

Agricultural potential and food security in Central Asia in the light of climate change

Siemen van Berkum



Introduction

1.1 Questions, background and approach

The Dutch Ministry of Economic Affairs and its Directorate-General for Agriculture and Nature (DG Agro) have elaborated on the following knowledge questions:

- What is the agricultural potential of the Central Asian region, comprised of Turkmenistan, Uzbekistan, Kyrgyzstan and Tajikistan, in the light of food security and the intensification of regional agricultural production? The focus should be on animal husbandry, arable farming and horticulture.
- What are the most obvious issues for the region in terms of agricultural development? Where possible, consider the agricultural potential in the light of the known and possible effects brought about by climate changes. How will a global rise in temperatures affect greenhouse gas emissions and, as a consequence, impact on land use and revenues per hectare? What does further intensification involving more input usage mean for both current and possible environmental issues and present and future greenhouse gas emissions?

The Dutch Ministry of Economic Affairs and DG Agro want to use this information as part of its preparation for a conference organised by the GRA (Global Research Alliance on Agricultural Greenhouse Gases), during which representatives of the countries mentioned above will be invited to discuss the situation in their respective countries. The conference will take place in September 2015.

This report provides an overview of readily available and relevant data and literature. It contains a number of indicators which demonstrate a country's agricultural potential and food security. These indicators of agricultural potential are based on the availability of land which is suitable for agriculture, the availability of water and climatic conditions. The utilisation of this potential becomes apparent through the production volumes and revenues per hectare or animal, in particular how these volumes and revenues develop. This report describes the most significant natural features and production figures for each country, with reference to agricultural performances (by benchmarking and identification of yield gaps) in other comparable countries. By using a range of indicators, including malnutrition, stunting and the need for imports, a picture will be produced of the food security situation in each country. One of the ways to improve food security is to expand domestic pro-

duction. The most significant problems which hinder the expansion and intensification of agricultural production will be identified using literature references. The agricultural potential in the region is currently limited both by agricultural and socio-economic circumstances. However, the latter of the aforementioned factors will not feature heavily in this report. Agriculture in Central Asia is very sensitive to the effects of climate change. The report will conclude with a short analysis of the consequences of climate change for developments in agriculture in the region and which short-term modifications these consequences entail.

Figure 1.1 Map of the region



Source: http://alabamamaps.ua.edu/contemporarymaps/world/asia/c_asia1.pdf

1.2 Summary

The four Central Asian countries mentioned are heavily agrarian societies and have a low income per capita, except for Turkmenistan due to its large oil and gas revenues. The region is characterised by mountainous terrain and dry areas. The climate is continental, with cold winters and dry, hot summers. There has been a noticeable degree of erosion and soil degradation resulting from the natural conditions of the countries and the intensive production methods adopted during the Soviet era that are still used today. Coupled with an inefficient use of water (as well as a general water shortage in Turkmenistan), this situation has led to agricultural activities characterised by low productivity levels. Agricultural land is regularly used for extensive livestock husbandry. Only a small part of the region's agricultural land can be used for crop and/or horticulture, and irrigation is almost always required if any considerable yields are to be achieved.

Agriculture is also characterised by its small-scale and use of out-of-date production methods with little input use. There is also large state intervention in many areas. Land, particularly the grass steppe, is regarded as communal property. In Tajikistan and Uzbekistan, land is frequently still in the hands of the state; and in Kyrgyzstan land ownership rights are still not clearly defined in records and/or land

registry systems. Farmers rent land and often have small plots which cannot be expanded due to the absence of a land market.

The four countries are all net importers of grains and some other important crops such as potatoes and sugar. Around a third of the population in Kyrgyzstan and Tajikistan live below the poverty line, and a substantial proportion of the population, in particular children, are chronically malnourished. The situation in Turkmenistan and Uzbekistan is somewhat better, but the situation of young children in particular is still a matter of concern.

Whilst the natural conditions are a major limitation on agricultural production in the region, socio-economic factors also impede better usage of the natural resources for food production. A range of studies have demonstrated that the potential of this region could be much higher if due attention was given to a whole set of socio-economic and institutional factors such as improvements in market operations and in public services like education and publicly available information.

Agriculture in the region is heavily influenced by the weather conditions and is vulnerable to climate change. The most frequently identified adaptation strategies to manage climate change include: modified sowing periods, changing crops and varieties and encouraging more effective use of inputs, particularly of water. However, the majority of farmers do not have the financial means to carry out such modifications in their operational management. In the coming ten to twenty years, Central Asia's susceptibility to the effects of climate change will be determined less by climate change itself and more by socio-economic factors and the legacy of the past that saw wide-spread environmental mismanagement and neglect of infrastructure.

This report only provides a preliminary insight into the region's agricultural potential. A follow-up could be to further explore the key problems regarding the usage of this potential, and then to look where quick gains could be achieved in connection with other donors' activities, both in terms of improving food security and ensuring the region is well prepared to deal with the effects of climate change. Alongside the government, the Dutch agricultural industry also has its own role to play in this process.

2 Kyrgyzstan



Kyrgyzstan is a mountainous country in the middle of Central Asia. Kyrgyzstan has a population of 5.2 million people who live in an area roughly six times the size of the Netherlands. It has a continental climate, with cold winters and dry, hot summers. 90% of the country's surface area is 1000 metres above sea level and 40% is higher than 3000 metres.

2.1 Agricultural potential

More than half of the population is employed in the agricultural sector and earn their living primarily from animal husbandry. This is due to the fact that only 7% of the land surface (around 1.3 million hectares) is suitable for agriculture (see table 8.1, p. 22), whilst 9.7 million hectares are suitable for animal husbandry. Kyrgyz agriculture is characterised by extensive animal husbandry, with sheep, reared mainly for their wool, being the traditional livestock. After the Second World War, the country's rural system, once full of nomadic herds, was transformed into an intensive system that was reliant on imported fodder (Fitzherbert, 2006). Following the collapse of the Soviet Union and the ensuing privatisation of land and companies, the number of sheep sharply decreased as the wool market collapsed and fodder became too expensive to purchase. The animal husbandry sector is now dominated by dairy cows and horses. Cattle are reared extensively, with households owning just one or two each and using the milk and meat primarily for their own purposes.

The most significant agricultural crops are wheat, barley, maize, potatoes, oilseeds and a range of vegetable crops. Some regions also produce sugar beet, cotton and tobacco. After the country gained independence in 1991, much of the land previously used to grow fodder crops was transformed into wheat fields. This was in response to the urgent need to ensure the country's food supply (Fitzherbert, 2006). In the mid 2000s, the country started to move back to the traditional fodder crops, as the productivity promised by wheat fell short of expectations and the growing livestock numbers needed more and more fodder.

Snow from the mountains feeds rivers and irrigation systems, but the latter are often very outdated. Currently around 1 million hectares (roughly 10% of agricultural land) are equipped with irrigation systems, especially those used for grain, potato and vegetable production. Water usage is inefficient due to the poor state of the irrigation canals and a high degree of evaporation, whilst flooded arable land is often plagued by salinisation (IFAD, 2012). The rest of the agricultural land, comprising around 300,000 hectares of crop land and approximately 10 million hectares of grasslands, is rain fed. With an average temperature of 25 °C to 30 °C in the period between May and September and almost no considerable precipitation from July until September, agriculture is extremely challenging without the use of water irrigation systems.

The legacy of the past is visible in the over-grazing of pastures and the degradation of grass steppes, particularly those at lower altitudes. The productivity of the grasslands - measured in the number of kilogrammes of dry material produced per hectare - dropped sharply during the communist era; some parts of the country even experienced a 50% drop (Fitzherbert, 2006: 19-20). Previous levels have still not been regained. The recovery process is also hampered by livestock numbers which have grown to meet the need for sufficient food supplies. The result is continued pressure on pastures, especially those surrounding villages, and a stagnant, low-productivity animal husbandry sector. In 2012, the International Fund for Agricultural Development (IFAD) noted that, alongside conditions where fodder, particularly winter fodder, is both scarce and of bad quality, animal diseases and poor operational management have been the main factors responsible for low productivity levels. According to estimations made by the World Bank, it would be very easy to produce 70% more milk and 50% more meat if the country had access to better quality fodder, operated effective disease management and had more agricultural and financial know-how (IFAD, 2012: 42). Given the number of small-scale farms and the dominance of animal husbandry in the Kyrgyz countryside, combating animal diseases and improved fodder production are - according to the World Bank and IFAD - the quickest and most effective ways to improve the incomes and food security of a large number of rural communities.

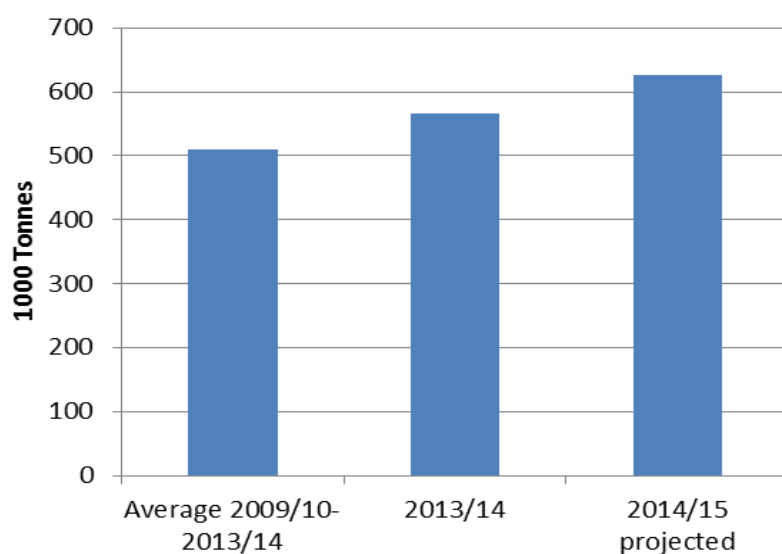
Arable farming also has low productivity levels: the average grain yield in recent years is between 2.3 and 2.9 tonnes per hectare (Table 8.1). On the one hand, this is partly due to the natural conditions in the country, such as drought, salinisation of irrigated agricultural land and a low level of natural soil fertility. On the other hand, the low yield is also the result of farmers' repeated usage of their own seeds, as well as poor pre-treatment and fertilisation of the soil. Artificial fertiliser is imported regularly from Uzbekistan. However, this fertiliser is often too expensive for farmers and is therefore very rarely used: whilst a government guideline recommends 175 kg per hectare, only 78 kg per hectare were used in 2009 and 2010 (IFAD, 2012). The country is also underdeveloped in terms of mechanisation. There are fewer tractors per hectare in Kyrgyzstan than in any other country. According to estimations made by IFAD (2012), the country would require 40% to 45% more tractors and other machines to ensure effective soil treatment, seeding and harvesting. This increase in machine usage would drastically improve agricultural productivity. A study by FAO and the World Bank carried out in 2009 (cited in IFAD, 2012) has shown that the value of the 'agricultural machinery gap' is equal to around 400 million USD. Insufficient access to credit and the small-scale nature

of companies¹ are the most significant key problems when introducing new technologies and mechanisation into the sector.

2.2 Food security

Around 37% of the population in Kyrgyzstan lives below the poverty line, and an estimated 12% are chronically malnourished (World Food Programme website, 2013 figures, see table 8.3). Roughly 18% of children below five years of age suffer from stunted growth and 39% are anaemic. According to a joint World Bank and UNICEF report published in May 2011 (cited in GASFP Fund, 2012), malnutrition results in approximately 20% of child mortalities below the age of five. The country is heavily dependent on food imports, particularly wheat (see Figure 2.1). Owing to the fact that the majority of the population spends over half of their income on food, price fluctuations on international and regional markets have a powerful effect on the domestic food situation. The shortage of food with a high nutritional value is an even bigger problem than a lack of sufficient food (IFAD, 2012). The UN World Food Programme (WFP) has been active in the country since 2008. There are now several projects under way, including a programme for school meals and activities aimed at strengthening 'national productive safety nets and long-term community resilience' (WFP, 2014).

Figure 2.1 Total cereal imports for Kyrgyzstan



NB: Total cereal includes rice in milled terms. Split years refer to the individual crop marketing years.

Source: FAO-GIEWS Country Balance Sheets

¹ Since the agricultural reforms of 2010, 75% of agricultural land is in private hands, and this is where more than 90% of agricultural production is made. The average size of more than 300,000 privately owned companies is between 0.5 and 0.7 hectares. Agriculture accounts for 25% of the gross domestic product (www.fao.org/in-action).

2.3 Development problems

Whilst progress in the technical and agronomic field can help to improve the food security situation, socio-economic circumstances are important too in enhancing food security. Kyrgyzstan has a poorly developed infrastructure, which increases the costs of transport of food and other goods. The country is dependent on imports of production resources such as artificial fertiliser, seeds and fuel (oil), taking into account that the latter fluctuate consistently in price, meaning farmers cannot be too sure of whether they can afford their inputs. Other economic risks are due to border interventions. During the last couple of years, the neighbouring countries of Kazakhstan and Uzbekistan have closed their borders unilaterally, with the result that Kyrgyz farmers are being excluded from potentially lucrative markets (EurAsiaNet.org, 2012). Because of all these instabilities, farmers are struggling to set up cultivation plans, as selling prices are very hard to predict. More stability and predictability in sales markets would certainly help to deliver improvements in agricultural services, which in turn would also aid Kyrgyzstan's food security situation and its rural communities.

Agriculture is an important source of income for a large part of the population, even though this income is small and unstable. Many people move to the cities in the hope of finding a job and a decent income, but even there there are few employment opportunities. Economic growth and employment outside the agricultural sector are a major driving force in making developments in agriculture possible. These developments need investments that require an increased scale of production in order to be profitable.

Alongside this, access to land and water is crucial for agricultural development. Even though Kyrgyzstan law states that pastures are the public 'property' of the community, agricultural land has been privatised since the country became independent. The farms are on average no larger than 3 hectares (GASFP Fund, 2012). Ownership rights and the management of public land are important aspects that govern access to land and how the land is used. Clarity in terms of ownership and rights of use will encourage farmers to invest in improving soil fertility management, which would improve yields per hectare. However, for part of the agricultural land, ownership rights seem disorganised (GASFP Fund, 2012). Access to water is also a decisive factor in the level of crop productivity. The infrastructure of irrigation channels and soil drainage also require improvements. People who use these systems should be obliged to invest in them, but the costs for the farmers to irrigate water are kept so low by the Kyrgyz parliament that the revenues are not high enough to warrant the investments in the irrigation system that would be necessary to achieve a more efficient use of the available water (GASP Fund, 2012).

3 Tajikistan



Tajikistan is a relatively small, mountainous and landlocked region, which experiences harsh winters and warm summers. Of the 8.2 million inhabitants, around three quarters live in rural areas. The climate is suitable for growing a large number of crops. The soil found in the south and in the higher-altitude valleys is fertile, whereas it is less fertile in the northern valleys. However, the agricultural land - around 4.8 million hectares, or 35% of the country's surface area - is very well suited for use as pastures, with the result that animal husbandry is the most important activity in the agricultural sector. Arable farming is performed on roughly 15% (750,000 hectares) of the agricultural land.

3.1 Agricultural potential

After the country gained independence in 1991², the structure of the agricultural production experienced extensive changes. Whilst the production of wheat, potatoes, vegetables and fruit has been on the increase, this growth has had a negative impact on fodder crops and grassland. Cotton has remained an important crop and is cultivated on around a third of the arable land available. Cotton also makes up 75% to 90% of the export revenues from agriculture. After a sharp drop in the number of animals, the animal husbandry sector, which rears mostly cows, sheep and goats, began to grow again after 2000. Having a sufficient supply of winter fodder is a major problem when it comes to increasing productivity and boosting the total production levels in the animal husbandry sector.

Whilst the soil fertility is quite good in parts of the country, particularly in the south, Walter (2011) states that the soil in Tajikistan is 'among the poorest in the world'. In any case, the soil is very hard to cultivate due to the country's mountainous topography: more than half of all farmers have to carry out their farming activities on very steep hills (see table 8.2).

Snow and water from the mountains can cause a large amount of damage and erosion. Rivers in general are quite shallow, meaning they quickly burst their

² This process was characterised by significant internal unrest, which in fact resulted in a civil war between 1992 and 1997.

banks and flood. A good water management system is needed to ensure water is used efficiently *and* to prevent any fertile soil from being washed away. Large areas of grassland - estimated at around 90% to 95% - are plagued by erosion due to over-grazing, whilst deforestation of hills makes these grasslands even more susceptible to erosion. Natural forest now covers only 2% of the country in comparison to 25% around 1900 (UNDP-UNEP, 2012: 13).

Roughly 80% to 85% of the arable land is irrigated (Walter, 2011). However, many of the installations are located on large cotton plantations, meaning only very few farmers in the surrounding area can benefit; the majority of farmers still have no access to irrigation systems. The irrigation systems in Tajikistan are very outdated and are poorly maintained. As a result, installations are only partially operational and water is used inefficiently. According to Akramov and Shreedhar (2012), parts of the irrigated areas are constantly threatened by water shortages. Drought and flooding have a powerful influence on agricultural production and in turn on the population's food security (WFP, 2014).

The country's cotton production was intensified during the communist era when copious amounts of artificial fertiliser and pesticides were used to meet export quotas and achieve production goals. This process both contaminated the soil and left behind toxic residue from the pesticides in the food chain (see for instance www.naturvernforbundet.no/international). In the recent, up-to-date strategy document for agricultural development, the government has announced its aim to develop a more sustainable and environmentally friendly agricultural sector. This aim will be supported by the UNDP-UNEP Poverty-Environment Initiative (PEI) (see www.unpei.org). The recommendations and approach of the PEI are based on UNEP's analysis of the causes, gravity and economic costs of land degradation in Tajikistan (UNDP-UNEP, 2012). Although only very little useful data is available, it remains clear that erosion and soil degradation have serious consequences for the productivity of agriculture. It is equally clear that improvements in the productivity of agriculture could be achieved with relatively minor interventions in cultivation techniques, water usage, crop rotation and use of pastures.

The potential of the agricultural sector is also dependent on the availability of labourers and the level of farmers' agricultural knowledge. For years now, Tajikistan has experienced large-scale emigration, particularly to Russia, which has resulted in a considerable drop in the workforce, most notably in the agricultural sector. Despite this development, roughly half the population is still employed in the agricultural sector, the majority of them women.³ The agricultural sector is hardly mechanised at all. The small farms, of which there are around 750,000, measure on average 0.3 hectares. 90,000 dehkan farms, which are individual or 'collective' farms, can be identified in addition to this number. Dehkan farms measure on average 7 hectares each. The land belongs to the state; instead of ownership rights, farmers have rights of use (Lerman, 2014).

Walter (2011) sees a lot of potential in the Tajik vegetable and fruit sector. This sector is already the main source of agricultural export revenues, and, according to Walter, the country has a very strong competitive advantage in the region thanks to its production of dried fruits (apricots, figs, etc.) and onions. Russia is currently

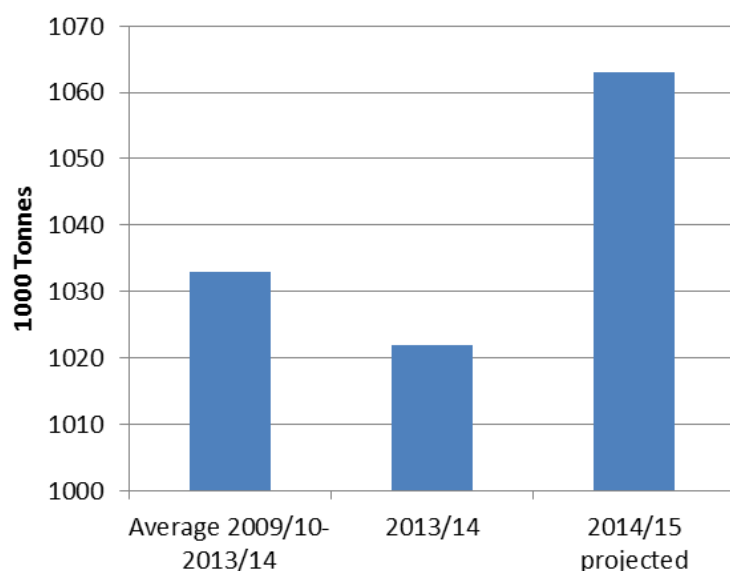
³ Around a million Tajiks (most of whom are men) are resident outside the country.

the most important sales market for these sorts of product. The distances to foreign markets and the often poorly maintained infrastructure hinder the expansion of export markets for fresh produce. Walter suggests introducing measures to attract foreign investors in order to take advantage of the potential.

3.2 Food security

Around a third of the population lives under the poverty line (FAO, GIEWS, 2015). Households spend on average 56% of their income on food. Tajikistan is a net importer of food. During the last couple of years, the country has imported on average around a million tonnes of grain (FAO GIEWS, see figure 3.1). Other indicators of food security also highlight that the situation in Tajikistan is much more acute than in the rest of the region: no less than 43% of the population suffers from chronic malnutrition, and almost 40% of children under the age of five are affected by stunted growth (see table 8.3).

Figure 3.1 Total cereal imports for Tajikistan



NB: The total cereal includes rice in milled terms. Split years refer to individual crop marketing years.

Source: FAO-GIEWS Country Balance Sheets

Tajikistan has the lowest income per capita of all four countries (see table 8.1). Due to the low average income and the need to import a significant part of the country's food requirements, the population is very vulnerable to fluctuations in the international market for agricultural products. Taken as an average over three recent years (2010 to 2012), Tajikistan spent 40% of its total export revenues on food imports.

3.3 Development problems

The natural conditions are a considerable limitation on the development of the agricultural sector in Tajikistan. A large part of the country is characterised by high-altitude mountainous terrain, in which hills are only suitable for extensive pasturing. The country has only 0.1 hectare of arable land per inhabitant (see table 8.2), but this number is falling due to population growth and soil degradation. The Tajik agricultural industry also suffers from the effects of erosion and soil degradation caused by natural conditions such as drought and floods and by the intensive use of chemical inputs in cotton cultivation. The productivity of both animal husbandry and agriculture could be improved with relatively minor technical interventions. The potential in the agricultural sector is limited further due to the prevalent small-scale structures and workers' low incomes, both of which restrict access to credit for investments. There is often a lack of useful market information which could give an indication of future sales prices. Subsequently, when opportunities arise to anticipate these prices, they are limited by a deficient, poorly maintained infrastructure and inefficient marketing and processing (EBRD, 2012; Swanson et al., 2011).

Akramov and Shreedhar (2012) refer to the fact that Tajikistan has only just begun with structural reforms in its economy, which even today still has many features typical of a centrally governed planned economy. The state still has a powerful influence in terms of ownership rights and market forces. Whilst the land reforms have brought about a healthy recovery in production and boosted productivity, impacting positively on rural incomes and food security, more than half of agricultural land was in state or collective hands in 2011. According to the World Bank (2015), important steps have been made in the legislative field, but there is still much work to be done on drawing up a clear land registry system. Farmers also have insufficient access to credit, modern inputs, advice and services in terms of cultivation techniques and how to market their products. These inputs and advice are needed to increase the productivity of the agricultural sector, which in turn would improve the country's food security.

4 Turkmenistan



Turkmenistan has large oil and gas reserves. These reserves have produced a trickle-down effect in the country, with the average income per capita (8,000 USD) of the 5.2 million inhabitants being two to three times higher than incomes in its Central Asian neighbours (see table 8.1). Just under half of the population (48%) makes their living from agriculture. The Karakum Desert covers around 80% of the country's surface area of 488,100 km² (48 million hectares). The country has an arid climate; the largest part is characterised by desert pasture with little land suitable for arable farming (1.8 million hectares). Agriculture is heavily dependent on rain and irrigation systems. However, as the country experiences very little rainfall (less than 80 mm in the north-east and a maximum of around 300 mm in the southern mountains), arable farming is almost completely reliant on irrigation.

4.1 Agricultural potential

Large state-owned companies collapsed following the country's independence in 1991 and were replaced by farmers' associations which now rent land from the state. The state plays a dominant role, in that it forces farmers to sell their products to state-owned companies and to obtain their inputs from state sources. This system is particularly prevalent in arable farming, whilst some degree of private enterprise is permitted in the animal husbandry sectors.

Turkmenistan is traditionally an important producer of cotton in the region. The state put an end to the previous monoculture by stimulating the production of wheat and rice. This was done in the view of improving the domestic food security situation. However, cotton remains the dominant crop in the arable sector. Given the dry climate, the country produces few fruit and vegetable crops. In contrast to the majority of former Soviet republics, Turkmenistan experienced a growth in its animal husbandry sector as early as the 1990s, due in part to the growth in milk yields per cow (Lerman et al., 2012). A majority of products from the animal husbandry sector, such as milk and meat, are processed and consumed for the farmers' own requirements. Products are also sold at local markets.

The area of arable land is comprised of mostly dry grass steppes and just under 2 million hectares of agriculture. Arable farming is only possible with irrigation systems. The amount of water which is extracted from rivers and oases has doubled since the 1970s. At the same time, the amount of water lost due to evaporation and infiltration has risen to more than 30% (FAO, 2014). Salinisation of flooded areas also poses another problem. It is thought that 90% to 95% of the irrigated arable land suffers from salinisation-related damages. Since 2005 and 2006, more technologically advanced irrigation systems have, to a limited extent, been applied to use water more efficiently. Despite this progress, it is usually the traditional cotton growing areas which benefit the most, to the detriment of areas used to grow livestock fodder such as alfalfa, as it is forbidden to irrigate these areas. However, the number of cotton-growing areas has decreased, which has had a positive effect on wheat agriculture. This trend towards wheat has also improved the efficiency of water usage, as wheat requires 40% less water per hectare than cotton (Lerman et al., 2012: 20).

The average production per hectare of grain is around 2000 kg; if wheat is grown in more fertile soils, its productivity can be 3000 kg per hectare. A higher productivity level could be achieved if better seeds and sufficient amounts of fertiliser and water were used. The Turkmen national grain production research institute has demonstrated in experiments that it would be possible to achieve up to 5,000 or 6,000 kg per hectare if new varieties of wheat were used (Lerman et al., 2012: 65).

Animal husbandry is concentrated in the pastures and grass steppes of northern Turkmenistan. The production of milk is an important source of income for farmers, the majority of whom run small-scale businesses. The milk yield per cow is around 2000 kg per year, which is not even half the amount produced in Ukraine or Belarus. Major obstacles in achieving higher productivity levels include the limited production of fodder crops and the genetic potential of the local dairy cows. More productive breeds also require fodder with specific nutritional properties. This is an area which will also require improvement. New breeds of cattle would also have to be resistant to both the local weather conditions and prevalent diseases, as the region is home to ticks (*Acariformes*) which transmit animal diseases.

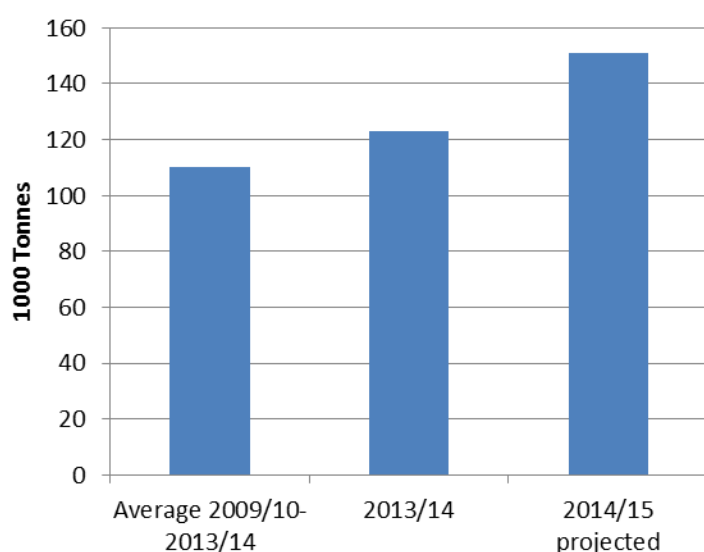
4.2 Food security

The percentage of the population which suffers from malnutrition has been decreasing for years, and is now at 5% (FAO Food insecurity indicators). Around 7% to 10% of the population is chronically malnourished (see table 8.3).

Prices for wheat flour and bread have increased dramatically, as subsidies have been scrapped (FAO GIEWS, September 2014). The high unemployment level, in particular in rural areas, as well as high prices for the most important food crops have had a negative impact on the food security of rural, low-income groups.

Turkmenistan must import more and more grain (see figure 4.1), as, due to a falling production per hectare, the total wheat production has been decreasing since 2006. The rice production is also falling short of necessary growth levels (see also FAOStat). Most of the grain is imported, with the majority of wheat coming from Kazakhstan and the majority of rice coming from Russia. Alongside these commodities, the country also imports sugar and potatoes.

Figure 4.1 Total cereal imports for Turkmenistan



NB: Total cereal includes rice in milled terms. Split years refer to individual crop marketing years.

Source: FAO-GIEWS Country Balance Sheets

4.3 Development problems

Water management and the salinisation of flooded areas present major issues for further agricultural development. The use of more efficient irrigation systems would allow Turkmenistan to increase both the area of irrigated land as well as this area's crop production per hectare. According to Lerman et al. (2012: 16), production could be increased by 30% if the current losses related to extracted water were halved. If new techniques to desalinate water were used, then the total irrigated area of arable land could be doubled (FAO, 2012). However, the necessary investments in irrigation and drainage systems would cost many billions of dollars. In light of this, FAO (2012) refers to a range of government investment programmes for the coming years.

Since 2008, the government has implemented a National Strategy on Economic Revival and Reform. This initiative sets out priorities for socio-economic development in the country until 2030. In terms of agriculture, the government aims to provide more freedom to the private sector and to reduce the large state influence. In spite of this, state-owned companies continue to manage the marketing of cotton and of the majority of other crops. Only in the animal husbandry sector and the meat and milk processing industry is there a degree of ownership by individual farmers and private farms. International trade is also subject to strict state controls, as the import and export conditions are determined by the government.⁴ New policies must stimulate a transition toward a more market-oriented economy. The EU and international financial institutions such as the World Bank, EBRD, Asian

⁴ Turkmenistan is not a member of the World Trade Organisation (WTO).

Development Bank, GIZ and USAID are providing support in this area. An EU document from 2012, which offers support for agricultural development, has highlighted once again the most significant shortcomings and key problems for further agricultural development in Turkmenistan. The problems specified can also be applied to the other Central Asian countries discussed in this paper, and can be summarised as follows:

- Agroproduction: 1) There is little or no usage of modern technology and operational management techniques.
2) The country has an inefficient irrigation system which is technologically outdated and covers only a limited surface area of country.
3) The unproductive and outdated technology results in low quality agrarian products.
- Agroprocessing: 1) Agroprocessing is fragmented.
2) There is very little attention given to product quality, food security and environmental requirements.
- The farmers' level of education and training, as well as that of other key players, including the government, is low, and should be improved through capacity development.

With its range of projects which are co-run and coordinated with other donors, the EU is contributing to the aim of boosting the productivity and competitiveness of the Turkmen agricultural sector in the coming years (EU, 2012).

5 Uzbekistan



Whilst Uzbekistan is roughly the size of Turkmenistan, its population of 30 million means it has many more inhabitants. The country's income per capita (1900 USD) is higher than in Kyrgyzstan and Tajikistan (see table 8.1) More than a quarter of the population lives below the poverty line. The climate is continental and very arid, with the central part of the country featuring desert-like conditions. Rivers, the country's natural water supplies, are located in the east and west along the southern border with Turkmenistan. Agriculture is concentrated in the areas surrounding these rivers and in some oasis-like spots.

5.1 Agricultural potential

Around 60% of the country's surface area is considered suitable for agriculture. The vast majority of Uzbekistan is made up of desert pastures, suitable only for sheep. Around 4.4 million hectares, or around 10% of the surface area, is suitable for growing crops (World Bank, WDI), and 85% of this land area is irrigated. However, half of the irrigated area, almost 2 million hectares, is plagued by salinisation and decreasing fertility levels (FAO GIEWS).

Measured according to arable land area, cotton and wheat are by far the country's major crops. Alongside these, the country cultivates fodder crops, such as barley and maize, as well as grapes, apples, tomatoes, potatoes and rice. Whilst the agricultural land area used to cultivate fruit and vegetables is relative small, the World Bank (2010) and Uzb-Cerbanet (2013) have found that the climatic conditions are suitable enough to enable this area to expand.

After a drop in the number of animals in the 1990s, the animal husbandry sector has grown dramatically. This has resulted in a doubling of the country's total meat and milk production over the past ten to fifteen years. Growth can be traced back in particular to the intensively reared cattle. The production of meat from chickens and pigs, which in terms of volume is much smaller than the beef industry, has still not returned to production levels seen at the beginning of the nineties. The problem for intensive animal husbandry is the availability of fodder, as fodder crops are only grown to a limited extent and purchasing or importing fodder is too expensive for many farmers (USDA, 2011).

The country's natural conditions present a real challenge for the agricultural sector. The already sparse water supplies are not used efficiently, and irrigation systems lead to the salinisation of the generally already salty soils. In addition, soil erosion due to the effects of wind, climate and land usage has contributed to a degradation of agrarian areas.

Despite these setbacks, there has been a strong growth in the per hectare yield of different crops in the last twenty years (FAOstat). This is illustrated by wheat yields that grew from 2.1 to 4.7 tonnes per hectare during the period 1995 to 2013, whilst the fodder grains increased from 1.2 to 4.0 tonnes per hectare. The total milk production doubled in this period to almost eight million tonnes. Privatisation has contributed to the recovery of production and productivity levels in the agricultural sector (Lerman 2008). While this is positive change, the World Bank believes the potential could be much higher if due attention were given to a whole range of socio-economic and institutional factors such as improved market operations and better public services, including education (Sutton et al., 2013).

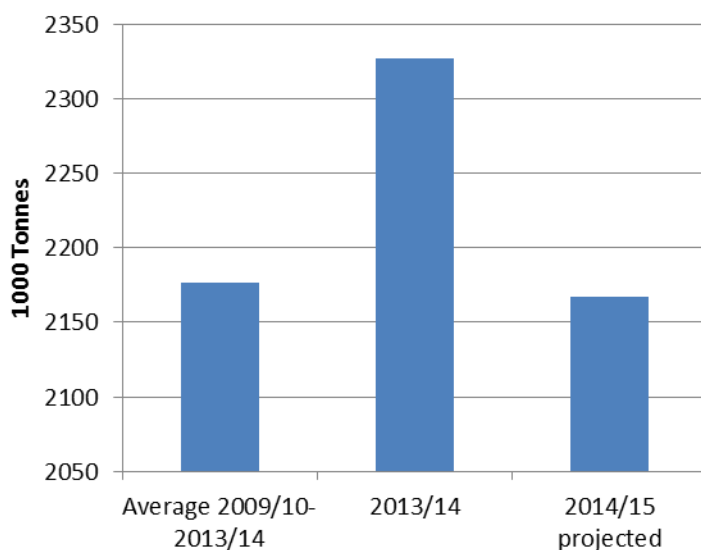
Uzbek agriculture is characterised by its small scale and fragmented nature. Almost all production is carried out by private farms. The state owns land and rents it to farmers. This system has remained unchanged since the country's independence. Akin to the situation in Tajikistan, the land is cultivated by household plots. These number around 4.5 million individual, small farms measuring on average 0.2 hectares. There are also 'new-style collectives,' in which farmers jointly rent a plot of land, measuring on average 40 hectares. The land cannot be sold or used as security for loans. This ownership structure and the small scale of most of the farms makes it difficult to obtain credit for investments.

5.2 Food security

Despite the relative stability of grain production over the last couple of years, Uzbekistan still needed to import half of its wheat requirements in the 2014/15 harvest year. This import amounts to around two million tonnes (see figure 5.1) and comes mainly from Kazakhstan, which supplies good-quality wheat and wheat flour.

Those with the lowest incomes spend 60% of their income on food and rely on wheat as a major source of nutrition. This group is the most vulnerable in terms of food security. Around 6% of the population suffer from serious malnutrition, and 12% suffer from chronic malnutrition (see Table 8.3). Uzbekistan has a very young population, with around a third of the population being younger than fifteen years old. Of the number of children under the age of five, 20% suffer from stunted growth and more than 40% are anaemic due to an iron deficiency in their unbalanced diet.

Figure 5.1 Total cereal imports for Uzbekistan



NB: Total cereal includes rice in milled terms. Split years refer to individual marketing years.

Source: FAO-GIEWS Country Balance Sheets

5.3 Development problems

Agriculture in Uzbekistan is heavily reliant on weather conditions and is susceptible to climate change. A study carried out by the World Bank (2010) predicts that in 2050 temperatures in the region will be 1.9 °C to 2.4 °C higher than current levels. For Uzbekistan, this will entail an even more acute water supply problem. The rise in temperatures will cause more evaporation in the summer, nullifying the effects of higher levels of precipitation. Coupled with increased rainfall, the rise in temperatures will also mean a greater likelihood of diseases and plagues for both the agricultural and animal husbandry sector. However, a longer growing season in the north of the country will increase productivity and provide opportunity to grow produce both in larger quantities and in more variations. Broadly speaking, it is expected that higher temperatures and water scarcity in 2050 will considerably reduce the yield per hectare, in relation to historic levels, for cotton (-20%), alfalfa (-20%) and wheat, rice and vegetables (all -15%). The same applies to the animal husbandry sector, in which production and reproduction will suffer from the effects of climate change (see the following chapter for more information).

There is a wide range of advice on adapting to the natural conditions and future climate changes. This ranges from gaining more knowledge in terms of agricultural techniques and supplying information on the weather to developing seeds and animal breeds which are more resilient to the droughts and the heat typical of the local climate. The Uzbek government seems to have become aware of the urgency to take action. And with this in mind, the government is encouraging a transition from cotton, which requires large amounts of water per kg of product, to fruit, vegetables and potatoes. The government also wants to invest in the development of new highly productive cotton and grain seeds that can thrive in salty soils and dry conditions (www.timesca.com/news/14917). A five-year plan for 2015 to 2019

has been put into place. It includes investments in modern mechanisation, updated irrigation facilities on an area of 1.4 million hectares, techniques to save energy and water, refrigeration facilities for fruit and vegetables and agro-logistics. The aim of the government programme is to improve domestic food security and to generate export revenues.

6 Effects of climate change on Central Asian agriculture

The Central Asian region is very susceptible to climate change. The text below provides a point-by-point summary of the literature which deals with the consequences of climate change for the agricultural sector in the region.

- Agriculture must endure long winters and hot, dry summers. In terms of agro-ecological zones, which are classifications used by FAO/IIASA to indicate the susceptibility of areas and agrosystems to climate change, the dryness of the agricultural land is the main problem encountered in Central Asia, including the countries discussed here. As roughly three quarters of the agricultural land area is affected by this, rain-fed crops have a low average yield per hectare.
- Climate change due to the increase of greenhouse gases in the atmosphere results in increasing temperatures and changes in wind and precipitation patterns. According to much referred to UN commissioned study on global impacts of climate change on agriculture Fischer et al. (2002) indicate a positive relationship between temperatures and precipitation in Central Asia. This positive relationship has been confirmed by the UK's Met Office, which also argue that there will be more water in rivers due to climate change, giving the agricultural sector opportunity to grow as water availability increases (MET Institute, 1999).
- Fischer et al. (2002) project that climate change will lead to an increase of agricultural land area in Central Asia, as warmer temperatures will reduce the 'cold-temperature constraint'. The area which is suitable for grain production is increasing in size, which in turn is enhancing the potential for grain production. However, as this involves mostly marginal land, the average production per hectare remains low.
- More recent studies have explored local situations in greater detail, and have assessed the effects of changing climatological conditions both on a national and on a regional scale within individual countries. The studies note that there is a great deal of doubt concerning the previously published projections. In particular, they point to the fluctuations in temperatures and precipitation levels that are already considerable in the region, and that may fluctuate even more noticeably due to climate change. To put it succinctly, the weather-related risks for agricultural production in Central Asia are set to increase in the future.
- Studies about the situation in specific Central Asian countries, including those carried out by Bobojonov et al., 2012; Nelson et al., 2010; Sutton et al., 2013, reveal that climate changes will have different effects depending on the crop and area in question. Positive effects on the yields per hectare are expected for rain-fed wheat, irrigated maize and potatoes, whilst cotton yields per hectare will decrease in the long term. The yields per hectare appear to show more positive developments in the more northern areas of the region, such as Kazakhstan and Kyrgyzstan, than in the southern areas, such as Tajikistan, Turkmenistan and Uzbekistan, where the main problem is fast becoming a lack of water which can be used for irrigation purposes. Irrespective of the scenario considered, Sutton et al. (2013) estimate that climate change will reduce the yields per hectare of each crop in Uzbekistan, with the exception of grasslands and alfalfa.
- The most frequently identified adaptation strategies include adjusting sowing periods, making changes to crops or varieties, as well as the more regular and more efficient use of inputs, particularly artificial fertiliser and pesticides. However,

most farmers have neither the financial means nor sufficient access to the credit needed to introduce such adaptations into their operational management (see Mirabaev, 2013).

- Measures aimed at more economical and efficient management of the available water are crucial if agricultural productivity is to be improved, both now and in the future in the light of continued climate change. See The World Bank (2009 and 2012), Sutton et al. (2013) and IFAD (2009), who urge quick action and investments in this area.
- In addition, the vulnerability to climate change and the ability of Central Asia to adapt to this will be determined less by climate change itself and more by the socio-economic factors and the legacy of the past, which witnessed the highly inefficient management of natural resources, or 'environmental mismanagement' (The World Bank, 2009), and which is responsible for the region's ailing infrastructure.

7 Neglected issues and subsequent steps

Based on readily available data and literature, this report only provides a preliminary insight into the region's agricultural potential. It is clear, though, that the natural conditions are a serious obstacle to growth in agricultural production. Analyses of the agricultural situation consistently point to socio-economic factors that prevent farmers from investing in environmentally responsible soil management and water usage which would allow them to improve the productivity of their crop cultivation and animal husbandry. A combination of investments in biophysical and socio-economic factors, including market factors, can stimulate agricultural development, thereby contributing to an improved food supply and food security of the local population. The governments of Turkmenistan and Uzbekistan seem aware of the urgent need to invest in their agricultural sector, given their strategic development programs. The whole region would be helped by policies that on the one hand stimulate agricultural production geared towards the population's food security requirements and on the other hand take into account the ecological and climatological vulnerability of the region. International aid and guidance would seem to be essential in supporting such policies.

A follow-up to this report would be to further explore the key problems regarding the usage of the agricultural potential of these four countries, and specifically to look where quick gains could be achieved in connection with other donors' activities, in terms of both improving food security and ensuring the region is well prepared to deal with the effects of climate change. Alongside involvement of the Dutch government in supporting multi- or unilateral aid programmes, the Dutch agricultural industry can also take a role in this process. The Dutch agrosector and its related service industries have extensive knowledge of soil and water management, financial services, product development, marketing and research. By pinpointing the needs and possibilities in these countries, it is possible to produce a picture of the role the Dutch business community could play in Central Asian agricultural development.

8 Summary tables

Table 8.1

Some socio-economic features

Indicators	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Average income per capita (USD, 2013)	1263	1037	7987	1878
Annual growth of average per capita income (average percentage for 2010-2013)	2.4	4.6	9.9	6.0
Grain yield per hectare (min./max. 2011-2013)	2.3-2.9	2.5-3.1	1.7-2.0	4.5-4.8
Food production index (2004 to 2006 = 100)	107	145	118	140
Value of food imports as a percentage of the total export (three-year average)	27	40	3	7
Rural population as a percentage of the total population	65	73	51	64

Source: The World Bank, World Development Indicators.

Table 8.2

Some features of countries and terrains in Central Asia (including Kazakhstan)

	Total surface area (in thousands of km ²)	% of agriculture in total (2009)	Arable land per capita (2007, hectares per capita)	Proportion of steep or hilly ground, %	Shallows, %	Risk of erosion
Kazakhstan	2.711	8.4	1.5	23	14	3
Kyrgyzstan	199	6.7	0.2	59	54	28
Tajikistan	142	5.3	0.1	54	48	26
Turkmenistan	471	3.9	0.4	19	7	1
Uzbekistan	445	10.1	0.2	25	9	3

Source: Akramov and Shreedhar, 2012, table 3.2

Table 8.3
Food security indicators

FOOD SECURITY INDICATORS	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
AVAILABILITY				
Average dietary energy supply adequacy (%)	123	99	132	122
ACCESS				
Prevalence of malnutrition (%)	6	32.3	<5	5.8
Depth of the food deficit (kcal/capita/day)	41	245	21	39
Prevalence of food inadequacy (%)	11.6	42.8	7	11.9
STABILITY				
Grain import dependency ratio (%)	23.7	43.9	n/a	19.5
Per capita food supply variability (kcal/capita/day)	24	31	50	45
UTILISATION				
Percentage of children under the age of five who are stunted	18.1	39.2	28.1	19.6
Percentage of children under the age of five who are underweight	2.7	15	10.5	7.1
Prevalence of anaemia among children under the age of five	35.8	27.4	31.8	43.2
ADDITIONAL USEFUL STATISTICS				
Total population (millions)	5.5	8.2	5.2	28.9
Number of people suffering from malnutrition (in millions)	0.3	2.7	n/a	1.7

FAO Food security indicators , 2014.

9 References

Kyrgyzstan:

IFAD, 2012. *Kyrgyz Republic Livestock and Market Development Programme*. Design Completion Report. Volume I: Main Report and Annexes. October 2012. IFAD Near East, North Africa and Europe Division. Programme Management Department.

FAO GIEWS, 2015. Country Brief Kyrgyzstan. 19 January 2015.

Fitzherbert, 2006. *Country pasture/forage profiles* Kyrgyzstan. FAO, Rome.

GASFP Fund, 2012. Kyrgyz Republic Proposal for Funding for Agriculture Productivity and Nutrition Improvements under the Global Agriculture and Food Security Program (GAFSP). Ministry of Agriculture and Land Improvement and Ministry of Health. March 2012.

WFP, 2014. WFP Kyrgyz Republic. Brief. Reporting period: 1 October–31 December 2014.

Tajikistan

Akramov, K.T. and Shreedhar, G., 2012. *Economic development, external shocks and food security in Tajikistan* IFPRI discussion paper 01163, March.

EBRD, 2012. *Strategy for Tajikistan*. EBRD, London.

FAO GIEWS, 2015. Country Brief Tajikistan, 19 February 2015.

Lerman, Z., 2014. *Changing land tenure and farm structure in Central Asia*. Presentation at the Agricultural transformation and food security in Central Asia regional research conference IFPRI and University of Central Asia, Bishkek, Kyrgyzstan, 8-9 April.

Swanson, B., Meyer, E., and van Weperen, W. 2011. *Strengthening the Pluralistic Extension and Advisory System in Tajikistan. Report on the MEAS Rapid Scoping Mission*. Second Draft Submitted to USAID Mission/Dushanbe, November 25, 2011.

UNDP-UNEP, 2012. *The Economics of Land Degradation for the Agriculture Sector in Tajikistan – A Scoping Study* UNDP-UNEP Poverty Environment Initiative. Dushanbe.

FAO/EBRD, 2006. *Expanding finance in rural areas in Kyrgyzstan and Tajikistan*. Report series number 11, August.

Walter, G., 2011. *International Comparative advantages of Tajikistan in the agro-food sector*. International Agribusiness Investment Forum. 18 to 19 October 2011. TAFF (Tajik Agricultural Finance Framework).

The World Bank, 2015. Tajikistan Partnership Programme snapshot. April

Turkmenistan

EU (2012). Annex 1 of the Commission implementing decision on the Annual Action Programme 2013 in favour of Turkmenistan. Action Fiche for Support for Further Sustainable Agriculture and Rural Development in Turkmenistan (Phase III).

FAO (2012) Aquastat Turkmenistan. FAO, Rome.

FAO (2014) GIEWS Country Brief. September.

Lerman, Z., Pridhodko, D., Punda, I., Sedic, D., Serova, E. and Swinnen, J., 2012. *Turkmenistan. Agricultural sector review*. FAO/EBRD, FAO Rome.

Uzbekistan

FAO GIEWS, 2014. Country Brief, Uzbekistan 14 August 2014.

Sutton, W.R., Srivastava, J.P., Neumann, J.E., Droogers, P. and Boehlert, B.B., 2013. *Reducing the Vulnerability of Uzbekistan's Agricultural Systems to Climate Change. Impact assessment and*

adaptation options. A World Bank study 81589. The World Bank, Washington.
<http://dx.doi.org/10.1596/978-1-4648-0000-9>

Timesca, 2015. [Uzbekistan to diversify agricultural production](http://www.timesca.com/news/14917-uzbekistan-to-diversify-agricultural-production).
<http://www.timesca.com/news/14917-uzbekistan-to-diversify-agricultural-production>

USDA, FAS, 2011. *Uzbekistan Livestock report 2011* Date 27 April 2011. GAIN report UZ1101

Uzb-Cerbanet, 2013. *Potential and development of agriculture in Uzbekistan*. Presentation at the Toronto Event 2013. www.cerbanet.org (CERBA: Canada Eurasia Russia Business Association)

The World Bank 2010. Uzbekistan Climate change and agriculture country note. September
www.worldbank.org/eca/climateandagriculture.

Climate studies

Bobojonov, I. and Aw-Hassan, A., 2014. *Impacts of climate change on farm income security in Central Asia: An integrated modeling approach*. Agriculture, Ecosystems and Environment 188 (2014) 245–255. <http://dx.doi.org/10.1016>

Fischer, G., Shah, M. and van Velthuisen, H., 2002. *Climate Change and Agricultural Vulnerability* A special report, prepared by the International Institute for Applied Systems Analysis under United Nations Institutional Contract Agreement No. 1113 on 'Climate Change and Agricultural Vulnerability' as a contribution to the World Summit on Sustainable Development, Johannesburg 2002.

Met Office, 1999. *Climate change and its impacts. Stabilisation of CO2 in the atmosphere*. Hadley Centre for Climate Prediction and Research The Met Office, London Road, Bracknell, RG12 2SY, UK

Mirzabaev, A., 2013. 'Impacts of Weather Variability and Climate Change on Agricultural Revenues in Central Asia.' *Quarterly Journal of International Agriculture* 52 (2013), No. 3: 237-252

The World Bank, 2009. *Adapting to climate change in ECA*. Knowledge Brief. June 2009. Volume 5.

The World Bank, 2012. *Adapting to Climate Change in Europe and Central Asia. Lessons from Recent Experiences and Suggested Future Directions*. June 28, 2012. Report No. 78416 – ECA. The World Bank Group. Europe and Central Asia Region

Contact

LEI Wageningen UR

P.O. Box 29703

2502 LS The Hague

The Netherlands

Name: Siemen van Berkum

Position: Senior researcher

T +31 (0)70 335 81 01

Name: Yvonne Fernhout

Position: press officer

T +31 (0)70 335 83 38

Lei.library.nl

2015-092