ClimaEast

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Strategic Action plan for the Promotion of CSA in Georgia

Promoting Climate Smart Agriculture (CSA) practice in Georgia and Armenia

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This report has been elaborated for **ClimaEast**

Authors:
Rieks Bosch & Jelmer Buijs
The Netherlands

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1. Introduction

This action plan for Climate Smart Agriculture has been written with reference to and builds upon the National Strategy for Agricultural Development in Georgia 2015-2020.

In this strategy, Climate Smart Agriculture has been formulated as a separate strategic direction. However, it is in fact a cross-cutting approach, overlapping most other national strategic directions. Climate Smart Agriculture is sustainable agriculture, applying good agricultural practices and strategic agricultural choices, seen through the lens of a changing climate.[1]

Climate Change is a dynamic process, to which CSA is anticipative & adaptive. This requires a feedback mechanism based on indicators to assess and monitor the results. Such a mechanism is required for all actions under the strategy.

For each proposed action the most suitable level for implementation (farm/livelihood, regional or national) is identified, since the effectiveness of each action is strongly level dependent.
The leading document for systematic Climate Smart Agriculture is the Sourcebook of the FAO[2]. This FAO Sourcebook is one of the few sources that contain guidelines that are wide enough in scope to allow for the successful adoption of CSA.

This Strategic Action Plan is built on the National Strategy for Agricultural Development in Georgia 2015 – 2020 in comparison with the Climate Smart Agriculture Sourcebook of the FAO, the WB publications on Climate Change Adaptation in Agriculture in Georgia[3] and the South Caucasus[4], the UNDP Climate Change Strategy for Adjara[5], 2013, and the publication Climate Change and Agriculture in the Kakheti Region[6], 2014. Additionally, it is also elaborated with reference to the CENN publications on Climate Change Adaptation and Disaster Mitigation[7], 2013 as well as other referenced publications and, above all, draws upon the experience of the experts in the region.

A comparison is made between the collective guidelines and recommendations of the above documents and the National Strategy for Agricultural Development in Georgia and the recommendations drawn from that comparison and the reflections of the experts who author this report.

Where Climatic data is referenced, this is built upon the Third National Communication for Climate Change to the IPCC.

The Climate Smart Agriculture handbook (FAO) provides guidelines on the following with a view to the implementation of successful CSA practices:

- Landscape approaches
- Water management / Soil management
- Use of Genetic resources
- Crops/ Livestock/Horticulture production systems
- Climate smart forestry
- Sustainable Food value chains
- Energy management
- Role of Institutions
- Mainstreaming CSA into national policies and programmes

[1] According to the FAO CSA Sourcebook (2014), Climate Smart Agriculture is an approach aimed at sustainably increasing agricultural productivity and incomes, whilst adapting and building resilience to climate change and reducing/removing greenhouse gases emissions where possible.
[2] Climate Smart Agriculture Sourcebook, Food and Agriculture Organization of the United Nations, 2014
[3] Reducing the Vulnerability of Georgia's Agricultural Systems to Climate Change, WB, 2014
[4] Building Resilience to Climate Change in the South Caucasus, WB, 2014
[5] Climate Change Strategy of Adjara, UNDP Georgia, 2013
[6] Climate Change and Agriculture in Kakheti Region, UNDP Georgia, 2014
[7] Climate Change Adaptation and Disaster Mitigation, USAID/CENN, Tbilisi, 2013, Analysis of Dynamics and Trends in Land degradation in the regions of Target Transboundary Territories of the rivers Khrami, Debed, Alazani and Iori Basins, EU, 2009, Replication Strategy For the Regional Project Sustainable Land Management for Mitigating Land Degradation and Reducing Poverty in the South Caucasus Region, 2012

- Financing CSA
- Capacity building
- Disaster Risk Reduction and strengthening livelihoods resilience
- Role of Safety nets for making CSA work for the most vulnerable households
- Assessment, feedback and monitoring

Most of these elements can also be found in the Strategy for Agricultural Development in Georgia 2015-2020. Disaster Risk Reduction and the Role of Safety Nets however, are lacking in the current strategy and should be brought under the strategic direction of CSA for Georgia. Disaster risk reduction is of the upmost importance as several disasters, like landslides, mudflows and fires, are induced or their likelihood is increased by land degradation and other bad agricultural practices like the burning of fields, and agriculture and their livelihoods often occur as a result of a lack of Disaster Risk Reduction strategies. Safety nets like insurance (health, crop/livestock disease, weather-based etc) and community agro-diversity are important to allow agriculture to survive agricultural and climatic risks like droughts.

From the above elements from the FAO guidelines, the recommendation is that, in the Georgian context, priority should be given to capacity building, information supply on CC, research, soil management, and availability of equipment.

2. Strategic measures and CSA directions

In the following table strategic measures have been prioritized and the relationships between the strategic measures and the CSA directions have been indicated. These priorities were discussed and agreed in participatory workshops held in Tbilisi under the framework of the Clima East Expert Facility Assignment 'Promoting Climate Smart Agriculture (CSA) practice in Georgia and Armenia '.

The table shows the relation between the Strategy for Agricultural Development for Georgia 2015-2020 and the FAO Climate Smart Agriculture Guidelines. In addition, reference was made to the World Bank report 'Reducing the Vulnerability of Georgia's Agricultural Systems to Climate Change' and the UNDP report on Climate Change strategies for Kakheti and Adjara.

The actions proposed are categorised according to the Strategy for Agricultural Development for Georgia 2015 – 2020.

Table legend

The table below highlights the relevance of CSA and its different components against the list of measures in the Strategy 2015-2020.
Priority 1; priority to be addressed for CSA development in year 1-3
Priority 2; priority to be addressed later
NA; Not Applicable
O; relation between the strategic measures of the Strategy for Agricultural Development 2015 – 2020 and CSA directions (FA0)

Strategic measure	CSA Priority	Landscape	Soil/water	Gen. Resources	Agro products	Food value chain	Energy	Institutional	Policy	Funding	Capacity building	Disaster reduction	Safety nets	Monitoring
Strategic Direction 3.1: Enhanced competitiveness of rural entrepreneurs														
Measure 3.1.1 - Improved farmer knowledge and information and the delivery of efficient agricultural extension service	1										O			
Measure 3.1.2 - Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector	1										O			
Measure 3.1.3- Developing agricultural land market and introducing modern approaches in land use	2							O						
Measure 3.1.4- Developing specific tools to strengthen the agricultural credit and leasing system	2								O	O			O	
Measure 3.1.5- Supporting development of agricultural insurance market	2									O			O	
Measure 3.1.6- Supporting the development of cooperation in agriculture	2					O							O	

Measure 3.1.7- Developing tools to increase awareness of agricultural investment opportunities	2									O				
Measure 3.1.8- Implementing national agri-food promotions and marketing program	NA													
Strategic Direction 3.2: Institutional Development														
Measure 3.2.1- Improved MoA organizational structure and human resource management and training system	1							O			O			
Measure 3.2.2- Supporting an efficient market information in the agricultural sector	2					O				O				
Measure 3.2.3- Creating farm registry	2							O	O					
Measure 3.2.4- Strengthening coordination between the MoA, donor community and other stakeholders	2							O						
Strategic Direction 3.3: Amelioration and Soil Fertility														
Measure 3.3.1- Improved irrigation and drainage systems	2		O					O						
Measure 3.3.2- Rational use of soil	1		O											
Strategic Direction 3.4: Regional and sectorial development - value chain development														
Measure 3.4.1- Defining and supporting rural development and investment strategies for each region	2					O		O	O	O			O	
Measure 3.4.2- Development, implementation and monitoring of sectorial agricultural programs	1							O	O					O
Measure 3.4.3- Supporting the further development of geographic indication schemes and appellations of origin	NA													
Measure 3.4.4 – Supporting the development of seed and planting material	1			O	O									
Measure 3.4.5- Supporting the seed/planting material certification process	2			O	O									
Measure 3.4.6. Development of Breeding System	2			O	O									

Measure 3.4.7- Strengthening post-harvest services, facilities, and operations	2				O	O								
Measure 3.4.8- Improved access to input supply services	2		O		O	O	O							
Measure 3.4.9- Improved access to agricultural machinery	1		O		O	O	O							
Strategic Direction 3.5: Ensuring Food Security														
Measure 3.5.1- Monitor food security	NA					O			O					
Strategic Direction 3.6: Food Safety, Veterinary and Plant Protection														
Measure 3.6.1- Developing efficient and flexible food safety system that will be consistent with EU legislation and reflecting specific features of the Georgian agricultural market	NA													
Measure 3.6.2- Veterinary	2			O	O	O								
Measure 3.6.3- Plant protection and phytosanitary reliability	2				O				O					
Measure 3.6.4- Laboratory Capacity Enhancement and Establishment of Modern Testing Techniques Compliant with the International Standards for Food Safety, Animal Health and Phyto-sanitary Control Programs	NA													
Measure 3.6.5- Review and develop border control veterinary and phytosanitary inspection points for agriculture import/export monitoring	NA													
Strategic Direction 3.7: Climate Change, Environment and Biodiversity														
Measure 3.7.1- Maintaining good agricultural practices, biodiversity and environmental sustainability programs	1	O	O		O						O			
Measure 3.7.2- Gene bank development/management of endemic genetic resources	1			O					O					
Measure 3.7.3- Promoting climate smart agriculture (CSA) practice	1	O	O		O			O			O	O		

The comparative table between the Strategy for Agricultural Development 2015 – 2020 and the guidelines for Climate Smart Agriculture of the FAO shows that the measures set out in the Strategy are cover the vast majority of the directions of the FAOs recommendations. This implies that CSA can be more 'easily' mainstreamed within the National Strategy. Bottlenecks exist at the level of implementation set out in the strategy and these can be addressed by adaptation activities under the measures.

Based on logical relationships, a priority is set for the measures. For example awareness raising follows capacity building and research, institutional strengthening follows capacity building and water management follows soil management. The priorities were discussed and agreed in national workshops on Climate Smart Agriculture.

Climate Smart Agriculture is an approach to be adopted by farmers. Authorities can provide incentives, but the actual decisions are made on the farm level so there needs to be buy-in.

Main priorities selected for Climate Smart Agriculture are therefore:

- Capacity building at a farm level and agricultural research coordinated and directed towards CSA
- Capacity building at ministerial level and focus of the institutional setting towards the regions
- Availability of seed material and adapted equipment for Climate Smart farm management
- Information supply on weather and climate
- Regional demonstration of best practices for CSA

In the following chapter activities under the first priority measures are worked out. In the Appendix the second priority measures are mentioned to be worked out as soon as capacity is available.

2.1. Actions for Climate Smart Agriculture

(Following the logic of the measures set out in the National Strategy for Agricultural Development for Georgia 2015 - 2020)

In this chapter the recommended first priorities are justified through an explanation of the rationale by which they were determined. Second priority activities are listed in the Annex 1.

For each section below we present:

- Introduction – background in Georgia, institutional setting, key issues and how CSA is relevant to that particular measure, which area of CSA this relates to (better information systems and climate knowledge, better understanding of impacts, better decision making, better management of agricultural practices, capacity building… etc)
- Activities for mainstreaming CSA in the measure– tasks to be carried out, with details on how, when, what, for whom (target)
- Budget and Timeframe

2.2. Measure 3.1.1 - Improved farmer knowledge and information and the delivery of efficient agricultural extension service

CSA Action 3.1.1.1 – Improving farmer's knowledge level

Introduction

The key issue for Climate Smart Agriculture is the availability of information and the ability at farm level to interpret them.

It is acknowledged that a large proportion of the present population of Georgian farmers do not have an education in agriculture. It is therefore important for training courses to be organized in order to reach this group of practicing farmers in a convenient manner for them, for instance through evening courses. In those courses the topic of CSA should be dealt with in non-technical language and should include an explanation of all consequences for the farming practitioners. In order to make those trainings possible, curricula must be elaborated and selected trainers of agricultural colleges trained in content and teaching methods in order to reach this group. Investigations need to be conducted into what other

trainings farmers are interested in. On that basis, modules and blocks of different subjects can be formulated.

Training of practicing farmers

In many cases, farmers have rich experience but little information from outside their direct environment. This is predominately the case in Georgia (see paragraph 3.1.1 of the Strategy for Agricultural Development 2015-2020). It was also confirmed by the farmers participating in the trainings that were conducted in the framework of this project. The impact of this in Georgia is increased by the fact that many present farmers moved after the perestroika from the city to rural areas and have limited agricultural knowledge. New information is required to react on and anticipate climate change and to conduct modernization of farms and farming practices in general. In trainings organized for this target group practical skills and theoretical knowledge must be integrated, since this combination is of more direct importance for the farmers. Separate curricula should be elaborated for arable farms, pasture farms, and orchard farms. The available reports (the Strategy for Agricultural Development 2015-2020 and the World Bank study 87948) give no quantification of the number of agricultural extensionists working in Georgia, the number of yearly consultations or the quantification of the farmer's field schools. They state however that the impact of those there are at present is very small. The farmers that participated in the project's training also confirmed that same fact. The Organic farming association Elkana has its own extensionists, but no figures are available on how many farmers they reach and on what issues they are consulted by which category of farmers. There are for different sectors quite different technical solutions to be taught. It is logical to start with general subjects and approaches for all farmers, like low till, fertility issues related to climate behaviour of crops, mechanization issues, variety choice etc. If the training courses are going to be well enough attended and if the teachers have the requisite experience, more specialized courses can be designed for special sectors, like arable farming, pasture management, horticulture etc.

Training methods

In order to guarantee a high degree of integration of practical and theoretical knowledge it would also be useful if field trainings were to be incorporated into the curricula. Use of active and interactive training methods should stimulate the quality of the trainings and the commitment of the trainees. During off season, use of video materials of different farm practices should become an integral part of the training methodology. In order to make a choice between different forms of knowledge transfer, the subjects must be divided into those that are more suitable for farmer field schools and those that are better for theoretical training courses and individual consultations.

Training of young farmers

Information on CSA should be preferably integrated in existing curricula. If this is not feasible in the short term, CSA should be taught as a separate block, and in the longer term integrated into present subjects.

Training of Trainers

In order to be able to organize the mentioned trainings for farmers and agricultural students, trainers must be trained in all relevant subjects. The ministry responsible for the agricultural colleges can form a task force that should formulate the targets of these training courses. They should also identify the learning materials and elaborate the teaching modules with lesson plans.

Access to training

Training should be held at moments that are convenient for farmers and financial conditions should also be acceptable for them to participate. The training courses should be actively offered to the target group including a reward in the form of certificates of participation. It is unlikely that all farmers are able to pay for the training themselves, so stipendia opportunities are likely to be required to give large groups of farmers access to the training courses.

Agricultural extension

In addition to agricultural training, extension services should provide farmers with relevant impartial information during their professional life. Extension services have a very important function with regards to modern agriculture in all countries. Farms cannot only rely on commercial sources of information from input suppliers. Extension services are not only important for CSA, but for any agricultural development, so in that sense they are not only a specific requirement for CSA.

LEPL Scientific-Research Center of the Ministry of Agriculture of Georgia is responsible for the information supply to the extension services in Georgia. It is important to assess their results and to integrate information on CSA in t their whole work. In addition it will be necessary to design information packages on CSA for specially focused action. The extension staff should obtain training on CSA to start with. Their staff could be trained together with the key teachers of agricultural colleges. The target group of the extension services should be each farm operating within the country. In total there were as of 2004, according to the Strategy for Agricultural Development in Georgia, 691000 farms of which 57000 were smaller than 0,1 ha and the majority (462000) with an area from 0,1-1 ha.

Activities

Summarized, the proposed activities to improve the farmers knowledge level, are:

- Elaboration of curricula for evening / winter courses
- Training of trainers to enable farm level CSA knowledge transfer
- Integration of CSA in existing course curricula, elaboration of modules and lesson plans
- Elaborate subsidy schemes for training (stipendia) to overcome financial bottlenecks
- Training of extensionists to enable the further spread the CSA knowledge
- Elaboration of tailor made information for Georgian sectors and regions
- Conducting farmer courses

Target group

The target group for improvement of the present extension system are the (public/private) extension services themselves and the structures managing and supporting them, like LEPL. Farmer associations like Elkana and others that also deal with extension should also be the target group.

Leading organization

A new Task force should be established by the Ministry of agriculture with representatives of farmer unions, extension services and the research community.

Goal	Actions	Estimated costs per sector (EUR)	Estimated costs for 5 sectors, covering 691000 farms
Improve level of knowledge of farmers	Elaboration of curricula for evening / winter courses	10000	50000
Improve training level of teachers of agricultural colleges	Training of trainers	10000 per sector (See CSA Action 3.1.2.1 – VET)	50000
Curricula adaptation	Integration of CSA in existing farmer course curricula, elaboration of modules and lesson plans	20000	100000 (for 5 sectors this is done nationally and not per region)
Increase access to training	Elaborate grant schemes for trainees (stipendia)	100 euro per farmer, for 30000 farmers per year=3 million	3 million
Increase awareness on CSA in extension service	Training of extensionists	100 extensionists trained for 50000	50000
Information packages on CSA	Elaboration of tailor made information for Georgian sectors	10000 per sector for electronic information to be used on PC or mobile phone	50000 for 5 sectors
Training of farmers	Conducting specialized courses	To be elaborated	To be elaborated

Indicators

- Elaborated evening courses for adult farmers
- Trained trainers
- Modernized curricula, ready for use modules and lesson plans
- Grant schemes operational for adult farmers
- Trained extensionists
- Information packages for key Georgian agricultural sectors

ღონისძიება / Measure 3.1.1 - Improved farmer knowledge and information and the delivery of efficient agricultural extension service				
CSA Action 3.1.1.1 – Improving farmer's knowledge level				
რეკომენდირებული ზომები / Recommended actions:	*2016*	*2017*	*2018*	*After 2018*
• Elaboration of curricula for evening / winter courses	x	x	x	X
• Training of trainers		x	x	
• Integration of CSA in existing course curricula, elaboration of modules and lesson plans	x	x		
• Elaborate subsidy schemes for training (stipendia)	x			
• Training of extensionists				
• Elaboration of tailor made information for Georgian sectors		x		
• Conducting farmer courses		x		
		x	x	x

პასუხისმგებელი ორგანიზაცია/ Responsible organization :	*ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:*
New Task force to be established by the Ministry of agriculture with representatives of Farming community, farmer unions, extension service, research community	

სავარაუდო დაფინანსება/ Estimated funding:	*თანხების განაწილება/ Distribution of funds*			*თანხების განაწილება წლების მიხედვით/ Distribution of funds according to the year:*		
	მთავრობა/ Government:	*დონორი ორგანიზაცია/ Donor organizations*	*კერძო სექტორი/ Private sector*	*% 2016*	*% 2017*	*% 2018*
3.3 million, excl. courses	80%	20%		30	30	40

მოსალოდნელი შედეგი/ Expected results:	*ძირითადი ინდიკატორები/ Main indicators:*
• Trained trainers in all 9 regions • Modernized curricula, ready for use modules and lesson plans • Available stipendia for adult farmers • Trained extensionists in CSA • Information packages for key Georgian agricultural sectors • Operational adult farmer courses in all 9 regions	• Number of trained trainers in the regions • Curricula & modules approved by all stakeholders, available for colleges • Number of stipendia available for adult farmers • Number of trained extensionists in the 9 regions • Number of packages distributed to the regions • Number of trained farmers in 9 regions

2.3. Measure 3 1 2 - Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector

CSA Action 3.1.2.1 – Mainstreaming CSA into Vocational Education Training (VET)
Introduction

The quality of farmer's VET and the access of farmers to VET is of decisive importance to the professional competences of farmers. At present the VET colleges suffer from low budgets, unsatisfactorily qualified teachers and outdated technical means.

Activities

-
- Elaboration of new CSA directed curricula
- Elaboration of new lesson plans
- Training of VET teachers (2 weeks)
- Development, production and distribution of CSA training materials
- Monitoring of quality to select champions and to improve the quality

Contribution to CSA

For the introduction of most of the measures needed for CSA, farmers are required that understand the possibilities to anticipate and react to climate change. As we have noticed before, it is even more important that they deeply understand the essentials of good management practices in general. For instance, soil fertility management is very important for any type of farming and it is heavy influencing the climate change resilience of all crops, including pastures. Soil fertility management is a subject that should be taught to any farmer. There is no need to call that subject CSA soil fertility management although CSA theory and practice might add certain aspects to soil fertility management. In sum, curricula and teaching materials can be slightly adapted and thus CSA theory and practice can be mainstreamed inside a system of ordinary agricultural training.

Target group

Agricultural VET colleges and their students

Lead organization

The lead organization in the process of modernization of VET curricula should be the Ministry that is responsible for the VET colleges. If they do not possess inside the ministry the necessary skills and experience to elaborate a new curricula, they can form a task force with members of different organizations including farmers groups. Since the former VET system has collapsed, only a few VET colleges have remained (source: verbal information from workshop participants). It means that the remaining VET colleges will have to bear a large responsibility in order to modernize and extend the role of the VET system. It is however, unthinkable that agricultural can be developed without a good VET system. The commercial service providers can pass certain information on to the farms, but they can never replace a good VET system. The same applies to the consultancy providers (extension services). If there are no qualified people inside the country, candidates must be trained abroad. For instance, undersigned authors have advised the Ministry of agriculture to train a core group of specialists on sustainable pasture management from the task force in Austria and Italy. There is no sense in re-inventing the wheel. The potential economic benefits of various aspects of CSA (as e.g. sustainable pasture management) fully justify such relatively small investments. In addition, the ministry can apply for the international funding of various activities. The activities can be earmarked as climate change mitigation, but also as economic development, or as biodiversity conservation, since various aspects of CSA (like pasture management) concern all fields.

Funding

Target group	Actions	Estimated costs per sector/region (EUR)	Estimated costs for sectors/regions (EUR)
VET colleges	Elaboration of new curricula	5000 per sector	For 5 sectors makes 25000
VET colleges	Elaboration of new lesson plans	7000 per sector	For 5 sectors makes 35000
VET colleges	Training of VET teachers (2 weeks)	10000 per sector	For 5 sectors 50000
VET colleges	Development, production and distribution of training materials	10000 per sector	For 5 sectors 50000

In this table it is assumed that separate curricula have to be elaborated for animal husbandry, arable farming, mixed farming, fruit production and for horticulture (grapes, tea, vegetables etc).

Indicators

- New curricula ready
- Lesson plans elaborated and approved
- Key groups of VET teachers trained
- Training materials produced and distributed to end users

ღონისძიება / **Measure 3 1 2 - Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector**				
CSA Action 3.1.2.1 – Vocational Educational Training (VET)				
*რეკომენდირებული ზომები / **Recommended actions:***	***2016***	***2017***	***2018***	*After 2018*
• Elaboration of new curricula	X	X	X	X
• Elaboration of new lesson plans	x	X	X	x
• Training of VET teachers (2 weeks)		X	X	
• Development, production and distribution of training materials		x	x	x

*პასუხისმგებელი ორგანიზაცია/ **Responsible organization:***	*ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით / **With support of following organizations:***
Ministry that is responsible for the VET colleges	Stakeholder organizations

*სავარაუდო დაფინანსება/ **Estimated funding:***	*თანხების განაწილება/ **Distribution of funds***			*თანხების განაწილება წლების მიხედვით/ **Distribution of funds according to the year:***		
	*მთავრობა/ **Government:***	*დონორი ორგანიზაცია/ **Donor organizations***	*კერძო სექტორი/ **Private sector***	***% 2016***	***% 2017***	***% 2018***
160000	90%	10%		40	40	20

*მოსალოდნელი შედეგი/ **Expected results:***	*ძირითადი ინდიკატორები/ **Main indicators:***
• Improved lesson packages on CSA • Updated curricula • Ready to use lesson plans • Trained VET teachers on CSA • Training materials	• available curricula for 5 agricultural profiles • Lesson plans elaborated and approved • Key groups of VET teachers trained on CSA • Training materials produced and distributed to end users

2.4. Measure 3 1 2 - Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector

CSA Action 3.1.2.2 – Improved quality of university education

Introduction

University graduates normally occupy positions in research, extension and in business management. It is crucial that graduates are well informed about and trained in CSA and that they have a tight relationship with agricultural practice. Statistical detail about the existing level of knowledge amongst university graduates in the field of CSA is however, not readily available.

Activities

A more detailed investigation should be made of those working in research, extension and in agro-business, what staff categories work in these spheres and which of them would be the best beneficiaries of CSA training. It should be made sure that the training recipients will have the real desire to cooperate with the farming sector in training and research.

Special field of attention are modelling and remote sensing. For this, students could also be selected to do their Masters on these at other universities like the UNESCO Centre of Excellence – ITC, NL.

In other countries, trial farms are used to conduct research and train university students. In addition, there are systems of private demonstration farms that are ordinary farms disseminating university expertise and that offer practical training opportunities to university students. Both are enhancing the student's integration of theoretical knowledge and practical experience. In Western European countries, like the Netherlands and Germany this system is working very well and they may serve as an example for Georgian initiatives. Exchange programs of agricultural students between Georgia and Germany have been running for years. They were focused on students and young farmers, not though on decision makers (source: personal information).

Contribution to CSA

Research, extension and agri-business are crucial elements for the introduction of CSA. It has been established that even the meteorological specialists need further training for the collection and processing of agricultural focused data. University training needs to be intensified on rotational grazing and more practice oriented, arable farming research needs to become focused on water conservation, humus accumulation and ecological restoration, irrigation etc. University students need to be intensively acquainted with the facts of the changing climate and with the climate mitigation measures. Abroad there is an abundance of materials on those topics, but they are not suitable for Georgia without adaptation.

Lead organization

The university should be able to form a task force that will be able to develop adapted curricula for students and specialized courses for those that are interested in CSA/improved management systems

Funding

Target group	Actions	Estimated costs per region (EUR)	Estimated costs for 9 regions (EUR)
University staff	Elaboration of CSA integration plan	With current budget	With current budget
	Identification and contracting of educational staff and guest teachers	50000	n.a. since there is only one agricultural university in Georgia
University staff	Selection of useful foreign training modules that can be used as example for Georgian training materials	10000	n.a. since there is only one agricultural university in Georgia
University council	Development of new courses	20000	n.a. since there is only one agricultural university in Georgia
Trial farms of university	Implementation of new field experiments on CSA on trial farms	50000	n.a. since there is only one agricultural university in Georgia
University supported demonstration farms	Establishment of demonstration farms in order to show improved management practices	30000	270000

Indicators

- CSA integration plan for university training programs
- New courses defined and operational
- CSA integrated in field trials of experimental farms
- Private demonstration farms implementing and demonstrating CSA practices
- Number of students trained

ღონისძიება / Measure 3 1 2 - Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector				
CSA Action 3.1.2.2 – Improved quality of university education				
რეკომენდირებული ზომები / Recommended actions:	2016	2017	2018	After 2018
• Elaboration of CSA integration plan • Development of new specialized courses, like on remote sensing and modelling • New staff attracted for these courses • Implementation of new field experiments on CSA on trial farms • Establishment of private demonstration farms in order to show improved management practices	x	X x	X x x	 x x

პასუხისმგებელი ორგანიზაცია/ Responsible organization :	ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:
The university with a task force that will be able to develop adapted curricula and take the lead for the trial farms and demonstration farms	

სავარაუდო დაფინანსება/ Estimated funding:	თანხების განაწილება/ Distribution of funds			თანხების განაწილება წლების მიხედვით/ Distribution of funds according to the year:		
	მთავრობა/ Government:	დონორი ორგანიზაცია/ Donor organizations	კერძო სექტორი/ Private sector	% 2016	% 2017	% 2018
390000	350000	40000		30	30	40

მოსალოდნელი შედეგი/ Expected results:	ძირითადი ინდიკატორები/ Main indicators:
• CSA integrated in university education • New specialized courses • Field experiments on CSA on trial farms • Private demonstration farms implement and demonstrate CSA practices	• CSA integration plan for university training programs approved & implemented • New courses defined and operational • Number of students following CSA course • CSA integrated in field trials of experimental farms • Number of private demonstration farms implementing and demonstrating CSA practices & number of registered demo farm visitors

2.5. Measure 3 1 2 - Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector

CSA Action 3.1.2.3 – Improved quality of research

Introduction

The links between research, agricultural practice, agri-business and administration are weak, resulting in a lack of innovation. The steering of the agricultural research at this current time is not based on the national strategy, resulting in weakly applicable results. The diversity of the climatic conditions require

a more regional approach in research with stronger links to practice. Applied research in this context is of high importance.

To enable the research to reach the farmers community there is need for regional and on-farm research combined with knowledge transfer and cooperation with extension services to spread the research results.

Activities

A set of related activities on research are required to enable CSA innovation and effective support of value-chain adaptation. It is essential that all agricultural research, under Agriculture or Education and Science, are focused in a national strategy towards CSA and multi-sectoral techno platforms are set up to stimulate innovation and cooperation between the stakeholders. Also more attention should be given to demonstration and dissemination to ensure outreach of the results:

- Elaboration of national research strategy
- Organization of national and regional meetings on CSA
- Multi sectoral Techno platforms formed including business, administration and educational institutes
- Integrating distance learning in the VET
- Setting up of research and demonstration plots
- Elaboration of demonstration plan (in cooperation with regional extension services)
- Intensive dissemination of research results

Contribution to CSA

To develop the research capacity on CSA, research priorities need to be formulated and national coordination between all agencies involved is needed. Research can deliver more accurate climatic information, better adapted breeds and varieties, and recommendations for resource saving cultivation methods. Research can in a more regional approach also contribute to better CC awareness on farm level. In all West-European countries there are intensive variety testing programs on research farms and on private farms. There are also research institutions that follow holistic research approaches, integrating various agro-ecologic factors. All those institutions can serve as a model for similar Georgian initiatives to draw upon.

Research can contribute to the development of farmer's tools (like summary degree days and other measurable tools) to predict crop development and in this way steering CSA management.

Research

To make optimal use of the research capacity national and cooperative steering is needed of the research. Good steps are already set by joining several research institutes. This could be based on the national agricultural strategy. Development of Technology platforms where research, agricultural practice, business and administration meet each other is a proven tool for innovation.

The diversity of the Georgian landscape makes more regional oriented research necessary. This can be implemented by regional and on-farm research and demonstration plots, in close cooperation with extension services for dissemination of information and for capacity building. In countries with such diverse climatic conditions like Georgia, it is very important to test and select good crop varieties for each region. Another urgent subject is the low till technologies for arable farming. In certain areas on-farm research should be the focus, because the fundamental research has already been done abroad. Implementation of rotational grazing practices is of immense importance in the mountain areas of Georgia. This should be implemented without the need for research first as experience from elsewhere suggests it is vital that this is done immediately. Soil fertility has an immense influence on the resilience of crops to the changing climate (as earlier mentioned). This aspect can be included in variety testing programs and in on-farm research.

As part of agricultural, scientific education and research is done by the universities, close cooperation is needed between the ministry of Agriculture and the ministry of Education and Science. Also more cooperation between the research institutes should be encouraged to optimize the available capacity and the cross-breeding between sectors.

Target groups

Research, Business sector representation, extension services, farmers

Lead organization

Ministry of Agriculture, Ministry of Education and Science

Funding

Target group	Actions	Estimated costs per region	Estimated costs for 9 regions
Universities	National Research strategy	Part of current budget	Part of current budget
Technical platform	National and regional meetings	10000	50000 for 5 sectors
Research institutes	Research and demonstration plots set up	250000	1750000
Applied research farms	Elaboration of demonstration plan (in cooperation with regional extension services)	100000	900000

Indicators

- National agricultural research strategy
- Technical platforms set up
- Regional and on-farm research and demonstration farms set up
- Demonstration plan per region (in cooperation with extension services)

ღონისძიება/Measure **Improved quality of vocational educational training (VET), university education and research within the food and agricultural sector**				
CSA Action 3.1.2.3 – Improved quality of research				
რეკომენდირებული ზომები/Recommended actions:	***2016***	***2017***	***2018***	***After 2018***
• Elaboration of national research strategy	x			
• Organization of national and regional meetings on CSA		x		
• Multi sectoral Techno platforms formed including business, administration and educational institutes		x	x	
• Integrating distance learning in the VET		x	x	
• Setting up of research and demonstration plots		x		
• Elaboration of demonstration plan (in cooperation with regional extension services)		x	x	X
• Intensive dissemination of research results				
პასუხისმგებელი ორგანიზაცია/ Responsible organization:	***ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:***			
Ministry of Agriculture, Ministry of Education and Science				

სავარაუდო დაფინანსება/ Estimated funding:	***თანხების განაწილება/ Distribution of funds***			***თანხების განაწილება წლების მიხედვით/ Distribution of funds according to the year:***		
	მთავრობა/ Government:	***დონორი ორგანიზაცია/ Donor organizations***	***კერძო სექტორი/ Private sector***	***% 2016***	***% 2017***	***% 2018***
2700.000	75%	20%	5%	20	40	40

მოსალოდნელი შედეგი/ ***Expected results:***	*ძირითადი ინდიკატორები/* ***Main indicators:***
• National agricultural research strategy • Technical platforms • Regional and on farm research and demonstration farms involved in CSA • Plan with priority demonstrations	• National agricultural research strategy approved and adopted • Technical platforms have regular meetings • Regional and on-farm research and demonstration farms set up • Demonstration plan per region adopted and implemented (in cooperation with extension services)

2.6. Measure 3 2 1- Improved MoA organizational structure and human resource management and training system

CSA Actions 3.2.1.1 CSA organization structure for MoA

Introduction

Due to the diversity of the Georgian landscape Climate Change can have a different impact in different regions. In order to address this diversity properly, a more regionalized approach is required. This requires in turn more regional climate change knowledge inside the ministry and regional communication platforms with the stakeholders. In order to fulfil the task of improving farmers access to agronomic technology and information and to optimize the use of extension services and the inter-sector and interagency coordination both way communications with the region should be increased. Farmers have to make new choices on the level of land use, land management, and marketing. Thus farmers need more information on weather, climate, potential products and natural resources. Partially the local authorities can provide such information to support the CSA development process, like on land use, land degradation, market development, etc. CSA development requires intensive communication between the farmers, authorities and agribusiness

Regional communication and cooperation

CSA requires good communication and cooperation between different stakeholders. It is crucial that communication between policy makers and stakeholders will have two directions. Both stakeholders and policy makers will benefit from good communication and cooperation. This requires mutual understanding & knowledge. For the Ministry of Agriculture this means a higher level of knowledge and understanding of the regions and of the regional impact of CC. Hence the ministry should understand the regional options for adaptation, and should regularly communicate on the changing situation and provide advice on the options for adaptation.

Cooperation is also feeding the partners with effective, nationally assessed information.

Strengthening the regional coordination structure of the ministry could also be considered as could bringing in more regional knowledge to the ministry. For this, regional communication platforms should be created or strengthened.

Within the MoA CSA related information has to be assessed on a regular basis. Based on this assessment the national communication department can prepare information and disseminate the CSA knowledge to farmers.

It is proposed that after the necessary capacity building, the regional communication and CSA will be brought under one ‘champion‘department.

Training system

Two components of the Ministry of Agriculture are meeting each other here: regional knowledge and CSA knowledge. To enable the staff to become updated on regional knowledge and CSA, the internal training system should be established. Ministries are centralized institutions, while CSA requires a strongly decentralized approach. Communication therefore in two directions is essential for the

development and implementation of CSA policies. At present the Ministry of Agriculture has only very superficial information about the farming sector.

Activities

To prepare the MoA for a more regional approach and CSA, capacity has to be prepared and two-directional communication with the region has to be set up, and information assessed and prepared for awareness raising, preferable coordinated by one department.

- Exchange of information with the regions based on regional platforms
- Assessing CSA information and prepare for the spreading of regional advice
- Conducting of communications training with rural stakeholders

Contribution to CSA

CC has a local and regional impact. Thus CSA requires local and regional adapted solutions and approaches. In order to address the CC dynamics both way communication with the stakeholders is required.

Target group

Regional / local level farming community and business

Lead organization

Ministry of Agriculture

Funding

Target group	Actions	Estimated costs per region	Estimated costs for 9 regions
Regional platform	Exchange of information	30000	270000
Information department	Assessing CSA and CC information and prepare for dissemination	60000	54000
Capacity building on communication	Conducting of communications training with rural stakeholders	30000 for all regions	30000
			354000

Indicators

- Regional communication platform in place
- Reports on regional communication
- Yearly report on regional CC adaptation and CSA
- Training system in place on regional aspects and CSA

***ღონისძიება/Measure* 3 2 1- Improved MoA organizational structure and human resource management and training system**				
CSA Actions 3.2.1.1 CSA organization structure for MoA				
რეკომენდირებული ზომები/Recommended actions:	***2016***	***2017***	***2018***	*After 2018*
• Exchange of information • Assessing information and prepare for spreading • Conducting of communications training with rural stakeholders	X X x	X X x	X X x	X X x
პასუხისმგებელი ორგანიზაცია/ Responsible organization :	***ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:***			
Ministry of Agriculture				

სავარაუდო დაფინანსება/ ***Estimated funding:***	*თანხების განაწილება/* ***Distribution of funds***			*თანხების განაწილება წლების მიხედვით/* ***Distribution of funds according to the year:***		
	მთავრობა/ ***Government:***	*დონორი ორგანიზაცია/* ***Donor organizations***	*კერძო სექტორი/* ***Private sector***	***% 2016***	***% 2017***	***% 2018***
354000				40	30	30

მოსალოდნელი შედეგი/ ***Expected results:***	*ძირითადი ინდიკატორები/* ***Main indicators:***
• Regional communication platform • Information on CC and CSA analyzed and made available for dissemination • Reports of the regional platforms • Yearly report on regional CC adaptation and CSA • Training system established on regional aspects and CSA	• Communication platform is working • Reports with information on CC and CSA analyzed and disseminated • Reports on regional communication approved • Year reports written and approved • Number of persons trained

2.7. Measure 3 3 2- Rational use of soil

CSA Actions 3.3.2.1 Stimulation of rational use of soil

Introduction

The quality of the soil suffers under many present systems of agriculture, especially when the soil lays bare part of the year, like in arable farming, vineyards etc. Also in the case of pasture land, due to heavy grazing, the soil often lays bare. This has a tremendous negative impact on the soil quality (and soil quantity). The changing climate, causing more extreme situations (higher temperature/more heavy rain/snowfall/droughts/ etc.) is worsening the impact of the soil degradation. The steepest lands are used as pasture and at present the shepherds have the practice to let their animals graze the alpine pastures very short in September (source: personal information). This practice is not only bad for the re-growth of the pastures in the spring, but it is also bad for the soil. Soil from the short grazed pastures moves in the spring together with melting water to the river beds.

Only an integrated approach can address this issue effectively. Under other measures and actions it has been already stated (and it will be stated in the next actions) that actions on various parallel levels are required. Effective systems of minimal tillage should be elaborated, and disseminated, and the suitable farm mechanization for those systems should become available for the farms **(CSA Action 3.4.9.1 - Improved access to agricultural machinery).** Agricultural and meteorological research must collect further data and process them for the end-users (**CSA Action 3.1.2.3 - Research**)

The theory of soil conservation should be integrated into the curricula and lesson programs on the VET colleges, agricultural universities and perhaps also on secondary schools, as a significant part of the farmers will never visit VET agricultural colleges (**CSA Action 3.1.2.1 - VET**). The overview information can be extracted from Climate Change monitoring (**CSA Action 3.4.2.1**), based on the Information on CSA (**CSA Action 3.7.3.1)**

Activities

Four activities on rational use of soil are identified as necessary to support Climate Smart Agriculture development in this stage:

- Investigation of the state of soil erosion (by remote sensing and by on-ground research)
- Elaboration of national soil protection plan
- Elaboration, production and distribution of brochures, and video films on measures on farm level
- Targeted demonstrations with dissemination program

Contribution to CSA

The sustainable land management practices will strongly contribute to climate smart agriculture. As it has been stated the changing rainfall patterns will even increase the present problems of erosion. In addition, in case of increasing winter temperatures the soils will become more exposed to erosion than before, when the soils were still frozen in the winter period. Reduced tillage can help to reduce water losses from evaporation. Strip tillage on slopes can significantly decrease surface run-off. Green soil cover in orchards can almost stop erosion altogether.

Target group

Farming community, agricultural supply business, research, extension services, education

Lead organization

It would be logical if the Ministry of Agriculture takes the lead by formulating an interdisciplinary task force. This task force should elaborate a detailed national plan with a regional action plan for the different regions of Georgia. In most cases this action plan will contain actions already formulated in the other adaptation actions in this report. In some cases, action may have to be undertaken to stop certain activities in certain regions, for instance potato cultivation on steep slopes.

Funding

Expenses related to most actions can be found under other actions in this report.

Target group	Actions	Estimated costs per region (EUR)	Estimated costs for 9 regions (EUR)
Ministry of agriculture /research institutes	Investigation of state of soil erosion	6000	54000
	Elaboration of national soil protection plan	20000	180000
Dissemination materials on soil conservation	Elaboration, production and distribution of brochures, and video films	5 dollar per farm for 100000 farms per year	500000 dollar per year
Soil protection demonstration plots	Targeted demonstrations with dissemination program	30000 per demonstration plot	9 regions, 5 sectors, makes total of 1,35 million
			3030000

Indicators

- Elaborated soil protection plan
- Brochures and video films produced and distributed
- Demonstrations implemented with dissemination program conducted

***ღონისძიება/Measure* 3 3 2- Rational use of soil**				
CSA Actions 3.3.2.1 Stimulation of rational use of soil				
რეკომენდირებული ზომები/Recommended actions:	***2016***	***2017***	***2018***	*After 2018*
• Investigation of the state of soil erosion (by remote sensing) • Elaboration of national soil protection plan • Elaboration, production and distribution of brochures, and video films • Targeted demonstrations with dissemination program	x	x X x x	x X x	X X x

პასუხისმგებელი ორგანიზაცია/ Responsible organization :	***ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:***
Task force of Ministry of Agriculture	

სავარაუდო დაფინანსება/ Estimated funding:	თანხების განაწილება/ Distribution of funds			თანხების განაწილება წლების მიხედვით/ Distribution of funds according to the year:		
	მთავრობა/ Government:	დონორი ორგანიზაცია/ Donor organizations	კერძო სექტორი/ Private sector	% 2016	% 2017	% 2018
3084000				10	40	40

მოსალოდნელი შედეგი/ Expected results:	მირითადი ინდიკატორები/ Main indicators:
• soil protection plan • brochures and video films • demonstrations with dissemination program	• Elaborated soil protection plan coordinated with the sectors • Brochures and video films produced and distributed • Demonstrations implemented in the regions

2.8. Measure 3 4 2- Development, implementation and monitoring of sectorial agricultural programs

CSA Action 3.4.2.1 Improved Integrated CSA advice for better agricultural decision making

Introduction

Climate Change is a dynamic process. Climate Smart Agriculture is based on predicted trends, each with their own reliability, which needs to be regularly calibrated based on recent climate data. Also the Climate Change Adaptation on farm, regional and national level is a dynamic process. This requires regular monitoring, evaluation and assessment of the present policy and of the agricultural practices and communicating this information with the agricultural representatives and the regions. A process called circular policy development or adaptive management needs to be applied. It is needed that market, productivity and climate impact are integrated assessed to come to a balanced and forward looking CSA advice to the farmers in the region

Monitoring

Key indicators for Climate change impact can be divided into a number of information sets. First there are the agro-economic information. However this does not offer information on the Climatic impact and is influenced by market value. Therefore more information is needed on agricultural land use and crop productivity and this to be related to climate change information collected under CSA Action 3.7.3.1. For land use and productivity, use can be made from regional inquiries and trade volumes. Integral NDVI analysis based on remote sensing offers a better source of information on productivity and land use, but requires specific capacities limited present in Georgia this moment and therefore to be built (see Measure 3.2.1). To assess the climate change factor of the productivity changes these data should be compared with regional data on yearly climate change parameters like summary degree days, heat days, drought lengths, farm land productivity, land degradation, and especially their trends. Based on these parameters the Climate Change Impact can be assessed and agricultural advice per region can be given. These and other tools should also be used to monitor and assess the effectiveness of the CSA measures and actions on farm level. Of course for each action specific indicators should be defined to monitor their effectiveness.

The physical monitoring can be based on the CC data collection as mentioned under **CSA Action 3.7.3.1.** It is needed to link the monitoring and advice with Research: **CSA action 3.2.3.1**

Staff capacity should be reserved for the assessment of the data.

Different types of data are monitored for this action to be related in an integrated way: agricultural production, land degradation, agricultural production, market development and climate information. Only integrated regional advice should be given. The data is mostly selective collected and from different scales. Modelling is increasingly seen as an essential tool for monitoring and assessment to bring the

different aspects of agricultural information together and allow multi-dimensional and integrated assessments and advice. Modelling allows for the assessment of different factors like climate, agricultural production common construction.

The following steps are needed:

1. Harmonization of information collection and monitoring of the above mentioned aspects of agriculture
2. All data should be geo-tagged, thus related to a certain region
3. The information should be collected in a quantitive way and care should be taken that the data collected really reflects the reality on the ground
4. Bilateral Relations between production, market, climate have to be worked out
5. A model build for the complex relationship

In the context of the limited human capacity in the field of modelling it is recommended to concentrate this capacity in one department. The capacity building includes the following steps:

1. Identification of GIS and modelling capacity in Georgia
2. Analysis of gaps in education
3. Identification of education capacity international (like ITC and IHE)
4. Preparation of targeting resources for modelling capacity building

Reporting and communication

A yearly compact report is needed to evaluate the options for regional Climate Change resilience in agriculture, and the results of the CSA, to motivate the stakeholder to proceed or to adapt the implementation of the CSA Actions. The regional, local authorities and extension services are playing an important role in the communication of the year report. The process of communication with the stakeholders, the right to be heard, is an essential step in the CC monitoring and adaptation of the strategy. The communication with the region is part of Action 3.2.1.1 CSA organization structure MoA.

Capacity building

There is a need for capacity building in the field of Integrated value chain monitoring inclusive Climate Change Adaptation and its interpretation, on national, regional and CC adaptation on farm level.

Activities

In summary, the following activities are recommended to be undertaken, to enable integrated CSA advice to the agricultural sector:

1. Capacity building on regional agriculture - MoA
2. Capacity building on modelling - NEA
3. Modelling and assessment of CSA parameters - NEA
4. Monitoring of implementation of CSA - Regional Extension Services
5. Communication with farms – Regional Extension Services
6. Assessment and Reporting – MoA / NEA
7. CSA Communication – MoA / NEA
8. Assessment and Reporting on Climate Change - NEA

Contribution to CSA

Enabling assessment of trends in climate change impact and assigning CSA measures.

Target group

Regional level, extension services, research community

Lead organization

Ministry of Agriculture, in cooperation with National Environmental Agency (NEA)

Funding

Target group	Actions	Estimated costs per region (EUR)	Estimated costs for 9 regions (EUR)
Ministry of Agriculture	Capacity building	150.000	150.000
National Environmental Agency	Modelling		120.000 for three years
Regional level and extension services	Monitoring of implementation of CSA	20.000	180.000
	Communication with farms	See 3.2.1.1	See 3.2.1.1
Min Agriculture / NEA	Assessment and Reporting	25000	175.000
	Communication	See 3.2.1.1	See 3.2.1.1
National Environmental Agency	Assessment and Reporting	To be elaborated	To be elaborated

Indicators

- Yearly CC report, reporting on the CSA action indicators,
- stakeholder communication reports,
- CSA adaptation report

ღონისძიება/Measure 3 4 2- Development, implementation and monitoring of sectorial agricultural programs				
CSA Action 3.4.2.1 Monitoring of Climate Change Impact				
რეკომენდირებული ზომები/Recommended actions:	*2016*	*2017*	*2018*	*After 2018*
• Capacity building on modelling	x	x		
• modelling and assessment of CSA parameters	x	x	X	X
• Monitoring of implementation of CSA	x	x	X	X
• Communication with farms	x	x	X	X
• Assessment and Reporting	x	x	X	X
• Communication	x	x	X	X
• Assessment and Reporting	x	x	x	x

პასუხისმგებელი ორგანიზაცია/ Responsible organization :	*ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:*
• Ministry of Agriculture • National Environmental Agency	

სავარაუდო დაფინანსება/ Estimated funding:	*თანხების განაწილება/ Distribution of funds*			*თანხების განაწილება წლების მიხედვით/ Distribution of funds according to the year:*		
	მთავრობა/ Government:	*დონორი ორგანიზაცია/ Donor organizations*	*კერძო სექტორი/ Private sector*	*% 2016*	*% 2017*	*% 2018*
				40	30	30

მოსალოდნელი შედეგი/ Expected results:	*ძირითადი ინდიკატორები/ Main indicators:*
• Yearly CC report, reporting on the agreed CSA action indicators • stakeholder communication reports • stakeholder's active participation in monitoring program • CSA adaptation report	• Reports contain topical data of the current climate change tendencies and on CSA practices of all regions • Reports reflect positions of all relevant stakeholders • Farming community aware of recommendations of CC monitoring • Recognizable input of stakeholders in program

	• CSA report reflects sufficiently the sectoral tendencies in CSA implementation

2.9. Measure 3.4.9- Improved access to agricultural machinery

CSA Action 3.4.9.1 - Improved access to agricultural machinery

Introduction

Agricultural equipment is of crucial importance for the whole agricultural sector. Any type of equipment has been designed to fulfil certain functions that fit into the whole cultivation system applied by the farms. In Georgia there are predominantly (97%) small farms of less than 5 ha, which require smaller sized equipment, or tight cooperation structures that provide services to many farms with larger equipment.

Arable farming
For CSA significant adaptations are required. In arable farming changing tillage will be an important challenge. Ploughing can in many areas be reduced and direct seeding practices developed. Direct seeding equipment is relatively expensive and this development can be started by the introduction of disc harrowing (two times as a rule) with sowing at the same date with a sowing machine with rotor cultivator for heavy soils. Spraying of herbicides can in many crops to be reduced and replaced by inter-row cultivation. Inter-row cultivation will decrease evaporation from soil surface and combat weeds. Lowering pressure of tires of agricultural equipment or the use of larger tires (or double tires) is one important measure to reduce soil compaction. Use heavy equipment should be avoided.

Animal husbandry
Grazing takes place predominantly on natural pastures where manure is accumulating in the valleys where the animals rest during the night. In order to prevent total depletion of fertility on slopes small equipment must be introduced to transport and spread farm yard manure on mountain slopes. Electric fencing must be introduced to ease the use of rotational grazing on paddocks (meant for 1 week of grazing by sheep).

Fruit production
Suitable irrigation and drainage systems for orchards are very important under changing climatic conditions. Proper information about the requirements of those systems is also crucial and as well of the consequences of those systems on the production. Too often those systems are not well designed and as a consequence, productivity of orchards will suffer. Too few drippers per tree may be bought, or too large outflow characteristics, the wrong diameter of hoses etc.

Activities

4 levels of activities are proposed to be undertaken for above mentioned agricultural sectors:

- Research of the effects of various types of foreign equipment on agricultural research institutions
- Demonstration farms - Selection and try out of new equipment and promotion towards farmers and business
- Lease companies - Introduction of lease schemes of other CSA adapted equipment
- Equipment cooperation / sharing - Investigations of constraints for cooperation in this sphere
- Extension services - Organization of open days, publication of written materials on new types of equipment, conducting farmer field schools

Amount of equipment

In general under conditions where there is a shortage of equipment, the time needed to conduct operations at farm level, regional level and national level increases. When tillage is conducted at the wrong time, the soil may be too hard or too wet. Changing climate disrupts the time window suitable for certain operations. Increasing the number of units of equipment is in itself already a measure of climate adaptation. Equipment cooperation/sharing and lease companies can contribute to the availability of suitable equipment.

Action level

At a national level suitable brands of equipment must be identified and subsequently tested on the regional level. Data must be systematically collected and made available for the agricultural community through open days, by press and by the media. Technical and economical evaluations should be conducted.

Contribution to CSA

Farm mechanization can play a very important role for the development of CSA. It will be highly specific for certain crop rotations, so if by climate change, the crops cultivated will be changed, the farm mechanization should also be reconsidered. In itself, improvement of farm mechanization is also needed for any agricultural development (in the Strategic Action Plan), but for CSA it should be selected by other criteria. Suitable farm mechanization in terms of CSA can be researched and demonstrated on research and demonstration farms on a regional basis, since soil and climatic conditions differ in various parts of the country. Once optimal solutions have been elaborated, the best equipment can be mainstreamed by lease companies that can provide farms with this equipment on favourable terms.

Target group

The final target group of actions in the sphere of agricultural mechanization are of course the farmers.

However in order to reach the farmers actions should be focused on demo-farms, agricultural extension services and lease companies of farm equipment.

Lead organization

Ministry of agriculture.
Agricultural mechanization Lease companies
Demonstration farms (in cooperation with extension services)

Funding

In the table an indication of possible actions are given including an estimation of costs involved

Target group	Actions	Estimated costs per region (EUR)	Estimated costs for 9 regions (EUR)
Demonstration farms	Selection and try out of new equipment	500.000 per region	4,5 million
Lease companies	Introduction of lease schemes of other equipment	3 million for one lease company in each region	27 million
Equipment cooperation / sharing	Investigations of constraints for cooperation in this sphere		45000
Extension services	Organization of open days, publication of written materials on new types of equipment, conducting farmer field schools	20.000	180.000

It is important first to identify the best options of equipment available on the market. Then it should be tested on demonstration farms, and after successful demonstrations they can be included in the lease schemes that exist in Georgia, or that have to be established.

Costs

The main costs involved are connected with the final introduction on the market via the lease companies. In this table only purchase costs are included for one Lease Company per region. If it turns out to be desirable to have more lease companies per region, costs will increase.

Indicators

- Demonstration farms per region experimenting and demonstrating new adapted equipment
- Regional lease companies have taken up new adapted equipment in package. Increase of equipment cooperation / sharing
- Activities of extension services extended on CSA

ღონისძიება/**Measure 3.4.9- Improved access to agricultural machinery**				
CSA Action 3.4.9.1 - Improved access to agricultural machinery				
*რეკომენდირებული ზომები/**Recommended actions:***	***2016***	***2017***	***2018***	*After 2018*
• Selection and try out of new equipment	X	X	X	X
• Introduction of lease schemes for other equipment	X	X	X	
• Organization of open days, publication of written materials on new types of equipment, conducting farmer field schools	X x	X x	X x	X X
• Agro equipment cooperation / sharing				

პასუხისმგებელი ორგანიზაცია/ ***Responsible organization :***	*ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/* ***With support of following organizations:***
Ministry of agriculture	Agricultural mechanization Lease companies Demonstration farms (in cooperation with extension services)

სავარაუდო დაფინანსება/ ***Estimated funding:***	*თანხების განაწილება/* ***Distribution of funds***			*თანხების განაწილება წლების მიხედვით/* ***Distribution of funds according to the year:***		
	მთავრობა/ Government:	***დონორი ორგანიზაცია/ Donor organizations***	***კერძო სექტორი/ Private sector***	***% 2016***	***% 2017***	***% 2018***
31,7 million				15	30	55

მოსალოდნელი შედეგი/ ***Expected results:***	*ძირითადი ინდიკატორები/* ***Main indicators:***
• Demonstration farms per region experimenting and demonstrating new adapted equipment • Regional lease companies have taken up new adapted equipment in package • Activities of extension services extended on CSA • Sharing or cooperative use of equipment	• Number of demonstration farms using a certain number of new units of equipment • Number of units of CSA equipment that have been leased out by lease companies • Number of CSA related services provided by extension services to their customers • Number of agro equipment cooperation initiatives

2.10. Measure 3.7.1- Maintaining good agricultural practices, biodiversity and environmental sustainability programs

CSA Action 3.7.1.1 – Promoting Landscape approaches

Introduction

In order to increase the sustainability of agriculture and to decrease vulnerability to climate change the use of natural resources has to be optimized. Natural resources cannot be seen as separate from each other, neither can soil, water, vegetation nor their minerals. This requires an integrated landscape interaction approach, covering parallel major fields like pasture management, on-farm biodiversity, and agro stability

Contribution to CSA

The Landscape interaction approach is an inherent part of CSA, since the landscape influences the micro-climate and it determines the agro-ecological conditions.

Promotion of a landscape interaction approach

In order to use the landscape interaction approach, understanding of the interrelations between the natural resources and agriculture is required. The positive interactions between landscape and agriculture are also called ecosystem services. In research the attempt should be made to try and qualify and quantify those services. Because of the complexity of landscapes this is not always easy. Close integration is required of actions in the spheres of environment, agriculture, nature protection and economy.

Pasture management

Pasture management is a typical example of a landscape approach. Soil fertility, vegetation cover, humus in soil, stability of the soil, water capacity of soil, infiltration capacity of water, water availability, productivity, anti-erosion capacity, combine. To make optimal use of the resources, an integrated approach is needed otherwise soil fertility, vegetation cover, nitrogen fixation & phosphate mobilization by legumes will be reduced. All the mentioned landscape qualities are directly linked. In addition, forests may store water, prevent wind and water erosion & provide shade and emergency fodder for livestock. This landscape interaction approach requires understanding from the local community, but also the feeling of ownership (responsibility) of the land users or communities. This feeling of ownership feeling is built on long term rights. Only when the land users feel the long term responsibility they will be prepared to invest in their land and improve its quality.

Integrated pasture management plans, demonstration areas and economic assessment are essential tools. There is also a link with credit facilities, Measure 3.1.4.

On-farm biodiversity

Ecosystem services play an important role by adapting to climate change. To understand the value of eco-system services of the farm flora, fauna, water and soil for different types of agriculture per sector their value and role in ecological stabilization of farming should be identified. This should be linked to Action 3.2.1.1; Research. In local/regional demo projects these values can be demonstrated.

Agro-ecosystem stability

Agriculture is building on and capitalizing eco-system services. But at the same time it may destabilize them. Examples are land degradation, erosion, landslides, water pollution and reduction of rural biodiversity. Climate change may increase the impact of land use on the ecosystem stability. Risk factors and areas should further be investigated and preventive actions supported like restoration of swamps for water storage, tree planting for landslide control, wild vegetation strips as habitat for pollinators and natural antagonists etc.

Activities

For each of the subjects mentioned above (Pasture management, On-farm biodiversity and Agro-ecosystem stability) a set of activities should be developed:

- Research on ecosystem services to get hard data
- Demonstrated landscape approaches and ecosystem services and raised awareness on them
- Cooperation between agriculture, forestry, nature protection, tourism and economy
- Improved farm management, making use of ecosystem services

The actions under these activities include: Introduction of rotational grazing, Research on ecosystem services for agriculture, Demonstration of ecosystem services for on-farm biodiversity and agro-ecosystem stability, Awareness raising of ecosystem services and Integration of ecosystem services in farm management.

Stakeholders

Farmers, Extension services, Research community

Lead organization

Ministry of Agriculture

Funding

Target group	Actions	Estimated costs per region (EUR)	Estimated costs for 9 regions (EUR)
Extension service, farmers	Introduction of rotational grazing	50000	450000
	Research on ecosystem services for agriculture	60000	60000
	Demonstration of ecosystem services for on-farm biodiversity and agro-ecosystem stability	25000	175000
	Awareness raising of ecosystem services	10000	90000
	Integration of ecosystem services in farm management	20000	180000
			955000

Indicators

- Demonstration of and awareness raising on landscape approaches and ecosystem services
- Cooperation between agriculture, forestry, nature protection, tourism and economy
- Improved pasture management

ღონისძიება/**Measure 3.7.1- Maintaining good agricultural practices, biodiversity and environmental sustainability programs**				
CSA Action 3.7.1.1 – Landscape approach				
რეკომენდირებული ზომები/**Recommended actions:**	**2016**	**2017**	**2018**	*After 2018*
• Research on ecosystem services for agriculture	X	X	X	X
• Demonstration of ecosystem services	X	X	X	X
• Awareness raising of ecosystem services	X	X	X	X
• Integration of ecosystem services in farm management	X	x	X	x

პასუხისმგებელი ორგანიზაცია/ **Responsible organization :**	ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ **With support of following organizations:**
Ministry of Agriculture	Agricultural extension services

სავარაუდო დაფინანსება/ **Estimated funding:**	თანხების განაწილება/ **Distribution of funds**			თანხების განაწილება წლების მიხედვით/ **Distribution of funds according to the year:**		
	მთავრობა/ **Government:**	დონორი ორგანიზაცია/ **Donor organizations**	კერძო სექტორი/ **Private sector**	**% 2016**	**% 2017**	**% 2018**
505000				30	30	40

მოსალოდნელი შედეგი/ **Expected results:**	ძირითადი ინდიკატორები/ **Main indicators:**
• Demonstrated landscape approaches and ecosystem services and raised awareness on them • Cooperation between agriculture, forestry, nature protection , tourism and economy • Improved farm management, making use of ecosystem services	• Number of visitors that have visited demonstration sites • Organization of platforms where people are actively cooperating for landscape conservation • Number of farms that are actively integrating landscape interaction approach

2.11. Measure 3 7 2 - Gene bank development/management for conservation of agro-diversity and endemic species

CSA Action 3.7.2.1 – Conservation and use of genetic resources of crops and domestic animals for CSA

Introduction

Originally in Georgia there was a large genetic diversity of crops cultivated and breeds of animals kept on farms. This diversity was reflected in the diversity of soil types, climatic conditions and farm practices in the country. Modern breeding practices are pre-dominantly focused on the selection of so called widely applicable crop varieties and breeds, because the investments required can be written off on more hectares and more animals respectively. This market mechanism, though logical, is not leading to breeding the most adapted and highest yielding crop varieties and animal breeds for the large variety of natural growing conditions in Georgia.

It is of national interest to conserve the variety of crops and breeds that are still present on the Georgian farms. Therefore, seed testing and seed production must reflect not only commercial interests of large breeders but also the real interest of the farmers that need access to the best varieties of crops and best breeds of animals. The first step in the process is to conserve the present agro-biodiversity by ensuring that farmers get more information about the qualities of those traditional crop varieties and animal breeds. In this way, farmers may start to appreciate their value more and therefore invest more in these. The traditional varieties (and breeds) might also have undesirable properties that need further selection work by the special institutions. For instance traditional cereal varieties have a relative low harvest index, and other resistances against diseases.

The genetic varieties that are facing the threat of disappearing from farms in Georgia need special measures such as the establishment of gene banks with local crop varieties and animal breeds. Genetic resources can be kept in field collections or under climate controlled storage conditions. There is a need to research on the quality of the Georgian genetic resources. From those sources the special breeding/selection specialists can also have easier access to the genetic material. In the selection process it needs to be kept in mind that epi-genetic factors should also be considered in the process of adaptation of plant varieties and animal breeds to local conditions.

Activities

Activities to be set up to safeguard the genetic resource enabling Climate Change Adaptation include the following:

- Main genetic resources of most important crops and animals established
  - Inquiries of the genetic resources of Georgia that are under threat of disappearance
  - Research on the qualities of genetic resources
- Research institutes for crop and animal breeding
  - Establishment of gene bank of national genetic resources of most important crops and animals preferably in most important climatic zones
- Farmers
  - Cultivation of crop varieties that have valuable genetic properties
- Private breeding companies including transboundary regional cooperation
  - Include local genetic donors in their work and conduct decentralized selection work

Contribution to CSA

In a country like Georgia with many different (micro) climatic zones, targeted use of adapted varieties is of utmost importance. Often the present selection and breeding stations focus on the most dominant climatic conditions, which don't reflect the many regional differences. CSA assumes that we go for the best local solutions. Private and state decentralized breeding activities are in this respect of great importance.

Target group

Public and private crop and animal breeding institutes/companies. Since the climatic and soil conditions in Georgia have a lot in common with neighboring countries, like Azerbaijan, Armenia and Turkey it would be the best to initiate regional activities. Through trans-boundary cooperation, the costs can be shared and there will be more scientists available to contribute to this important work.

Lead organization

Ministry of Agriculture

Funding

Target group	Actions	Estimated costs per region	Estimated costs for 9 regions
Main genetic resources of most important crops and animals established	Inquiries of the genetic resources of Georgia that are under threat of disappearance	To be elaborated	To be elaborated
	Research on the qualities of genetic resources	To be elaborated	To be elaborated
Research institutes for crop and animal breeding	Establishment of gene bank of national genetic resources of most important crops and animals preferably in most important climatic zones	To be elaborated	To be elaborated
Farmers	Cultivation of crop varieties that have valuable genetic properties	To be elaborated	To be elaborated
Private breeding companies including transboundary regional cooperation	Include local genetic donors in their work and conduct decentralized selection work	To be elaborated	To be elaborated

Indicators

- Report with clear description of important genetic resources under threat of disappearance
- Plan elaborated how these genetic resources can be most effectively conserved
- New gene banks established or old gene banks extended
- Projects started up for selection of new crop varieties and new animal breeds
- New commercial varieties and breeds developed and marketed

ღონისძიება/Measure 3 7 2 - Gene bank development/management for conservation of agro-diversity and endemic species				
CSA Action 3.7.2.1 - Gene bank development				
რეკომენდირებული ზომები/Recommended actions:	***2016***	***2017***	***2018***	*After 2018*
• Inquiries of the genetic resources of Georgia that are under threat of disappearance	x	x		
• Research on the qualities of the genetic resources	x	x	x	x
• Establishment of gene bank of national genetic resources of most important crops and animals preferably in most important climatic zones		x x	x x	x x

• Cultivation and promotion of crop varieties and animal breeds that have valuable genetic properties • Include local genetic donors in their work and conduct decentralized selection work		x	x	

პასუხისმგებელი ორგანიზაცია/ **Responsible organization :**	ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ **With support of following organizations:**
Ministry of Agriculture	Scientific Research Institutes

სავარაუდო დაფინანსება/ **Estimated funding:**	თანხების განაწილება/ **Distribution of funds**			თანხების განაწილება წლების მიხედვით/ **Distribution of funds according to the year:**		
	მთავრობა/ **Government:**	დონორი ორგანიზაცია/ **Donor organizations**	კერძო სექტორი/ **Private sector**	**% 2016**	**% 2017**	**% 2018**

მოსალოდნელი შედეგი/ **Expected results:**	ძირითადი ინდიკატორები/ **Main indicators:**
• Description of important genetic resources under threat of disappearance • Plan elaborated how these genetic resources can be most effectively conserved • New gene banks established or old gene banks extended • Projects started up for selection of new crop varieties and new animal breeds • New commercial varieties and breeds developed and marketed	• Appropriate report with deep analysis of genetic resources • Concrete conservation plan with recommendations for in situ or gene bank conservation • Conservation of agro-biodiversity operational • Breeding programs operational • Number of new breeds released

2.12. Measure 3 7 3- Promoting climate smart agriculture (CSA) practice

Action:3.7.3.1 – Implementing Climate Change data collection and Information supply

Introduction

Climate Smart Agriculture can only be smart as it is based on information supply on climate change. The information supply and building knowledge to interpret and use them are key in Climate Smart Agriculture. Lack of knowledge and information will block any further development of CSA.

This information can be split into short-term information like weather forecasting, more weekly information like landslide forecasts and long term trend analysis on climate change and land degradation. The information is needed at farm level and as oversight on national level. To interpret the data this should be transferred into regional adapted information accessible to the farmer.

The information needed can be divided in two groups: calculated agro-meteorological data and land use and quality data.

Where weather data should be supplied on a daily basis, climate related information should be supplied on weekly, monthly and yearly basis. The first for short term prediction and prevention of diseases and pest, the yearly information on trends in land degradation, heat and drought development, etc.

A crop yield increase of 0.1 % is expected to cover the increased cost. (Source: besides the traditional agro-meteorological data source, increasing use can be of remote sensing.)

Monitoring and Information supply are also of upmost importance for Disaster Risk reduction. The prevention of landslides, mudflows and fires should be prioritised, as they are strongly induced by agricultural practices and agriculture and farmers livelihoods are the first to suffer from it.

Data collection and assessment for effective CSA information supply

Weather forecasting

As weather in a mountainous country as Georgia is strongly place dependent more local oriented data should be made available. The location, slope and its orientation, altitude, soil having a high impact on the climate vulnerability. The basic meteorological data, like temperature and precipitation can be collected by a more intensive agro-meteorological network.

A number of weather events like hail, thunderstorms and night frost have a short term impact. The weather forecast for this events should be improved. For this more intensive data collection is needed. New equipment is needed, like radar and small agro-meteorological stations. Also remote sensing data would be of use.

Midterm Weather information

As guidance for agricultural climate adaptation mean temperatures and precipitation are of little value they should be recalculated towards more value information like summary heat/growing degree days, heat days (>25C, >32C), frost days (max < 0C) and length of drought periods. The use of this info is dependent on the translation of these data into information for the target group, an essential step. For the interpretation of the data additional capacity should be attracted.

Also Risk disaster forecasting should be included in this midterm forecast like landslides, avalanche and fire risk. All three can be monitored by remote sensing

Climate Change assessment

In addition to the hydro-meteorological data by remote sensing additional data of national value can be collected like altitude and altitude change for prediction of landslides and impact of flooding and mudflows, NDVI (trend) analysis for land productivity, land use and land degradation (based on the free available data and toolboxes of the EU). In future this can when the other Sentinel satellites are launched, be extended with other info like soil moisture and temperature. To interpret the data Modelling capacity has to be built up. By lack of educational capacity, use should be made of international (or distance learning) courses, or by the UNESCO centre of excellence, ITC. NL. Temporary local private capacity can be hired for this aim.

The NDVI analysis based on remote sensing has shown to be a reliable instrument to forecast harvest prediction, but also for long term processes such as land degradation and reducing land productivity as this data is already available from 1992.

Remote sensing is the most appropriated tool to monitor and forecast disasters like landslides and fires. Making use of the free data of the EU Copernicus programme (Sentinel 1 and 3), minor changes in altitude, forecasting landslides, can be monitored. Also land degradation and productivity and plant health (Sentinel 3a – NDVI analysis based on false-colour images) and fires (Sentinel 3a – thermal infrared instrumentation SLSTR) can be monitored and used as information material. The SLSTR also offers soil temperature information with an accuracy of 0.3 ^{o}C every three days.

This information can then be used by the MoA as basis for the regional recommendation for CSA.

Climate change information database

To enable permanent access to climate change information a public accessible database should be build. In this database the remote sensing data should be stored, yearly regional climate change report based on weather data and remote sensing. Regional experience on productivity and disasters should also be included in this database. In future geological risks maps should be added.

Here, strong cooperation is needed between the Climate change office (climate reporting), Ministry of Agriculture (agricultural knowledge), agricultural research and Hydromet (weather and remote sensing) to collect the relevant information, their information database and prepare the yearly reports showing the trends and advices for agriculture.

Disaster Risk Policy development

As the risk of drought in East Georgia is increasing, so is the risk on wild fires in nature and in agriculture. Burning fields in agriculture is one of the causes. Fires cause ecological damage but also cause damage to agriculture and agricultural practices.

Monitoring of the risk of wildfires can take place by remote sensing as mentioned above. This will help to identify the most risky regions and possible causes.

The advice is to develop a policy document for prevention and management of fires (MoNRE in cooperation with MoA) based on the above information to be collected by NEA

Information supply

To get the information in place by the stakeholder capacity should be build under the stakeholders and capacity within the ministry to translate the data at a regional level into farm level information offering direct farm management advice. This is closely linked to Action 3.2.1.1 CSA organization of MoA, strengthening the extension services and Action 3.1.2.3 Research.

An inter-ministerial policy document should be developed pointing out tasks, mechanisms, responsible authorities and budgets.

Activities

The activities under the Implementing Climate Change risk data collection and Information supply include

- Hardware supply for weather stations, radar and staff
- Assignment of qualified Staff and set up of a GIS data base with climate information
- Assessment of climate change and related disaster risk related indicators and their impact, and Dissemination of information
- Capacity building on agro meteorology, remote sensing and modelling
- Policy document for prevention and management of fires

Result

- Info supply on weather events (hail, drought, etc)
- Info supply on climate adapted agriculture (summery degree days, heat days, drought risk)
- Risk prevention (landslides, avalanches)
- Long term Climate related processes like land use, productivity and degradation monitored

Capacity building

The National Environmental Agency under the Min Environmental Protection is responsible for national environmental data collection including water and weather. It should be more than logical that their task would be extended in the direction of CCA, serving disaster risk, agriculture and environment. Also the transport sector is should be served with the new information for the same purpose as relates to transport risk reduction. The capacity for these services should be extended toward remote sensing and more capacity for detailed CC reporting and forecasting. Basic knowledge of remote sensing and NDVI analysis should be included. An option is through the UNESCO Centre of Excellence ITC, NL. Temporary use can be made of commercial companies in Georgia for the monthly / yearly remote sensing analysis.

The department of agricultural information capacity should be extended to translate the CC data towards agricultural advice. This should be based on additional research on the crop selection and characteristics, management and prevention, regional demonstrated.

The extension services should be strengthened to advice the famers based on the CC information.

Equipment

- Agro- meteorological station

- Rain radar
- GIS – remote sensing base

Contribution to CSA

Data collection for CSA, Assessment and Information supply, risk assessment and warning related to Climate Change

Target group

Farmers, Ministry of agriculture, regional authorities

Lead organisation

Hydromet, Ministry of Agriculture, Ministry of Environment

Financing

Target group	Actions	Estimated costs per region (EUR)	Estimated costs for 9 regions (EUR)
National Environmental Agency	Equipment – weather stations Radar Staff – remote sensing and modelling	to be elaborated	1 Million, to be further elaborated
Dep of Agro information	Staff GIS database		To be elaborated
Extension services	Dissemination of information	Budget plus capacity and capacity building to be elaborated	To be elaborated
Capacity building	Training – remote sensing, modelling		100.000
MoNRE	Policy document for prevention and management of fires in nature		To be elaborated

Indicators

- Database with relevant CC data
- GIS database including remote sensing data
- Daily weather event and risk reporting
- Weekly CCI reporting – Summery degree day plus advice on farm management
- Disaster risk report
- Yearly CC trend report
- Capacity by extension services to spread info to farmers and back reporting to MoA

ღონისძიება/Measure 3 7 3- Promoting climate smart agriculture (CSA) practice				
Action:3.7.3.1 – Climate Change risk data collection and Information supply				
რეკომენდირებული ზომები/Recommended actions:	***2016***	***2017***	***2018***	*After 2018*
• Hardware supply for weather stations, radar and staff		X	X	
• Staff and GIS data base	X	X	X	X
• Dissemination of information	X	X	X	X
• Capacity building on agro meteorology, remote sensing and modelling	X	X	X	x
• Policy document for prevention and management of fires in nature based on disaster risk information		X	X	

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With support of following organizations:</td></tr>
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National Environmental Agency</td><td colspan="4"></td></tr>
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Distribution of funds</td><td colspan="3">თანხების განაწილება წლების მიხედვით/
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Donor organizations</td><td>კერძო სექტორი/
Private sector</td><td>% 2016</td><td>% 2017</td><td>% 2018</td></tr>
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Expected results:</td><td colspan="4">ძირითადი ინდიკატორები/
Main indicators:</td></tr>
<tr><td colspan="3">• CSA indicators being collected, assessed and interpreted
• Capacity built on remote sensing, modelling or capacity attracted
• GIS database
• Daily weather event prognoses
• Disaster risk reports
• Yearly CC trend report
• Capacity by Extension services to spread CSA info to farmers and back reporting to MoA
• Policy document for prevention and management of fires in nature</td><td colspan="4">• Daily prognose reported , risk report and yearly trends assessment published and communicated with farmers
• Capacity in place
• GIS Data base operational
• Weather event prognoses available to community
• Risk reports published
• Trend reports published
• Extension services communicating CSA info with farmers and administrations
• Policy plan for prevention and management of fires accepted</td></tr>
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2.13. Measure 3 7 3- Promoting climate smart agriculture (CSA) practice

CSA Action: 3.7.3.2 Promoting greenhouse gases emissions reductions

Introduction

It is known that agriculture contributes significantly to the emissions of greenhouse gases, by emissions of CO2 (carbon dioxide), NO2 (nitrogen oxide) and CH4 (methane). In the case of Georgia it has been estimated that 17% of the national emissions are from agricultural activities. Adaptation of current practices may lead not only to decreasing emissions but also to higher humus contents of soil, less water pollution and lower costs for the farms and for society. In other words many of the actions cause win-win situations on different fronts.

Manure storage and handling

At present the conditions for manure storage in Georgia are often very poor, leading to emissions of NO2 and to pollution of water resources, which causes water purification costs down streams. If manure is properly handled, it will have a higher effect on crop yields and emit less harmful substances, like CH4 and NO2.

Soil tillage

Intensive tillage practices are a significant source of CO2 emissions. Introduction of low tillage practices will decrease the loss of humus and thereby decrease CO2 emissions. CO2 emissions of eroding pastures can also be reduced by introduction of rotational grazing.

Use of nitrogen fertilizers

Nitrogen fertilizers (together with farm yard manure) are an important source of NO2 emissions. In order to decrease nitrogen losses through NO2, the fertility of the land needs to be better monitored, which can prevent the use of excess of nitrogen fertilizers. The same applies for the proper storage, handling and use of farm yard manure.

Herbivore emissions

Herbivores emit significant amounts of CH4 (methane) from their digestion. The amount is strongly dependent on the nature of the feed. By balancing feed ingredients emissions can be strongly reduced

Activities

The activities to be developed are dependent on the size of the farms. It is proposed to focus in this stage on farms with more than 5 cows, and/or more than 0.5 ha of land.

- Farms with more than 5 cows
  - Investigation of manure storage and handling
  - Elaboration of plan for improved manure storage and handling
  - Implementation of improved manure storage and handling
  - Literature investigations on feeding and herbivore emissions
  - Elaboration of optimal feeding scheme for Georgian farming conditions
  - Implementation of program to influence feeding methods
- Farms with more than 0,5 ha arable land
  - Investigation of present tillage practices
  - Formulation of alternative tillage system
  - Introduction of alternative tillage
- Farms with more than 0,5 ha land
  - Investigations of use of mineral nitrogen
  - Elaboration of soil fertility manual for farmer
  - Dissemination of manual to farmers
  - Dissemination of simple nitrate measurement tools

Target group

The target group of those actions are all 691000 farms of Georgia (2004).

Leading organisation

An inter-ministerial task force to be established by the Ministry of Agriculture. Technical knowledge on emissions and emission prevention shall have to be provided by external experts.

Action level

The actions have to be carried out on farm level, but the regional representatives of the Ministry of Agriculture and the Ministry of Environment can be the implementing organisations.

Contribution to CSA

Reduction of emissions in itself doesn't lead to Climate Smart Agriculture. However, improved soil tillage, better manure application and other measures can indirectly contribute significantly to CSA

Actions

In the table an indication of possible actions are given including an estimation of costs involved for the reduction of N2O, NH4 and CO2 emissions. All actions start with the investigation of the current facts. Only when the situation on the farm level is fully clear, measures can be designed, prepared and implemented. At this moment, without the facts needed, therefore it is impossible to make cost estimation of different actions.

Target group	Actions	Estimated cost per farm	Estimated costs for 9 regions
Farms with more than 5 cows	Investigation of manure storage and handling Elaboration of plan for improved manure storage and handling Implementation of improved manure storage and handling	To elaborated	To be elaborated
Farms with more than 0,5 ha arable land	Investigation of present tillage practices Formulation of alternative tillage system Introduction of alternative tillage	To be elaborated	To be elaborated
Farms with more than 0,5 ha land	Investigations of use of mineral nitrogen Elaboration of soil fertility manual for farmer Dissemination of manual to farmers Dissemination of simple nitrate measurement tools	To be elaborated	To be elaborated
Farms with more than 5 cows	Literature investigations on feeding and herbivore emissions Elaboration of optimal feeding scheme for Georgian farming conditions Implementation of program to influence feeding methods	To be elaborated	To be elaborated

For farms, all four actions require investments but they have also economic advantages that will in the longer turn exceed the costs. The exact technical implementation of the actions will have to be elaborated by a highly qualified team that zooms in on the local level of the farms, and their possibilities to contribute to the actions needed. This can be in the form of labour, materials or in terms of money. By focusing on the farms with more than 0,5 ha or 5 cows, the number of farms to be worked with can be limited. Economic incentives can be used to channel investments to the category of farms with the best economic viability. With all actions, an attempt should be made to formulate the cheapest possible solutions for the issues at stake, because of the difficult economic conditions faced by the majority of farm(er)s.

Indicators

- Scientific report about manure handling written
- Plan for improved manure handling elaborated
- Program designed to stimulate land users to have proper manure handling
- Program implemented for achieving proper manure handling on farm level
- Present tillage practices described qualitative and quantitative
- Alternative tillage approaches elaborated in report
- Report with elaborated introduction program for alternative tillage practices
- Analysis made how farms decide on fertilizers purchase and how they apply them
- Farmer soil fertility manual elaborated with analyses methods recommended
- Do it yourself nitrate measuring tools on the market
- Report on the possibility to improve feeding in order to achieve emission reductions of GHG
- Improved feeding schemes implemented on demonstration farms and results measured
- Program to disseminate results of those investigations

ღონისძიება/Measure 3 7 3- Promoting climate smart agriculture (CSA) practice				
CSA Action: 3.7.3.2 Emission reduction				
რეკომენდირებული ზომები/Recommended actions:	2016	2017	2018	After 2018
• Investigation of manure storage and handling, Elaboration of plan for improved manure storage and handling, Implementation of improved manure storage and handling	X	X	X	X
• Investigation of present tillage practices, Formulation of alternative tillage system, Introduction of alternative tillage	X	X	X	X
• Investigations of use of mineral nitrogen, Elaboration of soil fertility manual for farmer, Dissemination of manual to farmers, Dissemination of simple nitrate measurement tools	X	X	X	X
• Literature investigations on feeding and herbivore emissions, Elaboration of optimal feeding scheme for Georgian farming conditions, Implementation of program to influence feeding methods	X	X	X	X
• Implementation of private demonstration farms with effective emission reduction practices	x	x	x	x

პასუხისმგებელი ორგანიზაცია/ Responsible organization :	ქვემოთ ჩამოთვლილ ორგანიზაციებთან თანამშრომლობით/მათი მხარდაჭერით/ With support of following organizations:
Inter-ministerial task force to be established by the Ministry of Agriculture	Research organizations and extension service

საერთაშორისო დაფინანსება/ Estimated funding:	თანხების განაწილება/ Distribution of funds			თანხების განაწილება წლების მიხედვით/ Distribution of funds according to the year:		
	მთავრობა/ Government:	დონორი ორგანიზაცია/ Donor organizations	კერძო სექტორი/ Private sector	% 2016	% 2017	% 2018

მოსალოდნელი შედეგი/ Expected results:	ძირითადი ინდიკატორები/ Main indicators:
• Scientific report about manure handling written • Plan for improved manure handling elaborated • Program designed to stimulate land users to have proper manure handling • Program implemented for achieving proper manure handling on farm level • Present tillage practices described qualitative and quantitative • Alternative tillage approaches elaborated in report • Report with elaborated introduction program for alternative tillage practices • Analysis made how farms decide on fertilizers purchase and how they apply them • Farmer soil fertility manual elaborated with analyses methods recommended • Do it yourself nitrate measuring tools on the market • Report on the possibility to improve feeding in order to achieve emission reductions of GHG • Improved emission reduction schemes implemented on demonstration farms and results measured • Program to disseminate results of those investigations	• Report containing sufficient qualitative and quantitative data about farming practices • Plan address the issues in a realistic way and according to accessible methods for the farms in terms of financing • Interventions proposed that can have a real effect on the farmer's practices • Number of farms that have made use of the program stimulation package • Concrete alternative tillage approaches proposed for the different sectors in 9 regions • Formulation of realistic package of measures to achieve adoption of alternative tillage practices • Report on the farming practices concerning fertilizers with suggestions for improvement • Farmer manual prepared and published how to achieve better soil fertility management • Do it yourself kits on the market with recommendations from extension service • Report containing Georgian data on proper feeding in order to reduce emission reductions spread • Demonstration farms in 9 regions demonstrating improved practices reducing farm emissions • Dissemination program implemented

Annexes

Annex I : Strategic measures of priority 2 and those that have no specific relationship with CSA*

*strategic directions that have no direct relationship with CSA are called: NA (Not Applicable)

Where in the main report the priority 1 strategic measures, formulated in the Strategy for Agricultural Development 2015 – 2020, were highlighted (to be started within 3 years), in this appendix the other strategic measures mentioned in the 'Strategy' with a lower priority (urgency after 3 years) are classified.

Measure 3 1 3- Developing agricultural land market and introducing modern approaches in land use
CSA Actions

- Land rights registration completed
- Introduction of transferable individualised long term grazing rights (>10 y)
- Land use planning / crop rotation / pasture restoration / rotational pasture management
- Development of cooperation between farmers in order to improve the joint crop rotation

CSA Direction(s): Institutional
Priority 2

Measure 3 1 4- Developing specific tools to strengthen the agricultural credit and leasing system
CSA Actions

- To overcome transition period of adaptation with soft credits
- Reconsidering of collaterals
- Credit union support
    - Legal base created
- Human capacity of banks on agro-lending to be developed

CSA Direction(s): Funding, Policy, Safety nets
Priority 2

Measure 3 1 5- Supporting development of agricultural insurance market
CSA Actions

- Development of tailor made Insurance products for most risky agricultural sectors
- Government rules for agricultural insurance providers
- Information on agricultural insurance for farmers or intermediates

CSA Direction(s): Funding, Safety nets
Priority 2

Measure 3 1 6- Supporting the development of cooperation in agriculture
CSA Actions

- Stimulation of cooperation between farmers in order to improve the joint crop rotation
- Stimulation of credit cooperatives
    - Legal base improved
- Stimulation of mechanisation cooperation
- Enabling policy in the field of cooperation between farmers for input supply and marketing

CSA Direction(s): Food value chain, Safety nets
Priority 2

Measure 3 1 7- Developing tools in order to increase awareness of agricultural investment opportunities
CSA Actions

- Improve adaptation investment
- Information on shifting climate zones offering investment opportunities
- Dissemination of knowledge on requirements of crops and animals under changing climate conditions

- Soil and water mapping

CSA Direction(s): Funding
Priority 2

Measure 3 1 8- Implementing national agro-food promotions and marketing program
CSA Direction(s): N.A.

Strategic Direction 3 2: Institutional Development

Measure 3 2 2- Supporting collection of market information, its processing and its dissemination among the different stakeholders actively engaged in the agricultural sector
CSA Actions

- Essential in the process of crop / land use adaptation
    - Elaboration of tailor made information on opportunities of different crops in the context of CC

CSA Direction(s): Food value chain, Funding
Priority 2

Measure 3 2 3- Creating farm registry
CSA Actions

- Establishment of regional database on ownership (cadastre linked)
- Agricultural production database (crops, livestock, land use, water management)

CSA Direction(s): Institutional, Policy
Priority 2

Measure 3 2 4- Strengthening coordination between the MoA, donor community and other stakeholders
CSA Actions

- Elaboration of mutual supportive support interventions
- Participation in joint training/brain storm events

CSA Direction(s): Institutional
Priority 2

Strategic Direction 3 3: Amelioration and Soil Fertility
Following the improvement of soil focussing on soil water (infiltration) capacity and fertility improved water management should get priority.

Measure 3 3 1- Improved irrigation and drainage systems
Climate change has a range of impacts on water availability, irrigation practices, soil and soil fertility. On the one hand the water supply will change, due to melting glaciers, melting perennial snow cover, and changing rainfall patterns. On the other hand evaporation will increase due to higher temperatures. Together this means that water shortages might more often occur in the future. Therefore efficiency of irrigation should be increased. A result of climate change is also a higher peak precipitation, which offers other requirements to drainage systems. Cooperation of water users in various forms (like WUA's) is a useful tool in order to overcome demand/supply constraints. Active support to them will become more important.
CSA Actions

- Raising Water efficiency of irrigation practices
- Databank on irrigation and drainage
- WUA – improving of WUA management

CSA Direction(s): Soil / water, Institutional
Priority 2

Strategic Direction 3 4: Regional and sector development - value chain development

In the context of regional and sector development there are various measures that should be undertaken. An evident subject to pay attention to is the regional water supply and drainage infrastructure. This infrastructure has national components, interregional component and regional components that should seamlessly fit together. If there are regional investment programs, they should include projects on water supply, drainage, energy production and energy efficiency. Energy efficiency can be improved by insulation of farm premises and by use of more energy efficient equipment. Energy can also be partially generated on farms by dissemination of solar technology and other means. Such measures can lead to reduction of emissions (as they are foreseen in the Paris agreements of 2015)
In the regions it must be established whether the present zones of cultivation of certain crops can be kept as they are, or whether they have to follow the changing climatic zones. Due to the shortage of weather stations, this cannot only be decided on basis of official weather data. Experience from farmers will have to be an important source of information. In this context it is important that in all major regions, variety testing will be conducted in order to find those varieties that are more climate resilient. On a regional basis it might be possible to stimulate rotational grazing practices on the mountain pastures.
Breeding schemes tend to be highly centralized today. For climate adaptation more attention should be paid to variety selection for the many micro climatic conditions that are there in Georgia. In this context also attention should be paid to epigenetic adaptations, that have attracted more attention in recent years. It should be made certain that once results have been obtained, they are swiftly disseminated to all the stakeholders. Good results in office shelves only are of no use to nobody.

Measure 3 4 1- Defining and supporting rural development and investment strategies for each region
CSA Actions

- CC chapter in the rural development plans
- Development of renewable energy sources
- Energy efficient Production and processing facilities

CSA Direction(s): Food value chain, Institutional, Policy, Funding, Monitoring
Priority 2

Measure 3 4 3- Supporting the further development of geographic indication schemes and appellations of origin
CSA Direction(s): NA

Measure 3 4 5- Supporting the seed/planting material certification process
CSA Actions

- Overview of climate characteristics included in plant description (state variety list)

CSA Direction(s): Genetic resources, Agro products
Priority 2

Measure 3 4 6 - Development of Breeding System
CSA Actions

- Identification of constraints of foreign plant varieties per region
- Identification of Characteristics of genetic donors of crops and animal breeds suitable for regional application
- Epigenetic breeding approaches applied

CSA Direction(s): Genetic resources, Agro products
Priority 2

Measure 3 4 7- Strengthening post-harvest services, facilities, and operations (handling, storage, grading/sizing, packing, processing, marketing)

- Not specific related to CSA but a general condition for Agricultural development

CSA Direction(s): Agro products, Food value chain
Priority 2

Measure 3 4 8- Improved access to input supply services

- Objective information supply of quality and characteristics of inputs and services in relation to climate change adaptation

CSA Direction(s): Soil-water, Agro products, Food value chain, energy
Priority 2

Strategic Direction 3 5: Ensuring Food Security
The changing conditions for farmers are influencing the produce and their markets. To prevent food shortages, or surpluses for certain key products and related price instability, monitoring of food security is essential in CSA.
Measure 3 5 1- Monitor food security

- Not specific for CCA, but the impact of CC on productivity has to be monitored

CSA Direction(s): N.A.

Strategic Direction 3 6: Food Safety, Veterinary and Plant Protection
Changing climatic conditions are likely to change the occurrence of pests and diseases in crops and animals. To anticipate these changes, the health of crops and animals must be closely monitored and crop varieties and animal breeds identified and tested that are suitable for the expected climatic conditions in the near future.
Since emissions from animals are also emitters of greenhouse gases, improvement of animal feeding should also play its role in the reduction of emissions. Modernized phytosanitary services can play a role in the reduction of imports of pests and diseases from abroad.

Measure 3 6 1- Developing efficient and flexible food safety system that will be consistent with EU legislation and reflecting specific features of the Georgian agricultural market
CSA Direction(s): N.A.

Measure 3 6 2- Veterinary
CSA Actions

- Low emission feeding ratios
- Monitoring of Climate Change related pest and diseases

CSA Direction(s): Agro products
Priority 2

Measure 3 6 3- Plant protection and phytosanitary reliability
CSA Actions

- Introduction of summary degree days
- Introduction of disease and pest resistant varieties
- Disease and pest prevention

CSA Direction(s): Agro products
Priority 2

Measure 3 6 4- Laboratory Capacity Enhancement and Establishment of Modern Testing Techniques Compliant with the International Standards for Food Safety, Animal Health and Phyto-sanitary Control Programs
CSA Direction(s): N.A.

Measure 3 6 5- Review and develop border control veterinary and phytosanitary inspection points for agriculture import/export monitoring
CSA Direction(s): N.A.