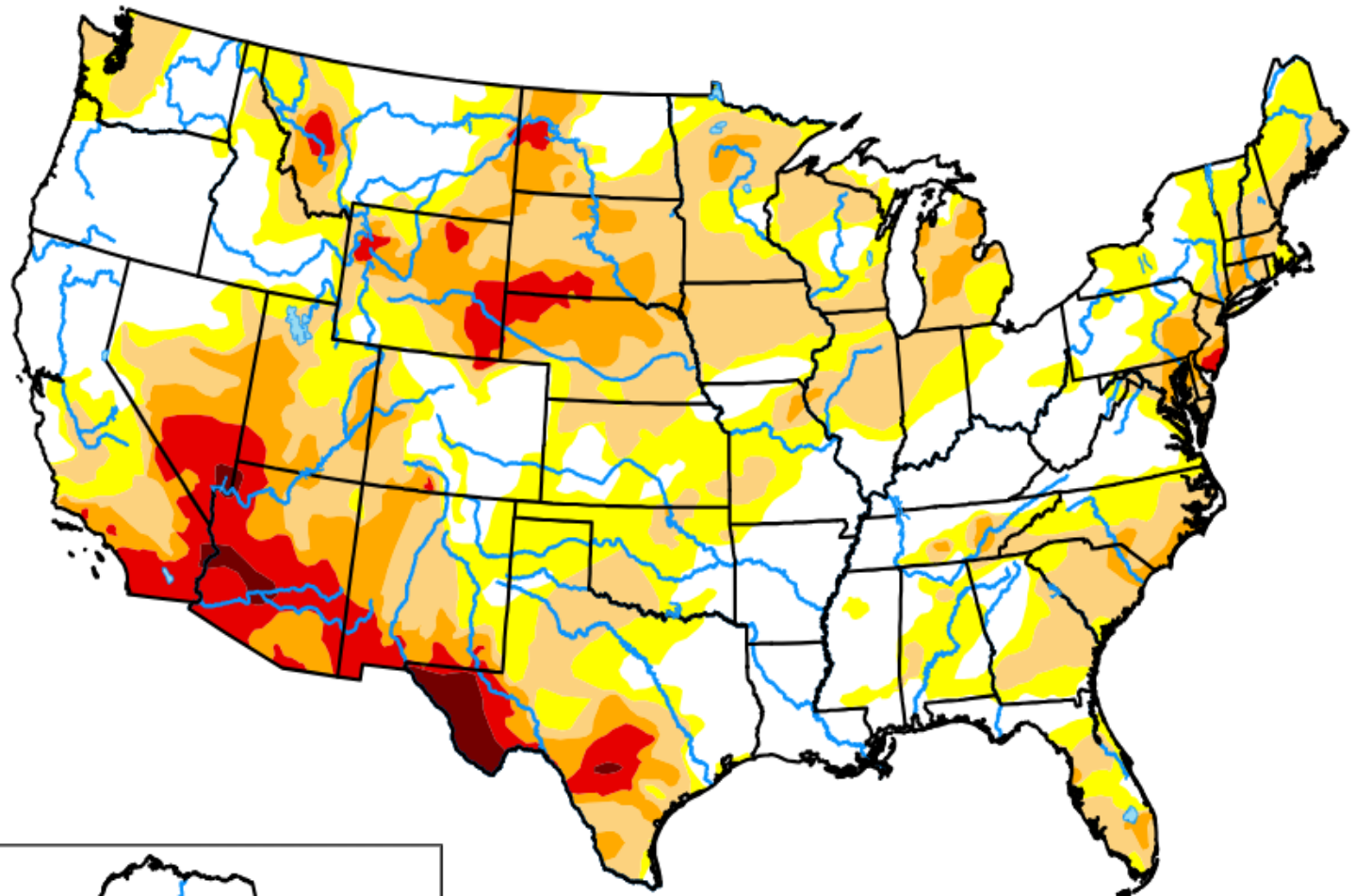
Rock type?

It's name?

Design Pics Inc/Alamy Stock Photo

U.S. Drought Monitor

Current | Maps | Data | Summary | About | Conditions & Outlooks | Ag in Drought | En Español | NADM



Map released: Thurs. March 6, 2025

Data valid: March 4, 2025 at 7 a.m. EST

Intensity

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

Authors

United States and Puerto Rico Author(s):

Curtis Riganti, National Drought Mitigation Center

Pacific Islands and Virgin Islands Author(s):

Brad Rippey, U.S. Department of Agriculture

Nebraska Examiner

ENVIRONMENT & AGRICULTURE

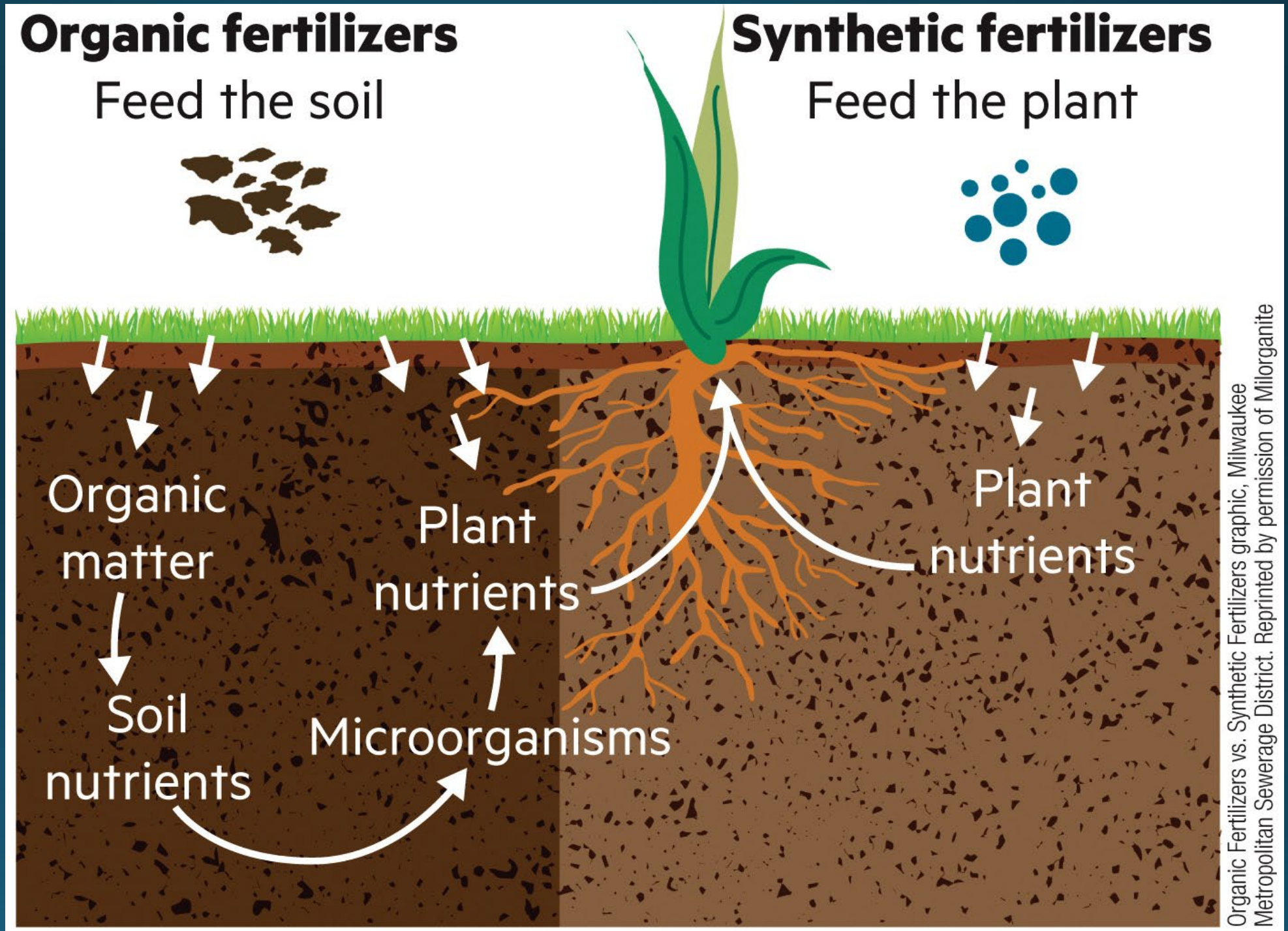
Agriculture built these High Plains towns. Now, it might run them dry.

BY: **ALLISON KITE AND KEVIN HARDY** - JANUARY 30, 2024 11:10 AM

Brownie Wilson kneels next to a decommissioned irrigation well outside Moscow, Kan., as part of the Kansas Geological Survey's efforts to measure the decline of the Ogallala Aquifer. Groundwater has been declining for decades because of irrigation in the eight states that rely on the aquifer. (Kevin Hardy/Stateline)

Iowa Nitrogen Initiative

Soil Health



Organic Fertilizers vs. Synthetic Fertilizers graphic, Milwaukee Metropolitan Sewerage District. Reprinted by permission of Milorganite

Rodrigo Gutierrez/Reuters/Newscom

Confined Animal Feeding Operations (CAFOs)

Benefits

- Efficient
- Lower costs/increase profits
- Increased production

Downsides

- Pollution (air, land, water)
- Antibiotic resistance
- Pandemic positive feedbacks

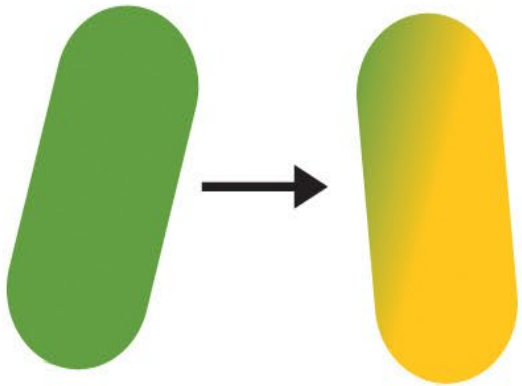
How Antibiotic Resistance Happens

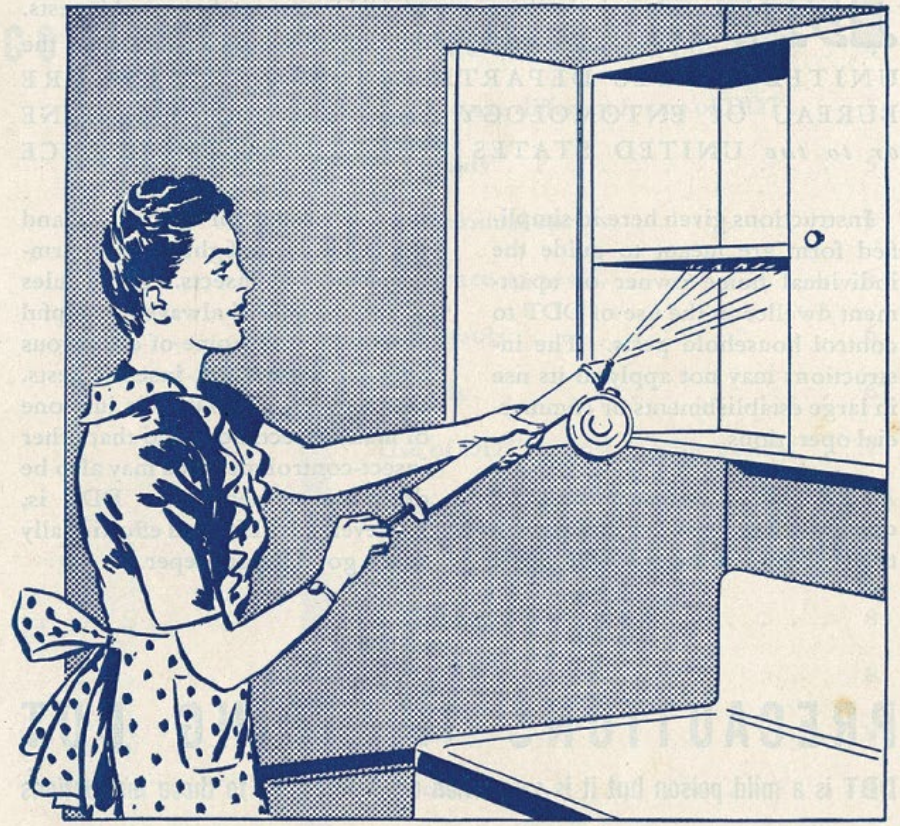
1 Among many germs, a few are drug resistant.

2 Antibiotics kill bacteria causing the illness, as well as good bacteria protecting the body from infection. Drug-resistant bacteria survive.

3 The drug-resistant bacteria grow in number and take over.

4 Some bacteria transfer their drug resistance to other bacteria, causing more problems.





DDT... FOR CONTROL OF HOUSEHOLD PESTS

Prepared by the
Bureau of Entomology and Plant Quarantine
Agricultural Research Administration
United States Department of Agriculture, and
the United States Public Health Service
Federal Security Agency
Washington, D. C. • Issued March 1947

Old Paper Studios/Alamy Stock Photo

Bottled water

RETAILER MARK UP 30%+

ENVIRONMENTAL COSTS

WATER

It takes 3x the amount of water to produce one bottle of water

CO2

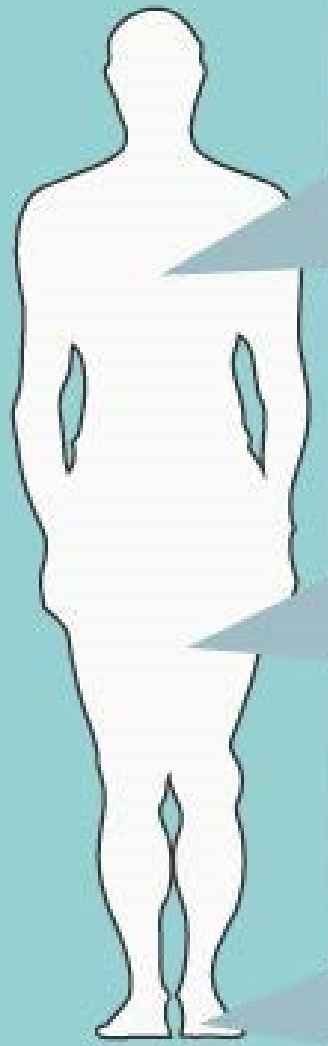
5 ounces CO2 produced for every 1 ounce of PET

OIL

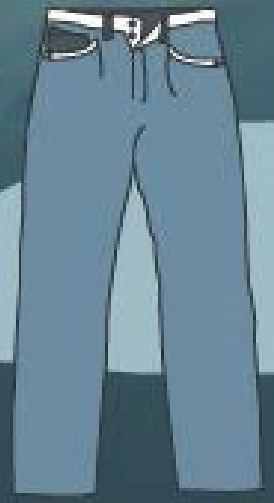
1/4 bottle full of oil is used to fill, transport, cool, and dispose of 1 bottle

Resulting in 15-20% profits...for a bottle often with a product cost of less than $0.00001

There's water in the making of your clothes...



It takes approximately **1,000** gallons of water to produce the half a pound of cotton it takes to make a single T-Shirt.



It takes approximately **1,500** gallons of water to produce the 1.5 pounds of cotton it takes to make a pair of jeans.

It takes approximately **2,000** gallons of water to produce all of the necessities for making a pair of tennis shoes.

What can you do?

Not saying you shouldn't buy clothes.

We all need to stay clothed of course. But you could look into purchasing second hand or even water efficient clothing! This is somewhat of a drastic life change so why not try and conserve the small amount of water we have in an easier way?

Become aware.

Awareness is the first step. Learn about water usage in the home and around the community. Measure the amount of water you use in a single day. Research how much water is used in objects of your everyday life.

Aware those around you.

Spreading this knowledge to friends and family is next. How much water do they use each day? If more people know about water usage, people will change their behavior.

Conserve.

Check pipes for leaks. Shorten showers. Turn off the faucet while brushing your teeth. These are all ways to conserve water.

The hidden water usage in food, clothing and material production is extremely consumptive, yet this water use is invisible. Water is a limited resource. It is the next oil. Become intelligent about water.

Distribution of mammals on Earth

Our World in Data

Mammal biomass is shown for the year 2015. or or = 1 million tonnes carbon (C)

Wild mammals
4% global mammal biomass

Livestock & pets
Poultry are not included
62% global mammal biomass

Cattle 35%

Buffalo 5%

Horses 2%

Goats 3%

Sheep 3%

Pigs 12%

Camels <1%

Asses <1%

Pets* <1%

Humans
34% global mammal biomass

*Bar-On et al. (2018) provide estimates of livesto
Pets have been added as an additional category b
Data source: Bar-On et al. (2018). The biomass di
OurWorldinData.org – Research and data to mak

https://ourworldindata.org

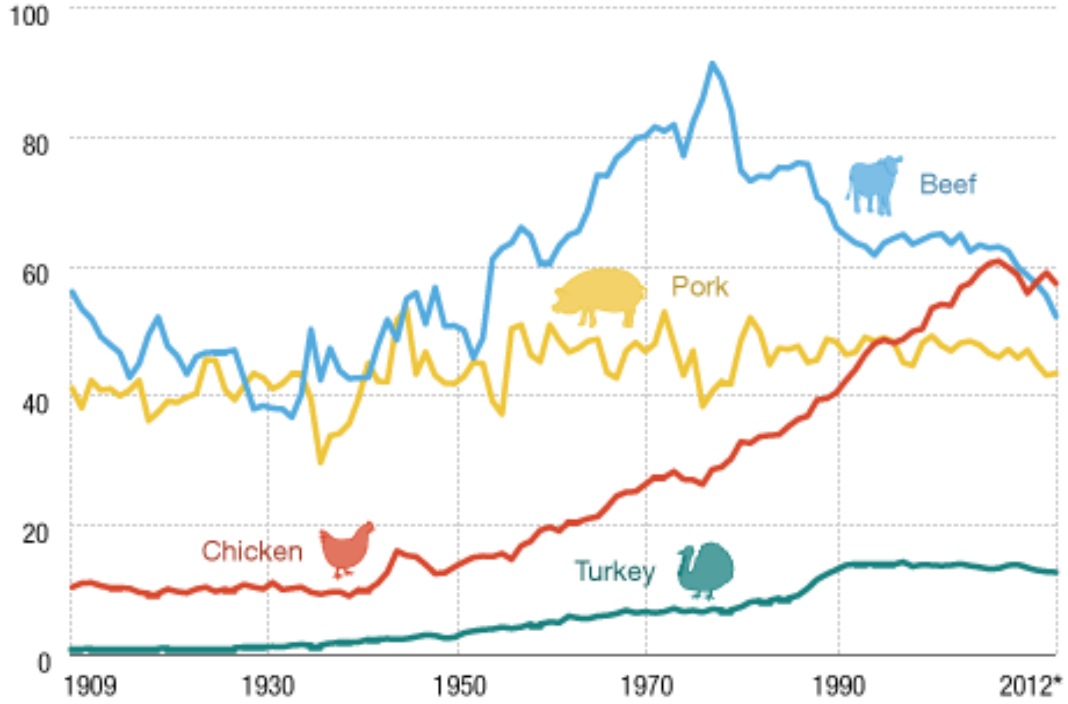


TABLE 12.1 Meat-Based versus Plant-Based Diets

Conventional (Grain-Fed) Meat	Plants
• Requires more land, water, and energy • Produces about twice the greenhouse gas emissions of vegetarian diets • Livestock are fed grains that people could be eating • Animal wastes can pollute water bodies • Ethical issues surround eating animals and confining them in feedlots • Overuse of antibiotics can cause anti-biotic resistance	• Requires less land, water, and energy • Produces about half the greenhouse gas emissions of conventional meat-based diets • Conventional tillage causes soil erosion • Plowing grasslands to plant crops reduces soil organic matter and releases carbon dioxide • Synthetic fertilizers and pesticides can pollute water bodies

Primary consumers

When we eat a plant-based diet, we are primary consumers and have 10% of the energy from the primary producers available to us.

1,000 units of energy

10,000 units of energy

Crops are primary producers.

Secondary Consumers

When we eat meat, we are secondary consumers and have just 1% of the energy from the primary producers available to us.

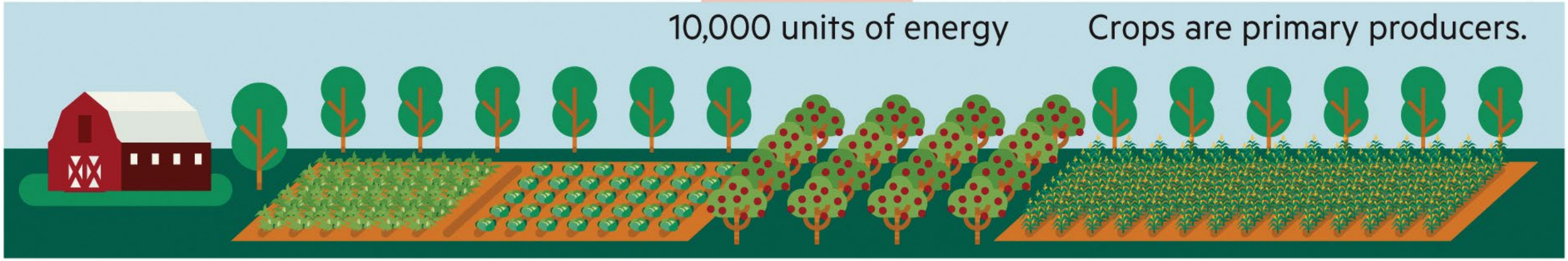
100 units of energy

1,000 units of energy

Livestock are primary consumers that require additional resources like water and generate pollution.

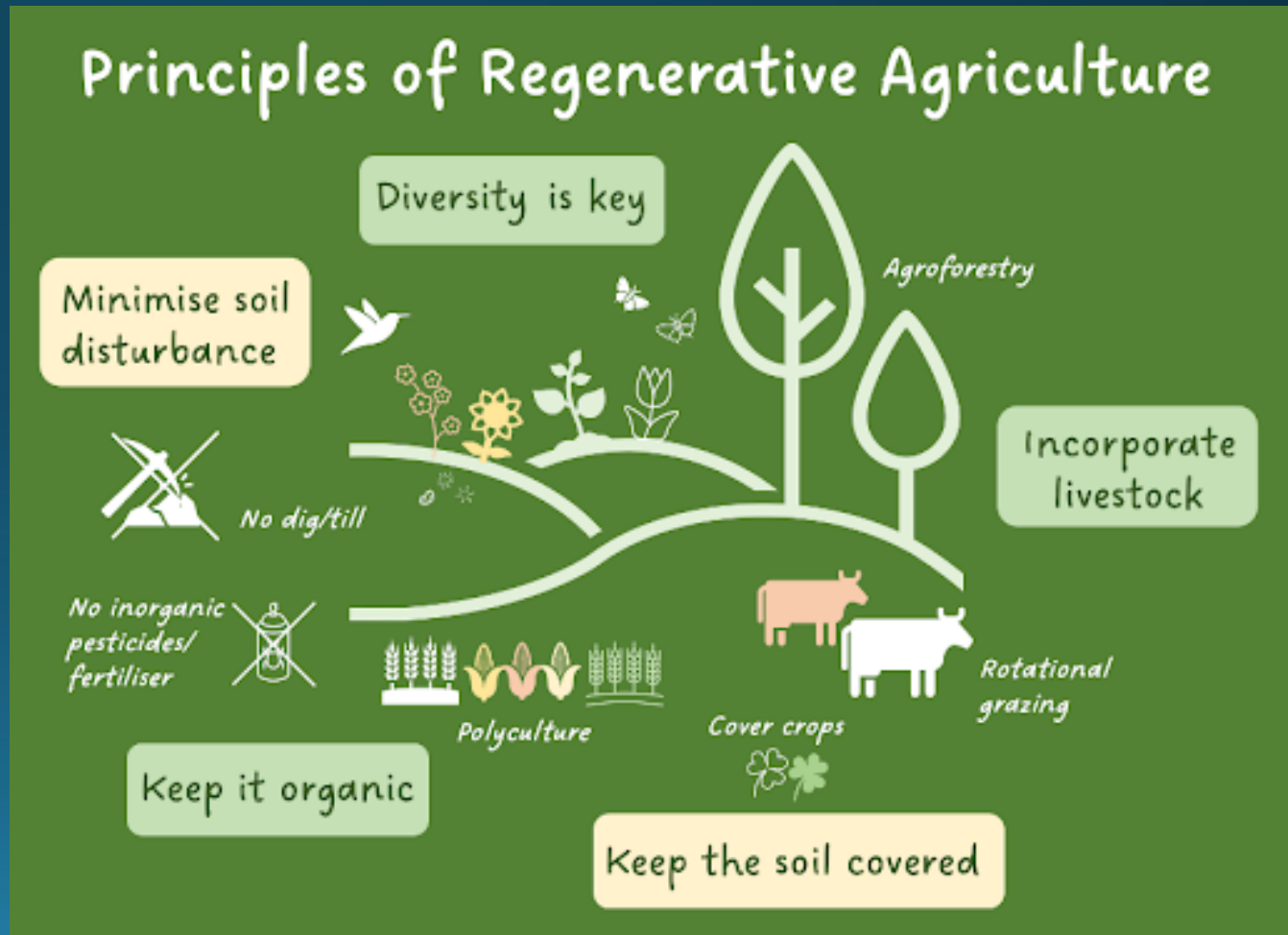
10,000 units of energy

Crops are primary producers.



Regenerative agriculture

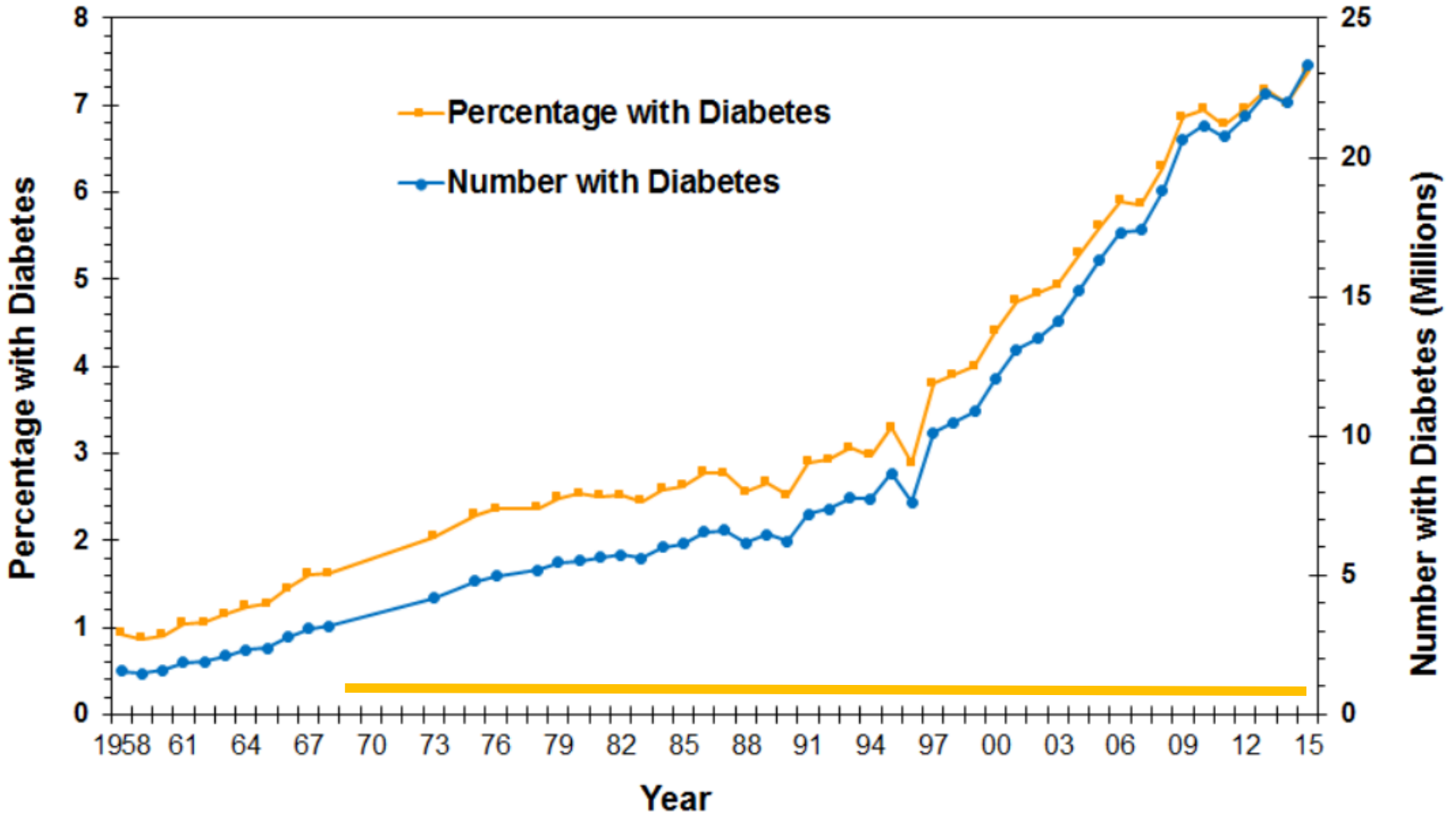
- Farming and grazing practices that aim to improve soil health, water quality, and biodiversity.
- Also aims to reduce greenhouse gas emissions and help communities adapt to climate change.




Raisin Bran Crunch
HONEY Mini Teddy Graham
GRAHAM SNACKS
Yoplait Light
CAPRI SUN
Tropical Punch
Kellogg's Eggo Original
SMUCKER'S
KRAFT Miracle Whip
Mountain Dew
GENUINE CHOCOLATE FLAVOR
HERSHEY'S
Nordica Twinkies
100% Whole Grain Wheat Thins
Ocean Spray
Jellied CRANBERRY SAUCE
Hi-C TORRENTIAL TROPICAL PUNCH
Mini OREO
KRAFT CoolWhip WHIPPED TOPPING
Strawberry Shortcake
7UP
POWER BAR
OATMEAL RAISIN

HFCS

Number and Percentage of U.S. Population with Diagnosed Diabetes, 1958-2015



CDC's Division of Diabetes Translation. United States Diabetes Surveillance System available at http://www.cdc.gov/diabetes/data

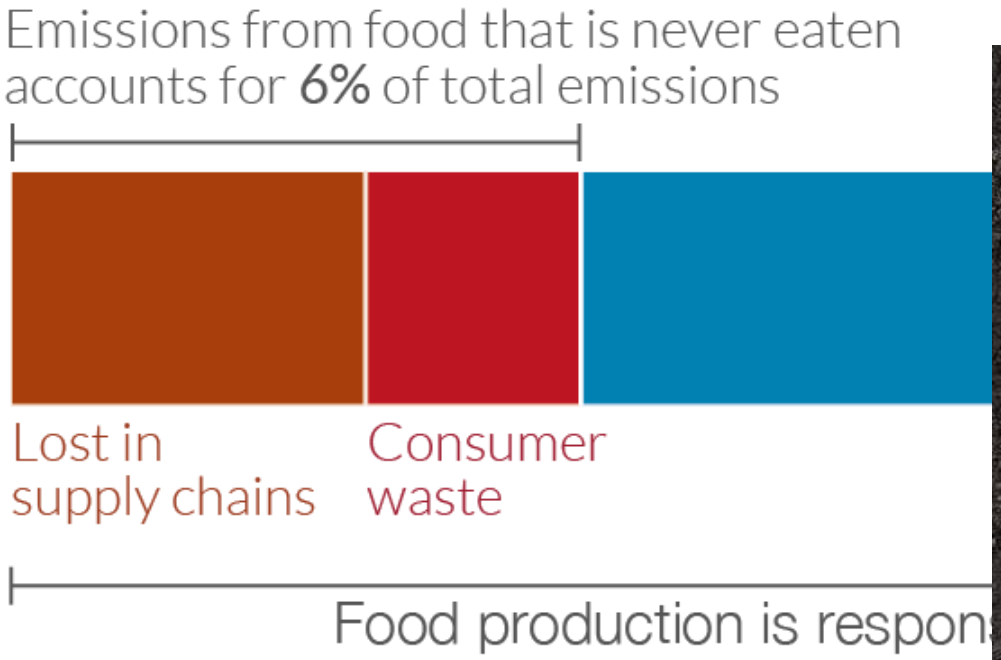

RITZ
CHICKEN
Colgate
Mars
AVON
SMARTIES
nutella
50g
15 g:
336 kJ
80 kcal
4 %*
100 g:
2252 kJ / 539 kcal
FERRERO
MILO
NOBBYS
MIXED FRUITS
Easy Cheese
NAN
CRUNCHY NUT

Palm oil

https://www.worldwildlife.org/p

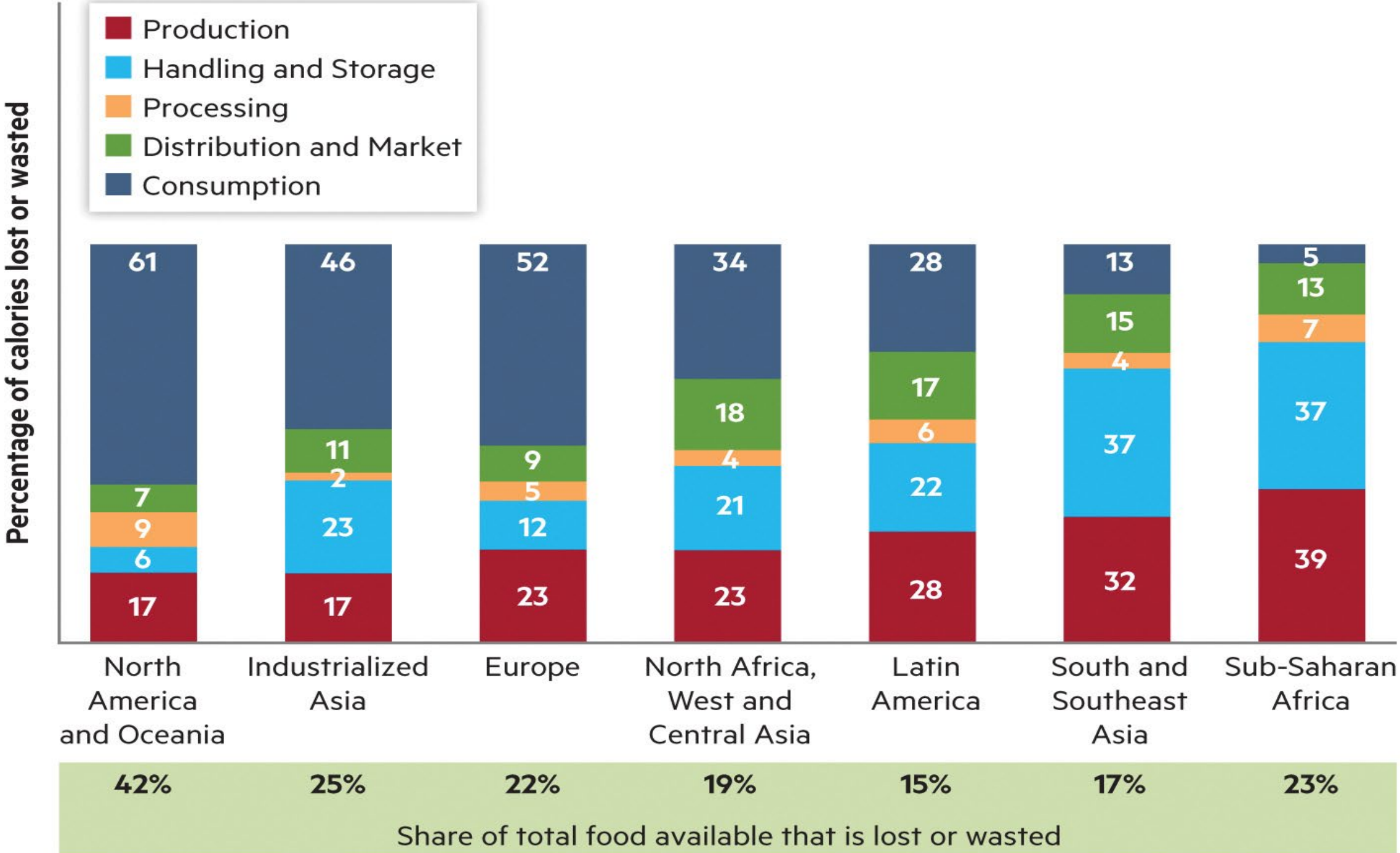
6% of global greenhouse gas emissions come from food losses and waste

Our World in Data



https://ourworldindata.org/food-waste-emissions

https://www.theguardian.com/environment/2016/jul/13/us-food-waste-ugly-fruit-vegetables-perfect


Production
Handling and Storage
Processing
Distribution and Market
Consumption
Percentage of calories lost or wasted
61
7
9
6
17
46
11
2
23
17
52
9
5
12
23
34
18
4
21
23
28
17
6
22
28
13
15
4
37
32
5
13
7
37
39
North America and Oceania
Industrialized Asia
Europe
North Africa, West and Central Asia
Latin America
South and Southeast Asia
Sub-Saharan Africa
42%
25%
22%
19%
15%
17%
23%
Share of total food available that is lost or wasted

Subway bread too sweet to be called bread: Irish court

Fast Food

VS.

Slow Food

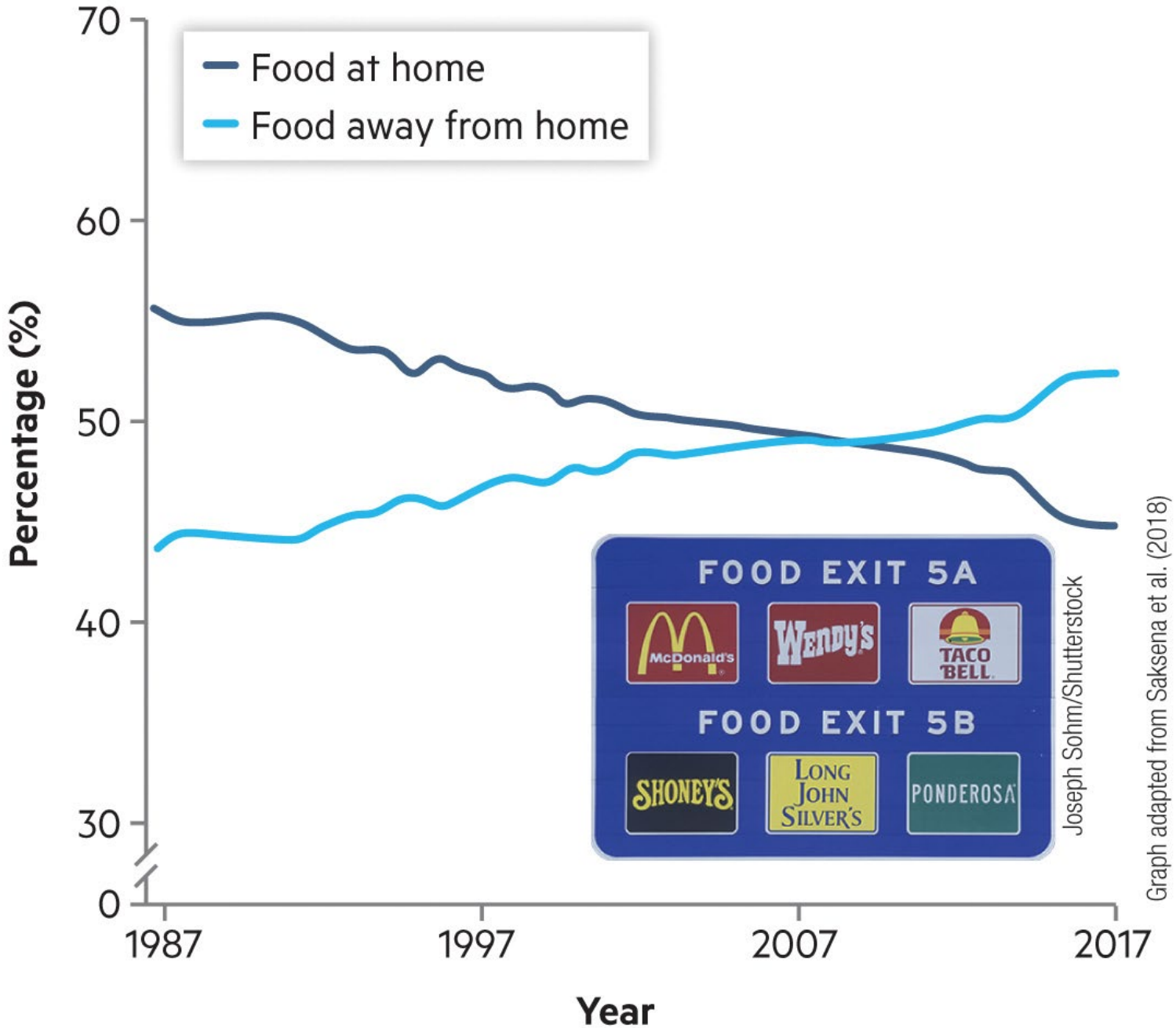
Fast Food	Slow Food
Cheap and quick.	Food purchased locally to support local growers.
Unhealthy processed ingredients.	Celebrates the meal, takes time gathering with family and friends.
Purchased on the go without much thought.	Values the taste of the food.
Eaten in a hurry.	Embraces the preparation and cooking of the meal.

Italy
Vs
Iceland

450 capacity

20 years ago	Today	Difference
 **333** calories	 **590** calories	**257** more calories
 **500** calories	 **850** calories	**350** more calories
 **210** calories	 **500** calories	**290** more calories

Where Americans Ate, 1987–2017



Graph adapted from Saksena et al. (2018)

More about Ag.

- Antibiotics
- Hormones
- Genetically modified organisms (GMO)
- Community supported agriculture (CSA)
- New agriculture
  - Lettuce in NJ
  - Marijuana in CO

Soil cannot be replaced in 'human-time'

- Destruction of the soil is the most fundamental kind of economic loss which the human race can suffer. With enough time and money, a neglected farm can be put back on its feet—if the soil is there. By expensive replanting and with a generation or two of waiting, a ruined forest can again be made productive – if the soil is there…But if the soil is gone, the loss is absolute and irrevocable.