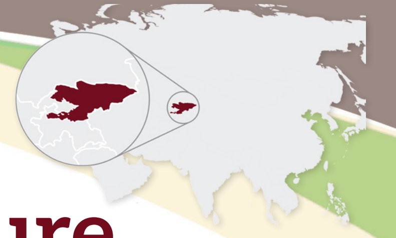


Climate-Smart Agriculture for the Kyrgyz Republic

Climate-smart agriculture (CSA) highlights

A P Agriculture is important for the livelihoods of the majority of the people in the Kyrgyz Republic. It contributes 15% of the country's total gross domestic product (GDP) and provides employment to 30% of the economically active population.

A M P I Climate change will impact crops and livestock but production systems will face heterogeneous consequences. A scaling out of CSA initiatives is key to increase the resilience of the agriculture sector. However, the overall adoption of CSA practices, such as conservation agriculture and drip irrigation, remains limited despite their multiple benefits. This is due to limited access to seeds and inputs, lack of accessible long-term credit, and inadequate training available for farmers.

A M P For livestock, the use of improved pastures and adapted breeds can increase livestock productivity and enhance resistance to climatic shock and stress. This will increase the availability of both food and income for farmers. Similarly, improved veterinary services would be beneficial to the livestock sector by reducing diseases, improving productivity, and increasing export potential.

A M P I $ Many institutions in the Kyrgyz Republic support sustainable agricultural development. Additionally, the country is party to multiple international environmental treaties and conventions, and plays an active role in climate change adaptation actions within Central Asia. Planned strategies have yet to be implemented due to a shortage of state funding.

A M P I Institutions and nongovernment organizations provide CSA-related services, including weather forecasts, capacity building, and awareness-raising activities for stakeholders. However, more effort is needed to expand the technical knowledge of farmers.

I $ Limited access to finance, driven by high interest rates and short repayment periods, is a major constraint for farmers to apply CSA. In addition, farmers usually have limited financial management skills and unstable income further reducing their ability to access finance.

A Adaptation **M** Mitigation **P** Productivity **I** Institutions **$** Finance

Climate-smart agriculture (CSA) is agriculture that has been transformed and reoriented to support development and ensure food security in the face of climate change. CSA aims to tackle three main objectives: sustainably increasing agricultural productivity and farmers' income, adapting and building resilience to climate change, and reducing and/or removing greenhouse gas emissions in line with national development priorities [1]. The CSA approach can help to identify and address synergies and trade-offs involved in pursuing these three objectives by addressing food and nutrition security and the environmental, social, and economic dimensions of sustainable development across agricultural landscapes. This approach helps to align the needs and priorities of different stakeholders to achieve more resilient, equitable, and sustainable food systems.

Although the CSA concept is still evolving, many of the practices and technologies that make up CSA have been successfully implemented globally [2]. Mainstreaming CSA in the Kyrgyz Republic will require the systematic identification of locally effective CSA practices, diagnosis of barriers to adoption of those practices, evaluation of strategies to overcome the barriers, and ensuring the presence of institutional and financial enablers.

This CSA Country Profile describes the risks posed by climate change to agriculture in the Kyrgyz Republic, discusses the potential of CSA to attenuate those risks, identifies factors that can influence the adoption of CSA practices, and highlights potential entry points for investment in CSA at scale.

WORLD BANK GROUP
CGIAR
RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS
CIAT 50 1967-2017

National context

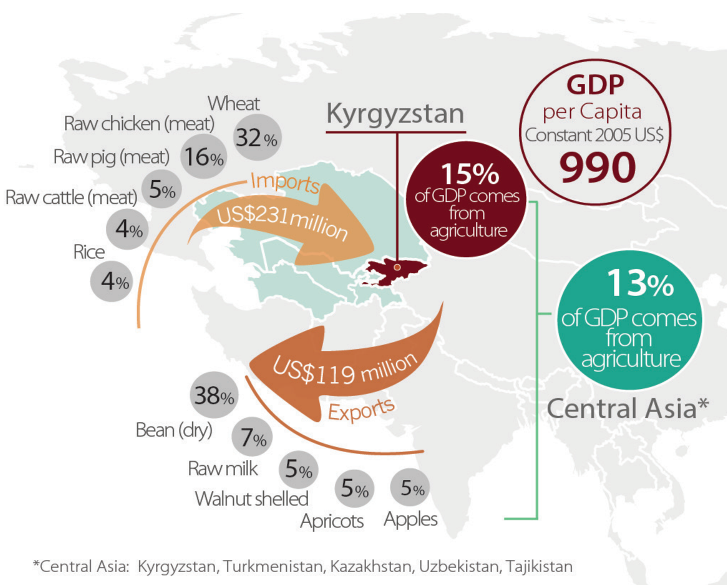
Economic relevance of agriculture

The Kyrgyz Republic is a mountainous country in Central Asia with a total land area of 199,951 km^2. It ranks 120th out of 188 countries in the 2016 Human Development Index and is classified by the World Bank as a lower-middle-income country. Out of a population of 6 million, more than 64% of the people reside in rural areas [3, 4, 5]. Agriculture is the mainstay of the Kyrgyz economy and is embedded within the traditional way of life for the majority of the people. During 2012–2016, agriculture contributed 15% of the country's total gross domestic product (GDP) [6]. Approximately 9.9% of total exports and 14.9% of total imports are related to the agricultural sector [7]. Leading agricultural products for export are vegetables, fruits, cotton, tobacco, and meat and dairy products. Commonly imported products in the Central Asia region include wheat, meat, prepared food, tea, and alcoholic drinks (Enikleeva, 2016). The development of the national economy, which was predominantly driven by agriculture from the late 1990s onward, has recently been impacted by a negative trade balance, political volatility, economic shocks, and frequent natural disasters [8, 9].

In the Kyrgyz Republic, an estimated 3.8 million people reside in rural areas, while the remaining population is distributed throughout towns and cities. The poverty rate has seen a moderate decrease, falling from 38% in 2012 to 25% in 2016 [5, 6]. The labor market, including wages and earnings from sales of agricultural products, has been the most important factor in poverty reduction [10]. Electricity is accessible to the entire population, while 89% have access to improved water supplies; however, access to clean drinking water and sanitation remains an important concern for people living in rural areas [11]. The gender inequality index of 0.4 suggests that there is room to reduce gender disparities in health, empowerment, and the labor market, highlighting the need for critical policy intervention [3, 5, 6].

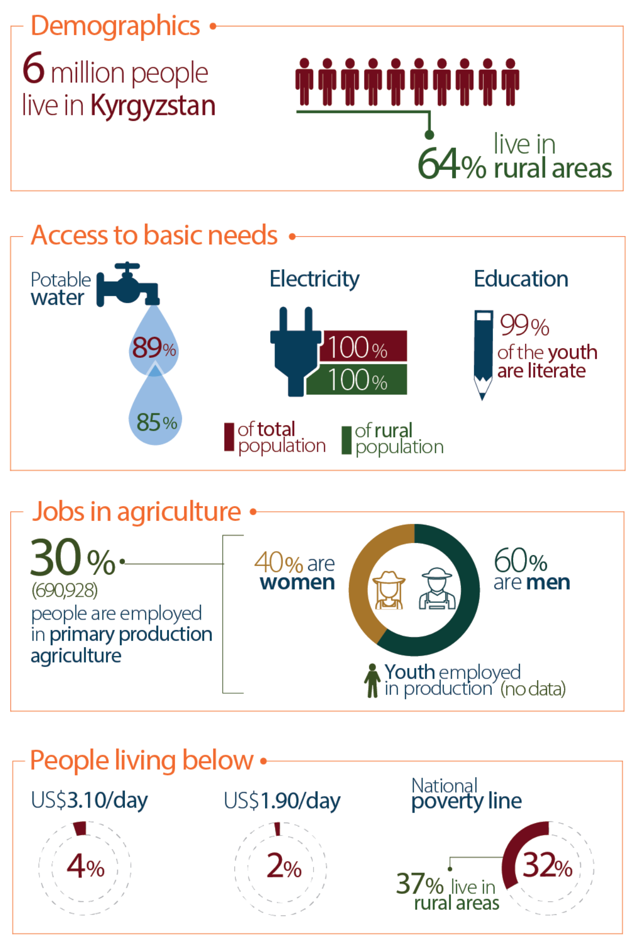
The collapse of the Soviet Union in 1991 made it necessary to reorganize the previously centralized agricultural systems. This was achieved through the transformation of state-owned agricultural land (formerly collective scheme farms) into privately owned land [12]. In 2012, the country had an estimated 535,716 privately owned farms. The vast majority of these farms (94%) can be categorized as small-scale, averaging 3 hectares [13]. The agricultural sector currently employs about 30% of the country's economically active population (40% female, 60% male) [14, 15].

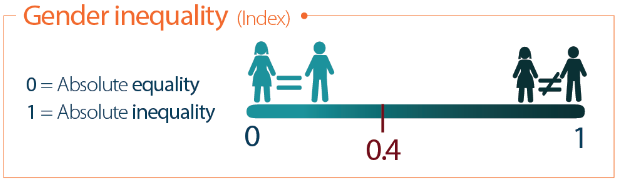
Economic relevance of agriculture in the Kyrgyz Republic [6, 9]

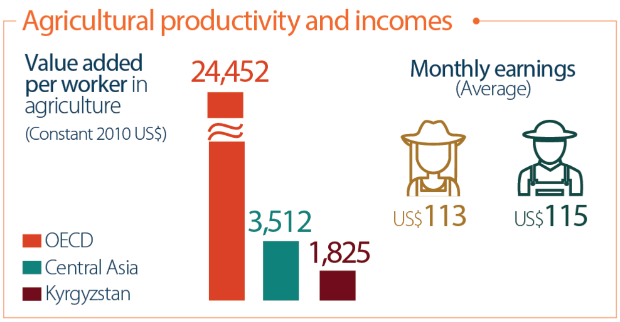


*Central Asia: Kyrgyzstan, Turkmenistan, Kazakhstan, Uzbekistan, Tajikistan

People, agriculture, and livelihoods in the Kyrgyz Republic [6, 9, 15, 16]







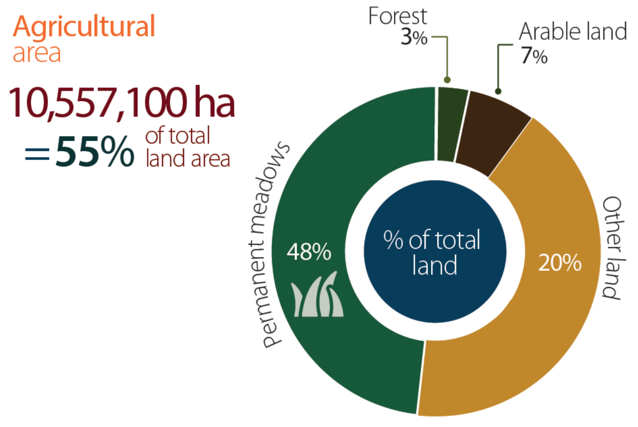
Land use

Land used for agricultural production accounts for 55.4% of Kyrgyz's total land area. Approximately 48% of this agricultural land area consists of permanent meadows and pastures, 7% constitutes arable land, and 3% is forestland [9, 17, 18]. Despite this relatively small percentage of forestland, these forests play a significant role in water regulation and soil conservation, while also sustaining the livelihoods of forest-dependent communities.

Livestock remain a key agricultural commodity for most farmers, both as a source of income and as a social safety net for low-income households [19]. However, pastureland and meadows adjacent to villages, as well as winter pastures, have been highly degraded because of poor management practices. Similarly, the more remote summer pastures have been underused as a result of limited access, which is usually due to deteriorating and ill-maintained infrastructure.

The majority of small-scale farmers (<5 ha) are characterized by intercropped and mixed crop-livestock systems, whose produce is often used for domestic consumption. Any surplus is usually sold unprocessed, thus reducing the possibility of generating additional income, which highlights the importance of value addition through agro-processing activities in CSA value chains. The middle and large-scale production systems are mostly privately owned and are characterized by commercial investment in large parcels of land used to cultivate wheat, barley, sugar beet, maize, and potato. These production systems often implement low-standard agricultural practices and technologies that guarantee financial remunerations from crop and animal yields, but potentially trigger or accelerate land degradation caused by an unsustainable use of pastures, forests, and arable land. Adopting new land management strategies and CSA practices is therefore essential to minimize this degradation, thus ensuring sustainable livelihoods and maintaining ecosystem services [21, 22].

Land use in the Kyrgyz Republic [6, 9, 20]



Agricultural production systems

Nearly 90% of Kyrgyz's territory is constituted by the Tien Shan mountain ranges, resulting in an average altitude of 2,750 m above sea level [23]. The Kyrgyz Republic can be divided into three broad agro-ecological regions. The first is the southern region, which encompasses the Fergana valley, including the Osh, Jalal-Abad, and Batken regions. The Naryn and Kara-Darya rivers run through the Fergana valley, supporting local agriculture, which is the main source of income in the region. Because of a high population density, farm sizes are often smaller in this region than in other parts of the country. Although a wide variety of crops are grown throughout the region, typical crops include cotton, tobacco, melon, and fruits.

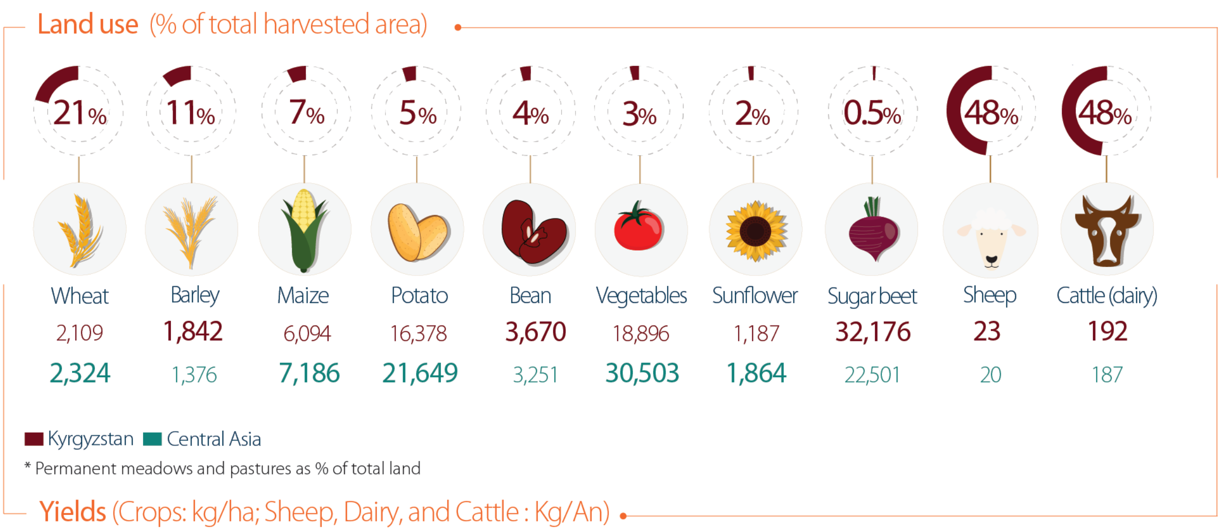
The central zone comprises vast alpine areas of inhospitable mountains, high-altitude rivers, and valleys. The alpine and subalpine pastures above 2,500 m in this zone are particularly well suited for livestock production [24]. The Naryn region has good winter grazing fields and sees light snowfall in the winter months. Potatoes, wheat, and barley are also produced in this region, although the climatic conditions are unfavorable for these crops.

The third agro-ecological zone is the northern region, which includes the Chui and Talas rivers, and the Issyk-Kol lake basin. The climate is favorable around the Issyk-Kol lake region, but it is more continental and drier along the Chui and Talas valleys. Most agricultural croplands are irrigated, although rainfed cultivation is still being practiced, especially for cereal crops. According to the Ministry of Agriculture, Food Industry, and Melioration [25], the Talas region accounted for 93% of the total beans cultivated and produced in 2015, making them the main agricultural commodity in terms of exports. Sugar beet is also an important crop in the Chui valley, and apples from the Issyk-Kul region are marketed almost year-round.

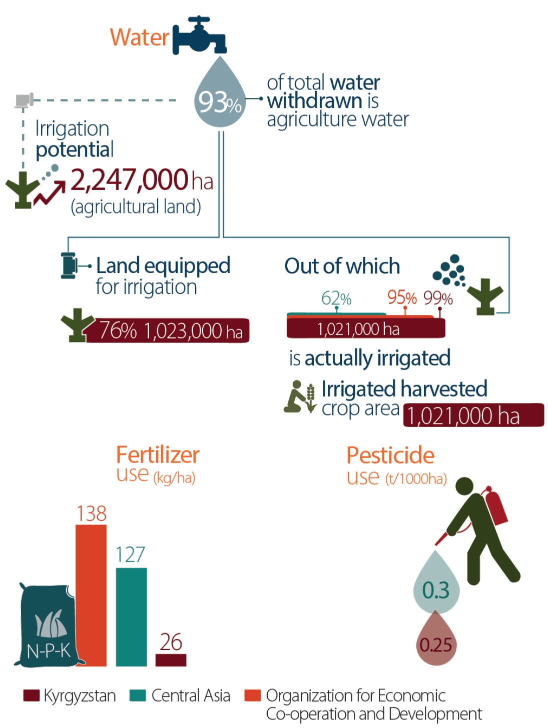
In terms of total harvested area, wheat (irrigated and rainfed) is the main agricultural product of the Kyrgyz Republic, representing on average 21% for the period 2012–2016, followed by irrigated and rainfed barley (11%), maize (7%), and fodder crops, which are also economically important [14]. Potatoes (5%), vegetables (3%), and beans (mostly kidney beans, 3.5%) occupy a smaller percentage of the total area, although their production has gradually increased in recent years. By contrast, the areas given to industrial crops such as cotton and tobacco are gradually decreasing due to reduced profitability [14].

Because of favorable climatic and topographical conditions, livestock farming can be found throughout the country. The main produce in this sector involves meat (beef, sheep, horse, others), cow's milk, wool, and eggs [26]. According to NSC [14], almost 9 million heads of livestock were bred in the Kyrgyz Republic in 2016 (excluding poultry). In principle, the pasture resources are sufficient to sustain livestock production if sustainable management is implemented in an attempt to preserve the productivity and biodiversity of pasturelands.

Production systems key for food security in the Kyrgyz Republic (6, 20)



Agricultural input use in the Kyrgyz Republic [6, 9, 26]



The country has traditionally had sufficient water resources and is therefore able to sustain irrigated land demands, although since 1960 the high-altitude glaciers have decreased in size by approximately 20% [27]. According to FAO [28], the proportion of agricultural land equipped for irrigation is about 76%. As of 2016, nearly all the irrigation systems are managed across 481 Water Users' Associations (WUAs), which are nongovernment organizations that manage, operate, and maintain irrigation systems at a local level [29, 30]. However, during drought and dry seasons, inefficient and ineffective irrigation practices can lead to acute water scarcity [26, 31, 32, 33].

There are 107 private and state-owned seed farms that supply certified seeds for: cereal crops (59–71%), maize, oilseed, cotton, alfalfa, and potato (45%) [34]. There is also one certified bean farm (Tilekeyev et al., 2018). To meet local demand, around 30% of maize, cotton, and potato seeds along with 95% of sugar beet and vegetables seeds are imported [34, 35]. Despite existing seed farms, because of the high demand for and relative scarcity of certified seeds, farmers also use uncertified, low-quality imported seeds [26]. Average annual fertilizer use is currently estimated at 138 kg/ha [6]. Because of their high costs, imported fertilizers are not always affordable for farmers, especially for those working on small-scale farms.

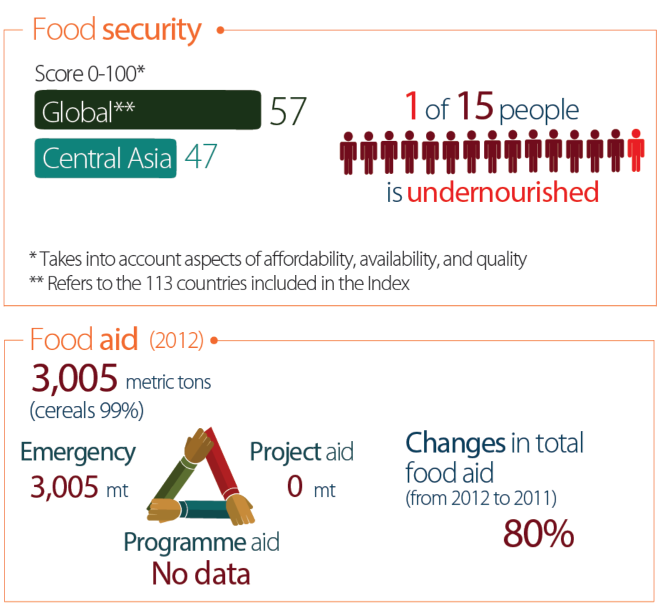
The previous infographic shows a selection of agricultural production systems that are vital for the country's food security. The importance of these systems can be measured through their direct contribution to economic, productivity, and nutrition quality indicators. (For more information on the methodology for the production system selection, consult Annex 1.)

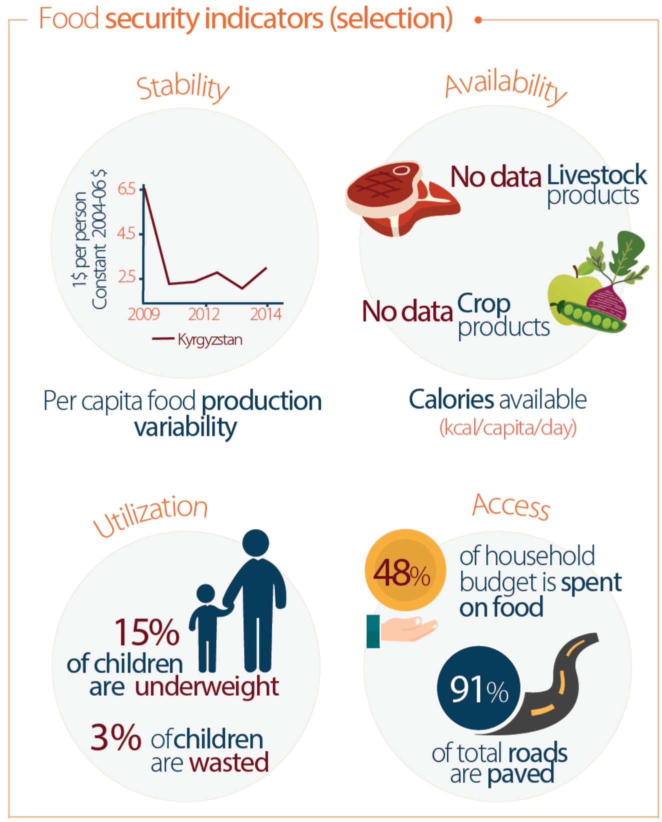
Food security, nutrition, and health

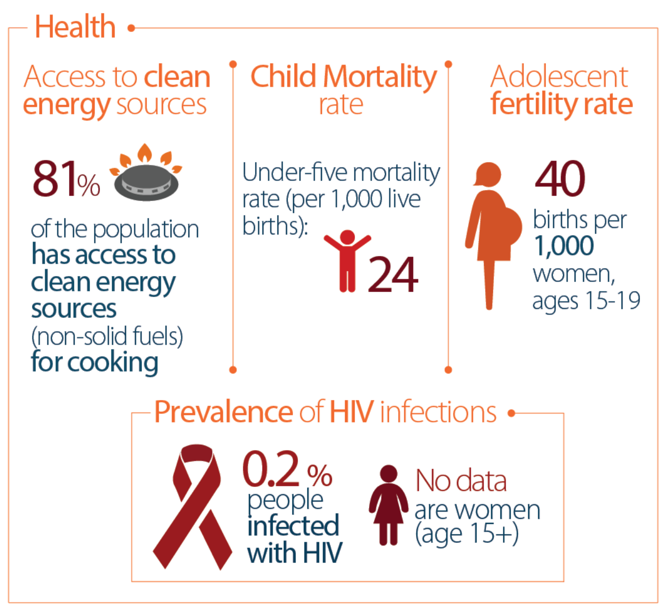
The Kyrgyz Republic is a low-income food-deficit country [36]. The agricultural sector is often at risk due to its geographical and topographical dynamics. Poor agricultural production threatens food security and pushes sectors of the population (mostly in rural settings) into economic instability and poverty. The people most at risk from food insecurity live in remote valleys and mountains, where high altitudes, harsh winters, and hot, dry summers limit their economic opportunities and standard of living. In addition, for women and youth, poor access to natural resources, education, and decision-making and healthcare systems heightens their vulnerability to changes in environmental parameters [37].

Approximately 6% of the population suffers from nutritional deficiencies associated with a high consumption of starch-based diets as opposed to nutrient-dense food, resulting in micronutrient deficits [38]. According to the National Statistical Committee [39], an average household spends 48% of its income on food, and, for lower-income groups, the total household income spent on food can be as much as 74% [40].

Food security, nutrition, and health in the Kyrgyz Republic [6, 9, 36, 39, 41, 42]





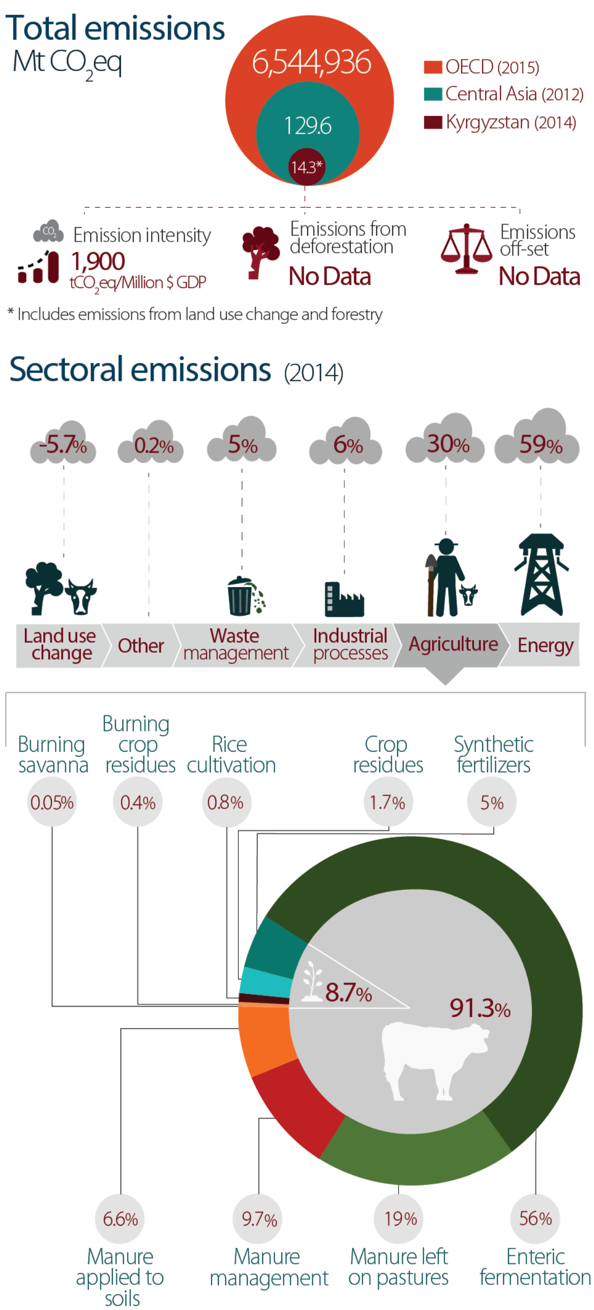


Agricultural greenhouse gas emissions

Currently, total greenhouse gas (GHG) emissions in the Kyrgyz Republic average 14.3 metric tons CO_2 equivalent (Mt CO_2eq) [9]. Approximately 59% of the country's emissions come from the energy sector, whereas agriculture accounts for 30% and industrial processes for 6% [43]. A large proportion (91%) of agricultural emissions come from livestock production, of which 56% result from enteric fermentation, followed by manure-related emissions. For crop production, synthetic fertilizers are the main source of

GHG (5%) [9]. In the Kyrgyz Republic Intended Nationally Determined Contribution (INDC), the government has committed to unconditionally reduce national GHG emissions by 11.5–13.8% below the reference scenario by 2030 and by 12.7–15.7% by 2050. Although the emissions per capita in the country are 2.6 t CO_2eq, less than half of the global average (6.3 t CO_2eq), the long-term goal of the government is to limit this value to 1.2 and 1.6 t CO_2eq by 2030 and 2050, respectively [43, 44, 45, 46]. In order to meet these targets, cross-cutting actions are required in the agricultural, forestry, and biodiversity sectors. Potential CSA interventions include organic farming, conservation agriculture, agroforestry, and agroecology [47, 48].

Greenhouse gas emissions in the Kyrgyz Republic [9, 43, 48]



Challenges for the agricultural sector

The agricultural sector in the Kyrgyz Republic faces several challenges. The biggest ones are population growth, socioeconomic vulnerability, land degradation, and a lack of adequate infrastructure.

Population growth will be a major challenge in the coming decades. According to predictive statistics, the total population will reach 7 million, an average density of 33 people per km^2 by 2030, and 8 million by 2050 (and an average density of 42 people per km^2). High population growth rates are expected in urban areas, which are forecast to increase from 34% of the population in 2018 to 49% in 2050 [49].

Population growth may be somewhat offset by migration, although this is neither sustainable nor predictable. Economic uncertainty has resulted in approximately 12% of the population leaving the country in order to seek employment elsewhere [50], most notably in the Russian Federation and Kazakhstan. According to the State Migration Service (2018), more than 700,000 Kyrgyz citizens are labor migrants. Approximately 76% of these migrants are women and men under the age of 35. The amount of remittances from migrants in 2014 represented around 30% of total GDP [50].

Another issue is the limited and underdeveloped infrastructure within the agricultural sector. The planned economy system that was developed during the Soviet Union era collapsed, and modern market infrastructure has not yet been fully developed to replace it. There have been positive steps to modernize the agricultural sector, although progress is slow. For example, over the last 20 years, an estimated 15% of farm machinery has been upgraded [34, 51].

Other examples of underdeveloped and out-dated infrastructure are agricultural storage capacity and methods, which are inadequate to meet the current needs of the sector. This has a negative effect on the quantity and the quality of Kyrgyz agricultural produce. It is estimated that approximately 15% of agricultural production is spoiled before it reaches the market because of inadequate storage [52].

Healthcare and the quality of veterinary services are an important infrastructural issue because of the importance of livestock in the Kyrgyz Republic. A lack of organizations that provide healthcare has been a key factor in limiting the development of the livestock sector. Poor animal health not only negatively affects animal productivity but also poses serious public health risks and limits the country's export potential. In 2017, the Development of the Veterinary Services of the Kyrgyz Republic for 2018–2023 (DVS) was set up, which marks a positive step in terms of infrastructural development pertaining to rearing livestock.

Water management is another important challenge for agricultural development. According to the Asian Development Bank [31, 32], water supply rarely corresponds to water need because of seasonal variations. For example, wheat requires one to three irrigations in spring and early summer when river flows tend to be low. As a result, wheat farmers often experience water shortages. This is not a problem of supply but of organization and management. There are 1,030 irrigation canals and drainage systems, which are governed by Water Users' Associations (WUA), which are independent non-commercial organizations charged with managing the use and maintenance of irrigation systems at the farm level. The efficiency of these organizations could be improved as a nation-wide increase in water loss has been observed in recent years. The ratio between total water usage and water intake from natural sources has decreased (0.8 in 1991 vis-à-vis 0.6–0.7 between 2005 and 2013). Of the total water intake, an estimated 40% is lost due to inefficient irrigation systems, compared with 33% in Uzbekistan and 34% in Turkmenistan. In the Kyrgyz Republic, the total annual water loss has been valued at around 2.4 km^3/year, although it has been argued that the real total water loss may be higher [33].

Land degradation, caused by anthropogenic and ecological factors, is another concern. Approximately 45.7% of the total agricultural land is exposed to water and/or wind erosion [53]. Moreover, by 2012, 49% of all pasturelands had become degraded in quality due to a lack of proper grazing management, which could be attributed to a lack of knowledge, lack of economic incentives, and poor infrastructure [54]. Soil tillage practices that invert soil using heavy machinery also pose a threat to soil structure and biological health, particularly in mountainous areas [55]. The degradation of pasturelands has led to the disappearance of the plant species most sensitive to grazing, and has resulted in the depletion of biodiversity, soil compaction, and erosion. Approximately 70% of winter pasture areas have been degraded due to overgrazing, most notably in densely populated areas such as the Chui and Fergana valleys [26], while uncontrolled grazing and firewood collection have amplified the depletion of natural resources. This has led to the threat of deforestation in certain areas of the Kyrgyz Republic [56].

Agriculture and climate change

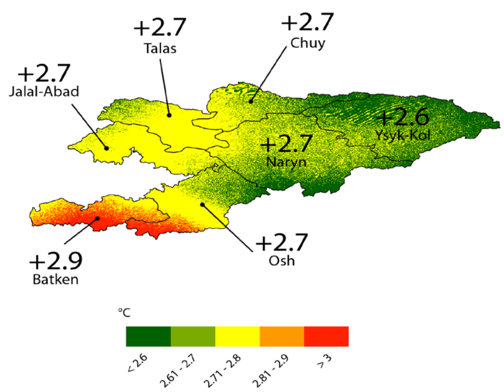
The Kyrgyz Republic is the third most vulnerable country to the impact of climate change in Eastern Europe and Central Asia, primarily due to the sensitivity of its agricultural systems [57]. The climate varies dramatically within the country, ranging from sharp continental to an almost oceanic climate due to the complex mountainous topography and the presence of Lake Issyk-Kol [27]. An analysis of the evolution of climate change parameters from 1960 to 2010 shows an accelerated increase over time. Annual temperatures have risen 2.4 °C on average for the period mentioned, and GCMs used to model climate projections for the country suggest that average temperatures are likely to continue increasing in all climate zones by 2.7 °C by 2050 and by up to 3.1 °C by 2070. No significant regional difference in temperature increase is expected, varying from 2.6 °C in Issyk-Kul to 2.9 °C in Batken. The country's average annual precipitation ranges from 300 to 600 mm per year. Instrumental observations reveal a steady increasing trend for the period 1960–2010, with a slight reduction for the period 1990–2010 [27]. Projections indicate on average a 6% and 7.5% increase in total annual precipitation by 2050 and 2070, respectively.

A large proportion of the country is prone to natural and climate-related disasters. Landslides, floods, mudflows, and avalanches have damaged infrastructure and led to economic losses in the agricultural sector. The average annual cost of damage caused by various types of climatic hazards, including drought for major crops (e.g., wheat, barley, vegetables, and sugar beet), is significant [27, 36, 61]. Additionally, projected trends up to 2050 in food security for Central Asian countries predict that marginal yield increases (e.g., 0.3% in maize) will result in declines in per capita maize harvests on account of population growth [62].

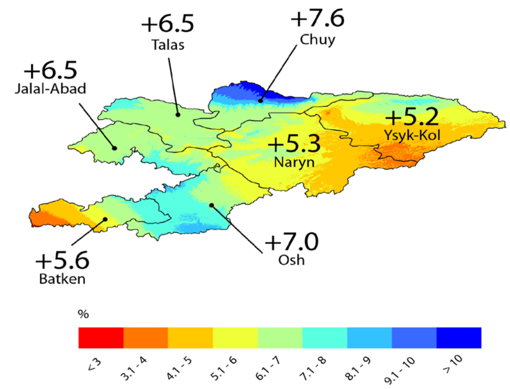
The Kyrgyz Republic is a major supplier of water for the Central Asian region as 4.1% of the total country area is covered by glaciers and snowfields. Melting processes associated with climate change pose a significant threat to hydropower generation and the quality and availability of water reserves for irrigated agriculture. Modeling studies suggest that, under a water scarcity scenario in the semiarid regions of the country, expected on farm incomes might decrease by about 15%, making the profitability of agricultural production more vulnerable to water availability changes [63, 64]. In parallel, the total volume of glaciers saw a sharp decline of 18% in a 40-year period (1960–2000). If the total glacial volume continues to decrease at this rate, this will exacerbate the above-mentioned climate-related impacts [65].

Projected change in Temperature and Precipitation in the Kyrgyz Republic by 2050 [58, 59, 60]

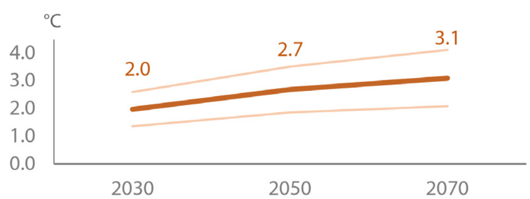
Changes in annual mean temperature (°C)



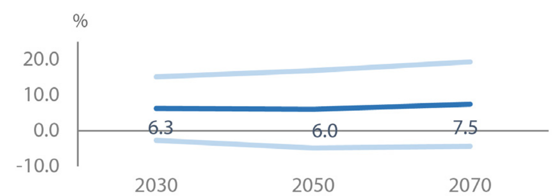
Changes in total precipitation (%)



Average temperature (°C)



Average precipitation (%)



Potential economic impacts of climate change

The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) developed by IFPRI [66] enables the assessment of future changes in yields, cropped area (or livestock numbers), and net trade under scenarios with and without climate change (CC and No-CC scenarios, respectively).

In terms of area and yield, production systems such as barley, sunflower, sugar beet, and bean are projected to simultaneously increase in yield and decrease in harvest area. This tendency has the potential to improve productivity and economic efficiency in response to altered climatic conditions. For instance, bean cultivated areas by 2050 might decrease by 8.5% coupled with a yield increase of 4.6%. This is measured as percentage differences between the CC and No-CC scenarios.

By contrast, wheat, maize, vegetable, and potato production systems are expected to increase in area as well as in yield. In the case of wheat, area and yield would increase by 2.9% and 27%, respectively. This has the potential to relieve the high land pressure for agricultural and industrial use through an increase in yield. (See Annex 2.)

Climate change impacts on international trade are represented as the gaps between production and local demand for each production system. This is calculated as the difference between the country's net trade growth with and without climate change. Under the climate change scenario, we observe a reduction in maize and wheat imports by 17.5 percentage points (pp) and 30.4 pp, respectively. Sunflower imports are projected to increase by 58.2 pp.

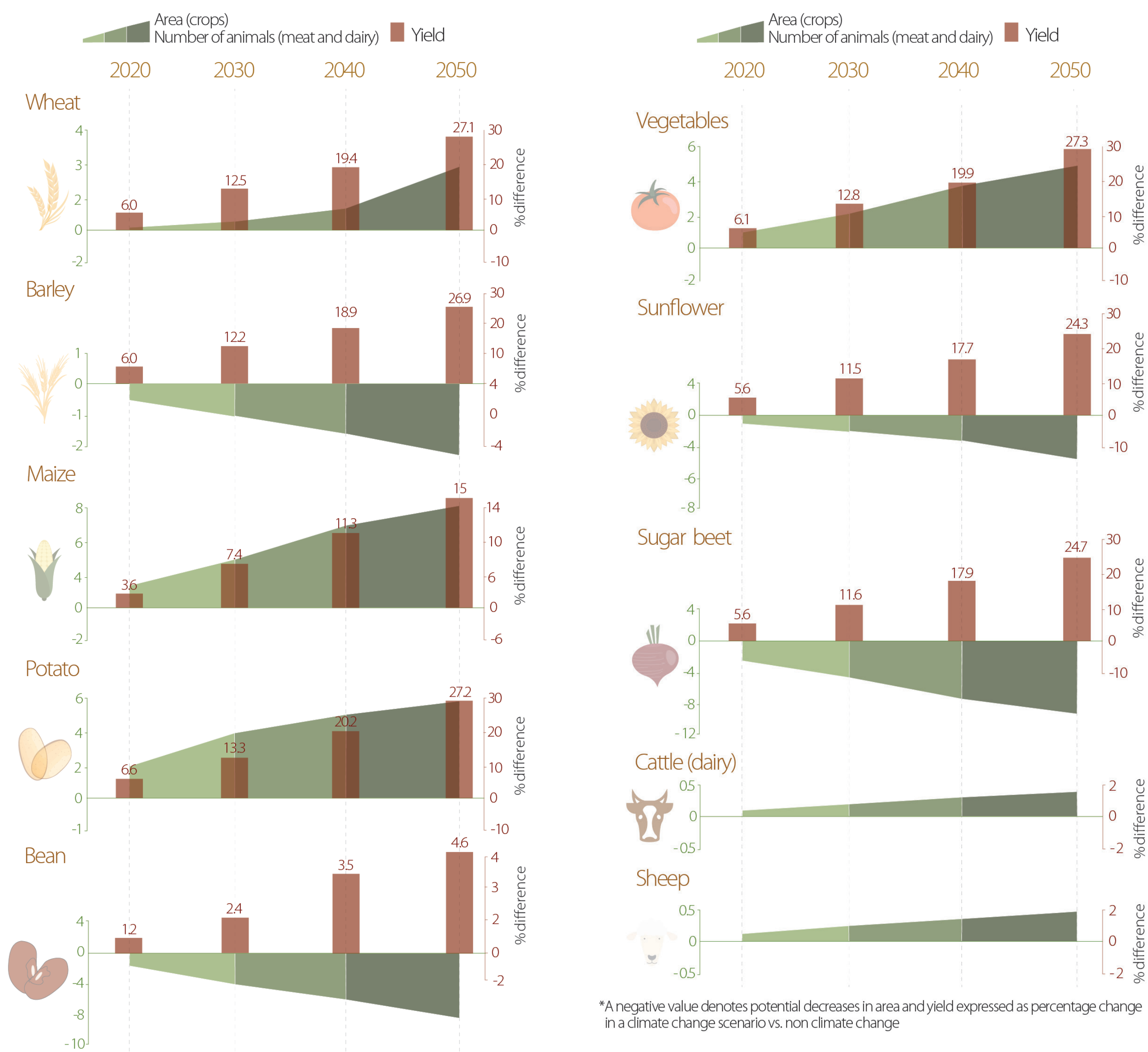
Additional entry points can be drawn from the model projections:

- Beans will require special attention given the projected decrease in area under production, but rise in yield. However, it is yet to be determined whether the potential gain in efficiency will be enough to expand exports.
- Cattle present an opportunity to tip the balance in favor of the export market. However, only livestock numbers

have been considered in this assessment. The inclusion of other factors such as feed availability, feed-use efficiency, and market prices should be considered.

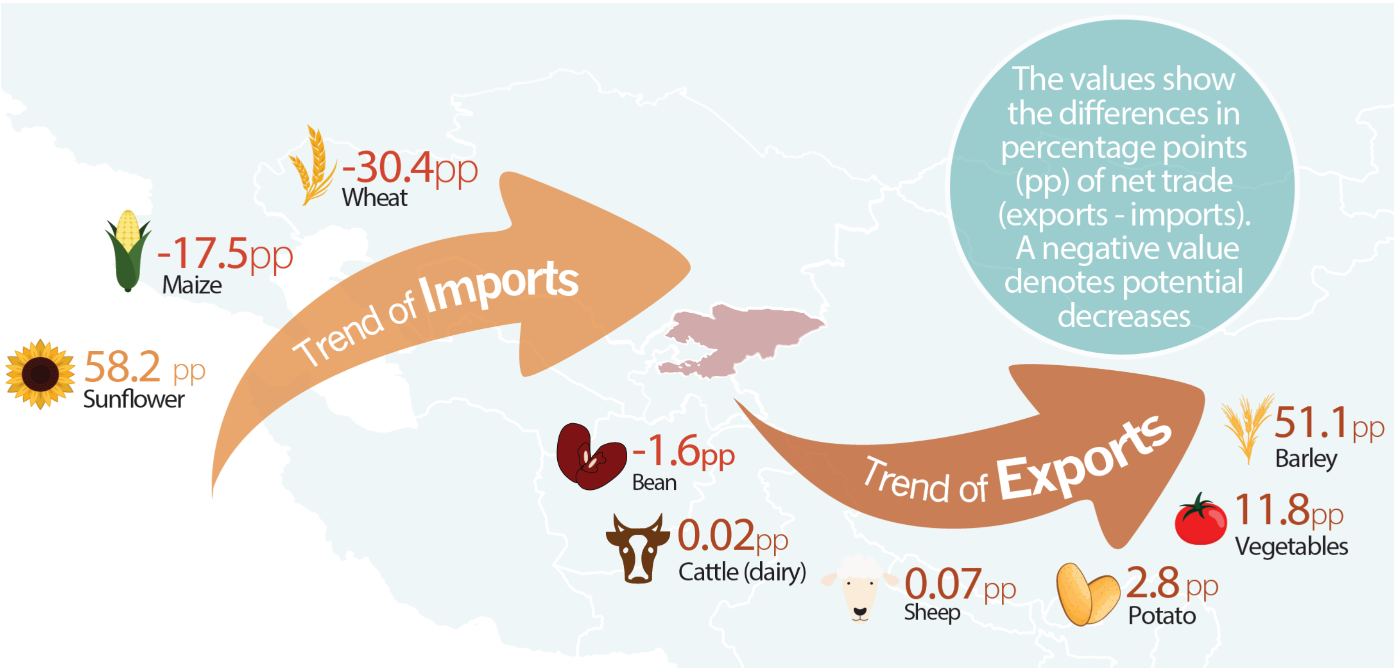
- Vegetable production is expected to expand with higher yield, area under production, and exports. This could stimulate new opportunities for agro-business and greater participation in export markets.
- Wheat and maize under the climate change scenario remain the most important production systems, with an increase in yield and area resulting in a decrease in import dependence.
- Barley and sugar beet production systems show a rise in yield, reduced area, and reduced import dependence.

Climate change impacts on yield, crop area, and livestock numbers in the Kyrgyz Republic



*A negative value denotes potential decreases in area and yield expressed as percentage change in a climate change scenario vs. non climate change

The impact of climate change on net trade in the Kyrgyz Republic (2020-2050)



CSA technologies and practices

CSA technologies and practices present opportunities for addressing climate change challenges as well as for stimulating economic growth and promoting sustainable development within Kyrgyz food and agricultural systems. For this profile, practices are considered CSA if they enhance food security as well as at least one of the other objectives of CSA (adaptation and/or mitigation). Hundreds of technologies and approaches around the world fall under the heading of CSA.

Conservation agriculture (CA) practices have been identified as a promising intervention for wheat, barley, sunflower, potato, maize, and sugar beet production. This technology offers numerous benefits across the CSA pillars. It has the potential to decrease soil degradation, raise productivity and resilience, and reduce production costs. Despite this, its overall adoption level is less than 30%. CA practices are currently implemented for sunflower, potato, and maize production systems in the southern region, and the technology has recently been piloted for maize and sugar beet production in the northern region.

In addition, FAO has implemented a pilot project on no-till cultivation on approximately 300 hectares of wheat [67]. Various studies conducted in the country show that a 25–38% increase in wheat yield could be obtained under raised-bed and no-tillage planting conditions compared with the conventional cultivation method. In addition to yield increases, seeding rates under CA in the Kyrgyz Republic could be reduced by 50% while the irrigation water requirement could be lowered by 27% [55, 68, 69].

Cover crops with leguminous species, use of organic fertilizers, breeding local and stress-tolerant varieties, and integrated pest management practices have been identified as promising practices across major production systems. Experts also list greenhouses as climate-smart technology, especially suitable for vegetable production. The adoption rate is about 30% by smallholder farmers. Currently, 676 greenhouse farms have a total area of 65 hectares and a production capacity of 2,166 tons of product per year [70]. However, the volume of production is insufficient; it does not meet the needs of the domestic market. Out of season, when farmers do not harvest from the fields but only from greenhouses, the domestic market is provided with a maximum of 20% of total product required [71]. In this scenario, efforts to scale up adoption of CSA practices should always include an assessment of market demand, the provision of extension services, and conductive policies to ensure farmers' adequate access to markets and profitable commercialization [71, 72]. Incorporation of big data analysis and modelling is also important to support informed decision-making in the short and long term.

Water-efficient technologies are key to improving farmers' livelihoods. Drip irrigation systems show multiple benefits in terms of adaptation and productivity. Although some small-scale farmers have already adopted this technology, large-scale adoption could be achieved through an inclusive strategy to organize stakeholders along the crop and livestock value chains [33].

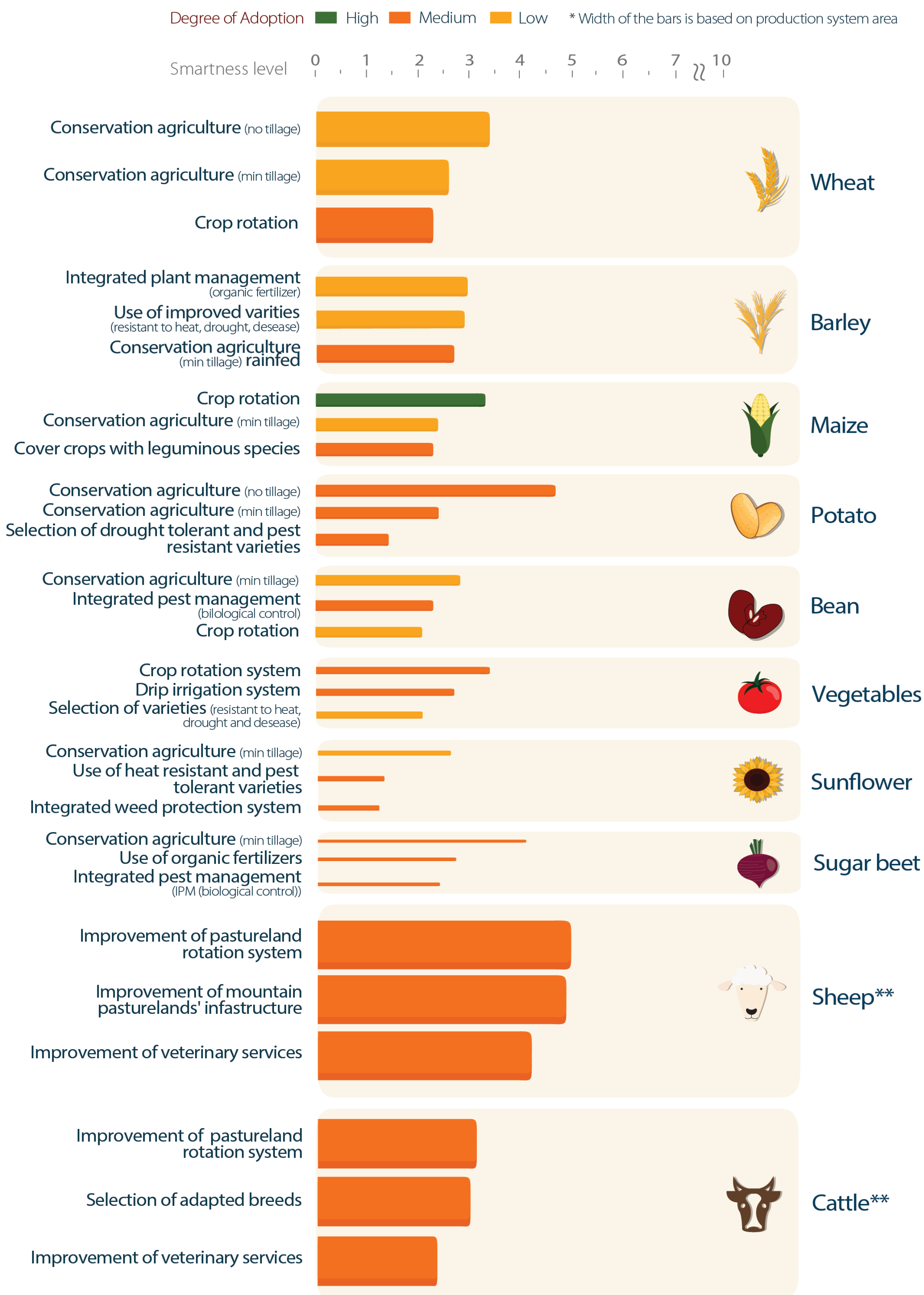
For livestock production, relevant CSA practices identified in Talas and Naryn regions include the promotion of rotational grazing systems, the development of infrastructure in pasturelands, selection of adapted breeds, and manure management techniques. The long-term adoption of these practices has the potential to increase farm productivity, improve soil fertility, and help to reduce GHG emissions per unit of product. The development of the livestock sector requires conjunctive efforts concerning the enhancement and organization of the national veterinary services, a focus on animal nutrition and healthcare, community-based pasture management, and an improvement of market and agro-processing infrastructure [57, 73]. Strengthening research on CSA practices to ensure diversification of farming systems and income sources (e.g., agroforestry and silvopastoral systems) is also important for maintaining socioeconomic and environmental resilience by reducing the risk of income loss [73, 74].

Most of the practices and technologies identified for crop and livestock systems have low to medium adoption rates despite their multiple CSA benefits. The key cross-cutting barriers to wider-scale adoption of CSA include limited knowledge on potential benefits of CSA practices among farmers, limited access to long-term credit, high investment costs, and limited access to agricultural tools and machinery. The barriers to adoption as well as the practices in the graphics have been selected for each production system deemed central for food security in the country, using the results of research as well as participatory stakeholder workshops and consultations for each production system.

The CSA practices identified in this study address important challenges faced by the country's agricultural sector. The next infographic presents a selection of CSA practices with high climate smartness scores on CSA indicators according to expert evaluations. The average climate smartness score is calculated based on the practice's individual scores on eight climate smartness dimensions that relate to the CSA pillars: yield (productivity), income, water, soil, risk (adaptation), energy, carbon, and nitrogen (mitigation). A practice can have a negative/positive/zero impact on a selected CSA indicator, with 10 (+/–) indicating a 100% change (positive/negative) and 0 indicating no change.

A detailed explanation of the methodology and a more comprehensive list of practices analyzed for the Kyrgyz Republic can be found in Annex 3.

Selected CSA practices and technologies for production systems key for food security in the Kyrgyz Republic



** Unidentified production system area

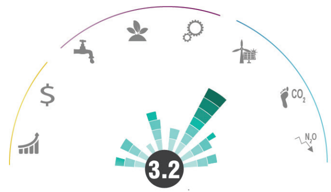
Case study: Effective village livelihood options

Agriculture is a mainstay in terms of livelihood in the Kyrgyz Republic. Almost every family is involved in agriculture in some way. However, because of climatic conditions, fruits and vegetables are available only on a seasonal basis. The Nutrition in Mountain Agro-ecosystems (NMA) project implemented by the Rural Advisory Services (RAS) in Jalal-Abad Province (2015–2018) has sought to improve access to nutritious food products.

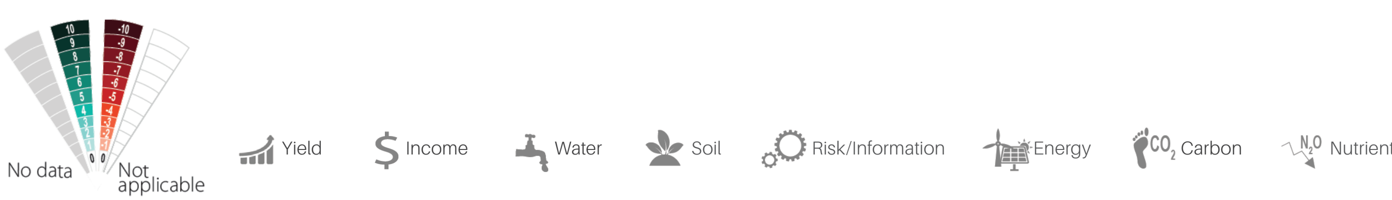
Ajimatov Abdygulam, who has been producing vegetables in his greenhouse for 3 years, is a teacher who works at Naiman school in one of the villages of the Nookat region in the southern part of the country. When he is not teaching, he dedicates his time to his farmland, growing a diverse range of vegetables to support his family. Abdygulam was interested in building a greenhouse, and visited several regions to increase his knowledge of agricultural methods. In the first year, he constructed a heated greenhouse covering 0.03 ha and tried to produce cucumber. Because of his lack of knowledge and techniques, his effort failed. In the second year, his relatives from Uzbekistan taught him practical skills in growing tomatoes, green leaves, and onions. Thanks to their input, Ajimatov's attempts provided much better results than they had in the previous year. However, profitability remained low and he was considering giving up growing his own produce. During the third year, his school started to cooperate with the RAS on implementing the "My successful garden" initiative at the local level. This initiative enabled Abdygulam to attend RAS training classes in 2016 along with other teachers, school children, and farmers. The training was based on emerging management practices, including greenhouse maintenance and the use of drip irrigation systems, with the aim of increasing productivity. These classes motivated him to develop a technical skillset in this area and allowed him to refine and improve his methods. Additionally, the RAS connected Abdygulam to local agronomist consultants, who could advise him on a regular basis. In 2017, he produced 2.7 tons of tomato and sold them to others in his village and at a local market. As a result, he earned US$1,723, making a net profit of US$1,418. While Abdygulam improved his farming knowledge and increased his income, he also became a lead farmer for local villagers in producing healthy food year-round using modern and accessible agricultural techniques.

Partly adapted, discussed, and translated from the Mountain Agro-ecosystem Action Network (MAAN), used with permission from the authors, Nasiba Mamasalieva and Mahabat Karaeva, from the RAS in Jalal-Abad Province. Photography: Toktosunov Askat. https://www.rasja.kg/en/current-projects/nutrition-in-mountain-agro-ecosystems/. https://maan.ifoam.bio/pages/viewpage.action?pageId=3571716

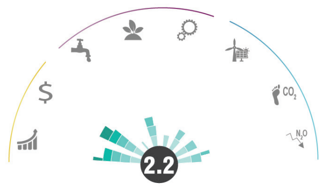
Table 1. Detailed smartness assessment for top ongoing CSA practices by production system as implemented in the Kyrgystan Republic.

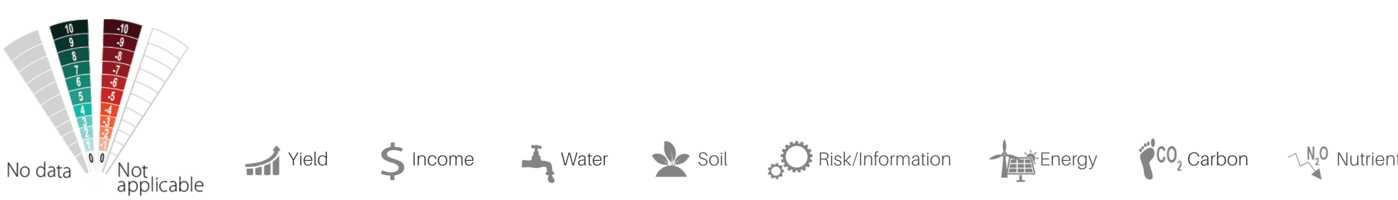
CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Wheat (21% of total harvested area)				
Conservation agriculture (no tillage)	Naryn (central) <30%	S		**Productivity** Overall agro-ecosystem productivity is maintained, thus increasing yield and reducing costs. **Adaptation** Prevents soil erosion. Promotes soil moisture conservation and water availability. Builds soil fertility by improving physical and biochemical soil characteristics. **Mitigation** Promotes medium- to long-term carbon storage in soil. Reductions in related GHG emissions from soil tillage and fossil fuel use.
	Ussyk-Kol (northern) <30%	S		
Conservation agriculture (min tillage)	Naryn (central) <30%	S		**Productivity** Overall agro-ecosystem productivity is maintained, thus improving productivity and profit. **Adaptation** Reduces soil erosion. Increases soil moisture conservation and water availability. Builds soil fertility by improving physical and biochemical soil characteristics. **Mitigation** Maintains or improves soil above- and below-ground carbon stocks and organic matter content in the medium and long term.
	Ussyk-Kol (northern) <30%	S		
Barley (11% of total harvested area)				
Integrated plant management (organic fertilizer)	Batken (Southern) 30-60%	S		**Productivity** Enhances production and product quality, hence potential increases in income. **Adaptation** Enhances soil quality (physical and bio-chemical), thus increasing the system's potential to overcome climate shocks. **Mitigation** Reduces GHG emissions due to reduction in energy and in external input needs. Enhances soil carbon stocks.
	Yssyk-Kol (Northern) 30-60%	S		

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Barley (11% of total harvested area)				
Use of improved varieties (resistant to heat, drought, diseases)	Batken (Southern) <30%	S		**Productivity** Increases yield per unit area, especially during dry and hot periods, hence ensuring income for the farmers. **Adaptation** Enhances water-use efficiency. Increases resilience to moisture stress, climate shocks, and diseases incidence. **Mitigation** Provides moderate reduction in GHG emissions per unit of food produced. Promotes long-term accumulation of organic matter in soil.
	Yssyk-Kol (Northern) <30%	S		
Maize (6% of total harvested area)t				
Crop rotation	Talas (Northern) >60%	M		**Productivity** Diversifies income and food sources. Enhances production per unit area and allows year-round agricultural production. **Adaptation** Increases farmers' capacity to limit crop exposure to climate risks. Reduces soil erosion. Increases water- and nutrient-use efficiency per unit of output. **Mitigation** Rotation with leguminous crops reduces the need for nitrogen-based synthetic fertilizers. Maintains soil structure or improves soil carbon stocks.
	Jalal-Abad (Southern) >60%	M		
Conservation agriculture (minimun tillage)	Talas (Northern) <30%	S		**Productivity** Reduces cost of production and increases profit. **Adaptation** Improves soil's retention of nutrients. Reduces erosion and conserves soil moisture. Increases biodiversity in the soil, thus improving soil fertility. **Mitigation** Provides moderate reduction in use of fossil fuels. Reduces GHG emissions related with soil ploughing. Maintains soil carbon stocks and soil organic matter.
	Jalal-Abad (Southern) <30%	S		



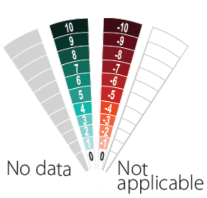
CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Potato (5% of total harvested area)				
Conservation agriculture (no tillage)	Chui Kemin (Nothern) 30-60%	M		**Productivity** Reduces production cost by reducing mechanization and synthetic fertilizer requirements. Increases income per unit of produce. **Adaptation** In combination with other conservation agriculture practices, promotes soil moisture conservation. Medium- to long-term increases in soil fertility by improving physical and biochemical soil characteristics. Reduces soil erosion. **Mitigation** Reduces energy use and GHG emissions (carbon footprint) by reducing use of fossil fuels during the tilling process. Maintains and/or improves soil carbon stocks.
	Yssyk-Kol (Northern) 30-60%	M		
Conservation agriculture (minimun tillage)	Chui Kemin (Nothern) 30-60%	M		**Productivity** Reduces production cost by reducing mechanization and synthetic fertilizer requirements. Increases income per unit of produce. **Adaptation** In combination with other conservation agriculture practices, improves soil structure (e.g., porosity), hence water retention capacity. Reduces runoff and erosion. **Mitigation** Some reductions in GHG emissions (carbon footprint) by reducing use of fossil fuels during the tilling process. Maintains and/or improves soil carbon stocks.
	Yssyk-Kol (Northern) 30-60%	M		
Bean (3.5% of total harvested area)				
Conservation agriculture (minimun tillage)	Batken (Southern) <30%	S		**Productivity** Higher profits due to increased crop yield and reduced production costs. Reduces impact on the agro-ecosystem. **Adaptation** Increases soil organic matter, hence soil water retention capacity. Reduces the risk of nutrients leaching into groundwater or surface water. Consequently prevents water pollution and eutrophication. **Mitigation** Reduces emissions of methane and other GHGs related to use of synthetic fertilizers and soil disturbance. Leguminous cover crops could present greater benefits.
	Talas (Nothern) 30-60%	S		

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Bean (3.5% of total harvested area)				
Integrated pest management (biological control)	Batken (Southern) 30-60%	M		**Productivity** Reduces crop losses from pests and diseases. Potential increases in profits due to increased crop yield and produce quality. **Adaptation** Reduces environmental degradation and biodiversity loss due to reduced use of pesticides. **Mitigation** Reduces GHG emissions by reducing use of synthetic pesticides.
	Talas (Nothern) 30-60%	M		
Tomato (3% of total harvested area)t				
Crop rotation system	Batken (Southern) 30-60%	L		**Productivity** Enhances total production and productivity per unit area. Increases income stability and food security due to harvest of multiple crops. **Adaptation** Reduces the risk of total crop failure under unfavorable climatic conditions due to crop diversification. Reduces soil erosion. **Mitigation** Promotes soil coverage during the year and increases soil organic matter. Legume integration can reduce the use of synthetic nitrogen-based fertilizers.
	Chuy (Northern) 30-60%	L		
Drip irrigation system	Batken (Southern) Hoek) 30-60%	S		**Productivity** Increases land and crop productivity per unit of water. Allows diversification of agricultural activities and income sources. **Adaptation** Enables larger area for cultivation even with limited water availability during the dry season. Reduces soil erosion. Increases water- and nutrient-use efficiency. **Mitigation** Provides moderate reduction in GHG emissions in the medium and long term per unit of food produced. May imply additional energy use.
	Chuy (Northern) 30-60%	S		



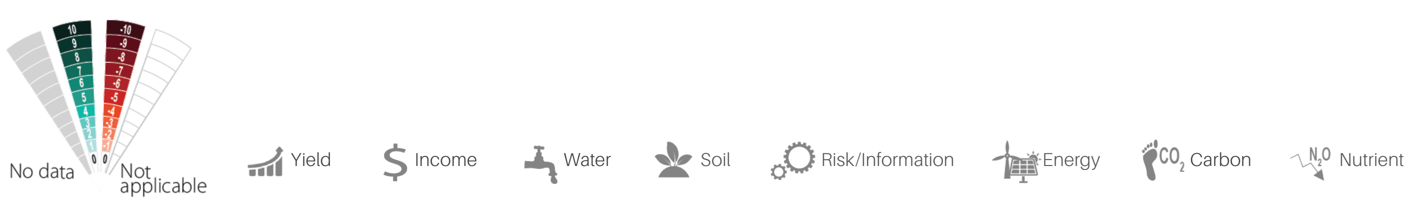
CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Sunflower (2% of total harvested area)				
Conservation agriculture (min tillage)	Northern <30%	S		**Productivity** Reduces production cost by reducing mechanization and synthetic fertilizer requirements. Increases income per unit of produce. **Adaptation** In combination with other conservation agriculture practices, promotes soil fertility and moisture conservation. **Mitigation** Reduces energy consumption for tillage. Maintains or improves soil carbon stocks and organic matter content.
	Southern <30%	S		
Use of heat resistant and pest tolerant varieties	Northern 30-60%	S		**Productivity** Potential increases in crop yield and quality, hence greater farmer profits. Increases food availability and access. **Adaptation** Increases farmers' capacity to limit crop exposure to climate hazards and pests. Potential reduction in water pollution due to pesticide use. Local varieties can present greater resistance to diseases and heat stress. **Mitigation** Reduces use of synthetic pesticides and fungicides, thus reducing related GHG emissions and carbon footprint.
	Southern 30-60%	S		
Sugar beet (0.5% of total harvested area)				
Conservation agriculture (min tillage)	Kemin (Northern) 30-60%	S		**Productivity** Increases yield due to enhanced soil health and fertility. Improves household nutrition. Reduces production costs. **Adaptation** Minimizes erosion and enhances in situ moisture and water infiltration due to improved soil structure characteristics. **Mitigation** Reduces GHG emissions attributed to ploughing and use of fossil fuels. Rotation with leguminous crops reduces input needs (e.g., nitrogen-based fertilizers) and related nitrous oxide emissions.
	Sokuluk (Northern) 30-60%	S		

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Sugar beet (0.5% of total harvested area)				
Use of organic fertilizers	Kemin (Northern) 30-60%	M		**Productivity** Promotes sustainable increase in productivity and income through greater product quality with minimal impact on the environment. **Adaptation** Enhances soil biodiversity as well as chemical and physical characteristics. Promotes efficient use of local inputs. Reduces runoff and erosion. Increases soil water retention capacity. **Mitigation** Maintains or improves soil carbon stocks. Reduces synthetic fertilizer requirements, hence reducing nitrous oxide emissions and carbon footprint.
	Sokuluk (Northern) 30-60%	M		
Sheep (48% of total harvested area)t				
Improvement of pastureland rotation system	Naryn (Central) 30-60%	S		**Productivity** Increases forage quantity and quality per unit area, thus increasing total productivity (meat and wool). Reduces cost from supplemental feed per unit of product. **Adaptation** Prevents pasture degradation and biodiversity loss. Limits soil erosion. Facilitates manure collection and management. **Mitigation** Increases carbon storage in soils. Reduces use of synthetic fertilizers and related GHG emissions/carbon footprint.
	Talas (Northern) 30-60%	M		
Improvement of mountain pasturelands' infrastructure	Naryn (Central) 30-60%	L		**Productivity** Increases productivity and income through equitable, efficient, and effective use of pasturelands. Repaired livestock driveways, bridges, and water sources, etc. **Adaptation** Reduces pressure on natural resources. Facilitates community-based natural resource management. Potential increases in food availability and reductions in postharvest loss. **Mitigation** Increases in production efficiency potentially reduce energy use and GHG emissions per unit of product.
	Talas (Northern) 30-60%			



Yield | Income | Water | Soil | Risk/Information | Energy | CO_2 Carbon | N_2O Nutrient

CSA practice	Region and adoption rate (%) <30 30-60 60>	Predominant farm scale S: small scale M: medium scale L: large scale	Climate smartness	Impact on CSA Pillars
Cattle (meat) (48% of total harvested area)				
Improvement of pastureland rotation system	Naryn (Central) 30-60%	S		**Productivity** Increases food availability and quality. Maximizes household income. **Adaptation** Prevents pasture degradation and biodiversity loss. Limits soil erosion. Facilitates manure collection and management. Reduces vulnerability to animal parasites and diseases. **Mitigation** Reduces GHG emissions per unit of product. Reduces methane emissions related to enteric fermentation.
	Talas (Nothern) 30-60%	S		
Selection of adapted breeds	Naryn (Central) 30-60%	M		**Productivity** Reduces loss of assets and income from livestock, thereby increasing household profits. **Adaptation** Increases resilience to adverse climate conditions, without compromising production and quality of produce. Local breeds can present greater resistance to diseases and heat stress. **Mitigation** Reduces fodder/forage and other inputs required for attaining maximum yield.
	Talas (Nothern) 30-60%	M		



Institutions and policies for CSA

Institutions

The Kyrgyz Republic has multiple institutions that support sustainable agricultural development and climate change adaptation. These institutions have various functions such as disseminating theoretical and practical knowledge, developing management skills, and conducting agricultural research and development, including for CSA practices. Several organizations also provide financial assistance and policy support.

In the Kyrgyz Republic, the promotion of CSA falls under the mandate of the Ministry of Agriculture, Food Industry, and Melioration (MoAFIM) and its areas of intervention involve livestock, aquaculture, plant growing, plant quarantine, land reclamation, soil fertility, land and water resources, irrigation, and improvement of infrastructure. The State Inspection on Veterinary and Phytosanitary Security (SIVP) is responsible for controlling and regulating veterinary and phytosanitary security in the country.

The State Agency for Environmental Protection and Forestry (SAEPF) implements policies and regulations pertaining to environmental protection, forestry, and natural resource management, which cover climate change, adaptation, and mitigation. The State Inspection on Ecological and Technical Security (SIETS) controls aspects of environmental and technical security, while the State Agency on Meteorology (SAM), working under the Ministry for Emergency Situations (MES), provides forecasts, climate projections, and early-warning signals for natural hazards directly to farmers through mobile devices.

Educational institutions, including the Kyrgyz National Agrarian University (KNAU), named after K.I. Skryabin, the Mountain Societies Research Institute (MSRI), and the University of Central Asia, are actively undertaking multidisciplinary research in the field of climate change, contributing to the dissemination of research. For example, KNAU collaborated with Finnish universities and FAO to carry out aquaculture research, which is an example of multi-agency research aimed toward implementing CSA practices.

The International Fund for Agricultural Development (IFAD) has been active since 1996 and it focuses on livestock productivity and enhancing the climate resilience of pastoral communities [75]. The World Bank has focused on improving irrigation infrastructure and food security through the Community Seed Funds project (2013–2018), which supplied farmers across 160 villages with high-quality seeds [76]. The Agro Horizon and Farmer-to-Farmer projects of USAID, which ran from 2013 to 2018, implemented agricultural programs that enhanced agricultural extension services to farmers. Approximately 70,000 farmers directly benefited from this project. Other projects have also been implemented with a focus on improving food security and agro-enterprise development [77].

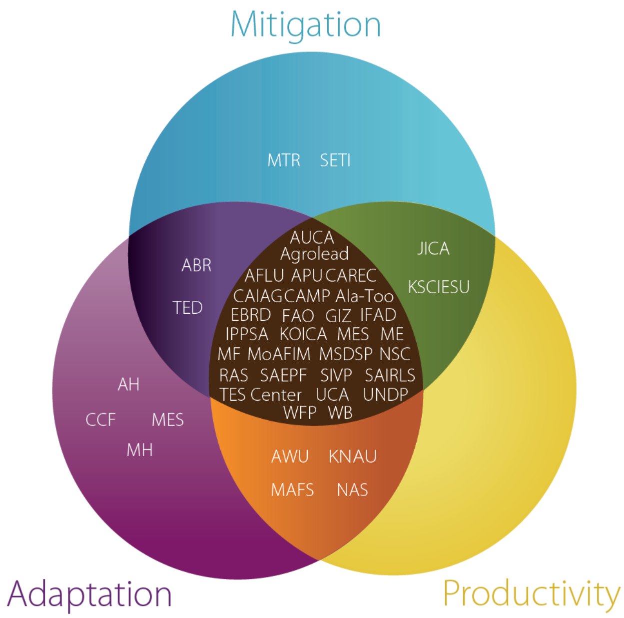
Further, a broad range of projects targeting issues related to forestry have been implemented. A prominent example is the Sustainable Management of Mountainous Forest and Land Resources under the Climate Change Conditions project, which began in 2014 and is scheduled to run until 2019, implemented by FAO and funded by the Global Environment Facility (GEF). The project's vision is to sustain the flow of ecosystem services through the enhancement of carbon stocks in agro-systems and forests [78]. The project developed participatory forest management methodologies for about 20,000 ha of forestland. The overall aim is to increase indigenous fast-growing forest trees, counteract deforestation, and offer a demonstration plot for current innovative agricultural practices. These demonstration sites enable local farmers to gain insight and practical experience, with the hope that they will adopt the most suitable practices for their farm conditions [78].

NGOs also contribute to support sustainable agriculture and CSA. CAMP Alatoo a leading nonprofit and nongovernment organization (NGO) in Central Asia based in Bishkek is a good example. It supports, develops, and implements innovative technologies in the management of natural resources [79]. The NGO implements CSA-based projects in cooperation with the German Agency for International Cooperation (GIZ) and Swiss Development Cooperation (SDC), alongside other bilateral organizations. An example of the work done by CAMP Alatoo is the implementation of a project on ecosystem-based adaptation (EbA) in the high mountainous regions of Central Asia (2015 to 2019), carried out in cooperation with Climate Initiative (IKI) and GIZ. Rural Advisory Services (RAS), the Association of Forest and Land Users (AFLU), and the Mountain Societies Development Support Programme (MSDSP) of the Aga-Khan Network are further examples of active NGOs in the Kyrgyz Republic. These organizations work to implement development strategies at several levels. These include planning food security initiatives, focusing on the development of rural and remote mountainous areas, implementing risk management initiatives, and practicing sustainable approaches to manage forestland, livestock, and agroforestry systems.

There is potential for local NGOs to support the implementation of CSA, which would be key to effectively generate and transfer knowledge and technologies relating to CSA practices to farmers. However, one of the major institutional challenges is the lack of state finance for agriculture. This situation has resulted in underdeveloped infrastructure and a shortage in the technologies necessary to implement such practices.

The following graphic highlights the key institutions whose main activities relate to one, two, or three CSA pillars (adaptation, productivity, and mitigation). More information on the methodology and results from interviews, surveys, and expert consultations is available in Annex 4.

Enabling institutions for CSA in the Kyrgyz Republic



ABR Asian Development Bank **AFLU** Association of Forest and Land Users **AH** Agency on Hydrometerology under Ministry for Emergency Situations **APU** Association of Pastureland Users **AUCA** American University in Central Asua **AWU** Association of Water Users **CAIAG** Central-Asian Institute for Applied Geosciences **CAREC** Regional environmental Centre **CCF** Center on Climate Finance **EBRD** European Bank for Reconstruction and Development **FAO** United Nations Food and Agriculture Organization **GIZ** German Development Cooperation Agency **IFAD** International Fund for Agricultural Development **IPPSA** Investment Promotion and Protection State Agency **JICA** Japan Agency for International Cooperation **KNAU** Kyrgyz National Agrarian University **KOICA** Korean Agency for International Cooperation **KSCIESU** Kyrgyz State Committee for Industry, Energy and Subsoil Use **ME** Ministry of Economy **MES** Ministry for Emergency Situations **MES** Ministry for Education and Science **MF** Ministry of Finance **MH** Ministry for Health **MoAFIM** Ministry for Agriculture, Food Industry and Melioration **MTR** Ministry for Transport and Roads **MSDSP** Mountain Societies Development Support Programme **NAS** National Academy of Sciences **NSC** National Statistical Committee **RAS** Rural Advisory Service **SAIRLS** State Agency for Interethnic Relations and Local Self-government **SAEPF** State Agency for Environmental Protection and Forestry **SETI** State Ecological and Technical Inspection **SIVP** State Inspection for Veterinary and Phytosanitation **UCA** University of Central Asia **UNDP** United National Development Programme **WB** World Bank **WFP** United Natons World Food Programme

Policies

Although a targeted climate change policy in the Kyrgyz Republic is lacking, government institutions, international agencies, and NGOs have actively integrated climate change measures into sectoral policies and sustainable development strategies and programs [77]. The National Sustainable Development Strategy of the Kyrgyz Republic (NSDS, 2013–2017) outlines key priorities for a long-term vision of the country's status. It provides a guiding framework on environmental activities and practices. The CSA-related items within this framework include the strengthening of regulations on energy-saving practices, the enhancement of product quality and efficiency of agricultural production, and the improvement of natural resource management mechanisms. The NSDS intends to create an enabling environment for the application of green technologies and investments toward climate change adaptation [80]. It led to the development of diverse programs in related fields, attracting investment in the agricultural sector as well as establishing a dialogue with various international organizations.

In spite of these positive achievements, the NSDS has faced implementation challenges. By the end of 2016, approximately 40% of the agriculture-related projects under the NSDS had not started, 25% of the projects were in their implementation stage, and the rest were in an uncertain stage due to a lack of state funding [81]. This highlights the need for strategic planning for the implementation of strategies and related policies.

Food security and issues related to nutrition are closely interrelated with the sustainable development policies of the country. After deliberations among government institutions, led by the Food Security Council and supported by FAO, the Food Security and Nutrition Programme (FSNP) and Action Plan (2015–2017) were drafted to outline four main targets: (1) food availability; (2) physical and economic access to food; (3) dietary quality, diversity, and caloric intake; and (4) control and supervision of food safety. However, the implementation status remains incomplete due to several reasons: a significant funding gap that stands at nearly 45% of the total estimated financial cost, a tenuous engagement plan among sectoral stakeholders, a lack of installed capacity, and an ambitious execution time. These factors pose key challenges to the translation of the policy into action [85].

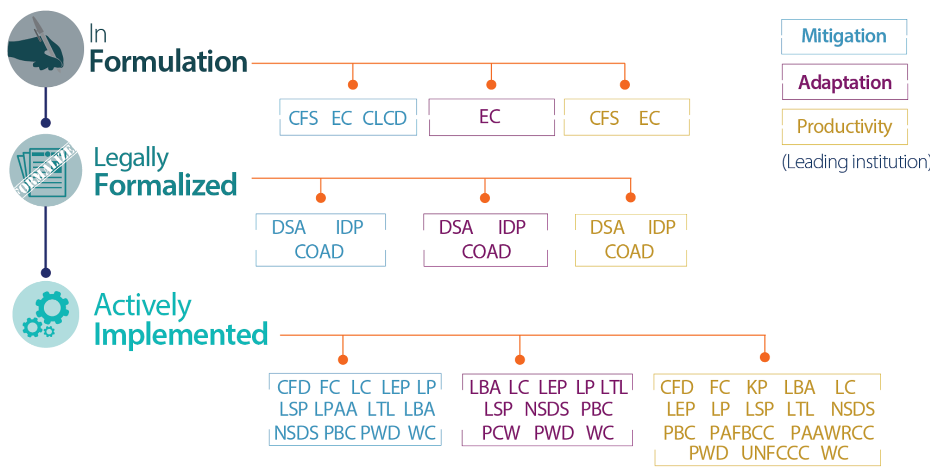
Policy relating to offsetting climate change is a central focus of the Kyrgyz government, and the country is a party to 13 international environmental treaties and conventions [80]. Moreover, the country ratified the UNFCCC in 2000 and the Kyoto Protocol in 2003, while the Paris Agreement has been signed but not yet ratified [44, 46]. The three National Communications were submitted in 2003, 2009, and 2017. These communications highlight the need to integrate climate change into sustainable development programs, promote gender equality, develop and transfer environmentally sound technologies as well as build capacity and support research [48].

Additionally, the Kyrgyz Republic Intended Nationally Determined Contributions (INDC) [65, 81, 82] refer to the "Priorities for Adaptation to Climate Change in the Kyrgyz Republic during 2013 to 2017." This policy-guiding document focuses on agriculture, energy, water, emergencies (e.g., natural disasters, risk management), healthcare, forests and biodiversity, and research. The INDC has a strong focus on minimizing risks related to climate change through the implementation of adaptation measures in vulnerable sectors. In the agricultural sector, this relates broadly to the efficiency of land use, and specifically to agricultural infrastructure, pasture management, breeding programs to enable farmers to access and use drought-resistant crops, and creating a system for climate and crop yield forecasting.

In compliance with this policy, the Climate Change Adaptation Programme and Action Plan for the Forests and Biodiversity Sectors (2017) and the Programme for Agriculture and Water Management Adaptation to Climate Change (2016–2020) were set up, alongside several guidelines in support of GHG emission reduction, commitments to renewable energy, and energy and fuel efficiency [31, 32, 65]. However, long-term efforts for enhancing national and regional coordination mechanisms on climate change are yet to be put in place. Such mechanisms are necessary to fully implement policy frameworks, thus maximizing synergies across previous and future stakeholders' initiatives within and beyond the agricultural sector. An example of this is the national commitment relating to GHG emission reduction, which, under an international support scenario, could rise to as much as 30.9% and 36.7% below BAU by 2030 and 2050, respectively [45].

The graphic below represents a selection of policies, strategies, and programs that relate to agriculture and climate change and that are considered key to the development of CSA in the Kyrgyz Republic. The policy cycle classification aims to show gaps and opportunities in policy-making, referring to the three main stages: (1) formulation (policy in an initial formulation stage/consultation process), (2) formalization (agricultural enterprise development), and (3) implementation (activities under way, with visible progress toward achieving larger policy goals). For more information on the methodology, see Annex 5.

Enabling policy environment for CSA in the Kyrgyz Republic



CFD Concept for Forestry Development (2004-2025) (State Agengy for Environmental Protection and Forestry) **CFS** Concept on Food Security (2018) (Ministry for Agriculture, Food Industry and Melioration) **CLCD** Concept on Low-Carbon Development (2020) (State Agengy for Environmental Protection and Forestry) **COAD** Concept for Organic Agriculture Development (2017-2022) (Ministry for Agriculture, Food Industry and Melioration) **DSA** Development Strategy for Agriculture (1999) (Ministry for Agriculture, Food Industry and Melioration) **EC** Ecology Code (2018) (State Agengy for Environmental Protection and Forestry) **FC** Forest Code (1999) (State Agengy for Environmental Protection and Forestry) **IDP** Irrigation Development Programme (2017) (Ministry for Agriculture, Food Industry and Melioration) **KP** Kyoto Protocol (2000) (State Agengy for Environmental Protection and Forestry) **LBA** Law on Biosphere Areas (1999) (State Agengy for Environmental Protection and Forestry) **LC** Land Code (1999) (Ministry for Agriculture, Food Industry and Melioration) **LEP** Law on Environmental Protection (1999) (State Agengy for Environmental Protection and Forestry) **LP** Law on Pasture (2009) (Ministry for Agriculture, Food Industry and Melioration) **LPA** Law on Protected Areas (2014) (State Agengy for Environmental Protection and Forestry) **LSP** Law on Seed Production (1997) (Ministry for Agriculture, Food Industry and Melioration) **LTL** Law on Transformation of Land (1999) (Ministry for Agriculture, Food Industry and Melioration) **NSDS** National Sustainable Development Strategy (2018) (government and all related ministries) **PAAWRCC** Program for Adaptation of Agriculture and Water Resources to Climate Change (2016-2020) (Ministry for Agriculture, Food Industry and Melioration) **PACC** Priorities for Adaptation to Climate Change (2013) (all related ministries) **PAFBCC** Program for Adaptation of Forest and Biodiversity to Climate Change (2015-2017) (State Agengy for Environmental Protection and Forestry) **PBC** Priorities for Biodiversity Conservation (2014) (State Agengy for Environmental Protection and Forestry) **PCW** Priorities on Conservation of Wetlands (2013-2023) (State Agengy for Environmental Protection and Forestry) **PWD** Programme on Walnut Fruit Forests Development (2014-2025) (State Agengy for Environmental Protection and Forestry) **UNFCCC** United National Framework Convention on Climate Change (2000) (Related ministries) **WC** Water Code (2005) (Ministry for Agriculture, Food Industry and Melioration)

Financing CSA

Access to finance for farmers and the private sector is vital for agricultural development and to scale CSA. According to the Ministry of Finance, the government allocated in 2018 US$2.35 billion to support investment in all sectors. The agricultural sector was allocated 3.4% of the total budget (including external funding and assistance) [83]. Out of the allocated funds, 58% will be used in implementing joint projects with partners in the field of agriculture and water management, 28%, for technical operations and maintenance including irrigation facilities, and 14% for environmental and ecosystem protection, landscape diversity, preservation of natural resources, and of natural sites.

Agricultural development loans can be accessed through 24 commercial banks and more than 300 microcredit institutions in the country. These loans are however subject to interest rates of 20% or more [51]. Because of these high interest rates coupled with short repayment periods, access to these financial services remains severely limited for a large percentage of farmers, who often have limited financial management skills and unstable incomes.

In response to this, the government has developed a program that offers agricultural subsidies to farmers through five different commercial banks (The Kyrgyzstan Commercial Bank, Ayl Bank, Bakai Bank, Optima Bank, and the Kyrgyz Investment and Credit Bank) in a project labeled “Financing Agriculture 6.” The aim is to provide state support to both businesses and individuals working within the agricultural sector, especially to offer support during the busy spring field work period. The sectors that benefit from this project are livestock, crop production, processing development, and agricultural services. Farmers can obtain a loan for up to 36 months with an interest rate varying from 6% to 10% regardless of the market rate. The government then compensates the banks for any difference in the average market interest rate on loans [84]. Overall, this marks a positive step, demonstrating support for CSA with the aim of reducing GHG emissions from the livestock sector.

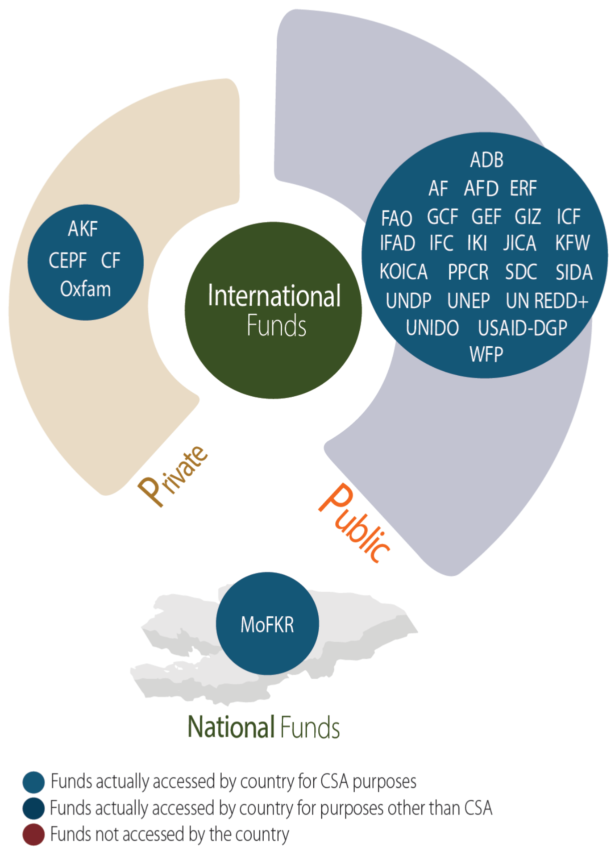
The Kyrgyz Republic has been active in attracting international funding for its economic sectors. In terms of grants and funding, during 2013–2014, donors contributed approximately US$60 million per year to climate-related development projects. However, only 5% of the total amount was spent on development within the agricultural sector [65].

With existing climate change legislation in place, avenues exist for seeking financing opportunities, including, but not limited to, GCF and GEF for CSA activities. As a result, key collaborating organizations are actively engaged in preparing project proposals targeting the agricultural sector. Thus, while funding is being sought, national and local programs and projects should be aligned to the CSA pillars, thus promoting sustainable agricultural development nationwide.

One of the challenges facing the Krygrz Republic is the reliance on NGOs for funding CSA and limited support from local government levels. There is also made more difficult by the lack of clarity on the legal framework and administrative mechanisms for collaboration between government and civil society. Such mechanisms are vital for ensuring that current and potential agricultural development funds will be accessed, managed, and used properly, thus maximizing the impact of sectoral programmes [81].

The next graphic highlights existing and potential financing opportunities for CSA in the Kyrgyz Republic. The methodology and a more detailed list of funds can be found in Annex 6.

Financing opportunities for CSA in the Kyrgyz Republic



ADB Asian Development Bank **AF** Adaptation Fund **AFD** French Development Agency **AKF** Aga-Khan Foundation **CF** Christensen Fund **ERF** Embassy of Russsian Federation **FAO** Food and Agriculture Organization of the United Nations **GCF** Green Climate Fund **GEF** Global Environment Facility **GIZ** German Society for International Cooperation **ICF** United Kingdom International Climate Fund **IFAD** International Fund for Agricultural Development **IFC** International Finance Corporation **JICA** Japan International Cooperation Agency **KfW** German Development Bank International Climate Initiative **KOICA** Korean International Cooperation Agency **PPCR** Pilot Program for Climate Resilience **SDC** Swiss Development Cooperation **SIDA** Swedish International Development Cooperation Agency **UNDP** United Nations Development Programme **UNEP** Unite Nations Environmental Programme **UNIDO** United Nations Industrial Development Organization **UN REDD** United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation **USAID-DGP** United States Agency for International Development – Development Grants Program **WFP** World Food Programme

Outlook

The Kyrgyz Government has developed various policies and strategies related to CSA activities and climate change with the support of international donors. However, the government needs to reinforce institutional dialogue and multi-stakeholders' planning to facilitate the implementation of long-term plans and strategies for agricultural development.

The Kyrgyz Republic needs to transform its conventional model of agriculture to incorporate CSA practices and move toward a more sustainable agricultural sector. Certain measures are particularly important to aid this transformation. Access to finance is a central issue, and working toward a sustainable nationwide allocation of credit with minimal interest rates and appropriate repayment periods is necessary.

This study has identified several promising CSA practices and technologies for the Kyrgyz Republic. These practices can contribute to the diversification of farming systems and income sources, and address climate change challenges while attracting investments to develop the agricultural sector. Long-term investments in agricultural infrastructure (food supply chain, veterinary, machinery, etc.), building capacity of farmers and value chain actors and, implementing CSA-related strategies and programs are all crucial to promote the sustainable development of agriculture in the Kyrgyz Republic.

Works cited

[1] FAO. 2010. "Climate-Smart" Agriculture. Policies, practices and financing for food security, adaptation and mitigation. Rome: Food and Agriculture Organization of the United Nations (FAO).

[2] FAO. 2013. Climate-smart agriculture sourcebook. Rome: FAO

[3] United Nations Development Programme (UNDP). 2016. Human development report, Kyrgyzstan. UNDP. Available at: http://hdr.undp.org/

[4] World Bank (WB). 2016. Country profile of the Kyrgyz Republic. Bishkek: World Bank. Available at: http://www.worldbank.org/

[5] The United Nations Development Assistance Framework (UNDAF) for the Kyrgyz Republic 2018-2022. Bishkek: UNDAF.

[6] WB (World Bank). 2018. World Development Indicators. Available at: https://bit.ly/1Cd8EkQ

[7] World Trade Organization (WTO). 2016. Profile of the Kyrgyz Republic. Statistical Database for 2016. Available at: http://stat.wto.org/CountryProfile

[8] Enikleeva Z. 2016. EAEU: opportunity or threat? (the case of the Kyrgyz Republic). Trade policy and strategy of national economic development. Institute of Trade Policy HSE. No. 4/8.

[9] FAOSTAT. 2018. Available at: www.fao.org/faostat/en/#data/RL

[10] World Bank (WB). 2015. Kyrgyz Republic: poverty profile for 2013. Report No 99772-KG.

[11] World Bank (WB). 2017. Kyrgyz Republic to Improve Water and Sanitation Services, with World Bank Support Press release. Available at: http://www.worldbank.org/en/news/press-release/2017/06/22/kyrgyz-republic-to-improve-water-and-sanitation-services-with-world-bank-support

[12] United States Agency for International Development (USAID). 2005. Land tenure and property rights assessment in Kyrgyzstan. Bishkek: USAID.

[13] Department of Cadastre and Registration of Rights to Real Estate (DCR). 2018. Zemelnii fond Kyrgyzstana na 2012. (in Russ). Bishkek: DCR. Available at: http://old.gosreg.kg/index.php?option=com_content&view=article&id=114

[14] National Statistic Committee of the Kyrgyz Republic (NSC). 2017. Cultivated area of agricultural crops in the Kyrgyz Republic. Database Available at:. http://www.stat.kg/en/statistics/selskoe-hozyajstvo/

[15] National Statistic Committee of the Kyrgyz Republic (NSC). 2018. Employed population by type of economic activity and employment population by sex and gender. Bishkek: Available at: http://www.stat.kg/ru/statistics/zanyatost/

[16] United Nations Development Programme (UNDP). 2018. Human development report. Available at: http://hdr.undp.org/en/data

[17] FAO. 2018. Kyrgyzstan country profile. Bishkek. FAO. Available at: http://www.fao.org/countryprofiles/

[18] National Statistic Committee of the Kyrgyz Republic (NSC). 2018. Kyrgyzstan: Kratkii statisticheskii spravochnik 2015-2017 (in Russ). Bishkek: NSC. Available at: http://www.stat.kg/

[19] The International Fund for Agricultural Development (IFAD). 2012. Kyrgyz Republic Livestock and market development programme design completion report.

[20] National Statistic Committee of the Kyrgyz Republic (NSC). 2018. Available at: http://www.stat.kg/en/opendata/

[21] Wolfgramm B; Shigaeva J; Nekushoeva G; Bonfoh B; Breu T; Liniger H. P. and Maselli D. 2010. Kyrgyz and Tajik land use in transition: Challenges, responses and opportunities. In: Hurni, H. and U. Wiesmann. editors. Global Change and Sustainable Development: A Synthesis of Regional Experiences from Research Partnerships. Perspectives of the Swiss National Centre of Competence in Research (NCCR) North–South, University of Bern. Bern. (5) pp. 241–254.

[22] IUCLAND. 2018. Information about implemented activities on project: 561841-Epp-1-2015-1-It-Eppka2-Cbhe-Jp Erasmus + IUCLAND. International University Cooperation on Land Protection in European-Asiatic Countries. Available at: http://erasmusplus.kg/wp-content/uploads/2017/12/iucland-oshtu-monitoring.pdf

[23] State Agency for Environmental Protection and Forestry (SAEPF) and FA0. 2010. Integrated assessment of natural resources 2008-2010. Report. Bishkek. http://www.fao.org/

[24] Broka S; Giertz Å; Christensen G; Hanif C; Rasmussen D; Rubaiza R. 2016. Kyrgyz Republic Agricultural Sector Risk Assessment. Agriculture global practice technical assistance paper. World Bank, Washington DC. Available at:https://openknowledge.worldbank.org/

[25] Ministry of Agriculture, Processing Industry and Melioration of the Kyrgyz Republic (MoAFIM). 2016. Overview of the agricultural crops harvesting of by regions and districts of the Kyrgyz Republic. Report. Bishkek: MoAFIM.

[26] Mogilevskii R; Abdrazakova N; Bolotbekova A; Chalbasova S; Dzhumaeva Sh; Tilekeyev K. 2017. The outcomes of 25 years of agricultural reforms in Kyrgyzstan. Leibniz Institute of Agriculture Development in Transition Economies. Germany. Discussion paper No 162.

[27] State Agency on Environment Protection and Forestry under the Government of the Kyrgyz Republic (SAEPF), UNDP-UNEP. 2012. Poverty and Environment Initiative in the Kyrgyz Republic. The National Report on the State of the Environment of the Kyrgyz Republic for 2006-2011. 126 p.

[28] FAO. 2018. FAO AQUASTAT for Kyrgyzstan between 2018-2013. FAO: Rome. Available at: http://www.fao.org/nr/water/aquastat/

[29] ACTED. 2013. Conflicts on irrigation water in the south of the Kyrgyz Republic. Report. ACTED, Bishkek.

[30] MoAFIM. 2018. Vodnoe hozyaistvo: report (in Russ). Bishkek. MoAFIM. Available at: http://www.agroprod.kg/

[31] Asian Development Bank (ADB). 2013. Kyrgyz Republic: Developing Water Resources Sector Strategies in Central and West Asia Financed by the Multi-Donor Trust Fund under the Water Financing Partnership Facility and ADB TASF-other sources. The consultants' report. Bishkek: ADB. https://www.adb.org/

[32] Asian Development Bank (ADB). 2013. Country Partnership Strategy: Kyrgyz Republic: 2013–2017 Climate change assessment. Bishkek: ADB

[33] The United Nations Economic Commission for Europe (UNECE), Union Water Initiative (EUWI) MoAFIM. 2015. Modern irrigation technologies and possibility of their application in Kyrgyzstan. National policy dialogue on integrated water resources management in Kyrgyzstan. Bishkek. Available at: https://www.oecd.org/env/outreach/KG_study_irrigation.pdf

[34] MoAFIM. 2016. Konsepsya razvitiya semennogo sectora na 2017-2022 gody (in Russ). MoAFM. Bishkek.

[35] Tilekeyev K. Mogilevskii R. Abdrazakova N. and Dzhumaeva Sh. 2018. Production and Exports of Kidney Beans in the Kyrgyz Republic: Value Chain Analysis. Bishkek: University of Central Asia. Available at: http://www.ucentralasia.org/

[36] FAO. 2016. Country profile of the Kyrgyz Republic. Bishkek: FAO. Available at: http://www.fao.org/

[37] Ilyasov Sh; Zabenko O; Gaydamak N; Kirilenko A; Myrsaliev N; Shevchenko V; Penkina L. 2013. Climate profile of the Kyrgyz Republic. SAEPF-UNDP. 99 pp.

[38] World Food Programme of the United Nations (WFP). 2017. Kyrgyz Republic Country Strategic Plan. Bishkek: WFP. Available at: https://docs.wfp.org/api/documents/

[39] National Statistic Committee of the Kyrgyz Republic (NSC). 2017. Living standard of population between 2012-2016 (in Russ). NSC. Bishkek, NSC.

[40] WFP. 2018. Country profile of the Kyrgyz Republic. Bishkek: WFP. http://www1.wfp.org/

[41] Economist Intelligence Unit (EIU). 2017. Global Food Security Index 2016. London, UK. Available at: http://foodsecurityindex.eiu.com/Resources

[42] Energy Sector Management Assistance Program (ESMAP). 2018. Tracking SDG7. The World Bank. Available at: https://trackingsdg7.esmap.org/country/kyrgyzstan

[43] World Resource Institute (WRI). 2014. Climate Data Explorer. Available at: http://cait.wri.org/

[44] USAID. 2017. Greenhouse Gas Emissions in Kyrgyzstan. Available at: https://www.climatelinks.org/countries/kyrgyzstan

[45] Government of the Kyrgyz Republic (GoKG). 2015. Intended Nationally Determined Contribution.

[46] UNFCCC. 2017. Paris Agreement – Status of Ratification. Available at: https://unfccc.int/process/

[47] FAO. 2013a. Mitigation of greenhouse emissions in livestock production: A review of technical options for non-CO2 emissions. Rome: FAO.

[48] GEF, GoKG, UNDP, 2016. Third National Communication of the Kyrgyz Republic under the UN Framework Convention on Climate Change. 264 p.

[49] UN-DESA. 2017. World population prospectus: The 2017 Revision. New York: UN-DESA. Available at: http://data.un.org/

[50] State Migration Service under the Government of the Kyrgyz Republic (SMS). 2018. Press release. Bishkek. SMS. Available at: http://ssm.gov.kg/en/

[51] Umarova M. 2017. Financial and credit support to agricultural producers of the Kyrgyz Republic. Report. The Kyrgyz National University after named K.I. Skryabin. Bishkek: KNAU.

[52] FAO. 2011. The Kyrgyz Republic Opportunities and challenges to agricultural growth. Report Rome: FAO/EBRD.

[53] Shamshiev B N. Teshebaeva Z A. and Ismailova J. A. 2017. Degradation of land in Kyrgyzstan and the ways of their solutions. Report. Bishkek: KNAU. Available at: http://knau.kg/

[54] World Bank (WB). 2007. Kyrgyz Republic - Livestock Sector Review: Embracing the New Challenges. Washington, DC. Available at: https://openknowledge.worldbank.org/handle/10986/8033

[55] Nurbekov A; Akramkhanov A; Kassam A; Sydyk D; Ziyadaullaev Z; Lamers JPA. 2016. Conservation Agriculture for combating land degradation in Central Asia: a synthesis. Agriculture and Food: 144-156.

[56] Jalilova G; Khadka C; Vacik H. 2012. Developing criteria and indicators for evaluating sustainable forest management: A case study in Kyrgyzstan. Forest Policy and Economics, 21, 32–43.

[57] Fay M; Block R; I. Ebinger, J. 2010. Climate change in Eastern Europe and Central Asia. The International Bank for Reconstruction and Development and The World Bank: Washington DC.

[58] Collins M; Knutti R; Arblaster J; Dufresne JL; Fichefet T; Friedlingstein P; Gao X; Gutowski WJ; Johns T; Krinner G; Shongwe M; Tebaldi C; Weaver AJ; Wehner M. 2013. Longterm climate change: Projections, commitments and irreversibility. In: Climate change. The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker TF; Qin D; Plattner GK; Tignor M; Allen SK; Boschung J; Nauels A; Xia Y; Bex V; Midgley PM. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. pp. 1029–1036. https://doi.org/10.1017/CBO9781107415324

[59] Ramírez J; Jarvis A. 2008. High-resolution statistically downscaled future climate surfaces. International Center for Tropical Agriculture (CIAT); CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Cali, Colombia**.**

[60] Ramírez-Villegas J; Thornton PK. 2015. Climate change impacts on African crop production. Working Paper No. 119. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Copenhagen, Denmark. Available at: http://hdl.handle.net/10568/66560

[61] Lipka O. 2017. Climate change and adaptation in Kyrgyzstan. In book: International Environmental Law- Making and Diplomacy Review 2015, Chapter: Climate Change and Adaptation in Kyrgyzstan, Publisher: University of Eastern Finland, Editors: E. Couzens, T. Honkonen, M. Lewis, pp.135-156

[62] Ray D.K; Mueller N.D; West, P.C; Foley, J.A. 2013. Yield Trends Are Insufficient to Double Global Crop Production by 2050. PLoS ONE 8(6): e66428. https://doi.org/10.1371/journal.pone.0066428

[63] Gan R; Luo Y; Zuo Q; Sun L. 2015. Effects of projected climate change on the glacier and runoff generationin the Naryn River Basin, Central Asia. Journal of Hydrology (523) 240-241. Available at: http://dx.doi.org/10.1016/j.jhydrol.2015.01.057

[64] Bobojonov, I., and Aw-Hassan A. 2014. Impacts of climate change on farm income security in Central Asia: An integrated modeling approach. Agriculture, Ecosystems & Environment. (188) 245-255. Available at: https://doi.org/10.1016/j.agee.2014.02.033

[65] Organization for Economic Co-operation and Development (OECD). 2016. Financing climate action in Kyrgyzstan. Paris: OECD. Available at: https://www.oecd.org/

[66] Robinson S; Mason-D'Croz D; Islam S; Sulser T; Gueneau A; Pitois G; Rosegrant MW. 2015. The International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT): Model description for version 3 (IFPRI Discussion Paper). Washington, D.C: International Food Policy Research Institute. Available at: http://ebrary.ifpri.org

[67] FAO. 2013. Conservation agriculture in Central Asia: status, policy, institutional support and strategic framework for its promotion. Ankara: FAO.

[68] Pozharskiy V M; Akimaliev J. 2002. Bed-planting winter wheat in Chu valley of the Kyrgyz Republic. International Workshop on Conservation Agriculture for Sustainable Wheat Production in Rotation with Cotton in Limited Water Resource Areas, 14 -18 October. Tashkent. 123-126

[69] Rashidov K A.2006. Produktivnost' perspektivnykh sortov pshenitsy pri grebnevom poseve v usloviyakh Tadzhikistana. In: Rashidov KA. Mumindzhanov KHA. Makhmadorov UM (Eds.) Materialy vtoroy Tsentral'no-Aziatskoy konferentsii po zernovym kul'turam (in Russ). Bishkek.

[70] NSC. 2016. Early agricultural production in the Kyrgyz Republic. Bishkek: NSC. Available at http://www.stat.kg/

[71] Asanbekova A. and Djumasheva J. A. 2017. Ekonomicheskoe obosnovanie razvitiya hozyaistv v Kyrgyzstane (in Russ). Journal « Vestnik KRSU». Tom 17, #11:16-19.Bishkek

[72] FAO. 2016b. Practices to Scale-Up Climate-Smart Agriculture. Webinar Summary Report. FAO. Available at: http://www.fao.org/3/a-bp163e.pdf

[73] IFAD. 2013. Livestock and Market Development Programme II. Project design report. Kyrgyz Republic.

[74] Djanibekov U; Villamor G; Dzhakypbekova K; Chamberlain J; Xu J. 2016. Adoption of Sustainable Land Uses in Post-Soviet Central Asia: The Case for Agroforestry. Sustainability. (8)1030. Available at: doi:10.3390/su8101030

[75] The International Fund for Agricultural Development (IFAD). 2018. Project profiles in Kyrgyzstan. The International Fund for Agricultural Development Rome: IFAD. Available at: https://www.ifad.org/

[76] World Bank. 2017. Support to Community Seed Funds: Implementation Status & Results Report

[77] USAID. 2018. Project profiles. Bishkek: USAID. Available at: https://www.usaid.gov/kyrgyz-republic/

[78] Global Environmental Facility (GEF). 2018. Projects profile. Available at: https://www.thegef.org/project/

[79] CAMP Alatoo (CA). 2018. The CAMP Alatoo profile. Bishkek: CA. Available at: http://en.camp.kg/

[80] National Council for Sustainable Development of the Kyrgyz Republic (NCSD). 2013. National sustainable development strategy for the Kyrgyz Republic for the period 2013-2017. Bishkek: NCSD. Available at: http://www.stat.kg/en/nsur/

[81] Government of the Kyrgyz Republic (GoKG). 2017. Climate Investment Programme. Final document. Bishkek: GoKG. Available at: https://www.climateinvestmentfunds.org/

[82] United Nations Environmental Programme (UNEP). 2016. Kyrgyzstan climate facts and policy profile: policies and processes. United National Environmental Programme. UNEP. Available at: http://wedocs.unep.org/

[83] Ministry of Finance of the Kyrgyz Republic (MF). 2018. Grajdanskii budget na 2018 god v Kyrgyzskoi Respublike (in Russ) Bishkek: MF. Available at: http://www.minfin.kg/

[84] Government of the Kyrgyz Republic (GoKG). 2018. Proekt "Finansirovanie selskogo hozyastva-6". Bishkek: GoKG. Available at: http://www.gov.kg/

[85] FAO. 2016. Food security and nutrition programme for Kyrgyzstan in action. How to implement policy in the most efficient way? FSN Forum in Europe and Central Asia. Rome. Available at: http://www.fao.org/3/a-bp179e.pdf

---

For further information and online versions of the Annexes

Annex 1: Selection of agriculture production systems key for food security in the Kyrgyz Republic (methodology)
Annex 2: IMPACT model results for the Kyrgyz Republic
Annex 3: Methodology for assessing climate smartness of ongoing practices
Annex 4: Institutions for CSA in the Kyrgyz Republic (methodology)
Annex 5: Policies for CSA in the Kyrgyz Republic (methodology)
Annex 6: Assessing CSA finances (methodology)

This publication is a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT) – lead Center of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) – and XXX. The document complements the CSA Profiles series developed between 2014 and 2017 by CIAT, CCAFS, the World Bank, and USAID for countries in Latin America, Asia, and Africa. The document was prepared under the co-leadership of Godefroy Grosjean (CIAT), Andrew Jarvis (CIAT, CCAFS), Felicitas Roehrig (CIAT), James Giles CIAT), and Miguel Lizarazo (CIAT-CCAFS). It is based on a methodology prepared by CIAT, the World Bank, and the Tropical Agricultural Research and Higher Education Center (CATIE) in 2014 and revisited in 2015, 2016 and 2017 by Andreea Nowak, Caitlin Corner-Dolloff, Miguel Lizarazo, Andy Jarvis, Evan Girvetz, Godefroy Grosjean, Felicitas Roehrig, Jennifer Twyman, Julian Ramirez, Carlos Navarro, Jaime Tarapues, Steve Prager, Carlos Eduardo Gonzalez (CIAT/CCAFS), Charles Spillane, Colm Duffy, and Una Murray (National University Ireland Galway).

Main author: Gulnaz Jalilova (independent consultant)

Editors: Daniel Knipe (independent editor) and Bill Hardy (independent editor)

Project leader for Asia: Godefroy Grosjean (CIAT)

Original graphics: Fernanda Rubiano (independent consultant)

Design and layout: CIAT and Fernanda Rubiano (independent consultant)

This document should be cited as:
CIAT; World Bank. 2018. Climate-Resilient Agriculture in the Kyrgyz Republic. CSA Country Profiles for Asia Series. International Center for Tropical Agriculture (CIAT); World Bank, Washington, D.C. 28 p.

Acknowledgements

This document has benefited from comments received from: Artavazd Hakobyan, Tobias Baedeker and Armine Juergenliemk.

November 2018