

Environmental Risks in Countryside

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Agenda

Topics covered

- introduction
- types of env. hazards
- case study
- prevention and mitigation
- final activity

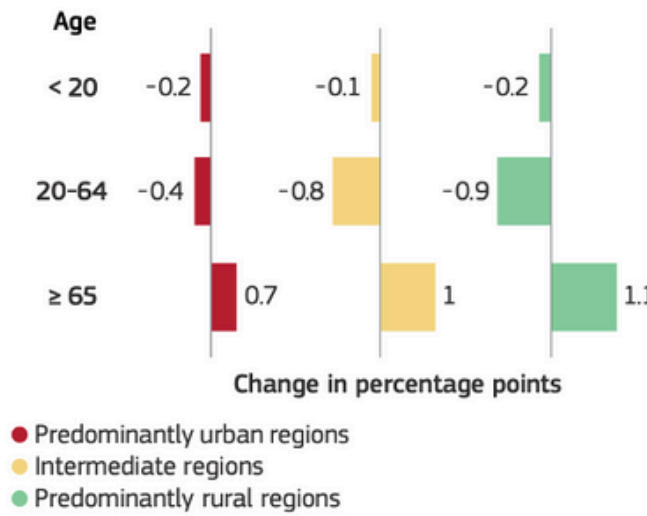
Distinct Environmental Vulnerabilities of Rural vs. Urban Areas

Rural regions are ageing faster while younger and working age population is decreasing

Rural residents trust more local authorities than national government or the European Union

Primary sector plays important role providing 11% of employment compared to 1% in urban areas

Figure 1 Change in population share in p.p. by age group 2019-2022 by urban-rural typology

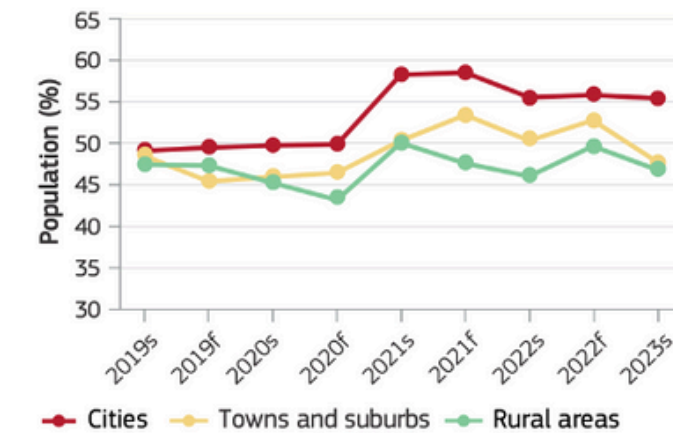


Ageing rural regions

The population over 65 in rural regions has increased by 1.1 pp (0.84 million) while the younger and working age population cohorts decreased. The average EU population age is increasing, but **rural regions are ageing faster**, due to lower natural growth and net migration.

Source: Eurostat (online data table: urt_pjangrp3), JRC calculations based on the provisional population census grid 2021

Figure 2 Evolution of trust in the EU institutions by degree of urbanisation

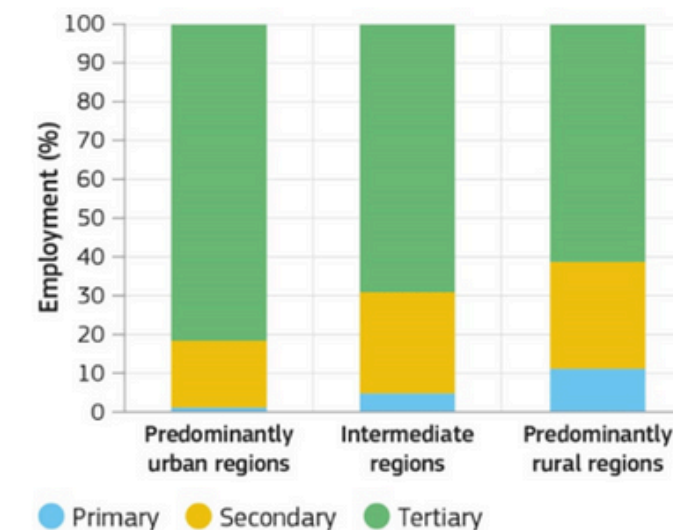


Empowering communities

Rural residents are more likely to trust local and regional authorities (61%) than their national government (31%) or the EU (47%).

Source: Rural observatory, trust in the EU institutions, national, regional and local authorities

Figure 7 Employment by economic sector in 2021 by urban-rural typology



A diversified rural economy

The **primary sector in rural regions remains important** (11% of employment compared to 1% in urban and 5% in intermediate regions); however the **secondary and tertiary sectors play a dominant role**, with a slight decrease of the primary sector (-1% between 2018 and 2021).

Source: Eurostat (online data table: nama_10r_3empers).

Distinct Environmental Vulnerabilities of Rural vs. Urban Areas

Loss of ecosystem services like pollination and pests control directly affecting livelihoods

Limited access to funding and policy support leaves rural areas less resilient to shocks

Decline in biodiversity negatively affects the mental health of residents

With **21 %**, **agriculture** is the most frequently reported pressure for habitats and species. Abandonment of grasslands and intensification is particularly impacting pollinator species, farmland birds and semi-natural habitats

Urbanisation and leisure activities account for **13 %** of all reported pressures, representing 48 % of all marine pressures.

Invasive alien species such as the False Indigo-bush, particularly affect dunes and sclerophyllous scrubs as well as species such as breeding seabirds.

Forestry activities represent **11 %** of all pressures, particularly affecting forest habitats, and woodland species.

Climate change is reported as a rising threat, particularly due to ongoing changes in the temperature and the decrease of precipitation.

The **modification on water regimes**, physical alterations of water bodies and removal of sediments predominantly affect freshwater habitats and fish.

13 % of all pressures for **birds** stem from the exploitation of species, mainly relating to **illegal killing and hunting**. In Europe, the annual hunting bag amounts to at least 52 million birds.

Almost **50 %** of all pressures related to **pollution** can be attributed to air, water and soil pollution caused by agriculture.



Settin the stage for final activity

Local farmers

serving a key role in local food supply chain

Local residents


concerned about their families and properties

Government officials

representing The Ministry of Agriculture and
Rural Development

Environmental activists

from regional environmental NGO



Types of environmental hazards

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Water pollution and scarcity

Presence in water of harmful and objectionable material – obtained from sewers, industrial wastes and rainwater run-off – in sufficient concentrations to make it unfit for use. (EEA)

Physical scarcity

When natural water resources are insufficient to meet the demand of the population.

Economic scarcity

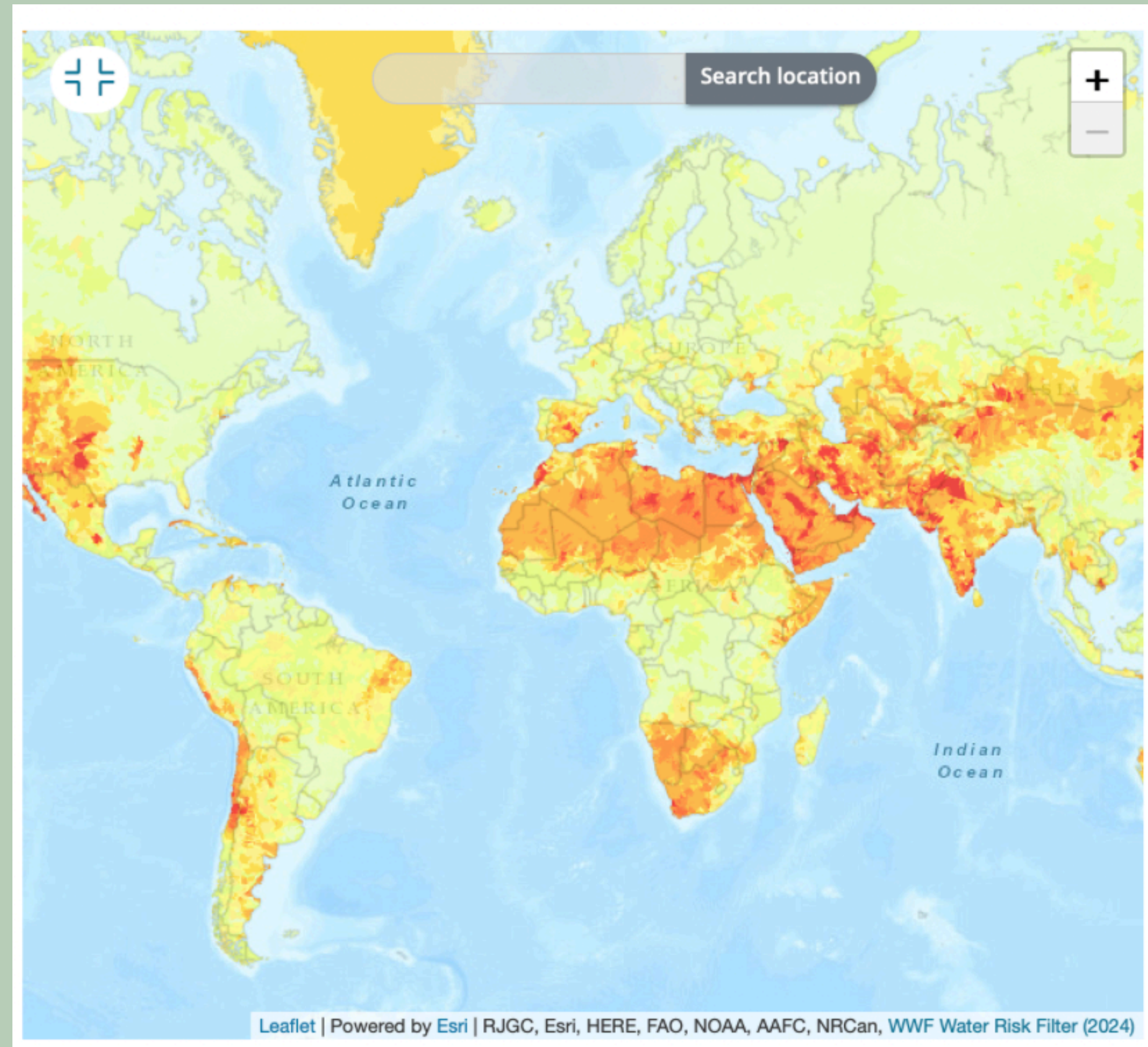
When water is available but inaccessible due to financial, institutional or infrastructural constraints.

Point Water Pollution

When the pollutants are identifiable and distinguished from others.

Non- point Water Pollution

When the pollutant is unknown or there is not a single and concrete source.



The Middle East, North Africa, and parts of Asia are highlighted as they are facing critical water scarcity and pollution challenges (World Resources Institute, 2019).

Main pollution sources:

- Agricultural Runoff: Nitrates and phosphates from fertilizers contaminate water.
- Industrial Discharges: Release of heavy metals and toxic chemicals.
- Improper Waste Disposal: Lack of sanitation infrastructure leads to microbial contamination

Apart from direct dumping into streams, lakes and oceans, there may also be accidental discharges of solid or liquid substances into water bodies. These include oil leakage, seepages etc.

Others:

- Groundwater pollution
- Urbanization
- Sediment pollution due to runoffs
- Saltwater intrusion

Consequences:

- The majority of the rural population suffers from mild to severe carcinogenic and non-carcinogenic **health impacts** due to water pollution. Waterpathogens are one of the major threats to human health in rural areas, causing diseases such as typhoid, cholera, hepatitis, diarrhea, and skin infection.
- **Ecosystem damage and loss of biodiversity** : Pollutants disrupt freshwater ecosystems, threatening aquatic life and suffering from toxins and reduced oxygen levels. What is more, the creation of algal bloom

Soil degradation

A change in soil health status resulting in a diminished capacity of the ecosystem to provide goods and services for its beneficiaries (FAO, 2020)

Types:

Biological

Decreased microbial activity due to biochemicals. It reduces yields and makes land less amenable to crop.

Chemical

Changes in soil chemistry by synthetic fertilizers and pesticides. It diminishes plant nutrition, declines beneficial microbes and the pH of the ground shifts.

Ecological

Mainly climate change. It decreases land productivity.

Physical

Loss of fertile topsoil due to physical impacts (floods, surface runoff, winds and storms, heavy machinery use). It harms soil fertility, composition, and structure.

Human activities

Such as deforestation, industrial agriculture or urbanization.

Six soil degradation processes

Linked to agriculture: erosion, organic carbon decline, soil biodiversity decline, compaction, contamination, and salinization and sodification.

Soil erosion is considered to be the main and the most widespread process of soil degradation. This process can be natural or accelerated by human activity.

Soil erosion affects 2 billion hectares of land, threatening food security and biodiversity (UNCCD, 2019).

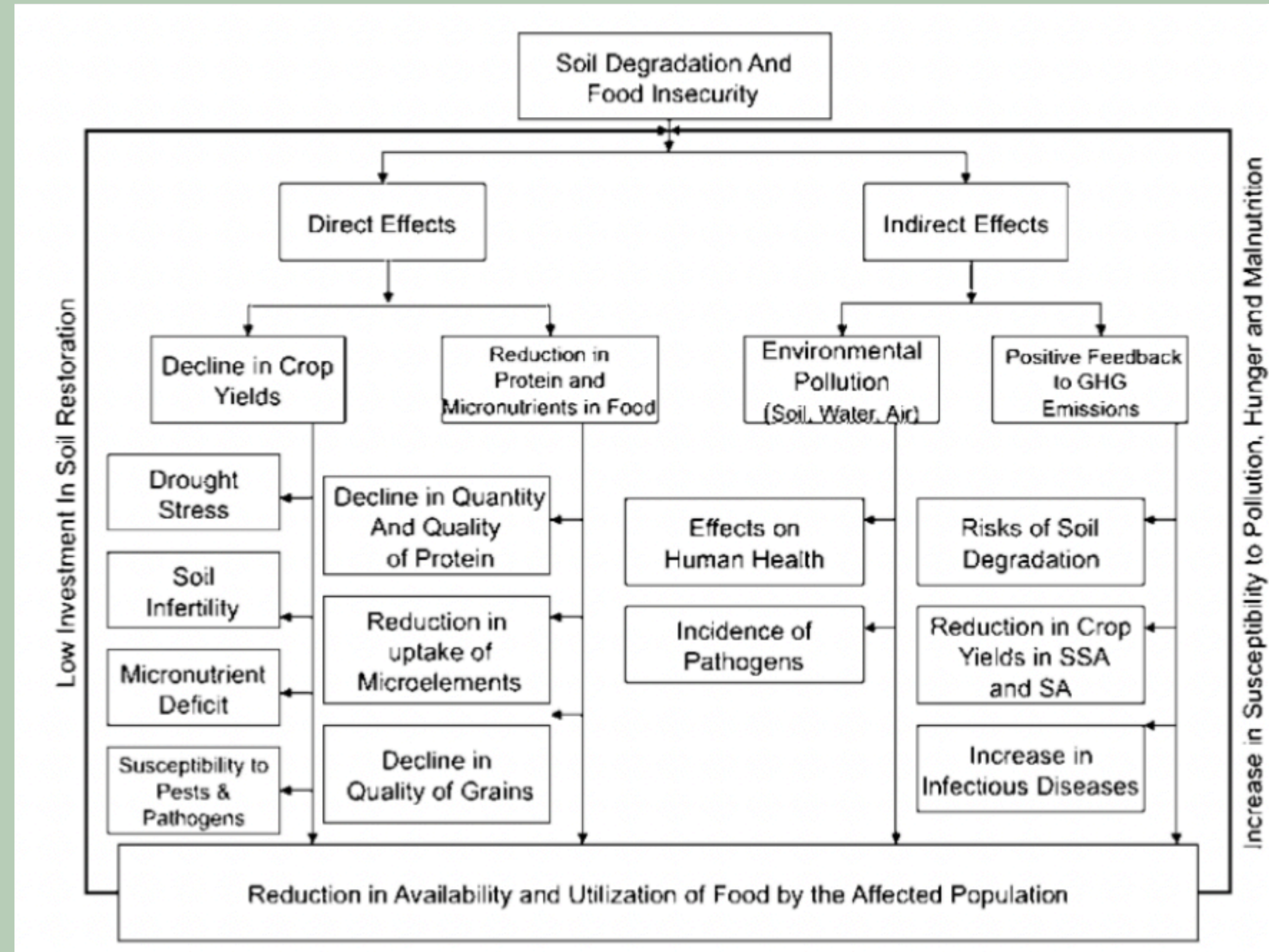
It is reported that 80% of the extreme poor live in rural areas and 65% work in the agricultural sector.

Consequences:

Loss of topsoil and crop yields: Decreasing levels of quality and quantity of crops yields. Inadequate agriculture practices are culpable for the loss of topsoil and destruction of soil characteristics.

Polluted waterways: Soil eroded from the land, along with the pesticides and fertilizers, washes into streams and waterways. This sedimentation damage freshwater, marine habitats and the local communities that depend on them, resulting in environmental migration.

Increased Flooding: When lands are transformed, the converted land is less able to soak up water, making flooding more common.



Air pollution

Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. (WHO)

Main causes:

- **Agricultural activities**, such as cultivating, harvesting, and grain handling release various pollutants, especially of particulate matter (PM) and ammonia (NH₃)
- **Agricultural burning** is faster and cheaper compared to other methods. However, this practice emits different airborne pollutants, including Particulate Matter, nitrogen dioxide (NO₂), carbon monoxide (CO) and volatile organic compounds (VOCs), raising concerns about air quality and human health.
- **Transportation:** As rural regions expand and more vehicles are used, the levels of air pollutants increase significantly. Key factors contributing to transportation-related air pollution include vehicle emissions and road or highway infrastructure expansion. Vehicles powered by petrol and diesel engines emit a range of harmful pollutants such as Carbon Monoxide (CO) and Nitrogen Oxides (NO_x)
- Not all air pollution comes from human activity, **sand and dust storms** produce PM_{2.5} pollution, **wildfires** PM along with CO and NO_x and **volcanoes** release NH₃ and SO₂ during eruptions.

Main Pollutants:

- Nitrogen oxides
- Particular matter (PM₁₀, PM_{2.5} and PM₁)
- Toxic Organic Micropollutants (TOMPS)
- Benzene
- Carbon monoxide
- Lead and heavy metals

In Europe, agricultural activities cause approximately 90% of ammonia emissions and 80% of methane emissions.

Consequences

1. **Health Risks:** Particulate Matter penetrates into the lungs, causing respiratory illnesses, and prolonged exposure can increase the risk of premature deaths, especially among children and the elderly.
1. **Environmental impacts:** Methane and nitrous oxide emissions from the burning crop residues exacerbate global warming. Also, a component of PM can accelerate the melting of glaciers.
1. **Ecosystem Impacts:** Airborne pollutants contribute to biodiversity loss.

Agricultural Pollution

Agricultural pollution is defined as the phenomena of damage, contamination and degradation of environment and ecosystem, and health hazards due to the by-products of farming practices.

- Agricultural activities are one of the sources of pollution of soil and water that contributes to environmental degradation.
- Fertilizer use increased from 27 million tons in 1960 to 190 million tons in 2015 (FAO, 2015). Pesticides, herbicides, and fertilizers, which are essential for modern farming, pose risks to soil and water systems.
- This dependency introduces excessive nitrogen and phosphorus into ecosystems, leading to widespread degradation.

Main Causes

- Chemical Runoff
- Excessive use of nitrogen and phosphorus fertilizers that to nutrient overloads.
- Livestock Waste
- Burning of Crop Residues

Consequences

- Eutrophication: Reduces oxygen and disrupts aquatic life.
- Water pollution
- Soil Degradation and erosion: Reduce microbial diversity.
- Soil Acidification: Overuse of nitrogen fertilizers alters soil pH, reducing productivity
- Health Risks: Contaminated drinking water can lead to diseases. Also, pesticide contamination is linked to cancers and neurological disorders.

Climate-Related Hazards

Extreme weather events such as droughts, floods, and heatwaves have intensified due to climate change and accelerated by every hazard above. These events disproportionately affect rural areas reliant on natural resources.

Main causes:

In most situations, a combination of **natural and human factors** contribute to the development of hazards.

Consequences:

- **Ecosystems** will become more fragile and sensitive and their function and structure will change.
- **Health Risks:** Increasing malnutrition and hunger, reduced water availability, mental health impacts. Disruption of food and clean water supply poses greater risk for gastrointestinal infections and malnutrition among children.
- These hazards can also bring **social and economic disruptions** such as problems of access to health care.
- **Migration:** Climate refugees increase while rural areas become uninhabitable.

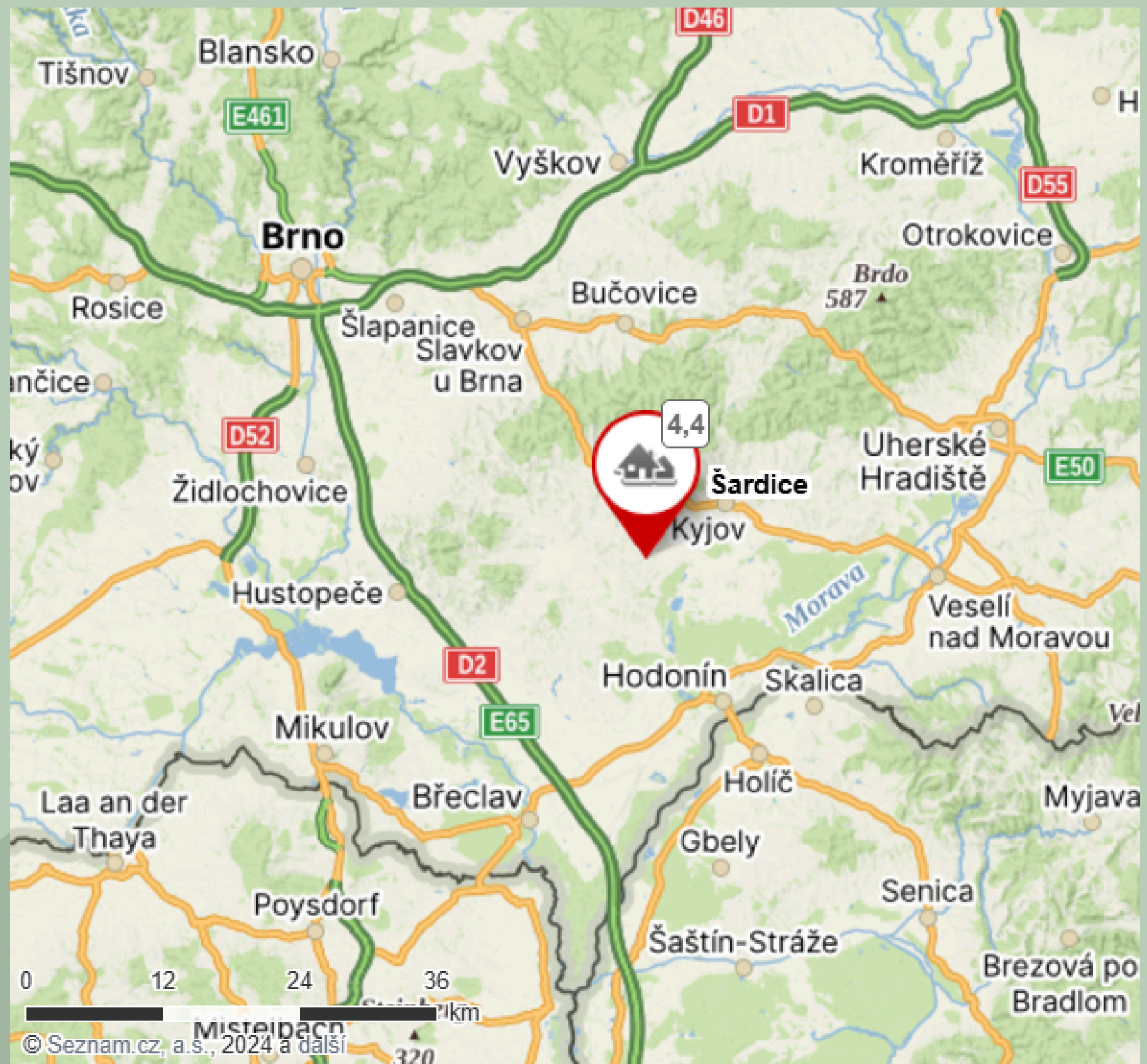
Climate-related risks and extreme events are often more visible in low- and middle-income countries, where adaptation capacities are limited.

CLIMATE CHANGE		
Climate Change, Table 1 Summary of some of the major outcomes of future climate change for different aspects of earth system: (Summarised from IPCC, 2007), and their implications for hazards		
IPCC subheading	Summary of likely changes (from IPCC, 2007)	Implications for hazards
Ecosystems	<ul style="list-style-type: none"> • Ecosystems will become more sensitive to environmental disturbance under future climate change • Ecosystems will contribute to changes in net carbon storage (to about 2050) and then outgassing (thereafter) • Increased risk of species' extinction under future climate change • Changes in ecosystem functioning, structure and biodiversity as a result of future CO₂ increase 	<ul style="list-style-type: none"> • Risk of invasive species and pathogens that contribute to biodiversity loss and/or crop failure • On mountains, increased forest cover that will stabilise slopes • Increased CH₄/CO₂ outgassing from warming permafrost and desiccation of wetlands and peatlands
Food	<ul style="list-style-type: none"> • Spatial changes in agricultural productivity, with likely increase in mid-latitude areas and decrease in low-latitude areas, with impacts on food security in many regions 	<ul style="list-style-type: none"> • Increased uncertainty in food and fibre production, particularly in agriculturally marginal areas in semi-arid regions and mountain slopes • Increased soil erosion and salinisation, loss of soil fertility • Reliance on irrigation in many areas, impacts on potable water quality; increase in water contamination, pollution and eutrophication
Coasts	<ul style="list-style-type: none"> • Increased risk of coastal erosion and flooding 	<ul style="list-style-type: none"> • Increased frequency and height of flooding along coastal fringes, river estuaries and floodplains • Increased likelihood of storm surges and increased height of storm waves • Increased coastal erosion along all coastline types (including rock and sandy coasts) • Increased sediment mobility in some areas, implications for port/harbour access and navigation channel infilling
Industry, settlements and society	<ul style="list-style-type: none"> • Increasing vulnerability of industry, settlements and society to hydrometeorological events, particularly in low-lying and coastal regions 	<ul style="list-style-type: none"> • Increased risk to all aspects of economic activity in coastal and low-lying areas from sea and river flooding • Increased risk of built and natural heritage loss in low-lying and coastal regions due to flood inundation and warmer sea temperatures, e.g. Venice, Great Barrier Reef
Health	<ul style="list-style-type: none"> • Increased risk of malnutrition and hunger as a result of variations in food production and hydrometeorological events • Increased risk of infectious and respiratory diseases and heat-related deaths, but fewer cold-related deaths 	<ul style="list-style-type: none"> • Mass movement and flood events can cause groundwater and river water contamination
Water	<ul style="list-style-type: none"> • Increase in water-stressed regions, particularly in areas with high urbanisation • Reduced water availability from retreating mountain glaciers • Increased precipitation in mid-latitude areas, decreased precipitation in some low-latitude and semi-arid areas • Increased precipitation variability and seasonality, decreased water quality 	<ul style="list-style-type: none"> • Increased mass loss from retreating glaciers, increased risk of downstream floods, jökulhlaups, landslides, mass and debris flows, rockfalls • Increased variability of precipitation at all latitudes with impacts on domestic, agricultural and industrial water supply and water quality, eutrophication

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case study:
Šardice



Dr. Ing. Petr Marada





erosion



wind storm

natural disaster, floods



land not able to hold water

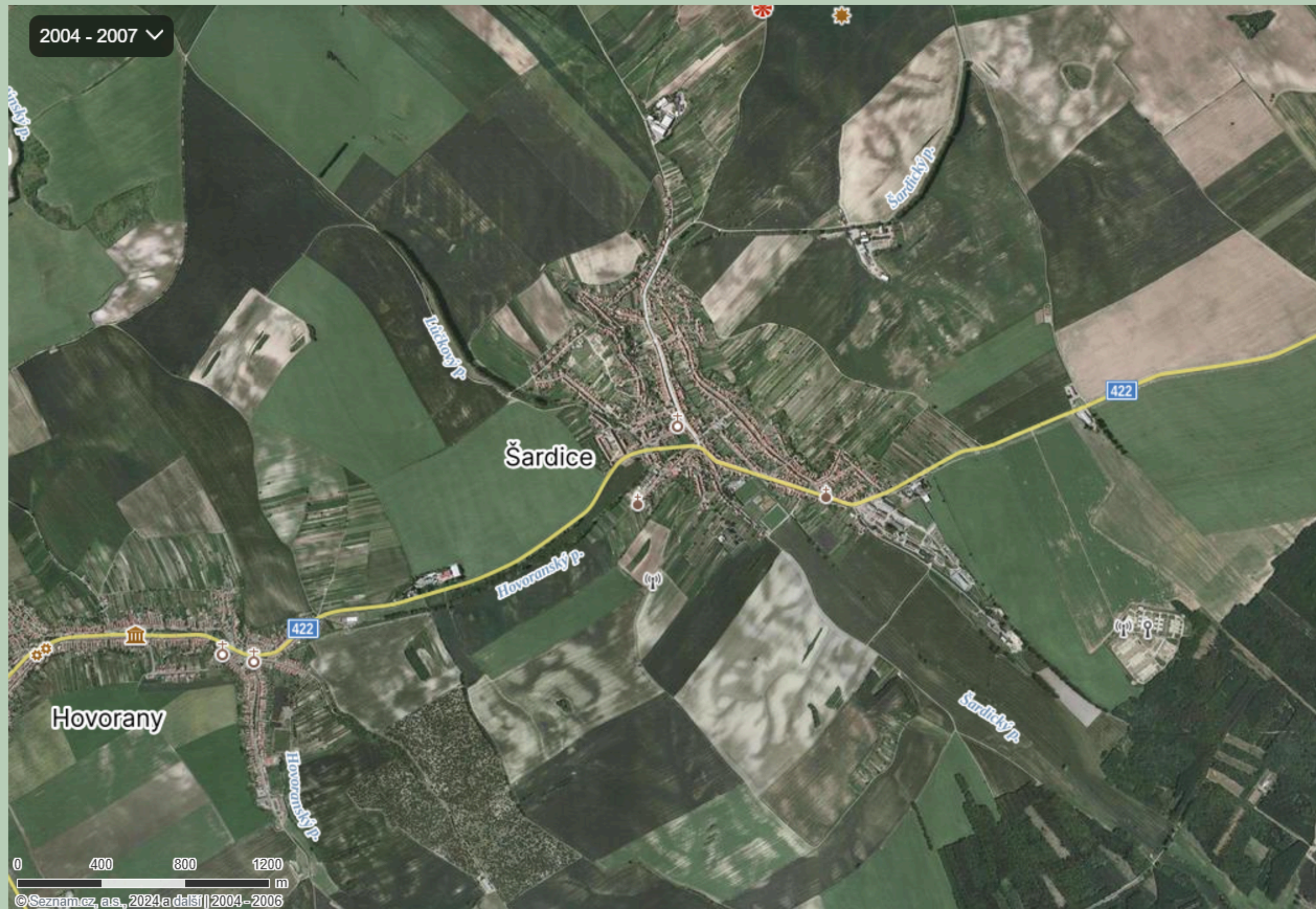


28 ha of extensive orchards,
22 ha of arable land,
6 ha of wooded land,
14 ha of landscape elements

2022



2004
-2007





Ekofarma Šardice



Copy link



Watch on  YouTube

keywords: the importance of knowledge of local conditions. agricultural land that is difficult to cultivate transformed to other landscape elements – orchards, wetlands, ponds. retention and accumulation of rainwater. biodiversity. the return of native wild plants. semi-natural farming. nature enjoyable not only for animals, but also for people.

wetlands



2001
-2003



04-07



10-12



13-15



16-18



19-21



2022



Sources

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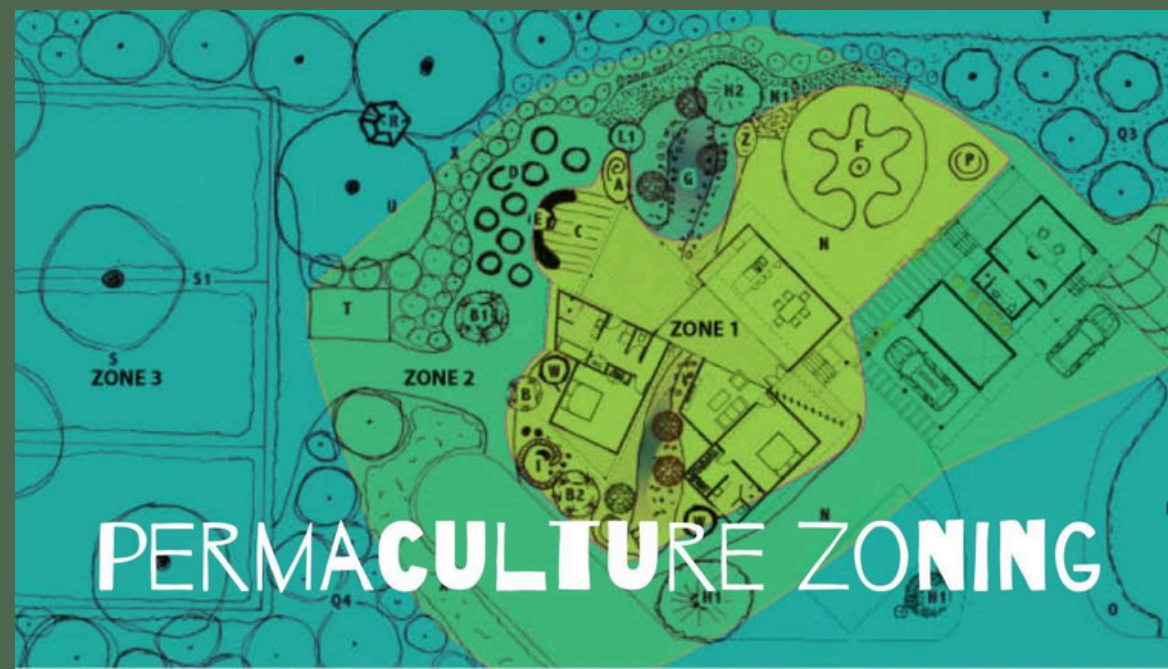
Mitigation and solutions

Sustainable agricultural practises

“farming that meets the needs of existing and future generations, while also ensuring profitability, environmental health and social and economic equity”



no tillage



intercropping

crop rotation, biological pest control and many more...

Regenerative farming

What is it?

way of farming that focuses on the **health and recovery of the soil** through this actions:

1. minimal soil movement
2. year-round ground cover, ideally with living roots
3. increasing the amount of the water and carbon in the soil
4. integrating animals (animals in the fields...)

The initiative "4 per 1000"

If the level of carbon stored by soils in the top 30 to 40 cm of soil increased by 0.4% (or 4‰) per year, the annual increase of carbon dioxide (CO₂) in the atmosphere would be significantly reduced.
Example: cooperative in Krakovany: 30 - 45 tonnes (average czech person - CO₂ per capita produce (included fossil fuels and industry, not land -use change) produces 7,9 t CO₂ per year



few steps further than organic

Tip for you

SOIL IS OUR

COMMON
GROUND



Community-based conservation initiatives



reforestation projects



community clean-up
projects



wildlife conservation

Reforestation initiatives

Can it be a problem?

1. often monoculture and non-native species plantations
2. there is a big importance in the mix of tree species ages
3. restoring a landscape by tree planting can skip stages of ecological succession
4. missing care in following periods of time

Why are the reforestation initiatives that POPULAR?

FAO: we are losing 10 million hectares of forest a year
forests store carbon, support biodiversity, provide shelter, food, medicine, nutrients, and building materials



Government and policy interventions

CZ: COMMON AGRICULTURAL POLICY 2023-2027

98 bil.
CZK

EU (100)

- In addition to basic area payment, there is:
 - B.) the **small farmers' payment** (payment for maximum of 4 hectares of farmland for farms up to 10 hectares in size)
 - C.) the **additional redistributive income support** for sustainability (for all applicants for a maximum area of 150 hectares of cultivated land)
 - D.) **eco-payment** (focusing on landscape care and conservation of natural resources) are newly introduced

EU (65) + CZ (35)

- A.) **the cultivation of intercrops** (e.g. ryegrass, peas) on standard arable land
- B.) **the establishment of areas with various plant species** suitable for pollinating insects and the establishment of bio belts
- compliance with **organic farming** conditions is also financed in the same way

18,6 bil.
CZK

EU Rural action plan (2023)

for rural communities, rural project holders and local authorities

-Between 2021 and 2024 the Commission financed a total of over **60 projects** contributing directly to rural areas for a budget of EUR 253 million - The funded projects mainly come from A.) Cluster 6 (Food, bioeconomy, natural resources, agriculture and environment), B.) Cluster 2 (Culture, creativity and inclusive society), C.) Cluster 5 (Climate, energy and mobility).



New EU Regulation on minimum requirements for wastewater reuse (2023)

- the main drivers: **water shortage and droughts** in Europe

- examples:

1. The regulation defines the following approved crops for agricultural irrigation **with treated municipal wastewater**:

f. e. Food crops consumed raw, i.e., intended for human consumption in an unprocessed state

(Class A, B and C),
Pastures and forage (Class B and C)

Industrial, energy and seeded crops (Class D)

Industrial, energy and seeded crops (Class D)

Recycled Water Class	Crop category ^a	Allowable irrigation methods
A	All food crops consumed raw where the edible part is in direct contact with reclaimed water and root crops consumed raw	All
B	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops used to feed milk- or meat-producing animals	All
C	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops used to feed milk- or meat-producing animals	Drip irrigation ^b or other irrigation method that avoids direct contact with the edible part of the crop
D	Industrial, energy and seeded crops	All ^c

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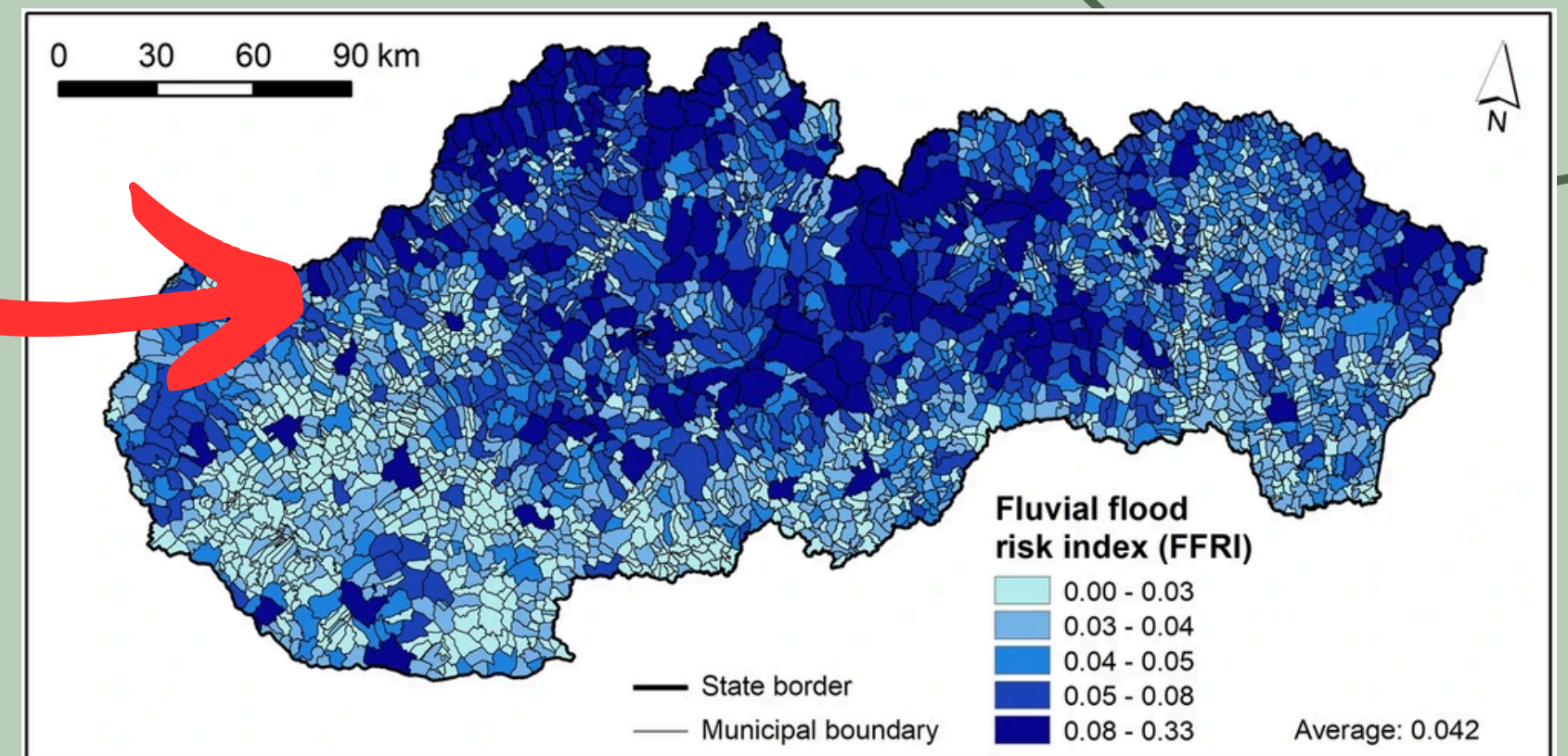
<https://4p1000.org/discover/?lang=en>

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Final activity

Model scenario

A small Slovak village nestled in a picturesque valley on northern border with Czech Republic, has been experiencing increasingly severe floods over the past decade. The floods destroy farmland, damage homes, and disrupt livelihoods. Residents have observed that floods are more frequent and intense than in previous generations, with water levels rising dangerously even after moderate rainfall.



Local context

- Deforestation in the nearby mountains to expand agricultural and logging activities has reduced the land's ability to absorb rainfall.
- Poor land-use management, including intensive monoculture farming on floodplains, has worsened soil erosion and reduced the landscape's water retention capacity.
- A lack of infrastructure, such as flood barriers or drainage systems, leaves the village ill-prepared to cope with high water volumes.

Sources for introduction and final activity

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Thank you!