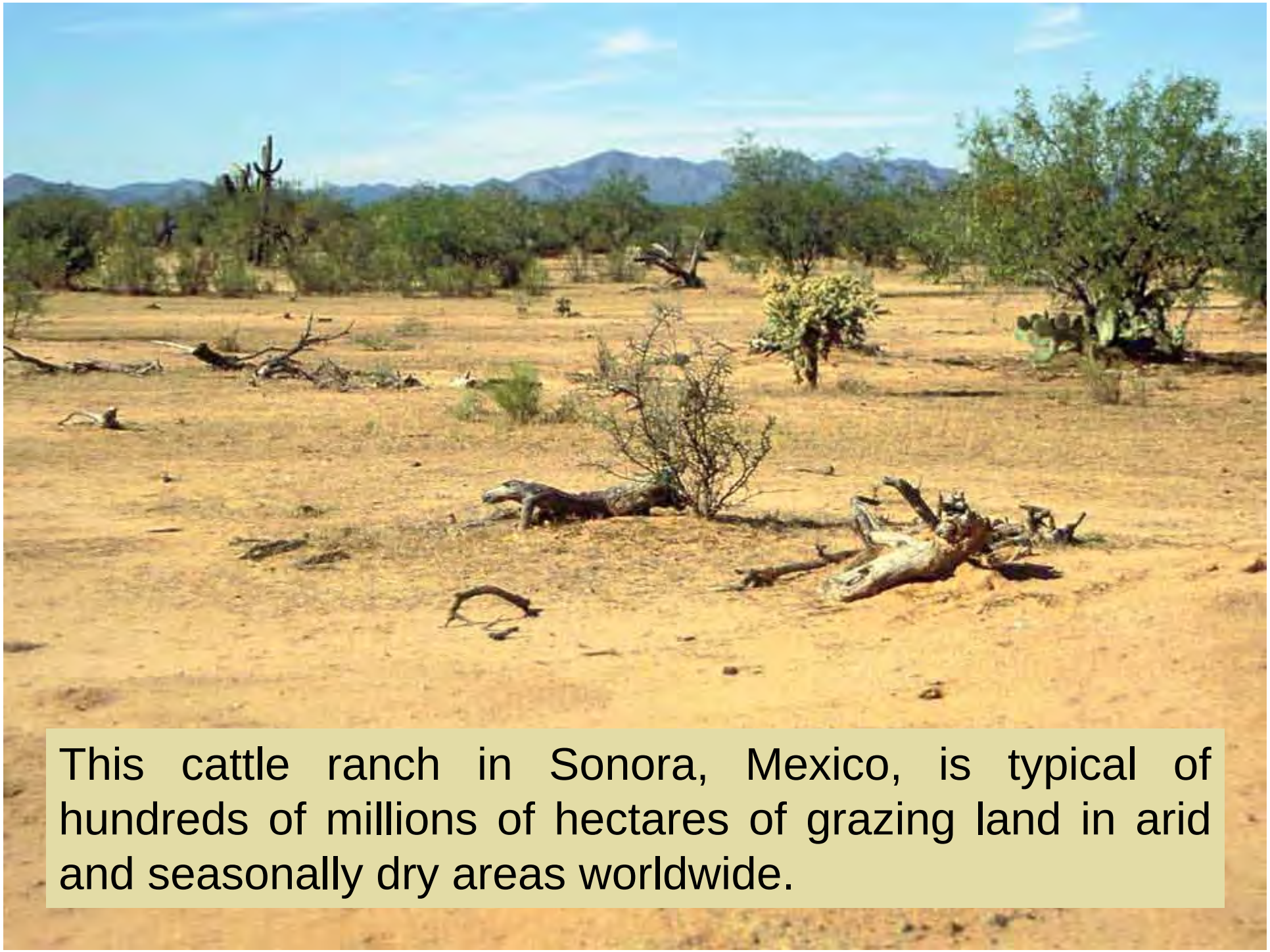
What does Carbon look like in nature?

- How can we tell, just by looking, that there is more carbon in one area than the next area?
- Note – not measure how much carbon is there, just that there is much more there?



This cattle ranch in Sonora, Mexico, is typical of hundreds of millions of hectares of grazing land in arid and seasonally dry areas worldwide.

This is the neighboring ranch, La Inmaculada.

This is the neighboring ranch, La Inmaculada.

- Same area
- Same rainfall
- Same soils
- Same plant species
- Same season (pictures taken on the same day)
- La Inmaculada actually has more cattle than the drier ranch
- The only difference is management

The simple maths behind Soil Carbon

- One hectare = 10,000 sq. metres
- Soil 33.5 cm deep (1 foot approx)
- Bulk density = 1.4 tonnes per cubic metre
- Soil mass per hectare = about 4,700 tonnes
- 1% change in soil organic matter = 47 tonnes
- Which gives about 27 tonnes Soil Carbon
- This captured 100 tonnes of atmospheric CO_2

Without frequent moves, grazers bite palatable plants again and again, keeping them small.

Because small leaves can only feed small roots…

…overgrazed plants suffer drought stress and die, while weeds and thorns can still reach water.

SOILS ARE THE ONLY SOLUTION THAT OFFERS SHORT TERM IMPACT ON GLOBAL WARMING

- The experts agree: only soils can sequester significant amounts of atmospheric Carbon in the next 30 years. Every other solution will take 30 years to start shifting meaningful volumes.

FACT FACT FACT

- FACT: “Carbon scrubbing” at source does not reduce the existing CO2 burden in the atmosphere

  FACT: “Geosequestation” (burial beneath deep cap rock formations and in exhausted oil wells) does not reduce the existing CO2 burden and researchers say it could take 100 years to determine if it is effective

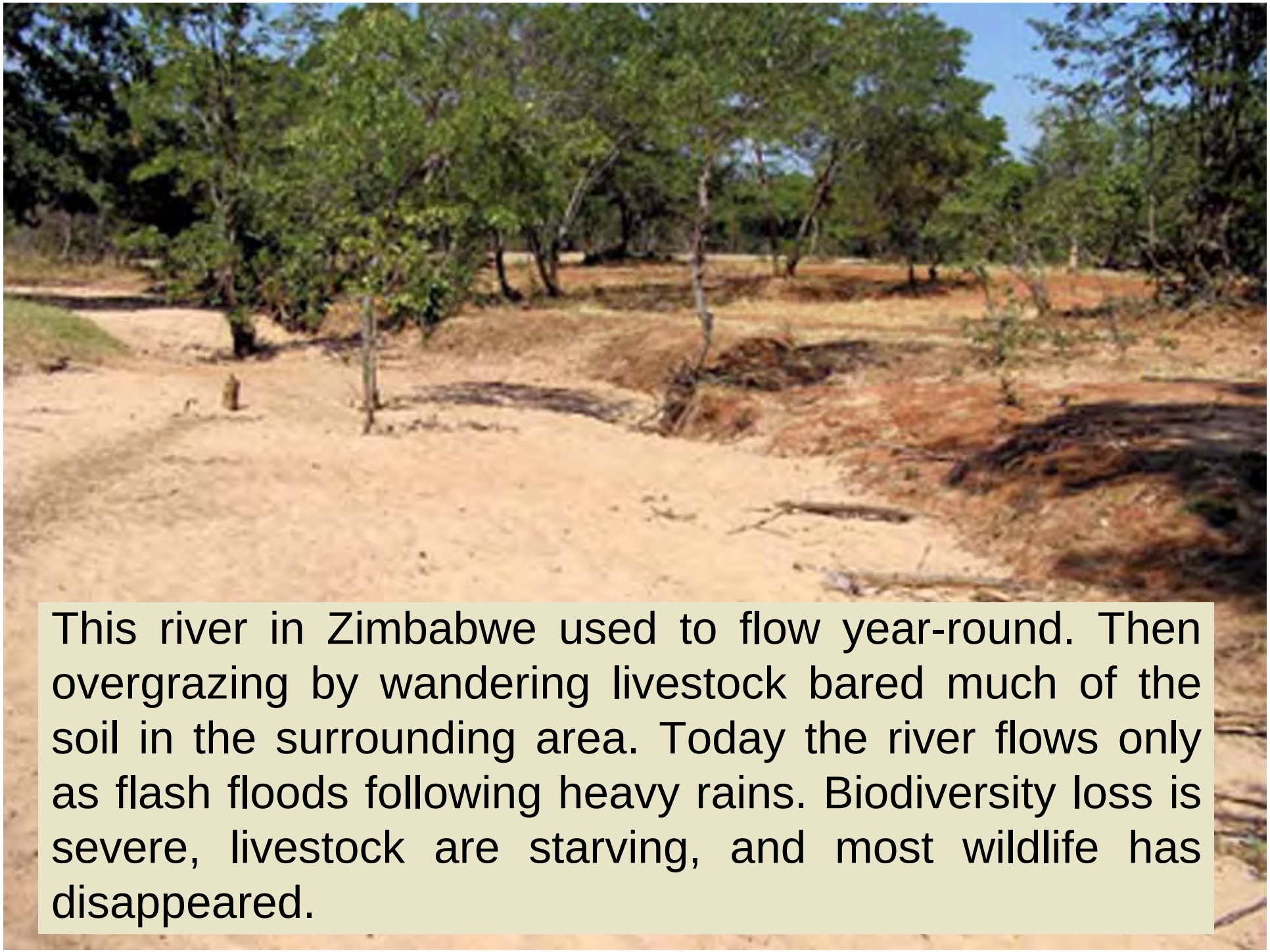
  FACT: Plantation tree farms can be net emitters in their early stages and take many years to reach their sequestration potential

FACT FACT FACT

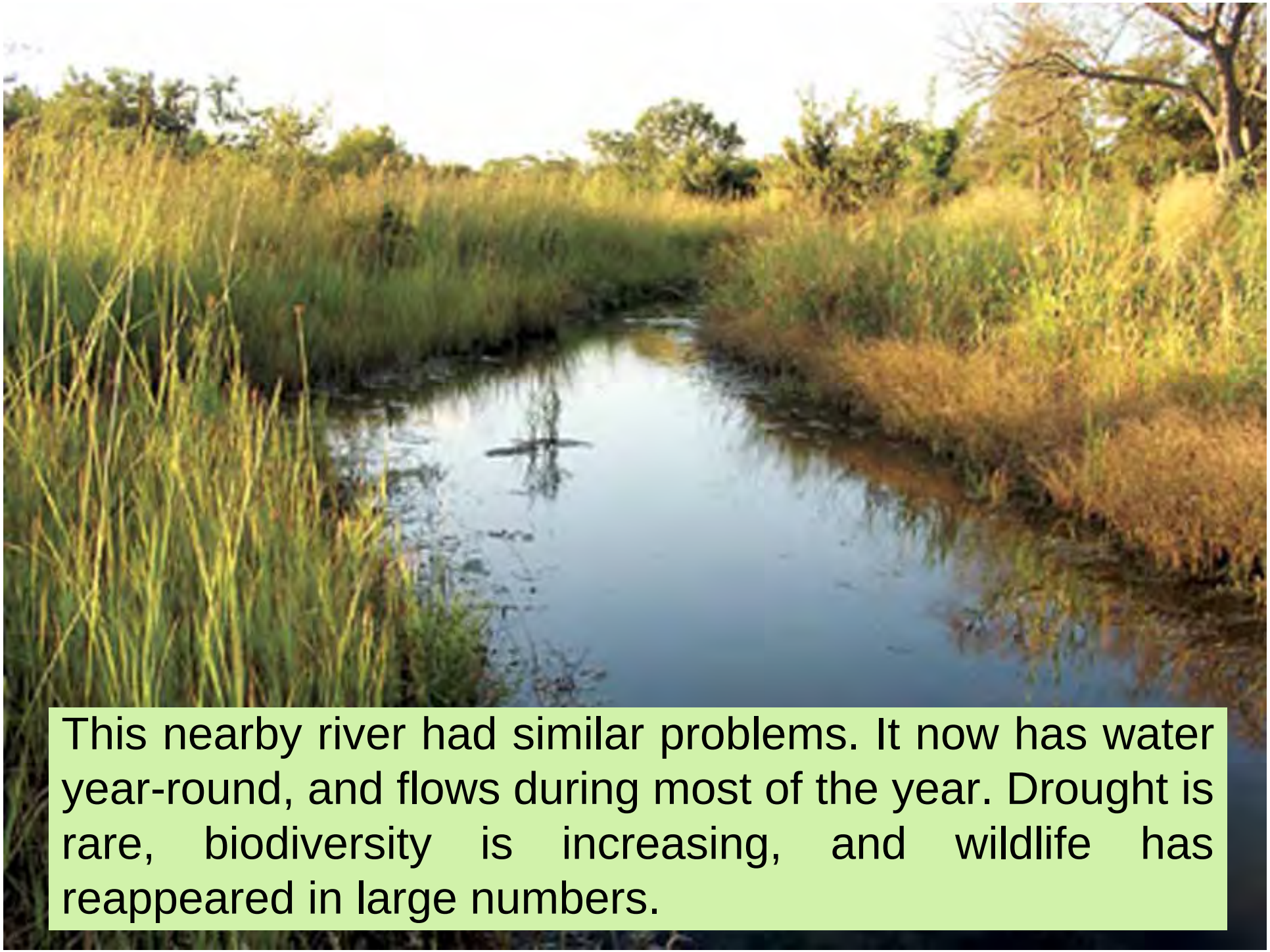
- FACT: Solar Power cannot sequester CO_2
- FACT: Wind turbines cannot sequester CO_2
- FACT: Deep sea burial threatens the chemical balance of the oceans (especially shell formation)

ARE AGRICULTURAL SOILS THE ANSWER?

- **CAPACITY**: "Soil organic carbon is the largest reservoir in interaction with the atmosphere." (United Nations Food & Agriculture Organisation) - Vegetation 650 gigatons, atmosphere 750 gigatons, soil 1500 gigatons
- **COST EFFECTIVE**: "Enhancing the natural processes that remove CO2 from the atmosphere is thought to be the most cost-effective means of reducing atmospheric levels of CO2." (US Department of Energy)
- **AVAILABLE**: Grazing land comprises two thirds of the total land surface – some 5 BILLION hectares



This river in Zimbabwe used to flow year-round. Then overgrazing by wandering livestock bared much of the soil in the surrounding area. Today the river flows only as flash floods following heavy rains. Biodiversity loss is severe, livestock are starving, and most wildlife has disappeared.



This nearby river had similar problems. It now has water year-round, and flows during most of the year. Drought is rare, biodiversity is increasing, and wildlife has reappeared in large numbers.

- Same area
- Same rainfall
- Same soils
- Same plant species
- Same season (pictures taken on the same day)

- The area above actually has more livestock
- It also has far more wildlife, including buffalo, elephant, and lion
- The only difference is management

Livestock in these areas get managed to:

- Increase the land's ability to absorb and hold water
- Build new soil
- Help new plants start
- Increase forage production
- Increase biodiversity
- Build a healthier landscape

Livestock in these areas do not.

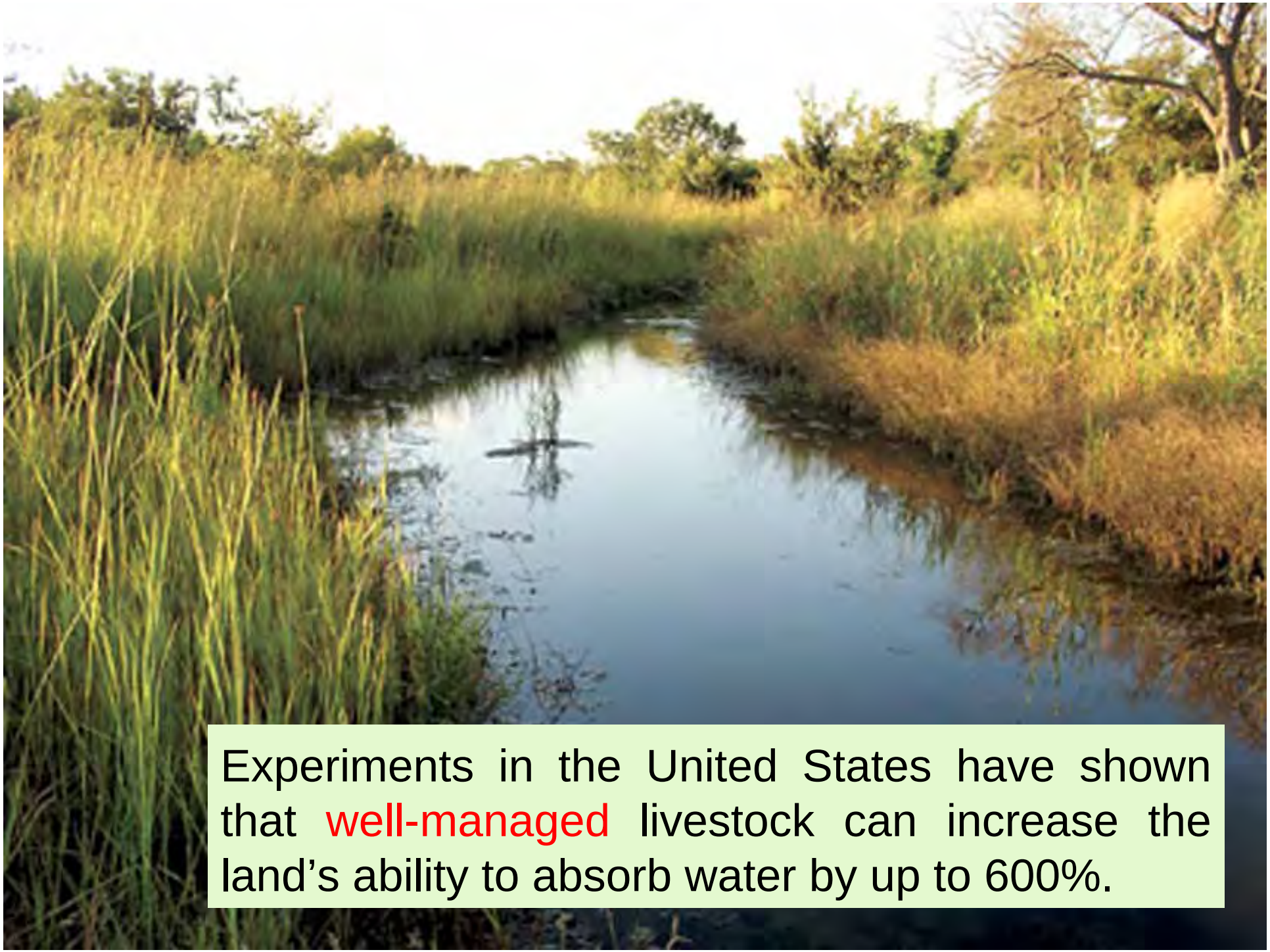
The result is drought, desertification, and economic hardship:

- Palatable plants get killed by overgrazing
- New plants cannot start successfully
- Less forage grows
- Most sunlight and rain get wasted on bare soil
- Soil loses its ability to absorb and hold water
- Streams and wells go dry
- Livestock production falls
- Wildlife disappears

The key isn't ***how much*** rain falls, but what happens ***after*** it falls.

Capturing just 1 mm more rain per year means:

- 1 liter more usable water per square meter
- 10,000 liters more water per hectare
- 1,000,000 liters more water per square kilometer
- Less drought, because more water stays in the soil to recharge rivers, springs, and wells
- More forage, because plants can also use that water



Experiments in the United States have shown that well-managed livestock can increase the land's ability to absorb water by up to 600%.

By increasing **effective rainfall**, even arid and badly damaged areas can be made productive. For example…

What method was used to restore part of this 450 hectare pile of copper mine tailings in the Sonoran Desert east of Phoenix, Arizona, U.S.A.?

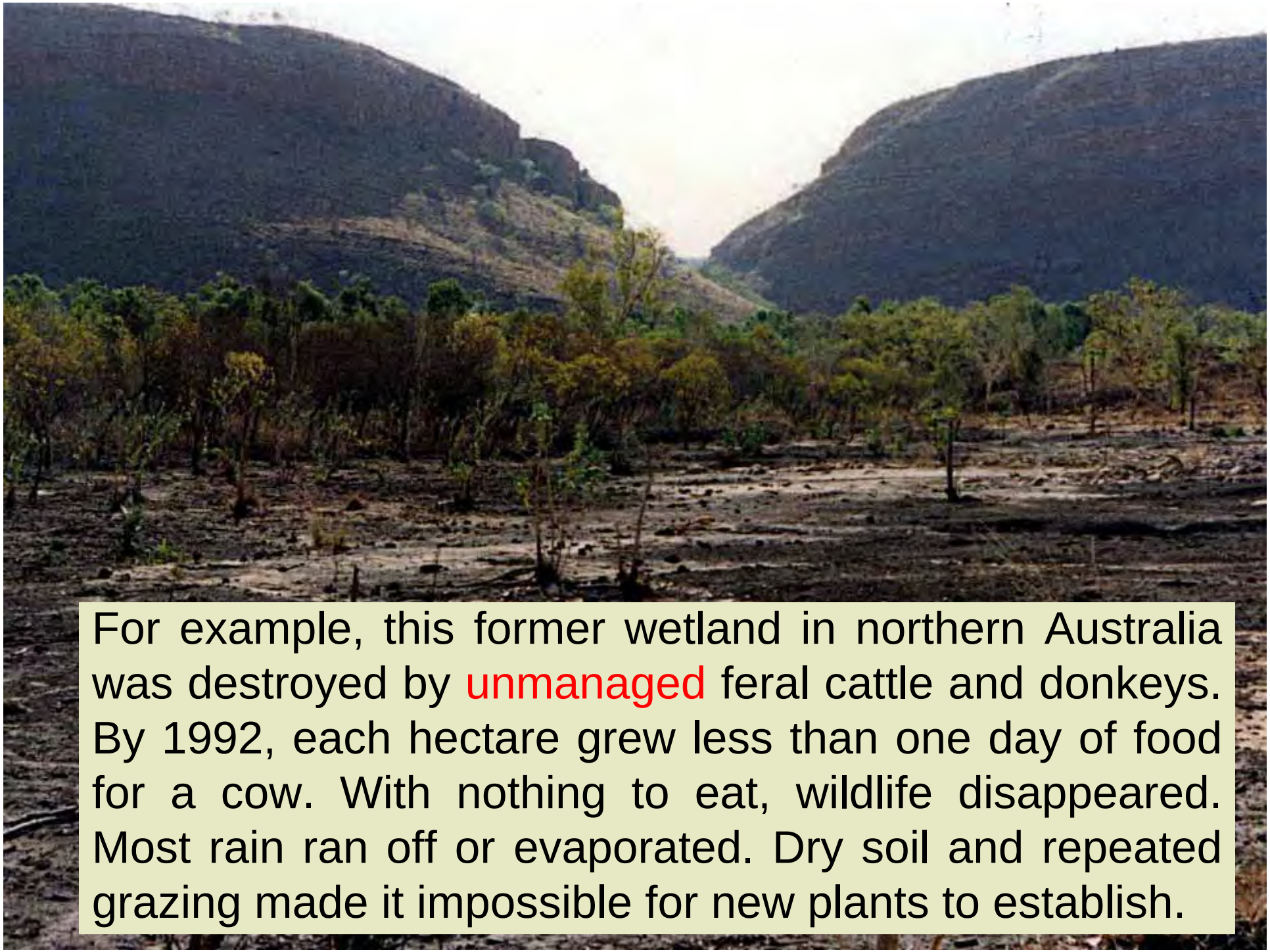

Restoration in
progress

By pushing hay and manure into the mine tailings, cattle created a layer of soil up to 300 mm (1 foot) thick where none had formed in up to 60 years of leaving the area to Nature.

This soil captures water and keeps it in the root zone, where it is available to plants.

All the dark material is over 50%sequestered atmospheric carbon dioxide!!

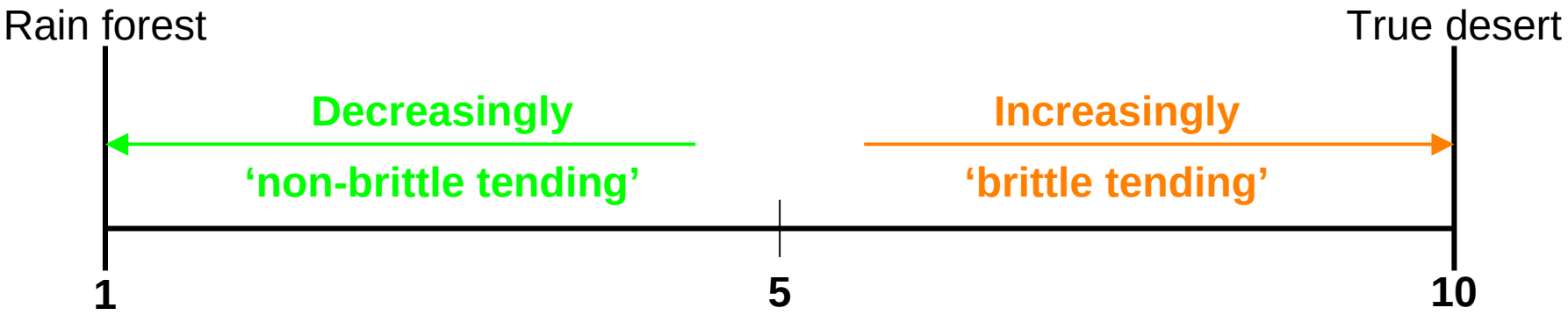

Restored by grazing…
…where technology (hydroseeding) failed following a heavy rain



For example, this former wetland in northern Australia was destroyed by unmanaged feral cattle and donkeys. By 1992, each hectare grew less than one day of food for a cow. With nothing to eat, wildlife disappeared. Most rain ran off or evaporated. Dry soil and repeated grazing made it impossible for new plants to establish.

By 2001, the same area grew 800 to 1100 stock-days of forage per hectare, harvested in 3 grazings by managed livestock.

Brittleness - modern and important knowledge



The more ‘non-brittle tending’ a location is, the more even is the annual distribution of atmospheric humidity.

These areas are often known as temperate regions.

The most even distribution is found in a true rain forest, where it is humid every day.

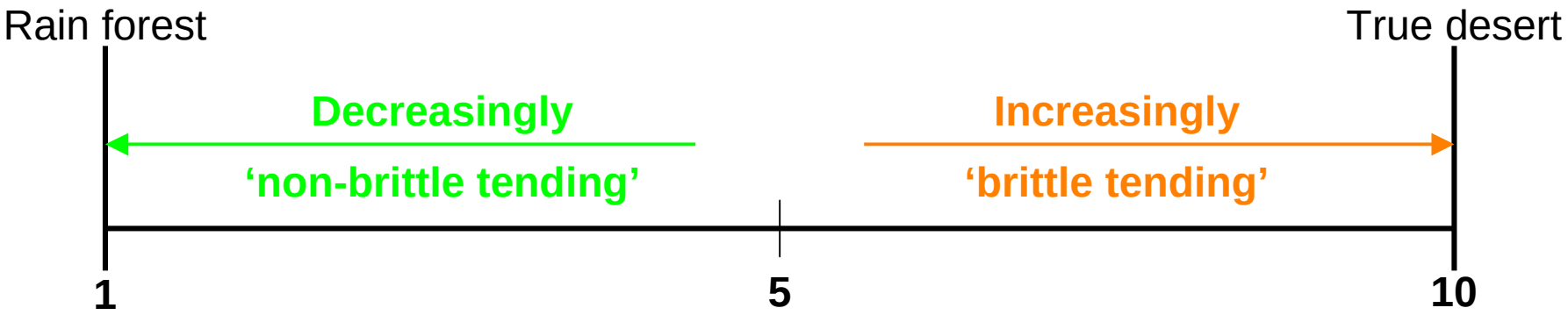
The more ‘brittle tending’ a location is, the more ‘seasonal’ is the annual distribution of atmospheric humidity.

Seasonal environments can be winter wet : summer dry; or summer wet : winter dry.

As distribution of atmospheric humidity becomes more uneven, total precipitation drops, moving towards a true desert, which is dry every day.

Brittleness is about the evenness of spread of humidity throughout the year, and not about the total rainfall. The more dry months there are compared to humid months, the more brittle tending is the location.

Brittleness - effects carbon recycling



Non-brittle tending areas represent no more than 1/3 of the earths surface. On most continents it is very much less than this.

In non-brittle environments, year round there is sufficient moisture to sustain constant populations of insects, beetles, bugs and microbes.

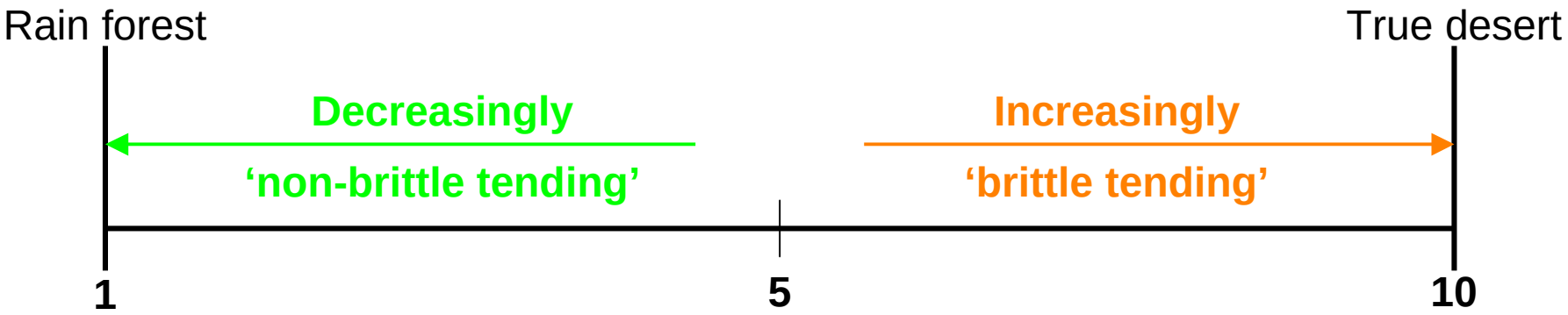
Carbon rich grass and woody vegetation growing in these environments is rapidly decomposed by these organisms, or is consumed by small animals who generally move around in small groups.

Overall, carbon cycling is a biological process sustained by the humid nature of the environment.

However, most of the world is seasonal or brittle-tending, where the natural function is periods of enormous plant production during the growing season, followed by rapid non-growing season plant death and/or dormancy. The large volume of dry, standing vegetation that is left must be cycled before the next growing season, but by now it is too dry for insects to participate in the process.

Naturally, in these environments the carbon cycling involves bunched herds of large herbivores. Vast microbial populations in their gut reduce plants to dung and urine, returning the carbon back to the soil. The animals also trample standing plants as they move around, maintaining a protective blanket of constantly decomposing soil cover.

Brittleness - requires different animal behaviours



It is difficult for human management practices to cause significant permanent damage to the natural carbon cycling capacity of non-brittle tending environments. If damaged, these environments tend to recover quickly once the inappropriate management procedures are changed.

The real problem is that the management practices that humans have used in the more forgiving non-brittle environments, have been widely adopted within the vast areas of brittle-tending landscapes, with devastating results.

Over time, individual herds of wild and domestic animals have generally become smaller. As well, density of the herd whilst the animals are on a piece of land tends to be lower than was natural for these environments - animals are more 'spread out'.

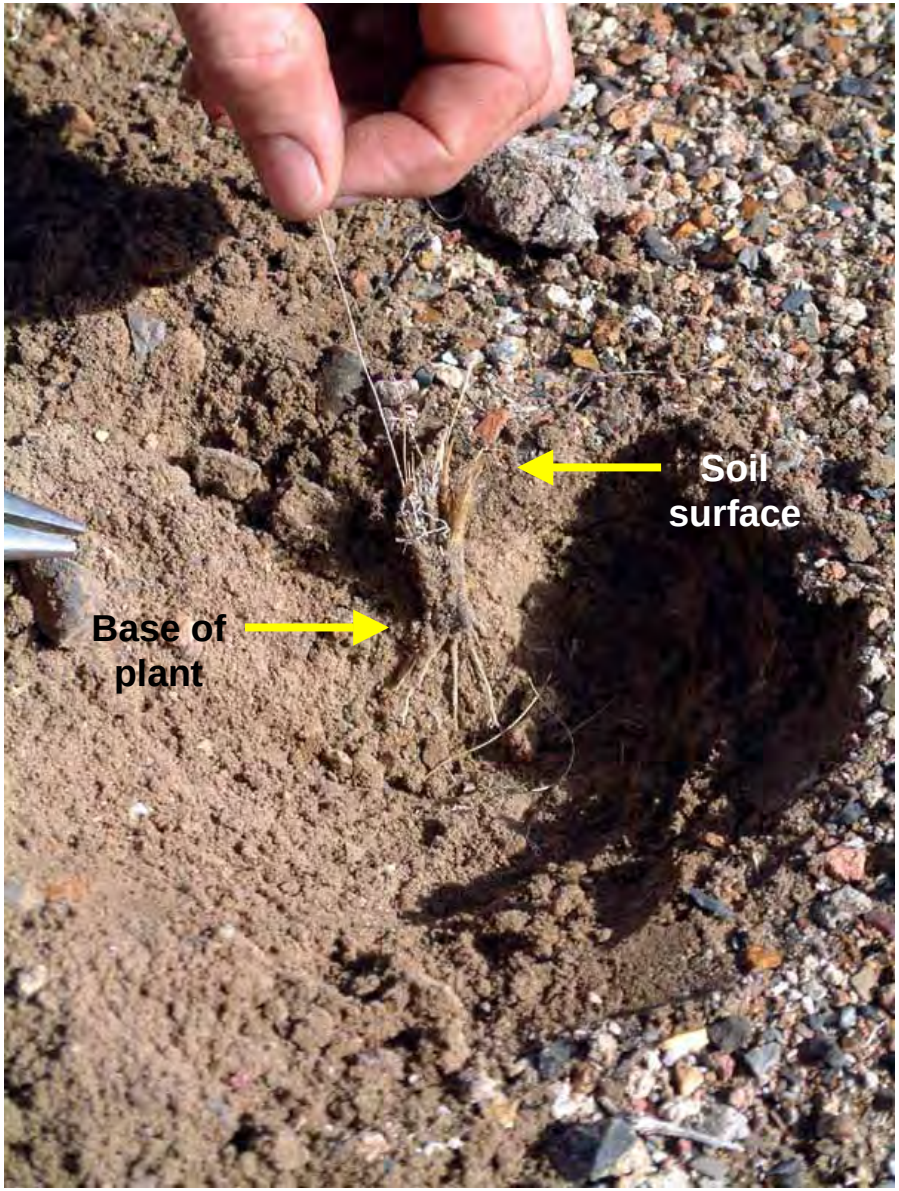
The effect is that herds generally remain on a piece of land far longer than once naturally occurred.

These three deviations from the natural function of brittle-tending environments has led to ecosystem breakdown and carbon cycling failure within most of the brittle-tending environments of our planet.

Now that we know this information, human management can replicate the key principles that sustained naturally functioning brittle-tending environments.

Without grazers to plant seeds and recycle nutrients, dryland ecosystems desertify because:

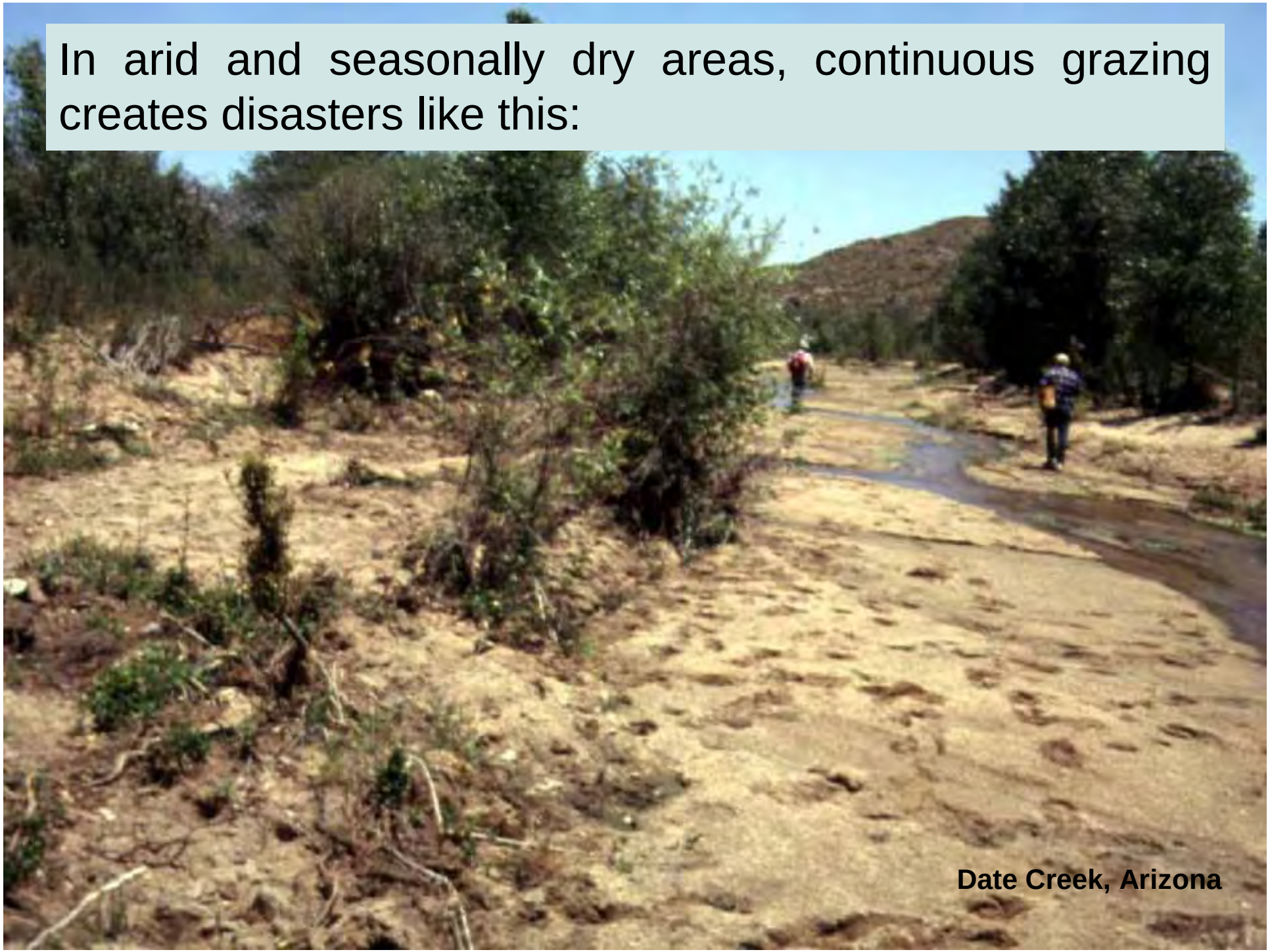
- Standing dead growth chokes plants, instead of mulching the soil
- Seeds sprout on the soil surface, then die
- As old plants die, bare ground increases
- Bare soil loses its ability to absorb and store water
- Rivers, springs, and wells go dry
- Droughts become the norm



In arid areas, seeds must be planted deeply or seedlings will die before their roots reach reliable water.

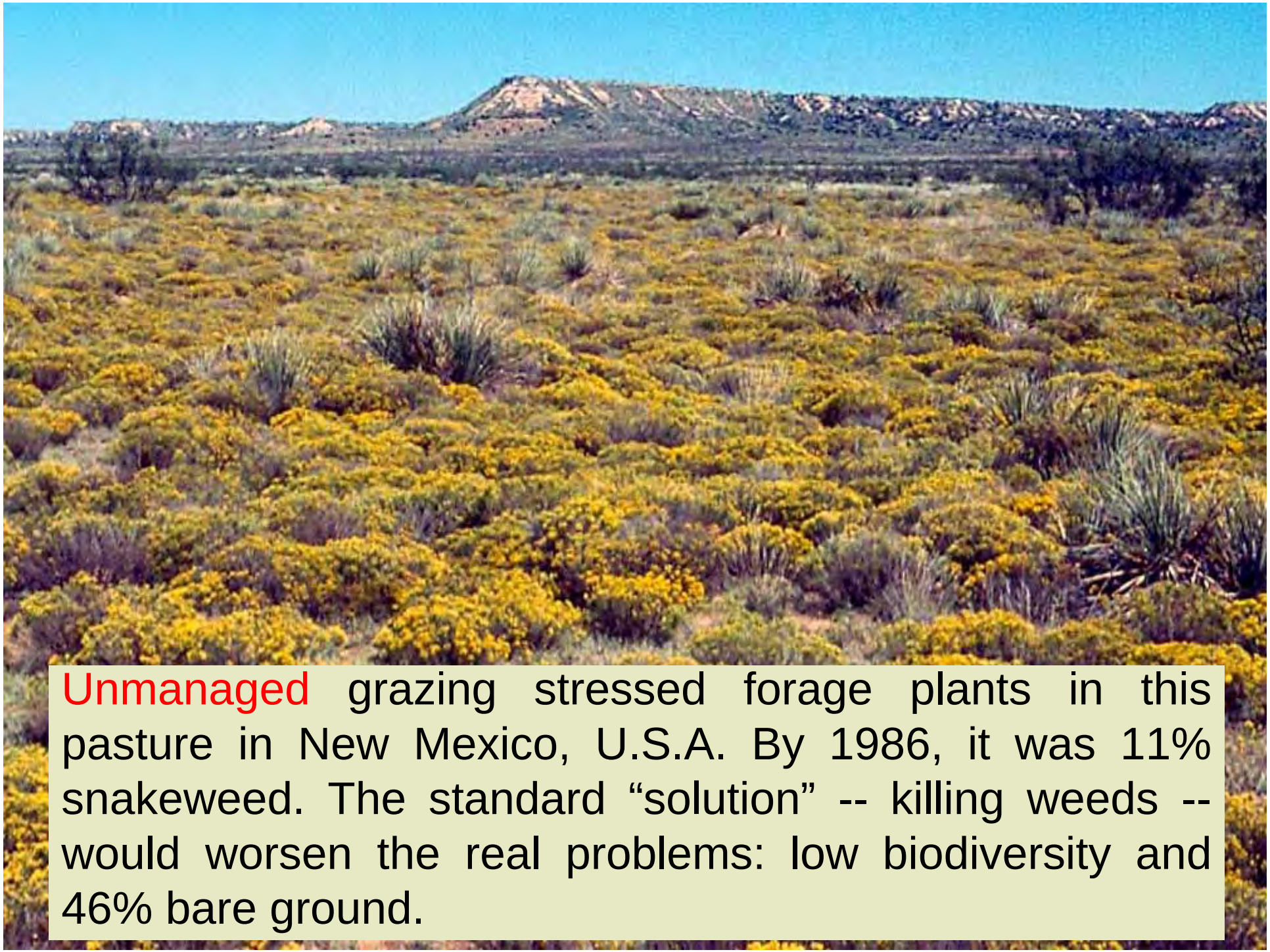
Only the hooves of grazing animals can do this economically over millions of hectares.

In arid and seasonally dry areas, continuous grazing creates disasters like this:

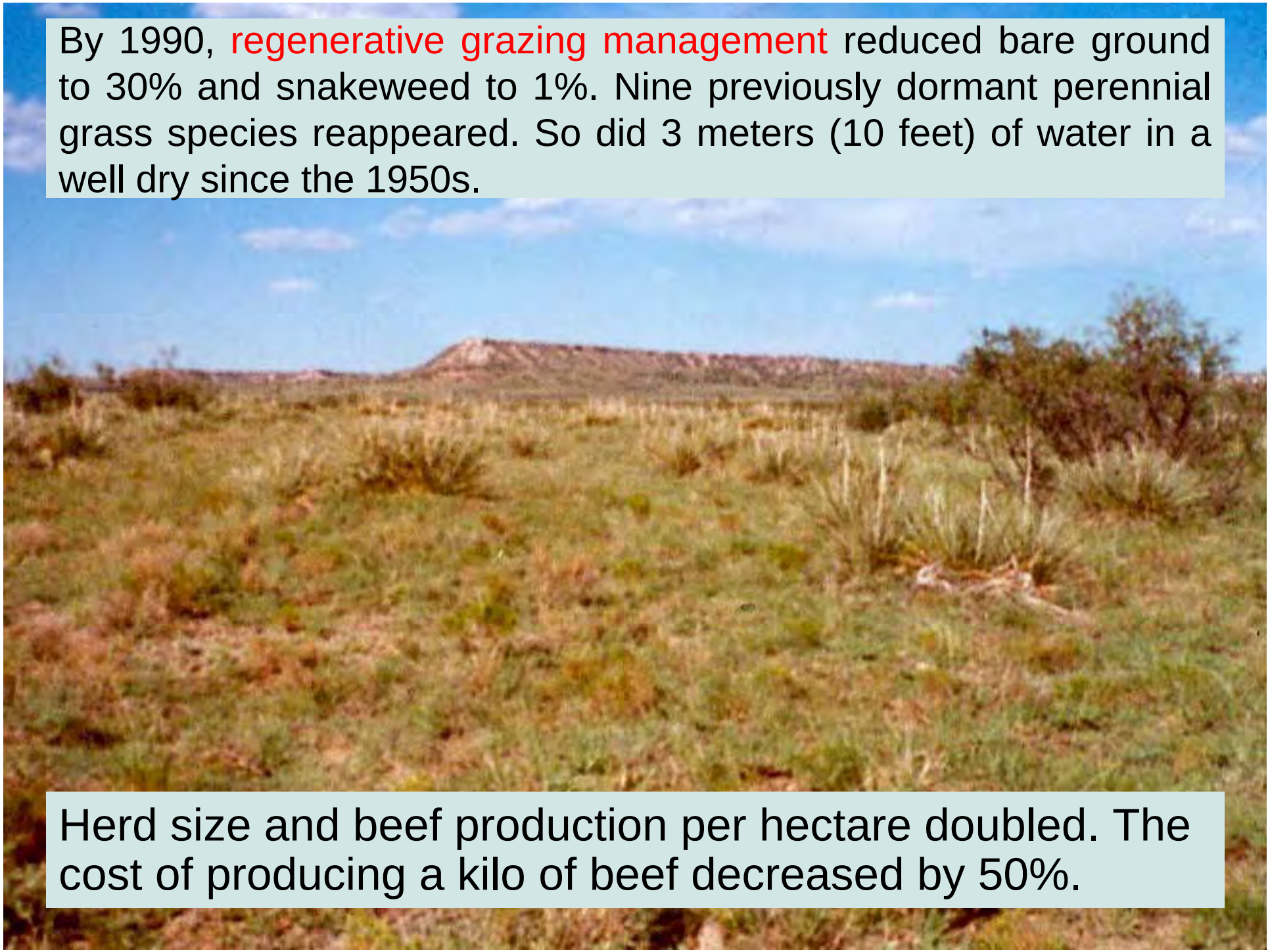


Date Creek, Arizona

Returning to herding-style management with long recovery periods between grazings heals the land.



Unmanaged grazing stressed forage plants in this pasture in New Mexico, U.S.A. By 1986, it was 11% snakeweed. The standard “solution” -- killing weeds -- would worsen the real problems: low biodiversity and 46% bare ground.


By 1990, regenerative grazing management reduced bare ground to 30% and snakeweed to 1%. Nine previously dormant perennial grass species reappeared. So did 3 meters (10 feet) of water in a well dry since the 1950s.
Herd size and beef production per hectare doubled. The cost of producing a kilo of beef decreased by 50%.

Regenerative grazing can be the most effective way to restore endangered species to viability.

Regenerative grazing can be the most effective way to restore endangered species to viability.

David Ogilvie's management of the U Bar Ranch in New Mexico has created a habitat that supports more endangered southwestern willow flycatchers than any preserve.

Regenerative grazing can be the most effective way to restore endangered species to viability.

The U Bar's flycatchers are also the most prolific population known to exist…

…and they seem to prefer areas that they share with cattle.

Regenerative grazing can be the most effective way to restore endangered species to viability.

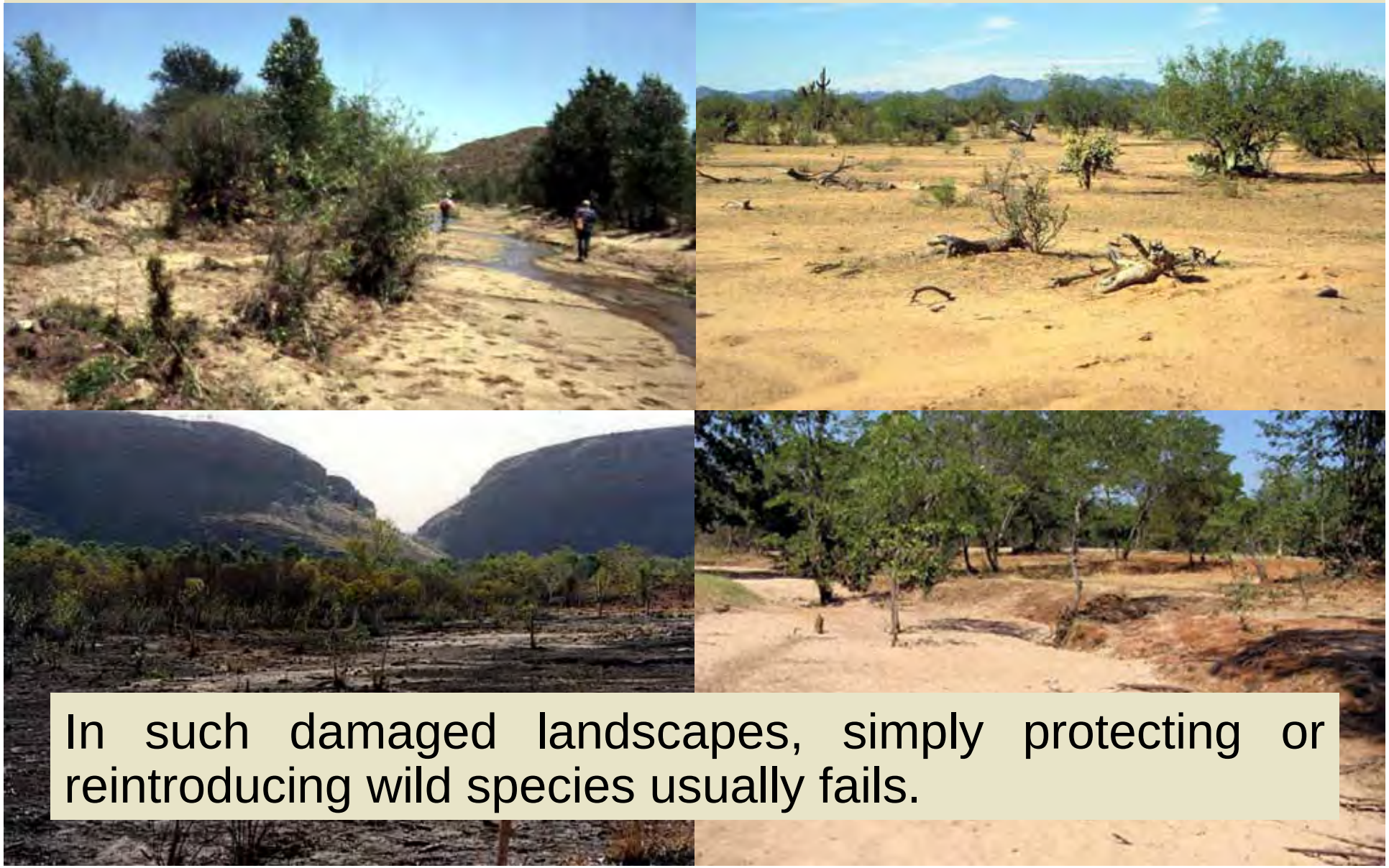
In 2001, 132 pairs of southwestern willow flycatchers were counted on the U Bar Ranch.

Two nearby wildlife preserves with a similar combined area yielded 7 southwestern willow flycatchers. These preserves are not grazed by livestock.

The U Bar also has:

- More common blackhawks (a threatened species)
- More spikedace (a threatened fish)
- Large populations of several other rare species
- The highest density of nesting songbirds known to exist in North America
- One of the highest ratios of native to exotic fish (99% native to 1% non-native)

Unfortunately, many habitats are now too damaged to support the wildlife that once maintained them.



In such damaged landscapes, simply protecting or reintroducing wild species usually fails.

Managed livestock can successfully restore these areas, then maintain them until wildlife populations recover.

Do we want this…

Or this…

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