Carbon Farming:
Unlocking The Opportunity For Kazakhstan

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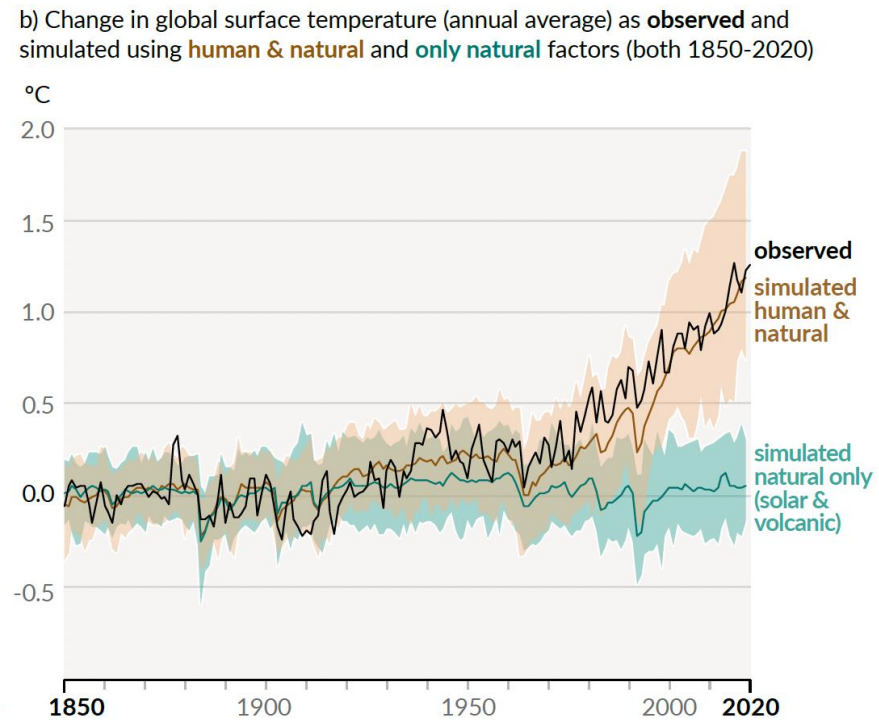
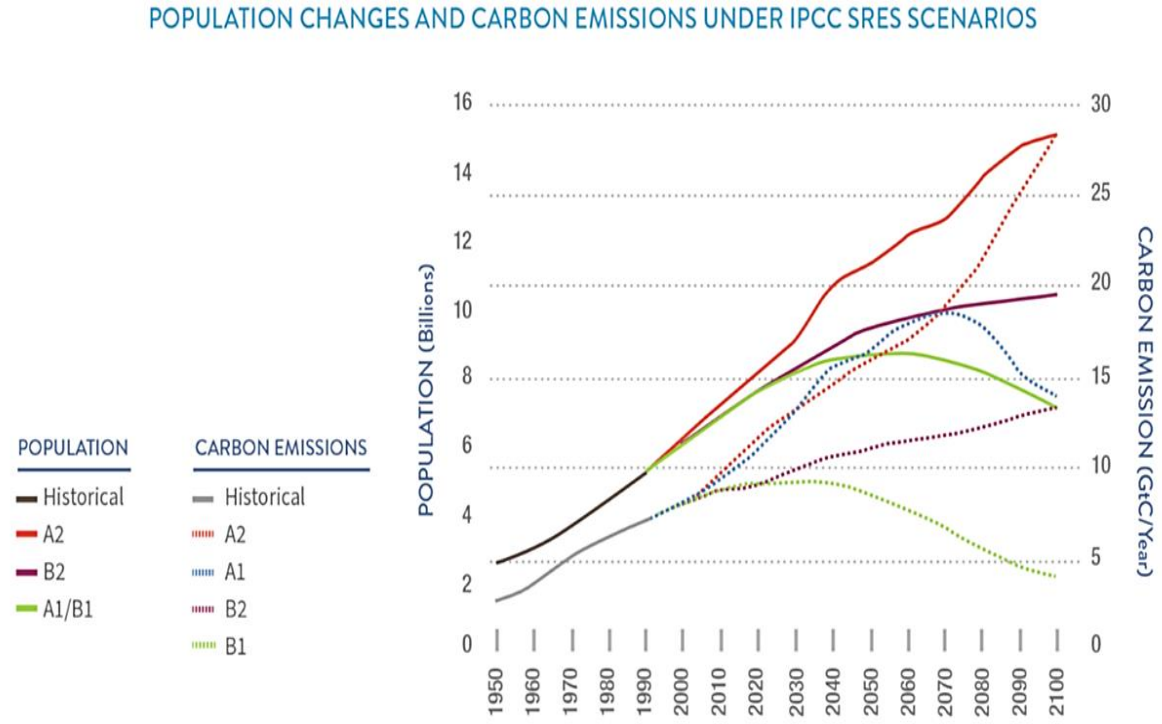
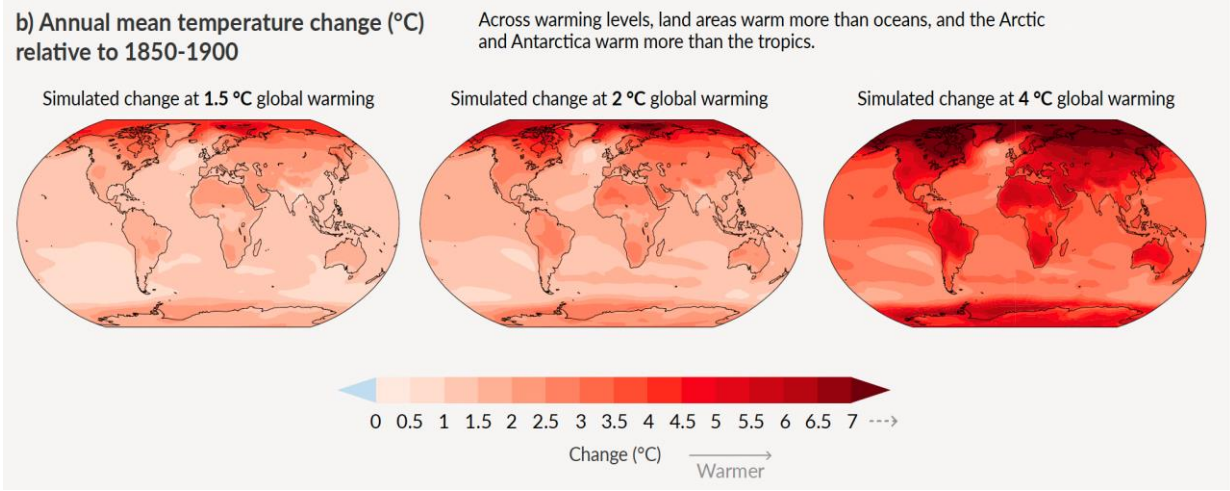
1. Global Greenhouse Gas Emissions Continue to Rise Leading to Major Negative Impacts Worldwide

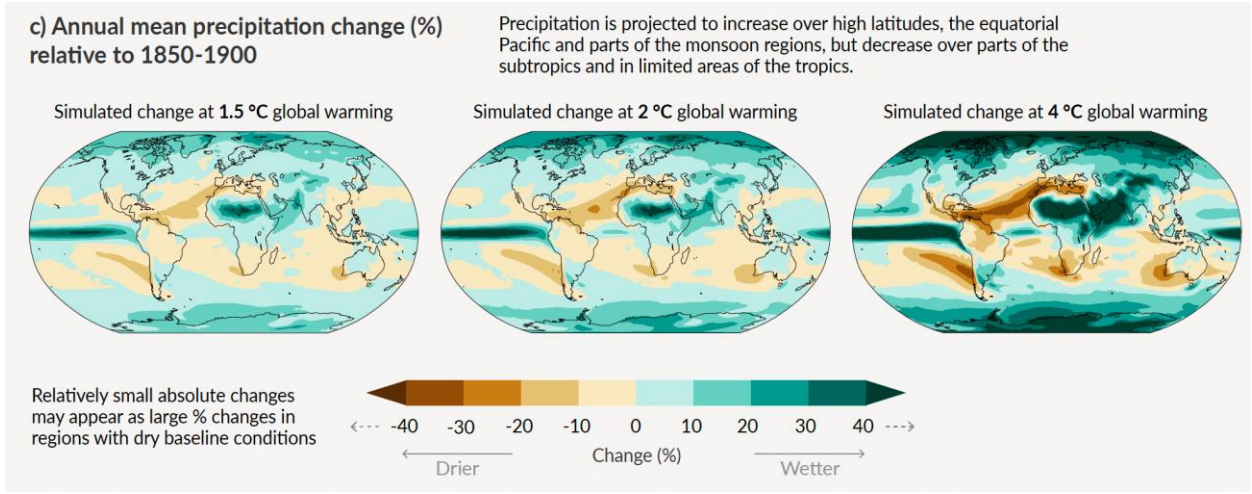


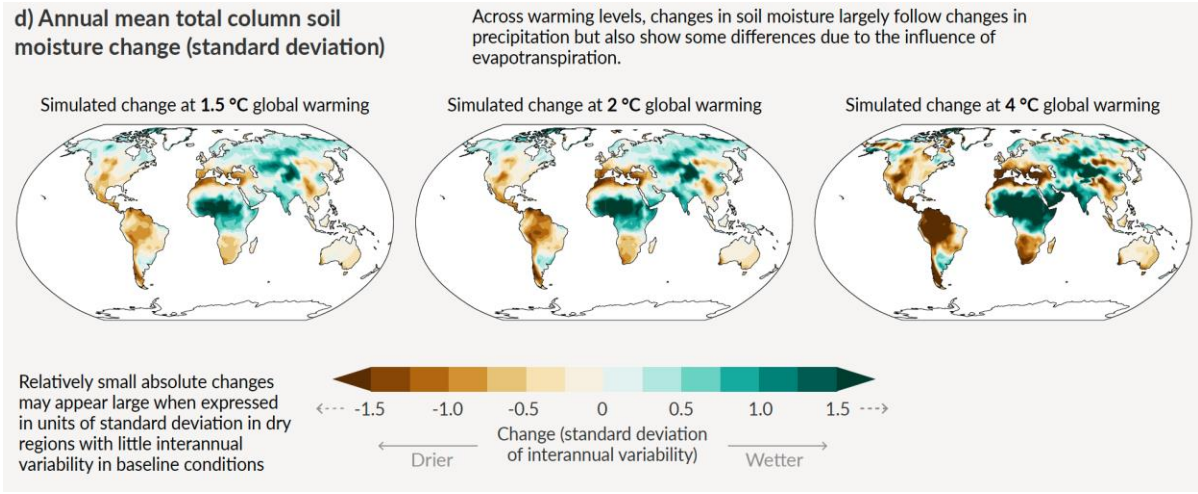


- Global industrial GHG emissions rise rapidly and will likely continue growing with rising populations and increasing demand for fuel and consumption. Current adoption rate of renewables means fossil fuels will not be completely replaced.

1. Global Greenhouse Gas Emissions Continue to Rise Leading to Major Shifts Worldwide

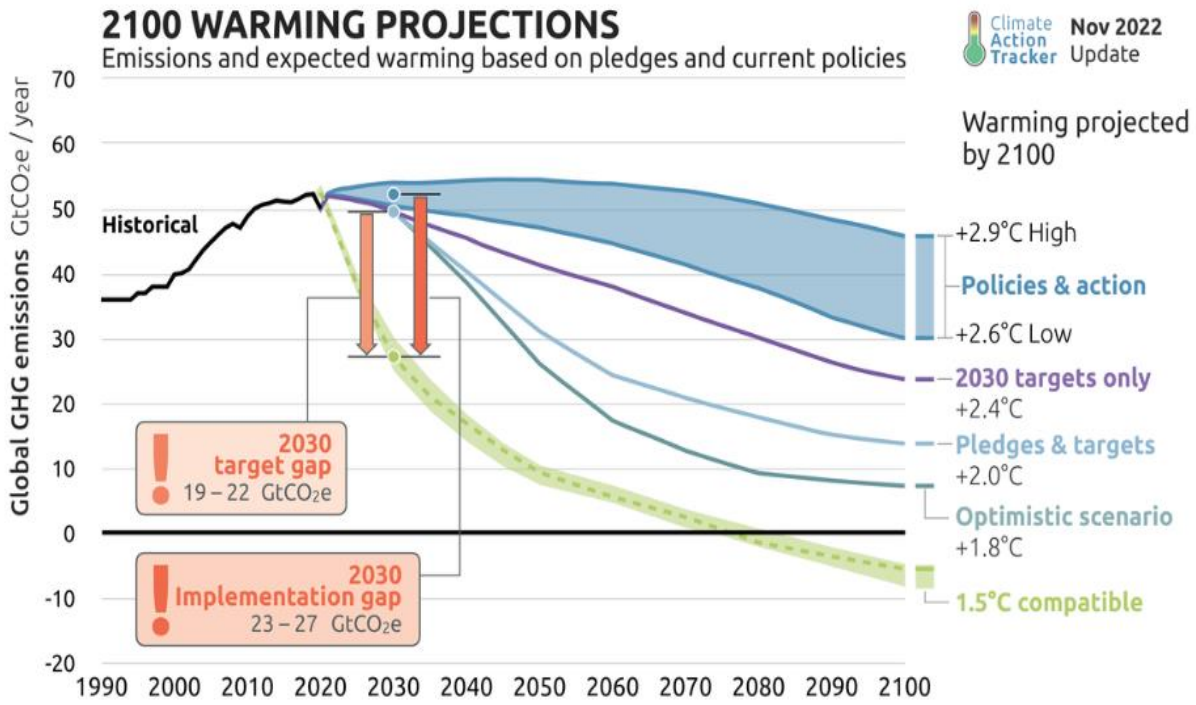






Source: IPCC

2. GHG Emissions Need to Be Contained to Limit Negative Impacts

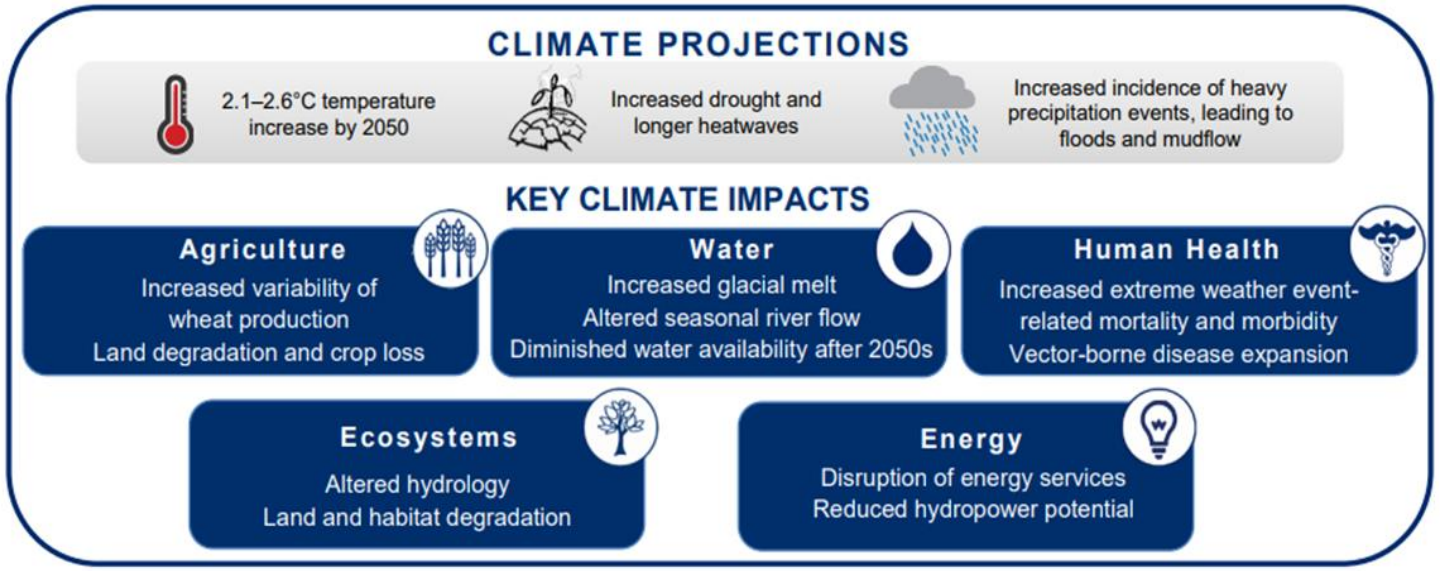


Source: Climate Action Tracker

- The 2015 Paris Agreement aspires 193 signatories to reduce global average temperatures to 2C above pre-industrial levels and take on efforts to limit the increase to 1.5C.
- To limit global warming to 1.5C requires peaking of GHG emissions by 2025, a decline of 43% by 2030 and **reach net-negative by about 2075** (CarbonBrief, 2022).

2. GHG Emissions Need to Be Contained to Limit Negative Impacts

- Rising global temperatures impact several sectors in Kazakhstan.



Source: USAID

Flood and mudslide risks have increased 4.7 times the levels in 1991 in mountainous regions including South Kazakhstan, Zhambyl, and Almaty.

Almaty oblast riverine flooding increased by 35% between 1991 to 2015 (ESCAP, 2022).

Rapid changes in ecosystems including greater frequencies of diseases, locusts' infestations, and pests which could affect agricultural productivity (World Bank, 2021). Locust infestations occur periodically in Kazakhstan, and rising temperatures can widen the geographical range of locusts in Kazakhstan.

Hot days can exacerbate droughts in western Kazakhstan and severely impact urban infrastructure e.g., roads, rain electrical systems, mobile towers, and water supply.

Climate related disasters in Middle East and Central Asia have injured and displaced 7 million in an average year, caused 2,600 deaths and appr. US$2 billion in physical damage (IMF, 2022).

3. Emission Trading for Meeting the Global Warming Targets

- The **Kyoto Protocol** introduced mechanisms including Emissions Trading and Joint Implementation of climate change mitigation policies.
- The Kyoto Protocol and in its succession - the **Paris Agreement** - have both highlighted the need for economic incentivization of emissions reductions.
- **Article 6** of the Paris Agreement has further allowed countries to join efforts in emissions reductions toward their nationally determined contributions (NDCs) which are countries' aspirations towards mitigation of climate change.
  - Countries can transfer carbon credits earned from the reduction of GHG emissions to help other countries meet climate targets. Within Article 6, Article 6.2 creates the basis for trading in GHG emission reductions (or "mitigation outcomes") across countries.
  - Article 6.4 further allows private companies to trade emissions reductions directly with other companies.
- Several bilateral agreements have emerged since Article 6. For example, Azerbaijan and Uzbekistan have both formed agreements with Japan.

4. Trading in Offsets Credits Gain Momentum

- **Carbon credits** signify concrete **actions toward reducing or removing emissions undertaken by an entity and paid for by another entity seeking to counterbalance their emissions**.
- The interest in trading carbon credits is growing fast globally, with demand coming from:
  - ✓ **Domestic industries** under compliance obligations, such as quotas or carbon tax. Companies can offset higher emission levels by carbon credits.
    - E.g., KAZ ETS covers 128 domestic companies in key sectors and allows them to use carbon credits toward ETS obligations obtained directly from projects or from commodity exchanges, e.g., Caspian Commodity Exchange.
  - ✓ **Domestic and international companies** who aspire to contribute to climate change mitigation or avoid carbon tariffs. Purchasing carbon credits can enhance their positive image for consumers and increase their ESG ratings.
    - E.g., Microsoft announced its commitment to become carbon negative by 2030.
  - ✓ **Foreign countries** seeking to meet their NDC targets.
    - E.g., the separate agreements discussed between Japan with Azerbaijan and Uzbekistan.

4. Trading in Offsets Credits Gain Momentum

- Voluntary Carbon Markets (VCMs) around the world have grown to reach almost US$ 2 billion in size as market preferences shift toward environmentally friendly consumption and trade.

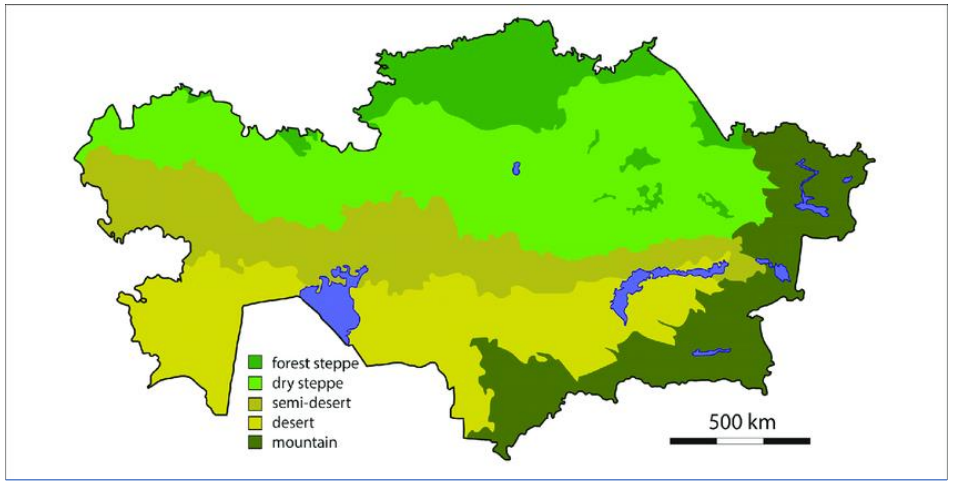
Source: World Bank Carbon Pricing State and Trends 2023

5. Several Countries Have Launched Projects that Generate Carbon Credits

- The rise of value and volume in the trading of carbon credits has led to several countries investing into their own carbon crediting mechanisms.

Country	Examples of Projects Generating Carbon Credits	Details
Australia	Agriculture and Livestock Prevention of Savannah burning Energy Efficiency Transport	Australia is operating a national Emissions Reduction Fund since 2015, whereby the supply of Australian Carbon Credit Units (ACCU) dominates domestic voluntary markets.
UK	Woodland Restoration Tree Plantation	Woodland Carbon Code scheme was launched in 2011 with the backing of the UK Government to restore woodlands across the UK. The project has developed 40 carbon woodlands and removed over 2.1 million tons of CO2eq.
EU	Several independent projects in REDD+ BECCS Agriculture and Livestock	Several private and independent organizations are selling carbon credits worldwide attained from a range of activities including renewable energy installations, forestry and peatland restorations. An EU-wide voluntary framework has been proposed which sets out to define high-quality carbon removals and the MRV processes for EU removals including technological and nature-based projects.
US	Rice Cultivation Soil Sequestration Agriculture and Livestock Forestry and REDD+ Ozone Depleting Substances	The US is investing to rapidly scale its own carbon farming industry. From 2013 to 2022, over 170 million tCO2e carbon credits were issued and traded for compliance market obligations e.g., in regional ETS systems, and 24.5 million tCO2e voluntary carbon credits from agriculture, forestry, and land use projects.
China	Forestry Methane Utilization Renewable Energy	China will relaunch its voluntary market scheme later this year. China Certified Emission Reductions (CCER) is expected to reach a total value of US$2.8 billion by 2025 and dominate domestic demands as the current ETS allows for some proportion of carbon credits to be used toward ETS obligations.

6. Carbon Farming: The Opportunity for Kazakhstan



Source: Miller et al., 2012

- Kazakhstan has about 57 Mha of degraded land ~21% of its total area, (UNCCD 2023), which offer a large carbon sequestration potential through an increase in the Soil Organic Carbon (SOC) and plant biomass.
- This may be especially true for 'Virgin Lands' intensively developed to expand crop production in the later 20th century: Estimated to have lost up to 43% of their soil carbon stock in the upper 10cm of soil through intensive agricultural practices (Rolinski et al., 2021).
- Increase the SOC pool could reverse soil degradation and improve soil health particularly in the regions of Northern Kazakhstan (steppe areas) as well as areas on the perimeters of the Aral Sea.

6. Carbon Farming: The Opportunity for Kazakhstan

- **Land management practices at farm level**, which either **increase** the amount of atmospheric **carbon sequestered** (i.e., captured and stored) by soils or plant biomass **or reduce GHG** (primarily, CO_2, N_2O and CH_4) **emissions from land-based activities** are referred to as **carbon farming.**
- Increase the SOC pool could reverse soil degradation and improve soil health particularly in the regions of Northern Kazakhstan (steppe areas) as well as areas on the perimeters of the Aral Sea.
- **Sustainable land management practices** are **currently applied on 1%** of Kazakhstan's agricultural lands and its LULUCF (=Land Use, Land-Use Change, and Forestry) sector remains a source of emissions rather than a sink.
- The **potential** for mitigation in **Kazakhstan's croplands** is **up to 35 million tons of CO2eq/year**, which is slightly more than its current 32 million tons of CO2eq/year emissions produced by croplands (Kazakhstan, Ministry of Ecology Communications to UNFCCC, 2023).
- In addition to carbon sequestration, carbon farming also has the potential to increase crop yields, for example from windbreak systems in arid and semiarid climates and show an increase in water productivity compared to open-field systems (Thevs et al., 2021).

7. Carbon farming activities

Land-based carbon farming practices may include:

Cropland Carbon Farming	Grassland Carbon Farming
No-till or reduced tillage	Improved grass variety, deep rooting grasses
Residue retention	Stock density management in accordance with carrying capacity
Improved crop varieties	Fodder banks and fodder diversification
Agroforestry	Savannah restoration
Cover cropping	Livestock grazing management
optimized use of fertilizers, organic amendments	
Improved water management	
Crop rotation	

Recent studies also suggest significant potential of enhanced weathering, i.e., rock powder application to agricultural fields (Carbon Drawdown, 2021).

7. Carbon farming activities

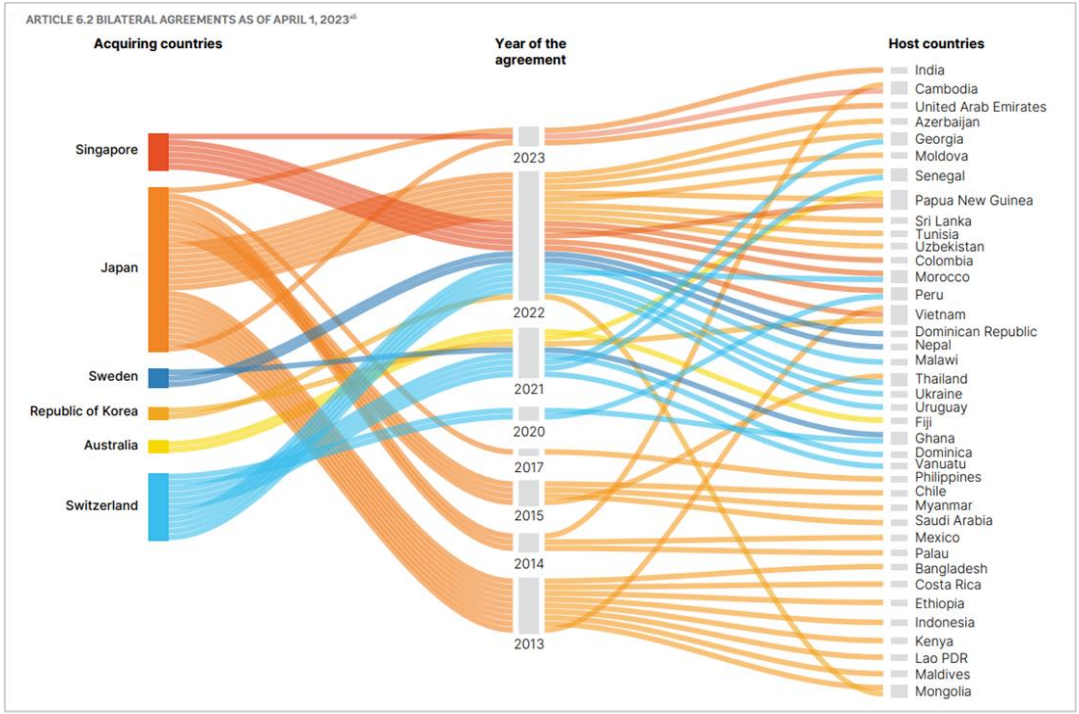
- Carbon farming implemented at scale will produce significant amounts of biomass. Its utilization as feedstock in industrial production processes can provide the foundation of a **circular bioeconomy**:
  - ✓ Biomass from carbon farming can be used to produce advanced (or 'second-generation') biofuels produced from a variety of more sustainable feedstock, including forest and agricultural residues and waste as well as less demanding energy crops that can be grown on degraded lands.
  - ✓ Biomass can also be used for non-energy applications including the manufacturing of construction materials (e.g., dried reed stalks for outbuildings), extraction of proteins for food or feed purposes, chemical applications, and others.

8. Key Necessary Systems for Carbon Farming to Work

- The generation of carbon credits must be done in line with international verification standards to ensure buyers of the quality of the offsetting activity.
- Carbon offset projects undergo measuring, reporting, and verification (MRV) procedures to be certified for production of carbon credits.
- Governments or projects can set their own MRV standards, or they can outsource to one of the several independent MRV agencies have emerged in recent years e.g., Gold Standard, Verra VCS, and others.
- MRV standards assess various aspects, most importantly, **additionality** which means that *any benefits from carbon sequestration or reduction activities must be intentional and in addition to the removals which would have occurred without intervention.* Projects are assessed against 'baseline' scenario i.e., without project intervention. Only those emissions reductions which can be proven in addition to the baseline scenario can be certified as carbon credits.
- There is no one MRV standard practice and no unified definition for additionality as carbon credits are heterogenous and current practices on soil sequestration are underdeveloped in comparison to other nature-based removals such as forestry.

8. Key Necessary Systems for Carbon Farming to Work

- Acceptance of carbon credits from carbon farming activities requires legal and institutional frameworks.
- Several bi- and multi-lateral agreements have been made (World Bank, 2023):
  - At COP27, Ghana and Vanuatu partnered with Switzerland and UNDP to devise projects generating authorized emissions reductions.
  - Singapore agreed in MoUs with crediting mechanisms such as the Gold Standard to allow carbon credits toward its carbon tax obligations.



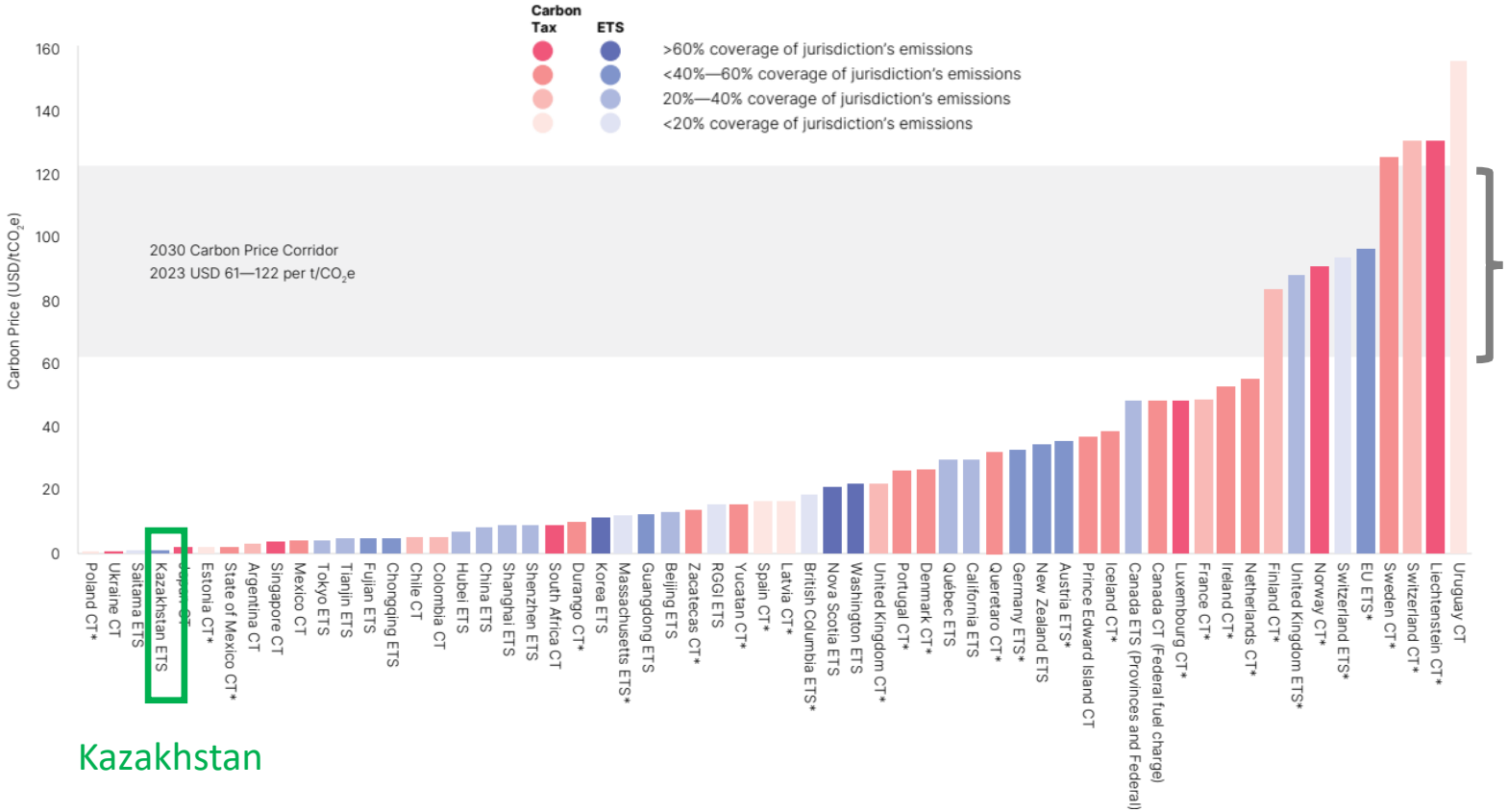
Source: World Bank Carbon Pricing State and Trends 2023

- Partnerships have also formed between private companies, governments, and verification agencies which are geared toward supporting countries meet their NDC targets either through directing the supply of carbon credits or joint projects for emissions offsets.

9. Economics of Carbon Farming

- Current carbon prices are significantly below the recommended levels to achieve effective emissions reductions.
- According to the High-Level Commission on Carbon Prices, carbon prices must reach at least US$ 50-100/tCO2eq in real terms by 2030 to limit global warming to 2C (World Bank, 2023).
- According to OECD, carbon must be priced at US$ 147/tCO2e by 2030 to achieve net-zero emissions by 2050 (World Bank, 2023).
- For Kazakhstan, IMF recommended to increase carbon prices to between US$25 and US$50 in the next years (IMF, 2022) to achieve significant reductions in emissions.

9. Economics of Carbon Farming



Kazakhstan

Carbon price corridor to guide the design of carbon-pricing instruments and other climate policies

Source: World Bank State and Trends of Carbon Pricing 2023

- In KAZ ETS, average secondary market price is reported at KZT 563 (US$ 1.22) which is one of the lowest carbon prices relative to other ETS systems.

9. Economics of Carbon Farming

- Implementation costs for carbon farming activities can range depending on the type of carbon farming method implemented but estimations can be made based on previous land management practices closely linked with carbon farming methods.
  - E.g., in the Katon Karagay region, 80 hectares of land was revitalized through sowing grasses such as sainfoin seeds costing less than US$50 per ha incl. maintenance (WOCAT, 2011).
- In the US, the average cost of sequestering carbon through no-tillage or adopting cover crops is US$10.61 to US$30.84 per tCO2e with an overall average of US$21.98 (Havens et al., 2023).
- In China, the cost of implementing cropland-livestock carbon farming practices is shown to be approximately US$15.92 per tCO2e (Tang, 2019).
- An effective implementation of a domestic carbon farming program would require Kazakhstan to increase prices of its carbon allowances above the fair valuation of carbon credits generated from carbon farming.

10. Implementation of Carbon Farming Promises Co-Benefits

- Soil carbon management and sequestration may deliver **immediate** significant social and economic co-benefits (=additional positive outcomes that are not directly linked with the action of sequestering carbon).
- Carbon Sequestration, Eco-restoration, and Land Degradation Neutrality should be building blocks. of the future approach.
- Carbon Farming and Trading strategy should put people at the center of the equation.
- The impact of Kazakhstan's efforts to promote carbon farming and NETs can be scaled across the ADB region and Kazakhstan’s own program can serve as valuable insights and learning opportunities for other countries striving to achieve their climate targets.

Soil conservation measures on cropland can create up to 1 additional full-time job per 1 ha (IUCN, 2021)

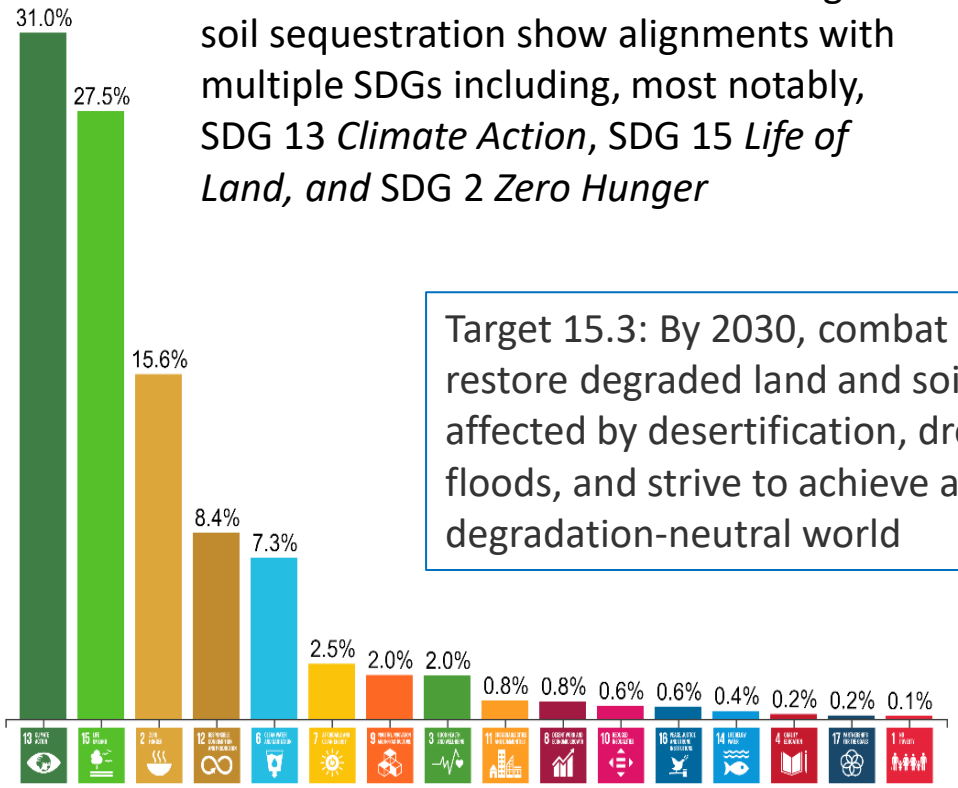
In the USA, landscape restoration creates between 10 and 39 jobs per USD 1 million of investment, at least twice that of the oil and gas sector.

Restoring 150 million hectares of degraded agricultural land could generate US$ 85 billion for national and local economies, US$ 30–40 billion a year in additional income for smallholder farmers (UNCCD, 2021).

Erosion protection can create indirect non-monetizable economic benefits captured by farmers and external health benefits by reducing dust storms and health damage from exposure to PM2.5 pollution.

10. Implementation of Carbon Farming Promises Co-Benefits

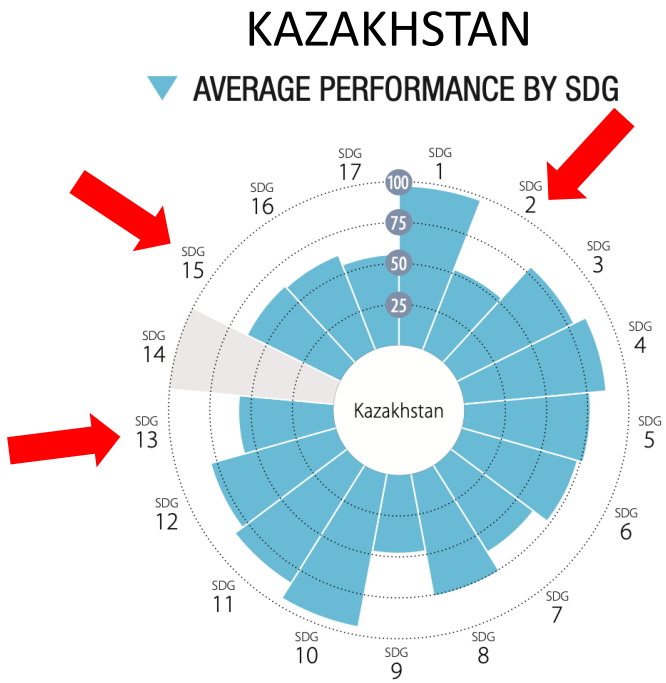
- Co-benefits and synergistic outcomes can be measured according to the UN Sustainable Development Goals (SDGs)



Scientific research on carbon farming and soil sequestration show alignments with multiple SDGs including, most notably, SDG 13 *Climate Action*, SDG 15 *Life of Land, and* SDG 2 *Zero Hunger*

Target 15.3: By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

Source: Carbon Farming: Unlocking Opportunity for Kazakhstan (created using EU JRC SDG Mapper)



Source: Sustainable Development Report 2023

Thank you for your attention! Comments? Questions? Suggestions?

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