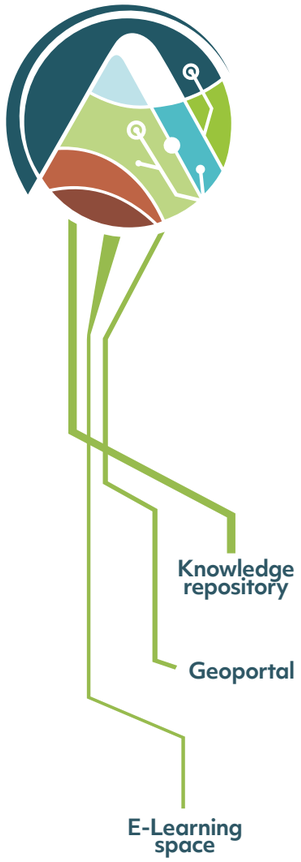
CACIP REVIEW

Issue 2: October-December 2021

AGRICULTURE AND ADAPTATION TO CLIMATE CHANGE

CENTRAL ASIA
CLIMATE INFORMATION PORTAL
centralasiaclimateportal.org



The Central Asian Climate Information Platform (CACIP) collects, organizes and creates visualizations of public domain climate and climate-relevant data and information, and supports their analysis and dissemination for decision-making. The platform provides links to high-quality data sets from global, regional and local sources and to analytical tools and interfaces for data visualization and interpretation.

Drawing on the themes and content of the information platform, CACIP Review's quarterly informational and analytical publications provide accessible and comprehensive analyses of various environmental and climate change issues in Central Asia. The Review is intended both to inform the general public and to support evidence-based and effective policy decisions for combating climate change. This second issue of CACIP Review focuses on links between climate change and Central Asian agriculture.

CACIP is developed by the Regional Environmental Center for Central Asia (CAREC) in collaboration with the International Center for Agricultural Research in the Dry Areas (ICARDA) within the framework of the Climate Adaptation and Mitigation Program for the Aral Sea Basin funded by the World Bank. The information platform continuously receives reliable data and information provided by key partners such as relevant authorities, international organizations and Central Asian NGOs.

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CACIP Review Issue 1
https://centralasiaclimateportal.org/geonode/knowledgehub/documents/53894

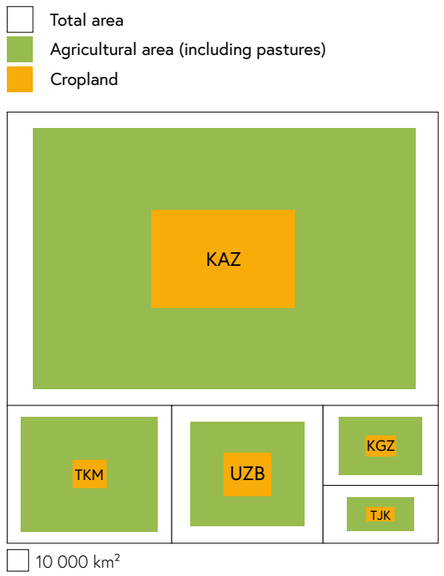
Agriculture in Central Asia

The highly important agricultural sector of Central Asian economy occupies 70 per cent of the land and provides jobs to a significant number of people – from 15 per cent of those employed in Kazakhstan to 45 per cent in Tajikistan.

Down by 30–40 per cent during the 1990s, Central Asian agricultural production has grown steadily since then. The production of milk almost doubled over the last three decades, while the production of fruit and vegetables more than tripled, and today not only meets the needs of the region but is also becoming a high-value complement and competitor to the traditional exports of water-intensive cotton and grains.

Climate change is becoming an obstacle to further growth and sustainability of Central Asian agriculture. The borders of agroecological zones are projected to shift, and the region overall is projected to become hotter and less suitable for traditional cultivation.

Agricultural land-use in Central Asian countries, 2019

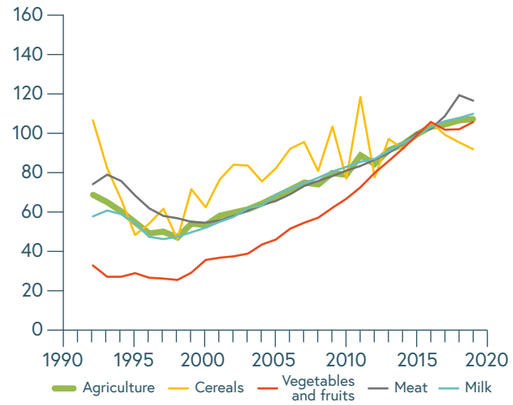


Cartogram produced by Zoï Environment Network, September 2021
Source: FAOSTAT (www.fao.org/faostat) →

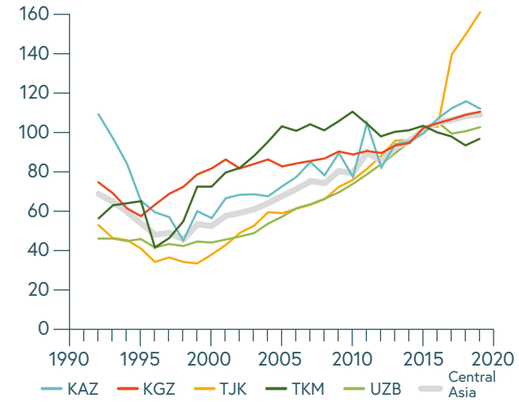
Agricultural production in Central Asia, 1992-2019

Gross Production Index (2014-2016 = 100)

Regional agricultural production



National agricultural production



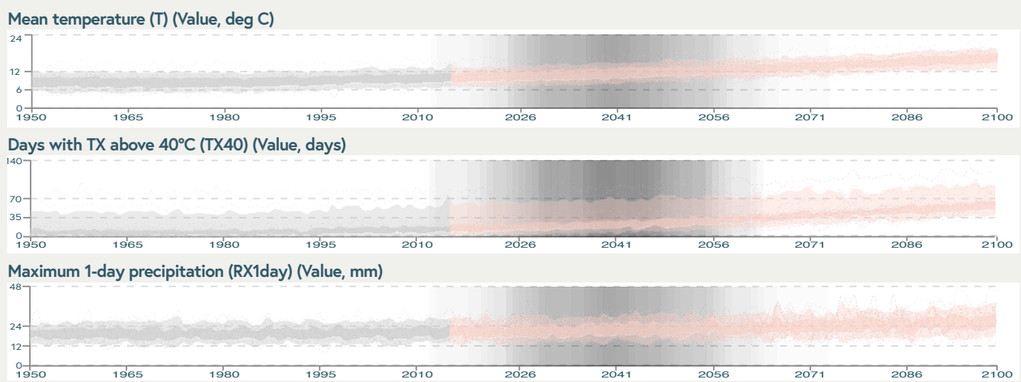
Data source: FAOSTAT http://www.fao.org/faostat/

@CACIP FAO Earth Map centralasiaclimateportal.org/tools/11
@CACIP Food Systems Dashboard centralasiaclimateportal.org/tools/17
@CACIP Crop Growth Monitoring System for Central Asia centralasiaclimateportal.org/tools/22

New findings – stronger trends

In 2021, the Intergovernmental Panel on Climate Change issued a report that builds on updated global GHG emission scenarios and new ways of synthesizing outputs from dozens of climate models. The report confirms and strengthens evidence about projected climate trends worldwide and across Central Asia. Under the high emissions scenario, average temperature in the Amu Darya basin is projected to increase by 5°C by the end of the century compared to today. Days with maximum temperature above 40°C are projected to grow from about 20 per year now to 60 per year by 2100. Changes in the overall precipitation remain uncertain, but the frequency and intensity of heavy rains will increase.

2021 IPCC projections of climate parameters for the Amu Darya basin



Source: IPCC WGI Interactive Atlas, https://interactive-atlas.ipcc.ch/

Present climate zones

- Arid desert
- Arid steppe
- Dry continental
- Humid continental
- Temperate
- Sub-polar / polar
- Irrigated cropland
- Rain-fed cropland

Potential future climate zones

- Climate zone changes compared to present time
- Direction of shifts of climate zone borders
- Vertical shift of climate zones in mountain ranges

Petropavlovsk
Kostanay
Lake Siletiteniz
Tobol
Russia
Uralsk
Ural
Aktobe
Esil
Nur-Sultan
Pavlodar
Irtysh
Semey
Oskemen
Lake Tengiz
Karaganda
Kazakhstan
Lake Zaysan
Atyrau
Sarysu
Northern Aral Sea
Balkhash
Lake Balkhash
Lake Alakol
Caspian Sea
Western Aral Sea
Aktau
Kyzylorda
Chu
Ili
Syr Darya
Almaty
Kapchagay Res
Taraz
Shymkent
Bishkek
Issyk-Kul
Karakol
Azerbaijan
Kara-bogazgol
Sarygamysh Lake
Nukus
Dashoguz
Urganch
Uzbekistan
Talas
Kyrgyzstan
Tashkent
Namangan
Naryn
Turkmenbashi
Balkanabat
Amu Darya
Aydar Lake
Ferghana
Osh
China
Turkmenistan
Bukhara
Samarkand
Khujand
Karakum Canal
Turkmenabat
Karshi
Zeravshan
Dushanbe
Tajikistan
Ashgabat
Bokhtar
Panj
Vakhsh
Mary
Termiz
Khorog
Tejen
Murghab
Iran
Afghanistan
Pakistan

0 200 km

Map produced by Zoi Environment Network, September 2021

Source: Present and future Köppen-Geiger climate classification maps at 1-km resolution; Beck, H.E., N.E. Zimmermann, T.R. McVicar, N. Vergopolan, A. Berg, E.F. Wood (www.gloh2o.org/koppen/)

Vulnerability of Central Asia's agriculture to climate change

Direct climate extremes such as heavy rainfall, hot nights and days, droughts, floods and cold have already affected crop suitability in many areas of Central Asia, as have indirect climate extremes such as the spread of pests and diseases facilitated by the changing climate. Global climate change and extreme weather affect crop yields and nutrient content and threaten food security. The projected changes are expected to have negative effects on livestock, fisheries, aquaculture, and on the suitability of land for agricultural use in some areas.

Kazakhstan's agricultural sector is dominated by the production of wheat, a major export crop for the largest producer and exporter of wheat in Central Asia. Other important crops include barley, cotton, sugar beets, sunflower and flax. Overall, Kazakhstan's agriculture is not strongly affected by climate change, and may even experience growth in productivity, but with large regional differences within the country. While Kostenay and North Kazakhstan provinces may see increased productivity, West Kazakhstan, Almaty, Zhambyl, Atyrau, Aktobe and Turkestan provinces will see declining productivity, with the southern provinces experiencing greater impacts due to low adaptive capacity and possible land degradation.

Kyrgyzstan's agriculture sector produces mainly animal fodder, wheat, barley and maize. Minor crops include tobacco, cotton and potatoes. The areas most vulnerable to climate change are Chuy, Issyk-Kul and the eastern part of Jalal-Abad and Osh provinces. Batken and Osh provinces could very well experience an increase in agricultural productivity thanks to increased levels of precipitation and a lower risk of drought.

Tajikistan's predominant crop is cotton, and the country imports approximately 70 per cent of its food. Climate change may cause an overall decrease in Tajikistan's agricultural productivity, although with regional variations. While a decrease is likely in Khatlon province, agriculture in the Fergana Valley may experience a slight rise due to greater precipitation and fewer droughts.

Turkmenistan's two most important crops are cotton – most of which is produced for export – and domestically consumed wheat. Citrus, dates and fibre crops are grown in oases. Most arable farming is irrigated and reliant upon water supply, and the areas hardest hit by climate change will be Dashoguz and Mary provinces due to the extended duration of droughts in combination with heavier precipitation. Livestock is also projected to be significantly affected.

Uzbekistan's most important crops are wheat and cotton. Other crops include potatoes and various fruits and vegetables. Like elsewhere in the region, the future and productivity of Uzbek agriculture is in particular threatened by the declining availability of water for irrigation: irrigated grain yields 6.5–7.0 tonnes per hectare, while rain-fed grain yields only 500 to 700 kilograms per hectare. The Surkhondarya, Jizzaks, Syrdarya and Tashkent provinces are expected to be the most affected. The overall decrease of soil productivity already evident in eastern Navoy, southern Kashkadarya, Surkhondarya, Tashkent and eastern Syrdarya and Fergana provinces may exacerbate climate impacts in those areas.

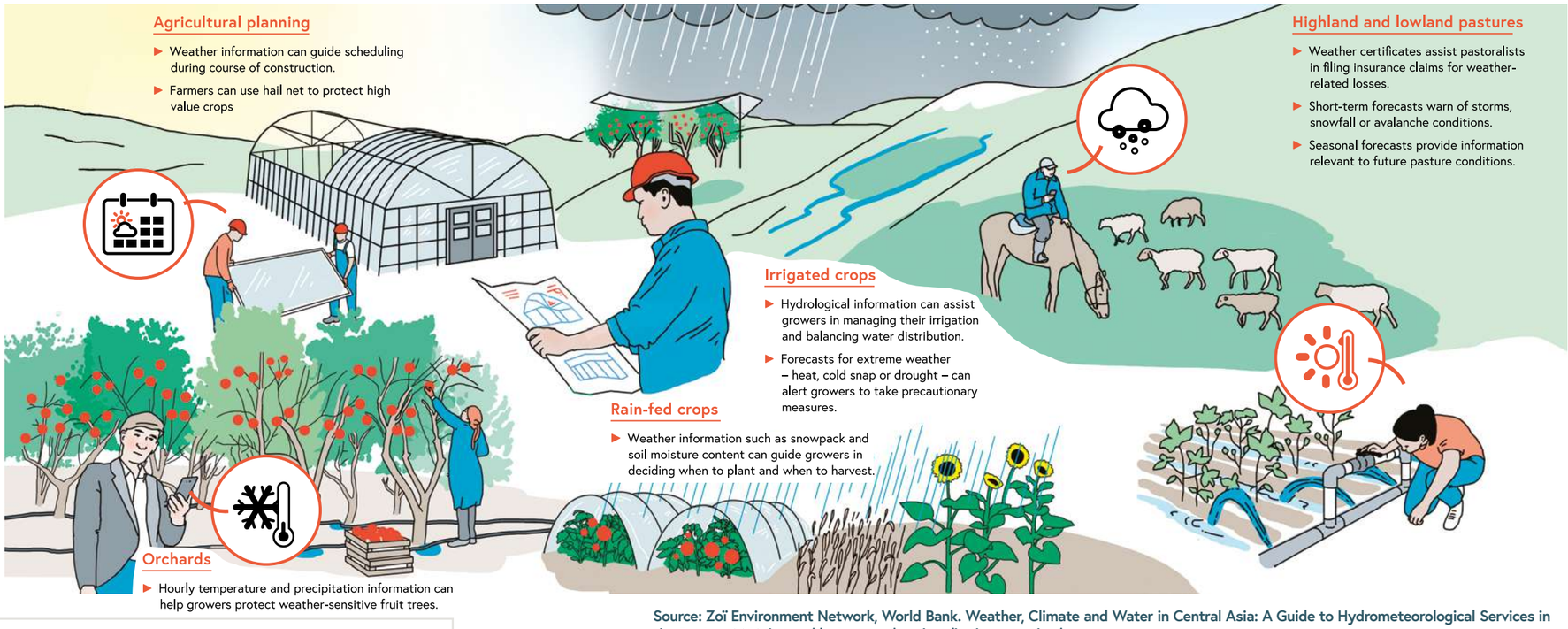
@CACIP Climate Dashboard centralasiaclimateportal.org/
@CACIP Central Asia Climate Dynamics centralasiaclimateportal.org/tools/25
@CACIP Current weather and trends in Central Asia centralasiaclimateportal.org/tools/28

A real-life case for adaptation: climate impacts on horticulture in Uzbekistan

The fruits and vegetables that have always been a vital part of Uzbek agriculture, serving both domestic and – increasingly – export demand include native species of apples, pears, almonds and pistachios. Orchards and vineyards occupy nearly 11 per cent of the country's cultivated (mostly irrigated) land, and a further 7 per cent are used for potatoes and other vegetables. While horticultural crops are widely produced by dehkan farmers for their own consumption, the commercial production of fruits and vegetables occurs mainly in the Fergana Valley, Tashkent and Samarkand oblasts, which are closer to the main consumption centres and have more suitable soil conditions. Tashkent, Samarkand and Andijan oblasts together produce almost 50 per cent of the country's vegetables. Uzbekistan's government is actively supporting the expansion of the horticultural sector, seeking to transition farmers from traditional cotton and wheat production to higher-value fruit and vegetable crops.

Horticultural production and yields are strongly influenced by weather and climate. The increasing climate aridity, the scarcity of water and the frequency of extreme weather events – droughts, early frosts, heavy rainfall, sandstorms and cold and heat waves – are affecting all parts of Uzbekistan. Over the last two decades, Uzbekistan has experienced several periods of drought, during which the affected areas lost 50–75 per cent of the agricultural harvest. Cold waves have caused significant damage too, in particular to horticulture. In recent years, night frosts and early flowering of fruit trees followed by snowfall have resulted in 15–30 per cent losses in yield. The most frequent damage to fruit and vegetable plantations from extreme weather during the last decade has occurred in the Tashkent, Jizzakh and Kashkadarya oblasts. Long-term losses related to climate change are expected to reach 50–60 per cent for apples, tomatoes and potatoes depending on the region and the GHG emission scenario.

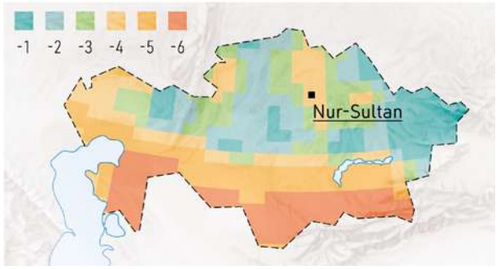
Source: Developing agrometeorological information services for climate change resilient production of fruit and vegetables in Uzbekistan. Green Climate Fund, 2019, https://www.greenclimate.fund/document/developing-agrometeorological-information-services-climate-change-resilient-production



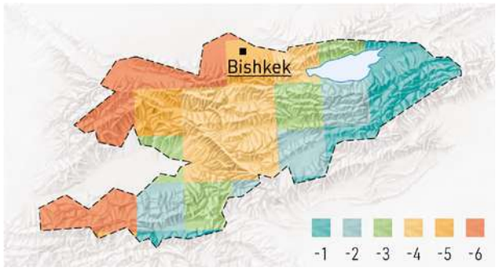
Source: Zoï Environment Network, World Bank. Weather, Climate and Water in Central Asia: A Guide to Hydrometeorological Services in the Region, 2019, https://zoinet.org/product/hydromet-atlas/

CACIP maintains a wide range of information on the effects of climate change across economic sectors. Maps provide detailed insights into the agriculture sector's vulnerability in Central Asian countries and potential adaptation options, and aggregated maps can support and facilitate dialogue, decisions and planning for adaptation to climate change both in the individual countries and in Central Asia as a whole.

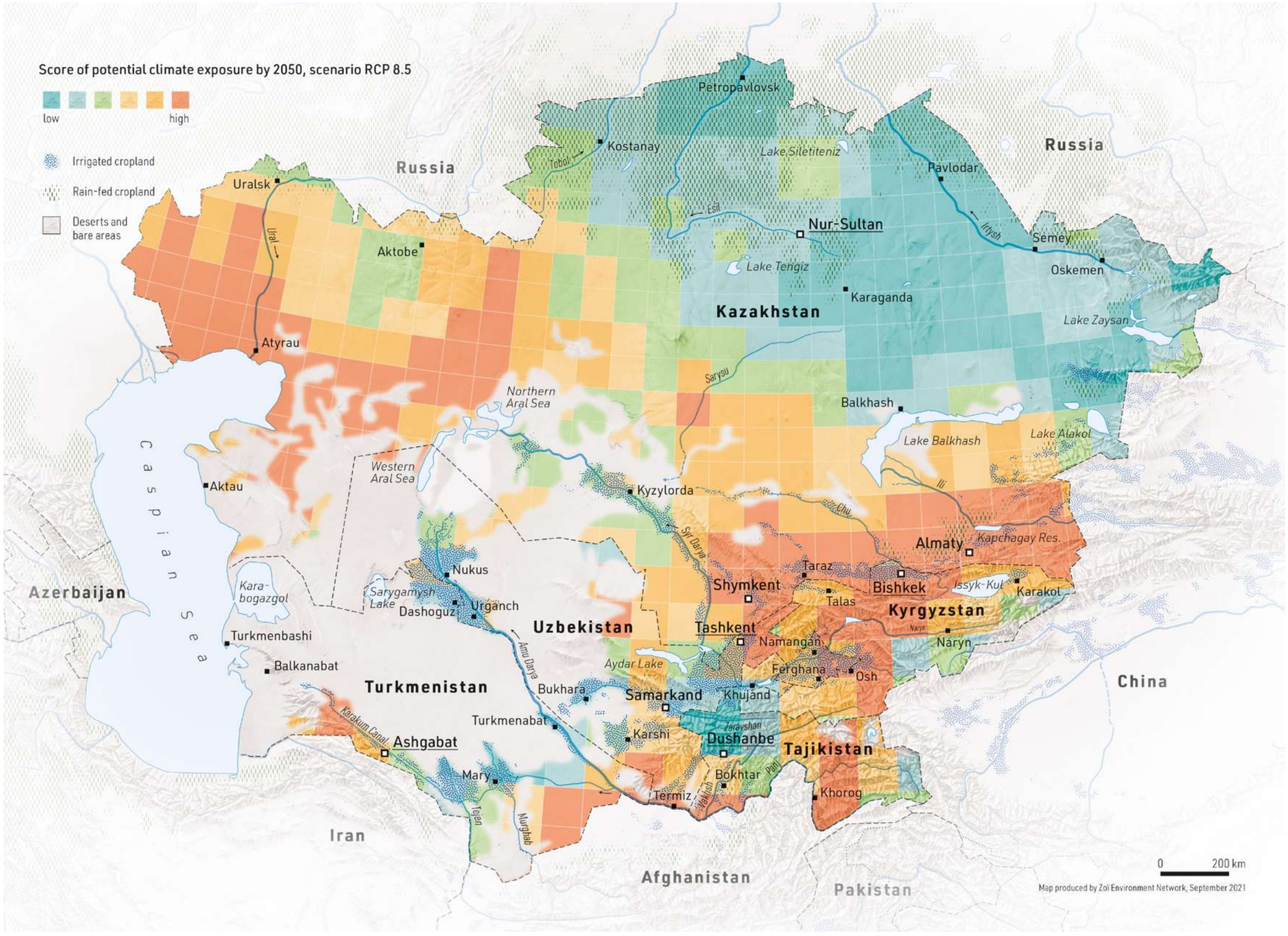
Climate exposure scores for rain-fed and irrigated agriculture in Kazakhstan by 2050



Projected change in the number of frost nights in Kyrgyzstan by 2050



Projected change in 50-year flood risk in Turkmenistan by 2050



Source: central asia ADAPT, https://crva.centralasiaclimateportal.org/

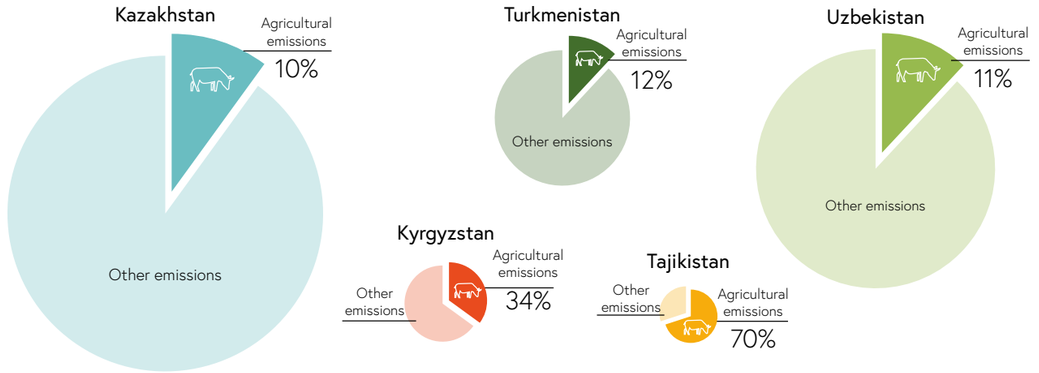
@CACIP Country maps of sensitivity, vulnerability and adaptation to climate change centralasiaclimateportal.org/geonode/maps/

@CACIP Agriculture Water Productivity Mapping for Central-Asia centralasiaclimateportal.org/tools/9

@CACIP Statistical and spatial data about climate change, water, land and agriculture centralasiaclimateportal.org/geonode/DataSets/ and centralasiaclimateportal.org/geonode/layers/

Agriculture as a contributor to climate change

Agricultural emissions as a part of total emissions



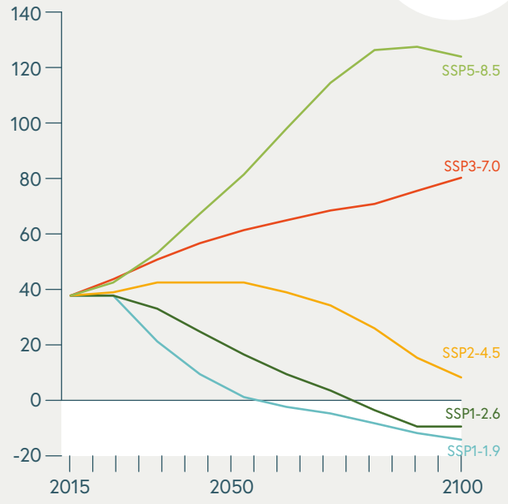
The sources of agricultural greenhouse gases are many and varied. Globally, most agricultural emissions come from livestock belching methane. Other methane emissions come from the cultivation of rice. The addition of fertilizers to soils results in releases of nitrous oxide. The burning of crop waste releases carbon dioxide, and ploughing and tilling the land releases gases trapped in the soil. The use of fuel in tractors and other farm equipment results in carbon emissions.

Growers have opportunities to reduce the emissions from their farms and to adapt their farms to the effects of climate change. Using composted manure, for example, improves the soil and reduces emissions compared to simply spreading manure or using chemical fertilizers. Likewise, the use of biological rather than chemical pest controls lowers emissions. And rice growers can apply proven techniques that reduce emissions and require less water while boosting yields. More efficient irrigation reduces the energy needed for pumping while also reducing water losses. Better land use management can increase the carbon sequestration capacity of soils and forests and improve growing conditions.

IPCC emission scenarios

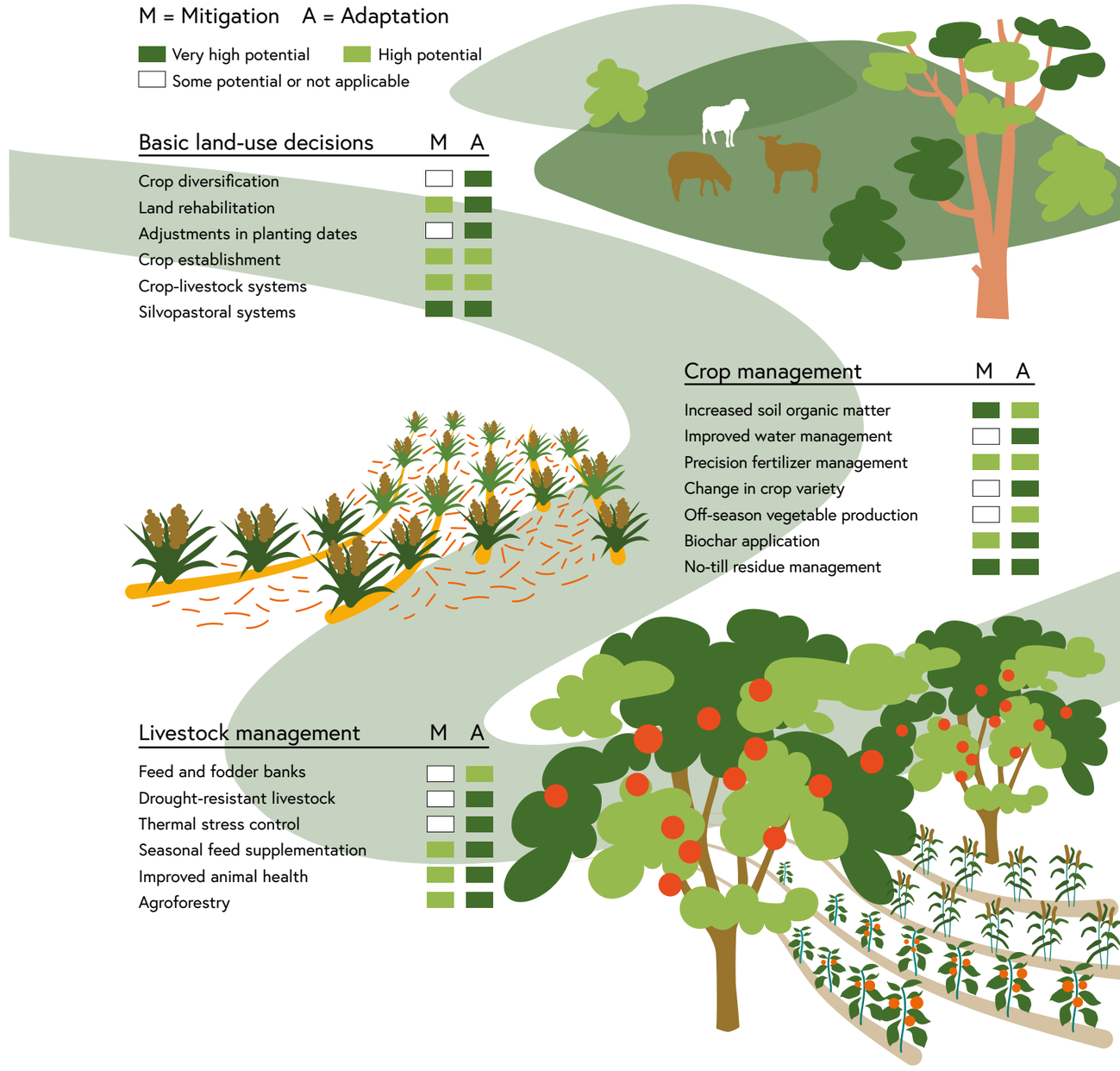
In its 6th Assessment Report, the IPCC uses five new emissions scenarios to project the climate response to a range of greenhouse gas, land use and air pollutant futures:

- → Very high GHG emissions (SSP5-8.5) and CO_2 emissions that roughly double from current levels by 2050
- → High GHG emissions (SSP3-7.0) and CO_2 emissions that roughly double from current levels by 2100
- → Intermediate GHG emissions (SSP2-4.5) and CO_2 emissions remaining around current levels until the middle of the century
- → Low GHG emissions (SSP1-2.6) and CO_2 emissions declining to net zero after 2050
- → Very low GHG emissions (SSP1-1.9) and CO_2 emissions declining to net zero around 2050



Source: Regional Environmental Centre for Central Asia, Zoï Environment Network. Women, food and climate change in Central Asia, 2020, https://zoinet.org/wp-content/uploads/2020/10/women-food-climate-en.pdf

Opportunities for mitigation and adaptation in the food system



Source: Regional Environmental Centre for Central Asia, Zoï Environment Network. Women, food and climate change in Central Asia, 2020, https://zoinet.org/wp-content/uploads/2020/10/women-food-climate-en.pdf

Adaptation pathways for Central Asian agriculture

Developed through CAREC's CAMP4ASB project with funding from the World Bank

LOCAL LEVEL

Arable Farming

Heat-resistant or earlier-ripening crops
Shifting from annuals to perennial crops
Adapted and proofed seeds and planting
Shaded cultivation
Low-till and no-till ploughing
Measures to contain pests and deceases

Livestock and pasture management

Optimizing access to water for livestock
Securing local drinking water supplies
Moving from free to rotational pasturing
Mobile electric fencing and canine herder use
Use of fodder crops that demand less water
Providing shade for livestock
More sustainable mixes of livestock
Haymaking for emergency fodder supply
Timely sale of livestock during drought
Lower quantity and higher quality of livestock
Migration corridors for migratory herds

Horticulture

Shaded cultivation
Drip irrigation
Use of crops that demand less water and are heat-resistant

REGIONAL LEVEL

Repair, sale, lease, financial and insurance services
Extension services, education and awareness
Investment facilities and market support
Value chains for new breeds and crops
Insurance and early warning for hazards
Risk management monitoring and planning
Processing and storage facilities

NATIONAL LEVEL

Early warning facilities and information freely provided to people
Investment in hydrometeorological monitoring
Funding for agriculture adaptation research
Improved distribution of seeds
Protection of genetic crop diversity
Development of new crop varieties
Help in diversifying smallholders' income
New or stronger social security systems
Weather-based insurance for smallholders
Improving access to finance
Improving rights and resources for women
Transition funds for farmers most affected by climate change
Assistance to pastoralists
Facilitating climate-smart decision-making
Support for adaptation-mitigation synergies
Land and water conservation at landscape scale

Source: summarized from the Regional Climate Vulnerability, Risk and Adaptation Portal (central asia ADAPT), https://crva.centralasiaclimateportal.org/

@CACIP Interactive map of the best water, land, and energy practices in Central Asia centralasiaclimateportal.org/tools/5

@CACIP Training courses in adaptation to climate change elearn.centralasiaclimateportal.org/

Information sources for the narrative:

- Regional Climate Vulnerability, Risk and Adaptation Portal (central asia ADAPT) https://crva.centralasiaclimateportal.org/
- Intergovernmental Panel on Climate Change. Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report https://www.ipcc.ch/report/ar6/wg1/
- Regional Environmental Centre for Central Asia, Zoï Environment Network. Women, food and climate change in Central Asia, 2020, https://zoinet.org/wp-content/uploads/2020/10/women-food-climate-en.pdf
- Inputs from national hydrometeorological services

Text, design and layout, maps, graphics, editing and translation: Zoï Environment Network.