Food and Agriculture Organization
of the United Nations

ANALYSING RESILIENCE FOR BETTER TARGETING AND ACTION

FAO RESILIENCE ANALYSIS REPORT No. 18

RESILIENCE ANALYSIS IN THE TARGET AREAS OF "CARBON SEQUESTRATION THROUGH CLIMATE INVESTMENT IN FORESTS AND RANGELANDS (CS-FOR)" PROJECT IN THE

KYRGYZ REPUBLIC

RESILIENCE INDEX MEASUREMENT AND ANALYSIS II RIMA II

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ACRONYMS

ABS	Access to basic services
AC	Adaptive Capacity
ATM	Automated Teller Machine
AST	Assets
CS-FOR	Carbon Sequestration through Climate Investment in Forests and Rangelands
DPIC	Investment Centre Division, Europe, Central Asia, Near East, North Africa, Latin America and the Caribbean Service
ECZ	Elevation Coastal Zones
FA	Factor Analysis
FAO	Food and Agriculture Organization of the United Nations
FIDH	International Federation for Human Rights
HQ	Headquarters
MIMIC	Multiple Indicators and Multiple Causes
NDVI	Normalized Difference Vegetation Index
OECD	Organisation for Economic Co-operation & Development
RAP	Resilience and Policies team
RCI	Resilience Capacity index
RIMA	Resilience Index Measurement Analysis
RM-TWG	Resilience Measurement Technical Working Group
RSM	Resilience structure matrix
SAEFP	State Agency for Environment and Forestry
SSN	Social safety nets
TLU	Tropical Livestock Unit
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States dollars

OBJECTIVE OF THE ANALYSIS

The Kyrgyz Republic is one of the most climate vulnerable countries in Central Asia. Situated on the north-east, and located between the Tien Shan and the Pamir mountain systems, it is considered one of the least accessible countries in the world. Its isolation poses is a vast obstacle to trade and transportation, further amplified by inadequate infrastructure (World Bank, 2010). Rainfall has been highly inconsistent and large parts of the country experienced a decrease in the precipitation in the last two decades, together with an increase in the temperature (more intense droughts with consequences on crop production and availability of water for livestock). Forests and pastures are particularly sensitive to climate change, and the reduced productivity of pastures, the declining resilience of forest ecosystems and the increased exposure to natural disasters, are increasing the overall vulnerability of communities and negatively affecting rural livelihoods.

The underdeveloped rural sector, the lack of off-farm employment, the low productivity of agriculture and the scarcity of natural resources are contributing to poverty in rural communities.

The increases in temperature and reduction of snowfall, leading to an increased frequency and severity of floods and droughts have led to greater uncertainty about water discharge patterns and may threaten domestic water supply, agriculture production and infrastructure, thus increasing the overall vulnerability of local populations.

Since the poor are more exposed and sensitive to such impacts and generally have a lower capacity to adapt, they are more vulnerable to climate change. Their vulnerability makes them less resilient to the impacts of climate change.

In Kyrgyzstan, the major emergencies triggered or enhanced by climatic change can be grouped as follows:

- Mudflows/landslides/avalanches;
- Heat waves and frost;
- Floods and flash floods.

As reported in the literature and confirmed by the Ministry of Agriculture, State Agency for Environment Protection and Forestry (SAEFP), and the Ministry of Emergency Situations, this also confirmed by the data analysis, the sectors most vulnerable to climate change are agriculture, forest and, in general, biodiversity related field. Osh (i.e. Uzgen district) and Jalal-Abad (i.e. Suzak and Toguz-Toro) regions are the most vulnerable to landslides. Jalal-Abad is also the region that is most vulnerable to avalanches and to mudflows and floods; the least vulnerable region is Naryn (Ak-Talaa) (UNDP and the State Agency for Environmental Protection and Forestry under the Government of the Kyrgyz Republic, 2013).

In view of the rising awareness of the impact of climatic change, building resilience to climate change has naturally become one of the major goals for institutional bodies (both national and international).

One of the most compelling features of the resilience approach is the identification of how the combined effect of extreme climate events, economic factors and social conditions have increased the frequency and severity of risk exposure among vulnerable populations.

One of the key objectives of resilience to climate change should be that of addressing the vulnerability that countries, communities and, ultimately, households face with regard to the environmental consequences of climatic change.

The costs of disasters related to climate change are rising significantly. Of late, there has been a notable increase in extreme events which, together with population growth, urbanization, land and eco-systems degradation and a scarcity of natural resources, will create more fragile humanitarian contexts and will increase the probability of new complex conflicts (European Commission, 2013).

The report presents the linkage between resilience and climatic change impact in order to test the reactivity of households and thereby verify the importance of different coping strategies available in the household context in their ability to impact the level of Resilience Capacity Index (RCI) and their climate sensitivity.

The **Rural Development Fund**, together with FAO (HQ),[1] agreed on the formulation of a **Livelihood Study for the Carbon Sequestration through Climate Investment in Forests and Rangelands in the Kyrgyz Republic (CS-FOR)**, part of the FAO design for a climate investment for Green Climate Fund financing. The goal of the project is to **contribute to the development of a low carbon-emission and climate-resilient economy, and its project objective** is to **increase carbon sequestration through supporting climate investments in forests** and **rangelands and through reducing drivers of degradation and emissions** via institutional support, participatory ecosystem-based sustainable management of natural resources and green growth investments. As co-benefits, the project will reinforce the population's resilience to climate change (assessing the resilience capacities and coping strategies of communities and households in relation to climatic change shocks is one of the main objectives of the study).

The definition of resilience adopted in this report is the following: "*the household capacity that ensures stressors and shocks do not have long-lasting development consequences*" (RM-TWG, 2014). Building on this definition, resilience capacity is estimated through the FAO Resilience Index Measurement Analysis (RIMA) approach (FAO, 2016). The RIMA methodology employs both latent variable statistical techniques – for estimating the RCI and the four pillars: Access to Basic Services (ABS), Asset (AST), Social Safety Nets (SSN) and Adaptive Capacity (AC) - as well as the climate sensitivity variable at household level.

[1] January, 2018.

1 KEY MESSAGES

This section summarizes the main results of the analysis and related implications for policy development and programming

The resilience to climate change, as a result of the analysis, is highly influenced by adaptive capacity and subsequently by access to basic services. The analysis highlighted the importance of the level of education and the diversification of income portfolio, followed by the role played by limited access to credit.

POLICY RECOMMENDATIONS

- *Given the importance of education in influencing influencing the final RCI score, it is recommended to develop plans to increase/facilitate access to universities.*
- *Intervention through the introduction of new financial tools to promote green technologies via green taxes, customs duties, green procurement practices and green investments generally would be beneficial.*
- ***Intervention to increase access AST** could include increasing crop yields and livestock feeding efficiency, and reducing inputs while maintaining or increasing outputs, which makes production more efficient; designing and implementing climate-smart solutions across sectors at regional and sub regional levels.*

The isolation of many settlements and the inadequacy of transport infrastructure translate into high transport costs. Given the poor condition of the roads, policies need to be put in place to improve road connection with the aim of decreasing the isolation affecting mountain districts and villages.

POLICY RECOMMENDATIONS

- *Considering the poor condition of the roads, efforts to improve domestic road infrastructure and quality are helping. That will translate in improved productivity in other economic sectors, technology enhancements, stimulation of renewable energy sector, and improved road access to remote areas.*

Households living in the control group area are more resilient with respect to those living in the intervention ones.[2] The resilience structure matrix (RSM) shows **AC as the most influential pillar** for both intervention and control groups. Furthermore, for the **intervention group access to ABS is the second most important pillar**, followed by **SSN and AST**. A quite different structure emerges from the control group, where **AST is the second most important** pillar, followed by **ABS and SSN**.

Heterogeneity in terms of pillars' impact on the final RCI score is found at the district level. The most resilient district is Ak-Talaa, followed by Toguz Toro, Suzak and Uzgen. **AST is found to be the most important pillar in terms of resilience to climate change for all the districts in the intervention group**. ABS is the second most important pillar for Suzak and Uzgen, while for Ak-Talaa and Toguz-Toro, AST is found to be the second most relevant pillar.

POLICY RECOMMENDATIONS

- ***Sanitation is found to be very inadequate.** Considering the importance of housing with regard to people's health, it is essential that housing be given priority attention to guarantee everyone's access to basic sanitary facilities.*
- *The results of the analysis **stressed a notable need for agricultural support and household income diversification support**.*
- ***Low social protection and limited access to credit are the factors most affecting the fall in the RCI.** Low transfers are limiting the important role played by social safety nets. Policy makers should consider increasing access to credit in anticipation of extreme climatic events, which, coupled with technical trainings, could help to increase income diversification mechanisms.*

[2] See Annex I for the statistical test used to check the significance of the difference in the mean.

2 MAIN FINDINGS, POLICY AND PROGRAMMING IMPLICATIONS

This section aims to identify the differences in resilience capacity between social groups and to isolate the more relevant pillars, as well as to identify variables determining such disparities. Knowing the socio-economic profiles of the least and the most resilient households is of crucial importance for shaping proper policies aiming to increase resilience capacity[3]

2.1 INTERVENTION AND CONTROL GROUP

MAIN FINDING 1

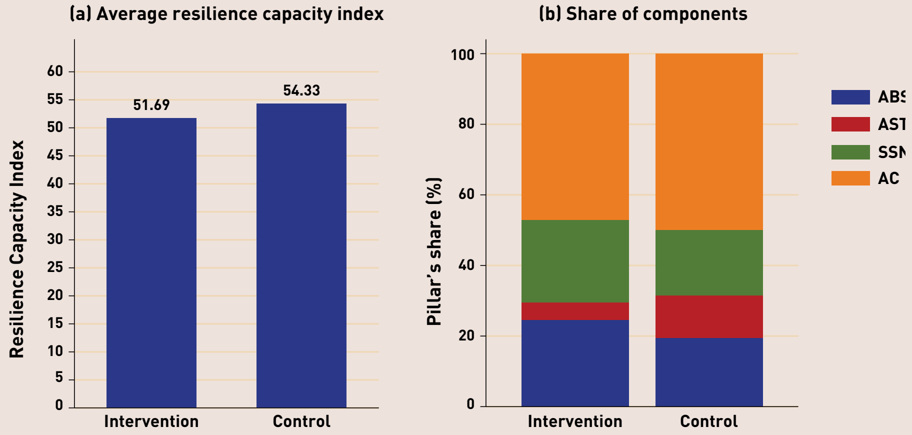
Within the framework of the Livelihood Study, the sample has been divided into two groups: intervention and control. The intervention group is expected to benefit from the project interventions throughout investments on integrated ecosystem-based natural resources management within a community-driven approach. The intervention area includes four districts: Uzgen, Suzak, Toguz-Toro and Ak-Talaa. The control group includes Talas, Bakai-Ata, Jayil and Toktogul districts.

As shown in Figure 1(a), **the control group is more resilient** with respect to the intervention group.[4] Looking at the RSM, shown in Figure1(b), for the **intervention group, AC is the most influential pillar** in terms of impact on the final RCI, **followed by ABS, SSN and AST**. Also for the control group **AC is the most important pillar, followed by AST, ABS and SSN**. For both the intervention and control groups, the importance of adaptive capacity is mainly driven by the high level of education (household head with university degree, which accounts for almost 25 percent on the final RCI score) and the diversification of income portfolios (which account for almost 16 percent in the intervention group and 11 percent in the control group). Several studies have pointed out the importance of diversification as one of the more effective adaptation strategies to mitigate the impact of climate variability (Newsham and Thomas, 2009). Concerning access to basic services, housing represents a major element in people's material living standards and is essential in providing shelter from weather conditions; housing conditions are good in both groups, but the level of sanitation remains low, with the percentage of households in the sample having access to flush toilet being low in both groups.

[3] Caveat in the interpretation of results. When a pillar and/or a variable are found to be less relevant to the actual resilience capacity level, it does not mean that they may not be relevant in the future and/or are not relevant for resilience in general.

[4] See Annex 1 for the statistical tests used to check the significance of the difference in the means.

Figure 1. **RCI vs RSM over intervention/control groups**



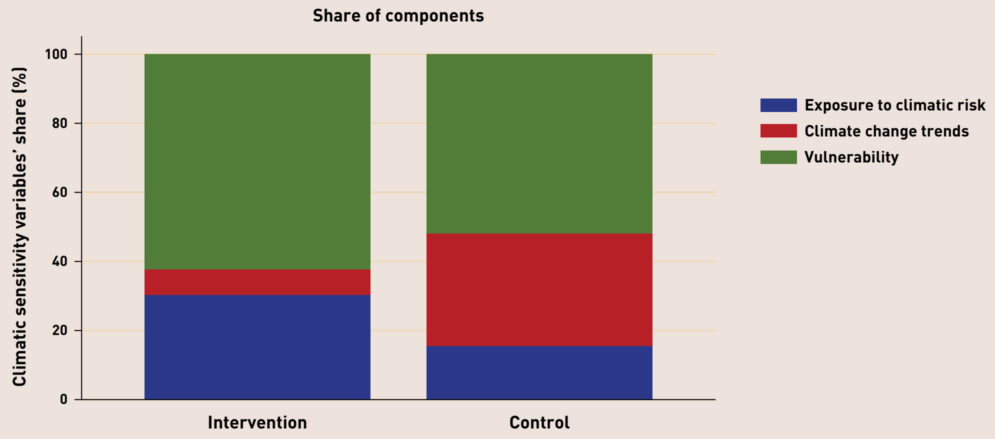
Source: Authors' own elaboration

The main problem remains **road access** and, in fact, many of the roads in the country are not open all year round as a result of the harsh winter conditions in the mountains.

From the assets point of view, **the level of well-being of the control group area is higher** compared to the intervention group; indeed, the vulnerability is lower with respect to the intervention group. What makes the difference in the two groups is the level of satisfaction (living standards and economic condition) and material status (used here as a proxy of the more general household well-being), with the control group being more satisfied with its material status. **The role played by livestock and agricultural activities is not straightforward**. Since being more specialized in livestock and/or agricultural activities make households more sensitive to extreme climatic events (as, for example, in case of drought which results in insufficient water for irrigation and enough water for the livestock), **having a differentiated livelihood makes a household more resilient to adverse climatic events**.

Concerning SSN, informal transfers are the main drivers of the pillar for both groups, also considering the fact that since the mid-2000s, migration processes have considerably increased in Kyrgyzstan. Approximately 50,000 Kyrgyz leave the country every year to work abroad, mainly to seek employment in Russia and Kazakhstan (International Federation for Human Rights (FIDH), 2016). Only 30 percent of the households in both groups (30 percent for the treated group and 29 percent for the control group) have access to credit; **indeed, access to credit is one of the main constraints in the Kyrgyz Republic**. Formal transfers are higher for the treated group (USD 77 per capita) compared to the control group (USD 69 per capita) (for more details see Table A1 in Annex II, Figure A3, Figure A4 and Figure A5 in Annex II).

Figure 2. **Climatic sensitivity - Intervention vs control group**



Source: Authors' own elaboration

With regard to the climatic sensitivity variables (Figure 2), the coefficient of variation of the long-term rainfall (representing the degree of variation in the rainfall in the last 15 years) is higher in the intervention group, while the coefficient of variation of the temperature is higher in the control group. Looking at the structure of the climatic sensitivity component, the control group is shown to be less vulnerable and less exposed to risk with respect to the intervention group, which is therefore **more sensitive to climatic change despite the climate change trend**.

POLICY RECOMMENDATIONS

- *At the more general level it is recommended that road conditions need to be improved, given that road surfaces vary from fair to poor. Furthermore, climatic events, especially during the winter period, could damage roads and severely affect transportation of supplies, increasing households' vulnerability.*
- *Bearing in mind that housing is essential for people's health, it is recommended that priority attention be given to housing to guarantee everyone access to basic sanitary facilities.*
- *Given households' vulnerability and risk exposure to climate change, there is a notable need for agricultural support (promoting a more diversified use of crops) and household income diversification support.*
- *The implementation of agricultural production and livestock training exercises, focused particularly on smart agriculture techniques, are strongly recommended. Supporting crop diversification through investments in local varieties could play an important role in improving incomes and reducing climate-related consequences. This could be complemented by increasing access to credit and providing technical training, which could promote improved use of agricultural inputs.*
- *Given the importance that the level of education plays in improving the adaptive capacity and on the final RCI, it is recommended that a plan be developed to increase access to higher education.*

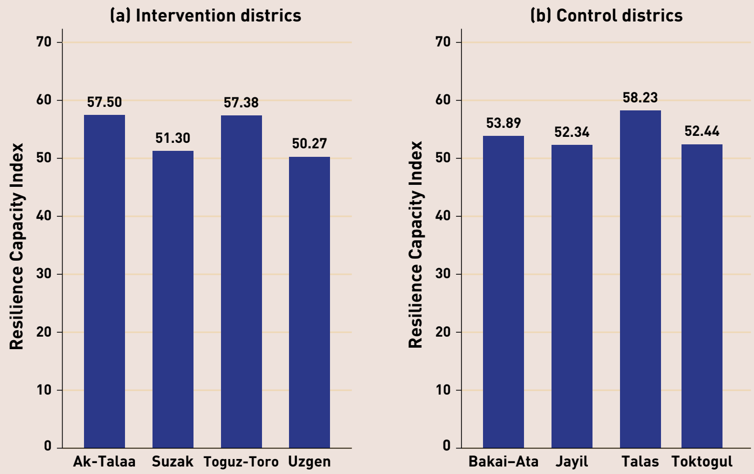
2.2 GEOGRAPHICAL PROFILES

MAIN FINDING 1

Considering the homogeneity of the two groups (intervention and control) showing same RSM pattern, and same importance in the variables behind each pillars, it becomes worthwhile to take a closer look at the district level, to check for more significant heterogeneity, focusing more on the intervention district (see ANNEX II – Figure A3 and Figure A4).

At the district level, the most resilient district is Talas (control group) followed by Ak-Talaa and Toguz-Toro (both in the intervention group); Uzgen is the least resilient district (see Figure 3).

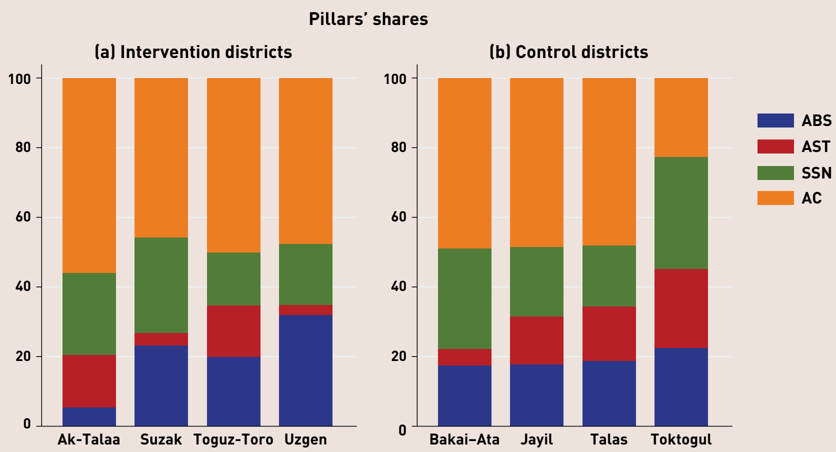
Figure 3. **Average resilience index at district level (taking into account intervention/control groups)**



Source: Authors' own elaboration

The RSM shows heterogeneity among districts in both the treated and in the control groups. As for Figure 4, AST is on average the most important pillar, both for the districts in the intervention group and in the control group, except for Toktogul (control group), where SSN is indeed the pillar having a greater impact on the final RCI score.

Figure 4. **RSM by district (intervention/control)**



Source: Authors' own elaboration

The results of the study which follow below take into consideration solely the districts of the treated group.

Ak-Talaa district

Situated in the Naryn region, this district comprises 13 municipalities. The great majority of households interviewed derive their income from livestock grazing, but farming is the main occupation of household heads. **Ak-Talaa appears to be the most resilient among the districts in the target area** and it is the one that shows **less climatic sensitivity and less exposure to climatic change related risks compared to the others** (see Tables A8, A9 and A10 for the statistics by districts). With regard to the perception of climate change, households living in Ak-Talaa reported perceiving less rain in the last five years. The climatic change trend is lower compared to other districts in the group. Ak-Talaa and Toguz-Toro are the districts with the **highest amount of forest cover. Forests play an important role in carbon sequestration**, and their main benefit is seen the role they perform by protecting soil, and increasing water retention in soils, livelihood support and poverty alleviation.

Despite the limited access to basic services, households in this district show a higher diversification of their income portfolios and the total number of crops planted, despite having a limited use of agricultural machinery ("Farmers with a variety of crops fared better than those who had planted fewer crops and families that also had livestock were able to sell them for emergency income" (Stubbs, 2016)).

Indeed, strategies related to crop diversification are the most efficient in the event of climatic shocks and are those that can actually affect the climatic sensitivity of households. The level of education of the household heads is the higher among the other treated districts, 57.45 percent of household heads have a secondary diploma and 26.7 percent a university degree. The same effect is found with regard to the households' more general well-being, with households feeling markedly satisfied with their material status. Lack of access to basic services makes the pillar one of the least important in terms of impact on the final RCI score. The situation concerning social safety nets is similar, where, despite the highest occurrence of formal transfers, **access to credit is still limited to few households**.

Toguz-Toro district

This district is part of the Jalal-Abad region and comprises 14 settlements within five municipalities. **Toguz-Toro is the second-most resilient district of the intervention group; climate sensitivity is relatively higher with respect to Ak-Talaa, as is the case of vulnerability[5] of households and the level of exposure to climate-related risks. Changes in temperature are negligible**, while the coefficient of variation of rain is higher with respect to Ak-Talaa. Concerning exposure to risk, Toguz-Toro has lost about **10 ha of forest in the last 15 years, and** households live in a high elevation coastal zone (average altitude is 1 400 m above sea level), so they are less exposed to flooding. Notwithstanding the higher Gini coefficient and the higher headcount poverty ratio, they are still able to manage extreme climate events thanks to the high level of adaptive capacity. As a matter of fact, the role played by the capacity development trainings attended here is more significant as compared to other districts.

[5] Vulnerability here is intended as the set of factors that are likely to influence the resilience to climatic change, like sectors dependent on natural resources.

The great majority of households are involved in livestock and governmental activities (46.67 percent and 40 percent respectively); none of the households in the sample are involved in farming as their main activity (in fact, the per capita land use is less than one hectare). The level of well-being of households is not satisfactory according to those interviewed. Only ten percent of the households interviewed claimed to be very satisfied with their own material status. Despite the higher level of formal transfer (which is mainly in the form of pensions), **access to credit still remains limited to 23 percent of the households. The level of education of the household head and a diverse income portfolio are still the main variables influencing the level of RCI, even though crop related strategies are the best solution in the event of extreme climate events**.

Suzak district

Located the Jalal-Abad region, this district comprises one town and 13 rural communities. **Suzak** shows a **higher exposure to climatic risks, thus making households more vulnerable to natural hazards** such as landslides and mudslides. Furthermore the perception households have of climate change in the last five years is in line find the findings**, with households reporting the perception of increased rains**. Since natural disasters pose a constant threat in this area, the need to move to other areas is important and, in fact, **migration strategies are among the best responses in cases of extreme climatic events** (see Table A6 for more details). That said, informal transfers, mainly remittances, are a consistent part of household income, thus making the variable important for the final RCI index.

The awareness of climate change (through household perception), trainings and the technological capacities attained (through educational level and the number of trainings attended by the households) seems to be more relevant than infrastructure (ABS) and social capital (AST and SSN), thus reinforcing the theory that knowledge represents an important determinant of adaptive capacity (Gallopin, 2006).

Uzgen district

A district of the Osh region, Uzgen comprises one town, 19 rural communities and 99 villages. Uzgen is the least resilient of the districts covered by this study. It has the highest average household climate sensitivity and it is characterized by a very high risk exposure and vulnerability. The district is subject to frequent landslides caused by floods initiated by heavy rains (Satke, 2017), snowmelt and breaches of natural dams. Climate change is affecting the grazing land that households and livestock rely on. The great majority of households are engaged in livestock keeping (64 percent), thus increasing risk exposure - indeed there is a negative correlation between the coefficient of variation of NDVI and the coefficient of variation of rain. There is lower (or even no) assistance from the government; informal transfers are also rare and access to credit is very limited. Given the fact that they are more specialized in livestock as main livelihood, households do not diversify their income portfolio much. They do gardening but the level of crop diversification is still very low.

Given the *quasi*-homogeneity in RSM patterns, policy recommendations will focus on the main deficiencies at the more general level.

POLICY RECOMMENDATIONS

The actions recommended should include:

- *The improvement of resources management;*
- *The creation or refinement of capacity-building;*
- *Creation of a global information network enabling everyone to know about the climate and related risks.*

Policies should focus on:

- *Adjusting to or resisting the perturbations;*
- *Reducing potential damages;*
- *Taking advantage of opportunities; and*
- *Coping with the consequences of the transformations that do occur.*

More generally, the need to improve the capacity for risk management emerged from the analysis; this could be carried out through institutional channels, by promoting the passage of legislation on the use of natural resources and corresponding economic mechanisms in order to create favourable conditions for the application of technologies and adaptation to climate change.

Taking a more in-depth look at the resilience to climate change determinants, the channels on which policies need to focus on more are: **access to credit, use of different crops in order to guarantee a differentiated basket of products in case of extreme climate events (also through the improvement of agricultural tools and technology), income diversification through capacity building (trainings) and livestock production**.

POLICY RECOMMENDATIONS

- ***Access to credit.*** *Given the limited access to credit, the introduction of new financial tools to promote green technologies via green taxes, customs duties, green procurement practices and green investments in general would be beneficial. Improving adequate financial information would be also beneficial (the percentage of households involved in financial and credit trainings is very low), thus creating risk management and credit assessment skills.*
- ***Crop diversification.*** *This is often considered one of the best tools in achieving a higher level of climate resilience and it is one of the most-used climate risk management strategies. By diversifying, farmers increase not only food supply, but also their income sources. In order to avoid producing consequences on people's vulnerability, it is also recommended* ***to increase crop yields and livestock feeding efficiency, reducing inputs while maintaining or increasing outputs****, which make production more efficient; and to design and implement climate-smart solutions across sectors at the regional sub regional levels.*

POLICY RECOMMENDATIONS

- ***Agricultural wealth index.*** *The diffusion and creation of the necessary agricultural practices and technologies could help households, especially farmers, to better adapt to extreme climatic events. Agricultural innovation could be the focus in mitigating climate change consequences (Khan et al., 2009). Considering the poor road conditions, post-harvest losses may increase as a result of difficulties in reaching isolated villages; it is therefore recommended that road connections among isolated districts and villages be improved.*
- ***Income diversification.*** *Income diversification could be a substitute form of risk management, as a means of protecting households from climate change. Diversification enhances household economic stability, and this could be achieved by encouraging profit-oriented activities, and creating incentives and opportunities.*
- ***Livestock productivity.*** *In the framework of climate change, promoting climate investment could help livestock farmers to increase climate adaptive capacity (especially as livestock-related strategies are those most used by households in the sample). Modernization of livestock is crucial in this respect and could be achieved through improvements in animal husbandry and health services, and of know-how in animal husbandry.*

3 METHODOLOGY AND COVERAGE

This section presents the dataset used in this resilience analysis, the project intervention areas, and describes the FAO RIMA-II approach employed for estimating household resilience capacity. It also provides information on the questionnaire modules

The definition of resilience adopted in the report is the following: "the household capacity that ensures stressors and shocks do not have long-lasting development consequences" (RM-TWG, 2014). Building on this definition, resilience capacity is estimated through the FAO RIMA approach (FAO, 2016), taking into account climate sensitivity variables. The RIMA methodology employs both latent variable statistical techniques – for estimating the RCI and the four resilience pillars, ABS, AST, SSN and AC at household level – and regression models. Annex I provides details on the resilience measurement through RIMA methodology.

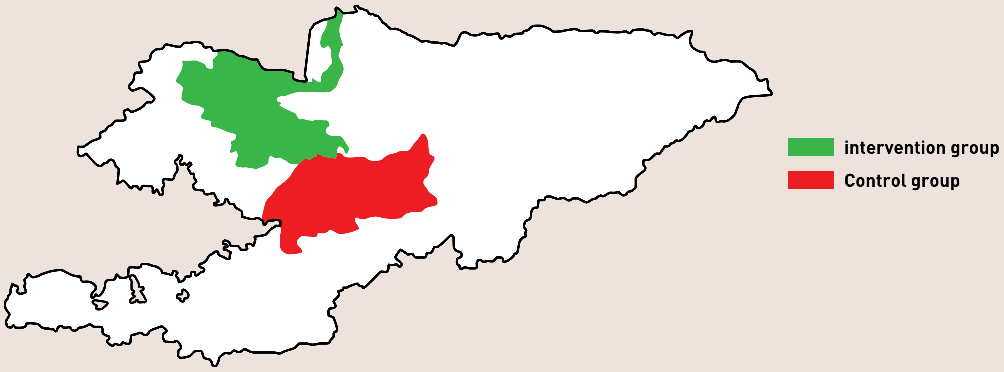
The livelihood survey comes from a household survey carried out to inform the design of the FAO-Green Climate Fund known as the "**the Carbon Sequestration through Climate Investment in Forests and Rangelands in the Kyrgyz Republic (CS-FOR)**" Project (2018). The study took place in eight districts, four of them are the districts receiving the benefits (see Figure 4 above in red), and those are:

1. Osh region, **Uzgen district**;
2. Jalalabat region, **Suzak district**;
3. Jalalabat region, **Toguz-Toro district**;
4. Naryn region, **Ak-Talaa district**.

In order to assess the results of the interventions, a control group has been formed(see Figure 5 in green), covering the following districts and area:

1. Talas region, **Talas district**;
2. Talas region, **Bakai-Ata district**;
3. Chui region, **Jayil district**;
4. Jalalabat region, **Toktogul district**.

Figure 5. **District part of the livelihood survey**



Source:
Authors' own elaboration based on the United Nations Geospatial Information Section

The livelihood survey is a combination of quantitative and qualitative information. It is divided into the following eight principal parts:

1. demography and household assets;
2. pasture use;
3. forest use;
4. capacity development;
5. agricultural productivity;
6. access to pasture and forest, conflicts;
7. consumption and food security;
8. climate information.

The total sample is composed of 903 households, of which 600 households are part of the intervention districts, and 303 households are part of the control groups.

In addition to the household survey, geo variables have been used to check for climate sensitivity. Climate indicators have been constructed using:

- average yearly rainfall (long-term data);
- average min/max yearly temperatures (long-term data).

For the present analysis the coefficient of variation of rainfall and temperature has been utilized, which represents the coefficient of variations between the year the survey took place (2018) and the previous 15 years.

4 NEXT STEPS

This section provides information on the report dissemination, and report using for the forthcoming project activities

The findings have provided an overview of the factors affecting households' resilience capacity to climate change in Kyrgyzstan. It is crucial to note that, based on the findings, the recommended actions are to be taken up both by FAO as well as by the different actors whose shared mandate is to support interventions based on the recommendations listed, and together with the Government of Kyrgyzstan.

Kyrgyzstan's road quality is negligible, and the low level of importation as a result of poor transportation access is one of the major stumbling blocks to economic development.

Housing conditions are still not well developed, as demonstrated by the fact that the number of households having a flush toilet in the house is still very low (on average, just 4 percent).

With regard to SSN, policy should focus also on social protection, especially for those who are more vulnerable and exposed to extreme climatic events.

Since agriculture and livestock keeping are still the main sources of income in Kyrgyzstan, it is recommended to expand and improve cropping techniques by adopting climate-smart agriculture; improve rural infrastructure to guarantee water and forage to livestock under extreme weather conditions and trade capacity to increase market access notwithstanding road conditions.

Income diversification seems to be the best solution as a means of limiting vulnerability and exposure to climate change; it is therefore recommended that policies to push for diversification be developed.

Flooding and landslides caused a reduction in agricultural and pastoral areas and the displacement of pastoralists and farmers to more suitable areas for their activities, thus increasing general inequalities and discrimination among people. For this reason, it is recommended to:

- improve the capacity of farmers by improving production technologies through increased knowledge about the consequences of climate extreme events;
- increase access to improved and adapted inputs (food, forage, seed and animal resource banks, manure management, composting, etc.) to reduce high losses;
- train households on climate risks and introduce smart agricultural practices, such as farm schools to teach how to use crops resistant to bad weather conditions and how to deal with lack of feed and forage, and the recommendation to secure access to livestock/ animal health services.

Concerning AC, results suggest that attention should go also to the educational sector. Given the great importance of education on the final RCI score, it would be ideal to guarantee easy access to university in order to reduce geographical, socioeconomic and gender disparities, and to promote access to education services for the most disadvantaged and vulnerable households.

It is also recommended that monitoring of the prioritized interventions is required as part of measuring resilience capacity of households over time.

4.1 FROM BASELINE TO MIDLINE

FAO-RAP has a long experience in impact evaluation (Somalia, Lesotho, Karamoja-Uganda and WB/Gaza Strip). In the specific case of Somalia (Dolow), results showed **an increase in resilience capacity (23 percent)**, obtained through a positive impact on agricultural production, income deriving from livestock, transfers, diversification of income sources and access to infrastructures. Concerning Lesotho, the analysis provided the evidence for the positive effect of social protection transfers on resilience capacity. Evaluation of the effect addresses the idea that predictable and regular social protection transfers may serve as a way to increase the resilience capacity of households.

Given the promising results of these past projects leading to an increase of resilience capacity index, positive feedbacks are expected from the intervention proposed in the present analysis through the channels of: access to credit, use of different crops in order to guarantee a differentiated basket of products in case of extreme climatic events (also through the improvement of agricultural tools and technology), income diversification through capacity building (trainings) and livestock production.

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ANNEX I

A1.1 RIMA CONCEPTUAL FRAMEWORK

In order to cope with climatic shocks, people, communities and society need to be able to recover from such shocks and stresses, and have coping strategies to deal with them. Coping is a reactive response over a short time frame, performed to interact with shocks. Figure A1 on the next page describes what happens to a household's well-being when a shock occurs and resilience mechanisms are activated. Y_0 (e.g. the level of household well-being at time 0) is obtained through a set of time-variant and time-invariant characteristics, a number of pillars contributing to household resilience capacity. When a shock occurs, a series of coping strategies is activated, principally consumption smoothing, assets smoothing and adoption of new livelihood strategies. Household resilience contributes to these absorptive, coping and transformative capacities in an attempt to bounce back to the previous state of well-being. This can result (over the long-term) in an increase or decrease in Y. Any change in Y has an effect on resilience capacity and, consequently, can limit future capacity to react to shocks.

A1.2 ESTIMATION OF THE RESILIENCE CAPACITY INDEX

To calculate the resilience capacity index, two steps are necessary. In the first step, factor analysis[6] (FA) is used to identify the pillars that contribute to household resilience and the aggregate indexes for the household's climate sensitivity, starting from observed variables. This variable reduction technique relies on finding cross-correlations between the observed variables, identifying a number of (unobservable) factors reflecting in correlations and predicting the latent outcome (pillars and climate sensitivity index) as a linear combination of underlying factors.

In the second step, a mixed-modelling technique termed Multiple Indicators and Multiple Causes (MIMIC) is used to estimate the resilience capacity index (RCI).

The MIMIC model was built by Jöreskog and Goldberger (1975) and it is a procedure for the estimation of a model in which one observes multiple indicators and multiple causes of a single latent variable. The MIMIC model has both a structural component (relating pillars to resilience) and a measurement component linking resilience to households' climate sensitivity.

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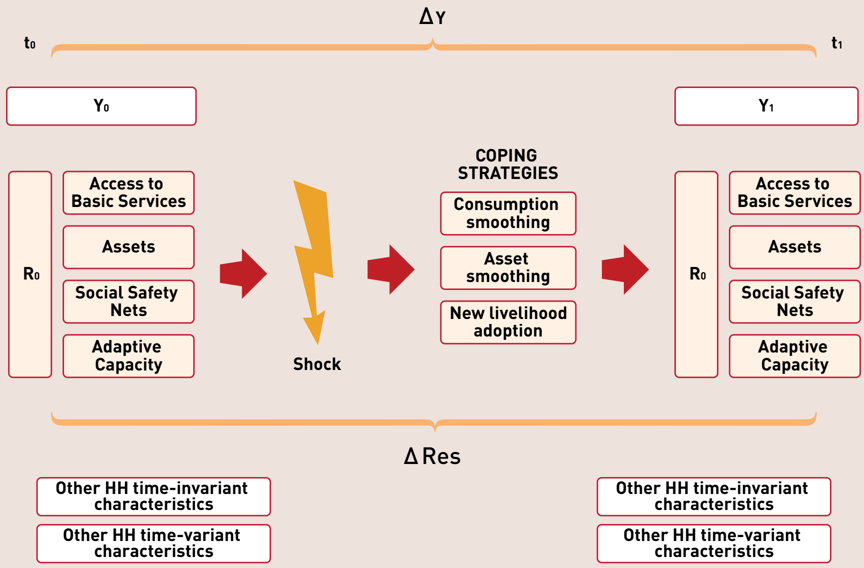
[6] Factor analysis is a tool for investigating variable relationships for complex concepts such as socioeconomic status, dietary patterns, or psychological scales. It allows researchers to investigate concepts that are not easily measured directly by collapsing a large number of variables into a few interpretable underlying factors.

Figure A1. **Resilience conceptual framework**



What MIMIC basically does it is to divide the model in two simultaneous parts.

- The structural part (also known as the formative model), which displays the casual link among the latent variable and the observed variables.
- The measurement part (also known as the reflective model), which shows how the latent variable (the resilience to climate change) is estimated through the observed variables (the assumed indicators: climate change trends, exposure to risk and vulnerability).

Introducing the notation of the theoretical framework, in formal terms, the simultaneous equation model is formulated as follows:

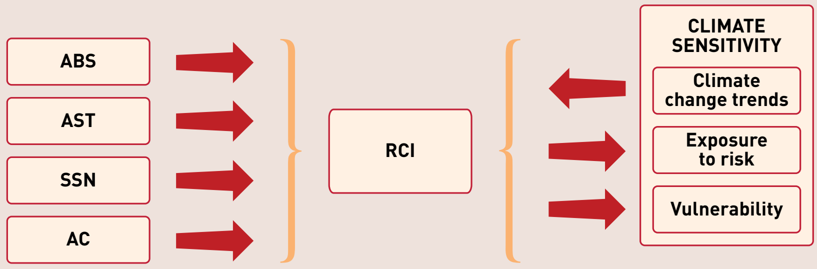
$$[RCI] = [\beta_1, \beta_2, \beta_3, \beta_4] \times \begin{bmatrix} ABS \\ AST \\ SSN \\ AC \end{bmatrix} + [\varepsilon_1] \quad (1)$$

$$\begin{bmatrix} Climate\ Change\ trends \\ Exposure\ to\ risks \\ Vulnerability \end{bmatrix} = [\Lambda_1] \times [RCI] + [\varepsilon_2] \quad (2)$$

As already mentioned, the model is divided into two parts: (1) is the structural equation that specifies the causal relationship between the observed covariates causes and the RCI; (2) is the measurement equation of the RCI. The model can be also identified through a graphical representation, using path analysis[7] (see Figure A2 for more details).

[7] Here path coefficients are the regression coefficients (from pillars to RCI, and from RCI to each single measurement indicator).

Figure A2. **Path diagram of MIMIC model for the resilience to climate change**



Climate sensitivity reflects the natural hazard, the exposure to climate-related risk and the vulnerability of households. As a natural hazard is an exogenous variable (covariate), the hypothesis behind the model is that the relation with resilience is inverse, meaning that the natural hazard causes changes in resilience (exposure causes risks).

The main idea behind the resilience capacity index is that in the short run resilience could be defined as the ability of households, whose livelihoods and agricultural production are highly dependent on natural resources, to recover their production to the original condition in resistance to environmental variability (such as climatic shocks). In the long run, resilience can be defined as the adaptive capacity of a household to (Walker *et al.*, 2009):

- **Absorb shocks:** resist a shock by reducing risks, and maintain functions in the face of external stresses imposed upon it by climate change.
- **Adapt to changing conditions:** respond to change by making ad hoc choices in order to improve the sustainability of the household, thus being better prepared for future climate change impacts.
- **Learn, innovate and transform:** improve choices leading to positive changes.

A1.3 VARIABLES DESCRIPTION

For the present study, four pillars have been used in the structural part of the MIMIC model, those are: ABS, AST, SSN and AC (see Table A1 for more details).

Table A1. **Variables used to construct the pillars**

Pillar	Definition
ABS	**Access to basic services:** proximity to main services, proximity to water source, safe drinking water, sanitation and housing index.
AST	**Household assets:** per capita land used (ha), financial assets, per capita number of livestock owned, household's wealth perception and agricultural wealth index.
SSN	**Social safety nets:** formal transfers (per capita, USD), Informal transfers (per capita, USD), access to credit.
AC	**Adaptive capacity:** diverse Income portfolio, number of trainings attended by a household, crop diversification index, household head with a university degree.

Having or not having access to basic services, such as schools, health centres, electricity and water, are fundamental aspects of household well-being. In order to build the pillars five variables have been used, namely: proximity to main services, proximity to a water source, safe drinking water, sanitation and housing index.

- **Proximity to main services:** proxies all the distances to the main services reported in the livelihood survey.[8] The index has been constructed using FA, and following RIMA rules which hypothesizes that variables inside the pillar need to go in the same direction (positive is good, negative is bad), and inverse measurements of each of the distances have been taken (being close to main service increases household well-being).
- **Proximity of water source:** the same methodology has been applied for this variable and inverse measurements of the distances in minutes have been taken.
- **Safe drinking water:** is a dummy variable, taking value one if the family has tap water inside the house and zero otherwise.
- **Sanitation:** is a dummy variable taking value one if the family has a flush toilet in the house and zero otherwise.
- **Housing index:** is a proxy describing the more general level of house condition. It has been constructed through FA, using the type of roofing material, the floor and walls (i.e. solid materials such as cement).

When analysing household response to shocks, a central issue to be considered is the role of assets. If the latter contribute directly to the income generation process (productive assets), shocks can have diverse consequences and lead to different behaviours, i.e. selling assets or slowing down asset accumulation could have important implications for future income generation. RIMA methodology considers productive and non-productive assets to be the preferable proxies for income. Five variables have been employed in the pillars' construction.

- **Land used** (ha, per capita using adult-equivalent scale), total land used by the household (not only owned, but also rented) for agricultural production. For the analysis, the inverse of the land data has been used. The hypothesis is that being less farming oriented makes households less exposed to climatic risk consequences.
- **Financial assets**, dummy variable taking value one if the household has savings, zero otherwise.
- **Livestock owned** (per capita, using adult equivalent scale), total number of animals (using conversion factors) owned by the household at the time of the survey. Here again, the inverse of the variable has been used. The hypothesis is that being less livestock oriented (as main source of income) makes households less exposed to climate change consequences.
- **Wealth perception** dummy variable taking value one if the household is quite satisfied with its material status (living standard and economic condition), and zero otherwise.
- **Agricultural wealth index** is an aggregate index build using FA; variables used are all the types of agricultural inputs owned by the households.

[8] Distances reported in the survey are to: primary school, ssecondary school, public/government hospital, health facility, pprivate hospital, health facility, chemist/pharmacy, police post/station, mosque, livestock market, agriculture-crops market, petty trading market, bank/financial services, ATM machine, public means of transport, vet clinic; courthouse, local agriculture/livestock office, college/training institutions, local municipality office.

Access to transfers, whether cash or in-kind, represents a major source of poverty alleviation in many developing countries. Public and private transfers make up a substantial portion of poor households' annual income, providing cash important to the generation of additional income. The **SSN** pillar includes:

- **Formal transfers:** per capita amount in USD;
- **Informal transfers:** per capita amount in USD;
- **Access to credit:** dummy variable taking value one if the household had the possibility to access a loan in the past, and zero otherwise.

Ecological and economic systems are non-linear (Levin *et al.*, 1998) and therefore adaptive capacity of a household has to be taken into account. Adaptive capacity represents household ability to adapt to the changing environment in which it operates. In order to capture all the possible sources of adaptation, the pillar includes:

- **Diverse income portfolio:** based on the different sources of a household's income;
- **Number of trainings:** number of trainings the household has been involved in the two years prior to the survey;
- **Crop diversification index:** based on the number of crops planted by the household;
- **Household head with university degree:** dummy variable taking value one if the household head has a university degree, and zero otherwise.

For the household's climate sensitivity, three main aggregate indices have been used, see Table A2 below for details.

Table A2. **Climate sensitivity aggregate index**

Variable	Definition
Climate change trends	Coefficient of variation long-term temperature, coefficient of variation long-term rain.
Exposure to risk	Total of forest lost in the last 15 years (ha), percentage of village population with respect to total district population, village altitude.
Vulnerability	Number of migrants per household, share of household members at working, village Gini's coefficient, poverty headcount ratio.

There is a broad range of literature on the link between resilience and climate change, and many attempts have been made to measure resilience to climate change, to find the right method and the right index. Following OECD publications on the subject (OECD, 2014; Agrawala *et al.*, 2011; and Hallegatte *et al.*, 2008) three major indices have been created using FA: climate change trends, exposure to risk and household's vulnerability. More precisely:

- **Climate change trends:** is and index capturing climate change. It has been constructed using long-term distance in the average rainfall and temperature of the past 20 years. The hypothesis is that large variations in the index mean that extreme climate events happen (either drought or flood), so the effect should be negative. The coefficients are constructed as follows:

$$\sqrt{\frac{(\text{Distance}^2 \times (\text{last year - first years}))}{(\text{Average last year + Average first years})}} \quad (3)$$

These coefficients could be considered as 'relative' Euclidean distance. The hypothesis is that large variations in the index mean that extreme climate events have taken place. To take into account extreme weather conditions, a dummy variable has been created (floods) taking value one if the average value of the distance (as growth rate) is greater than its standard deviation, and has been added in the measurement part of the MIMIC as control variable;

- **Exposure to risk:** variables used for the index construction are forest lost area (ha) in the past 15 years, percentage of the village population with respect to the total district population as a proxy of the population density and village altitude as a proxy of the Elevation Coastal Zones (ECZ);
- **Vulnerability:** variables used for the index construction are the number of migrants per household, share of household members in working age, share of agricultural income in total income, village Gini's coefficient and households' poverty headcount ratio.

ANNEX II

A2.1 T-TEST – TREATED/CONTROL

Table A3. **T-test for the differences in intervention/control group**

	Observation	Mean	St. error	St. dev.	[95% Conf. interval]	
Control	303	54.330	0.958	16.680	[52.442	56.211]
Intervention	600	51.680	0.673	16.490	[50.363	53.000]
Combined	903	52.570	0.552	16.590	[51.494	53.652]
Difference		2.646**	1.160		[0.362	4.931]

Note: *** p<0.01, ** p<0.05, * p<0.1

Source:
Authors' own calculations

A2.2 REGRESSION RESULTS

Table A4. **Climate sensitivity analysis over the pillars' variables**

Climate sensitivity	(1) Macro-level	(2) Treated	(3) Ak-Talaa	(4) Suzak	(5) Toguz-Toro	(6) Uzgen
Distance index	-0.451 *(0.453)*	-0.169 *(0.417)*	-0.153 *(2.137)*	-0.185 *(0.515)*	-14.990 *(10.03)*	0.038 *(0.79)*
Proximity to water source	-0.048 *(0.18)*	0.066 *(0.178)*	-0.182 *(1.111)*	0.096 *(0.247)*	-0.023 *(1.26)*	0.276 *(0.302)*
Safe drinking water	0.028 *(0.066)*	-0.027 *(0.067)*	0.046 *(0.304)*	-0.017 *(0.091)*	0.076 *(0.437)*	-0.061 *(0.121)*
Sanitation	-0.099 *(0.111)*	-0.083 *(0.101)*	-0.253 *(0.663)*	0.017 *(0.146)*	-0.589 *(0.631)*	-0.181 *(0.157)*
Housing index	0.013 *(0.079)*	0.015 *(0.078)*	0.289 *(0.412)*	0.092 *(0.111)*	0.232 *(0.531)*	-0.058 *(0.139)*
Per capita land (ha)	0.017 *(0.028)*	-0.031 *(0.027)*	-0.113 *(0.252)*	0.028 *(0.067)*	-0.807** *(0.265)*	0.094 *(0.061)*
Financial assets	-0.029 *(0.067)*	-0.012 *(0.066)*	0.529 *(0.353)*	-0.022 *(0.092)*	-0.586 *(0.403)*	-0.033 *(0.109)*
Per capita TLU	-0.038 *(0.026)*	-0.009 *(0.027)*	-0.115 *(0.153)*	-0.034 *(0.039)*	0.339** *(0.132)*	0.048 *(0.049)*
Wealth perception	0.172*** *(0.063)*	0.157** *(0.063)*	0.056 *(0.273)*	0.176** *(0.084)*	0.111 *(0.455)*	0.058 *(0.112)*
Agricultural wealth index	-0.084 *(0.328)*	-0.021 *(0.355)*	-0.821 *(2.019)*	0.220 *(0.529)*	0.371 *(2.753)*	-0.330 *(0.535)*
Formal transfers	0.0266** *(0.011)*	0.0254** *(0.010)*	0.054 *(0.051)*	0.0288** *(0.014)*	0.058 *(0.073)*	0.0400** *(0.018)*
Informal transfers	0.101*** *(0.012)*	0.099*** *(0.012)*	0.122* *(0.071)*	0.096*** *(0.015)*	-0.146 *(0.102)*	0.125*** *(0.023)*
Credit	0.034 *(0.057)*	0.031 *(0.056)*	-0.306 *(0.291)*	0.085 *(0.075)*	0.060 *(0.302)*	-0.033 *(0.094)*
Diverse income portfolio	0.173*** *(0.063)*	0.265*** *(0.061)*	-0.422 *(0.259)*	0.308*** *(0.088)*	1.425*** *(0.433)*	0.227** *(0.103)*
Number of trainings	0.035 *(0.023)*	0.013 *(0.023)*	-0.022 *(0.171)*	0.006 *(0.028)*	-0.235 *(0.309)*	0.0740* *(0.041)*
Crop diversification index	0.189** *(0.086)*	0.146* *(0.084)*	0.129 *(0.348)*	0.084 *(0.115)*	0.352 *(0.549)*	0.247* *(0.148)*
Household heads with university degree	-0.132* *(0.072)*	-0.133* *(0.077)*	0.105 *(0.301)*	-0.179* *(0.103)*	0.483 *(0.403)*	-0.429*** *(0.161)*
Ak-Talaa	0.185 *(0.126)*	--				
Suzak	2.106*** *(0.063)*	1.899*** *(0.103)*				
Toguz-Toro	2.287*** *(0.149)*	2.065*** *(0.149)*				
Uzgen	2.913*** *(0.070)*	2.709*** *(0.105)*				
Constant	-1.601*** *(0.144)*	-1.473*** *(0.162)*	-1.434 *(0.846)*	0.335* *(0.175)*	3.832 *(2.295)*	1.095*** *(0.248)*
Observations	903	600	44	301	30	224
R-squared	0.727	0.602	0.453	0.187	0.691	0.236

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' own calculations

Table A5. **RCI/Climate sensitivity analysis on climate related strategies**

VARIABLES	(1) RCI	(2) Climate sensitivity
Crop related strategies	0.989 *(1.746)*	-0.016 *(0.074)*
Livestock related strategies	-0.726 *(1.734)*	0.062 *(0.074)*
Migration strategies	-3.092 *(2.725)*	-0.075 *(0.116)*
New job strategies	0.071 *(2.125)*	0.000 *(0.091)*
Leased land strategies	-2.341 *(3.461)*	-0.054 *(0.147)*
Insurance strategies	1.054 *(2.994)*	0.045 *(0.128)*
Suzak	-6.895*** *(2.576)*	1.969*** *(0.111)*
Toguz-Toro	0.614 *(3.789)*	2.060*** *(0.161)*
Uzgen	-7.594*** *(2.641)*	2.730*** *(0.113)*
Constant	46.60*** *(2.461)*	-1.338*** *(0.105)*
Observations	600	600
R-squared	0.029	0.515

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source:
Authors' own calculations

Table A6. **Climate sensitivity analysis on climate related strategies - Districts level**

Climate sensitivity	(1) Ak-Talaa	(2) Suzak	(3) Toguz-Toro	(4) Uzgen
Female HH	0.613 *(0.384)*	-0.160 *(0.111)*	1.137* *(0.604)*	-0.266** *(0.129)*
Age of HH	-0.009 *(0.009)*	-0.002 *(0.003)*	-0.0280*** *(0.009)*	0.00659* *(0.003)*
Household size	0.180*** *(0.059)*	-0.0778*** *(0.026)*	-0.160** *(0.057)*	-0.0955*** *(0.031)*
Crop related strategies	-0.375* *(0.216)*	0.138 *(0.105)*	-0.695** *(0.312)*	-0.028 *(0.126)*
Livestock related strategies	0.176 *(0.212)*	-0.113 *(0.106)*	0.529 *(0.354)*	0.198* *(0.119)*
Migration strategies	-0.415 *(0.392)*	-0.180** *(0.054)*	-0.634 *(0.399)*	-0.166 *(0.196)*
New job strategies	0.131 *(0.368)*	-0.009 *(0.127)*	-0.340 *(0.676)*	-0.014 *(0.143)*
Leased land strategies		0.002 *(0.223)*		-0.055 *(0.201)*
Insurance strategies		-0.010 *(0.165)*	-0.277 *(0.612)*	0.030 *(0.216)*
Constant	-1.788*** *(0.598)*	1.153*** *(0.212)*	3.284*** *(0.634)*	1.537*** *(0.244)*
Observations	44	301	30	224
R-squared	0.354	0.047	0.496	0.077

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source:
Authors' own calculations

Table A7. **Resilience analysis on climate related strategies - district level**

RCI	(1) Ak-Talaa	(2) Suzak	(3) Toguz-Toro	(4) Uzgen
Female HH	13.940 *(13.251)*	2.211 *(2.758)*	23.840 *(23.244)*	-2.101 *(2.809)*
Age of HH	-0.409 *(0.312)*	-0.010 *(0.081)*	0.302 *(0.347)*	0.023 *(0.081)*
Household size	-0.097 *(2.069)*	0.459 *(0.634)*	0.720 *(2.191)*	0.305 *(0.671)*
Crop related strategies	2.584 *(7.477)*	0.544 *(2.604)*	-8.861 *(11.532)*	1.494 *(2.731)*
Livestock related strategies	-15.84** *(7.339)*	0.874 *(2.632)*	3.173 *(13.623)*	-0.768 *(2.585)*
Migration strategies	-13.440 *(13.481)*	-2.693 *(4.019)*	7.319 *(15.342)*	-2.284 *(4.259)*
New job strategies	-4.868 *(12.732)*	2.742 *(3.142)*	18.460 *(26.254)*	-2.843 *(3.048)*
Leased land strategies		-7.537 *(5.545)*		0.008 *(4.371)*
Insurance strategies		1.225 *(4.089)*	2.671 *(23.521)*	0.684 *(4.695)*
Constant	71.831*** *(20.661)*	37.002*** *(5.251)*	26.820 *(24.374)*	36.533*** *(5.315)*
Observations	44	301	30	224
R-squared	0.211	0.014	0.154	0.014

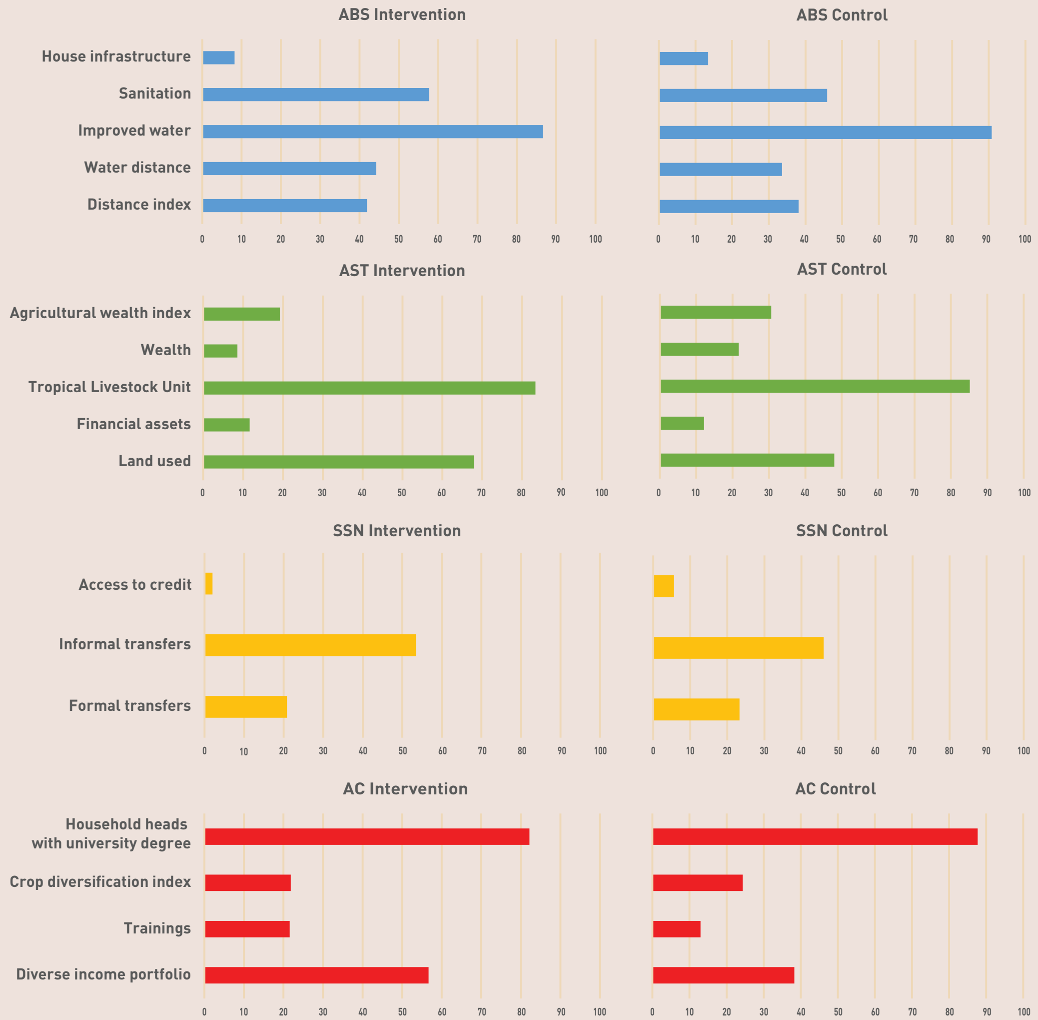
Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source:
Authors' own calculations

ANNEX III

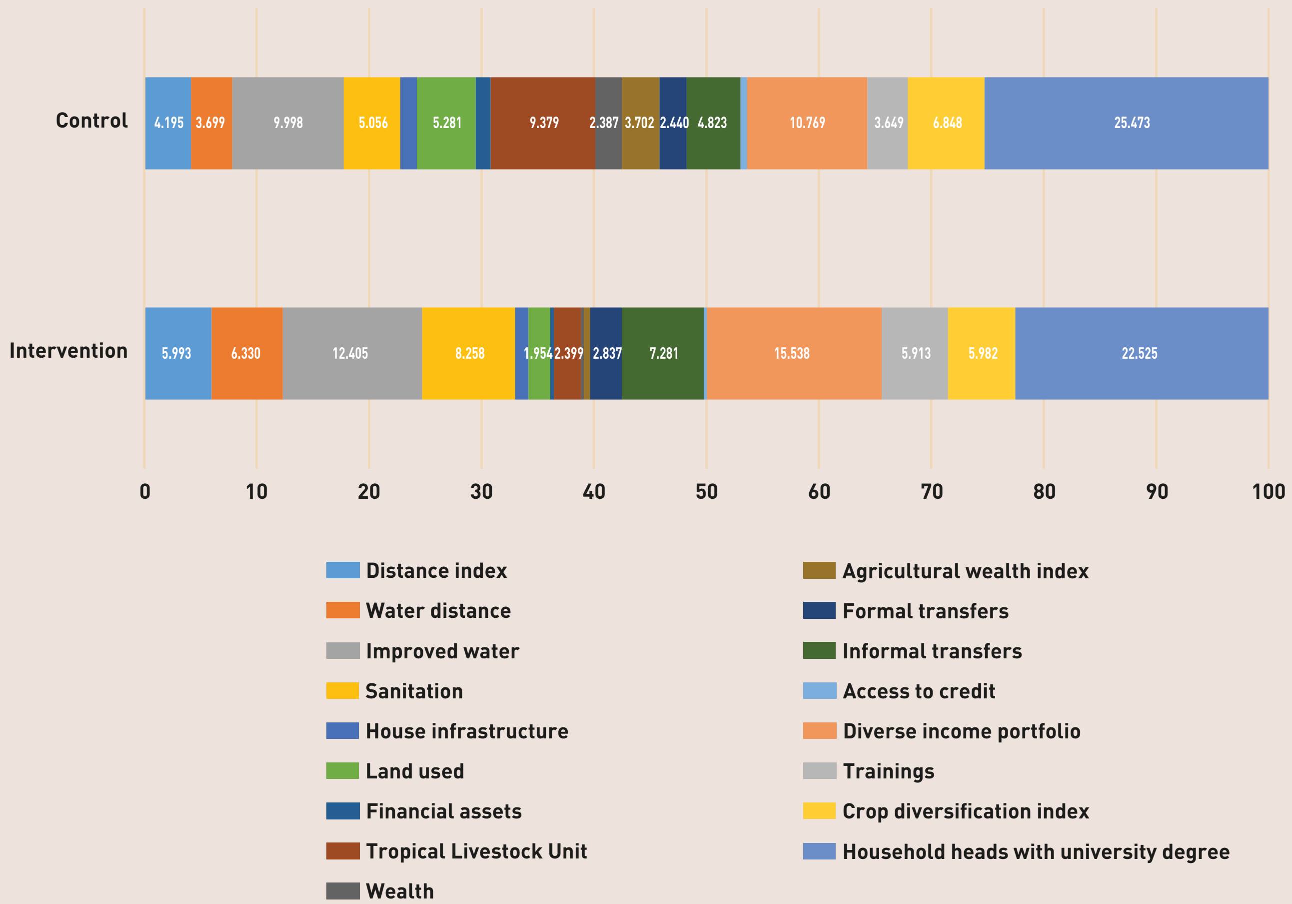
A3.1 TABLES AND STATISTICS

Figure A3. **Variables' weight in each pillars, by intervention/control (%)**



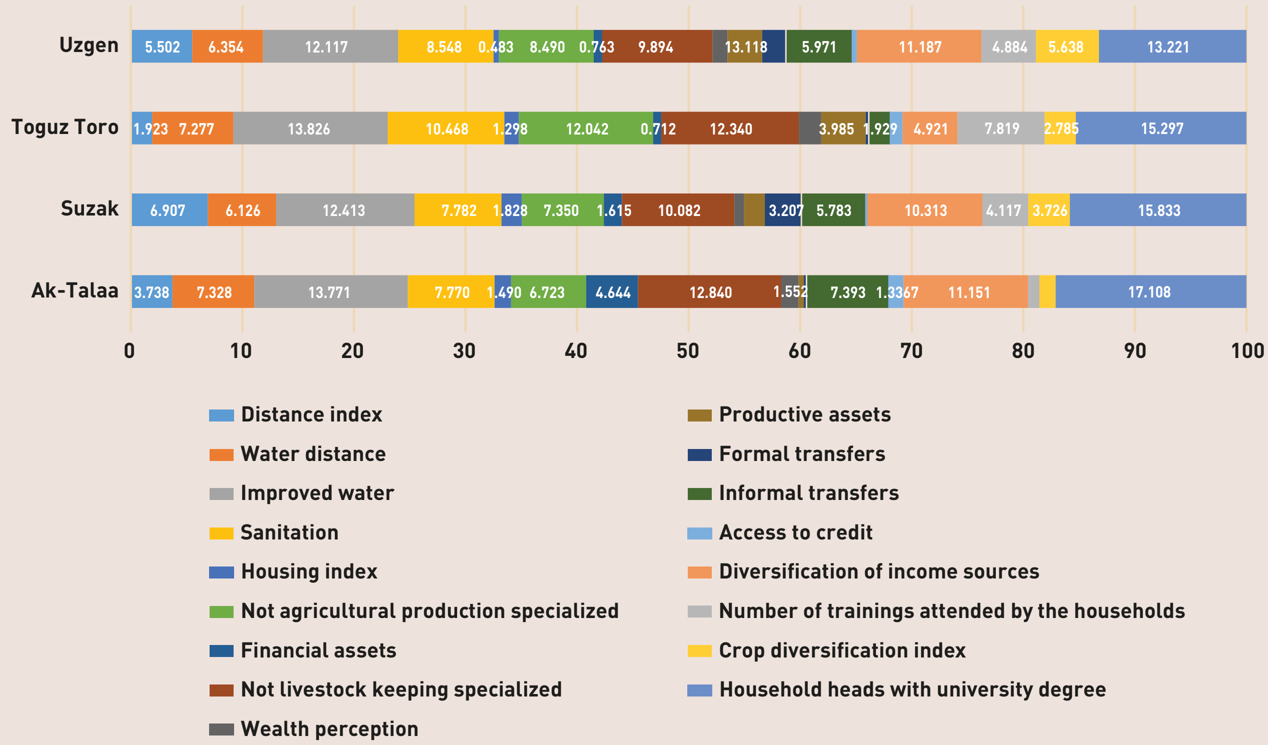
Source:
Authors' own calculations

Figure A4. **Variable's weight with respect to the final RCI at intervention/control group (%)**



Source:
Authors' own calculations

Figure A5. **Variable's weight with respect to the final RCI at district level (%)**



Source: Authors' own calculations

Table A8. **Variables' statistics**

Variable	Macro level	Intervention	Control	Ak -Talaa	Suzak	Toguz-Toro	Uzgen	Bakai-Ata	Jayil	Talas	Toktogul
ABS	**0.174**	**0.180**	**0.165**	**0.184**	**0.171**	**0.137**	**0.196**	**0.180**	**0.180**	**0.161**	**0.148**
Proximity index	0.254	0.255	0.252	0.255	0.256	0.241	0.255	0.257	0.246	0.252	0.254
Proximity to water source	0.115	0.122	0.104	0.096	0.114	0.132	0.135	0.077	0.111	0.114	0.109
Safe drinking water (%)	0.327	0.333	0.323	0.378	0.306	0.233	0.375	0.338	0.391	0.321	0.267
Sanitation (%)	0.065	0.078	0.036	0.044	0.066	0.067	0.103	0.062	0.047	0.024	0.022
Houseing index	0.702	0.697	0.713	0.710	0.701	0.716	0.686	0.716	0.719	0.703	0.717
AST	**0.113**	**0.113**	**0.114**	**0.114**	**0.109**	**0.117**	**0.118**	**0.100**	**0.112**	**0.142**	**0.101**
Per capita land used (ha)	0.581	0.590	0.557	1.293	0.448	0.642	0.634	0.534	0.788	0.398	0.559
Financial assets	0.185	0.190	0.178	0.200	0.183	0.167	0.201	0.185	0.172	0.202	0.156
Per capita TLU	1.001	0.993	1.005	1.355	0.941	1.113	0.975	0.969	0.990	1.020	1.030
Wealth perception	0.222	0.215	0.238	0.267	0.229	0.100	0.201	0.231	0.344	0.226	0.178
Agricultural wealth index	0.051	0.049	0.055	0.042	0.052	0.052	0.046	0.051	0.052	0.062	0.054
SSN	**0.049**	**0.051**	**0.042**	**0.031**	**0.065**	**0.012**	**0.043**	**0.066**	**0.073**	**0.046**	**0.000**
Transfers (formal, per capita, USD)	74.410	77.040	69.670	95.830	74.300	114.900	71.870	83.250	62.020	66.000	68.730
Transfers (informal, per capita, USD)	60.740	53.940	73.410	27.800	70.040	14.970	42.770	75.370	89.540	70.920	62.840
Access to credit (%)	0.304	0.308	0.294	0.222	0.316	0.233	0.326	0.262	0.422	0.345	0.178
AC	**0.190**	**0.181**	**0.211**	**0.277**	**0.178**	**0.223**	**0.160**	**0.238**	**0.207**	**0.263**	**0.146**
Diverse income portfolio	0.219	0.237	0.195	0.289	0.213	0.233	0.259	0.246	0.141	0.250	0.144
Number of trainings	0.415	0.400	0.439	0.244	0.415	0.167	0.442	0.231	0.641	0.393	0.489
Crop diversification index	0.171	0.176	0.161	0.266	0.170	0.159	0.169	0.168	0.211	0.148	0.134
Household heads with university degree	0.158	0.132	0.211	0.267	0.140	0.233	0.080	0.246	0.203	0.286	0.122
Climate change trend	**0.518**	**0.644**	**0.272**	**0.696**	**0.622**	**0.888**	**0.632**	**0.347**	**0.446**	**0.152**	**0.205**
Coefficient of variation long-term temperature	0.524	0.448	0.674	0.339	0.431	0.000	0.553	0.584	0.197	1.000	0.773
Coefficient of variation long-term rainfall	0.489	0.689	0.095	0.389	0.526	0.441	1.000	0.339	0.084	0.015	0.000
Exposure to climatic risk	**0.782**	**0.800**	**0.747**	**0.801**	**0.815**	**0.701**	**0.794**	**0.776**	**0.765**	**0.656**	**0.797**
Total forest lost in the past 15 years (ha)	0.388	0.281	0.599	37.579	38.352	10.618	59.530	34.175	41.238	101.526	132.145
Village population with respect to district population (%)	0.032	0.052	0.023	0.074	0.010	0.046	0.027	0.105	0.036	0.040	0.036
Altitude	0.460	0.406	0.487	0.657	0.469	0.615	0.461	0.500	0.249	0.460	0.400
Vulnerability	**0.434**	**0.446**	**0.411**	**0.446**	**0.452**	**0.437**	**0.439**	**0.406**	**0.429**	**0.437**	**0.377**
N. of migrants per household	0.423	0.485	0.392	0.400	0.449	0.333	0.321	0.446	0.516	0.595	0.389
Share of household members in working age (15-55)	0.730	0.744	0.703	0.762	0.746	0.757	0.736	0.705	0.736	0.720	0.660
Gini coefficient	0.533	0.545	0.509	0.520	0.552	0.644	0.527	0.516	0.537	0.455	0.535
Poverty headcount ratio	0.254	0.291	0.179	0.238	0.281	0.421	0.298	0.210	0.212	0.153	0.157
Climate sensitivity	**0.545**	**0.616**	**0.405**	**0.578**	**0.580**	**0.743**	**0.656**	**0.379**	**0.267**	**0.487**	**0.383**
RCI	**52.574**	**51.686**	**54.333**	**57.498**	**51.298**	**57.386**	**50.278**	**53.877**	**52.340**	**58.230**	**52.442**
Observations	903	600	303	45	301	30	224	65	64	84	90

Source: Authors' own calculations

Table A9. **Perception of climate change (self-reported, %)**

Perception of climate change	Ak-Talaa	Suzak	Toguz-Toro	Uzgen
No change in rain pattern	42.222	38.206	63.333	39.732
Less rain than usual	42.222	39.867	13.333	37.946
More rain that ususal	11.111	12.292	10.000	14.732

Source:
Authors' own calculations

Table A10. **Households' strategies as a results of the perceived climate change (%)**

Strategies	Ak-Talaa	Suzak	Toguz-Toro	Uzgen
Crop related strategies	28.889	25.914	26.667	28.125
Livestock related strategies	28.889	0.272	16.667	29.464
Migration strategies	8.889	6.977	6.667	7.143
New job strategy	8.889	13.953	3.333	15.625
Leased land	0.000	3.322	0.000	7.143
Insurance	2.222	6.977	3.333	6.696

Source:
Authors' own calculations

Graphic designer: Tomaso Lezzi

This report is part of a series of country level analysis prepared by the FAO Resilience Analysis and Policies (RAP) team. The series aims at providing programming and policy guidance to policy makers, practitioners, UN agencies, NGOs and other stakeholders by identifying the key factors that contribute to the resilience of households in food insecure countries and regions.

The analysis is largely based on the use of the FAO Resilience Index Measurement and Analysis (RIMA) tool.

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