ERASMUS-EDU-2023-CBHE
Project number: 101129032

Duration: 36 months
(01/01/2024 – 31/12/2026)

LESLIE
LAND MANAGEMENT
ENVIRONMENT &
SOLID-WASTE

MICRO-CREDENTIAL

CLIMATE CHANGE FOR SUSTAINABLE LAND MANAGEMENT IN CENTRAL ASIA

6. – Agriculture, Food Security and Rural Livelihoods

Crop Yields, Growing Seasons and Water Stress

CC-W06-V21

Co-funded by the European Union

Bukhara State Technical University
(*prev. "TIIIAME" NRU BINRM*)

Learning objectives

1. Understand how climate change affects crop yields and growing seasons in Central Asia
2. Analyse the role of water stress in agricultural productivity
3. Explore adaptation options to sustain crop production and food security
4. Apply this knowledge to support sustainable land management in the region

→ Climate-resilient crop systems are essential for food security, rural livelihoods and resilient ecosystems in Central Asia.

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Agriculture in Central Asia



Agriculture is a key sector for economies and rural livelihoods

Employs **20–40%** of the workforce in many countries

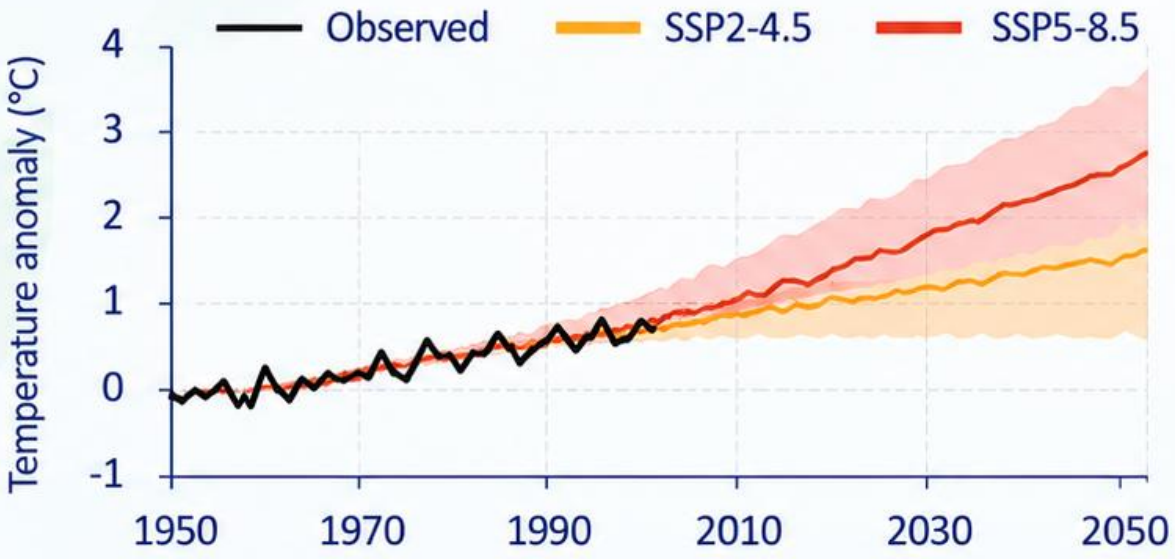
Main crops: wheat, cotton, maize, rice, fruits and vegetables

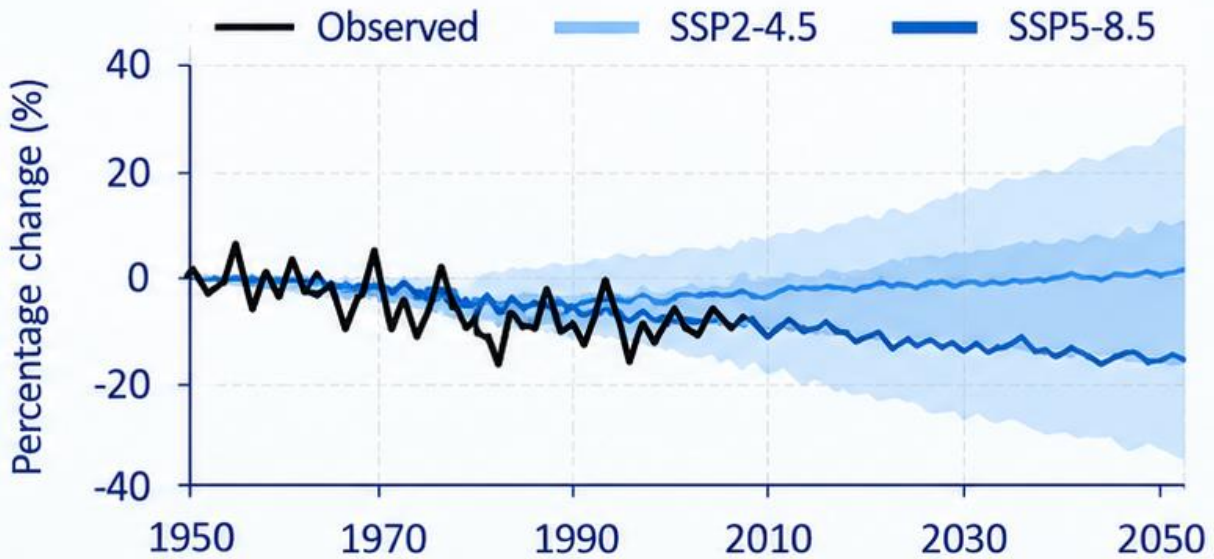
Diverse agro-climatic conditions from irrigated valleys to rainfed steppes and mountainous areas

Sustaining agricultural production is critical for food security and regional stability.

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Observed and projected climate change





Source: IPCC AR6, WGI (2021), Central Asia regional factsheet.

Warmer temperatures and more variable precipitation increase risks for crop production.

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How climate change affects crop yields



Higher temperatures

- Faster development
- Shorter grain filling period
- Heat stress



Changes in water availability

- More frequent droughts
- Greater competition for water
- Increased irrigation demand



More pests, diseases and weeds

- Expanded ranges
- Higher survival rates in warmer conditions
- New pest pressures



Extreme events

- Heatwaves
- Late frosts
- Hail and heavy rainfall
- Increased risk of crop failure

The combined effects of these factors can significantly reduce and destabilise crop yields.

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Changes in growing seasons

Historical example: northern Kazakhstan



Future projection (mid-century)



Key messages:

- Growing seasons are generally becoming longer due to higher temperatures.
- However, higher variability and extreme events can offset potential benefits.
- Crop calendars may need to be adjusted by region and crop.

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Water stress and irrigation challenges



Key challenges

- High dependence on irrigation
- Ageing and inefficient irrigation infrastructure
- Increasing water demand from agriculture, energy and cities
- Upstream–downstream tensions in transboundary rivers
- Higher risk of droughts and reduced river flows under climate change

Improving water use efficiency is essential for resilient agriculture in Central Asia.

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Crop-specific impacts in Central Asia

Crop	Current importance	Main climate change impacts
Wheat	Staple food, widely grown	Heat and drought stress; shorter growing period
Cotton	Major cash crop (Uzbekistan, Turkmenistan)	Higher water demand; heat stress; pest pressure
Maize	Growing importance in some regions	Sensitive to heat and water stress; affected flowering and grain filling
Rice	Important in irrigated areas	High water requirement; vulnerable to water scarcity
Fruits & vegetables	High value, growing sector	Sensitive to frost, heatwaves and water stress; new opportunities with longer seasons

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Key takeaways



1. Climate change is already affecting crop yields and growing seasons in Central Asia.
2. Water stress is a major constraint for agriculture and is likely to intensify.
3. Adaptation measures are essential to sustain food production and rural livelihoods.
4. Integrated land and water management can increase resilience and support long-term food security.

→ Resilient agriculture is possible through knowledge, innovation and cooperation.

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Adaptation options for crop production

1 More efficient water use

- Drip and sprinkler irrigation
- Improved scheduling and monitoring
- Reduction of conveyance losses

2 Climate-resilient varieties

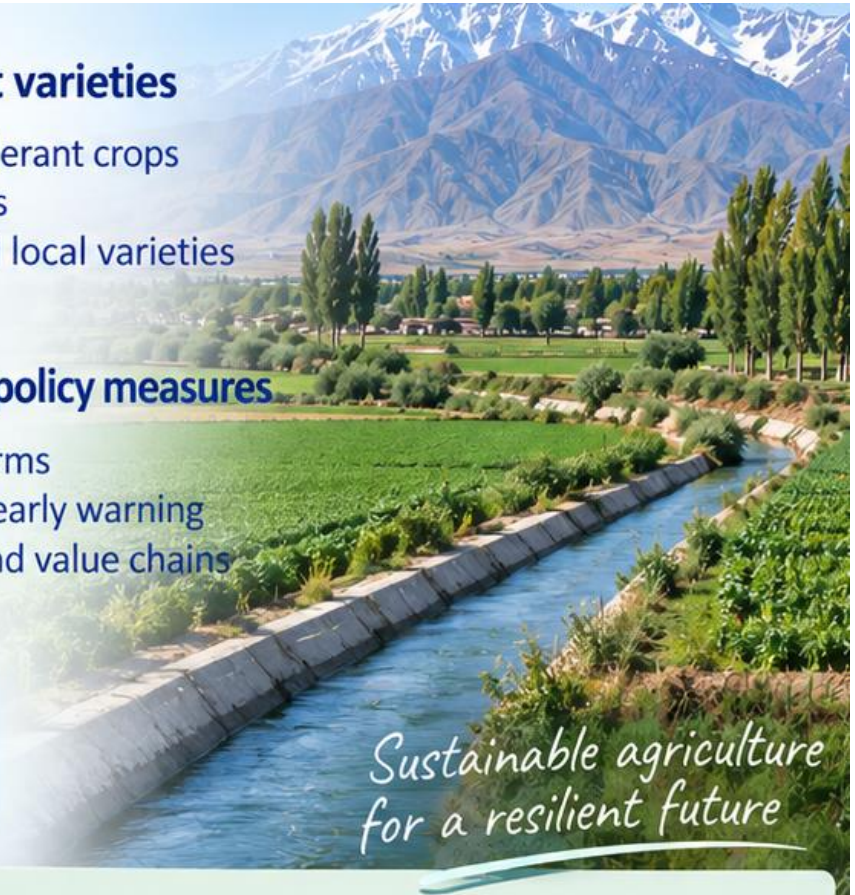
- Drought- and heat-tolerant crops
- Shorter-cycle varieties
- Use of traditional and local varieties

3 Improved agronomic practices

- Conservation agriculture
- Soil moisture retention (mulching, cover crops)
- Optimised fertilisation

4 Institutional and policy measures

- Water allocation reforms
- Climate services and early warning
- Support to farmers and value chains



> *Adaptation is most effective when combining technological, management and institutional solutions.*

Adaptation should be treated as a portfolio, not as a single technology.

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Examples of adaptation in Central Asia



Kazakhstan – Drought-tolerant wheat

- Adoption of drought-tolerant varieties
- Adjustments in sowing dates
- Improved fallow management in dry areas



Uzbekistan – Efficient irrigation

- Drip irrigation in cotton and horticulture
- Modernisation of canals and on-farm systems
- Use of digital tools for scheduling



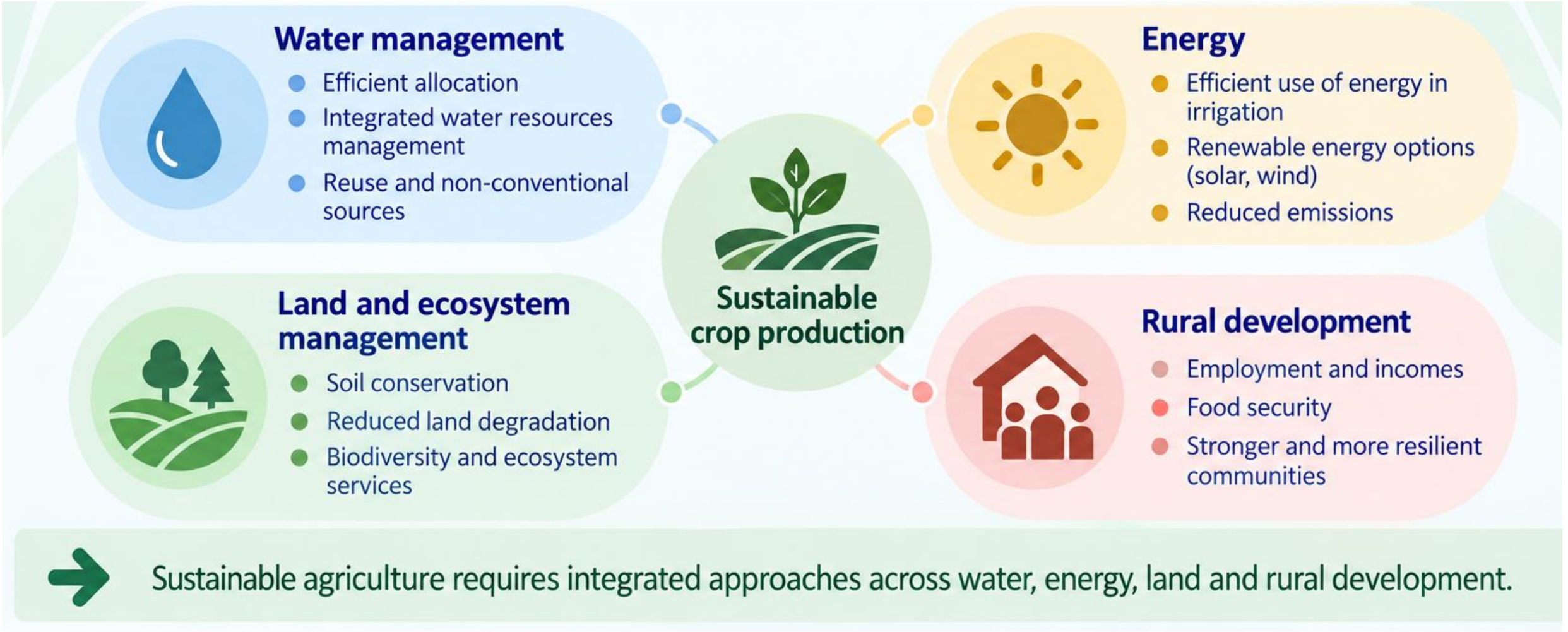
Kyrgyzstan – Diversification and local crops

- Greater use of legumes, fodder crops and vegetables
- Revival of traditional varieties
- Integration with small-scale irrigation and agroforestry

→ Context-specific solutions can increase resilience and sustain rural livelihoods.

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Synergies with other sectors



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Check your learning



1. How is climate change expected to affect growing seasons in Central Asia?

2. Which factor is most likely to reduce crop yields in the region?
   a) Lower CO_2 concentrations
   b) Higher temperatures and increased water stress
   c) Longer winter periods
   d) Increased use of organic fertilisers

3. Name two adaptation options to improve water use efficiency in agriculture.

4. How can crop diversification contribute to resilience?

Take a few minutes to reflect on these questions and test your understanding.

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Further reading and resources



IPCC (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability (WGII).
https://www.ipcc.ch/report/ar6/wg2/



FAO (2021). Climate change and food security: risks and responses.
https://www.fao.org/climate-change



World Bank (2021). Climate Smart Agriculture in Central Asia.
https://www.worldbank.org



CAREC (2021). Regional Climate Change Knowledge Products.
https://www.carececo.org



CGIAR (2021). Climate-resilient crops and water management.
https://www.cgiar.org

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