

Climate Change in Central Asia



Sustainable Development and Sustainability Science, 2026

Guest lecture by V. Novikov, Zoi Environment Network



Zoi Environment Network is a non-profit organization that helps build sustainable societies through **informed analysis, visual communication, design and action.**



Our topics are

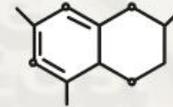
Climate change



Biodiversity



Chemicals and Waste



Security and conflict



Water

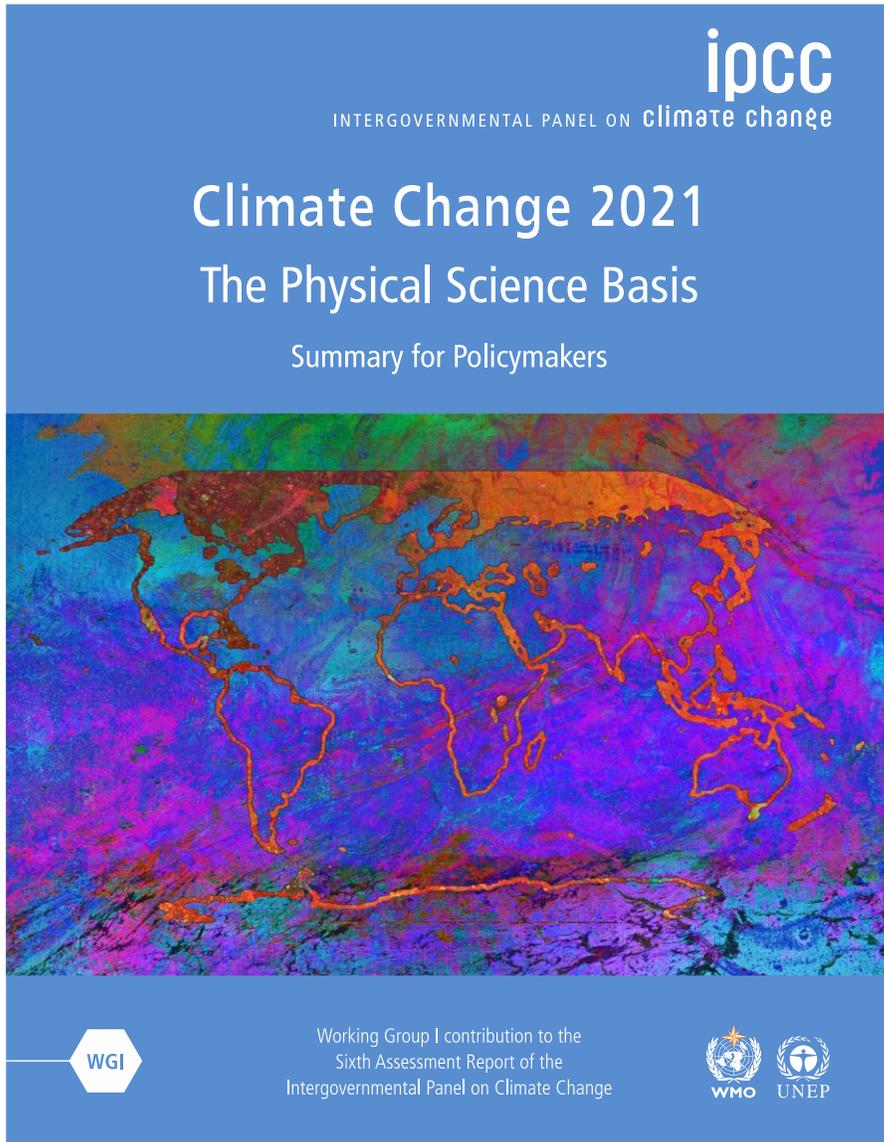


Access to information

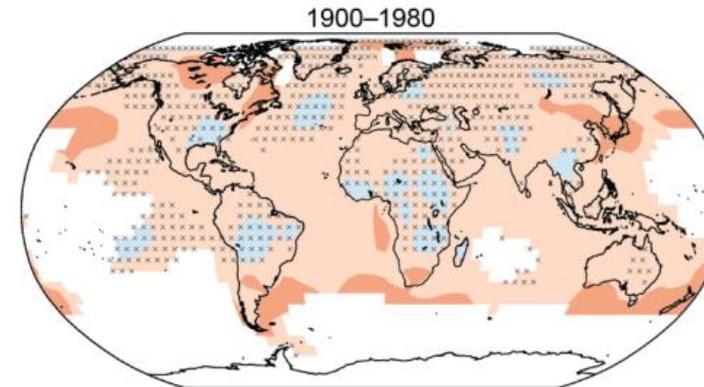


<https://zoinet.org/products/>

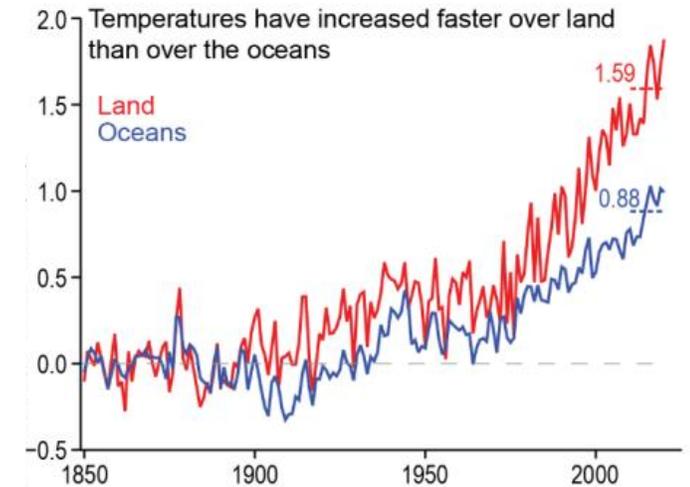
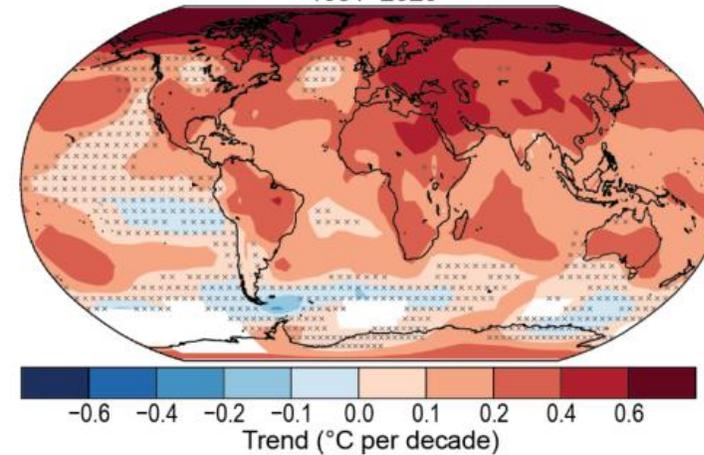
From Global to Regional, National and Local Climate Change Information



Warming accelerated after the 1970s, but not all regions are warming equally



x = non-significant trend
1981–2020



IPCC Global Climate Assessments and WMO reports

<https://library.wmo.int/records/item/69674-state-of-the-climate-update-for-cop30>



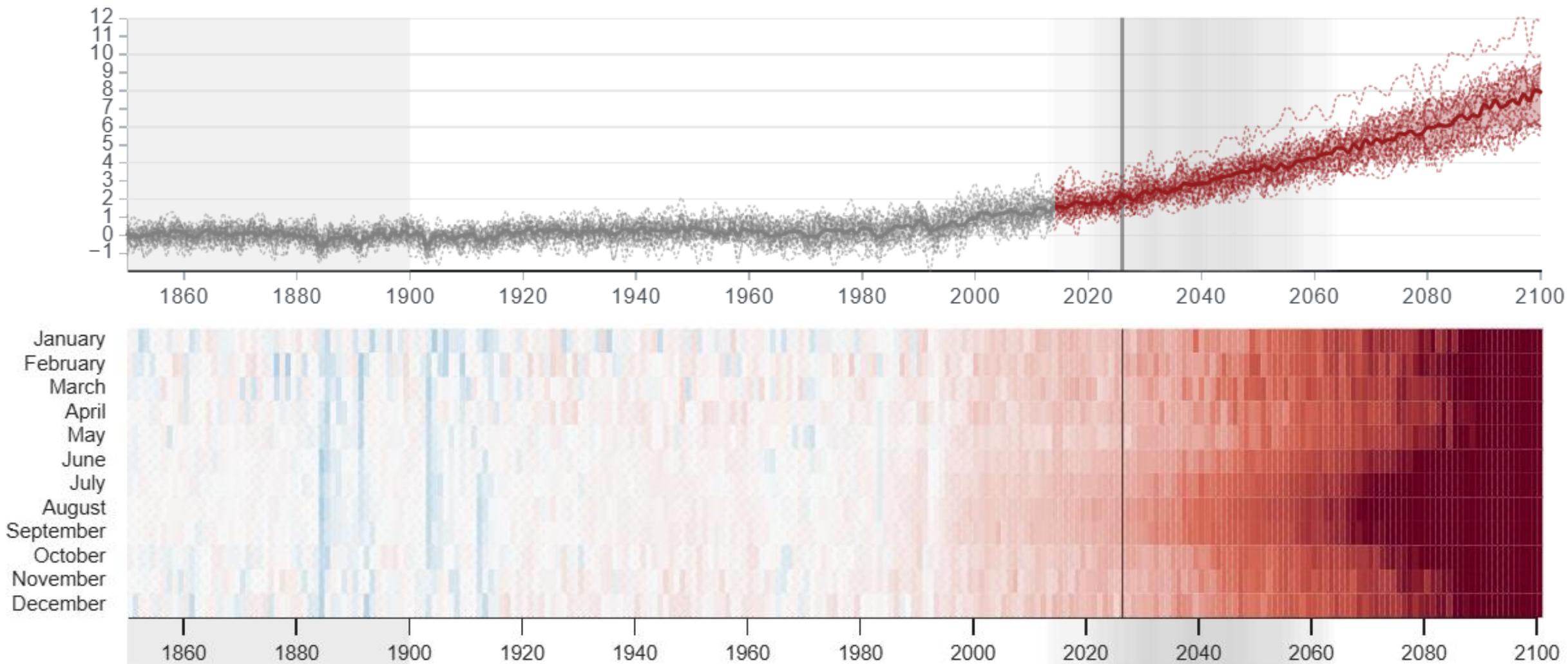
PROGRAMME OF
THE EUROPEAN UNION



IMPLEMENTED BY

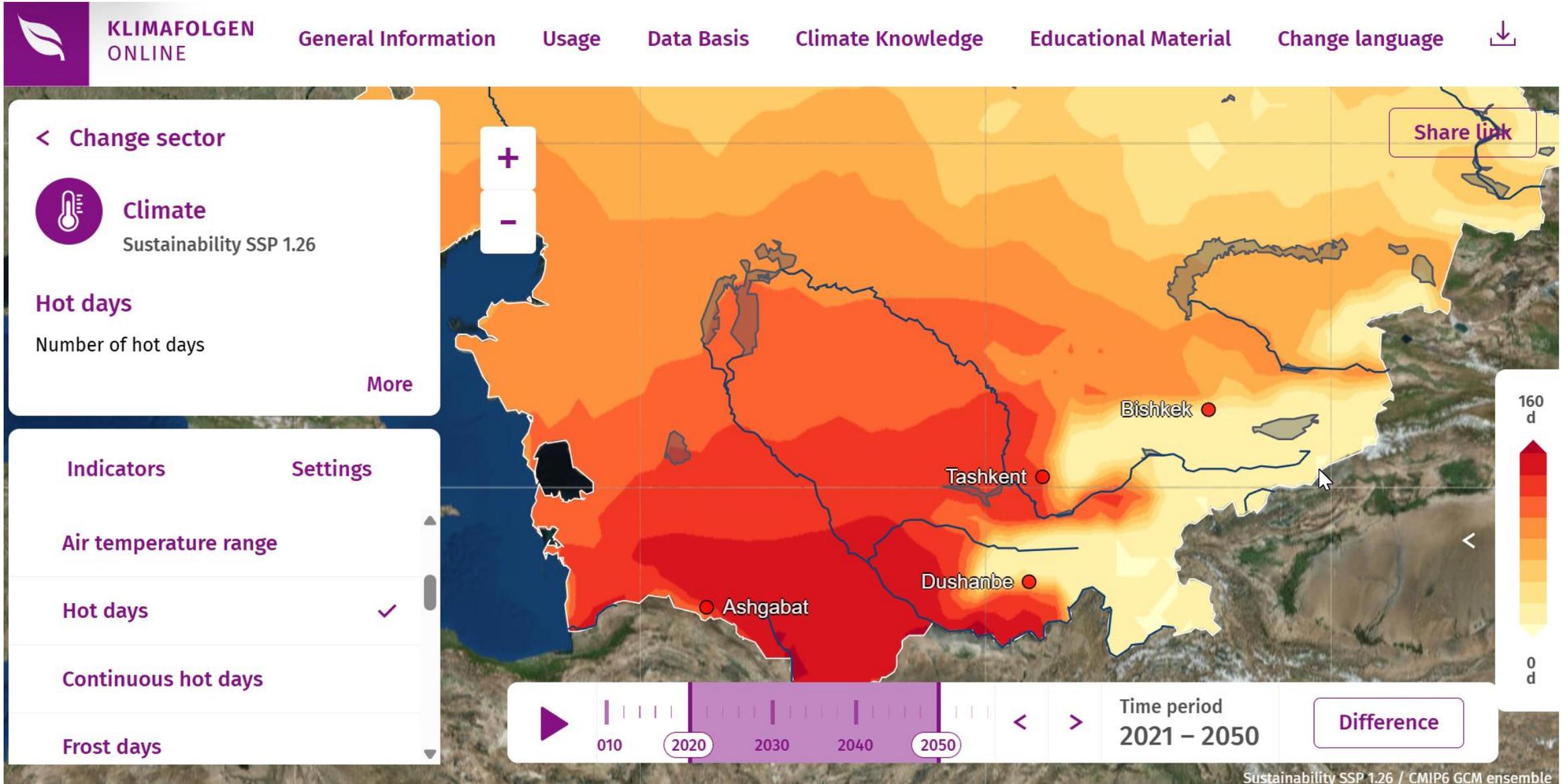


Copernicus Climate Change Atlas: Western and Central Asia



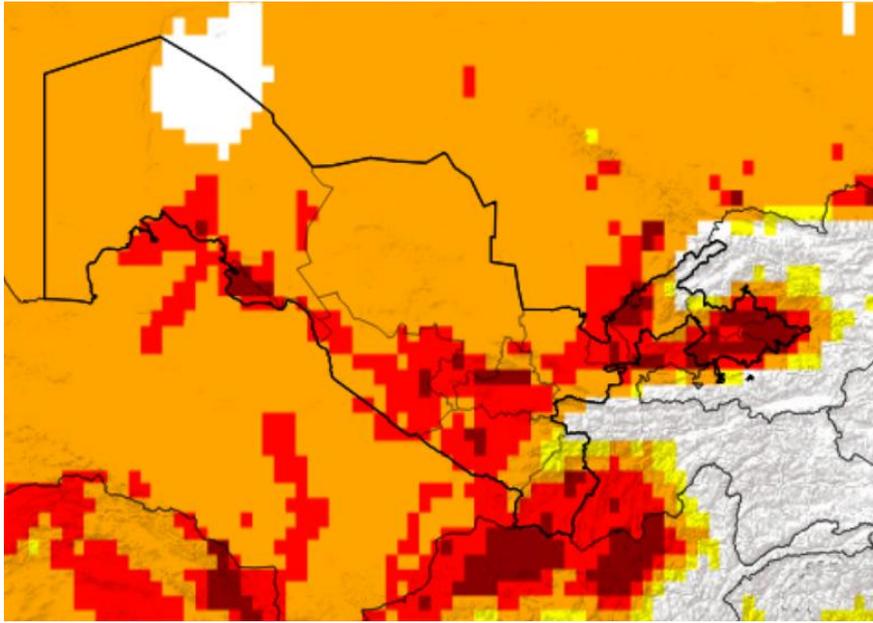
<https://atlas.climate.copernicus.eu/atlas>

PIK (Potsdam Climate Institute) Climate Change Portal for Central Asia



https://www.klimafolgenonline.com/ca/index_de.html?language_id=de

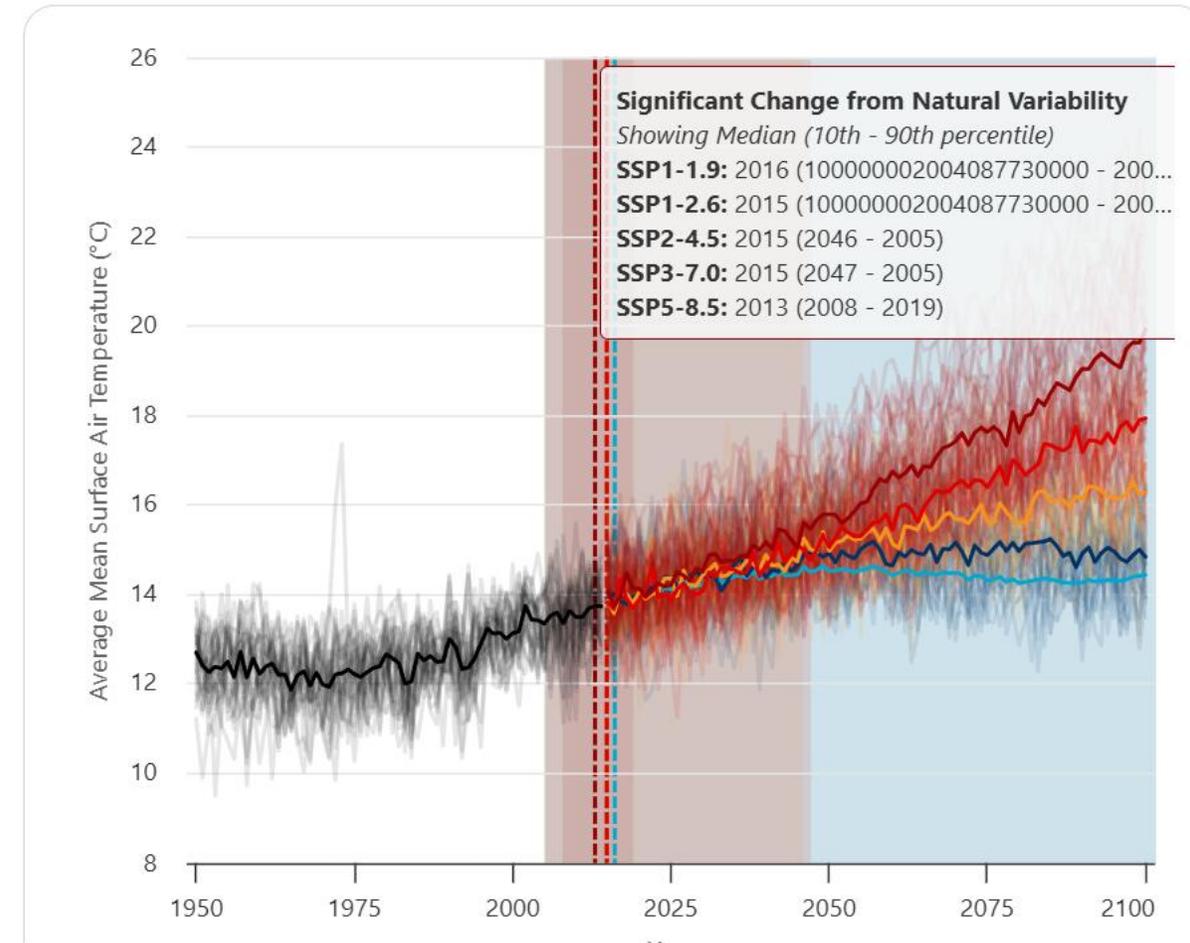
World Bank Climate Knowledge Portal & Climate and Development / Risk Reports



What you can see in this figure

The map shows the level of risk when combining temperature (hazard) and population (exposure), for different periods into the future and different warming scenarios. Risk Categorizations are calculated to account for both climate conditions (in this

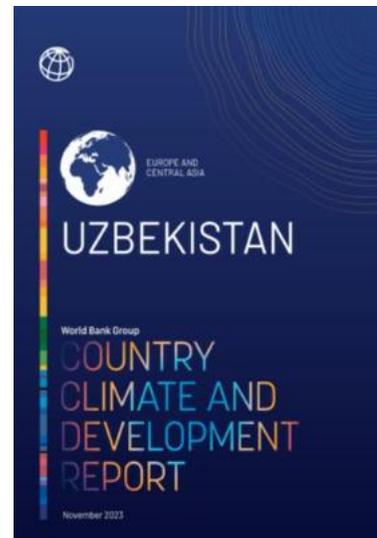
Uzbekistan • SSP2-4.5



<https://www.worldbank.org/en/publication/country-climate-development-reports>

<https://openknowledge.worldbank.org/handle/10986/40608>

<https://www.adb.org/sites/default/files/publication/736686/climate-risk-country-profile-uzbekistan.pdf>



<https://climateknowledgeportal.worldbank.org/explore>

Central Asia Climate Information Portal (CACIP)

Country Climate Risk Portal: Uzbekistan

- Contents**
- Country Profile
 - Key Facts & Figures
 - Geography & Population
 - Climate Summary
- Climate Risks by Sector
 - Agriculture
 - Energy
 - Water
 - Transport
 - Hazards
 - Health

Country Profile

Key Facts & Figures

425,400 km² Area	37.86 million Population	18.6 million (49%) Rural Population	19.3 million (51%) Urban Population	84 / km² Population Density
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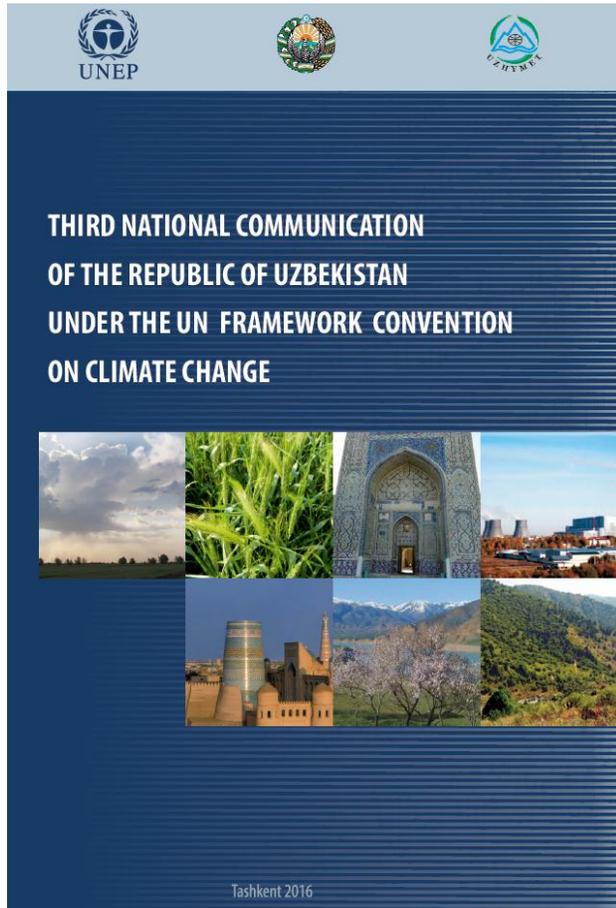


Geography & Population

With a territory of about 425,400 km², Uzbekistan has an estimated permanent population of 37.86 million in mid-2025. This gives a population density of around 84 inhabitants per km². About 18.6 million (49%) people live in rural areas, while around 19.3 million (51%) reside in urban centers.

Feedback

National Official Sources of Climate Change and Hydromet Information



<https://unfccc.int/non-annex-I-NCs>

<https://unfccc.int/BURs>

National Communications, Biennial Update and Transparency Reports



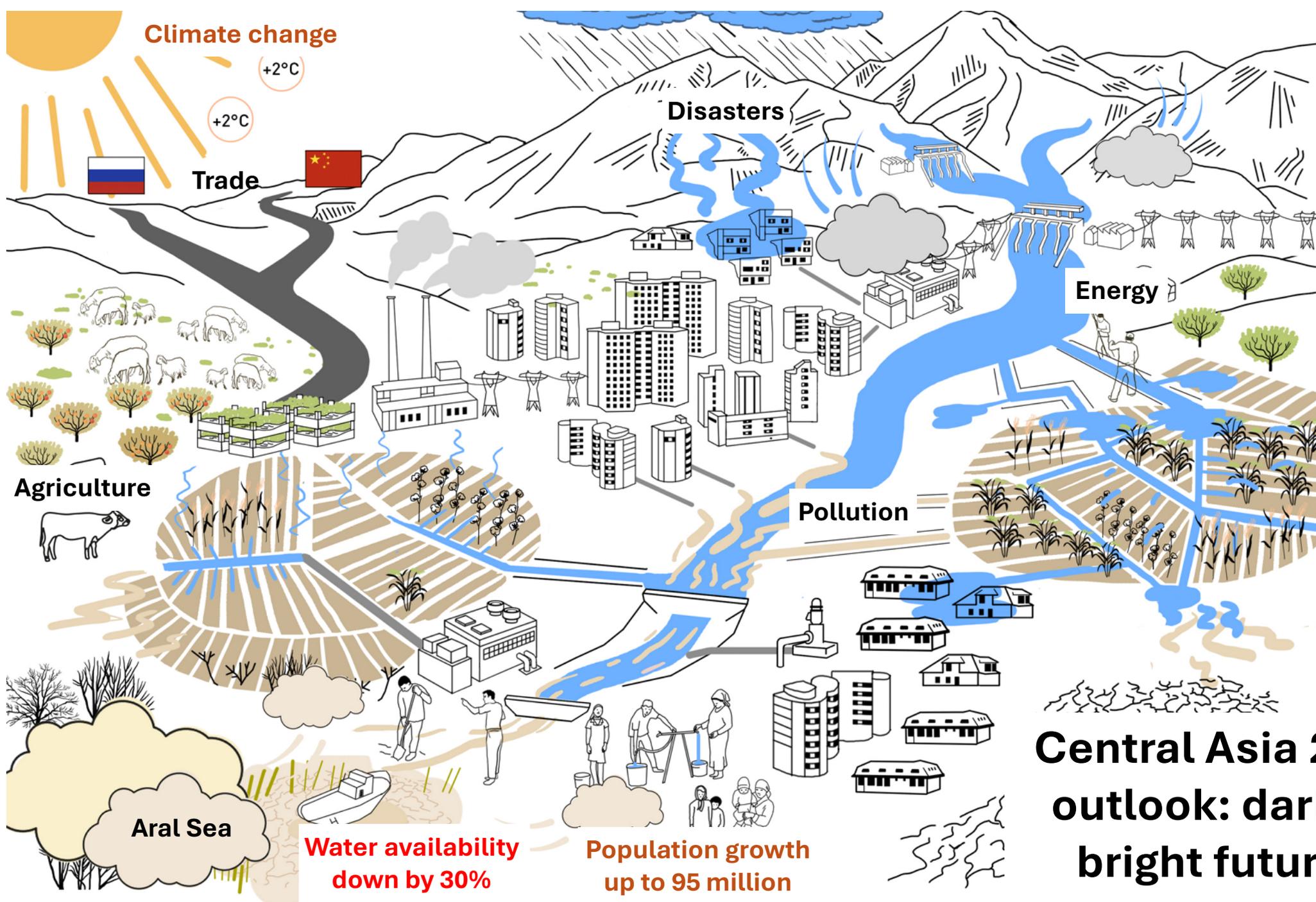
<https://unfccc.int/NDCREG>

Nationally Determined Contributions (NDCs)



<https://gov.uz/oz/hydromet>

Weather and climate reports by the National Hydromet Services (NHMS)



Climate change

+2°C

+2°C

Trade

Disasters

Energy

Agriculture

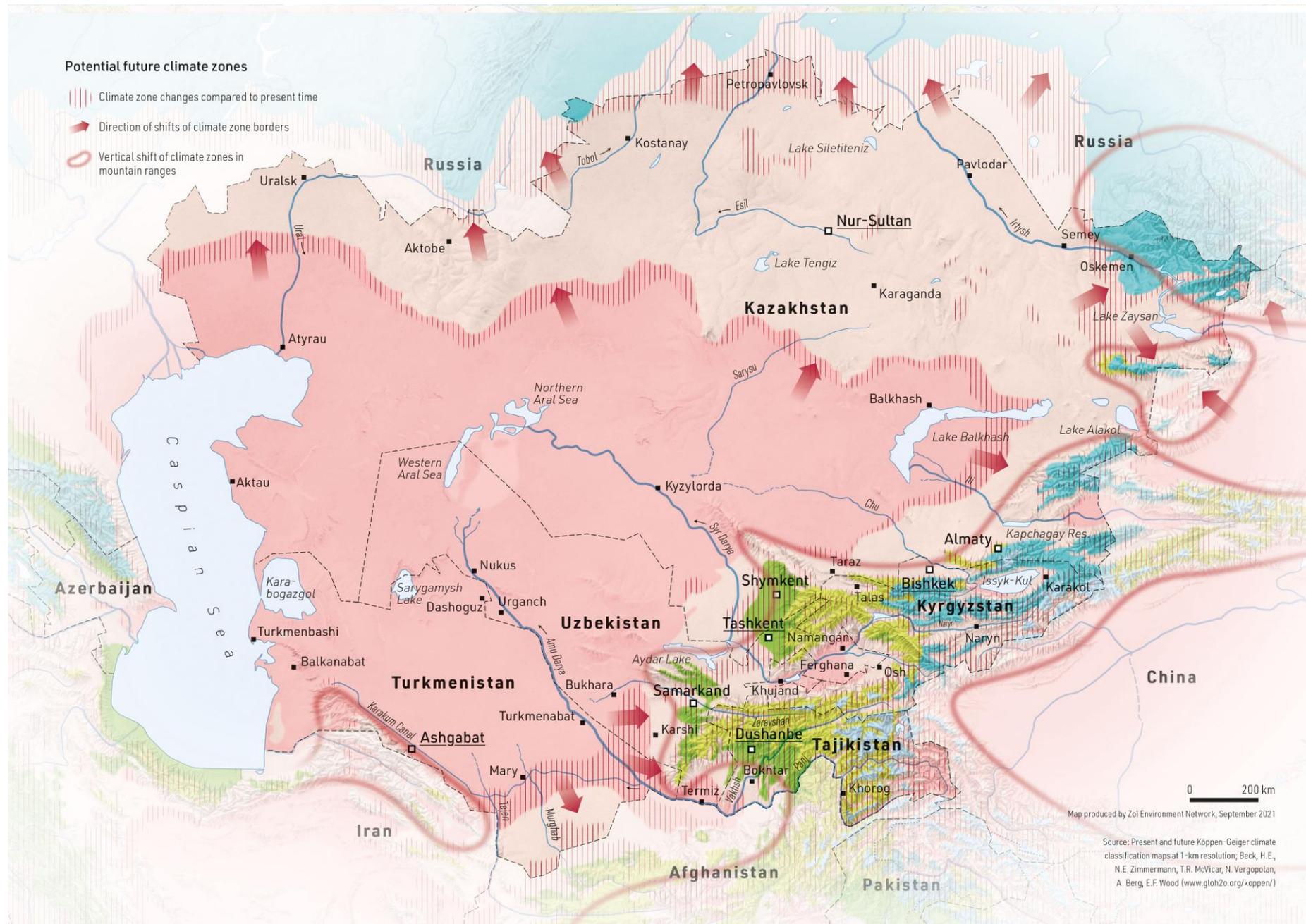
Pollution

Aral Sea

Water availability
down by 30%

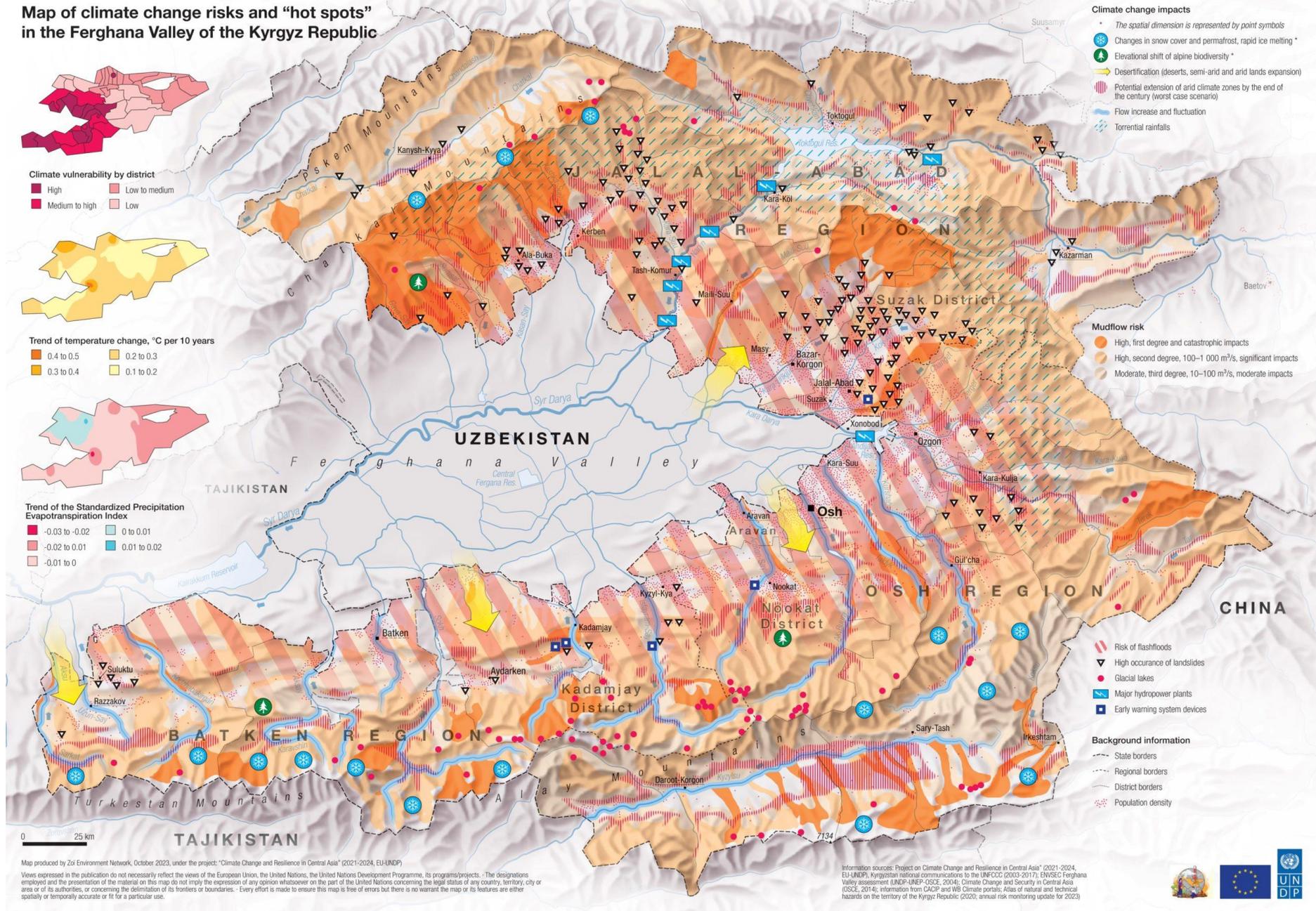
Population growth
up to 95 million

**Central Asia 2050
outlook: dark or
bright future?**



<https://zoinet.org/product/cacip-review/>

Map of climate change risks and "hot spots" in the Ferghana Valley of the Kyrgyz Republic

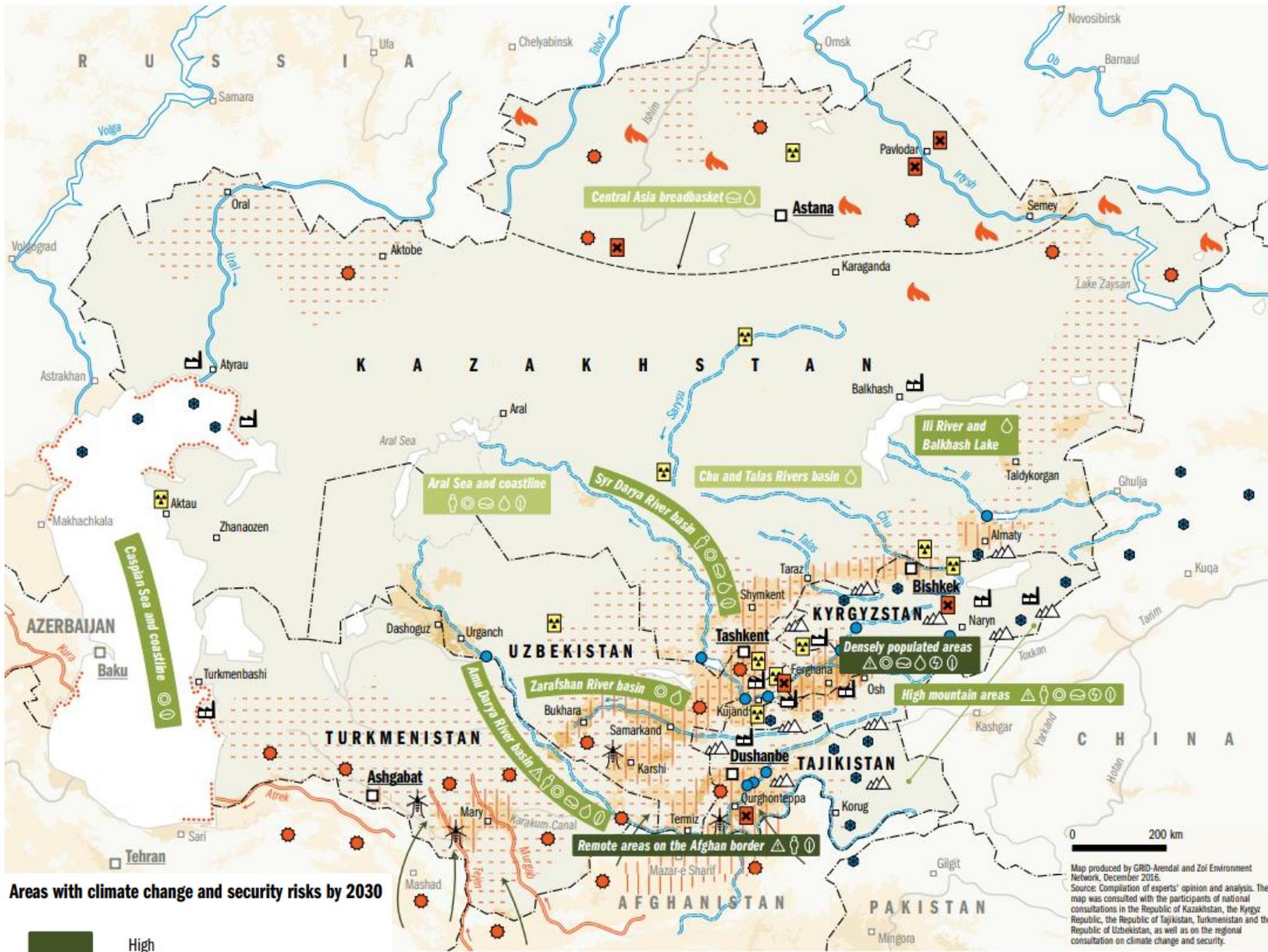


Map produced by Zoi Environment Network, October 2023, under the project: "Climate Change and Resilience in Central Asia" (2021-2024, EU-UNDP)

Views expressed in the publication do not necessarily reflect the views of the European Union, the United Nations, the United Nations Development Programme, its programs/projects. The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Every effort is made to ensure this map is free of errors but there is no warrant the map or its features are either spatially or temporally accurate or fit for a particular use.

Information sources: Project on Climate Change and Resilience in Central Asia" (2021-2024, EU-UNDP); Kyrgyzstan national communications to the UNFCCC (2003-2017); ENRSC; Ferghana Valley assessment (UNDP-UNEP-OSCE, 2004); Climate Change and Security in Central Asia (OSCE, 2014); information from CACIP and WB Climate portals; Atlas of natural and technical hazards on the territory of the Kyrgyz Republic (2021); annual risk monitoring update for 2023





Areas with climate change and security risks by 2030

- High
- Medium
- Low

Category of security implication

- Social insecurity
- Human health insecurity
- Economic and livelihood insecurity, damage to infrastructure
- Food insecurity
- Water insecurity, water resources scarcity
- Energy insecurity
- Land degradation, biodiversity, cultural and natural heritage

Densely populated and industrialized regions near mountains: environmental stress, water and energy insecurity

Desertification

High mountain areas at risk: energy insecurity, major ecosystem changes, natural disasters, infrastructure damages

Caspian Sea: risk of flooding due to sea level fluctuation

Fire-prone area

Severe drought impacts

Predicted change in annual river flow

Projected increase of river flow by mid-century

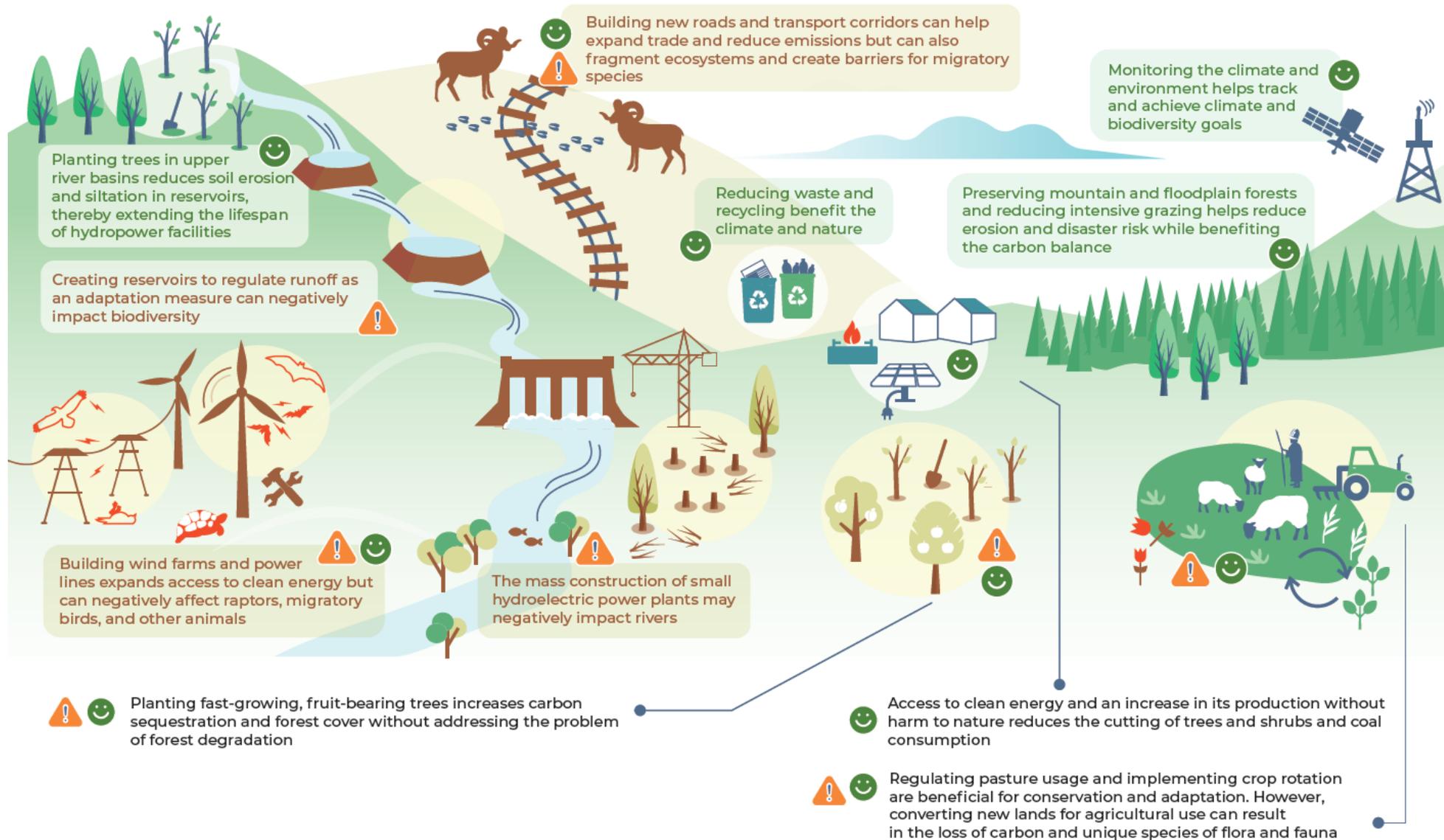
Projected increase of river flow till 2030 - 2050 followed by overall decrease and seasonal change

Projected decrease of river flow by 2030 - 2050

no change/no information

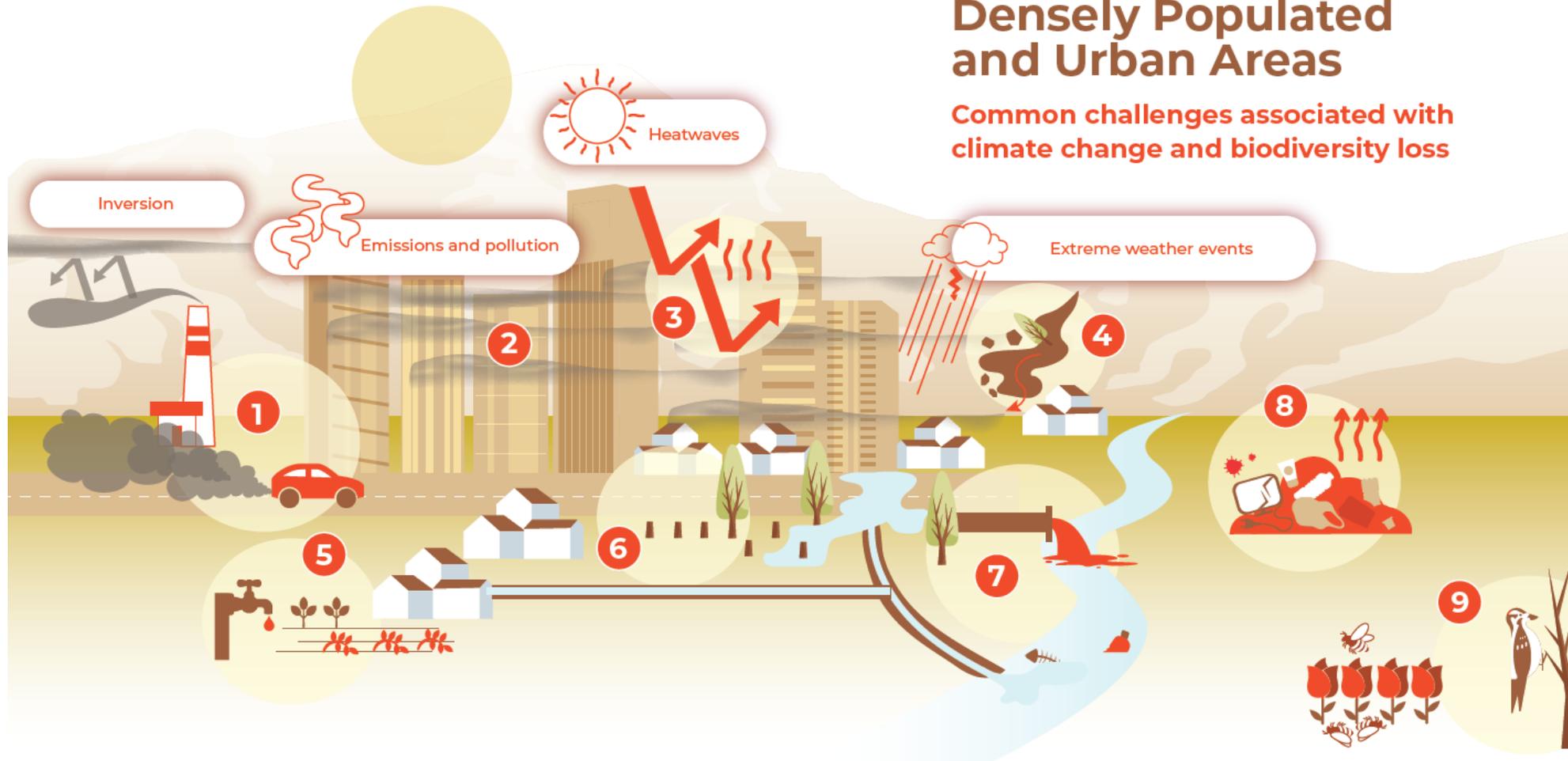
Climate and Biodiversity Alignment

Examples of win-wins and tradeoffs



Densely Populated and Urban Areas

Common challenges associated with climate change and biodiversity loss



1 Poor air quality, especially during inversions

2 Dense urban development and climate-blind planning impede airflow

3 Heated roads, buildings, and poor air circulation create an urban heat island

4 Mudflows

5 Lack of water resources

6 Lack of green spaces

7 Poor sewage treatment and urban drainage

8 High temperatures worsen pollution, landfill fires

9 Reduction in the number of pollinators and birds that feed on insects

Densely Populated and Urban Areas

Mutual benefits and synergies of climate and biodiversity measures



1 Green belts around cities

2 Energy-efficient buildings and light facades with green architectural solutions

3 Green spaces using native species

4 Urban parks, lakes and fountains

5 Incentives and conditions for public and electric transportation

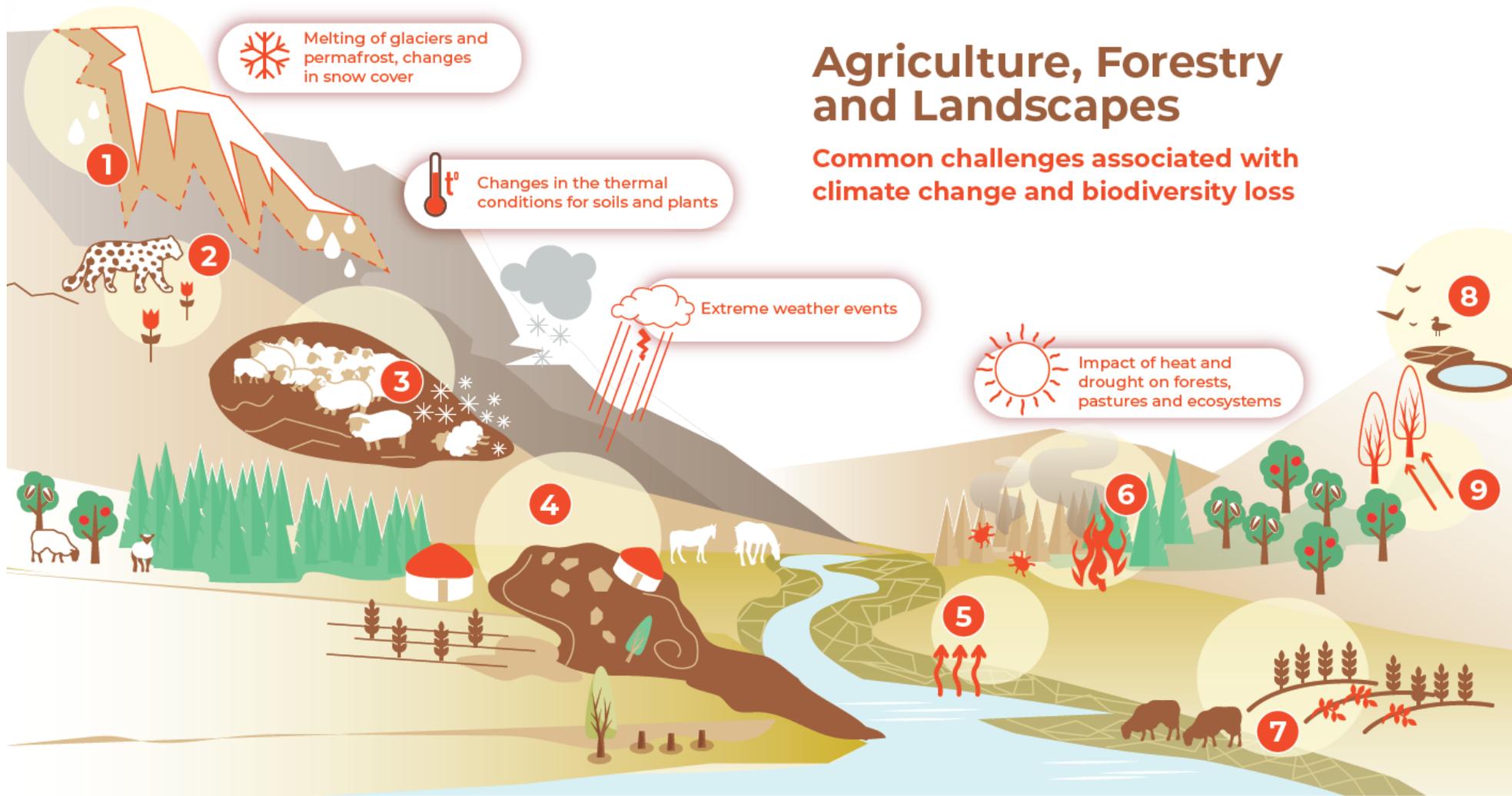
6 Renewable energy and gasification

7 Wastewater treatment

8 Monitoring of water and air quality

9 National parks and eco-tourism destinations near cities. Biodiversity awareness and clean-up campaigns

10 Waste reduction and recycling



Agriculture, Forestry and Landscapes

Common challenges associated with climate change and biodiversity loss

- 1** Reduction of glacier area, changes in high-mountain landscapes
- 2** Changes in the conditions and habitats of flora and fauna species
- 3** Pasture degradation due to intensive grazing, livestock deaths due to lack of forage, and extreme weather events

- 4** Extreme weather events can cause landslides and mudflows, especially when forests and pastures are degraded and slopes are used for farming
- 5** Impact of heat and drought on water resources and aquatic species and ecosystems
- 6** Deterioration of forests and an increased risk of fires due to pests, increased heat, and drought

- 7** Food insecurity
- 8** The impact of climate change and land development on migratory species, sites of species aggregation and wildlife habitats
- 9** Degradation and shifting of forests due to climate warming and changes in precipitation

Agriculture, Forestry and Landscapes

Mutual benefits and synergies of climate and biodiversity measures



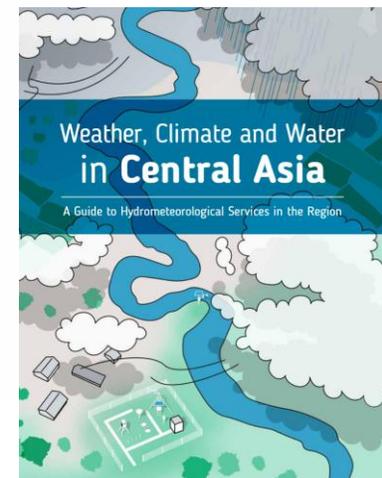
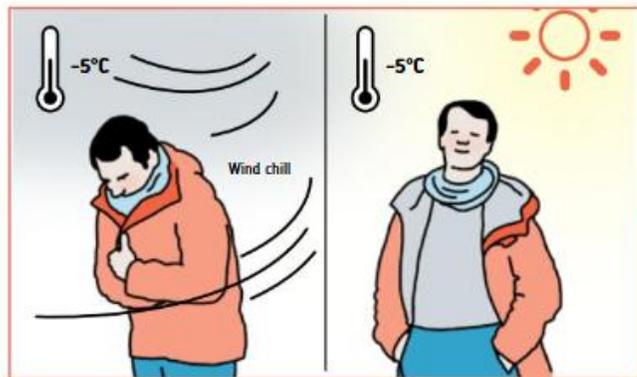
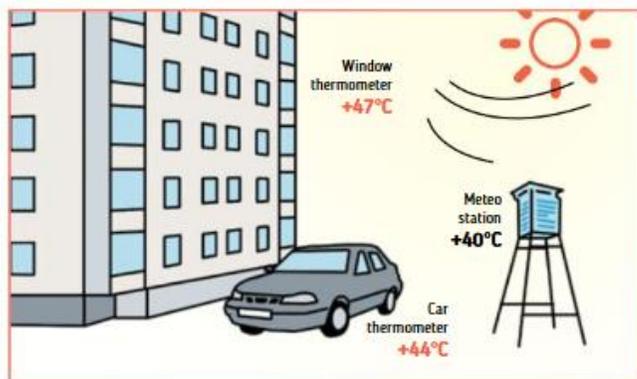
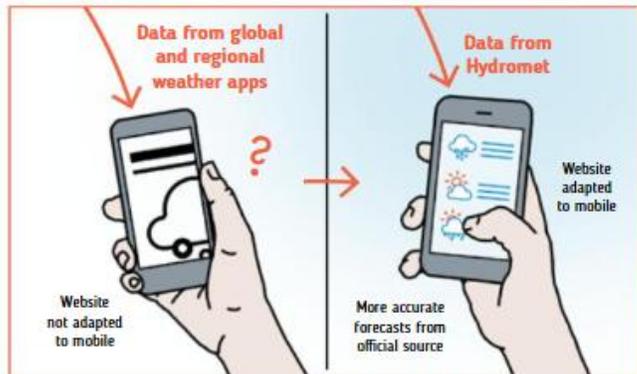
- 1 Monitoring and projections of snow, glaciers and permafrost
- 2 Protecting habitats and creating migration corridors for vulnerable animal species
- 3 Creating artificial glaciers and water reserves
- 4 Regulate livestock grazing based on weather and pasture productivity forecasts

- 5 Grass seeding and pasture restoration using native plant species
- 6 Protecting livestock from extreme weather
- 7 Planting trees around populated areas, on mountain slopes, and along river and canal banks
- 8 Agroforestry, reducing grazing in forests

- 9 Drought-resistant agricultural crops
- 10 Greenhouse farming
- 11 Canal lining
- 12 Drip irrigation

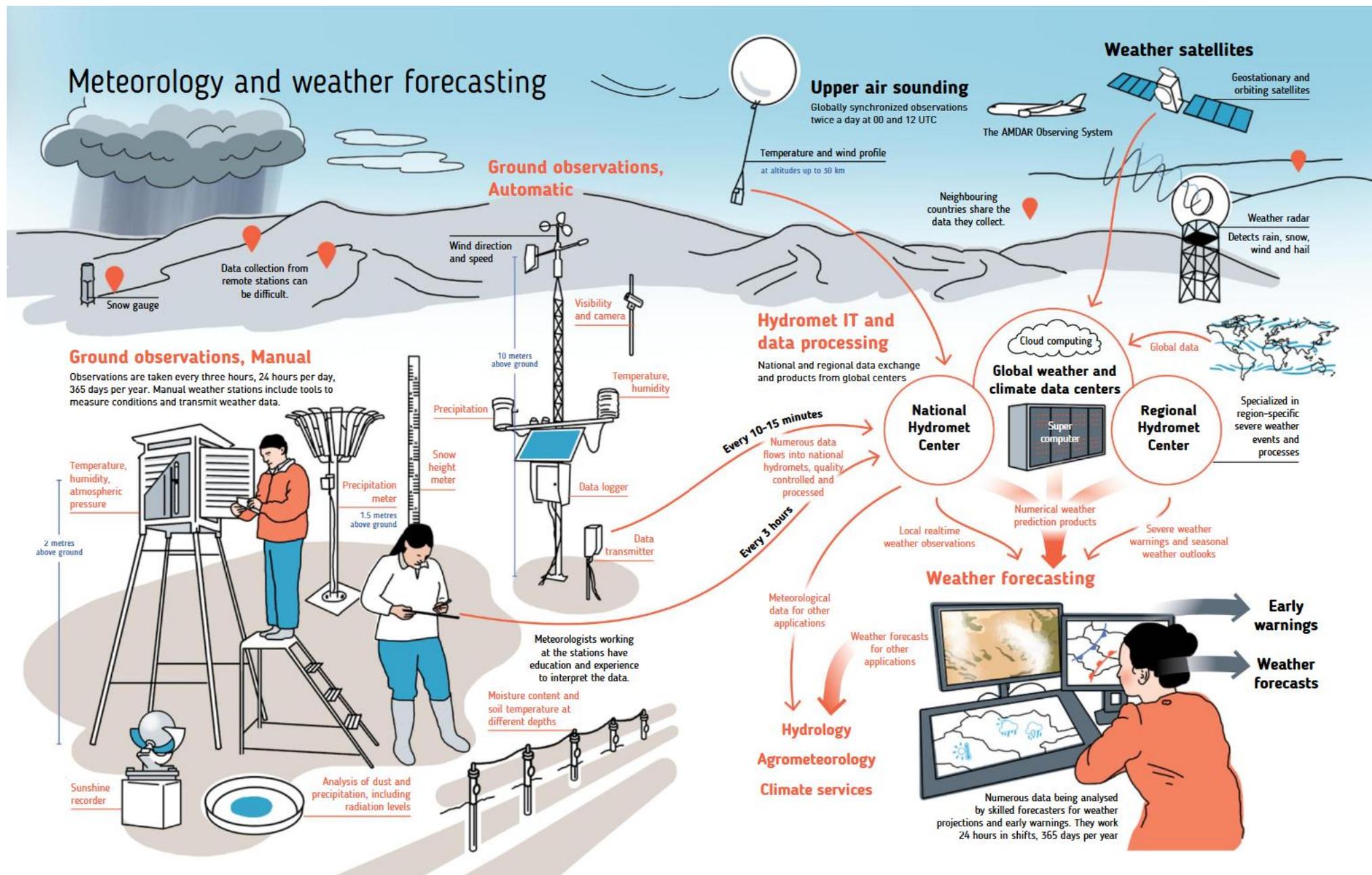
- 13 Forest management and conservation with consideration of climate change scenarios
- 14 Expanding forest plantations using native species
- 15 Monitoring and conservation of water systems

Weather formation in Central Asia



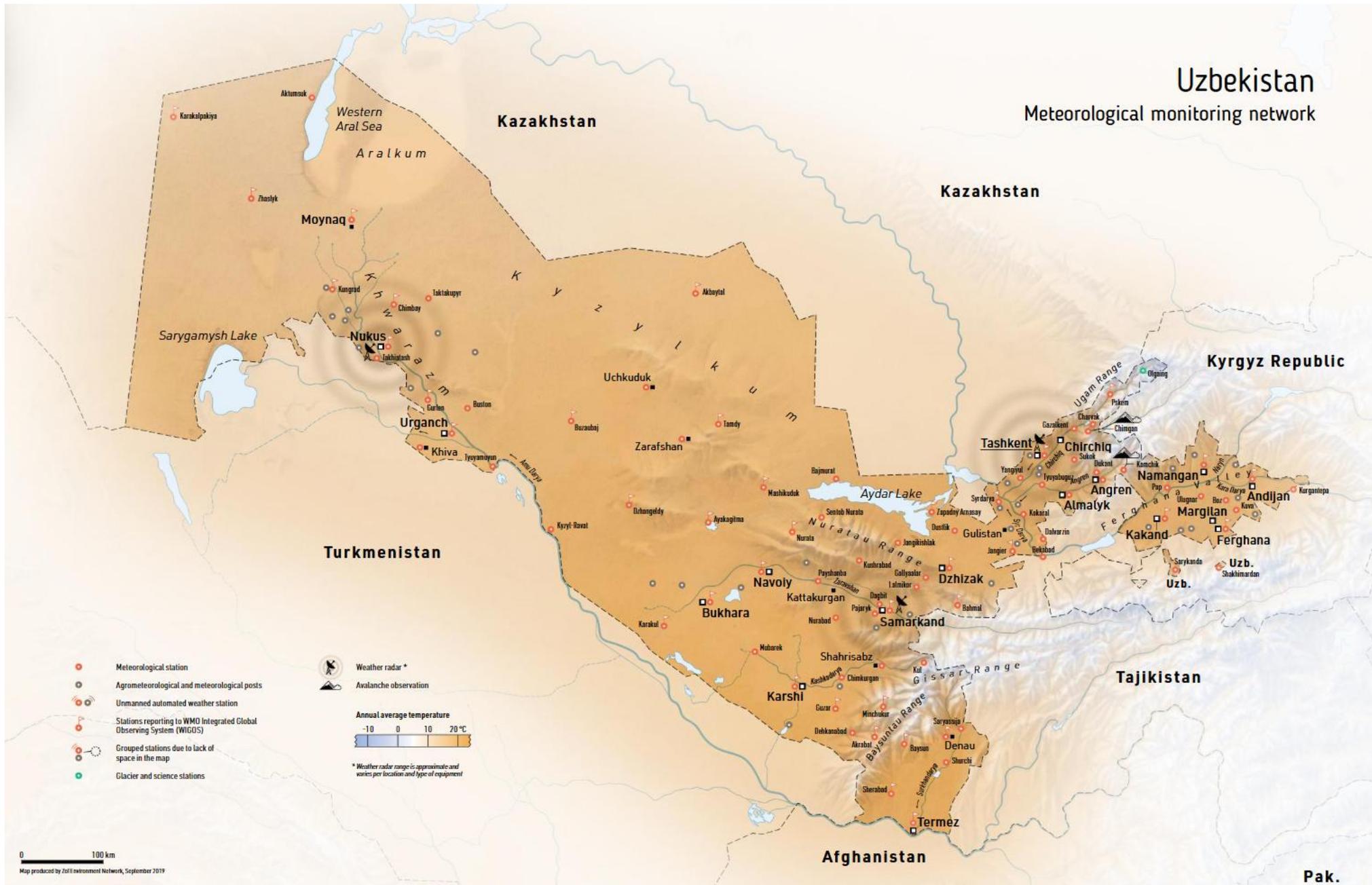
Thickness of air mass corresponds to the relative occurrence of weather phenomena during the year.
Based on estimates of V. Bugaev

<https://zoinet.org/product/hydromet-atlas/>



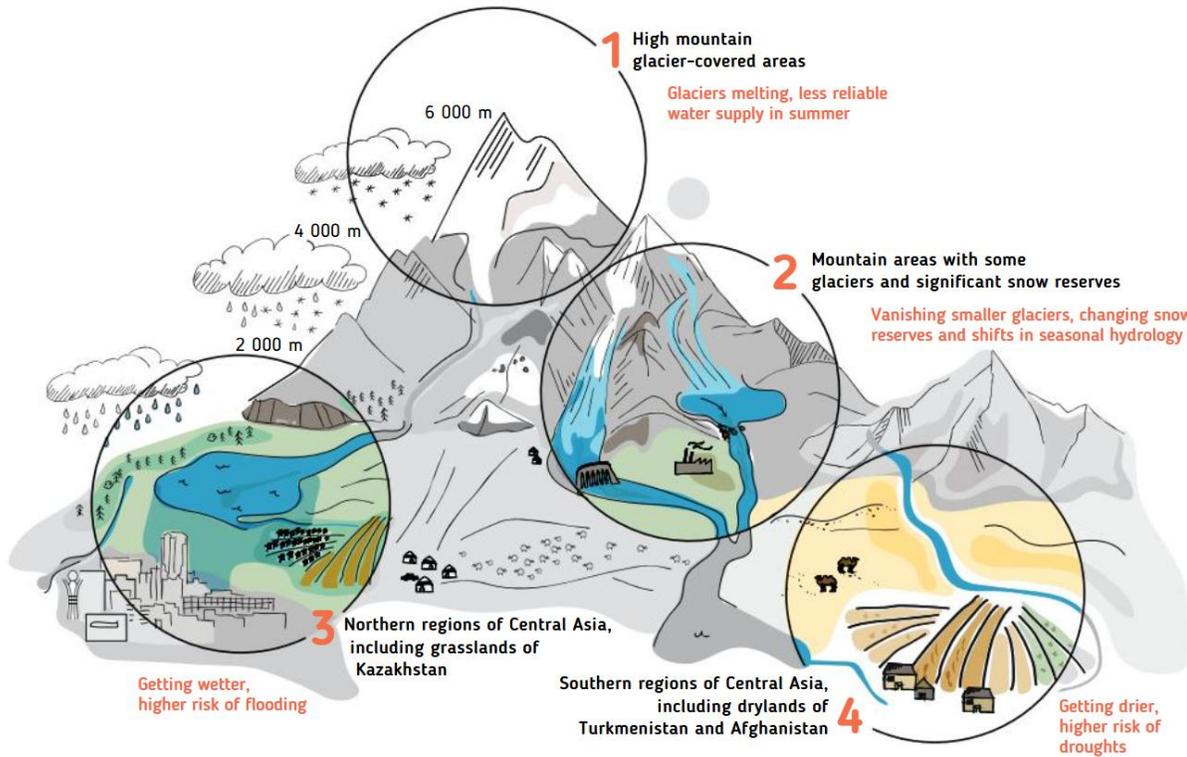
Uzbekistan

Meteorological monitoring network

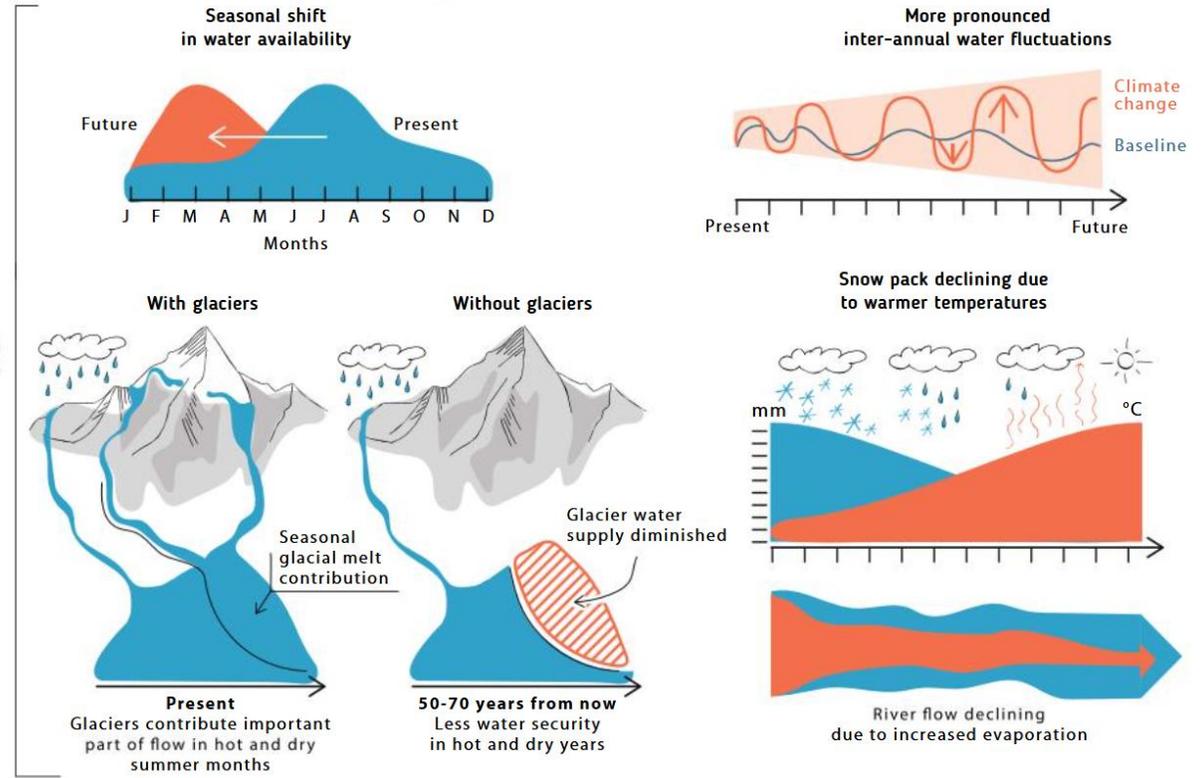


<https://zoinet.org/product/hydromet-atlas/>

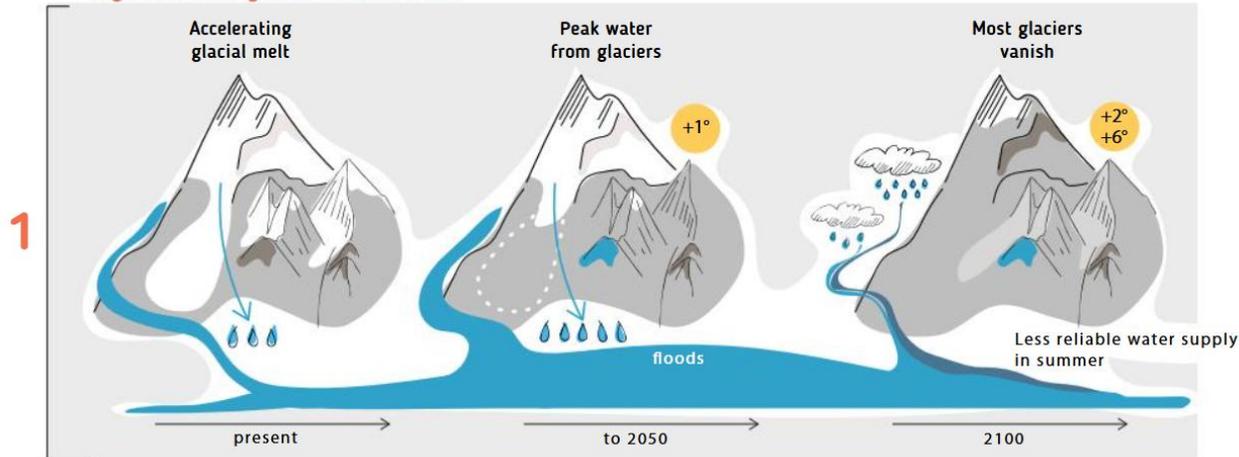
Climate change impacts on water resources



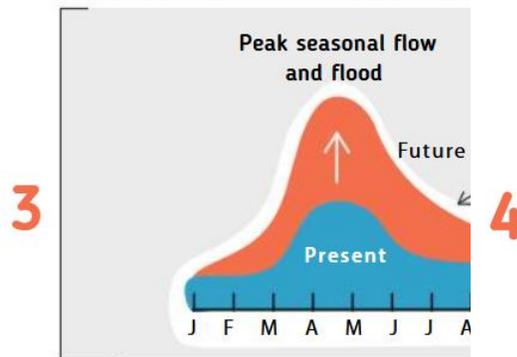
Mountain areas with some glaciers and significant snow reserves



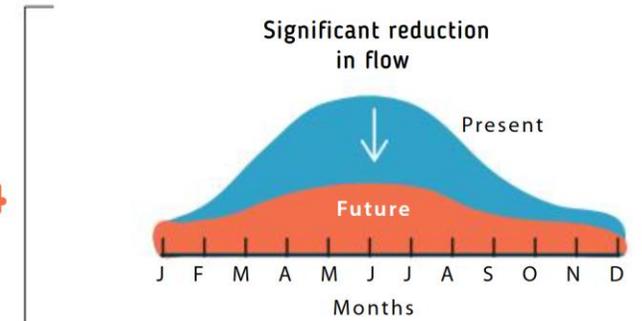
High mountain glacier-covered areas



Northern regions of Central Asia,



Southern regions of Central Asia, including drylands of Turkmenistan and Afghanistan



Agriculture

Agricultural planning

- ▶ Weather information can guide scheduling during course of construction.
- ▶ Farmers can use hail net to protect high value crops



- ▶ Historical data on area snowfall and wind can guide roof design.



Highland and lowland pastures

- ▶ Weather certificates assist pastoralists in filing insurance claims for weather-related losses.
- ▶ Short-term forecasts warn of storms, snowfall or avalanche conditions.
- ▶ Seasonal forecasts provide information relevant to future pasture conditions.



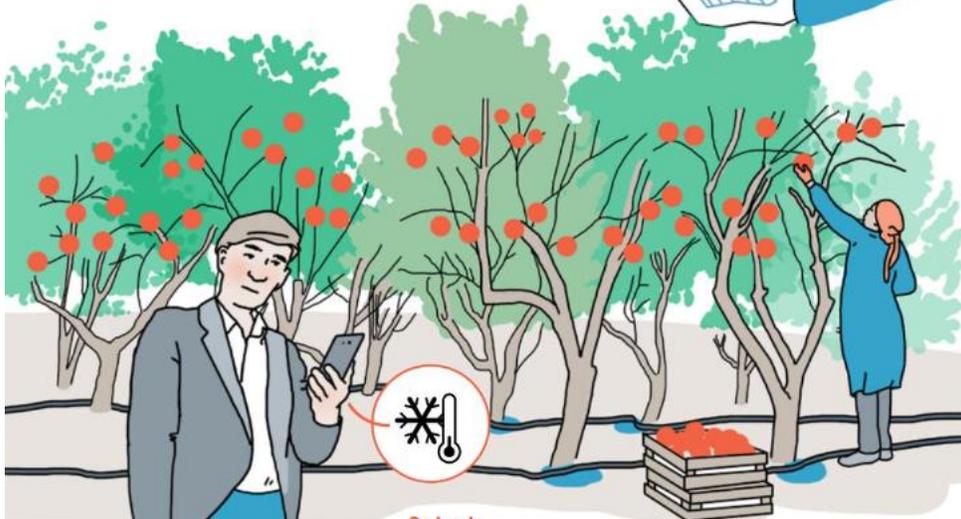
Irrigated crops

- ▶ Hydrological information can assist growers in managing their irrigation and balancing water distribution.
- ▶ Forecasts for extreme weather – heat, cold snap or drought – can alert growers to take precautionary measures.



Rain-fed crops

- ▶ Weather information such as snowpack and soil moisture content can guide growers in deciding when to plant and when to harvest.



Orchards

- ▶ Hourly temperature and precipitation information can help growers protect weather-sensitive fruit trees.



Energy

Coal

- ▶ Forecasts help planners estimate the beginning and end of the heating season.
- ▶ Seasonal weather forecasts can help managers project energy production requirements.



Oil rigs

- ▶ Forecasts of wind, visibility and ice conditions can help determine transport schedules to and from rigs.



Heating demand



Gas

- ▶ Temperature forecasts provide the opportunity to regulate the pressure in sensitive gas pipes.



Power transmission lines

- ▶ Historical data can guide the placement of lines to avoid power disruptions.
- ▶ Short-term weather forecasts can inform maintenance schedules.
- ▶ Electric load forecasting models can incorporate hourly temperature, humidity, precipitation, cloud cover and wind data for better accuracy.

Hydropower

- ▶ Historical data helps hydropower planners ensure sufficient water flow.
- ▶ Short-term weather forecasts can guide work schedules during the course of construction.
- ▶ Seasonal data helps water managers ensure sufficient water for agriculture and power production.
- ▶ Forecasts of extreme weather can lead to risk reduction measures.
- ▶ Short-term forecasts help determine operational contingencies, and medium-term forecasts help with planning.



Solar and wind power

- ▶ Weather forecasts can inform wind and solar power production projections.
- ▶ Historical data can guide the siting of installations, and shorter-term forecasts can inform the scheduling of maintenance.



Nuclear power

- ▶ Wind direction and speed are useful in emergency response.
- ▶ Historical data and weather forecasts can guide site planning and construction.
- ▶ Radiation monitoring helps managers understand background levels and detect leaks.
- ▶ Hydrology information can inform plant managers of the status and availability of cooling water.



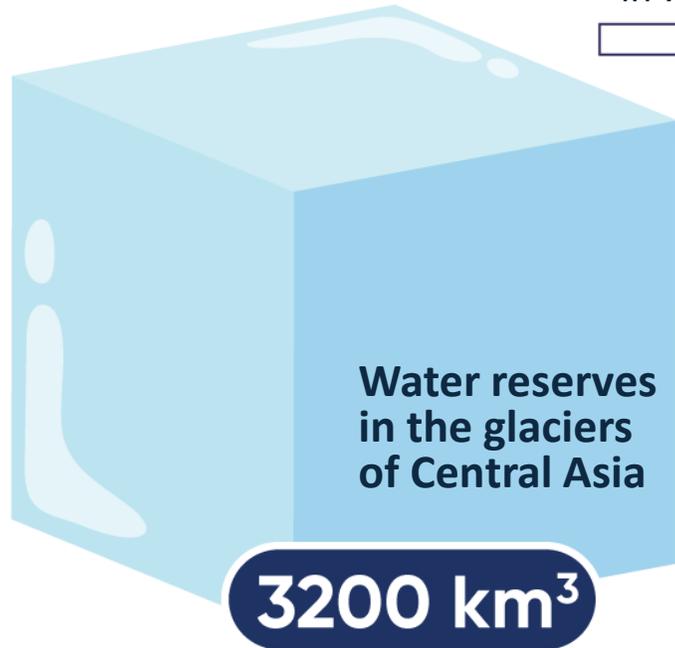
Sports, tourism and outdoor events



Scenarios for glaciers

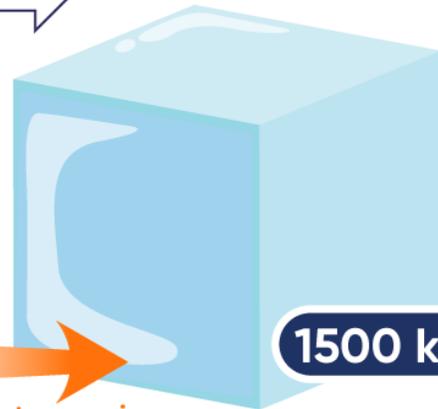


Projected reduction
in 70 years



moderate warming

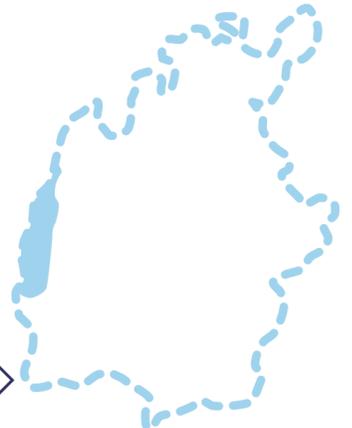
strong warming



A dramatic example of the Aral



Reduction
in 70 years



1960

2020s

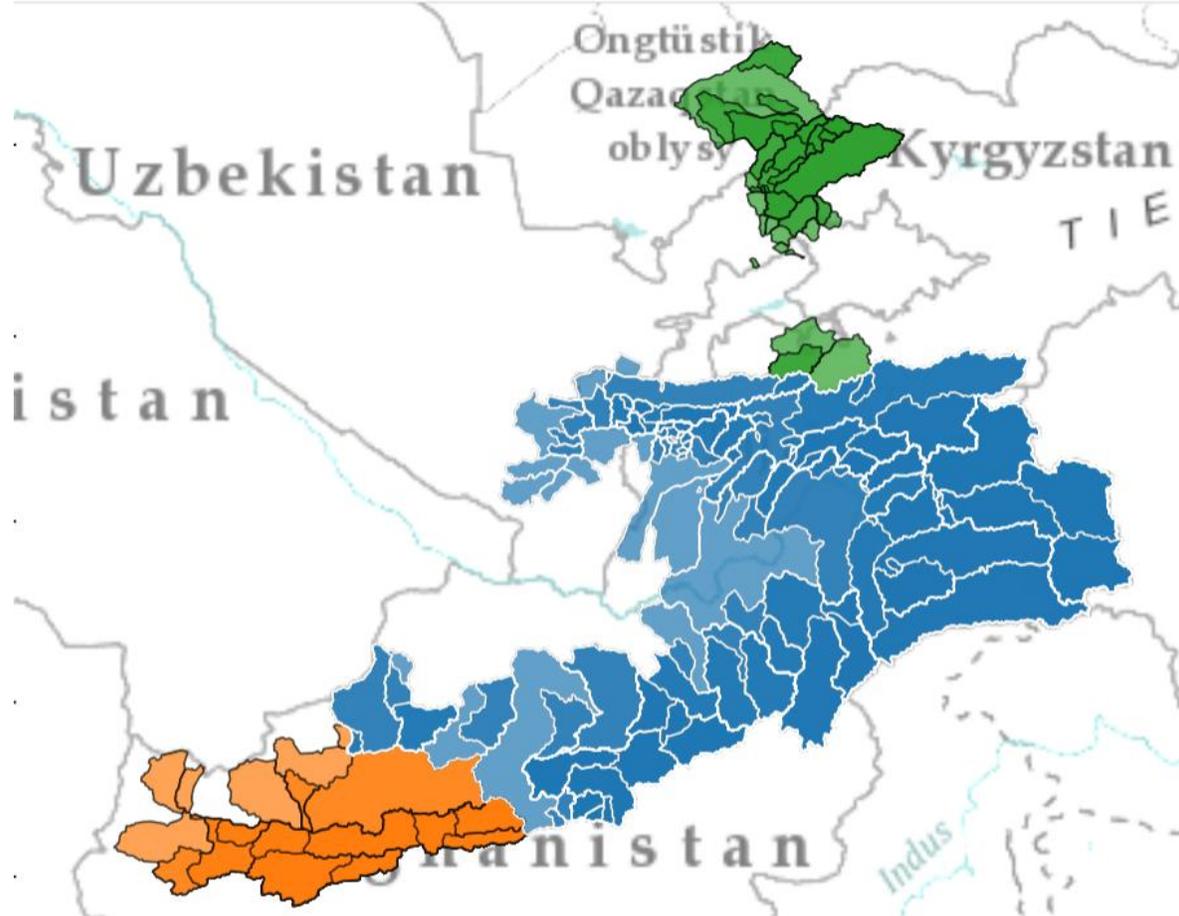
Water volume of the Aral Sea



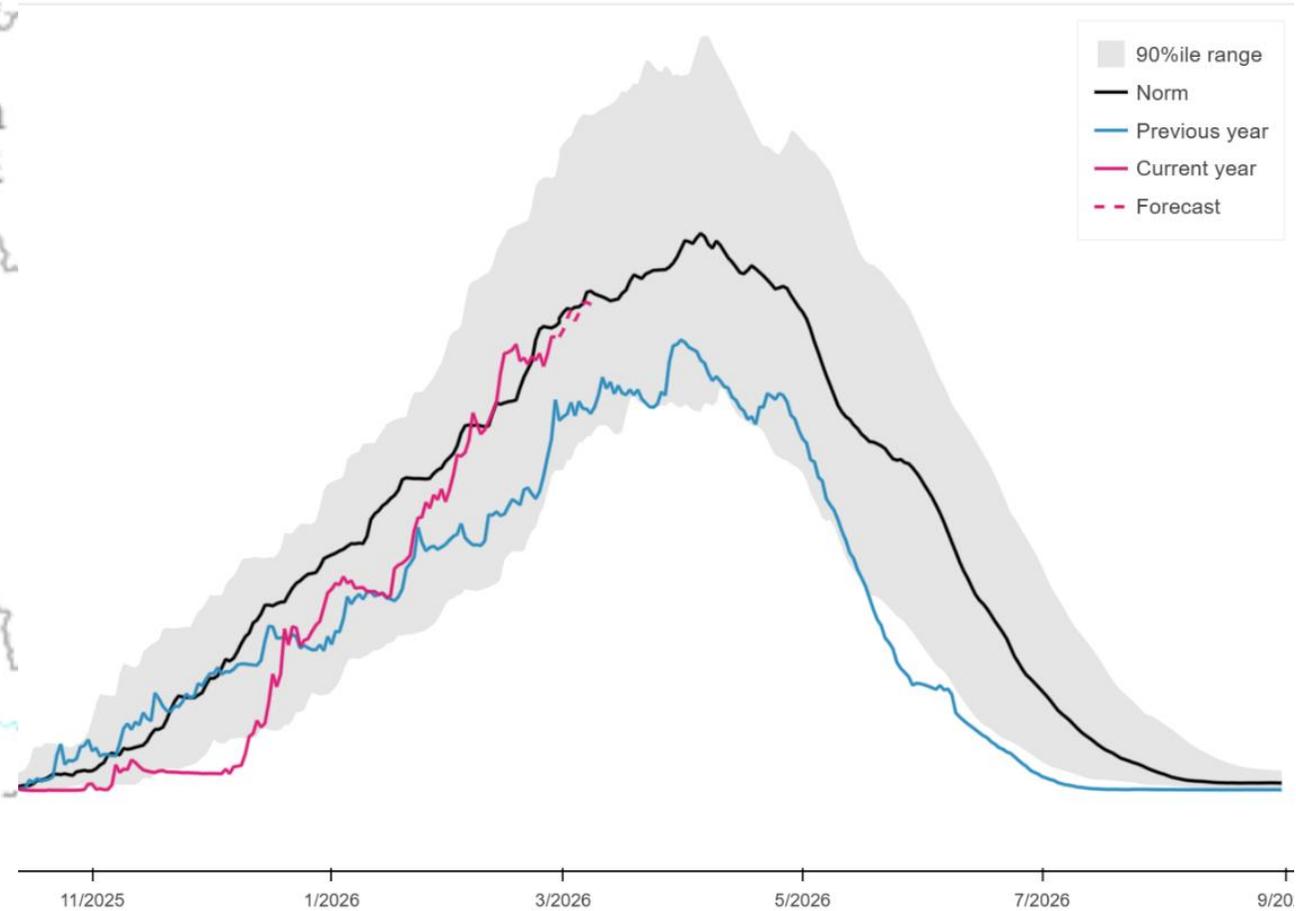


Snow Situation in Mountainous Central Asia

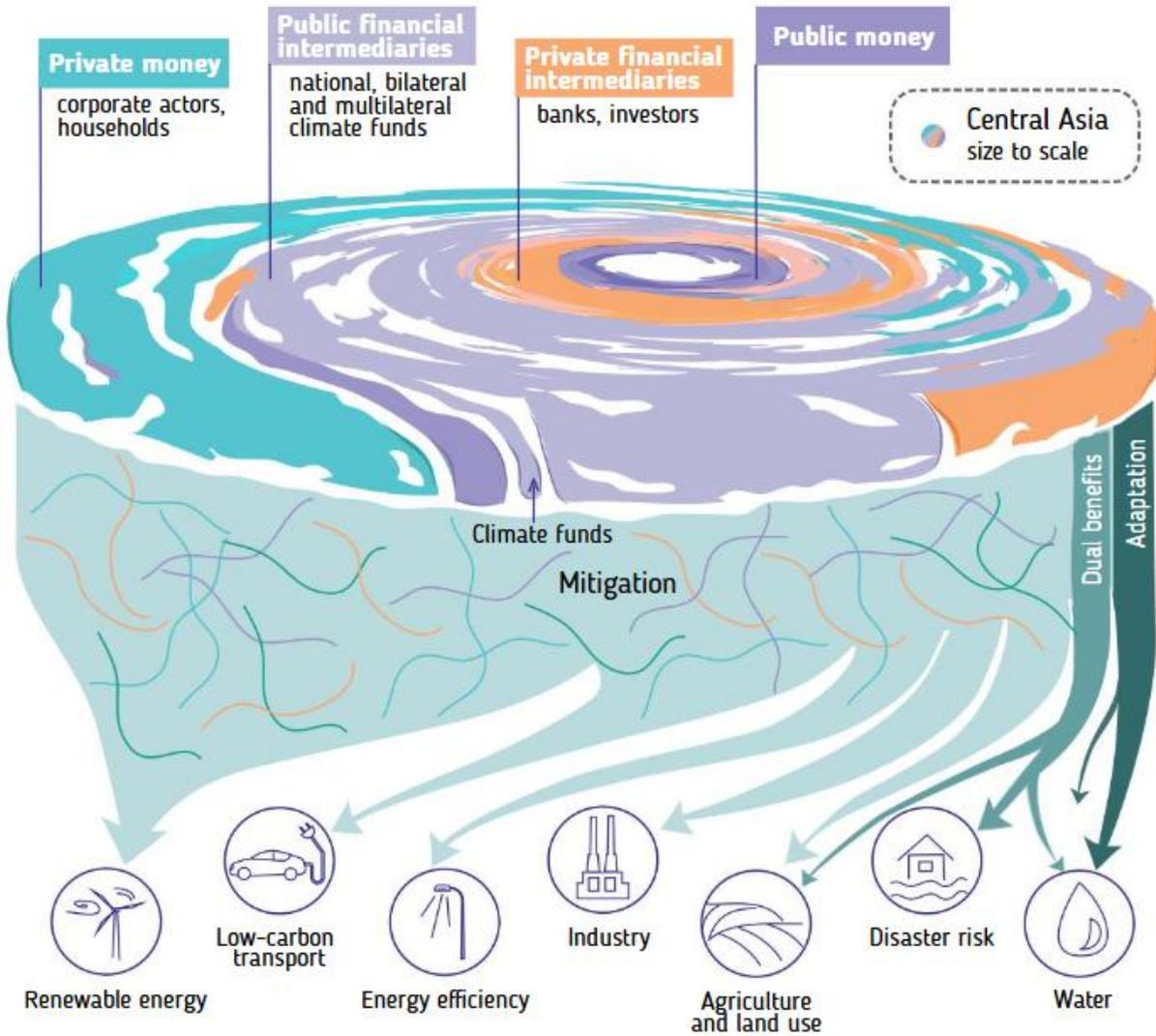
Regional river basins



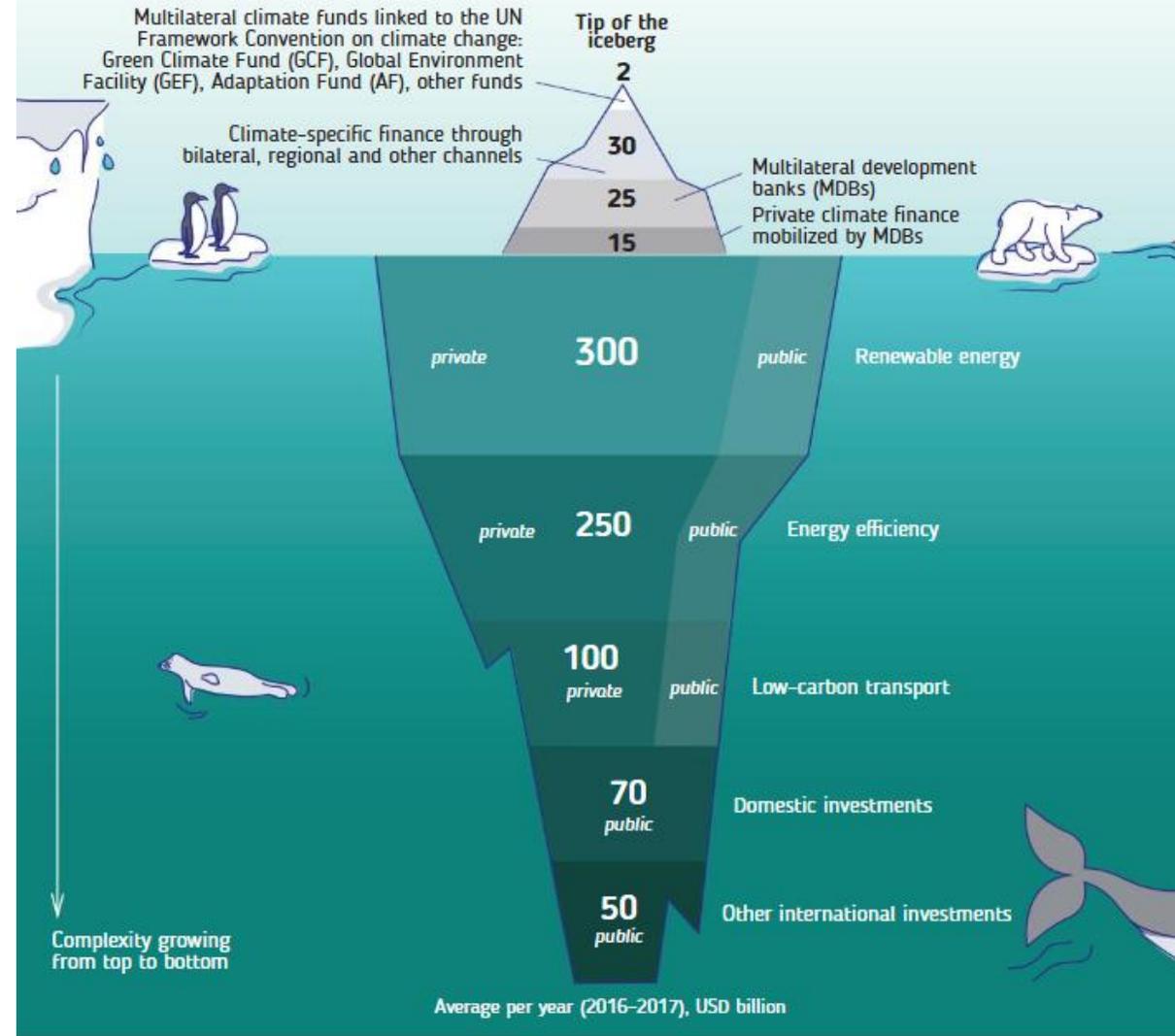
for the Amu Darya basin



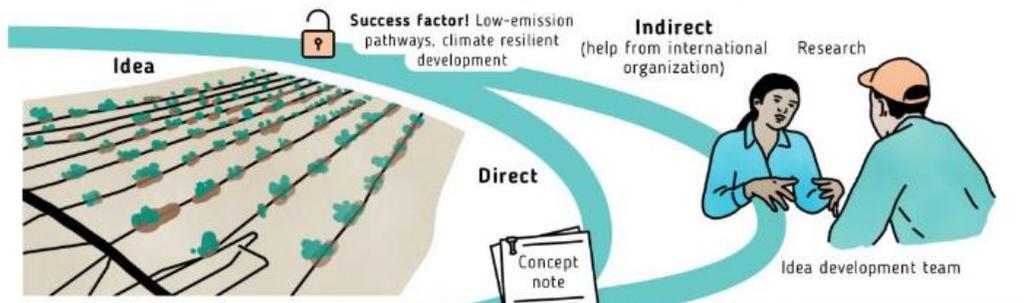
Global climate financing and Central Asia



Global climate financing profile



1. Idea development and concept note phase (duration around 6 months)



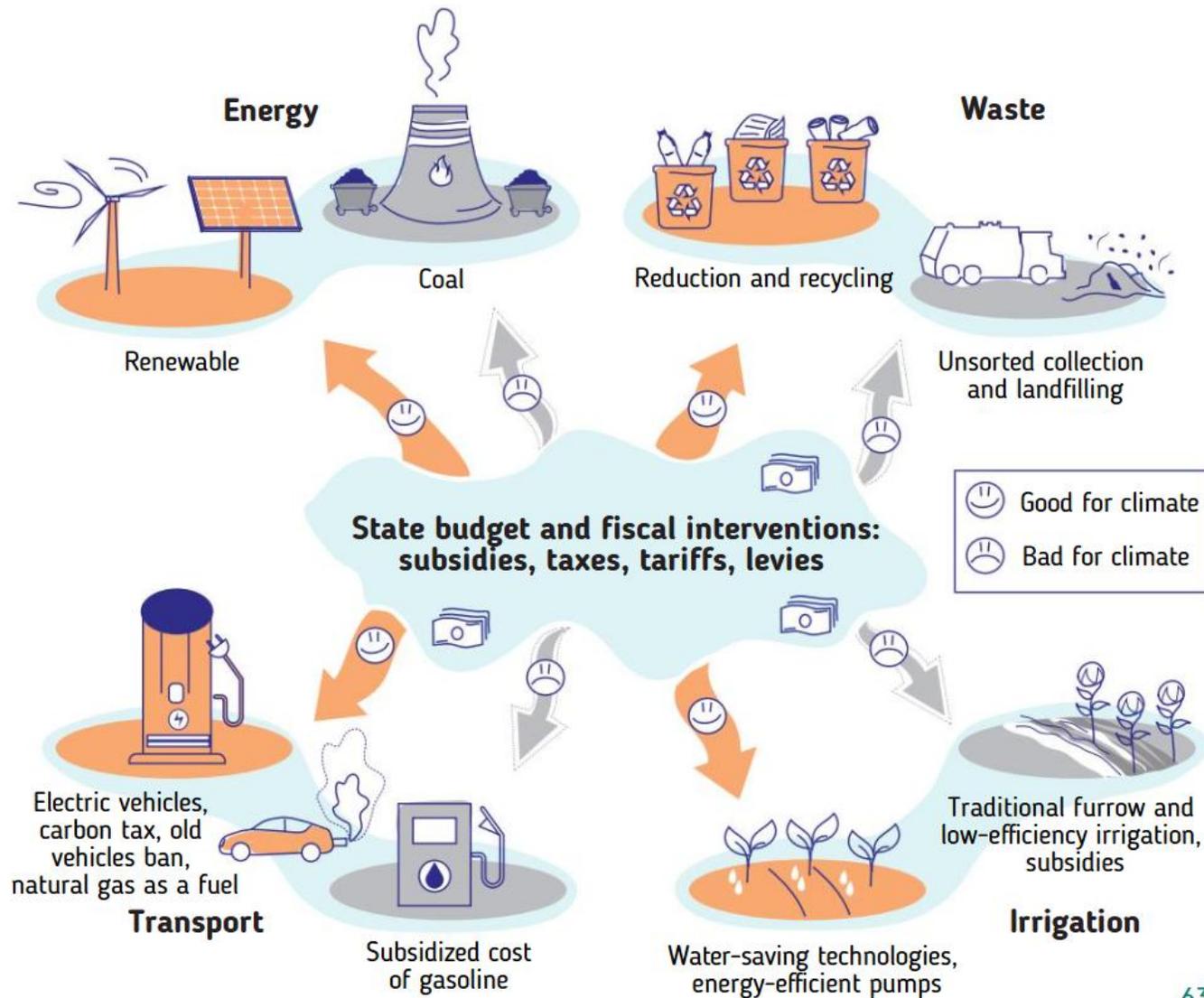
2. Proposal (duration around 6 months or longer)



3. Decision

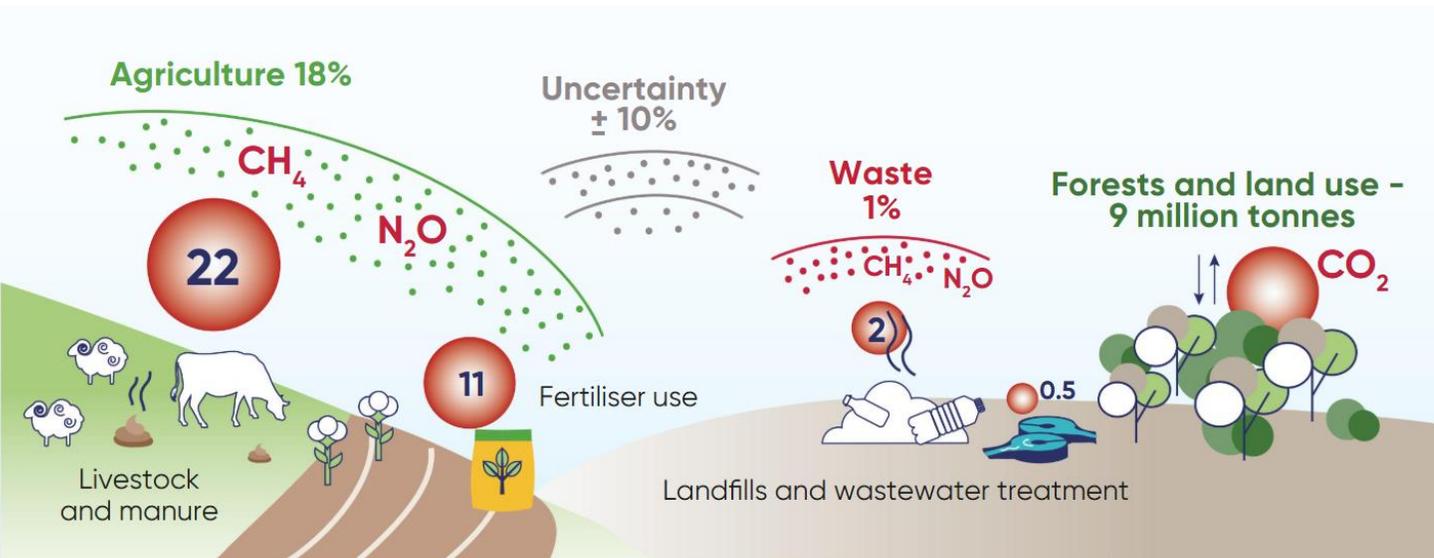
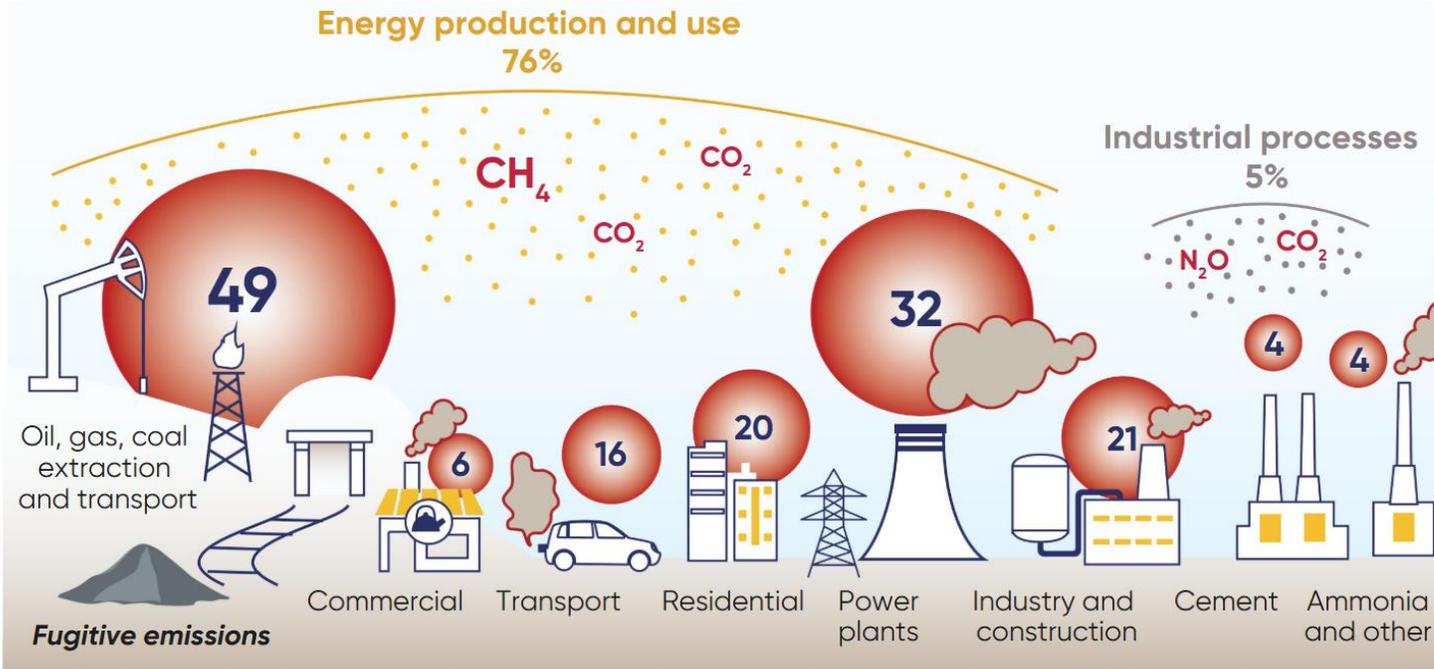


Domestic climate-relevant finance regulations

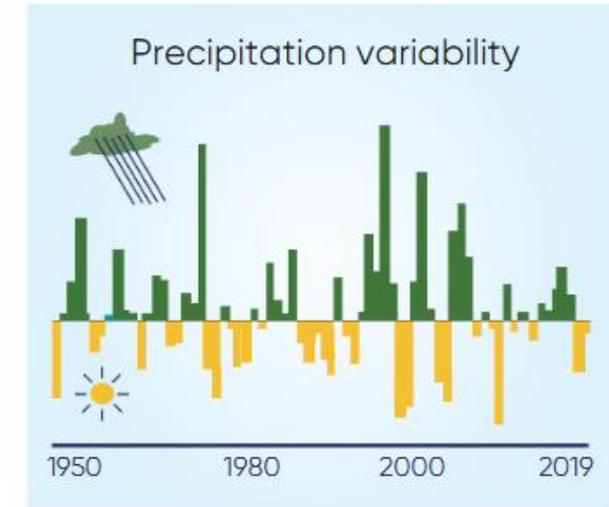
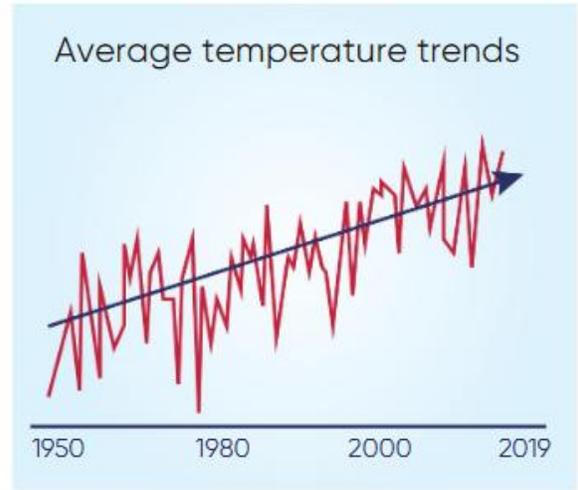


Uzbekistan GHG emissions

million tonnes of CO₂ - equivalent

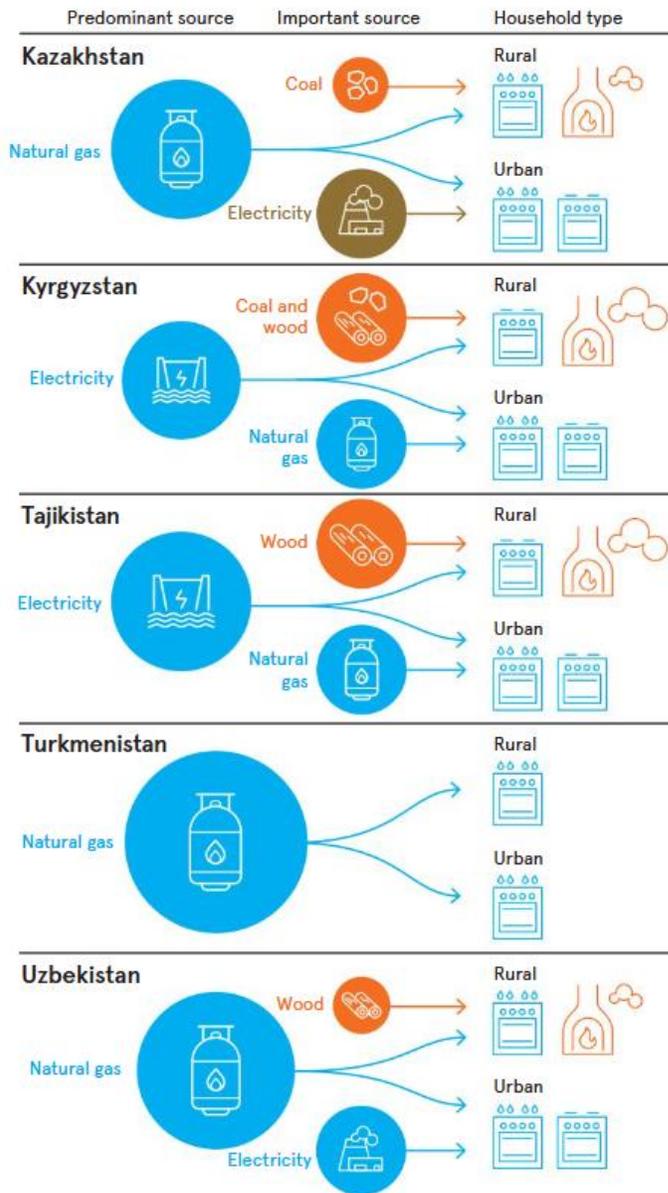


Uzbekistan climate change trends



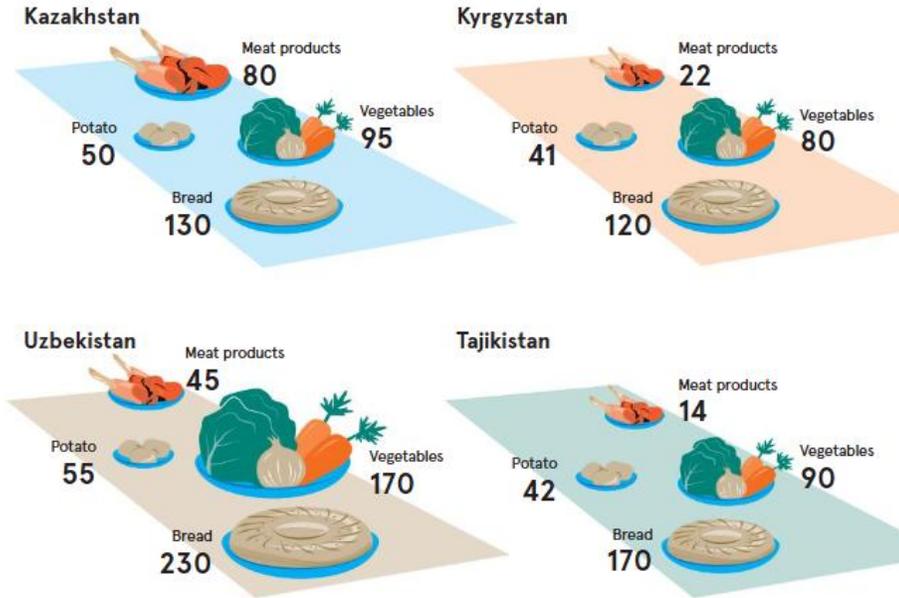
<https://zoinet.org/product/uzb-soe/>

<https://zoinet.org/product/ca-climate-2020/>



Food composition (diet)

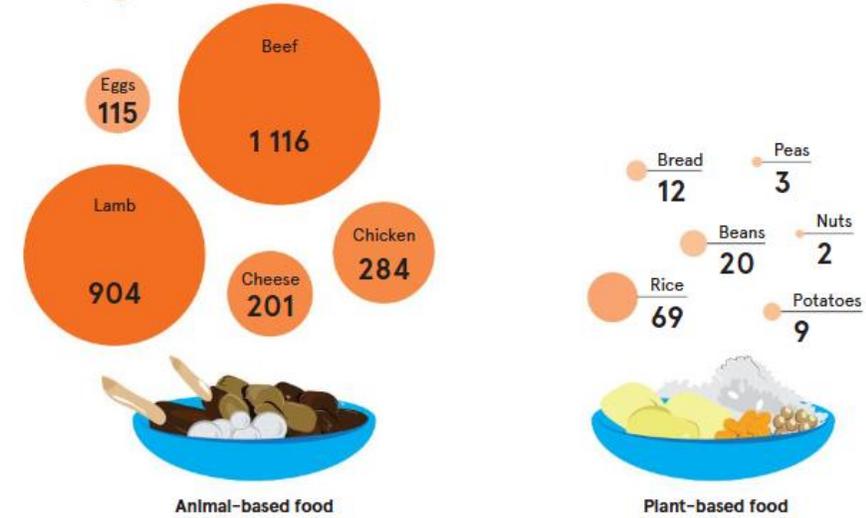
kg per year per person, latest available data for 2017-2019



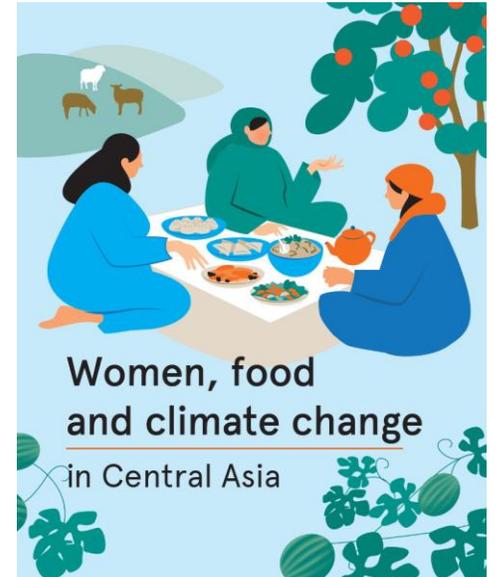
Emissions related to consumption

Annual GHG emissions related to food consumption

Emissions (in kg)*



* The calculation of emissions is based on a diet that includes the food item 3-5 times per week.



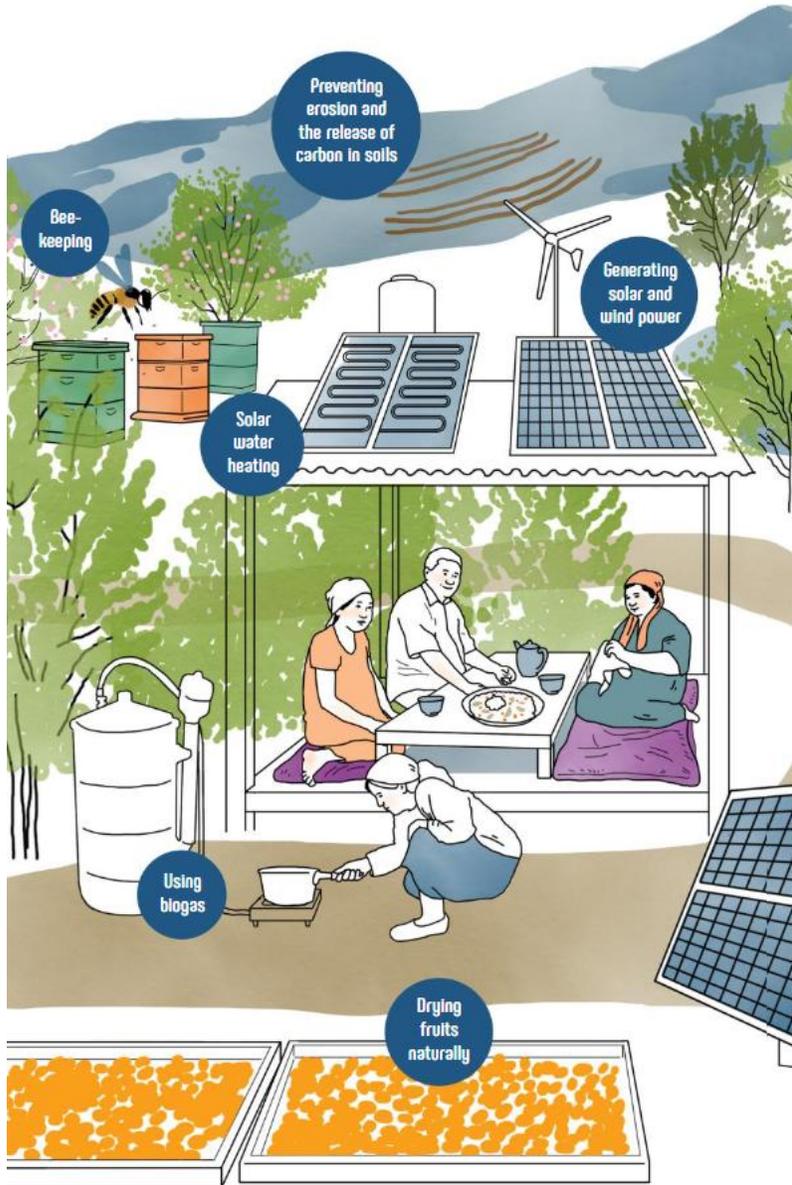
Climate-friendly and energy-saving approaches in an urban kitchen



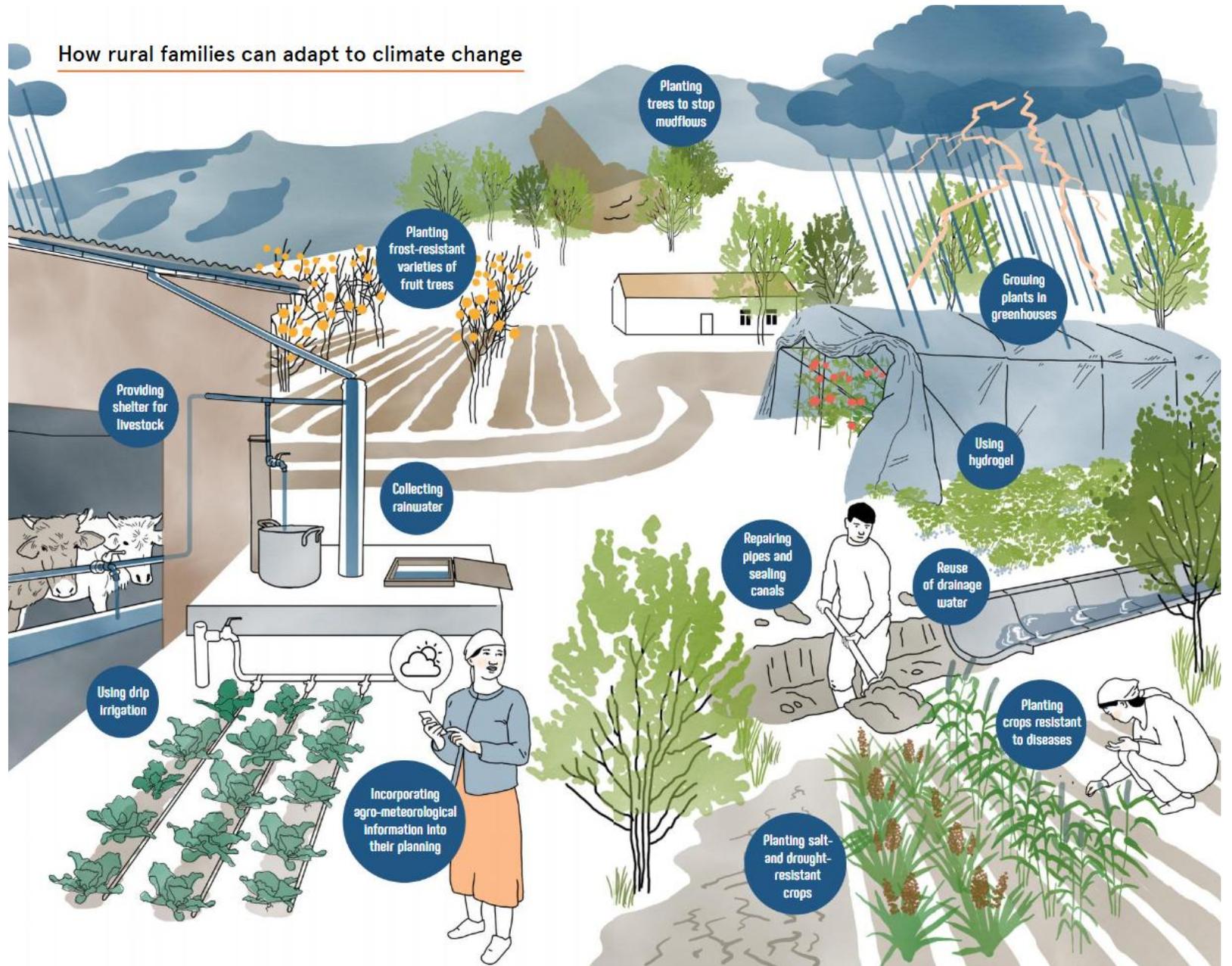
Climate-friendly and energy-saving approaches in a rural kitchen



How rural families can reduce their climate impacts



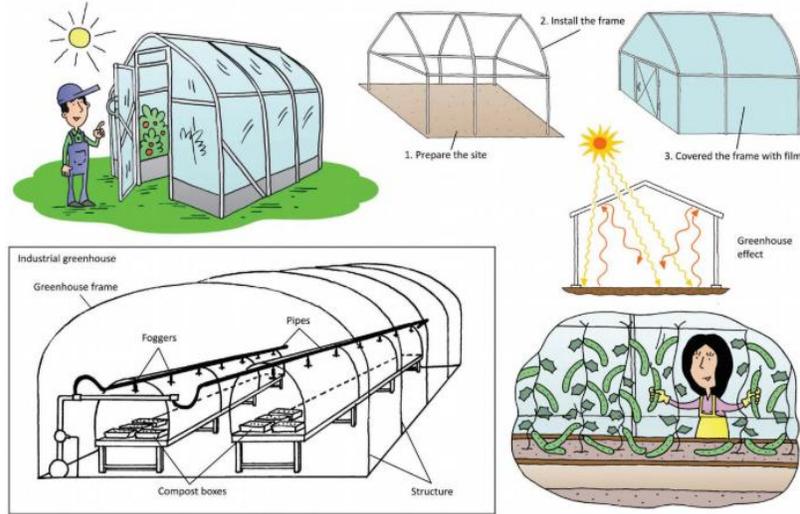
How rural families can adapt to climate change



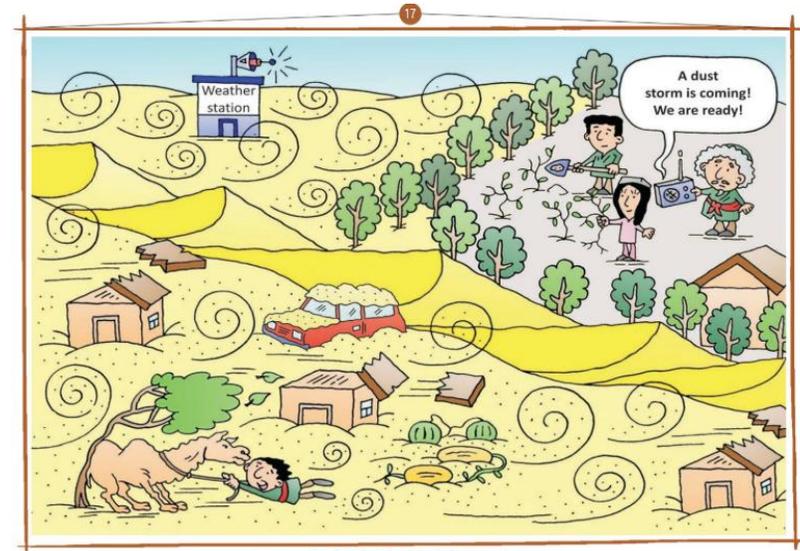
Green technologies and climate information:
application guide in cartoons



Greenhouse



Backyard or professional greenhouses reduce the impacts of adverse weather, and can grow crops almost year-round.



Forest shelter belts and early storm warnings reduce storm damage.

<https://zoinet.org/product/green-technologies-cartoons/>

Интенсивность метеорологических процессов: осадки и ветер / Шиддатнокии равандҳои ҳавошиносӣ: боришот ва шамол



<https://zoinet.org/product/ru-tj-hydromet-glossary/>