

Soil biodiversity and human health

Introduction of a paper by

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Soil biodiversity

- Species richness
- Functional diversity
- Foodweb structure
- Biotic interactions

Poor land management

- Deforestation
- Degradation
- Desertification
- Urbanization
- Pollution

Climate change

- Precipitation
- Temperature
- Extreme events

Loss of ecosystem functioning and service provision

- Water infiltration
- Regulation of pests and pathogens
- Erosion control
- Nutrient release

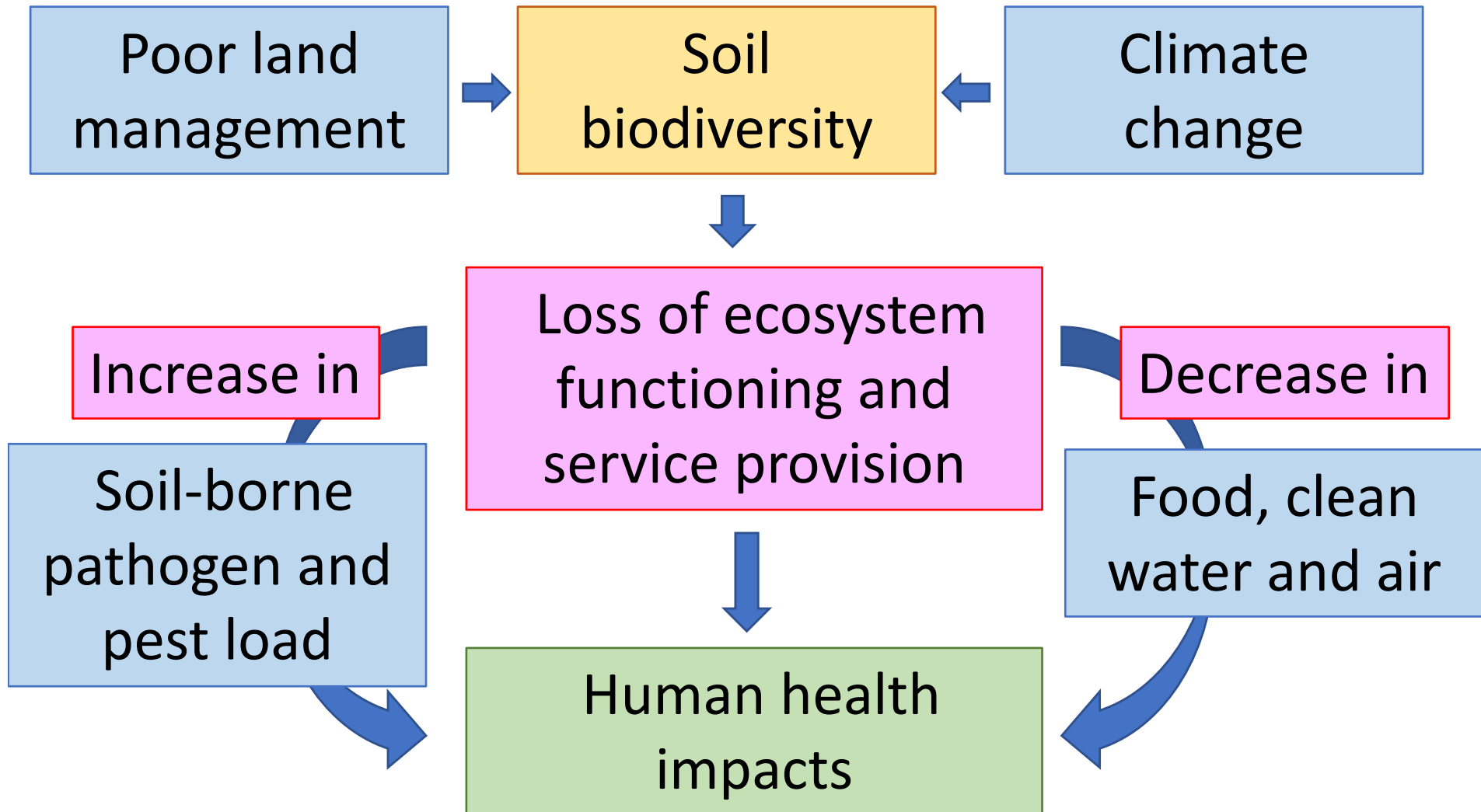
What is caused:

- Increased soil-borne pathogen and pest load
- Reduced supply of food and clean water and air

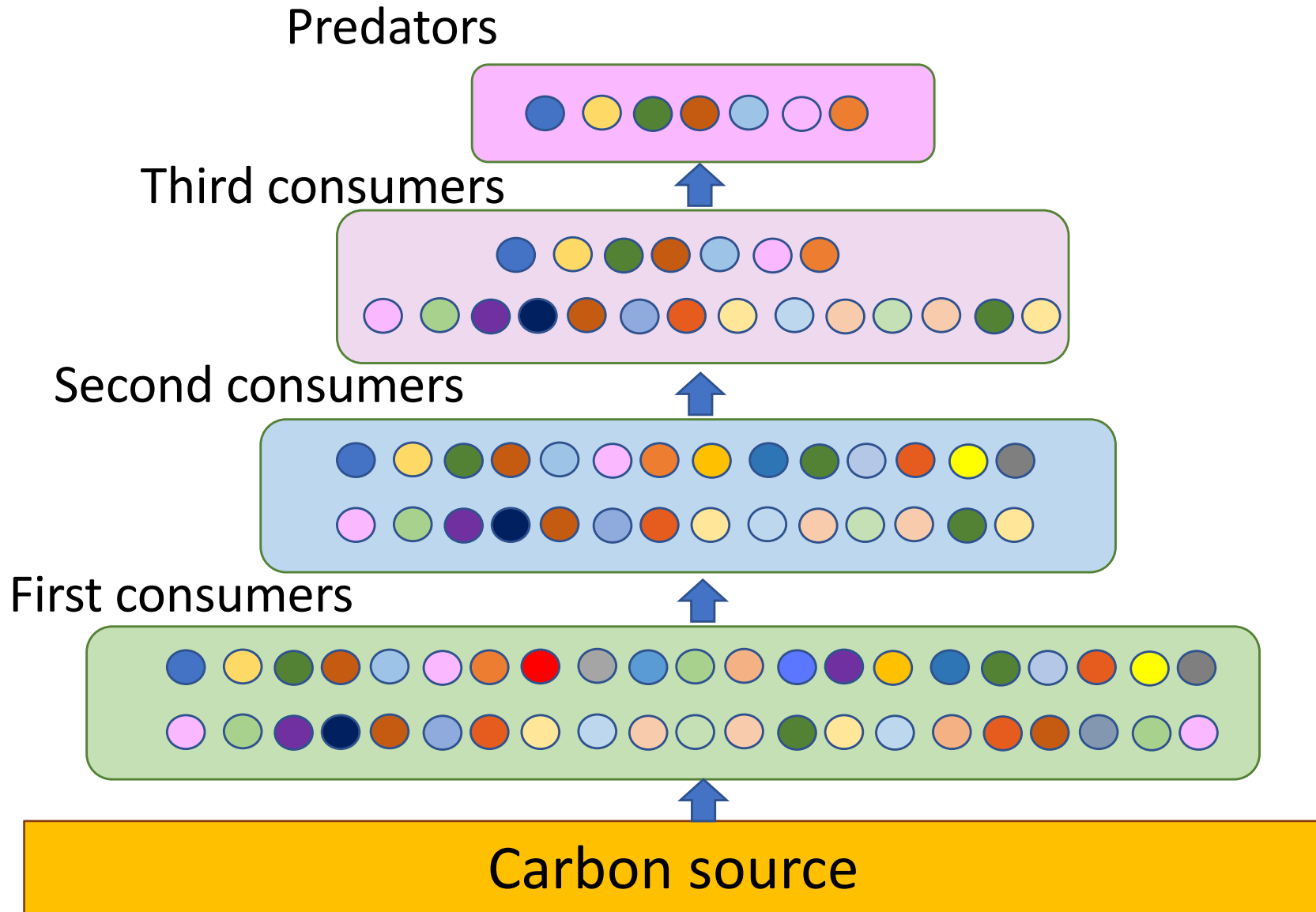
Human health impacts

- Increased risk of diseases
 - caused by human pests and pathogens
 - caused by less nutritious food
 - caused by lack of clean water and air

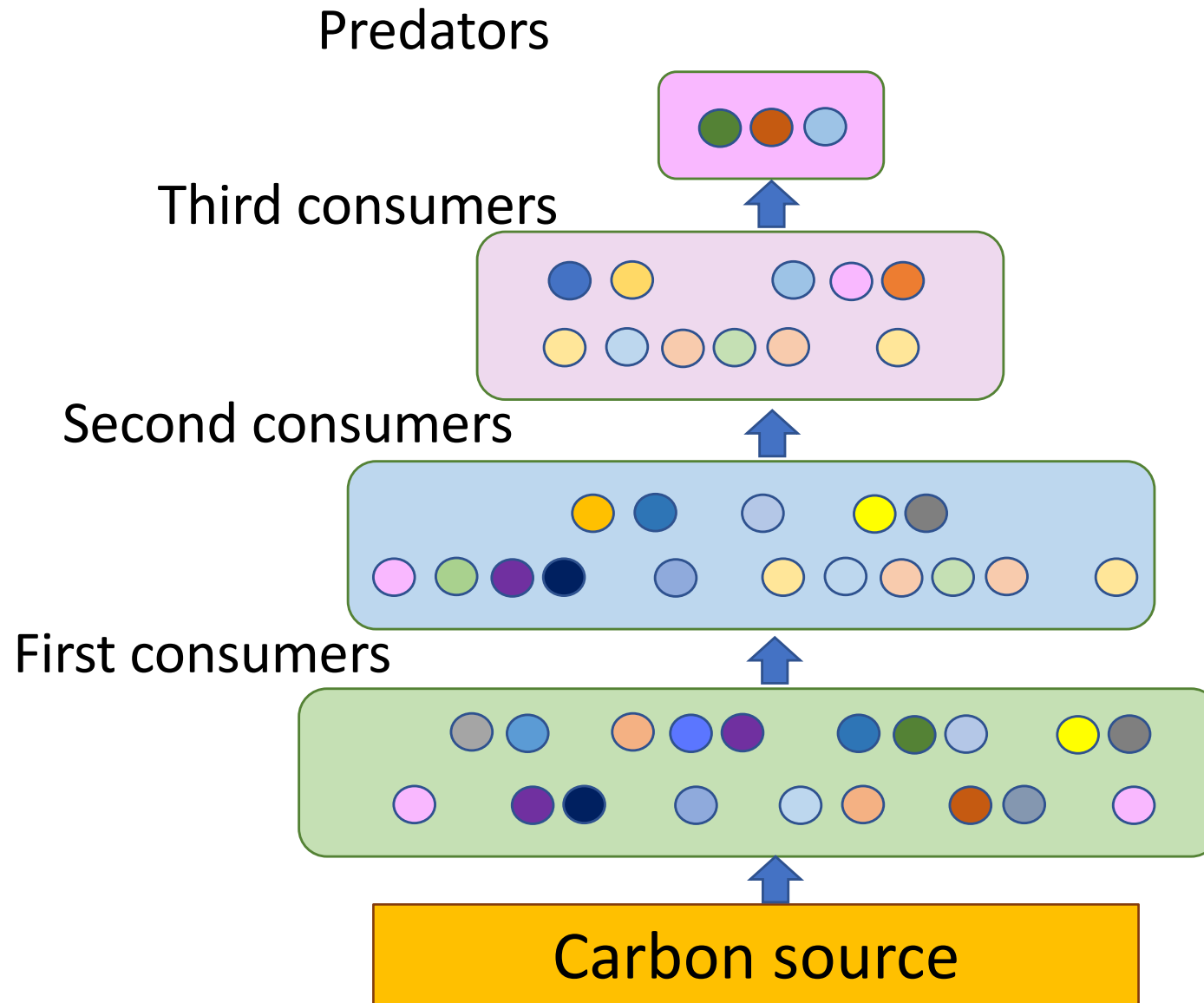
Scheme of deterioration



Complex foodweb



Simple foodweb



Human influence on soil foodwebs

Complex foodweb



Global changes and
Agricultural intensification

Simple foodweb



Lost or impaired functioning

How decisions on land use management are linked to human health through the effect on soil biodiversity

Land-use management	Intensive	Sustainable
Pest and pathogens	Increase	Decrease
Beneficial organisms	Decrease	Increase
Soil biodiversity	Low	High
Plant health	Decrease	Increase
Animal health	Decrease	Increase
Human health	Decrease	Increase



External drivers:
Climate change, nitrogen deposition,
invasive species, and pollution

Soil pathogens and parasites of humans

Euedaphic pathogens	Soil transmitted pathogens
Anthrax	Diarrhoea
Listeriosis	Salmonellosis
	Typhoid fever
Aspergillosis	Toxoplasmosis
Valley fever	Ascariasis
Histoplasmosis	Hookworm
	strongyloidiasis
	Beef tapeworm

Soil pathogens and parasites of animals and plants

Euedaphic pathogens	Soil transmitted pathogens
Animals	
Anthrax	Haemonchosis
Plants	
Crown gall	
Potato blight	
Root knot	
Pine wood	

Soil biodiversity and soil-borne pathogens

- Soil-borne pathogens and parasites that cause human diseases represent a minority of the species living in soils.
- Most of soil organisms have positive effects on human health through their roles in controlling soil-borne pathogens and pests.

Soil and allergies

- Exposure to soil microorganisms lessens the prevalence of allergic diseases.
- Individuals living in more urban environments have lower diversity of bacteria on their skin and lower immunity expression.

Food, fiber and biomass production

- All terrestrial crop production is soil-based.
- Sustainable use of our soil is essential for long-term human health.
- Enriched soil life increases nutrient use efficiency, plant nutrient uptake and thereby crop yields.

Air quality

- Land use change is related to
- Frequency of dust storms,
- Emission of greenhouse gases,
- Release of volatile organic compounds and biota in air.
- The mis-use of land increases dust and the formation of particulate matter of less than 10 micrometer in size (PM10).

Air quality

- Soil organisms such as arbuscular mycorrhizae, saprotrophic fungi and earthworms play a key part in stabilizing soil.
- Management options such as reduced tillage have been shown to decrease PM10 formation.

Water quality

- Land use changes, especially in urban areas, affect the relationship between runoff versus infiltration of water.
- It has potential impacts on local surface water bodies, groundwater levels, areas downstream of point source pollution and the recharge of aquifers.

Water quality

- Soil biodiversity acts to enhance the structure of soils and thereby infiltration and percolation of water through the soil profile.
- This improves water use efficiencies by crops (1), limit the amount of agricultural runoff and associated contamination into adjacent land areas (2), and filter out pathogens and contaminants (3).

UN Sustainable Development Goals closely related to soil biodiversity

Goal 2

- End hunger
- Achieve food security and improved nutrition
- Promote sustainable agriculture
- Globally, one in nine people are undernourished. This goal aims to end hunger.

UN Sustainable Development Goals closely related to soil biodiversity

Goal 3

- Ensure healthy lives
- Promote well-beings for all at all ages
- Ensuring people live healthy lives can cut child mortality and raise life expectancy.

UN Sustainable Development Goals closely related to soil biodiversity

Goal 3

Target 3.9

- Reduce harmful chemicals
- Reduce air, water and soil pollution

UN Sustainable Development Goals closely related to soil biodiversity

Goal 3

Target 3.3

- Ending epidemics of tropical and other communicable diseases

UN Sustainable Development Goals closely related to soil biodiversity

Goal 6

- Sustainable management of water and sanitation
- Clean water protects people from disease, yet three in 10 people lack access to it.

UN Sustainable Development Goals closely related to soil biodiversity

Goal 12

- Ensure sustainable consumption and production patterns
- This goal aims to foster eco-friendly production, reduce waste and boost recycling.

UN Sustainable Development Goals closely related to soil biodiversity

Goal 15

- Protect, restore and promote sustainable use of terrestrial ecosystems,
- Sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss
- To stop degradation, we must preserve forest, desert and mountain ecosystems.

Soil lies in the background

- Benefits related to “Food”, “air”, “water” or “disease” control are all simultaneously dependent on soils and soil biodiversity