C-ADAPT

Climate Resilience for Food Security: ANALYSES, INNOVATIONS & STANDARDS

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KYRGYZ REPUBLIC
An overview of climate trends and the impact on food security

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World Food Programme
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With support from:

State Agency on the Environment al Protection and Forestry

Tian Shan Policy Center of the American University of Central Asia

Climate Change Center of the Kyrgyz Republic

National Agency for Hydrometeorology

CLIMATE RISK and Food Security

- The livelihoods and food security of households that depend on small-scale farming, unskilled wage labor and social allowances for their main income are particularly vulnerable to climate risks.

WHAT is this Analysis?

This document is part of the **Climate Adaptation and Resilience for Food Security: Analyses, Innovations and Standards** Series. It is an analysis of climate trends and impacts on food security in the Kyrgyz Republic. It aims to outline how the negative impact of climate risks on agricultural production is transmitted to the most vulnerable communities and households. The study provides a set of key policies to build adaptive capacity and reduce climate-related food insecurity.

WHO is this Analysis for?

- **Implementers:** Identifying trends will help international development workers plan and implement adequate projects and activities to help build the climate resilience of food-insecure people.

- **Policy makers:** A greater understanding of climate risks, and potential threats and trends can inform decision-making and encourage investment in high risk, vulnerable areas where gaps may exist.

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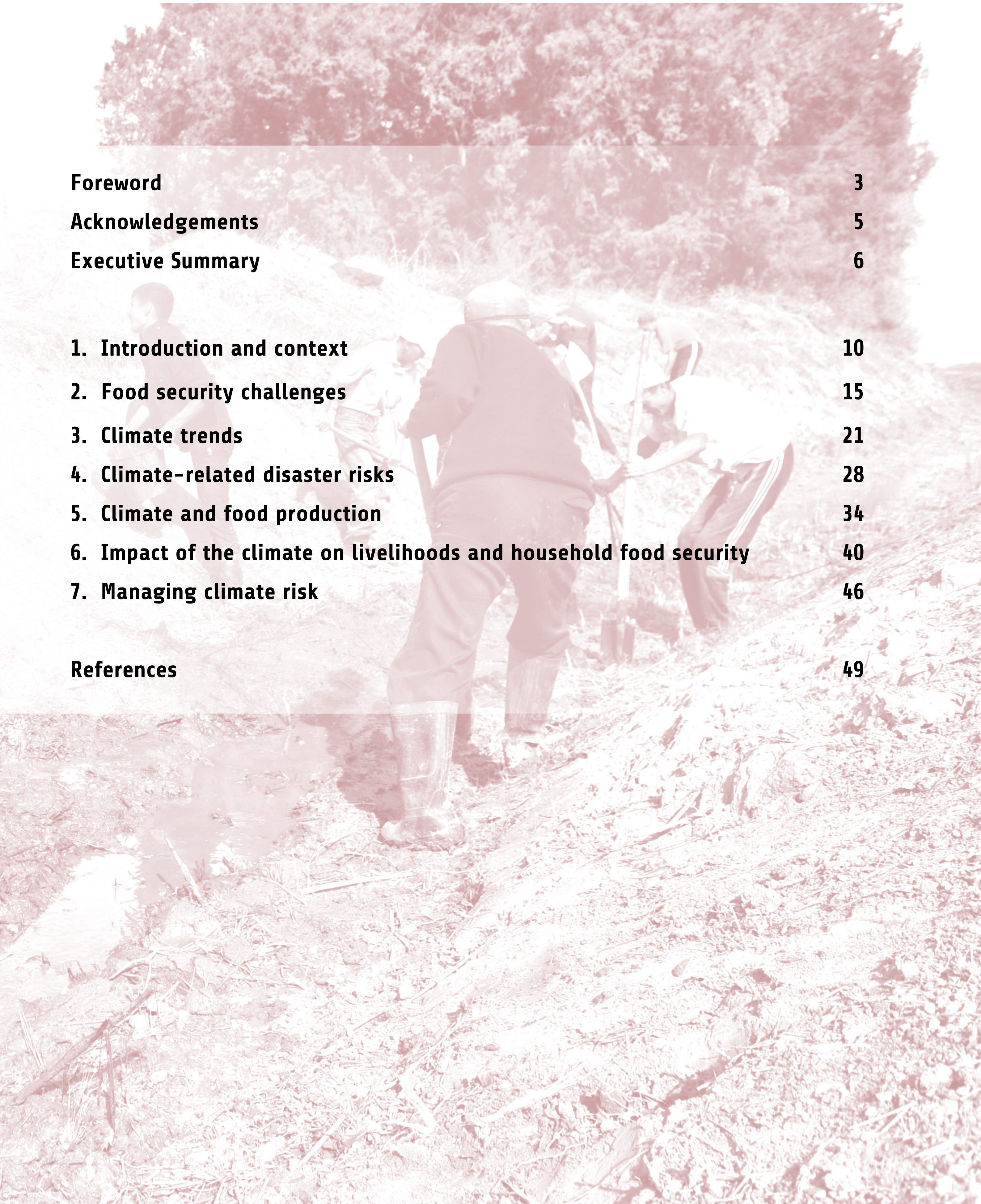


- Households reduce the quality of their diet frequency to mitigate the impact of the food security related shocks, such as high and volatile food prices, harvest failure and income losses.

FOREWORD

The State Agency on Environmental Protection and Forestry

The Kyrgyz Republic is highly vulnerable to shocks associated with climate change. Recent years have been marked by changing rainfall patterns, heavy snowfall events, and landslides – all of which have had a negative impact on the livelihoods and food security of vulnerable people throughout the country.

The negative impacts of climate change in the Kyrgyz Republic are real: the latest scientific evidence suggests that increasingly erratic rainfall and glacier melt will likely result in more extreme weather events. These events are predicted to have a detrimental effect on livelihoods and food security. As a consequence, the government recognised that food security in the Kyrgyz Republic is especially sensitive to climatic conditions, as elaborated in our National Communication to the United Nations Framework Convention on Climate Change (UNFCCC).

It is therefore critical to ensure food security for those most at-risk and to enhance resilience among vulnerable populations. In order to identify policies that support the most vulnerable it is important to understand the impact of climatic change on such populations, and then use this information to identify where the most vulnerable are and why they are the most vulnerable in order to prioritise interventions. This report provides a comprehensive analysis of climate risk and its potential impact on food security and livelihoods that could form the basis of a prioritisation of typologies of interventions to manage risks.

This report explores several key issues. For instance, it examines the historical relationship between the climate and food security, and also analyses the sensitivities of livelihoods to climate conditions and uses this information to identify who is potentially most at risk. We consider that this type of work is instrumental not only to advancing the climate change and food security dialogue in the Kyrgyz Republic, but also to providing concrete input for adaptation planning.

Finally, I would like to acknowledge the dedication that has gone into this analysis. This report is the result of a collaborative effort between the United Nations World Food Programme, the State Agency for Environmental Protection and Forestry, Tian Shan Policy Center, the Climate Change Center and the National Hydrometeorology Agency. Collaboration between international and national organisations is needed to engage experts from different fields to better understand the different risks and range of implications on livelihoods and food security that climate conditions present.

Sabirzhan Atadjanov
Director General

State Agency on Environmental Protection and Forestry, Kyrgyz Republic

The World Food Programme

The Kyrgyz Republic is highly vulnerable to climate risks due to the high frequency of climate-related disasters and its dependency on the rural economy. Despite progress made in reducing extreme poverty in the Kyrgyz Republic in the last few years, climate risks pose significant threats to ensuring sustainable livelihoods and food security. Recent events, such as the increasing numbers of floods and mudflows each spring, drought in 2008 and severe cold spells in 2008-9, and the consequent impact on livelihoods and food security highlight the country's vulnerability to climate risks.

Water availability in particular, as identified in this study, is the key climatic variable affecting food security in the Kyrgyz Republic. This report further suggests that the livelihoods and food security of households that depend on small-scale farming, unskilled wage labour and social allowances for their main income are particularly vulnerable to climate risks, due to the negative impact on crop productivity, increases in food prices, and limited coping capacities.

Given the clear impact of the climate on food security, WFP has made addressing the impact of climate change on food security a priority in the most vulnerable countries. WFP's strategy to address climate change issues emphasises the importance of enhancing the resilience of vulnerable communities through asset creation and capacity development at national and community levels. A core component of this strategy is to strengthen the evidence base of the climate impact on food security, and to use this information to better inform food security policies, programmes and community-level activities.

This exercise aims to outline how climate risks impact on household food security and livelihoods in the Kyrgyz Republic. We believe that this is a key step towards identifying the regions and communities that should be prioritised for support and interventions, and also that this provides concrete information for adaptation planning to build resilience, particularly among the most vulnerable groups in the country.

Ram Saravanamuttu
Representative / Country Director

United Nations World Food Programme
Kyrgyz Republic

ACKNOWLEDGEMENTS

The World Food Programme (WFP) wishes to acknowledge the contribution and support of various organisations to this study on Climate Risks and Food Security.

The exercise was a collaborative effort involving many institutions in its preparation and implementation, including in the production of this report.

Our appreciation goes firstly to the State Agency on Environment Protection and Forestry (SAEPF) and the Climate Change Center of the Kyrgyz Republic for providing climatological and environmental expertise for the study's preparation, review and feedback.

Special recognition goes to the Tian Shan Policy Center of the American University of Central Asia which provided technical guidance and facilitated consultations with stakeholders. In addition, we would like to acknowledge the National Agency for Hydrometeorology and the Ministry of Emergency Situations for providing data and methodological advice. In addition, we would like to thank Mr. Krishna Krishnamurthi, Climate Change and Hunger Analyst in WFP, for providing climate trend analysis and technical guidance on related methodology.

For feedback, clarification or comments please contact:

James Feeney
Deputy Country Director WFP in the Kyrgyz Republic
james.feeney@wfp.org

Keigo Obara
Head of Vulnerability Analysis and Mapping (VAM)
WFP in the Kyrgyz Republic
keigo.obara@wfp.org

Dinara Abzhamilova
VAM Officer
WFP in the Kyrgyz Republic
dinara.abzhamilova@wfp.org

EXECUTIVE SUMMARY

The latest scientific evidence suggests that changes in the climate will exacerbate existing threats to food security and livelihoods through a combination of increasing the magnitude of climate hazards, diminishing agricultural yields and production, and intensifying competition over scarce resources. Efforts to reduce the impact of changing climatic conditions on food insecurity and the resilience of the most vulnerable communities are critical elements of the global effort to respond to the increasing climate risks.

However, these efforts are challenged by the limited understanding of the impact of changing climatic conditions on food security beyond the impact on agricultural production. This study aims to outline how the negative impact of climate risks on agricultural production is transmitted to the most vulnerable communities and households. In order to do so, the following aspects are examined:

1. The main challenges against the four food security dimensions (availability, access, utilisation and stability) in the Kyrgyz Republic

2. Temporal and spatial trends of climate variability and related risks

3. Potential linkages between the identified food security challenges and climate risks

The final component of this study is to identify a **set of key policies to build adaptive capacity and reduce climate-related food insecurity** in the most vulnerable communities.

Food Security in the Kyrgyz Republic

Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. People are food secure only when food is both available and accessible - food must not only be produced, but people must be able to afford it. From this perspective, food security in the Kyrgyz Republic is facing the following challenges:

First, more than a third of the population is unable to meet the minimum requirement for an active and healthy life. The population living below poverty line increased from 32 percent to 38 percent between 2009 and 2012 partly as a result of increased prices for essential items, including food. The poverty rate remains higher in rural areas, reflecting limited income opportunities and the dependence on natural resources.

Second, while the majority of the population in the Kyrgyz Republic achieved sufficient levels of food consumption in terms of calories, dietary patterns are characterised by low consumption of nutrient-dense food, such as meat and eggs, and high consumption of wheat and cooking oils (see Figure 2.5 in the main report). This entails risks for the health and nutritional status of vulnerable household members through nutrient deficiencies, especially micronutrients.

Third, households reduce the quality of their diet frequently to mitigate the impact of food security related shocks, such as high and volatile food prices, harvest failure and income losses.

Fourth, food consumption-related coping strategies were adopted more frequently by households who rely on income from small-scale farming, unskilled wage labour and social allowances.

Spatial and temporal climate trends and risks

Precipitation trends are highly variable in both inter-annual and inter-seasonal time scales across the country. Trends have been highly erratic between 1982 and 2011. The largest decreases have been between June and August in north-eastern parts of the country. On the other hand, increases in rainfall have occurred between April and June, especially in southern parts of the country. This trend could be linked to higher flood risk.

The temperature has been steadily increasing between 1982 and 2011. Overall temperatures between October and December have increased throughout the country. This trend could exacerbate glacial melt and reduce snow cover, which are critical to ensuring the availability of water for key agricultural activities. Temperatures have also increased between July and September while rainfall has decreased during the same period. The combination of these two factors could result in an increased risk of drought.

Climate-related disasters, such as droughts, floods, mudflows and landslides, have become more frequent over the last two decades (Figure 4.2 in the main report). A seasonal analysis of rainfall and temperatures suggests an increase in flood and landslide risks in the south, and higher drought risks in the north-eastern parts of the country. In addition, increased precipitation and water availability through glacial lakes are likely to be associated with intensified floods and mudflows in the southern areas. For example, a harsh winter in 2011-12 with unusually low temperatures and heavy snowfall, and melting snow and heavy rains in the early spring resulted in mudflows and flash floods.

Climate and crop production

Agriculture in the Kyrgyz Republic is sensitive to climate conditions. Both rainfall and temperature are positively correlated with crop yields, suggesting that increases in both rainfall and temperatures are linked to higher crop production. Vegetables, wheat, and potato are the most sensitive products to changes in climatic patterns, specifically to decreases in rainfall. Crops are also sensitive to variations in seasonal rainfall. There is a strong positive correlation between yields and April-June rainfall, highlighting that the timing of rainfall is critical to ensuring adequate food production. Changes in the timing of rainfall due to the changing climate could therefore pose a significant risk to food security. It has to be noted that more rainfall and higher temperatures could also result in an increased risk of disasters.

Climate and household food security

Changes in the production of agricultural crops could have a detrimental impact on the livelihoods of smallholder producers and on retail prices in local markets, which could reduce economic access to food among the poor. For example, small-scale subsistence farming households who obtain a significant proportion of their food from their own production could become dependent on markets due to reduced crop productivity. Food prices are likely to increase in local markets due to reduced availability, thereby reducing the ability of households to buy food.

The main source of wheat flour for all livelihood groups - including farmers - is from purchasing it within the market. A reduction of wheat productivity is therefore unlikely to have impact on the consumption of wheat flour. However, the impact of a reduction or fluctuation in production will most likely be transmitted to market prices. A wheat flour price increase will have a disproportionate impact on already food-insecure market dependent households, such as households with income from small-scale agriculture, unskilled wage labour and social allowances, because they spend a larger proportion of their budget on purchasing wheat flour.

For most livelihood groups, the main source of potatoes and vegetables is through people's own production - and this is particularly among the households which derive their main income from agriculture, wage labour and social allowances. Therefore, the negative impact of a change in climatic conditions on potato and vegetable productivity is likely to have a direct impact on the consumption among these groups. Food insecurity levels in terms of economic access to food and the severity of coping strategies are also higher among these groups compared to other livelihood groups. Reduced local supply due to the negative impact of climate risks may increase market prices of potatoes and vegetables if trade flows are not able to fully compensate for reduced local availability. Therefore, reduced potato and vegetable productivity will have both a direct and indirect impact on food consumption, particularly among these groups.

Climate predictions

To date, there have been limited climate projections undertaken for the Kyrgyz Republic. These uncertainties in future projections are in part a function of a lack of long-term historical data, as well as the difficulty of modelling the key climatic processes in the region – the prevailing westerlies (particularly the Siberian High) and the polar front. However, four main trends appear to be consistent among climate projections:

First, models suggest an increase in temperature together with lower annual rainfall – potentially resulting in an increased drought risk.

Second, glacier and snow cover are likely to decrease with a significant impact on water availability, both in the short-term and the long-term.

Third, changes in seasonal precipitation are expected, with increases in winter (including snowfall) and decreases in summer rainfall.

Fourth, low-lying parts of Central Asia could gradually become arid, thereby affecting vulnerable livelihood systems, such as subsistence agriculture.

These trends suggest that extreme climatic events could potentially become more common in the future, while long-term changes in seasonal patterns could also have a detrimental impact on food security – particularly in the southern parts of the country.

To conclude, the report identifies the following three priority actions to enhance food security and climate risk management outcomes:

! Focus on the most vulnerable

A reduction in crop production and increase in market prices will have a disproportionate impact on already food-insecure market dependent households, such as households with income from small-scale agriculture, unskilled wage labour and social allowances. Strategies for livelihood and income diversification are critical to ensuring resilience against projected more intense climate-related risks. For example, migration (both seasonal and permanent) has become an important source of household income for at-risk populations. Land rehabilitation, improving water-use efficiency, reducing post-harvest losses and supporting food processing and supply chains can be a more sustainable solution to manage climate risks.

Manage uncertainties associated with climate change

Extreme climate events, such as droughts and floods, could potentially become more common in the future with potentially devastating impacts on crop production. Strategies to address climate risk should focus on developing capacities to better analyse and anticipate risks. The introduction of early warning systems, profiling of climate risks and food security at sub-national levels and developing contingency plans can support climate risk management and food security strategies.

Mainstreaming climate risk management into social protection and food security strategies

Integrating climate risk management structures into broader social protection and food security strategies offers critical platforms for investing in risk management for the most vulnerable. For example, technologies, knowledge, skills and information for adaptation can be disseminated among the most vulnerable groups as part of targeted social safety net schemes.

Technologies, knowledge, skills and information for adaptation can be disseminated among the most vulnerable groups as part of the targeted social safety net schemes.

1 INTRODUCTION and context

KEY MESSAGES

This analysis has three main objectives:

- Identify the main challenges against the four food security dimensions (availability, access, utilisation and stability) in the Kyrgyz Republic.
- Examine the temporal and spatial trends of climate variability and related risks.
- Identify potential linkages between the identified food security challenges and climate-related risks.

Contextual factors include:

The pressure on natural resources is growing in the Kyrgyz Republic

- The population is growing but productive arable land under irrigation is limited and concentrated in certain areas.
- Lack of maintenance has resulted in the irrigation water supply system that is unable to meet increasing demand.
- Inadequate management of natural resources, such as water, land, pastures and forests, is a potential source of social tension.

40 percent of rural households are below the national poverty threshold

- Significant progress has been made to reduce poverty, with poverty incidence declining from 63 percent to 32 percent between 2000 and 2008. However it has worsened since 2009.
- Regional disparity in poverty incidence is considerable. Chuy province and Bishkek city have a poverty incidence level below the national average, while the level is significantly higher in Jalalabad and Osh provinces.

Introduction

The latest scientific evidence suggests that changes in climatic conditions will exacerbate existing threats to food security and livelihoods through a combination of increasing the magnitude of climate hazards, diminishing agricultural yields and production, and intensifying competitions over scarce resources. Efforts to reduce the impact of changes in the climate on food insecurity and the resilience of the most vulnerable communities are critical elements of the global effort to respond to the increasing climate risk.

However, these efforts are challenged by the limited understanding of the impact of climate change on food security beyond the impact on agricultural production. This study aims to outline how the negative impact of climate risks on agricultural production is transmitted to the most vulnerable communities and households.

In order to do so, the following aspects are examined: **the main food security challenges; temporal and spatial climatic risks, and potential linkages between these two factors.**

The final component of this study is to identify a set of key policies to build adaptive capacity and reduce climate-related food insecurity in the most vulnerable communities.

National context

Demography

Kyrgyz Republic is a Central Asian country with a population of around 5.5 million[1]. The population is unevenly distributed across the country: lowland areas in Chuy, Osh and Jalalabad provinces are more densely populated while highlands and mountainous areas are less densely populated because of limited soil productivity and harsh climatic condition (Figure 1.1).

The annual population growth rate in the Kyrgyz Republic (1.35) was the highest among Central Asian countries after Tajikistan (2.43).[2] As Figure 1.2 shows, growth rates are higher in rural areas, particularly in the southern provinces (Batken, Osh, and Jalalabad) and Talas province.

The population growth contributes to the growing pressure on natural resources: productive arable land under irrigation is limited, as Figure 1.3 below shows, and concentrated in certain areas. This is compounded by increasing resource consumption and lack of infrastructure development (Government of Kyrgyzstan, 2013). Inadequate management of and unequal access to natural resources, such as water, land, pastures and forests, is a potential source of social tension (UNDP, 2013).

1. United Nations Department of Economic and Social Affairs, 2012.

2. Ibid.

FIGURE 1.1
Population map of the Kyrgyz Republic

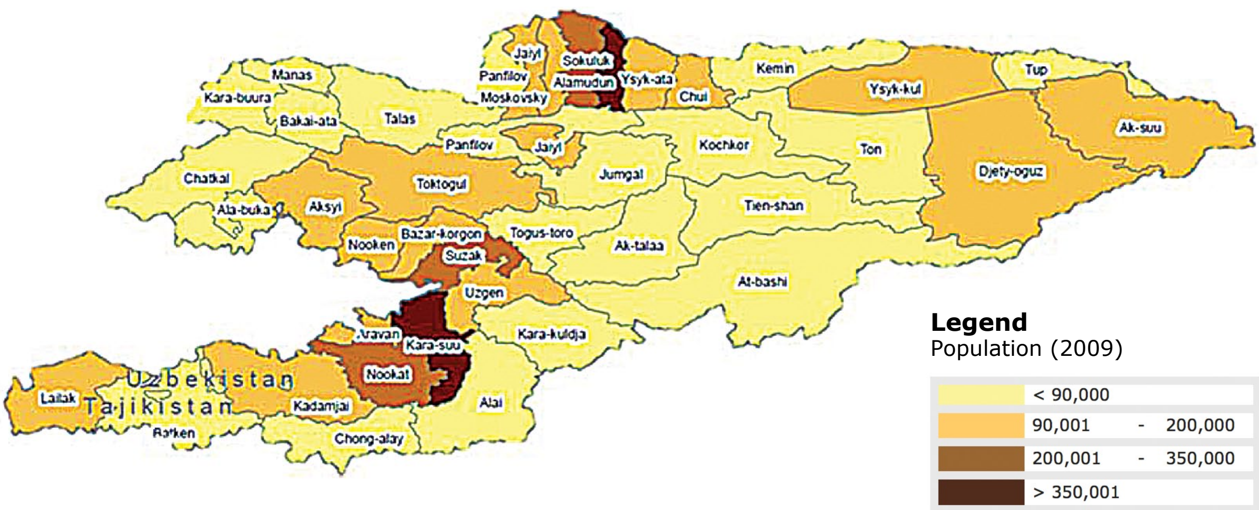


FIGURE 1.2
Population growth in the Kyrgyz Republic

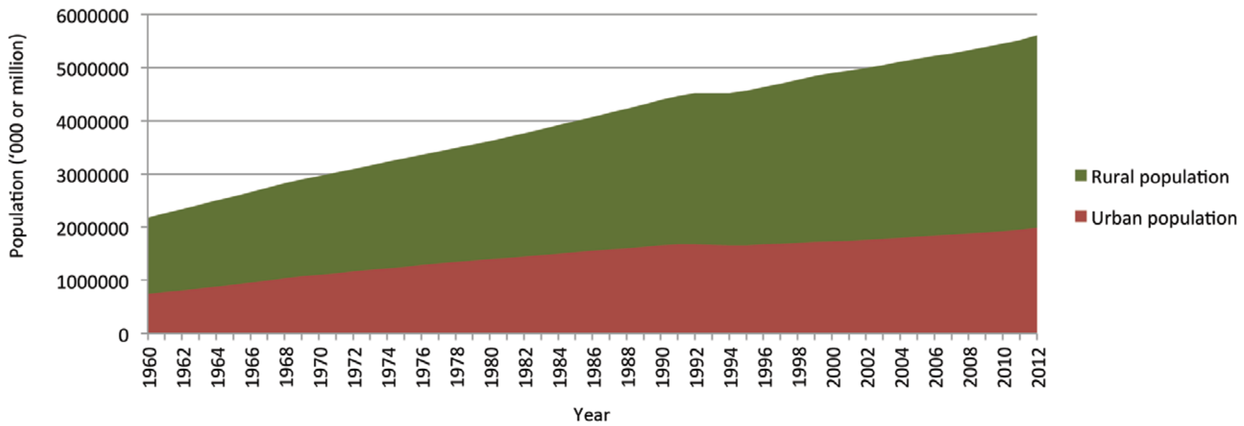
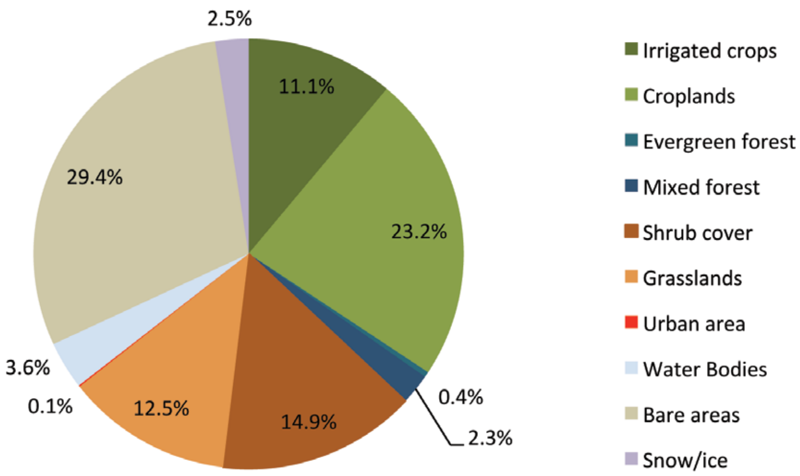


FIGURE 1.3
Land cover distribution (% of country area)

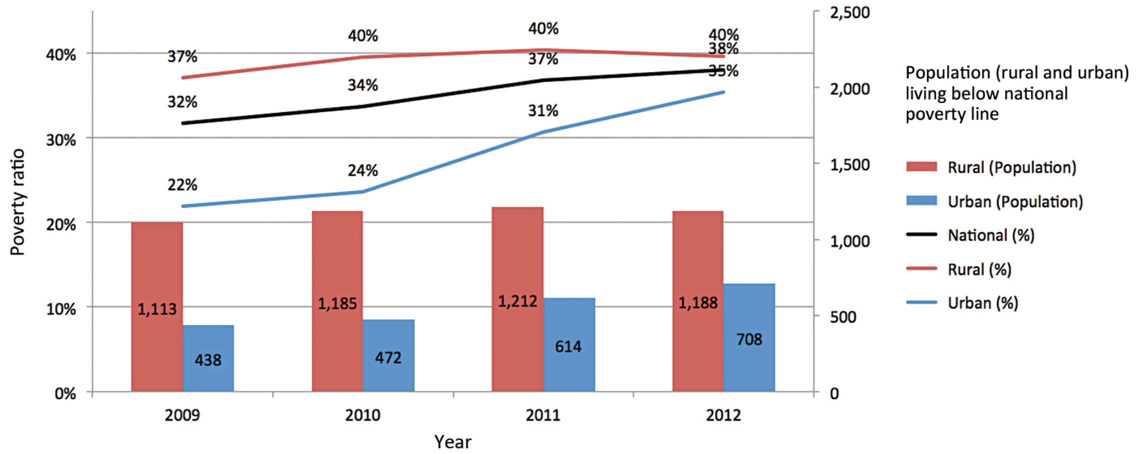


Source: GlobCover, European Space Agency.

Poverty

Some progress has been made to reduce poverty, with poverty incidence declining from 63 percent to 32 percent between 2000 and 2008. However, the national poverty rate has increased from 32 percent to 38 percent between 2009 and 2012, partly as a result of slower growth in remittances since late 2011 and increased prices for essential items. The poverty rate remains higher in rural areas, reflecting their dependence on natural resources. According to the latest Kyrgyz Integrated Household Survey (KIHS), 40 percent of rural households are below the national poverty threshold, compared to 35 percent in towns and 21 percent in Bishkek. As a result, three quarters of poor households live in rural areas while the rural sector accounts for 66 percent of the population. Chuy province and Bishkek city have a poverty incidence level below the national average, while the level is significantly higher in Jalalabad and Osh provinces.

FIGURE 1.4
Trend of poverty ratio and estimated population living below the national poverty line in the Kyrgyz Republic (2009–2012)

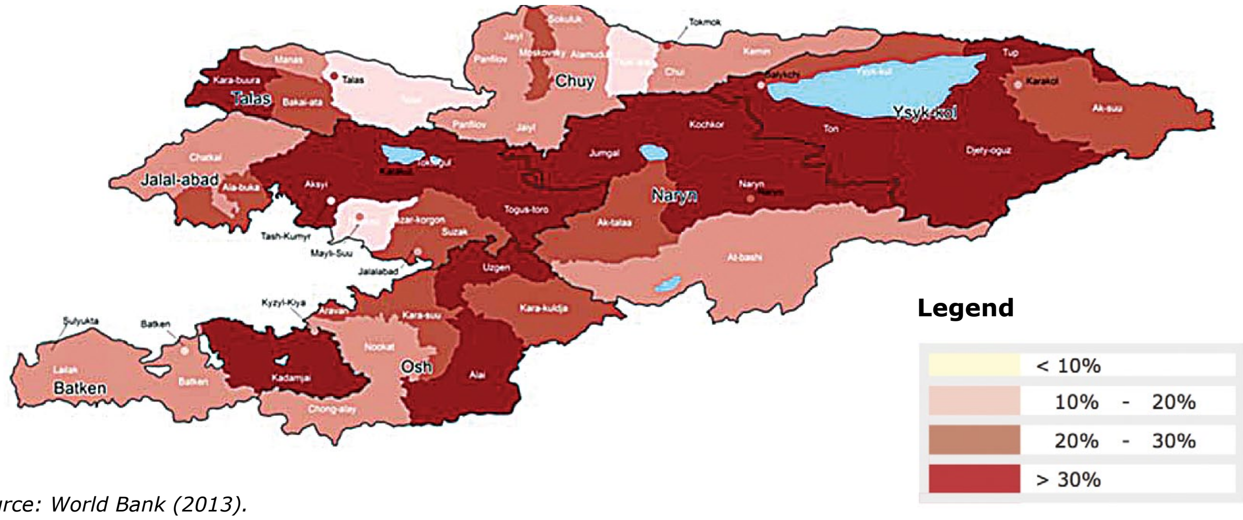


Source: National Statistics Committee.

In the Kyrgyz Republic, official poverty rates are not produced below province level. The World Bank estimated district-level poverty incidents based on KIHS 2009 and the Population and Housing Census 2009 using the Small Area Estimation method, which is commonly used to obtain poverty estimates at a level at which the survey is not representative. The result shows that the central highland areas stand out as the worst-off, while most of the districts in the productive northern lowland areas are better-off. Figure 1.4 presents the estimated poverty rates at district level. These results are consistent with WFP's Household Food Security Assessments (HFSA), which have been conducted on a biannual basis since 2010. Expenditure levels were consistently lower in Naryn and Jalalabad and higher in northern areas, including Bishkek, Chuy and Talas (WFP 2010, 2011, 2012, 2013). The wealth index, which measures household wealth based on the ownership of non-productive assets (such as cell phones, radios and vehicles), suggests that urban households possess more assets than rural households.

These findings highlight large disparities in poverty rates between urban and rural areas, as well as between provinces.

FIGURE 1.5
Estimated proportion of the household living below absolute poverty line (2009)



Source: World Bank (2013).

- Land rehabilitation, improving water use efficiency through improved irrigation systems and strengthening the capacity of the Water Users Association can be more sustainable solutions to manage climate risks.

2 FOOD SECURITY challenges

KEY MESSAGES

Limited economic access to food from market purchases results in the consumption of a diet lacking variety or a high nutritional value

- The proportion of the population with an unbalanced starch-based diet was significantly higher among poor households.
- The proportion of poor households significantly increased from 32 percent in 2009 to 38 percent in 2012.

Domestic crop production has been stagnant for the last few years. Import dependency makes the domestic wheat market highly prone to international price volatilities

- Over the next decade, cereal prices are expected to be projected well above the average of the previous decade.

Average dietary energy intake is well above the minimum requirements. However, dietary diversity levels are low in the Kyrgyz Republic

- Wheat and potato account for nearly 60 percent of energy intake.

Households further reduce the quality of diets frequently to mitigate the impact of food security related shocks, such as high and volatile food prices, harvest failure and income losses

- This indicates that the quality of consumption is highly sensitive to external shocks such as food prices and climate-related disasters.
- This could result in micronutrient deficiencies, thereby jeopardising the nutrition status of vulnerable household members.

Food insecurity levels are higher among rural farmers and wage labourers

- The Coping Strategy Index (CSI) was higher among these groups, indicating that food consumption-related coping strategies were adopted more frequently than other groups.
- Wealth levels measured by Monthly Per Capita Expenditure (MPCE) were significantly lower among these groups.

Food insecurity is highly seasonal in the Kyrgyz Republic

- Poor households are more dependent on the market, and their dietary diversity is lower during the winter and early spring. This is due to depleted food stocks, high prices in the market and expenditure on heating.

Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit, 1996).

People are food secure only when food is both available and accessible - food must not only be in the market but people must be able to afford it. From this perspective, **food security in the Kyrgyz Republic is facing the following challenges:**

1. **Limited economic access to food from market purchase results in the consumption of a diet lacking varied and high nutritional quality food.**

As Figure 2.1 indicates, the proportion of the population who had a 'poor' or 'borderline' Food Consumption Score (FCS),[3] which reflects an unbalanced starch-based diet, was significantly higher among poor households (16 percent) compared to non-poor households (7 percent), highlighting low purchasing power as a key underlying cause of food insecurity. In 2012, 38 percent of the total population was living below the national poverty line, a significant increase from the 32 percent reported in 2009, partly as a result of increased prices for essential items including food. The poverty rate is higher in rural areas, reflecting limited income opportunities and the dependence on natural resources.

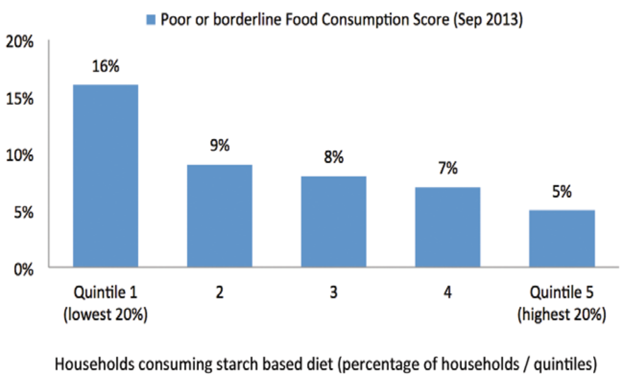
These results are consistent with WFP's Household Food Security Assessments (HFSA), which have been conducted on a biannual basis since 2010. Expenditure levels were consistently lower in Naryn and Jalalabad and higher in northern areas, including Bishkek, Chuy and Talas (WFP 2010, 2011, 2012, 2013). The wealth index, which measures household wealth based on the ownership of non-productive assets (such as cell phones, radios and vehicles), suggests that urban households possess more assets than rural households. These findings highlight large disparities in poverty rates between urban and rural areas, as well as between provinces.

2. **Domestic crop production has been stagnant for the last few years.**

Following a gradual increase from the mid-1990s to early 2000s (Figure 2.2), domestic crop production has stagnated over the last few years. The reductions appear to be linked to inefficient irrigation systems and land degradation (Government of the Kyrgyz Republic 2013), as well as climate-related hazards. The supply of wheat flour, the most important item for caloric contribution, is not enough to meet domestic demand and therefore imports play a key role to supplement food consumption. As a result of import dependency, the wheat market in the Kyrgyz Republic is highly prone to international price volatilities. Over the next decade, it is anticipated that cereal prices will be projected well above the average of the previous decade (OECD/ FAO Agricultural Outlook 2013-2022).

An average household spends 38 percent of its monthly budget on food. However, among the 20 percent poorest households the total expenditure on food is as high as 63 percent, representing a significant exposure to increases in food prices (Figure 2.4).

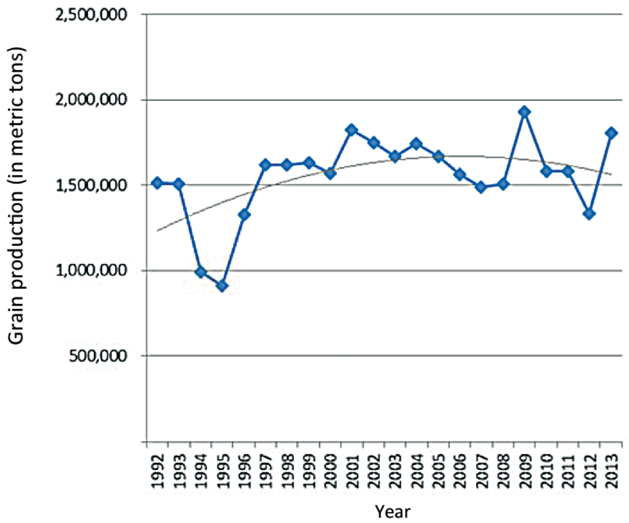
FIGURE 2.1
Proportion of households with an unbalanced starch-based diet in the week preceding the survey (measured by the FCS)



Source: WFP (2003).

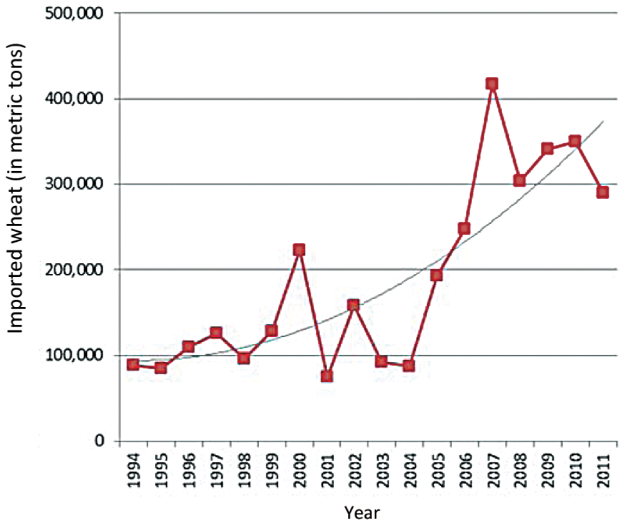
[3] See box 1 for the methodology and reference.

FIGURE 2.2
Grain production in the Kyrgyz Republic (Metric Ton)



Data source: National Statistics Committee.

FIGURE 2.3
Wheat Import quantity in the Kyrgyz Republic (Metric Ton)



Data source: FAOSTAT.

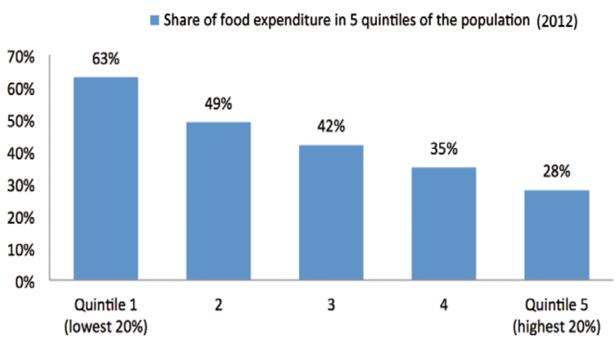
3. **Food price volatility is a major source of risk for poor households due to their low purchasing power and a high share of household income spent on purchasing food.**

Food price volatility is a major source of risk for poor households due to their low purchasing power and a high share of household income spent on purchasing food. An average household spends 38 percent of its monthly budget on food; however, among the 20 percent poorest households the total expenditure on food is as high as 63 percent, representing a significant exposure to increases in food prices (Figure 2.4).

4. **Food consumption patterns contribute to poor nutrition, particularly in vulnerable household members.**

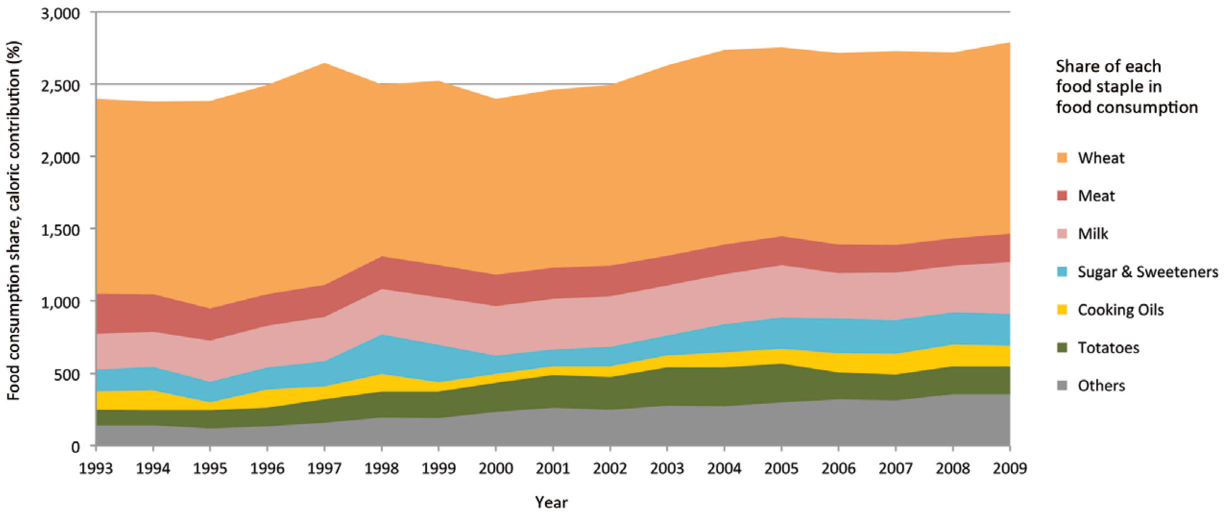
While the majority of the population in the Kyrgyz Republic has achieved sufficient levels of food consumption in terms of calories, dietary patterns are characterised by a low consumption of nutrient-dense food, such as meat and eggs, and a high consumption of wheat and cooking oils (Figure 2.5). This generates risks for the health and nutritional status of vulnerable people through nutrient deficiencies, especially in micronutrients.

FIGURE 2.4
Share of food expenditure (2012)



Data source: National Statistics Committee (2012).

FIGURE 2.5
Food consumption share, in caloric contribution (%)



Data source: Food Balance Sheet.

5. **Households further reduce the quality of diets frequently to mitigate the impact of food security related shocks, such as high and volatile food prices, harvest failure and income losses.**

According to all seven of WFP's periodic HFSAs analysed how households cope with shocks and difficulties, reducing consumption quality was the coping strategy most frequently employed by households.[4] This indicates that the quality of consumption is highly sensitive to external shocks, such as food prices and climate-related disasters. This could result in micronutrient deficiencies thereby jeopardising the nutrition status of vulnerable household members.

6. **Food insecurity levels are higher among households who rely on income from farming, unskilled wage labour and social allowances.**

As Figure 2.7 shows, the Coping Strategy Index (CSI)[5] was higher among these groups, indicating that food consumption related coping strategies were adopted more frequently than by other groups. Wealth levels measured by Monthly Per Capita Expenditure (MPCE) were significantly lower among these groups.

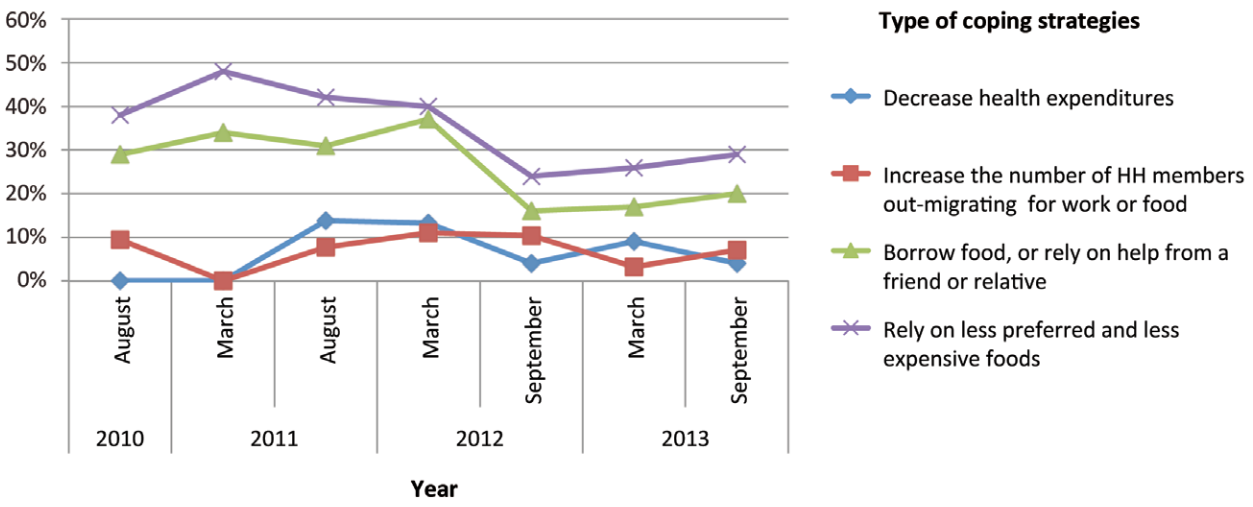
7. **Householdfood insecurity is highly seasonal in the Kyrgyz Republic.**

High dependency on markets for food purchases and low dietary diversity are exacerbated during winter and early spring, most often due to depleted food stocks at the household level, higher food prices in markets, and increased expenditure on heating and agricultural inputs (WFP 2013).

4. HFSA asked "What do you do when you don't have enough food, and don't have enough money to buy food?" The questionnaire used for the assessment is available in the final report of the Household Food Security Assessment in September 2013 (www.wfp.org/content/ kyrgyz-republic-household-food-security-assessment-september-2013).

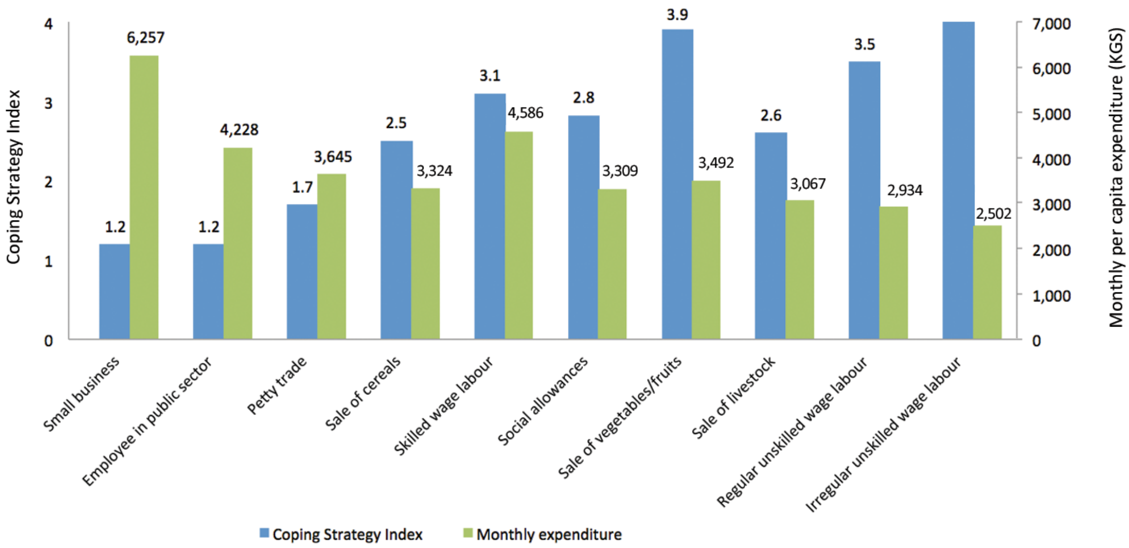
5. Maxwell and R. Caldwell, "The Coping Strategy Index," Field Methods Manual, Second Edition, 2008

FIGURE 2.6
Type of coping strategies employed by households facing a shortage of food



Source: WFP 2010, 2011, 2012, 2013.

FIGURE 2.7
Food security levels measured by CSI and MPCE by household main income source



Source: WFP 2013.

BOX 1.
How to measure household food security

Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit, 1996). Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization, and stability (vulnerability and shocks) over time. Each food security dimension is expressed through specific indicators. No single indicator is able to capture the complexity and multidimensionality of food security (State of Food Insecurity (SOFI) 2013, FAO/WFP/IFAD).

In the Household Food Security Assessments (HFSA) conducted by the WFP in the Kyrgyz Republic, household food security was assessed by the following indicators:

Measuring the quality/ diversity of food that its members consume: Households consuming a non-diversified, unbalanced and unhealthy diet can be classified as food insecure. Food insecure people spend a larger share, if not all, of their food budget on cereals and tubers, such as wheat and potatoes, which provide low cost and accessible sources of calories. They tend to consume fewer nutrient dense foods that provide a good source of protein and micronutrients. Therefore, the less varied the food intake by members of a household, the more likely they are to be food insecure. In the HFSA, dietary diversity was captured by the Food Consumption Score (FCS), which measures the number of food groups that a household consumes over a reference period of seven days.

Calculating the FCS: The FCS combines food diversity and food frequency (the number of days each food group is consumed), weighted by the relative nutritional importance of different food groups. Cereals, tubers and root crops are assigned a weighting of 2; pulses a weighting of 3; vegetables, relish and fruit 1; meat, eggs, fish and dairy 4; sugar, oils, fats and butter 0.5. The food consumption score uses standardised thresholds that subsequently divide households into three groups: poor food consumption, borderline food consumption and acceptable food consumption.

For more details on the FCS, see the following guidelines and research:

World Bank, 2013, 'Shorter, Cheaper, Quicker, Better: Linking Measures of Household Food Security to Nutritional Outcomes in Bangladesh, Nepal, Pakistan, Uganda, and Tanzania'

WFP, 2009, 'Technical Guidance Sheet - Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis'

International Food Policy Research Institute (IFPRI), 2008, 'Validation of the world food programme's food consumption score and alternative indicators of household food security'

Measuring the level of stress caused by various shocks with the Reduced Coping Strategy Index (RCSI): Households use coping strategies to mitigate the impact of food security related shocks, such as food availability shortfalls, high food prices or loss of income opportunities. The frequency and type of coping strategies indicate the level of stress caused by various shocks. The Reduced Coping Strategy Index (RCSI) is calculated by counting the number of times the following strategies had been employed during the seven days preceding the survey.

- Rely on less preferred and less expensive food;
- Borrow food, or rely on help from a friend or relative;
- Limit portion size at meal times;
- Restrict consumption by adults in order for small children to eat;
- Reduce number of meals eaten in a day.

The index captures typical coping strategies related to food that households employ when they face difficulties in meeting their food consumption requirements. The higher the RCSI, the more frequently households had to use the strategies in an attempt to resolve their difficulties, thus reflecting greater hardship for these households.

For more details on the RCSI, see:
Maxwell, D. & Caldwell, R. 2008. The Coping Strategies Index: Field Methods Manual. CARE/ WFP/TANGO/ Tufts University.

3 CLIMATE TRENDS

KEY MESSAGES !

Climate trends are highly variable, both in space and time.

- The proportion of the population with an unbalanced starch-based diet was significantly higher among poor households.
- The proportion of poor households significantly increased from 32 percent in 2009 to 38 percent in 2012.

Rainfall trends have been highly erratic between 1982 and 2011. Data from meteorological stations does not suggest a clear long-term trend in rainfall in the long-run. However, large parts of the country have experienced decreases in precipitation.

- The largest decreases have been between June and August in north-eastern parts of the country.
- The largest increases in rainfall have occurred between March and May, especially in southern parts of the country. This trend could be linked to higher flood risks.

Temperature has been increasing steadily between 1982 and 2011.

- Overall temperature between October and December has increased throughout the country. This trend could exacerbate glacier melt and reduce snow cover, which are critical to ensuring the availability of water for key agricultural activities.
- Temperatures have also increased between June and August while rainfall has decreased.
- The combination of these two factors could result in an increased drought risk.

The following four main trends appear to be consistent among future climate projections for the Kyrgyz Republic:

- Increases in temperature together with lower annual rainfall.
- Reductions in the country's glaciers and snow cover, leading to increasing pressure on the country's water.
- Changes in seasonal rainfall. The majority of models suggest an increase in winter precipitation (including snowfall) and a decrease in summer precipitation for Central Asia.
- Low-lying parts of Central Asia are likely to gradually become arid deserts due to reduced glacial runoff.

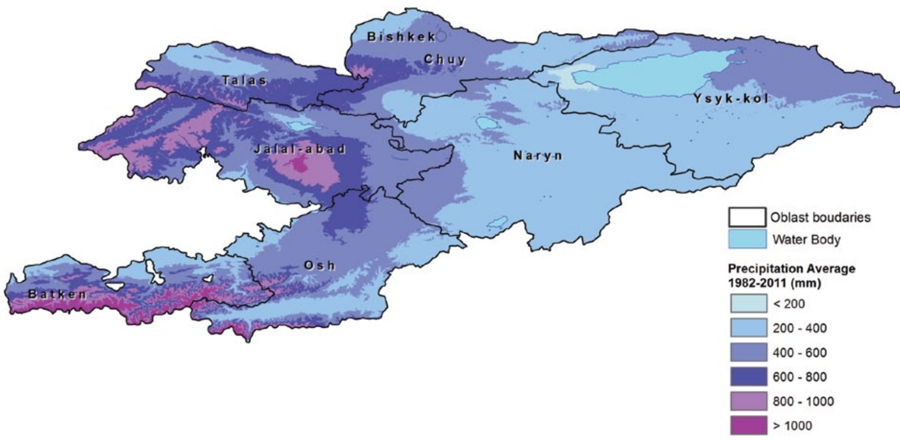
Rainfall and temperature trends

The Kyrgyz Republic is a highly mountainous country. These topographical variations affect climate patterns and add a layer of complexity to any analysis of climate trends. WorldClim data corrected with meteorological station data corroborate that rainfall is highly variable across the country (Figure 3.1).

The western regions (parts of Jalalabad, northern Osh and Batken provinces) of the country receive most the rainfall, while the eastern parts (Naryn and Issyk-Kul provinces) and southern regions (south-eastern Osh) receive the least amount of rainfall.

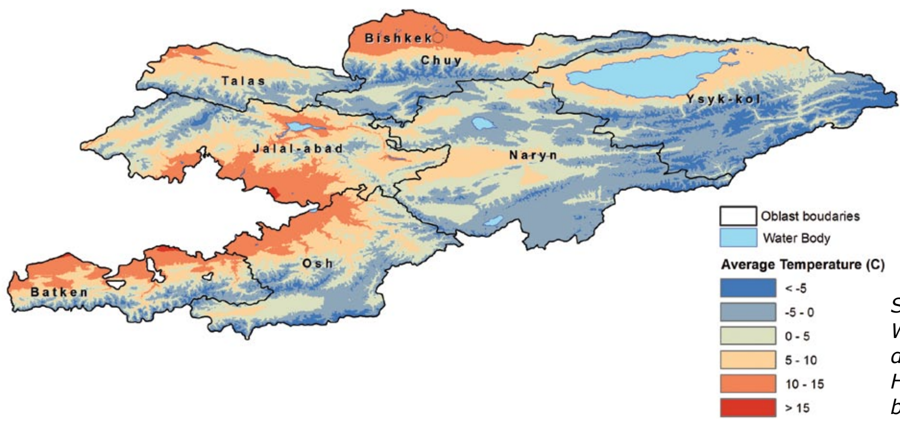
WorldClim data corrected with meteorological station data also shows that the temperatures are highly variable across the country (Figure 3.2). The warmest areas of the country are in the western regions (Jalalabad, Osh and Batken provinces) and northern Chuy, while the coldest regions are in the easternmost parts of the country (Issyk-Kul and Naryn provinces) and southern Chuy.

FIGURE 3.1
Overview of mean annual precipitation in the Kyrgyz Republic during the period 1982–2011



Source:
WorldClim corrected with station data from Kyrgyz State Agency for Hydrometeorology. Map produced by WFP/OSZAF.

FIGURE 3.2
Overview of mean annual precipitation in the Kyrgyz Republic during the period 1982–2011

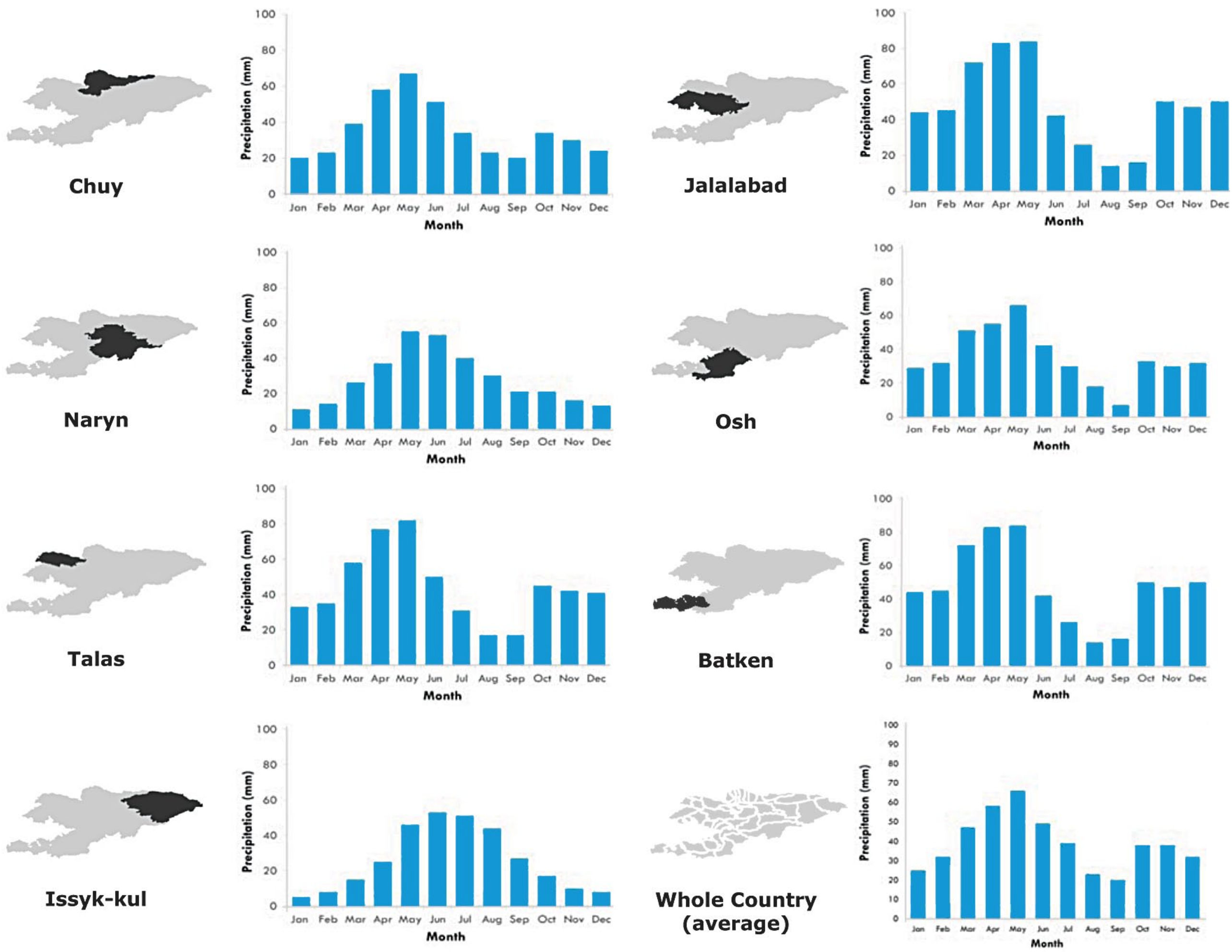


Source:
WorldClim corrected with station data from Kyrgyz State Agency for Hydrometeorology. Map produced by WFP/OSZAF.

There are two main rainfall regimes in the Kyrgyz Republic: most of the country receives the majority of its rainfall between April and June, except for the north-eastern parts of the country which receive most of their rainfall during the period July-September. Figure 3.3 below provides a more detailed overview of monthly rainfall patterns by province.

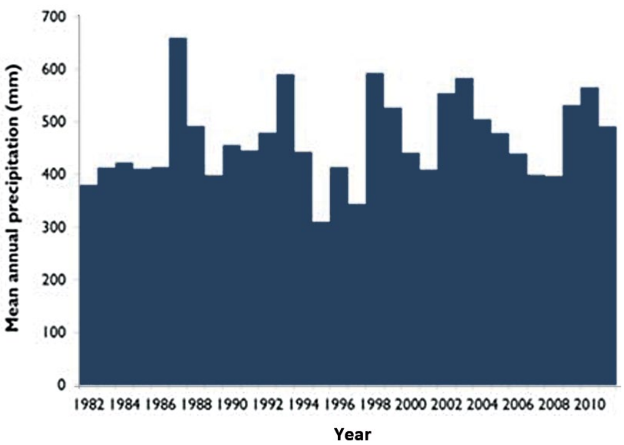
Annual rainfall patterns in the Kyrgyz Republic, and more generally across Central Asia, are linked to two key processes: the prevailing westerlies (particularly the Siberian High) and the polar front. Meteorological station data shows high inter-annual and inter-decadal precipitation variability, although an overall decline has been observed in large parts of the country in the period 1982-2011. However, the inter-annual variability in rainfall is so large that it is difficult to ascertain long-term trends associated with anthropogenic climate variability alone (Figure 3.4).

FIGURE 3.3
Overview of rainfall regimes



Source: WorldClim corrected with station data from Kyrgyz State Agency for Hydrometeorology. Map produced by WFP/OSZAF.

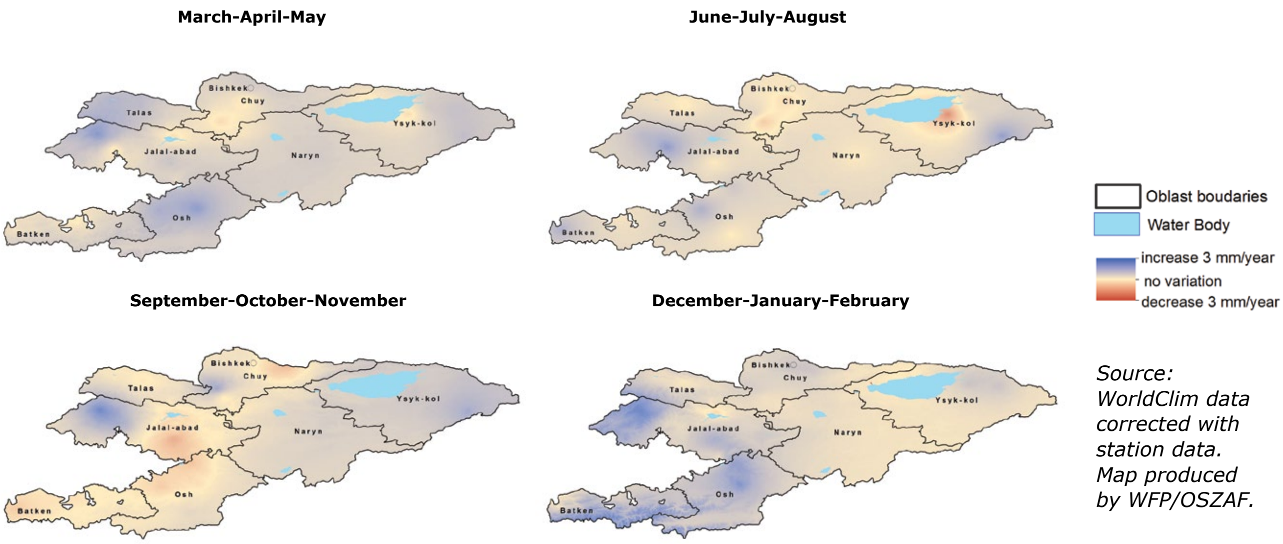
FIGURE 3.4
Precipitation trends between 1982 and 2011



Source: Kyrgyz State Agency for Hydrometeorology.

The chart highlights the trends in mean annual precipitation between 1982 and 2011. The results show high inter-annual variability with some years having above-average precipitation and others with low precipitation. Spatial rainfall trends also show high variability. The spatial distribution of average precipitation shows that the western part of the country receives the majority of precipitation. There is an overall positive trend in precipitation records from 1982 to 2011, with the exception of limited areas in Chuy and Issyk-Kul, which register very weak negative trends. The largest decreases in precipitation have been between June and August in north-eastern parts of the country (Figure 3.5). On the other hand, increases have occurred between April and June, especially in southern parts of the country (Figure 3.6). This trend could be linked to higher risks of flood and mudflow.

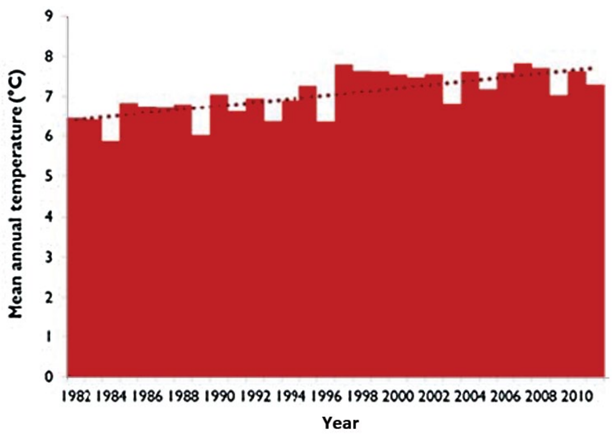
FIGURE 3.5
Precipitation trends (1982–2011), changes in rainfall per year (mm)



Source: WorldClim data corrected with station data. Map produced by WFP/OSZAF.

The temperature has been steadily increasing between 1982 and 2011, most likely linked to anthropogenic climate change (Figure 3.6). Changes in temperature have not been equally distributed throughout the year. Overall temperatures between October and December have increased throughout the country (Figure 3.7). A difference in the spatial distribution of the average temperature between lowlands and mountain areas are also evident – lowlands in Chuy, Talas, Osh and Jalalabad provinces have experienced an increase in temperature between June and August, while temperatures increased between September and February in highlands and mountain areas. This trend could exacerbate glacial melt and reduce snow cover, which are critical to ensure the availability of water for key agricultural activities. Temperatures have also increased between June and August while rainfall has decreased during the same period. The combination of these two factors could result in increased risk of drought.

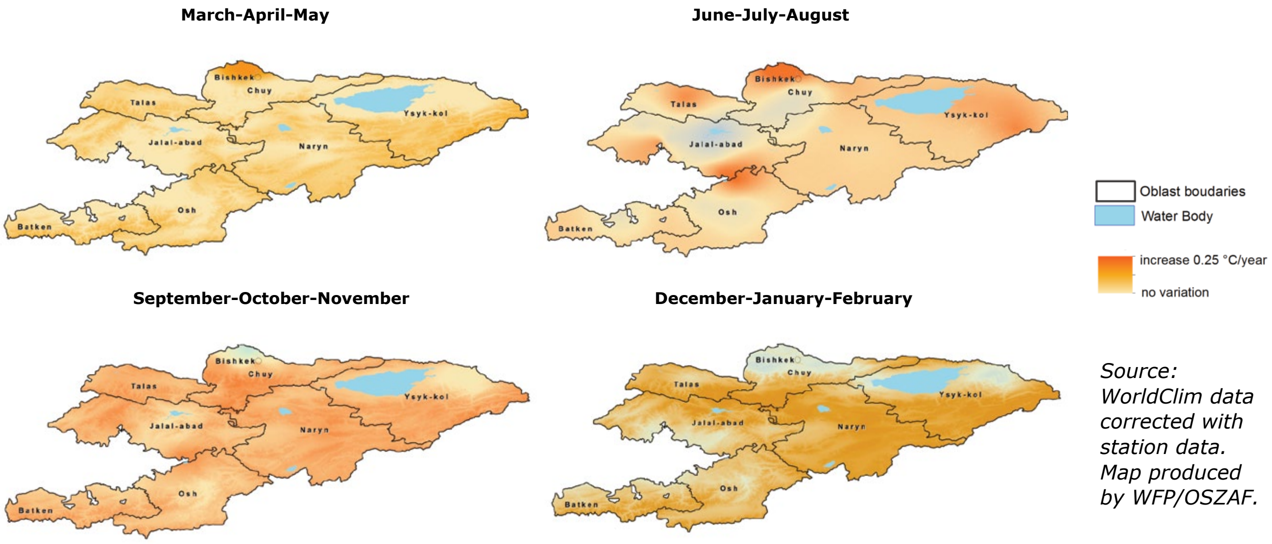
FIGURE 3.6
Temperature trends between 1982 and 2011



Source: Kyrgyz State Agency for Hydrometeorology.

The chart highlights the trends in mean annual temperature between 1982 and 2011. The results show a long-term increase in temperature in this period, most likely linked to anthropogenic climate change.

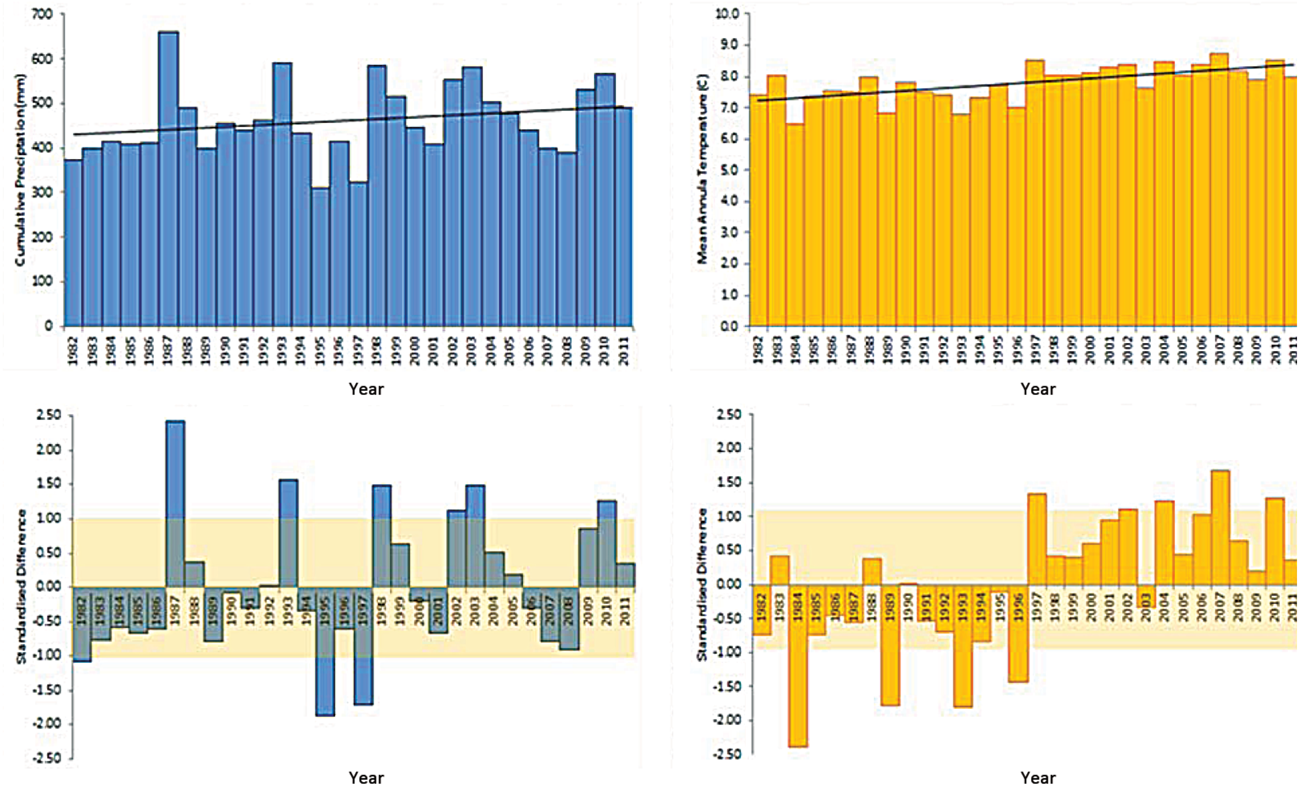
FIGURE 3.7
Temperature trends (1982-2011), changes in temperature per year (°C)



Source: WorldClim data corrected with station data. Map produced by WFP/OSZAF.

As Figure 3.8 shows, exceptionally cold winters (with standardised difference < -1) are strongly related to drought years (see 1984, 1989 and 1996), but also other winter seasons with temperatures below the average (with standard difference between -1 and 0) are associated with drought years (see 1982, 1985, 1986). Only 1987, 1993 and 2003 cold winters are not followed by drought months.

FIGURE 3.8
Relationships between rainfall (left) and temperature (right) trends



Source: WorldClim data corrected with station data. Produced by WFP/OSZAF.

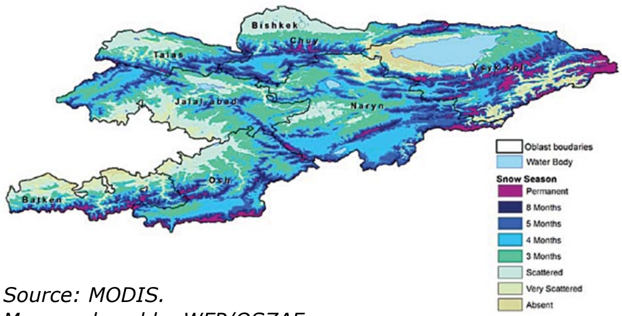
Snowfall trends

Snowfall is also an important climatic parameter in the context of the Kyrgyz Republic, given that large amounts of water for domestic and agricultural use originate from glaciers and snow melt. It is estimated that more than 80 percent of the water resulting from glacier melt is utilised for agriculture, but the irrigation system is inefficient because infrastructure is relatively obsolete.

There is a general consensus among the scientific community that the increasing rate of glacier melt could contribute to freshwater supply in the short term, but could result in lower water availability in the longer run. Moreover, population growth and increasing summer temperatures would increase demand for water resources, especially water from glaciers.

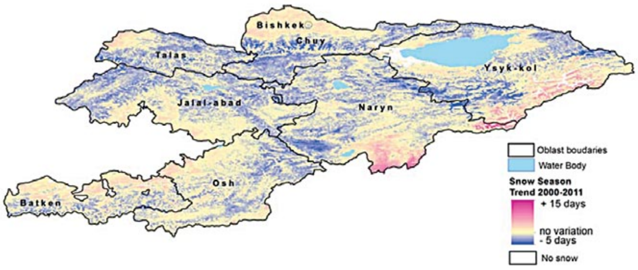
The following maps and charts show the probability of snow/ice presence (length of season) in the Kyrgyz Republic and the trend from the analysis of the MODIS data time series 2000-2011 (Figure 3.9).

FIGURE 3.9
Distribution of snow season (months)



Source: MODIS.
Map produced by WFP/OSZAF.

FIGURE 3.10
Snow season trend (change in number of days)



Source: MODIS.
Map produced by WFP/OSZAF.

Figure 3.10 shows the trend of snow cover seasons, which indicates a shorter snow cover season in altitudes between 1500 and 4000 meters (which accounts for over 75% of the national territory), while the season appears to be longer at lower and higher elevations.

Projections of future climate

There is limited analysis of climate projections for the Kyrgyz Republic. These large uncertainties in future projections are in part a function of the lack of long-term historical data, as well as the difficulty of modelling the key climate processes in the region, the prevailing westerlies (particularly the Siberian High) and the polar front. However, **four main trends appear to be consistent among climate projections:**

First, most model projections suggest an increase in temperature together with lower annual rainfall. The combination of higher temperatures and lower rainfall could result in more intense droughts and heat waves, with potentially devastating effects on crop production and the availability of water and pastures for livestock. Reductions in crop and livestock production will have a detrimental impact on people's livelihoods, and could negatively impact their food security.

Second, projections suggest reductions in the country's glaciers and snow cover, leading to increasing pressure on the country's water supply. Over the short-term, glacier melt will lead to an increased availability of water and more intense floods. However, in the longer-term glacier melt will result in water scarcity and drought risk.

Third, models indicate changes in seasonal rainfall. The majority of models suggest an increase in winter precipitation (including snowfall) and a decrease in summer precipitation for Central Asia. The timing of rainfall, the intensity of the rainy season, the delay of the rainy season, and inter-annual variability may change with potentially long-lasting effects on rural livelihoods that are predominantly dependent on reliable rainfall patterns.

Fourth, low-lying parts of Central Asia are likely to gradually become arid deserts due to reduced glacial runoff. A change in the landscape of the country would have significant consequences for the livelihoods of vulnerable populations, and could mean that households in affected areas will have to change their traditional livelihood activities in order to adapt to the emerging landscape.

These emerging trends all highlight the changing environment that Kyrgyz Republic may face as a result of changing climate conditions. It is important to identify adaptation options to help communities and the Government to manage these risks.

4 CLIMATE-RELATED disaster risk

KEY MESSAGES

Kyrgyz Republic has been frequently affected by droughts, floods, mudflows, landslides.

- All of these are expected to increase in intensity under a climate change scenario.
- These events have become more frequent for the period from 1999 to 2009.

The seasonal analysis of rainfall and temperature suggests increased flood and landslide risks in the south, and higher drought risks in the north-eastern parts of the country.

- The largest increases in rainfall have occurred in April-June, especially in the southern areas.
- The largest decreases in rainfall have occurred in July-September, in the north-eastern areas.

Drought seasons will become more erratic.

- Improving capacity to monitor these types of weather patterns and their impact on agriculture and food security will be increasingly important in the context of climate change.
- The below-average precipitation in 2007 during winter and high temperatures during spring and summer in 2008 contributed to the intensity of the 2008 drought.

Floods and mudflows were more frequent in the south and south-western areas.

- Increased precipitation and increased water availability through glacier lakes are likely to be associated with intensified floods and mudflows in the southern areas.
- For example, a harsh winter in 2011-12 with unusually low temperatures and heavy snowfall, and melting snow and heavy rains in early spring caused mudflows and flash floods.

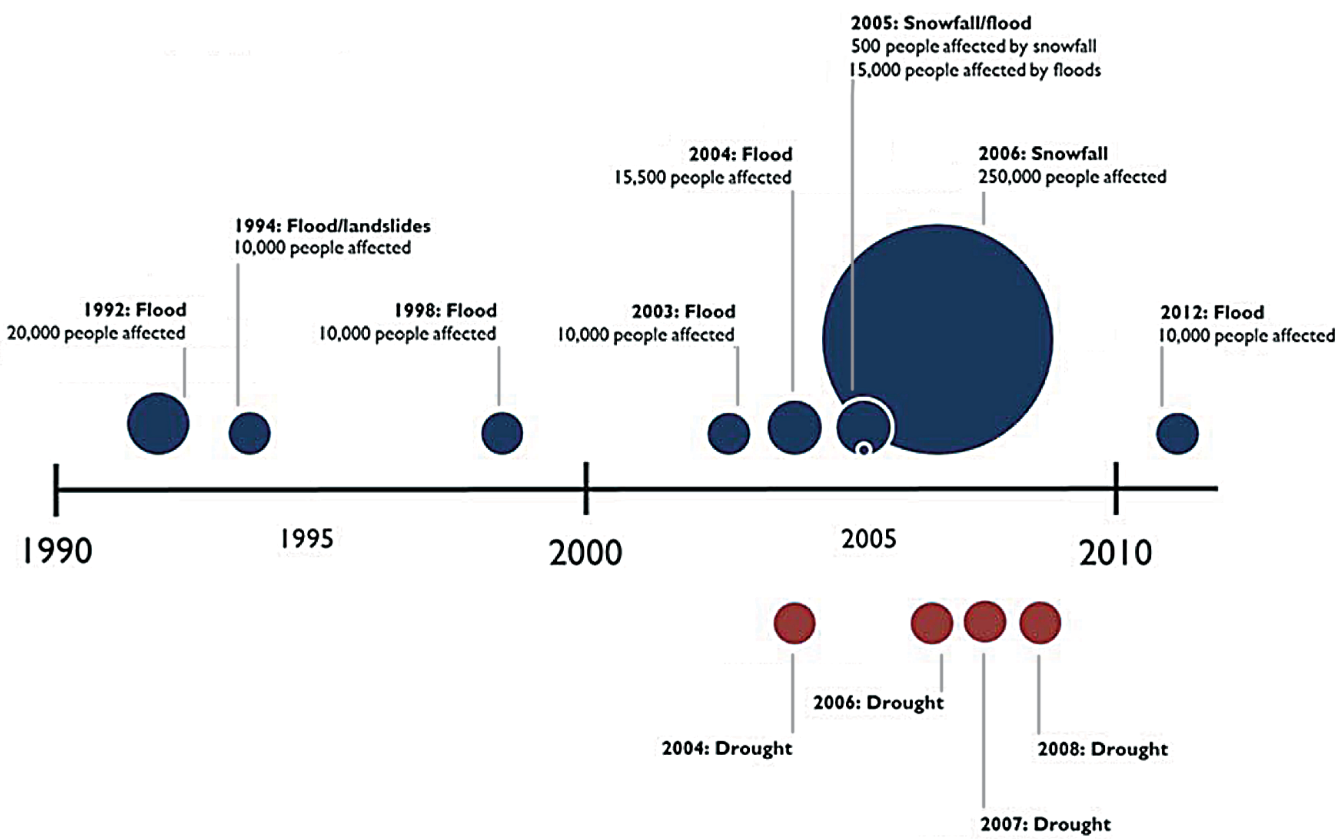
Climate-related disaster trends

The Kyrgyz Republic has been frequently affected by droughts, floods, mudflows and landslides – all of which are expected to increase in intensity under a climate change scenario. Disaster reports released by the Office for Coordination of Humanitarian Affair's (OCHA) ReliefWeb reveal that, over the last 22 years, floods and droughts have become more frequent (Figure 4.1).

Between 2003 and 2008, at least one flood or drought with significant impact on livelihoods and food security has been reported annually.

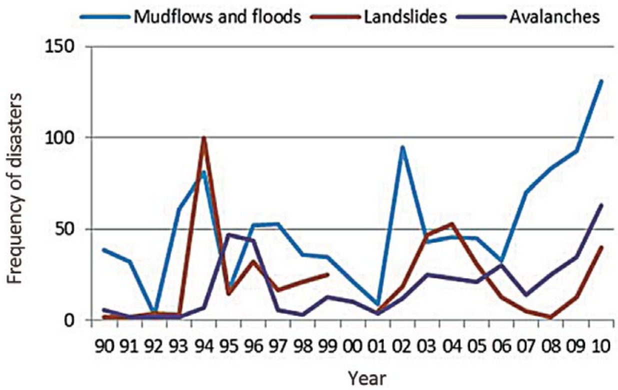
Disaster incidents recorded by the Ministry of Emergency Situations of the Kyrgyz Republic (Figure 4.2) also reveal that, for the period from 1990 to 2009, floods, mudflows, landslides and avalanches have become more frequent. The record shows major floods have occurred between April and May, and have affected the southern provinces.

FIGURE 4.1
Disaster trends (1989–2010)



Source: Reliefweb.

FIGURE 4.2
Frequency of climate-related disasters (1990–2010)

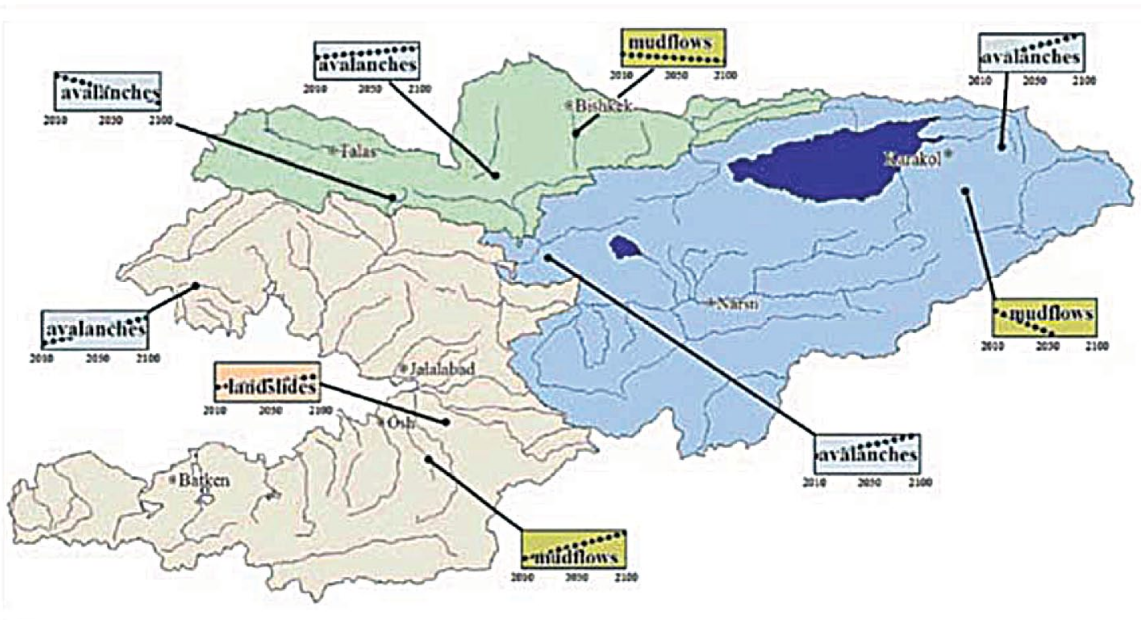


Source: Ministry of Emergency Situation of the Kyrgyz Republic. Chart produced by WFP.

As the climate trend analysis in the previous section shows, the seasonal analysis of rainfall also highlights different trends in variability during the year. Overall, the largest increases in rainfall have occurred between March and May, especially in the southern parts of the country (Figure 3.5). In contrast, the largest decreases have occurred in the period June-August, in the north-eastern parts of the country (Figure 3.7). This trend suggests increased flood and landslide risk in the south, and higher drought risk in the north-eastern part of the country.

The trend also appears to be consistent with findings from the vulnerability assessments of landslides, mudflows and avalanches in the Second National Communication to the UNFCCC, which projects increase in these disasters in the southern parts of the country (Government of the Kyrgyz Republic 2009).

FIGURE 4.3
Expected climate-related disaster trends



Source: Government of the Kyrgyz Republic (2009).

BOX 2.
Community perception on climate-related disasters

WFP has implemented the Seasonal Livelihood Programme (SLP) in Osh and Naryn provinces, which is a consultative process that brings together communities, government and development partners to design integrated operational plans. During the five-day consultative process, communities in both Osh and Naryn provinces highlighted emerging climate-related risks and their impact on livelihoods.

Participants from Osh province identified early rain/snowfall and localised flooding as the most recently experienced shocks. The participants identified 2011 and 2012 as bad years, mainly because of heavy early snowfall in the autumn of 2011 and early rainfall in the spring of 2012.

The participants experienced harvest loss and failed collection of animal fodder due to the early snowfall in 2011, while early rainfall in 2012 caused localised flooding. They also highlighted that rains are becoming more erratic recent years.

On the other hand, drought/dry spells was identified as the main shock by the participants from the communities in Naryn province. People experienced drought/dry spells in 2004, 2005, 2010 and 2011. Erratic rain and less snowfall in winter were also highlighted by the participants from Naryn province.

Source: WFP 2014a, WFP 2014b.

Drought

Total annual rainfall is highly variable (see Section 3, Climate Trends). Historically, poor rainfall has had a negative impact on vegetation development and as consequence on agriculture and pastoral production. The impact of high temperature is more uncertain. Higher temperatures result in increased snow melt and therefore increased water availability. However, higher temperatures also increase evapotranspiration rates resulting in higher water requirements for rainfed crops and pasture.

There is concern that drought seasons will become more erratic due to the changing climate. For example, 2007 was classified as a drought year in terms of total precipitation (see Figure 3.8 and 4.1). However, the below-average rainfall was registered during the winter months and did not directly affect the vegetation development during the 2007 growing season. Nevertheless, the below-average 2007 precipitation distribution probably contributed to the intensity of the 2008 drought. The 2008 season was also characterised by unusual high temperatures during spring and summer months, and thereby increased water requirements by crops. Therefore, although 2007 had below-average rainfall, the 2007 agricultural season was not directly affected while 2008 experienced average rainfall, but the growing season was affected by the previous year's climate pattern. Improving capacity to monitor these types of weather patterns and their impact on agriculture and food security will be increasingly important in the context of climate change.

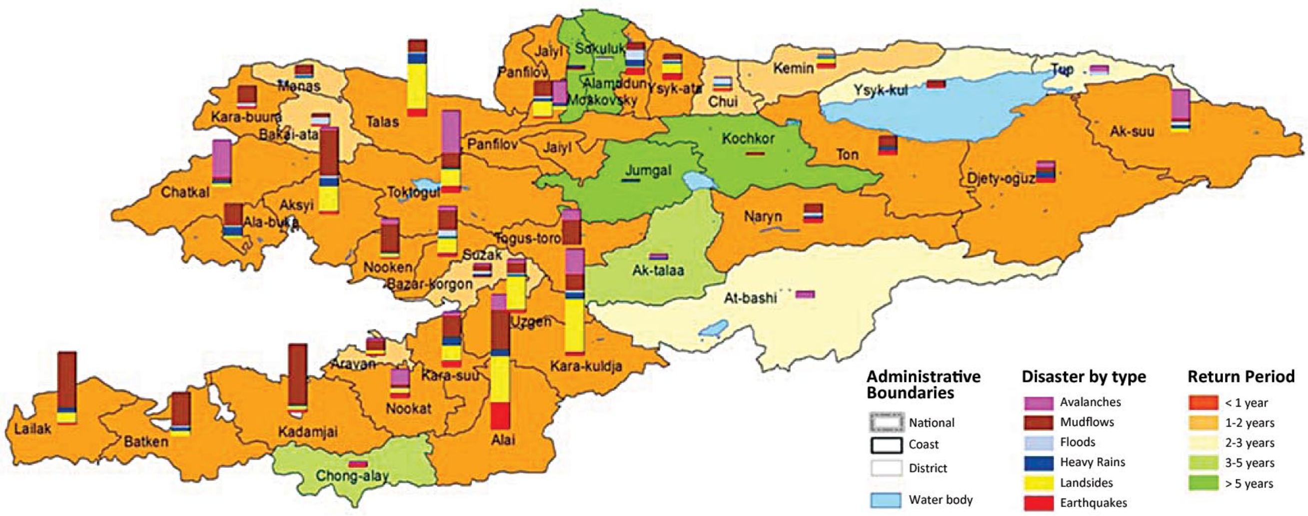
Flood and mudflow

Floods and mudflows have become more frequent (Figure 4.2), and can be associated with the increased frequency of heavy rainfall/snowfall and increased water availability from glacier lakes. For example, a harsh winter in 2011-12 with unusually low temperatures and heavy snowfall, followed by melting snow and heavy rains in early spring caused mudflows and flash floods across the country. Naryn, Osh, Jalalabad and Batken provinces, including remote districts throughout the region, were most affected. The most destructive flash floods hit Osh, Batken and Jalalabad from 23 to 29 April 2012, affecting more than 9,400 people.

The incidence of floods and mudflows follow a geographic pattern: Figure 4.4 below shows the recurrence of the major natural disasters during 1999-2009. It is worth noting that floods and mudflows were more frequent in the south and south-western parts of the country, particularly in Batken, Osh and Jalalabad provinces.

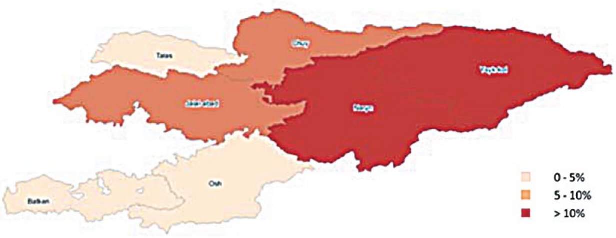
These findings correlated closely with people's perceptions of climate-related shocks. As Figure 4.5 and 4.6 indicates, the majority of households reporting drought as a major natural disaster over the last 10 years were located in the north-eastern part of the country, particularly Issyk-Kul and Naryn provinces, while more households reported floods and mudflows in southern provinces.

FIGURE 4.4
Expected climate-related disaster trends



Source: Ministry of Emergency Situation of the Kyrgyz Republic. Map produced by WFP.

FIGURE 4.5
Percentage of households reporting drought as major natural disaster for the last 10 years



Source: WFP (2013).

FIGURE 4.6
Percentage of households reporting flood/ mudflow as major natural disaster for the last 10 years

Source: WFP (2013).

Impact of glacier melt

The Kyrgyz Republic has more than 8,500 glaciers, which cover around 4 percent of the national territory. According to the Second National Communication to the UNFCCC (Government of the Kyrgyz Republic 2009), warmer temperatures over the past 50 years have resulted in a 40 percent loss in glacier cover, mainly in south-eastern parts of the Kyrgyz Republic.

More recent analysis, such as Sorg et al. (2013), also shows that glaciers are shrinking rapidly in lower-elevation areas of the Kyrgyz Republic. These are areas where summers are dry and snow and glacial melt-water is an essential source of water for livelihood activities. Changes in glacier extent and runoff could intensify the growing pressure on natural resources.

However, increasing glacier melt can result in both reduced and increased water availability through glacier lake outburst floods (GLOF). Such outburst floods result when water dammed in glacier lakes is released too quickly, and can have a devastating impact on agriculture and livelihoods. For instance, the 2008 GLOF of the Zyndan glacier lake in the Ton District of Issyk-Kul province killed three people and numerous livestock, destroyed infrastructure, and devastated potato and barley crops as well as pastures.

The diversity of the potential impacts of glacier melt highlights the importance of understanding and preparing for an uncertain future by implementing adaptation interventions that can account for both flood and drought risk.

5 CLIMATE
and food production

KEY MESSAGES !

Agriculture in the Kyrgyz Republic is sensitive to climate conditions.

- Almost 40 percent of fluctuations in agricultural production can be explained by changes in rainfall and temperature.
- When comparing the results with analysis at the global level, which shows that around 30 per cent of the fluctuations are explained by rainfall and temperature, it is suggested that the Kyrgyz Republic has particular vulnerability to changing climate conditions.

Both rainfall and temperature are positively correlated with crop yields. Crop yields are sensitive to variations in the seasonality of rainfall.

- Yields are especially sensitive to rainfall changes in the spring (April-June), suggesting that the availability of water in these months is key to agricultural production.
- However, under changing climatic conditions, more rainfall and higher temperatures will result in increased risks of disasters. More rainfall could lead to increased flood or landslide risk, particularly between April and June.
- Higher temperatures could result in increased glacier melt and, when they coincide with lower rainfall, more intense droughts.
- Therefore, the extent to which higher rainfall and temperatures can continue to benefit agricultural production is uncertain.
- Vegetables, wheat, and potatoes are the most sensitive products to changes in climate patterns, specifically to decreases in rainfall.

The trend in the vegetation growing season shows a delayed start in most of the lowlands (northern Chuy, western Talas, and parts of Jalalabad and Osh provinces).

- There is also a strong trend towards an early start to the season in the central highlands.
- This appears to be closely linked to snow season trends.
- The early start of the vegetation growing season has a positive impact on vegetation development, particularly in areas that depend on pasture and rainfed agriculture – in these areas the early start of the season can increase vegetation development.

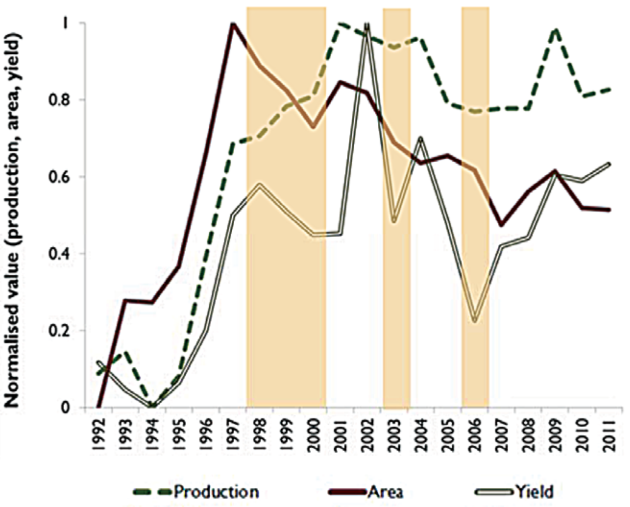
Crop production trends

Production of potatoes, wheat, vegetables and tobacco has almost doubled between 1992 and 2011 – the period for which agricultural data is available. Overall, crop production has increased steadily until 2000 and has since levelled off (Figure 5.1). The most rapid increases in crop production were between 1994 and 1997; the majority of this increase is linked to increases in the area under cultivation, which increased steadily between 1992 and 1997, but has since decreased. This reduction could be linked to the financial crisis of 1997 in the region, which may have increased the prices of agricultural inputs and fuel due to a sharp currency devaluation. This may have incentivised farmers to diversify income sources.

Yield trends have been more erratic. Overall, yields have increased by approximately 40 percent between 1992 and 2011, but have decreased since 2002. Some reductions in yields appear to be linked to climate-related hazards, particularly in 2006 following a heavy snowfall and a drought. Others, such as that between 1997 and 2000, may be linked to financial crises in Russia in 1997.

- Yields are especially sensitive to rainfall changes in the spring (April-June), suggesting that the availability of water in these months is key to agricultural production.

FIGURE 5.1
Trends in production, area under harvest, and yields for total potatoes, wheat, vegetables and tobacco (normalised values)

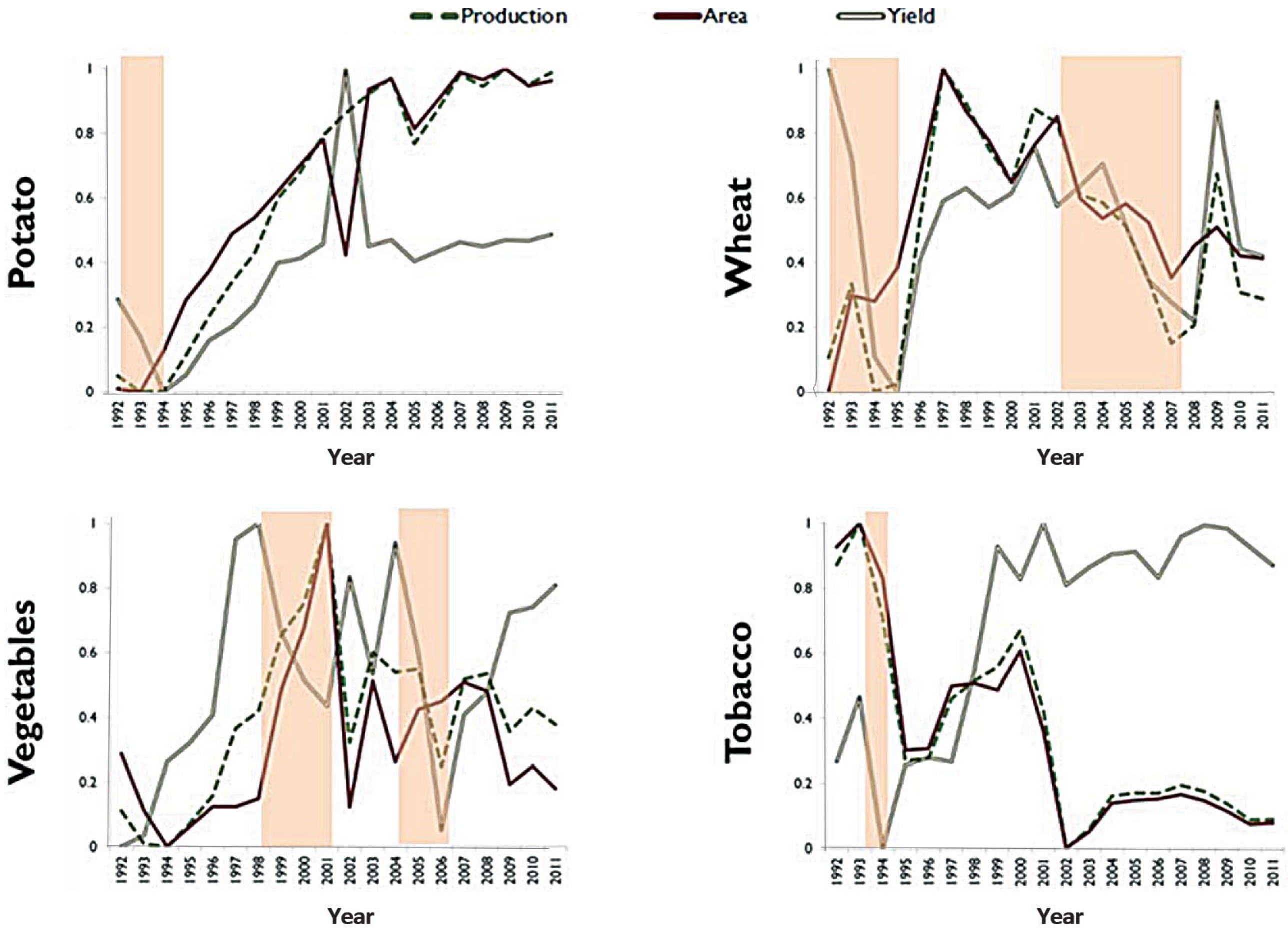


(Years with significant reductions in yield are shown in orange)

Source: FAOSTAT. Chart produced by WFP.

The trend in production, area under cultivation, and yields for key crops are on the following page.

FIGURE 5.2
Trends in production, area under harvest, and yields for potato, wheat, vegetables, and tobacco (normalised values)



Source: FAOSTAT. Chart produced by WFP.

Wheat. Production and the harvested area of wheat, the major staple for most people in the Kyrgyz Republic, declined since the late 1990s, after a sharp increase between 1994 and 1997. From 2002 to 2010, the harvested area decreased by 27 percent and wheat production contracted by 292,000 tonnes. This reflects diversion of land to other crops, mainly fodder crops in response to the fast-growing livestock economy. A joint WFP/FAO Crop and Food Security Assessment Mission (CFSAM) noted that the gross income from fodder crops ranged from 1.5 to 5 times higher than that from wheat crops (WFP/FAO 2010).

Vegetables. Production of vegetables has increased in a non-linear form. Increases occurred just after the national land reform started in 1992 and again after the financial crisis in 1997, and more recently between 2002 and 2004. However, significant decreases occurred between 2004 and 2008.

Tobacco. Production of tobacco has decreased significantly between 1992 and 2011, most notably in 1994, 2000 and 2001, due to a significantly decreased harvested area.

Potatoes. Production of potatoes has steadily increased between 1992 and 2011, except for a minor decrease in 2005, mainly due to an increase in area harvested.

Climate variability and impact on crop production

Changes in climatic conditions have already affected the production of some staple crops, and future climate change threatens to exacerbate this. In the Kyrgyz Republic, higher temperatures will lead to accelerated glacier melt, which will have an impact on yields, while changes in rainfall could affect both crop quality and quantity. More frequent and intense extreme climate-related events, such as droughts, floods and landslides, could also have a detrimental impact on crop production.

Climate variability has a significant relationship with crop yields. About 40 percent of variations in the total production of potatoes, wheat, vegetables, tobacco and cotton is explained by interannual rainfall and temperature variability ($R^2 = 0.405$, $p<0.05$). When comparing the results with analysis at the global level (e.g. Lobell and Field, 2007), which shows that around 30 per cent of the fluctuations are explained by rainfall and temperature, it is suggested that the Kyrgyz Republic has particular vulnerability to changing climate conditions.

The most sensitive agricultural products are vegetables, wheat and potatoes given their high correlations with precipitation and temperature (see Table 1). These crops are positively correlated with both precipitation and temperature, which suggests that an increase in either precipitation or temperature has been linked to increased agricultural production. The main exception is wheat, which has a significant negative correlation with temperature. This is probably because the summer months are a critical growing period for spring wheat and harvest period for winter wheat. A warm summer results in major wheat losses. However, this has to be interpreted with caution, because this could also be linked to an overall reduction in production due to diversion of land to other crops (see Figure 5.1).

That 60 percent of variations in yield are unexplained by the model highlights and the importance of other climatic and non-climatic variables that are not included, such as differences in farm inputs, irrigation techniques, and economic changes influencing agricultural management techniques. However, as 40 percent of variability in yields can be correlated with precipitation and temperature variation, this indicates that climate data provides substantial information about crop production changes. These results suggest that, in the absence of adaptation measures, climate change could affect food production in the country.

TABLE 1
Correlation of vegetables, wheat, potatoes and tobacco yields with precipitation and temperature

	Crop yield			
	Vegetables	Wheat	Potatoes	Tobacco
Precipitation	0.443	0.429	0.209	0.041
Temperature	0.400	0.351	0.210	0.210

Data source: National Statistics Committee, Kyrgyz State Agency for Hydrometeorology.

Differences in precipitation have a higher explanatory power than temperature in describing changes in crop yields: correlation between precipitation and yields is R=0.422, whereas correlation between temperature and yields is R=0.346. This suggests that wetter years are associated with higher crop production. However, this relationship is not entirely linear. While higher precipitation could generally be associated with higher yields, it is important to note that extreme rainfall could lead to flood events and consequently to lower crop production. The results also suggest that warmer years are linked to increased production. This could be due to the greater availability of water resulting from glacier melt. However, in the long-run warmer temperatures could also lead to drought if combined with decreases in precipitation.

Using first-differences time series for climate and crop production (i.e. the difference in values from one year to the next) it is possible to evaluate the relationship between climate and crop production, assuming that production trends are attributable to technological advances (cf. Lobell et al., 2005; Lobell and Field, 2007). The results of the analysis show that yields are particularly sensitive to precipitation (Figure 5.3).

The charts highlight that yields are particularly sensitive to precipitation. However, the relationship is not entirely linear. Extreme rainfall could lead to flood events and consequently to lower crop production.

FIGURE 5.3
Relationship between first-differences in precipitation with crop yield

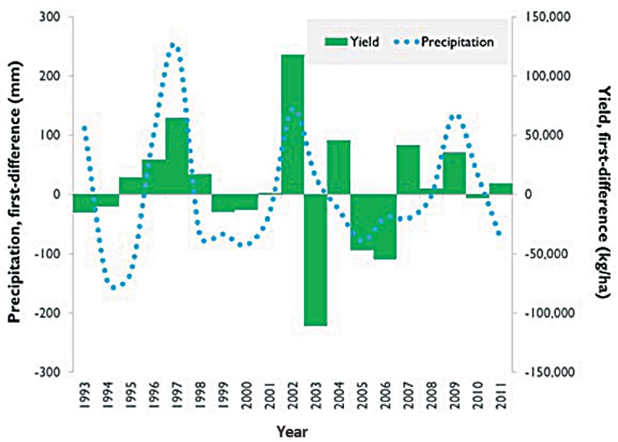
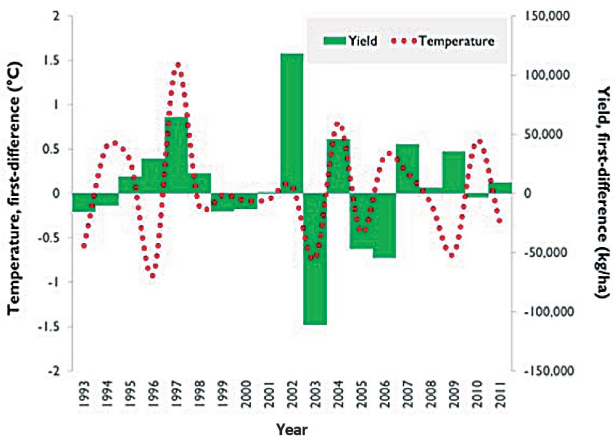


FIGURE 5.4
Relationship between first-differences in temperature with crop yield



Data source: FAOSTAT, National Statistics Committee, Kyrgyz State Agency for Hydrometeorology. Charts produced by WFP.

Crop yields are also sensitive to variations in seasonal rainfall (Table 2). An analysis of first-differences in seasonal (three-month) precipitation highlights that yields are especially sensitive to changes in the spring (April-June, R=0.383, p<0.05). The positive correlation in the period April-June suggests that the availability of water in these months is key to agricultural production. The communities in Osh and Naryn provinces highlighted during the SLP consultation that water availability is critical during land preparation and sowing, which are mainly in March-June in Osh, and in April-June in Naryn provinces.

TABLE 2

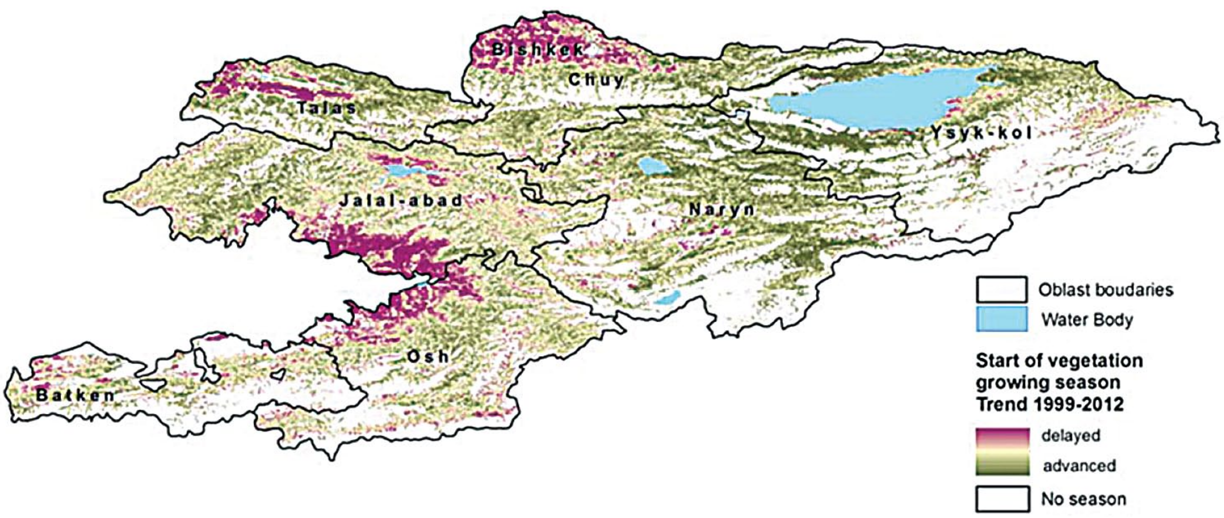
Correlations between first-differences in seasonal precipitation, and yields (total, potatoes, wheat, vegetables, and tobacco)

		Crop yield				
		Total	Potatoes	Wheat	Vegetables	Tobacco
Quarter (months)	Jan-Mar	0.234	0.244	0.141	0.128	0.119
	Apr-Jun	0.383	0.362	0.347	0.245	-0.130
	Jul-Sept	0.088	0.061	0.500	0.012	0.645
	Oct-Dec	-0.333	-0.286	-0.172	-0.253	0.119

Data source: National Statistics Committee, Kyrgyz State Agency for Hydrometeorology.

FIGURE 5.5

Trends in the start of the vegetation growing season



Source: SPOT-VGT. Map produced by WFP/OSZAF.

6 IMPACT
of the climate on livelihoods and household food security

KEY MESSAGES !

The effects of climate change and variability on crop production is only part of the impact on food security, because different types of households in terms of livelihoods will be affected in different ways.

- Small-scale subsistence farming households who obtain a significant proportion of their food from their own production could become dependent on the market if their crop productivity decreases due to climate change.
- Food prices are likely to increase in local markets, thereby reducing the ability of households to buy food, especially among the poor who are highly dependent on markets.

The projected reduction of wheat productivity will have a disproportionate impact on already food-insecure, market-dependent households, such as households with income from small-scale agriculture, unskilled wage labour and social allowances.

- Market purchase is the main source of wheat flour for all livelihood groups, including farmers, indicating that the projected reduction of wheat productivity is unlikely to have a direct impact on the consumption of wheat flour.
- However, the impact of reduced and fluctuating production will most likely be transmitted to market prices.

Reduction of potato productivity will have a disproportionate impact on low-income livelihood groups, who mainly produce their own potatoes for consumption.

- The main source of potatoes for most livelihood groups is their own production, particularly among low-income livelihood groups, indicating that the projected negative impact of climate change on potato productivity is likely to have a direct impact on the potato consumption among these groups.
- Food insecurity levels are also higher among these groups. Therefore, these households are the most vulnerable to the negative impact of the changing climate on potato production.

Reduction of vegetable productivity will have a disproportionate impact on low-income livelihood groups, who mainly consume vegetable from own production.

- The main source of vegetables for farming households is their own production, while other livelihood groups mainly purchase vegetables from markets.
- Reduced vegetable productivity is likely to have a direct impact on vegetable consumption among farming households, particularly those with a small land size and limited off-farm income opportunities.
- Reduced local supply due to the negative impact of climate risks may increase market prices of vegetables if trade flows are not able to fully compensate for reduced availability. This will have a disproportionate impact on low-income households.

Households faced by shortfalls in food consumption are more likely to cope with such stresses by reducing the quality of food consumed. This could result in micronutrient deficiencies thereby jeopardising the nutrition status of vulnerable household members.

The effects of climate change and variability on crop production and climate-related disasters is only a part of the impact on food security, because different types of households, in terms of livelihoods, will be affected in different ways. This section analyses the sensitivity of households in the Kyrgyz Republic to climate risks using data from the bi-annual HFSA conducted by WFP since August 2010. The analysis considers how different livelihood components, such as food sources, income sources and coping strategies, are related to climate risks.

Food sources

Small-scale subsistence farming households who obtain a significant proportion of their food from their own production could become dependent on markets if their crop productivity decreases due to climate change. Food prices are likely to increase in local market, thereby reducing the ability of households to buy food, especially among the poor.

Wheat, potatoes and vegetables are the main crops grown in the Kyrgyz Republic and analysed in this study.[6] Figure 6.1 shows the proportion of households who mainly consumed these crops by district. Potatoes are widely consumed from households' own production across the entire country, with the exception of areas surrounding large cities, such as Bishkek, Osh and Jalalabad. Vegetables are also consumed mainly from households' own production in Talas, Chuy, Issyk-Kul and Batken provinces, while in the central highlands and areas surrounding large cities the main source of vegetables is the market. Wheat is consumed primarily following market purchases across the entire country.

6. The result is indicative only, since it combines calculations using different sets of HFSA data; however, it gives a good sense of the geographical dynamics of food sources of different crops.

TABLE 3
Correlation of vegetables, wheat, potatoes and tobacco yields with precipitation and temperature

Food source	Climate sensitivity
Own production	• Erratic rainfall patterns and climate-related disasters, such as floods and droughts, could affect crop production. • Reduced crop production will have a direct impact on their food consumption. • Smallholders, especially subsistence farmers who rely on their own production for food consumption, are likely to become more dependent on markets. • The longer vegetation period in the north-eastern highlands could improve yields.
Purchase	• Changes in production due to climate risks are likely to increase food prices. • Increases in food prices will have a disproportionate impact on poor households.

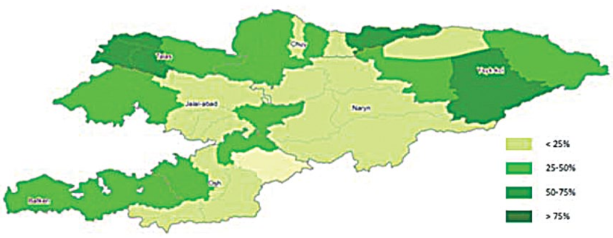
FIGURE 6.1
Proportion of households which mainly consumed wheat flour from own production

Source: WFP 2012, WFP 2013.

FIGURE 6.2
Proportion of households which mainly consumed potatoes from own production

Source: WFP 2012, WFP 2013.

FIGURE 6.3
Proportion of households which mainly consumed vegetables from own production



Source: WFP 2012, WFP 2013.

Food sources depend not only on the crop that is being consumed, but also the main income source of a household. The following analysis of food sources and income sources identifies the sensitivities of different livelihood groups to the impact of climate risk on different crops.

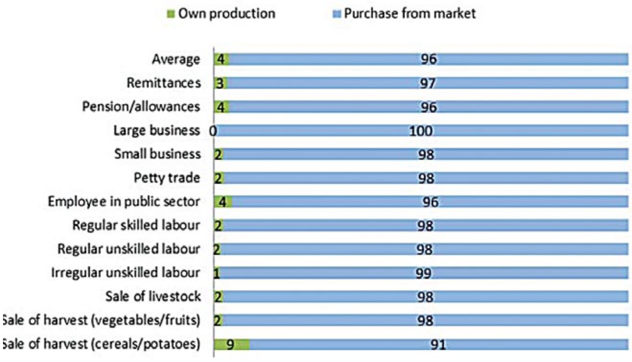
Wheat flour

The main source of wheat flour for all livelihood groups is the market, including farmers (Figure 6.3). Only a very limited number of households produce their own flour. This indicates that the projected reduction of wheat productivity in lowland areas in Bishkek and Chuy and Talas provinces due to an increase in temperature (See Table 3 in Part II) is unlikely to have a direct impact on the consumption of wheat flour. However, the impact of reduced and fluctuating production will most likely be transmitted to market prices, particularly in Bishkek and Chuy and Talas provinces. This will have a disproportionate impact on already food insecure market-dependent households, such as households with income from small-scale agriculture, unskilled wage labour and social allowances.

Potatoes

In contrast to wheat, the main source of potatoes for most livelihood groups is their own production, particularly among farmers, unskilled wage labourers and households who rely on remittances and social allowance (Figure 6.4). This indicates that the projected negative impact of climate change on potato productivity is likely to have a direct impact on potato consumption among these groups. It has to be noted that, as Figure 2.7 shows, food insecurity levels are also higher among farmers, unskilled wage labourers and households who rely on remittances and social allowances. Therefore, these households are most vulnerable to the negative impacts of climate risks on potato production.

FIGURE 6.4
Household market dependency for wheat flour

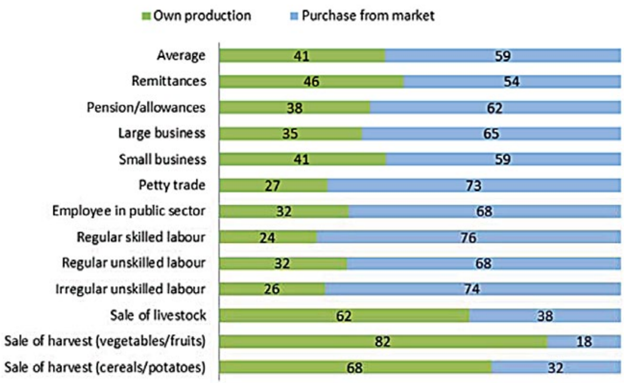


Source: WFP 2013.

FIGURE 6.5
Household market dependency for potatoes

Source: WFP 2013.

FIGURE 6.6
Household market dependency for vegetables



Source: WFP 2013.

Projected improvement in crop productivity in the central highlands (such as Naryn province) due to a longer vegetation growing season (Figure 5.3 and Table 2) will be an opportunity for these vulnerable groups to increase potato production.

Vegetables

Similarly to potatoes, the main source of vegetables for farming households is their own production, while most of the households who rely on incomes from wage labour, business, trade and public employment purchase vegetables from markets (Figure 6.5). This indicates that the projected negative impact of climate risks on vegetable productivity is likely to have a direct impact on the consumption levels of farming households who are considered to be the most food insecure (See Figure 2.7). Reduced local supplies due to the negative impact of climate risks may increase market prices of vegetables if trade flows are not able to fully compensate for reduced availability. This will have a disproportionate impact on low-income households who spend a large proportion of their budget on their basic needs, including food.

Projected improvement in crop productivity in the central highlands (such as Naryn province) due to a longer vegetation growing season (Figure 5.3 and Table 2) will be an opportunity for these vulnerable groups to increase vegetable production, decrease reliance on market purchases and increase income from the sale of vegetables.

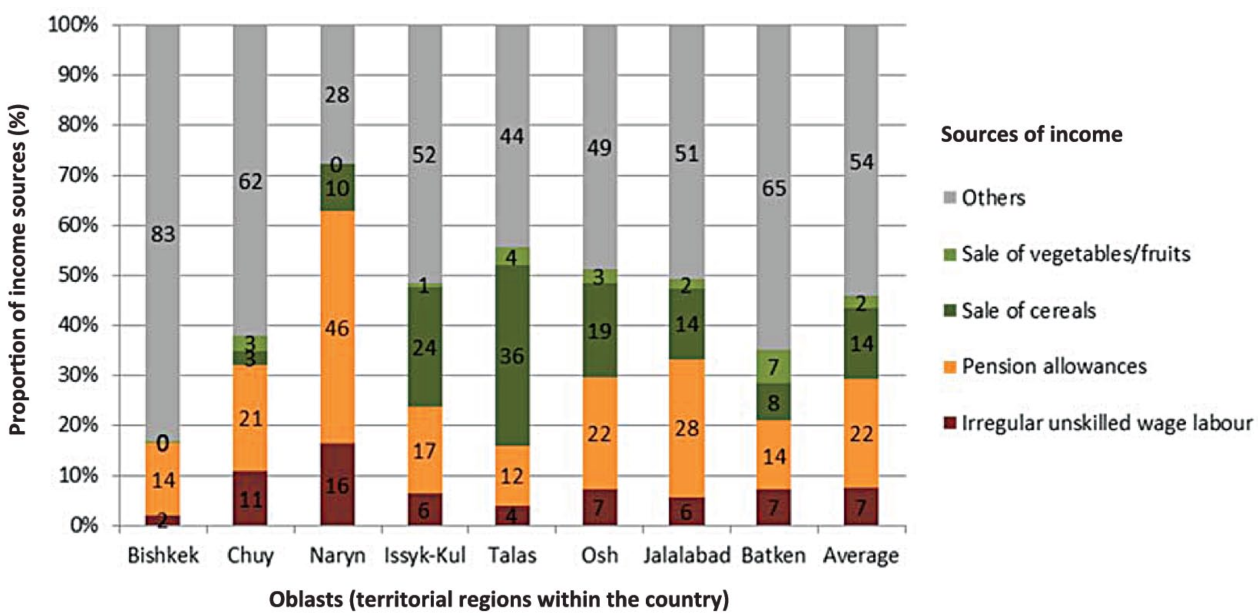
Income sources

Overall, there is a high dependency on income from climate-sensitive income sources, such as agriculture and low and unsustainable income sources, including unskilled labour and social allowances. Figure 6.6 shows the proportion of such income source by province, highlighting a large proportion in Naryn, Talas, Osh, Jalalabad and Issyk-Kul provinces. Given a potential increase in climate-related disasters in these locations, income sources in these areas are highly sensitive to climate conditions.

Climate-related shocks and coping strategies

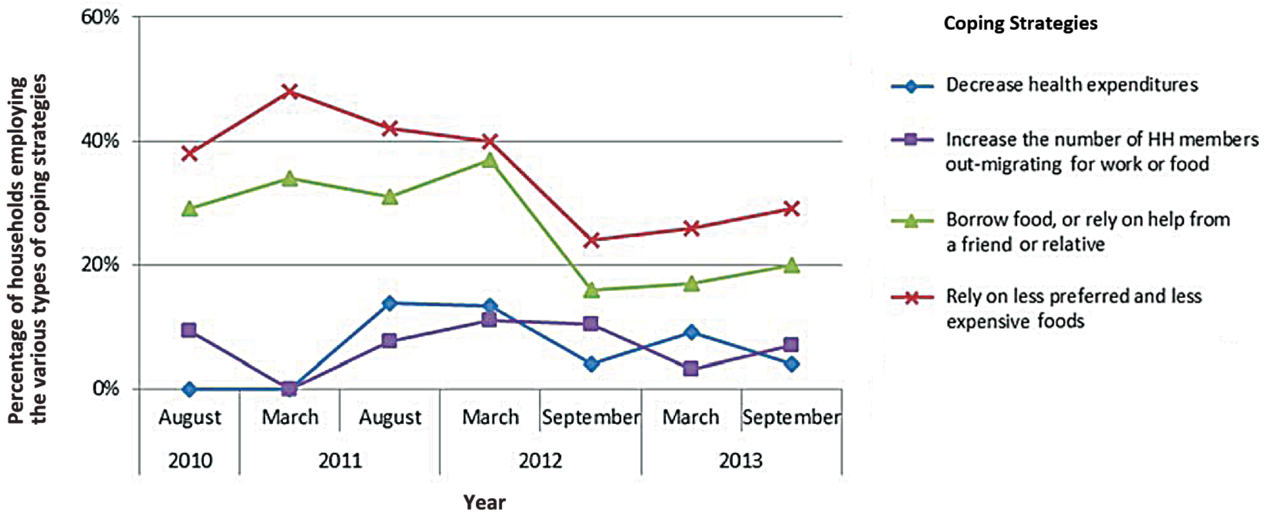
The identified potential impacts of climate risks, such as lower agricultural productivity of some main crops, higher market prices of crops and an increase in climate-related disasters, affects the ability of households to meet their food requirements. In times of such stress, households often resort to coping mechanisms that may further impact their food security status. In the Kyrgyz Republic, household coping strategies have been monitored by WFP's HFSAs on a bi-annual basis since 2010 and the results consistently conclude that households faced by shortfalls in food consumption are more likely to cope with such stresses by reducing the quality of food consumed (Figure 6.7). Rural households tend to change their food consumption more frequently during early spring, probably reflecting increasing food prices and decreasing varieties available during winter, given their high dependency on food purchases. This could result in micronutrient deficiencies thereby jeopardising the nutrition status of vulnerable household members. Micronutrient deficiencies already affect a large proportion of the population of the Kyrgyz Republic: 43 percent of children under five years old and 35 percent of women of reproductive age (15-49 years) are anaemic, and 33 percent of children are Vitamin A deficient.

FIGURE 6.7
Proportion of income sources by province



Source: WFP 2013.

FIGURE 6.8
Type of coping strategies employed by households facing a shortage of food



Source: WFP 2010, 2011, 2012, 2013.

- The identified potential impacts of climate risks, such as lower agricultural productivity of some main crops, higher market prices of crops and an increase in climate-related disasters, affects the ability of households to meet their food requirements.

7 MANAGING climate risk

KEY MESSAGES

THE FOLLOWING PRIORITY ACTIONS TO ENHANCE FOOD SECURITY AND CLIMATE RISK MANAGEMENT OUTCOMES HAVE BEEN IDENTIFIED:

Focus on the most vulnerable

- Climate risks will have a disproportionate impact on already food-insecure market dependent households, such as those with income from small-scale agriculture, unskilled wage labour and social allowances.
- Strategies for livelihood and income diversification are critical to ensuring resilience against the projected more intense climate-related risks.
- Migration has become an important source of household income for at-risk populations.
- Land rehabilitation, improving water-use efficiency, reducing post-harvest losses, and supporting food processing and supply chains can be more sustainable solutions to manage climate risks.
- Awareness raising on dietary diversity through food and nutrition education will be needed, given the potential further deterioration of dietary diversity among the vulnerable groups.

Manage uncertainties associated with changing climatic conditions

- Market extreme climate events could become more common in the future with potentially devastating impacts on crop production.
- The introduction of early warning systems, profiling of climate risks and food security at sub-national levels, and developing contingency plans can support climate risk management and food security strategies.

Mainstream climate risk management into social protection and food security strategies

- Technologies, knowledge, skills and information for adaptation can be disseminated among the most vulnerable groups as components of targeted social safety net schemes.

Support home gardening in urban and peri-urban areas to enhance access to diverse food among low-income households vulnerable to climate risks

- They provide technical support for efficient and sustainable home gardening.

Enhance national mechanisms for price stability

- Establish an early warning system for food price hikes.
- Efficient management of national material reserve.

Strengthen the evidence-base on climate risks and food security at the sub-national level

- Climate change impacts on food security will vary within the country or a province due to highly diverse agro-ecological characteristics.
- Climate risk and food security profiling at provincial or district levels will be useful for designing relevant actions tailor-made for addressing climate risks and food security challenges identified in each area.

Food security and agricultural policies in the Kyrgyz Republic need to consider the serious implications of climate change on food security, particularly the potential for more erratic rainfall and increasing temperatures. The likelihood of reduced crop production due to the occurrence of droughts, floods and mudslides in certain areas is of particular concern to food security amongst those in vulnerable southern and north-eastern areas.

The climate change adaptation priorities of the Kyrgyz Republic are expressed through the "Priority Directions for Adaptation to Climate Change in the Kyrgyz Republic till 2017", approved by the government of the Kyrgyz Republic in October 2013. The document prioritises agriculture and food security as sectors most vulnerable to the adverse effects of climate change and variability. It highlights a multisectoral approach to adaptation with particular emphasis on improvements in production systems, drought resisting crops, pastureland management, improvement of agriculture infrastructure, food security monitoring systems and an early warning system. The reported impacts of climate risks on food security in this study corroborate the importance of these priority directions. National adaptation action plans are being developed for each sector by relevant ministries. **This study identifies the following priority actions to enhance food security and climate risk management outcomes:**

! Focus on the most vulnerable

Reduction in crop production and increases in market prices will have a disproportionate impact on already food-insecure market dependent households, such as households with income from small-scale agriculture, unskilled wage labour and social allowances. Strategies for livelihood and income diversification are critical to ensuring resilience against projected, more intense climate- related risks. For example, migration has become an important source of household income for at-risk populations. Land rehabilitation, improving water-use efficiency through improved irrigation systems and strengthening the capacity of the Water User Associations (WUA), reducing post- harvest losses, and supporting food processing and supply chains can be more sustainable solutions to manage climate risks.

Awareness raising on dietary diversity through food and nutrition education will be needed, given the potential for further deterioration of dietary diversity and micronutrient status, particularly among vulnerable groups.

! Manage uncertainties associated with climate change

Extreme climate events, such as droughts and floods, could become more common in the future with potentially devastating impacts on crop production. Strategies to address climate risk should focus on developing capacities to better analyse and anticipate risks. The introduction of early warning systems, profiling of climate risks and food security at sub-national levels and developing contingency plans can support climate risk management and food security strategies.

! Mainstream climate risk management into social protection and food security strategies

Integrating climate risk management structures into broader social protection and food security strategies offers critical platforms for investing in risk management for the most vulnerable. For example, technologies, knowledge, skills and information for adaptation can be disseminated among the most vulnerable groups as components of targeted social safety net schemes.

Support home gardening in urban and periurban areas to enhance access to diverse food among low-income households vulnerable to climate risks

In the Kyrgyz Republic, home gardening is one of the main food sources in urban and peri-urban areas. Vegetables, fruit and potatoes are mainly produced in private backyards. Vulnerable urban households are still largely dependent on market purchases, but home gardening plays an important role in enhancing their access to diverse food. However, climate risks, particularly irregularity of rainfall and drought, will undermine the potential of home gardening. Provision of technical support for efficient and sustainable home gardening, such as micro-garden technology, will be needed.

Enhance national mechanisms for price stability

Price stability is also critical for adaptation, particularly during winter and early spring when vulnerable households have depleted food stocks and increased expenditures on agricultural inputs.

This is compounded by climate-related natural disasters, such as flooding, mudflows and avalanches, which are more frequent at this time of the year. National mechanisms for price monitoring, early warning of food price hikes and efficient management of the national material reserve will become more important as the climate changes.

Strengthen the evidence-base on climate risks and food security at the sub-national level

Cllimate change impacts on food security will vary within a province because agro-ecological characteristics are highly diverse within a province. Climate risk and food security profiling at provincial or district levels will be useful for designing adaptation actions tailor-made for addressing the climate risks and food security challenges identified in each location.

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Strategies addressing climate risks should focus on developing capacities to better analyse and anticipate risks.

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C-ADAPT

Climate Resilience
for Food Security:
ANALYSES, INNOVATIONS
& STANDARDS

June 2014

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The Climate Adaptation Management and Innovation Initiative (C-ADAPT) is an initiative funded by the Government of Sweden's fast-track climate finance that allows WFP and partners to explore innovative climate-induced food insecurity analyses and programmes, with the goal to help individuals, communities and governments meet their food and nutrition needs under a changing climate.

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KYRGYZ REPUBLIC
An overview of climate trends and the impact on food security

World Food Programme - Via C.G. Viola, 68/70
00148 Rome, Italy - Tel: +39 06 65131
www.wfp.org/cadapt
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