Food and Agriculture Organization of the United Nations

ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT

SYNTHESIS

REGIONAL ANALYSIS OF THE NATIONALLY DETERMINED CONTRIBUTIONS OF COUNTRIES IN SOUTHERN-EASTERN EUROPE AND CENTRAL ASIA

Gaps and opportunities in the agriculture sectors

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Krystal Crumpler, Valentyna Slivinska, Sandro Federici, Mirella Salvatore, Julia Wolf, Alexandre Meybeck and Martial Bernoux

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CONTENTS

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BACKGROUND

The Paris Agreement constitutes a landmark achievement in the international response to climate change, as developed and developing countries alike committed to do their part in the transition to a low-emission and climate-resilient future. Underpinning the Agreement are the (Intended) Nationally Determined Contributions, (I)NDCs,[1] representing the main national policy framework, under the United Nations Framework Convention on Climate Change (UNFCCC), by which Parties communicate their commitment to reducing national greenhouse gas emissions (GHG) and adapting to the impacts of climate change, based on national priorities, circumstances and capabilities, and support needs. The success of the Paris Agreement rests upon the enhanced ambition of Parties to progressively revise and strengthen their respective mitigation and adaptation plans over time[2].

Linked to climate action are the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda, which sets out a vision for a hunger-free, more equitable, sustainable, peaceful and resilient world in 2030. Closing the emissions gap while safeguarding food security and pulling the millions out of extreme poverty can only be achieved in a context of sustainable development, and sustainable development can only be achieved if coupled with a low-emission and climate-resilient future.

Insofar as the agriculture sectors[3] feature prominently in the NDCs of developing countries (FAO, 2016a), **FAO has a critical role to play** in supporting Member Countries to leverage the mitigation and adaptation potential in the agriculture sectors and harness their synergies, while "leaving no one behind."

[1] For the purpose of this document, the (I)NDCs and NDCs are collectively referred to as NDCs..

[2] Article 4.2 of the Paris Agreement.

[3] For the purpose of this document, the 'agriculture sectors' comprise crops, livestock, fisheries and aquaculture, and forestry.

OBJECTIVE

The main objective of this report is to provide a regional synthesis of the current climate change mitigation and adaptation commitments in the agriculture sectors of the Southern Europe, Eastern Europe and Central Asia (SEECA) region, as set forth in the NDCs, and to identify opportunities for enhancing mitigation and adaptation ambitions, capturing their synergies and leveraging climate finance and international support options in the region. It aims to guide international agencies – and policy makers and practitioners in the region – committed to providing the country support required for accelerating progress on and scaling up NDCs in the agriculture sectors, and ensuring that future commitments are clear, quantifiable, comparable, transparent and ambitious.

The SEECA region refers to the composition of geographical regions called Southern Europe, Eastern Europe and Central Asia (UNSD, n.d.). The SEECA region comprises three Annex I Parties to the UNFCCC (Belarus, Ukraine and the Russian Federation) and 11 non-Annex I Parties (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Republic of Moldova, Albania, Bosnia and Herzegovina, Montenegro, Serbia and the Former Yugoslav Republic of Macedonia). All countries in the region, with the exception of three,[4] ratified the Paris Agreement at the time that the present report was developed.

The NDCs are the product of a bottom-up process characterized by different national approaches and processes. They vary greatly in terms of format, scale and detail, resulting from differing perspectives, degrees of technical and institutional capacity, biophysical and economic opportunity and political will. For instance, not all countries integrate in their NDC an adaptation component. For these reasons any comparison between them has to be taken with caution. To facilitate the synthesis and analysis of the NDCs in the agriculture sectors FAO developed a common framework and methodology (see methodological notes).

The report is divided into four main parts:

Part 1 provides an overview of the regional and sub-regional trends driving emission trajectories, climate vulnerabilities, adaptive capacities and food security and nutrition outcomes in the region.

Part 2 presents a common framework for the synthesis and analysis of the NDCs in the agriculture sectors. It reflects the heterogeneous nature of country commitments and illustrates regional trends. It analyzes the scope, specificity, measurability and timeline of the mitigation and adaptation contributions in the agriculture sectors. The data informs the gap and opportunity analysis in Part 3.

[4] Kyrgyzstan, Uzbekistan and the Russian Federation have not ratified the Paris Agreement as of September 1, 2018.

Part 3 describes the results of the gap and opportunity analysis of the mitigation and adaptation contribution in the agriculture sectors. This analysis is meant to support the NDC revision process and ambition-building mechanism of the Paris Agreement. It also assesses the opportunities for capturing mitigation and adaptation co-benefits, as well as leveraging synergies between climate actions in the agriculture sectors and the 2030 Agenda for Sustainable Development.

Part 4 addresses what is needed to ensure that the NDCs are clear, quantifiable, comparable, transparent and ambitious in 2020 and future NDC submission cycles. It presents the results of an NDC Ambition Index and a menu of options for enhancing the NDCs in the agriculture sectors around six main pillars of climate action.

EXECUTIVE SUMMARY

The main objective of this report is to provide a regional synthesis of the current climate change mitigation and adaptation commitments in the agriculture sectors of the Southern Europe, Eastern Europe and Central Asia (SEECA) region, as set forth in the NDCs, and to identify opportunities for enhancing mitigation and adaptation ambitions, capturing their synergies and leveraging climate finance and international support options in the region.

Gaps and opportunities for enhancing mitigation in the agriculture sectors

Without implementation of the NDCs in the SEECA region, total baseline net emissions in 2030 are expected to double those reported in 2015. With implementation, regional net emissions are expected to fall by 27 percent in 2030 compared to the 2015 baseline.

The Agriculture, Forestry and Other Land Use (AFOLU) sector[5] represents the second largest share of emissions in the region (15 percent), after the Energy sector. When emissions from the agriculture and Land Use, Land Use Change and Forestry (LULUCF) sectors are combined, the largest GHG hotspots in the region are emissions from cropland (29 percent), followed by biomass burning from forest land (24 percent), managed soils (22 percent) and enteric fermentation (18 percent), largely generated in Eastern Europe and Central Asia.

Eleven countries[6] include the agriculture sector (79 percent), eight countries[7] include the LULUCF sector (57 percent) and eight countries (57 percent) include both sectors (i.e. AFOLU) in their general mitigation contributions. Six countries in the region (43 percent) include at least one policy and measure in the agriculture sector, of which the majority of measures aim to reduce sectoral emissions through improved livestock management. Eight countries (57 percent) include at least one policy and measure in the LULUCF sector, of which the majority of measures aim to reduce net emission sources and enhance sinks on forest land.

Overall, the most significant regional gaps are observed in mitigation policies and measures in the agriculture sectors **aiming to reduce net emissions from cropland, enteric fermentation and managed soils.**

Gaps and opportunities for enhancing adaptation in the agriculture sectors

The majority of countries report the occurrence of extreme heat and drought amongst observed and/or projected climate-related hazards (57 percent of countries with climate impacts reported, respectively) and **water stress amongst climate-related slow onset risks and events in ecosystems** (71 percent).

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[5] The AFOLU sector refers to the Agriculture and LULUCF sector as defined by the Intergovernmental Panel on Climate Change (IPCC, 2006).

[6] Belarus, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Republic of Moldova, Montenegro, Russian Federation, Serbia, Tajikistan, Turkmenistan and Ukraine.

[7] Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Serbia, Tajikistan and Ukraine.

Seven countries identify at least one observed and/or expected impact, vulnerability and risk induced by climate change in ecosystems, particularly agro-ecosystems (86 percent of countries with climate impacts reported), with forestry and crops (71 percent, respectively) most frequently reported as vulnerable sub-sectors to climate change.

Overall, seven countries[8] (88 percent of countries with adaptation) **include adaptation priority sector(s) and/or measures in the agriculture sectors,** of which the majority of countries prioritize adaptation in the forestry and water sub-sectors (50 percent of countries, respectively), with irrigation and drainage as the most frequently promoted adaptation option.

Water is reported as the most vulnerable natural resource to climate change (39 percent of impacts), in all ecosystems and particularly inland water ecosystems. The majority of countries include water resources amongst cross-sectoral adaptation priorities (88 percent of countries with adaptation).

Ecosystem management, conservation and restoration activities is most frequently promoted amongst adaptation measures outside of farming systems (30 percent of measures), primarily in forest and woodland ecosystems.

Overall, the largest regional gaps are found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response to the climate-related hazards, impacts and vulnerabilities observed and/or projected in the crop sub-sector, followed by forest and mountain ecosystems, amongst others.

Adverse health (80 percent of countries with impacts reported) **is most reported amongst observed and/or expected climate-related impacts, vulnerabilities and risks in social systems.** Health (63 percent of countries with adaptation represents the greatest cross-cutting adaptation priority in social systems amongst countries in the region.

The majority of countries that reference non-climatic drivers of vulnerability indicate poverty and low levels of human development (60 percent of countries) as the greatest stressors.

Only four countries (50 percent of countries with adaptation) **identify at least one adaptation measure in social systems.** The majority of countries prioritize options related to socio-economics and well-being, with gender equality and women empowerment as the most prioritized adaptation options.

Overall, the largest policy gaps found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response **to observed and/or projected adverse health and food insecurity and malnutrition outcomes.**

Farming-systems approach to climate action

Based on the results of the gap and opportunity analysis, a farming-system approach integrating mitigation and adaptation priorities across agro-ecosystems and rural livelihoods is proposed per major farming system found in the SEECA region.

Opportunities for leveraging synergies with the 2030 agenda

The high degree of convergence between the climate and sustainable development agendas suggests that aligning their implementation provides a great opportunity to national and sub-national governments to accelerate progress across both agendas. After SDG 13 "Climate action," the greatest area of convergence between SEECA region climate actions in the agriculture sectors and the SDGs is found around targets 12.2 "Efficient use of natural resources" and 2.3 "Assure agricultural productivity for marginalized."

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[8] Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Belarus, Republic of Moldova, and Serbia.

Support needs

Eight countries (57 percent) express support needs in the form of either technology transfer, capacity development and/or finance. Five countries[9] reference technology costs or needs; three[10] cite capacity building needs; and eight[11] make their NDCs contingent upon financial support.

Towards 2020

The results of the NDC Ambition Index analysis point to a set of options for enhancing NDCs across six main pillars of climate action in the agriculture sectors: i) building mitigation ambition; ii) strengthening adaptation options; iii) aligning national planning processes; iv) monitoring mitigation and adaptation progress; v) enhancing the transparency of reporting; and vi) accelerating the means of implementation. The options presented across these six pillars aim to inform the 2020 review and revision cycle of the NDCs to ensure that future NDCs in the agriculture sectors are transparent, quantifiable, comparable and ambitious.

[9] Kazakhstan, Republic of Moldova, Tajikistan, Turkmenistan and Uzbekistan.

[10] Republic of Moldova, Turkmenistan and Uzbekistan.

[11] Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, The Former Yugoslav Republic of Macedonia, Turkmenistan and Uzbekistan.

PART 1

PART

1

REGIONAL CIRCUMSTANCES

1.1 CLIMATE AND NATURAL RESOURCES

Climate varies across the region, with the most predominant climate zones classified as boreal moist and cool temperate dry (JRC, 2010). Land area is about 2.3 billion ha, or 17 percent of the world's land. While Central Asia is largely covered by grassland, forest land covers most of Southern and Eastern Europe (FAOa, n.d.). The amount of arable land per capita ranges from 2.3 hectares per capita in Eastern Europe to one in Central Asia and less than half in Southern Europe (FAOa, n.d.). Overall, the majority of land is categorized by soils with no or slight constraints for agriculture, or high natural fertility, with only ten percent of land classified as severe or very severely constrained (FAOb, n.d.). The distribution of freshwater resources is uneven across the region with water stress or scarcity being identified in some areas even if it does not appear at the national level (FAOc, n.d.). Comparable trends are observed in agricultural water use, as sectoral withdrawal represents a very low share of total annual renewable resources in Eastern and Southern Europe, but a driver of water stress [12] in Central Asia (FAOc, n.d.).

[12] Refers to basin-level water stress threshold defined by Luo *et al.*, (2015).

1.2 FARMING SYSTEMS

The diversity of the landscape and natural resource base across the region gives way to varying farming activities and livelihood patterns. Large differences in agro-ecologies are observed amongst farming systems in the SEECA region (**Table 1**), ranging from one of the world's most fertile regions in Southern and Eastern Europe, to the poor, water-scarce regions of Central Asia. The dominant farming system is sparse (cold), followed by extensive cereal-livestock systems (FAO and WB, 2001). The majority of the population lives in the extensive cereal-livestock farming system, followed by large-scale cereal-vegetable and pastoral systems (ORNL, 2010).

TABLE 1.

MAJOR FARMING SYSTEMS IN THE SEECA REGION

FARMING SYSTEM	% OF TOTAL AREA	% OF POPULATION	PRINCIPAL LIVELIHOODS	PREVALENCE OF POVERTY
SPARSE (COLD)	58%	8%	RYE, OATS, REINDEER, POTATOES, PIGS, FORESTRY	EXTENSIVE
EXTENSIVE CEREAL-LIVESTOCK	20%	33%	WHEAT, HAY, FODDER, CATTLE, SHEEP	MODERATE-EXTENSIVE
LARGE-SCALE CEREAL-VEGETABLE	5%	23%	WHEAT, BARLEY, SHEEP AND GOATS	MODERATE
PASTORAL	4%	11%	SHEEP, CATTLE, CEREALS, FODDER CROPS, POTATOES	MODERATE-EXTENSIVE
FOREST-BASED LIVESTOCK	2%	7%	FODDER, HAY, CEREALS, INDUSTRIAL CROPS, POTATOES	MODERATE
IRRIGATED	1%	9%	COTTON, RICE, OTHER CEREALS, TOBACCO, FRUIT, VEGETABLES, OFF-FARM	MODERATE-EXTENSIVE
MIXED	<1%	<1%	WHEAT, MAIZE, OILCROPS, BARLEY, LIVESTOCK	LOW-MODERATE
HORTI-CULTURE MIXED	1%	6%	WHEAT, MAIZE, OILCROPS, FRUIT, INTENSIVE VEGETABLES, LIVESTOCK, OFF-FARM INCOME	MODERATE-EXTENSIVE

Source: FAO and WB, 2001; ORNL, 2010.
Note: Prevalence of poverty refers to number in poverty, not depth of poverty, and is a relative assessment for this region. Water bodies account for 5 percent of the total regional land area.

1.3 POPULATION AND RURAL ECONOMY

The total population of 300 million people making up the region today is projected to decline by 2050 (UN DESA, 2017). Slow population growth is mostly driven by Central Asia, while stagnation and negative growth are expected in Eastern and Southern Europe. Annual gross domestic product (GDP) growth in the region is accelerating at 4 percent compared to the global average and per capita GDP

ranks higher than the global average (WB, n.d.), with large differences within and across countries.[13] Agriculture plays a significant role in the region's economy, accounting for a declining average of 12 percent of GDP[14] (WB, n.d.) and 23 percent of total employment (ILO, n.d.).

1.4 FOOD SECURITY AND NUTRITION

Currently, the share of total population with severe food insecurity ranges between 2.9 to 3.9 percent of total population. Albania experiences the most severe of food insecurity situations in the region, with one in ten people going a full day without eating multiple times throughout the year (FAOa, n.d.). Overall, the prevalence of undernourishment in the total population decreased in Central Asia (from 11 to 6 percent of total population) and remained stable in Eastern and Southern Europe (<2.5 percent, respectively) at levels below the global average between 2004 and 2017 (FAOa, n.d.). While inadequate or unbalanced consumption patterns lacking in macronutrients or essential micronutrients fell between 2012 and 2017, a simultaneous increase in obesity of the adult population above 18 years of age was observed, reaching double the worldwide average in Eastern Europe (25 percent of the population) and well above the worldwide average in Southern Europe (22 percent) and Central Asia (16 percent).[15] Climate variability and extremes will impact food security and nutrition outcomes in Central Asia and Southern Europe, where most countries are net importers of cereal, particularly Montenegro.[16] Long-term changes in precipitation and temperature may negatively impact yields and productivity, while climatic extremes may destabilize food markets in net-exporting regions, such as Eastern Europe.[17]

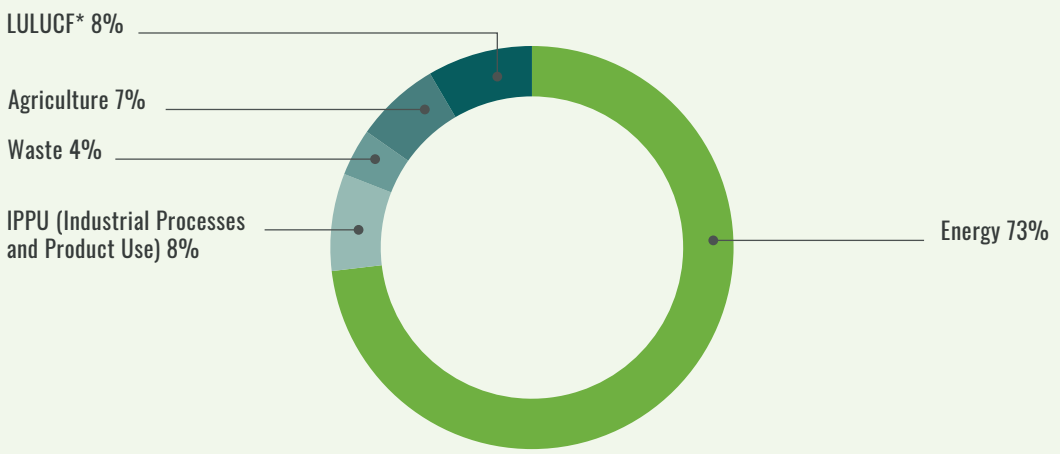
1.5 GHG EMISSIONS PROFILE

The Agriculture, Forestry and Other Land Use (AFOLU) sector[18] represents the second largest share of emissions in the region (15 percent), after the Energy sector (**Figure 1**).

[13] Data refers to year 2016 for Europe and Central Asia region, excluding high income countries (WB, n.d.).
[14] Refers to 2015 data (WB, n.d.).
[15] Global average prevalence of obesity in adult population over 18 years of age was 13.2 percent in 2016 (UNICEF, WHO and International Bank for Reconstruction and Development/WB. 2018).
[16] Kyrgyzstan, Tajikistan, Uzbekistan, Belarus, Albania, Bosnia and Herzegovina, The former Yugoslav Republic of Macedonia and Montenegro were net cereal importers in 2011-2013 (FAOa, n.d.).
[17] Kazakhstan, Republic of Moldova, Russian Federation, Ukraine and Serbia were net cereal exporters in 2011-2013 (FAOa, n.d.).
[18] The AFOLU sector refers to the Agriculture and LULUCF sector as defined by the Intergovernmental Panel on Climate Change (IPCC, 2006).

FIGURE 1.

SHARE OF REGIONAL ECONOMY-WIDE EMISSIONS, PER SECTOR



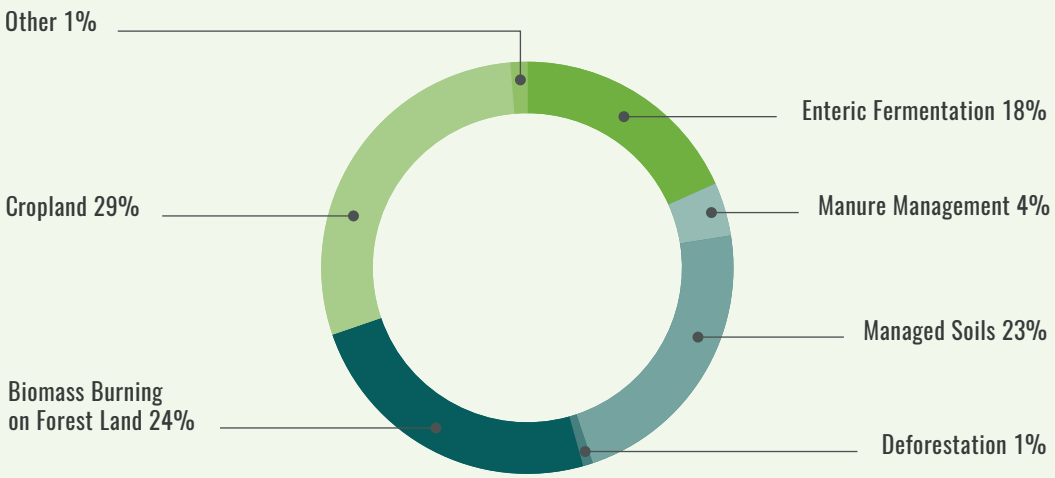
Source: National Greenhouse Gas Inventory (NGHGI), National Communication (NC) and Biennial-Update-Report (BUR), last year reported.
** Excluding removals.*

Within the AFOLU sector (Figure 2), **the most significant GHG sources are cropland**[19] (29 percent), **biomass burning on forest land**[20] (24 percent), **managed soils**[21] (23 percent) **and enteric fermentation** (18 percent). Within the agriculture sector, the largest sources of emissions are managed soils[22] (50 percent), enteric fermentation (41 percent) and manure management (9 percent). The Land Use, Land Use Change and Forestry (LULUCF) sector constitutes a net sink at the regional level, mainly from CO_2 removals by forest management[23] (89 percent) and grassland (9 percent). Excluding CO_2 removals, however, emissions from cropland represent the greatest source of land use emissions (52 percent), followed by the biomass burning on forest land (43 percent).

[19] Corresponds to the IPCC (2006) category "Cropland" excluding net CO_2 for "Forest land converted to cropland" and the IPCC (1996) category "CO_2 emissions and removals from soil".
[20] Corresponds to the IPCC (2006) sub-category "Biomass burning" under land use category "Forest land".
[21] Corresponds to the IPCC (2006) categories "Direct and indirect N20 emissions from agricultural", "Liming", "Urea application" and the IPCC (1996) category "Agricultural soils".
[22] Corresponds to the IPCC (2006) categories "Direct and indirect N20 emissions from agricultural", "Liming", "Urea application" and the IPCC (1996) category "Agricultural soils".
[23] Forest management accounts for total net emissions related to IPCC (2006) land use category "Forest land remaining forest land" and IPCC (1996) category "Changes in forest and other woody biomass," when those categories are a net sink at national level.

FIGURE 2.

SHARE OF REGIONAL EMISSIONS IN THE AFOLU SECTOR, PER MAJOR CATEGORY



Source: NGHGI, NC, BUR; last year reported.
** The emission categories and sub-categories with a share less than 1% of the total are excluded from the figure.*

PART 2

PART

2

MITIGATION AND ADAPTATION CONTRIBUTIONS IN THE AGRICULTURE SECTORS

2.1 MITIGATION CONTRIBUTION

2.1.1 GHG targets

All 14 countries communicated their domestic mitigation contribution to stabilize the global climate under Article 2 of the Paris Agreement. Thirteen countries set a GHG target, while one country[24] qualifies its general mitigation contribution in terms of "Action-only."

Eleven countries[25] include the agriculture sector (79 percent), **eight countries[26] include the LULUCF sector** (57 percent) include both sectors (i.e. AFOLU in their general mitigation contributions (**Figure 3**).

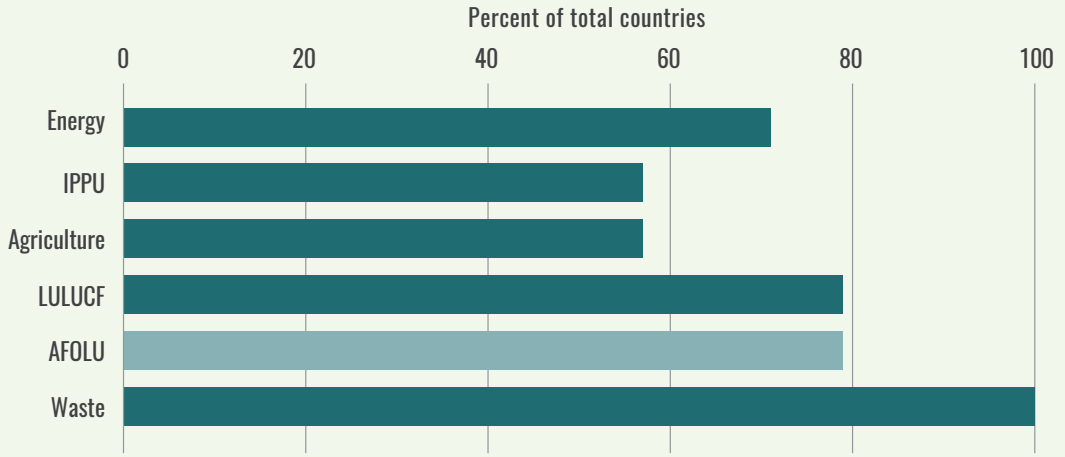
[24] Turkmenistan.

[25] Belarus, Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Republic of Moldova, Montenegro, Russian Federation, Serbia, Tajikistan, Turkmenistan and Ukraine.

[26] Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Republic of Moldova, Russian Federation, Serbia, Tajikistan and Ukraine.

FIGURE 3.

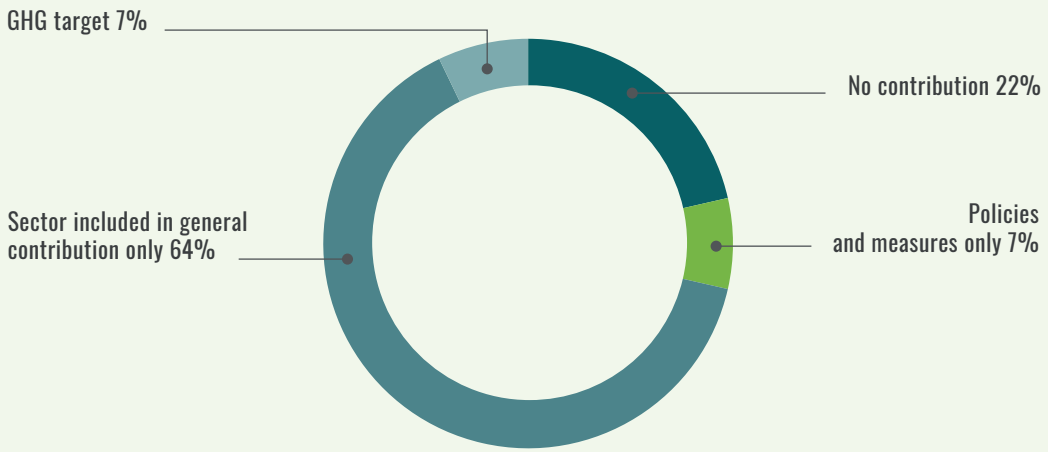
SHARE OF COUNTRIES WITH A GENERAL MITIGATION CONTRIBUTION, BY SECTOR INCLUDED



Out of the 11 countries that include the agriculture sector in their general mitigation contribution (Figure 4), **only one[27] sets a sectoral GHG target,** expressed as an absolute reduction of net emissions compared to a base year level, one[28] includes a set of mitigation policies and measures and the remaining nine countries include the sector only as part of their general mitigation contribution.

FIGURE 4.

SHARE OF COUNTRIES WITH A MITIGATION CONTRIBUTION IN THE AGRICULTURE SECTOR, BY TYPE

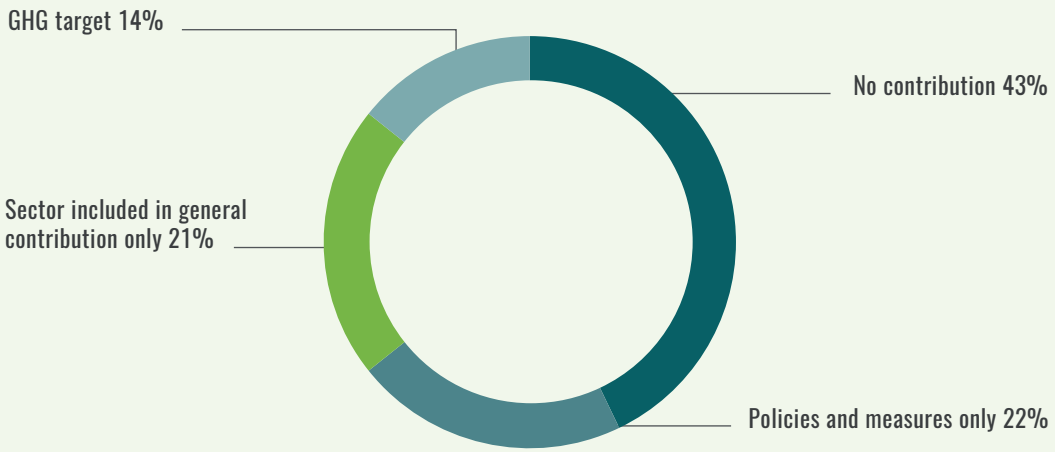


[27] Bosnia and Herzegovina and Republic of Moldova.
[28] Republic of Moldova.

Out of the eight countries that include the LULUCF sector in their general mitigation contribution (**Figure 5**), two[29] set sectoral GHG targets, both expressed as an absolute reduction of net emissions compared to a base year level. Three countries[30] include a set of mitigation policies and measures, and the remaining three countries include the sector only as part of their general mitigation contribution.

FIGURE 5.

SHARE OF COUNTRIES WITH A MITIGATION CONTRIBUTION IN THE LULUCF SECTOR, BY TYPE



2.1.2 Policies and measures

Countries often qualify their sectoral mitigation contribution by a number of policies and measures that aim to reduce net emissions or emission intensity, or enhance carbon sinks, from a particular agricultural activity and/or land use.

Overall, the majority of policies and measures have quantified targets (57 percent of measures), most in terms of GHG emission reductions.

Around three-fourths of policies and measures require a combination of domestic and international financial support, while only a small share of policies and measures are unconditional, and an even smaller share are fully conditional.

The majority of mitigation policies and measures are supply-side oriented (93 percent of measures), with a small share of demand-side interventions.

Of all measures, the majority target the production phase of agriculture and food value chains (88 percent of measures), followed by small shares of waste, consumption and full value chain phases.

[29] Bosnia and Herzegovina and Republic of Moldova.
[30] Kazakhstan, Tajikistan and Russian Federation.

Policies and measures in the agriculture sector

Six countries in the region (43 percent) include at least one policy and measure in the agriculture sector. The majority of these countries have one or more policies and measures targeting livestock management (29 percent), followed by bioenergy production from agriculture and cropland management (21 percent), integrated systems (14 percent) and grassland and agriculture land management (7 percent, respectively). **Figure 6** illustrates the share of countries in the region with one or more (to avoid bias of representation) policies and measures in the agriculture sector per land use category or sub-sector.

FIGURE 6.

SHARE OF COUNTRIES WITH POLICIES AND MEASURES IN THE AGRICULTURE SECTOR, BY COUNTRY AND LAND USE/SUB-SECTOR

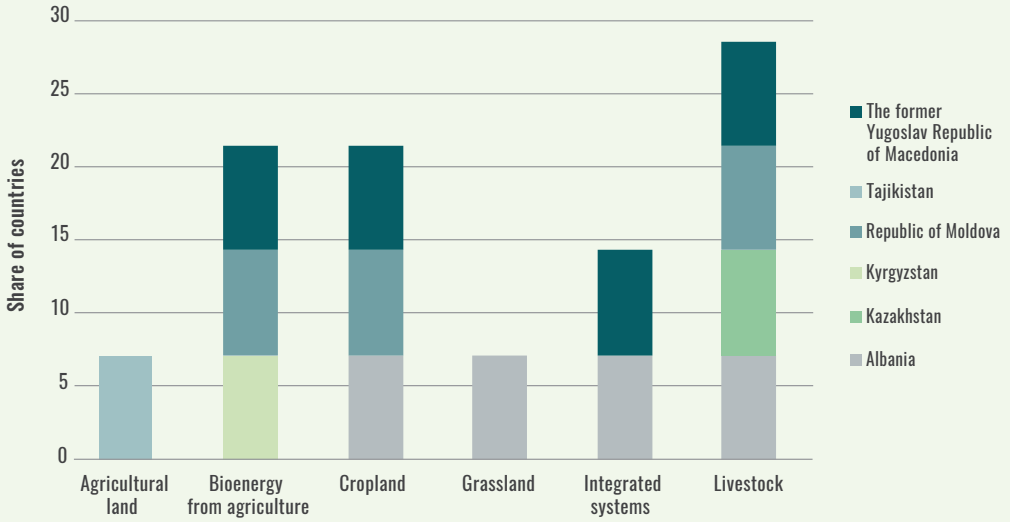
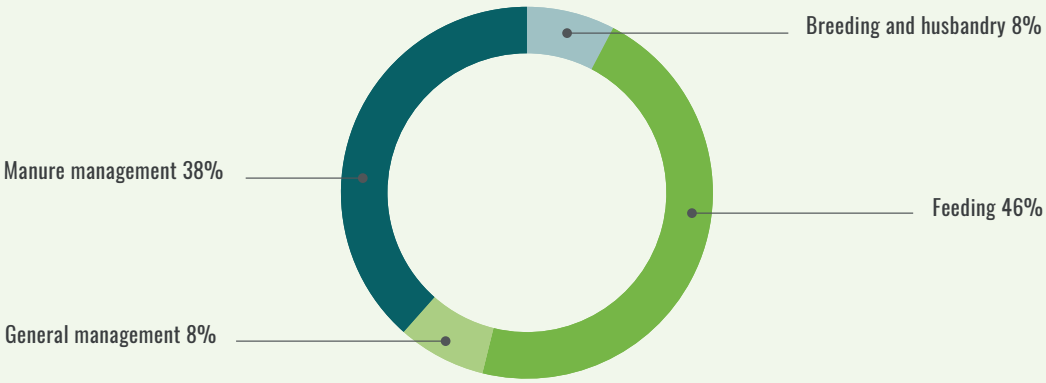


FIGURE 7.

SHARE OF MITIGATION POLICIES AND MEASURES IN THE LIVESTOCK SUB-SECTOR, BY MANAGEMENT ACTIVITY

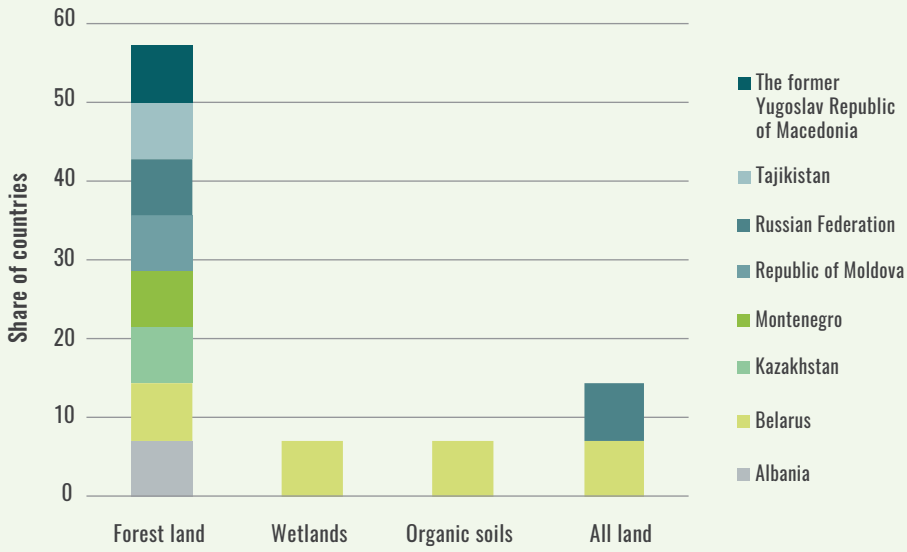


Policies and measures in the LULUCF sector

Eight countries (57 percent) include at least one policy and measure in the LULUCF sector. The majority of these countries have one or more policies and measures aiming to reduce sectoral emissions or enhance sinks through management activities on forest land (57 percent of countries), followed by all land types (14 percent) and wetlands and organic soils (7 percent, respectively). **Figure 8** illustrates the share of countries in the region with one or more (to avoid bias of representation) policies and measures in the LULUCF sector per land use category.

FIGURE 8.

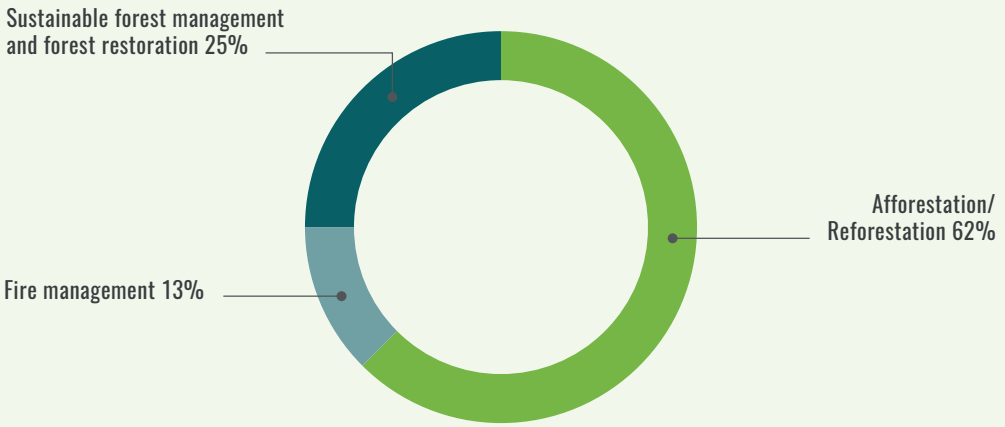
SHARE OF COUNTRIES WITH POLICIES AND MEASURES IN THE LULUCF SECTOR, BY COUNTRY AND LAND USE



Amongst mitigation policies and measures on forest land, the majority refer to afforestation/reforestation (62 percent of measures), followed by sustainable forest management and forest restoration (25 percent) and fire management (13 percent). **Figure 9** indicates the distribution of all mitigation policies and measures on forest land for all countries.

FIGURE 9.

SHARE OF MITIGATION POLICIES AND MEASURES ON FOREST LAND, BY MANAGEMENT ACTIVITY



Bioenergy policies and measures from agriculture and forests

Overall, five countries (36 percent of countries) **include at least one policy and measure related to bioenergy from the agriculture and/or LULUCF sectors.** The majority of bioenergy-related policies and measures from agriculture and/or forest biomass relate to liquid biofuel production (33 percent of measures). The majority of policies target bioenergy production from agricultural biomass rather than from forest biomass.

2.2 ADAPTATION CONTRIBUTION

Climate change directly affects the natural resources and ecosystems upon which agricultural production, food systems and rural livelihoods rely. Climate change impacts on food security and nutrition are transmitted through different pathways, and the severity of the impact is determined by climate drivers and risks, and by the underlying vulnerability of ecosystems, agro-ecosystems, rural economies and households (FAO. 2016b). A key way to moderate, reduce and/or avoid climate-related impacts is to reduce a system's underlying vulnerabilities, strengthen its adaptive capacity and increase its resilience (FAO, 2016c).

2.2.1 Climate-related hazards, impacts, and vulnerabilities

Seven countries[31] in the region (50 percent) **included observed and/or projected climate-related hazards, impacts and vulnerabilities** in ecosystems and/or social systems order to inform or contextualize the need for adaptation to climate change.

[31] Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Belarus, Republic of Moldova, and Serbia.

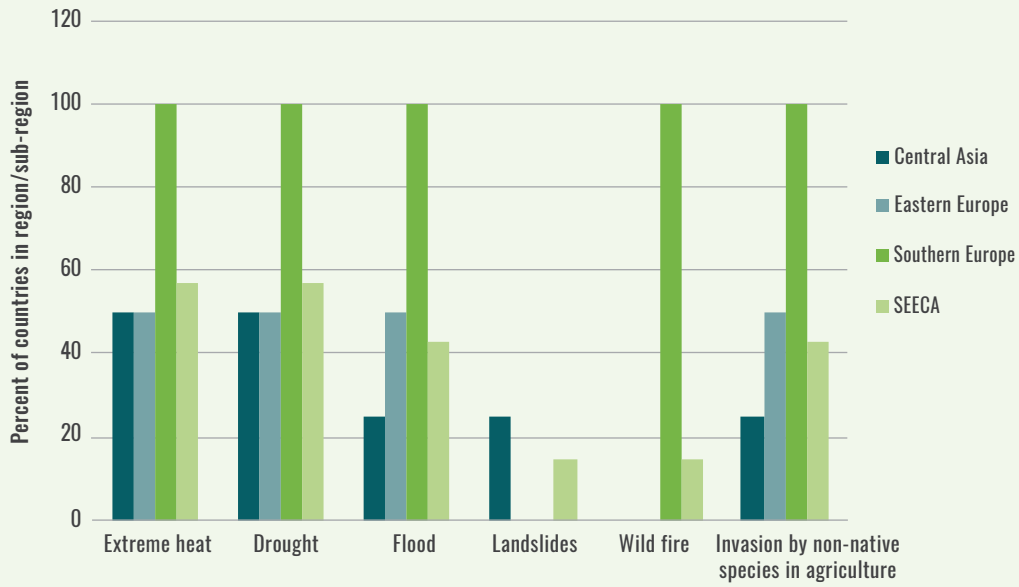
Climate-related hazards and slow onset events

Out of those seven countries, five (71 percent) report observed and/or projected changes in meteorological variables, namely variations in mean annual precipitation and surface air temperature and the frequency and intensity of climate extremes.

The majority of those countries report the occurrence of extreme heat and drought (57 percent of countries with climate impacts, respectively), **amongst observed and/or projected climate-related hazards,**[32] followed by floods and invasion by non-native species (43 percent, respectively) and wild fire and land slides (14 percent, respectively). **Figure 10** illustrates the share of countries, at the sub-regional and regional level, that report observed and/or projected climate-related hazards by type of hazard.

FIGURE 10.

SHARE OF COUNTRIES THAT REPORT OBSERVED AND/OR PROJECTED CLIMATE-RELATED HAZARDS, BY HAZARD TYPE

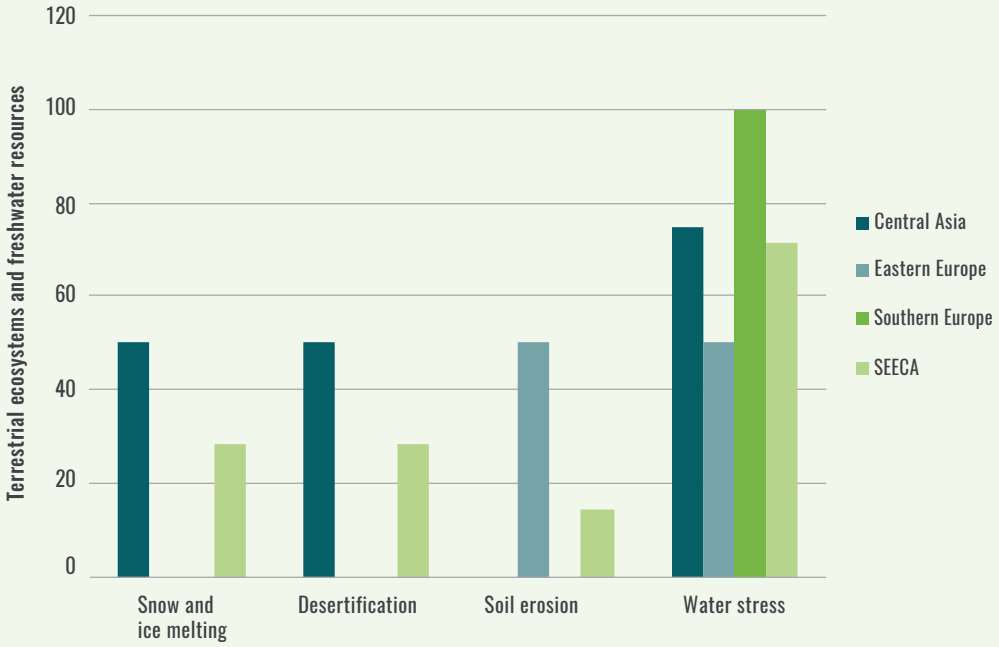


Water stress is most frequently reported amongst observed and/or projected climate-related slow onset risks and events[33] **in terrestrial ecosystems and for freshwater resources** (71 percent of countries with climate impacts), followed by desertification and snow and ice melting (29 percent, respectively). **Figure 11** illustrates the share of countries, at the sub-regional and regional level, that report observed and/or projected climate-related risks and slow onset events by type of risk.

[32] Definition of climate-related hazard adapted from IPCC (2014b) and EM-DAT (n.d.).
[33] Definition of climate-related slow onset risks and events adopted from IPCC (2014b).

FIGURE 11.

SHARE OF COUNTRIES THAT REPORT OBSERVED AND/OR PROJECTED CLIMATE-RELATED RISKS AND SLOW ONSET EVENTS, BY RISK TYPE



Out of the five countries that reference non-climatic drivers of vulnerability,[34] the majority indicate poverty and low levels of human development (60 percent of countries), followed by geography and topography, economic dependence on agriculture and natural resources and political instability and civil conflict (40 percent, respectively) as the largest stressors of vulnerability.

Climate-driven impacts, vulnerabilities and risks in ecosystems

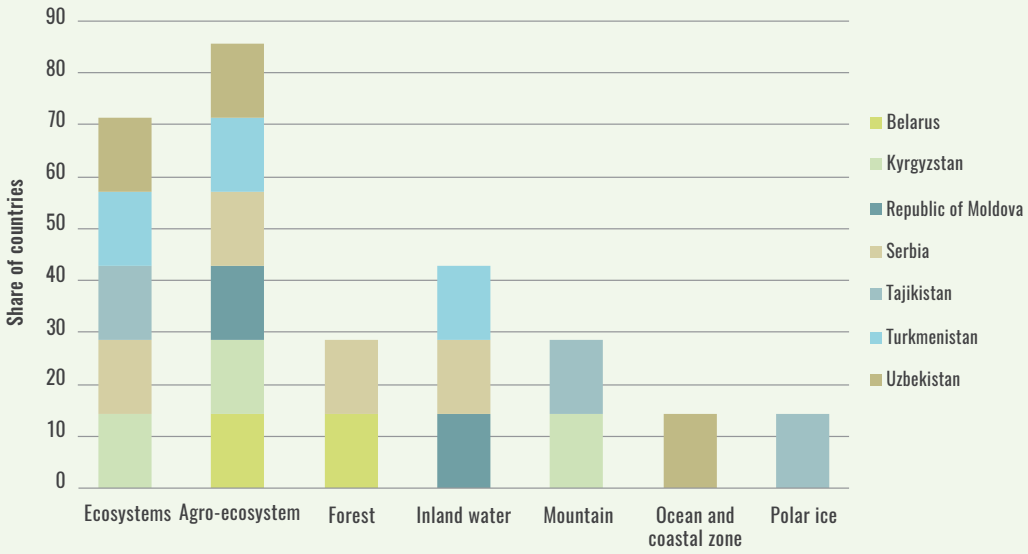
Seven countries in the region (50 percent) identify at least one observed and/or expected impact, vulnerability and risk[35] induced by climate change in ecosystems. **Figure 12** illustrates the share of countries that report one or more observed and/or expected climate-related impact, vulnerability and risk in ecosystems by type of ecosystem.

Of those seven countries, the majority indicate agro-ecosystems as the most vulnerable ecosystem to climate change (86 percent of countries), followed by all ecosystems in general (71 percent), inland water (43 percent), mountain and forest ecosystems (29 percent, respectively) and polar ice ecosystems and ocean and coastal zones (14 percent, respectively).

[34] Definition of non-climatic stressors adapted from IPCC (2014b).
[35] Definition of impact, vulnerability and risk in natural systems adapted from IPCC (2014).

FIGURE 12.

SHARE OF COUNTRIES THAT REPORT OBSERVED AND/OR PROJECTED CLIMATE-DRIVEN IMPACTS, VULNERABILITIES AND RISKS IN ECOSYSTEMS, BY COUNTRY AND ECOSYSTEM TYPE



Water is reported as the most vulnerable natural resource to climate change (39 percent of impacts), in all ecosystems and particularly inland water ecosystems, followed by genetic resources (23 percent), all natural resources (23 percent), primarily in mountain and forest ecosystems, and land and soil resources (15 percent).

Amongst impacts on ecosystem services, the loss of ecosystem, biodiversity and ecosystem goods, functions and services is reported the most (43 percent of impacts), primarily in forest and mountain ecosystems.

In agro-ecosystems, the majority of countries indicate forestry and crops as the most vulnerable sub-sectors to climate change (71 percent of countries, respectively), followed by the agriculture sector in general (43 percent).

In agro-ecosystems, genetic resources are considered the most vulnerable natural resource to climate change (79 percent of impacts), primarily in the forestry sub-sector.

Amongst impacts on ecosystem services in agro-ecosystems the loss of primary production and productivity (86 percent of impacts) **is most frequently reported,** primarily in forestry and the agriculture sector in general, followed by pest and disease incidence in forestry and changes in water availability in the crop sub-sector.

Climate-driven impacts, vulnerabilities and risks in social systems

Five countries in the region (36 percent) identify at least one observed and/or expected impact, vulnerability and risk induced by climate change in social systems.[36]

Overall, the majority of countries report health as the social dimension most at risk under climate change (80 percent of countries), **followed by food insecurity and malnutrition**

[36] Definition of impact, vulnerability and risk in natural systems adapted from IPCC (2014b).

(40 percent). **Figure 13** illustrates the share of countries that report one or more observed and/or expected climate-related impact, vulnerability and risk in social systems by type.

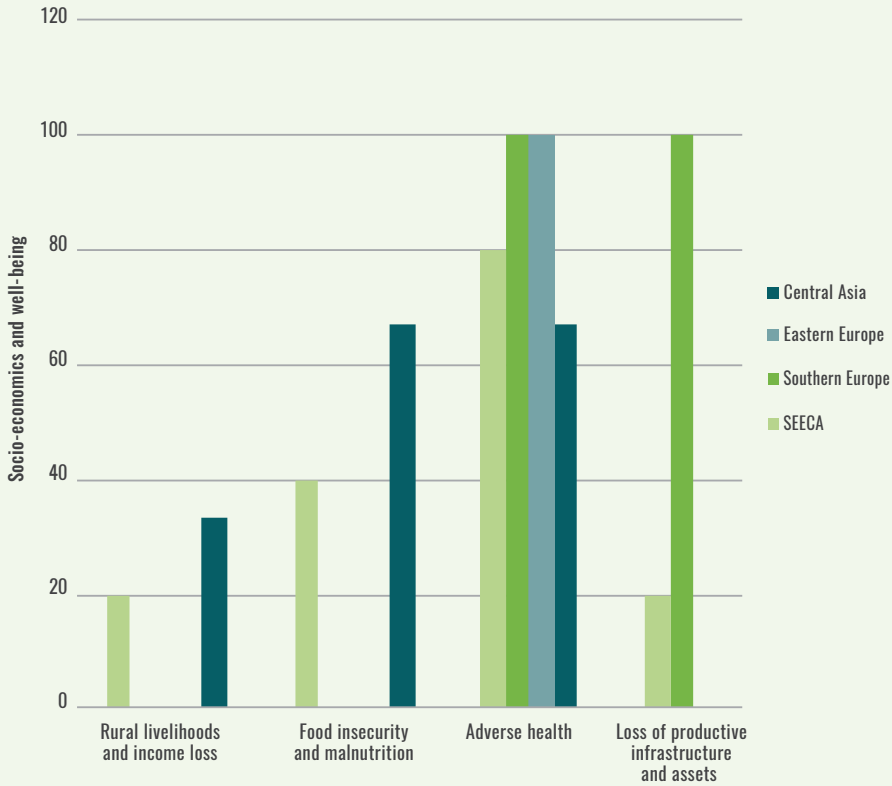
2.2.3 Adaptation priorities and measures

Eight countries[37] in the region (57 percent) **communicated an adaptation component** in their respective NDCs to the UNFCCC in line with the global goal to enhance adaptive capacity and resilience, and reduce vulnerability to climate change, set under Article 7.10 of the Paris Agreement.

Out of the eight countries with an adaptation component, seven[38] (88 percent) **include priority sector(s) and/or measures in the agriculture sectors,** characterized by varying degrees of detail and breadth (**Figure 14**). Four of those countries (50 percent) include a set of priority sector(s) and measures and three (38 percent) include a set of priority sector(s) for adaptation in the agriculture sectors. Twenty-five percent of countries with adaptation include a long-term adaptation goal.

FIGURE 13.

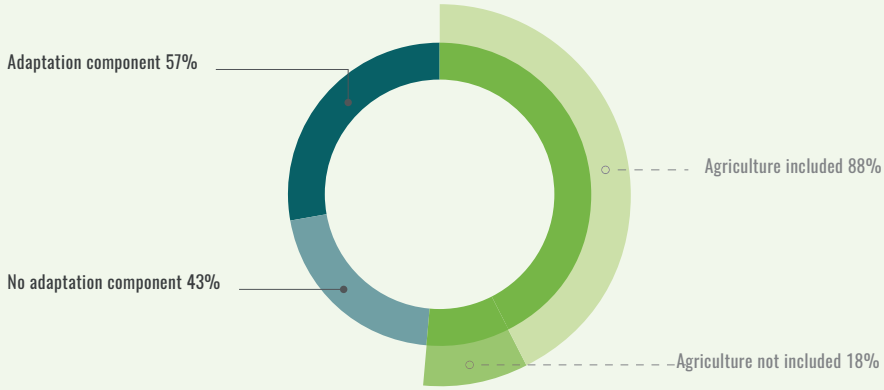
SHARE OF COUNTRIES THAT REPORT OBSERVED AND/OR PROJECTED CLIMATE-DRIVEN IMPACTS, VULNERABILITIES AND RISKS IN SOCIAL SYSTEMS, BY TYPE



[37] Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Belarus, Republic of Moldova, Ukraine and Serbia.
[38] Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Belarus, Republic of Moldova, and Serbia.

FIGURE 14.

SHARE OF COUNTRIES WITH AGRICULURE IN THE ADPTATION COMPONENT

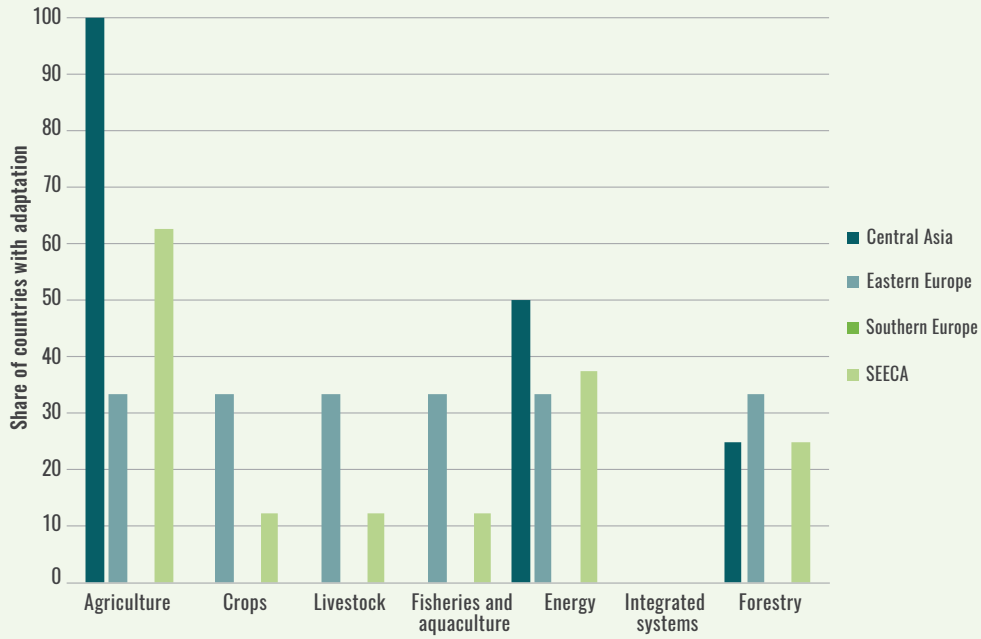


Priority sectors and cross-cutting priorities

Amongst priority sectors for adaptation, the majority of countries prioritize the agriculture sector in general (63 percent of countries with adaptation) and the energy sub-sector (38 percent), followed by forestry (25 percent) and crops, livestock and fisheries and aquaculture sub-sectors to an equal degree (13 percent, respectively). **Figure 15** illustrates the share of countries with adaptation that include priorities in the agriculture sectors by sub-sector.

FIGURE 15.

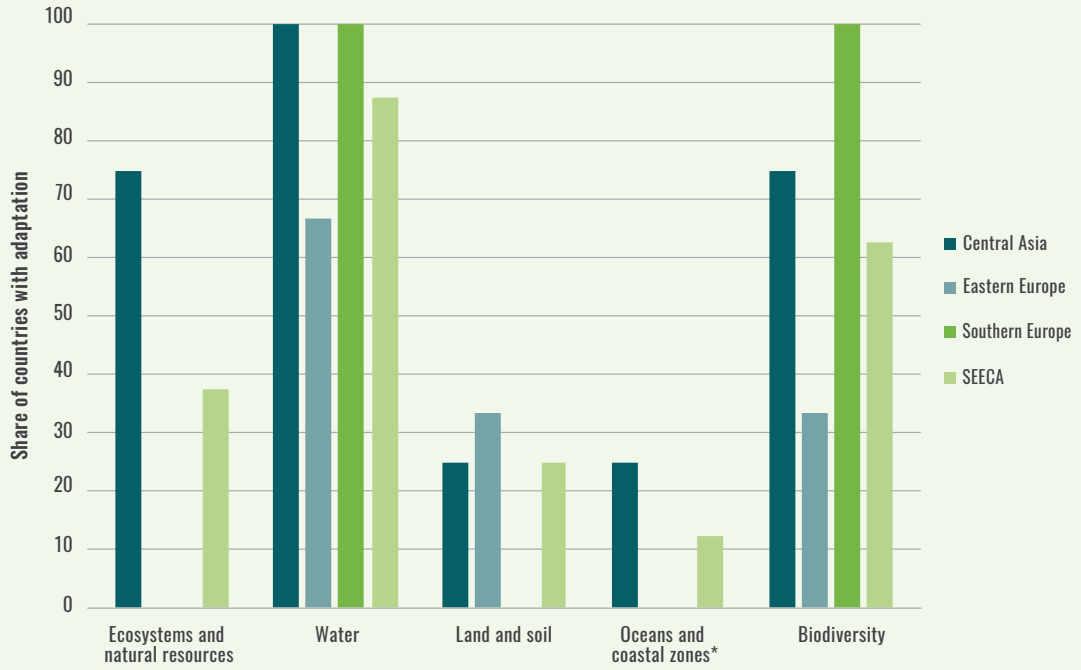
SHARE OF COUNTRIES WITH ADAPTATION PRIORITIES IN THE AGRICULTURE SECTORS, BY (SUB-) SECTOR



Overall, the majority of countries include water resources amongst cross-sectoral adaptation priorities (88 percent of countries with adaptation), followed by biodiversity (63 percent), ecosystems and natural resources (38 percent), land and soil (25 percent) and oceans and coastal zones (13 percent). **Figure 16** illustrates the share of countries with adaptation that include cross-sectoral adaptation priorities by type of natural resource or ecosystem.

FIGURE 16.

SHARE OF COUNTRIES WITH CROSS-SECTORAL ADAPTATION PRIORITIES IN ECOSYSTEMS, BY NATURAL RESOURCE OR ECOSYSTEM TYPE

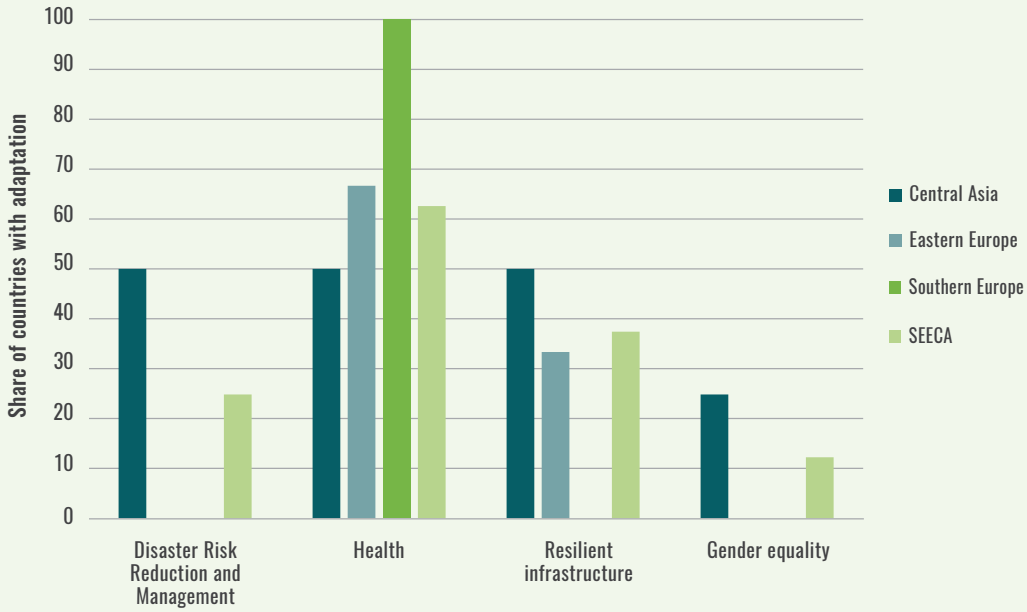


** Seven countries in the SEECA region are classified as landlocked developing countries.*

Health represents the greatest cross-cutting adaptation priority in social systems amongst countries in the region (63 percent of countries with adaptation), followed by resilient infrastructure (38 percent), Disaster Risk Reduction and Management (DRR/M) (25 percent) and gender equality (13 percent). **Figure 17** illustrates the share of countries with adaptation that include cross-cutting adaptation priorities in social systems by type.

FIGURE 17.

SHARE OF COUNTRIES WITH CROSS-CUTTING ADAPTATION PRIORITIES IN SOCIAL SYSTEMS, BY TYPE



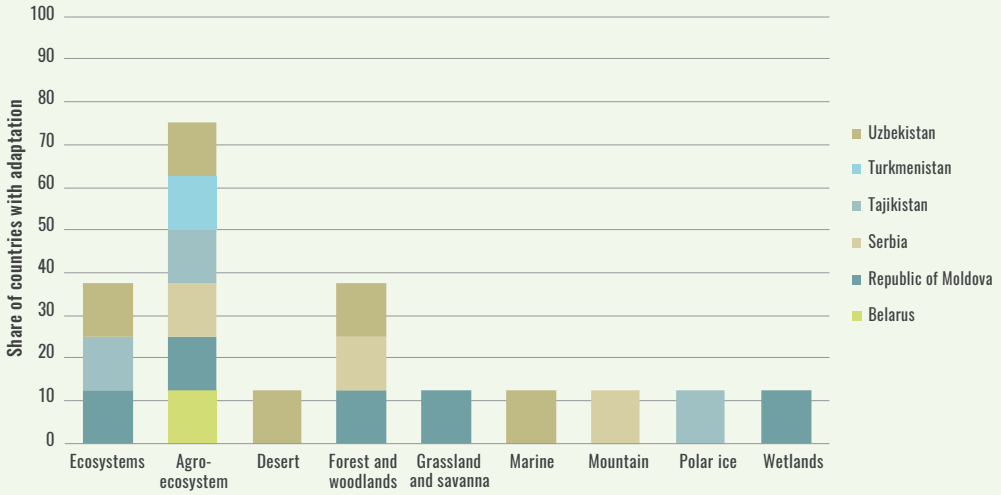
Adaptation measures in ecosystems

Overall, only one percent of adaptation measures have quantified targets, likely due to the challenges related to measuring adaptation baselines and outcomes at the local and national scale. The majority of measures require a combination of domestic and international financial support (90 percent of measures), while only a small share of policies and measures are fully conditional and an even smaller share are unconditional. Of all adaptation measures, the majority is either supply-side (production) oriented (50 percent of measures), with a small share of demand-side interventions.

Out of those countries with an adaptation component, six (75 percent) identify at least one adaptation measure in ecosystems. The majority of countries prioritize adaptation in agro-ecosystems (75 percent of countries with adaptation), followed by forest and woodlands and ecosystems in general (38 percent, respectively), and grassland and savanna, marine, mountain, polar ice, wetlands and desert ecosystems (13 percent, respectively). **Figure 18** illustrates the share of countries with adaptation that include one or more (to avoid bias of representation) adaptation measure in ecosystems by type of ecosystem.

FIGURE 18.

SHARE OF COUNTRIES WITH ADAPTATION MEASURES IN ECOSYSTEMS, BY COUNTRY AND ECOSYSTEM TYPE

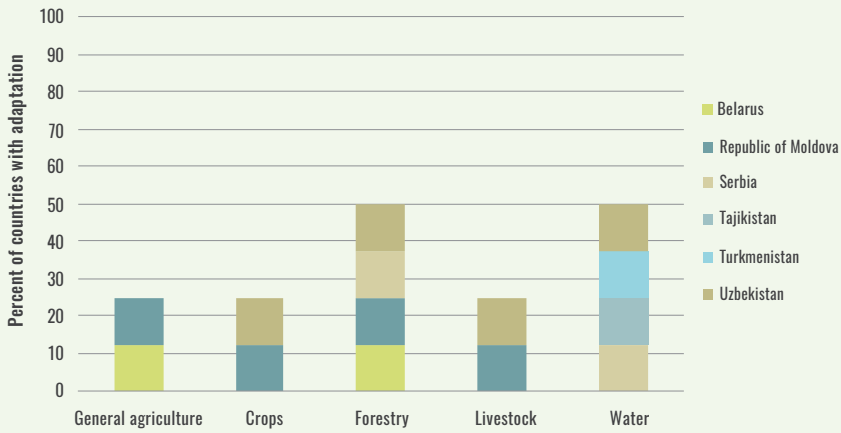


Amongst adaptation measures, ecosystem management, conservation and restoration activities are most frequent (30 percent of measures), **primarily in forest and woodland ecosystems,** followed by biodiversity protection, conservation and restoration (22 percent), in desert, forest and woodlands, marine and mountain ecosystems, and land/soil management, restoration and rehabilitation (19 percent), in ecosystems in general as well as in forest and woodlands ecosystems.

Within agro-ecosystems, the majority of countries prioritize adaptation in the forestry and water sub-sectors (50 percent of countries with adaptation, respectively), followed by livestock, crops and agriculture in general (25 percent, respectively). **Figure 19** illustrates the share of countries with adaptation that include one or more (to avoid bias of representation) adaptation measure in agro-ecosystems by sub-sector.

FIGURE 19.

SHARE OF COUNTRIES WITH ADAPTATION MEASURES IN AGRO-ECOSYSTEMS, BY COUNTRY AND SUB-SECTOR



Amongst adaptation measures in agro-ecosystems, the majority promote irrigation and drainage (15 percent of measures), followed by afforestation/reforestation and plant management (12 percent, respectively).

Adaptation measures in social systems

Out of those countries with an adaptation component, four (50 percent) identify at least one adaptation measure in social systems. The majority of countries prioritize options related to socio-economics and well-being and knowledge and capacity (50 percent of countries, respectively), followed by institutions and governance (38 percent). Figure 20 illustrates the share of countries with adaptation that include one or more (to avoid bias of representation) adaptation measure in social systems by pillar and intervention area.

FIGURE 20.

SHARE OF COUNTRIES WITH ADAPTATION MEASURES IN SOCIAL SYSTEMS, BY PILLAR AND INTERVENTION AREA

Amongst adaptation measures along the socio-economics and well-being pillar, those targeting gender equality and women empowerment are most prominent (22 percent of measures) followed by food security and nutrition and health information and services (14 percent, respectively), amongst others.

Amongst adaptation measures along the knowledge and capacity pillar, the majority aim to increase research and development (R&D) (40 percent of measures), followed by awareness raising and education (27 percent) and human resource training for climate action (20 percent), amongst others.

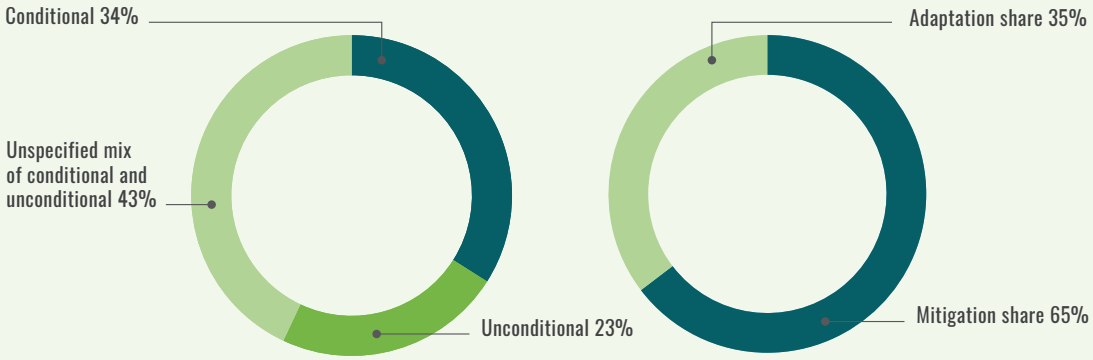
Amongst adaptation measures along the institutions and governance pillar, the majority aim to enhance policy mainstreaming and coherence (41 percent of measures), followed by DRR/M (25 percent) and transparency and accountability and institutional capacity building for climate action (17 percent, respectively), amongst others.

2.3 SUPPORT NEEDS

Overall, eight countries (57 percent) express support needs in the form of either technology transfer, capacity development and/or finance for implementation of their respective NDC. Five countries[39] reference technology costs or needs; three[40] cite capacity building needs; and eight[41] make their NDCs contingent upon financial support. Of those eight, only five[42] quantify the cost of implementation, which totals 35.4 billion USD, or 0.6 billion USD per year. The distribution of those costs reported across Central Asia, Eastern Europe and Southern Europe is 39, 15 and 46 percent, respectively. Of those five countries that report implementation costs (**Figure 21**), three[43] specify the share contingent upon international financial support, in which 34 percent of total costs are fully conditional, 23 percent unconditional and 43 percent partially conditional to external support. The same three countries disaggregate mitigation and adaptation costs, in which mitigation accounts for 65 percent of total costs and 35 percent for adaptation.

FIGURE 21.

SHARE OF TOTAL FINANCIAL RESOURCES FOR NDC IMPLEMENTATION, BY CONDITIONALITY AND MITIGATION AND ADAPTATION SHARE



[39] Kazakhstan, Republic of Moldova, Tajikistan, Turkmenistan and Uzbekistan.
[40] Republic of Moldova, Turkmenistan and Uzbekistan.
[41] Bosnia and Herzegovina, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, The Former Yugoslav Republic of Macedonia, Turkmenistan and Uzbekistan.
[42] Bosnia and Herzegovina, Kyrgyzstan, Republic of Moldova, The Former Yugoslav Republic of Macedonia and Turkmenistan.
[43] Kazakhstan, Republic of Moldova and Bosnia and Herzegovina.

PART 3

PART

3

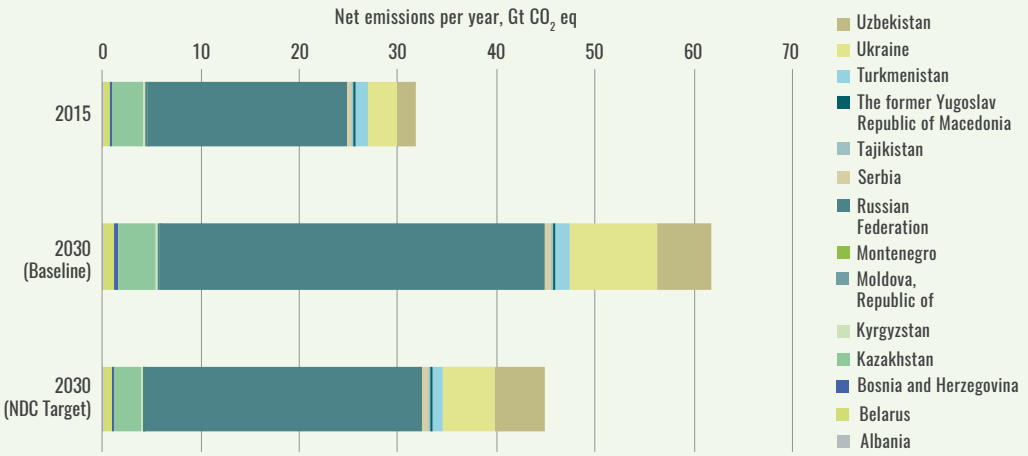
GAPS AND OPPORTUNITIES IN THE AGRICULTURE SECTORS

3.1 MITIGATION ANALYSIS

3.1.1 Baseline emissions and NDC targets

FIGURE 22.

ECONOMY-WIDE BASELINE EMISSIONS (2030) AND NDC MITIGATION TARGET (2030) FOR ALL SECTORS IN 2030, COMPARED AGAINST HISTORICAL NET EMISSIONS (2015) IN THE SEECA REGION



Without implementation of the NDCs in the SEECA region, total baseline net emissions in 2030 are expected to double those reported in 2015, rising from 3.1 Gt CO_2 eq. in 2015 to 6.2 Gt CO_2 eq. in 2030. **Figure 22** presents aggregated net emissions reported by all SEECA countries for 2015 net emissions, baseline net emissions in 2030 and projected net emissions in 2030 under NDC implementation.[44]

Under NDC implementation, regional net emissions are expected to be reduced by 27 percent in 2030 compared to baseline projected levels, or equal to 4.5 Gt CO_2 eq. in 2030. The net emission reduction is equivalent to approximately -1.7 Gt CO_2 eq. However, when compared against historical values, net emissions are nevertheless projected to increase by approximately 41 percent in 2030 under the mitigation scenario.

In the agriculture sector, only one country[45] communicated an absolute GHG target, with a cumulated net reduction in the Republic of Moldova estimated to be approximately -18 Mt CO_2 eq. over the implementation period of 2021 to 2030.

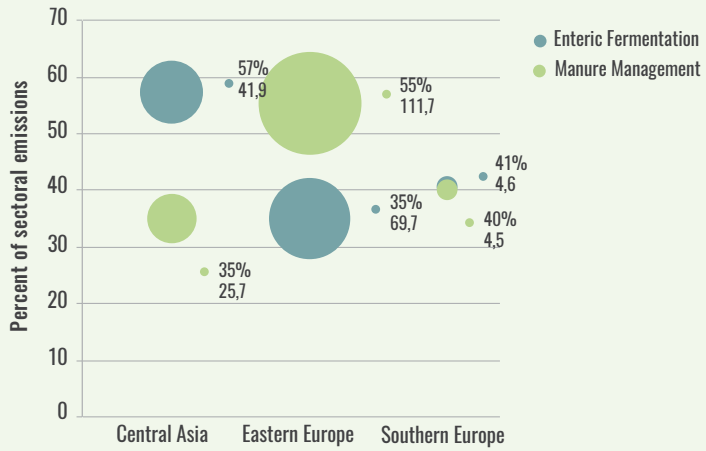
In the LULUCF sector, only two countries[46] communicated an absolute GHG target, with annual sequestration capacity in Bosnia and Herzegovina to remain constant between 2016 and 2030 at -6,470 kt CO_2 per year, and cumulated removals in the Republic of Moldova to reach -30 Mt CO_2 eq. between 2021 and 2030.

3.1.2 GHG hotspots

In the agriculture sector, the largest GHG hotspots in the region are emissions from managed soils (50 percent), mostly generated in Eastern Europe, and enteric fermentation (41 percent), predominantly from Eastern Europe and Central Asia. **Figure 23** illustrates the sectoral GHG hotspots in the agriculture sector, at the sub-regional level, in terms of share of sectoral emissions (% : y-axis) as well as sectoral emissions (kt CO_2 eq : size of gap).

FIGURE 23.

SUB-REGIONAL GHG HOTSPOTS IN THE AGRICULTURE SECTOR



[44] Refer to methodological notes for extrapolation, interpolation and the use of a proxy for estimates when data was not available for 2015 and/or 2030.

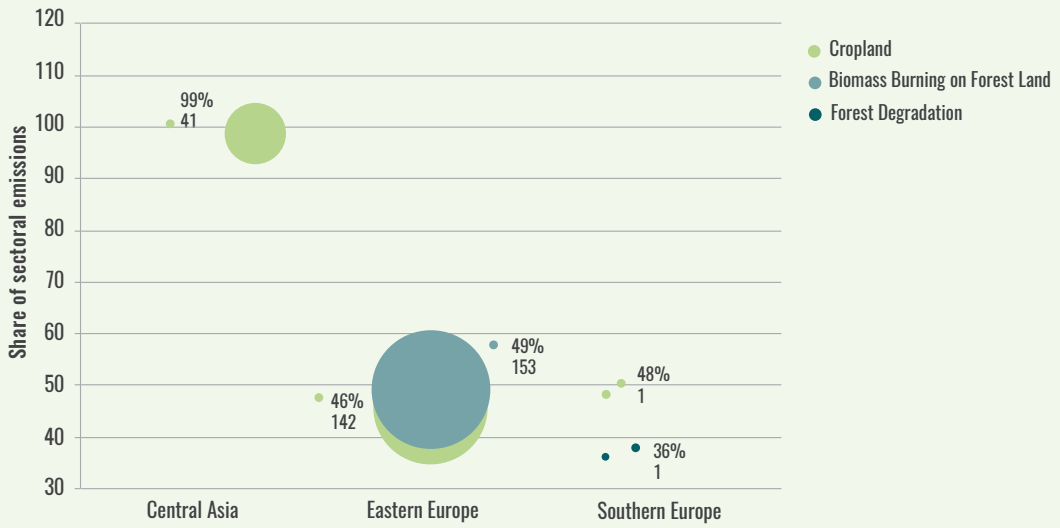
[45] Republic of Moldova.

[46] Bosnia and Herzegovina and the Republic of Moldova.

In the LULUCF sector, the largest GHG hotspots in the region are emissions from cropland (52 percent) and biomass burning on forest land (43 percent), generated mostly in Eastern Europe. **Figure 24** illustrates the sectoral GHG hotspots in the LULUCF sector, at the sub-regional level, in terms of share of sectoral emissions (% : y-axis) as well as sectoral emissions (kt CO_2 eq : size of gap).

FIGURE 24.

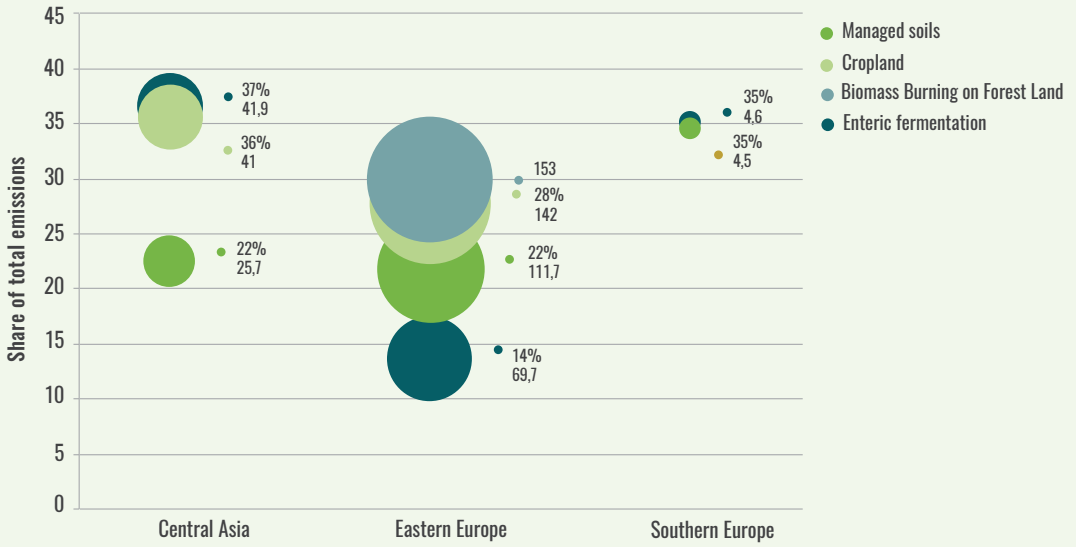
SUB-REGIONAL GHG HOTSPOTS IN THE LULUCF SECTOR



When emissions from the agriculture and LULUCF sector are combined, the largest GHG hotspots in the region are emissions from cropland (29 percent), followed by biomass burning from forest land (24 percent), managed soils (22 percent), and enteric fermentation (18 percent), largely generated in Eastern Europe and Central Asia. **Figure 25** illustrates the sectoral GHG hotspots in the AFOLU sector, at the sub-regional level, in terms of share of sectoral emissions (% : y-axis) as well as sectoral emissions (kt CO_2 eq : size of gap).

FIGURE 25.

SUB-REGIONAL GHG HOTSPOTS IN THE AFOLU SECTOR



3.1.3 Gaps and opportunities for enhancing mitigation

A gap analysis is performed to assess the degree to which sectoral policies and measures in the agriculture sectors address the main sources of sectoral GHG emissions, or GHG hotspots, to illustrate not only current policy "gaps" but also potential "opportunities" for enhancing future NDCs.

Overall, the most significant regional gaps are observed in mitigation policies and measures in the agriculture sectors aiming to reduce net emissions from cropland, enteric fermentation and managed soils. Table 2 presents the results of the mitigation policy gap and opportunity analysis by GHG hotspot in the AFOLU sector for which the size of the policy gap is greater than 10 percent regionally, ordered from largest to smallest policy gap. For each GHG hotspot, its contribution to regional AFOLU emissions is indicated, as well as the share of countries in the region to which the hotspot is associated. The farming systems most related to the GHG hotspot are identified.

TABLE 2.

MITIGATION POLICY GAPS PER GHG HOTSPOT IN THE AFOLU SECTOR (<5 PERCENT OF EMISSIONS) AMONGST SEECA COUNTRIES, ORDERED BY SIZE OF GAP (<10 PERCENT), FROM LARGEST TO SMALLEST.

GHG HOTPOT	HOTSPOT SHARE OF AFOLU EMISSIONS	% OF COUNTRIES WITH HOTSPOT	MITIGATION POLICY GAP	RELATED FARMING SYSTEM
CROPLAND	29%	57%	100%	LARGE-SCALE CEREAL-VEGETABLE; EXTENSIVE CEREAL-LIVESTOCK; IRRIGATED; HORTICULTURE MIXED; MIXED; SPARSE (COLD AND ARID)
ENTERIC FERMENTATION	18%	100%	79%	EXTENSIVE CEREAL-LIVESTOCK; PASTORAL; LARGE-SCALE CEREAL-VEGETABLE; FOREST-BASED LIVESTOCK
MANAGED SOILS	22%	79%	73%	LARGE-SCALE CEREAL-VEGETABLE; EXTENSIVE CEREAL-LIVESTOCK; IRRIGATED: HORTICULTURE MIXED; MIXED; PASTORAL

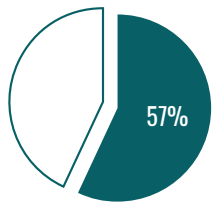
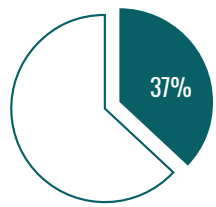
Note: Related farming system based on FAO and WB (2001) and FAO expert consideration.

The sub-regional results are presented below:

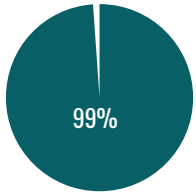
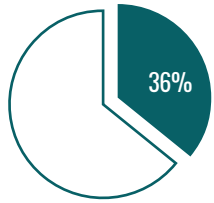
CENTRAL ASIA

In Central Asia, the largest gaps are found in the policies and measures aimed at reducing emissions from enteric fermentation and cropland. Emissions from these sources represent the largest GHG hotspots in terms of sectoral and AFOLU emissions. On the other hand, moderate alignment was found in policies and measures targeting emissions from managed soils.

ENTERIC FERMENTATION

NUMBER OF COUNTRIES WITH HOTSPOT	HOTSPOT SHARE OF SECTORAL EMISSIONS	HOTSPOT SHARE OF AFOLU EMISSIONS	POLICY AND MEASURE GAP
			
100%			

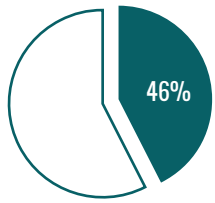
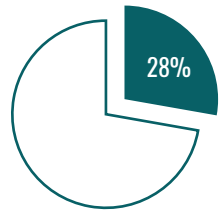
CROPLAND

NUMBER OF COUNTRIES WITH HOTSPOT	HOTSPOT SHARE OF SECTORAL EMISSIONS	HOTSPOT SHARE OF AFOLU EMISSIONS	POLICY AND MEASURE GAP
			
40%			

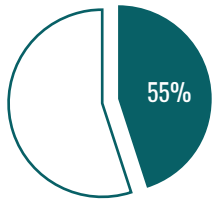
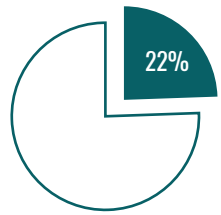
EASTERN EUROPE

In Eastern Europe, the largest gaps are found in the policy and measures aiming to reduce emissions from cropland and managed soils. Emissions from cropland and managed soils represent approximately half of respective sectoral emissions. A low degree of alignment in policies and measures targeting emissions from enteric fermentation is also observed. Conversely, policy and measures are very highly aligned with efforts to reduce emissions from biomass burning on forest land.

CROPLAND

NUMBER OF COUNTRIES WITH HOTSPOT	HOTSPOT SHARE OF SECTORAL EMISSIONS	HOTSPOT SHARE OF AFOLU EMISSIONS	POLICY AND MEASURE GAP
			
75%			

MANAGED SOILS

NUMBER OF COUNTRIES WITH HOTSPOT	HOTSPOT SHARE OF SECTORAL EMISSIONS	HOTSPOT SHARE OF AFOLU EMISSIONS	POLICY AND MEASURE GAP
			
100%			

SOUTHERN EUROPE

In Southern Europe, the largest gaps are found in policies and measures aiming to reduce emissions from cropland, followed by managed soils and enteric fermentation. Cropland emissions represent almost half of sectoral emissions yet no policy alignment is observed. Moderate policy alignment is found in those targeting managed soils and enteric fermentation, with opportunity to include additional mitigation measures. On the other hand, policy and measures targeting forest degradation are very highly aligned.

CROPLAND

NUMBER OF COUNTRIES WITH HOTSPOT	HOTSPOT SHARE OF SECTORAL EMISSIONS	HOTSPOT SHARE OF AFOLU EMISSIONS	POLICY AND MEASURE GAP
60%	48%	7%	100%

3.2 ADAPTATION ANALYSIS

3.2.1 Gaps and opportunities for enhancing adaptation

A gap analysis is performed to compare the adaptation measures in ecosystems and social systems against the observed and/or projected climate-related hazards, impacts and vulnerabilities reported. The analysis aims to identify gaps and opportunities for enhancing adaptation options in the next round of NDCs.

Gaps and opportunities in natural systems

Overall, the largest regional gaps are found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response to the climate-related hazards, impacts and vulnerabilities observed and/or projected in the crop sub-sector, followed by forest and mountain ecosystems, amongst others. **Table 3** presents the results of the adaptation policy gap and opportunity analysis by climate-related vulnerability category most frequently reported for which the size of the policy gap is greater than 10 percent regionally, ordered from largest to smallest policy gap. For each climate-related vulnerability category, the share of countries that report the vulnerability is indicated. The farming systems most related to the climate-related vulnerability are also identified.

TABLE 3.

ADAPTATION POLICY GAPS PER CLIMATE-RELATED VULNERABILITY CATEGORY MOST FREQUENTLY REPORTED IN ECOSYSTEMS AMONGST SEECA COUNTRIES (<10 PERCENT OF COUNTRIES), ORDERED BY SIZE OF GAP (<0 PERCENT GAP), FROM LARGEST TO SMALLEST

MAJOR CLIMATE-RELATED VULNERABILITY CATEGORY	% OF COUNTRIES WITH MAJOR IMPACT REPORTED	ADAPTATION POLICY GAP	RELATED FARMING SYSTEM
CROPS	21%	67%	EXTENSIVE CEREAL-LIVESTOCK; LARGE-SCALE CEREAL-VEGETABLE; IRRIGATED; SPARSE (ARID AND COLD);
FOREST ECOSYSTEM	14%	50%	FOREST-BASED LIVESTOCK
MOUNTAIN ECOSYSTEM	14%	50%	PASTORAL
GENERAL ECOSYSTEMS	36%	40%	ALL
GENERAL NATURAL RESOURCES	43%	33%	ALL
GENETIC RESOURCES	43%	33%	ALL
INLAND WATER ECOSYSTEM	21%	33%	WATER BODIES
FORESTRY	36%	20%	FOREST-BASED LIVESTOCK
GENERAL ECOSYSTEM SERVICES	36%	20%	ALL

Note: Related farming system based on FAO and WB (2001) and FAO expert consideration.

The sub-regional results are presented below:

CENTRAL ASIA

In Central Asia, the most significant climate-related hazards reported are drought and extreme heat, while the greatest climate-related slow onset risks reported are water stress and desertification. The most vulnerable ecosystems are agro-ecosystems, followed by inland water and mountain ecosystems. The most vulnerable agro-ecosystems are the forestry and crops sub-sectors. The most frequent ecosystem service impact category in ecosystems outside of farming systems reported is freshwater provision, followed by the maintenance of genetic diversity and abundance and nutrient cycling and soil formation. The most frequent ecosystem service impact category in agro-ecosystems reported is forestry (wood and non-timber forest products) and freshwater provision. The most frequent ecosystem service impact category in ecosystems outside of farming systems reported is water flow regulation, primarily in inland water ecosystems. In mountain ecosystems, the most frequently reported is freshwater provision. Overall, the most frequent natural resource impact category reported is water, followed by genetic resources and land and soil resources.

Overall, the largest gaps are found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response to the climate-related hazards, impacts and vulnerabilities observed and/or projected in the crops sub-sector and inland water ecosystems. Moderate policy alignment is observed in adaptation priorities and measures targeting the forestry sub-sector, the provision of forest products and mountain ecosystems. All other major impact categories, including water resources, the maintenance of genetic diversity and abundance and nutrient cycling and soil formation, amongst others, are addressed by current adaptation priorities and measures in the NDCs.

MAJOR CLIMATE-RELATED VULNERABILITY	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED VULNERABILITY	POLICY GAP
CROPS	 **20%**	

MAJOR CLIMATE-RELATED VULNERABILITY	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED VULNERABILITY	POLICY GAP
INLAND WATER ECOSYSTEM	 **40%**	

EASTERN EUROPE

In Eastern Europe, the most significant climate-related hazards reported are drought and invasion by non-native species in agriculture, while the greatest climate-related slow onset risks reported are water stress and soil erosion. The most vulnerable ecosystems are agro-ecosystems, including forests, followed by inland water ecosystems. The most vulnerable agro-ecosystems are the forestry and crops sub-sectors. The most frequent ecosystem service impact category in agro-ecosystems reported is forestry (wood and non-timber forest products) and crops provision. The most frequent ecosystem service impact category reported ecosystems outside of farming is freshwater provision, primarily in inland ecosystems. Overall, the most frequent natural resource impact category reported is genetic resources, followed by water.

Overall, the largest gaps are found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response to the climate-related hazards, impacts and vulnerabilities observed and/or projected in forest ecosystems, followed by genetic resources. All other major impact categories, including the crops sub-sectors, the provision of freshwater and inland water ecosystems, are addressed by adaptation priorities and measures in the NDCs, exhibiting very high policy alignment.

MAJOR CLIMATE-RELATED VULNERABILITY	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED VULNERABILITY	POLICY GAP
FOREST ECOSYSTEM	 **25%**	

SOUTHERN EUROPE

In Southern Europe, the most significant climate-related hazards reported are drought and invasion by non-native species in agriculture, while the greatest climate-related slow onset risk reported is water stress. The most frequent ecosystem service impact category reported in ecosystems outside of farming is maintenance of genetic diversity and abundance and water flow regulation. The most frequent ecosystem service impact category reported in agro-ecosystems is biological control, followed by forestry (wood and non-timber forest products) and crops provision. The most frequent ecosystem service impact category reported in ecosystems outside of farming is freshwater provision, primarily in inland ecosystems. Overall, the most frequent natural resource impact category reported is genetic resources, followed by water.

Overall, the largest gaps are found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response to the climate-related hazards, impacts and vulnerabilities observed and/or projected in the crop sub-sector. All other major impact categories, including forest and inland water ecosystems, biological control, freshwater provision and genetic resources, are addressed by current adaptation priorities and measures considered very highly aligned in the NDCs.

MAJOR CLIMATE-RELATED VULNERABILITY	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED VULNERABILITY	POLICY GAP
CROPS	 **20%**	

Gaps and opportunities in social systems

Overall, the largest policy gaps are found in adaptation priorities and measures in social systems aiming to reduce vulnerability and increase adaptive capacity in response to observed and/or projected adverse health and food security and nutrition. Table 4 presents the results of the adaptation policy gap and opportunity analysis by climate-related risk category most frequently reported for which the size of the policy gap is greater than 10 percent regionally, ordered from largest to smallest policy gap. For each climate-related risk category, the share of countries that report the risk is indicated. The farming systems most related to the climate-related risk are also identified.

TABLE 4.

ADAPTATION POLICY GAPS PER CLIMATE-RELATED RISK CATEGORY MOST FREQUENTLY REPORTED IN SOCIAL SYSTEMS AMONGST SEECA COUNTRIES (<10 PERCENT OF COUNTRIES), ORDERED BY SIZE OF GAP (<0 PERCENT GAP), FROM LARGEST TO SMALLEST

MAJOR CLIMATE-RELATED RISK CATEGORY	% OF COUNTRIES WITH MAJOR IMPACT REPORTED	ADAPTATION POLICY GAP	RELATED FARMING SYSTEM
ADVERSE HEALTH EFFECTS	29%	50%	ALL
FOOD INSECURITY AND MALNUTRITION	14%	50%	ALL

Note: Related farming system based on FAO and WB (2001) and FAO expert consideration.

The sub-regional results are presented below:

CENTRAL ASIA

In Central Asia, the most significant climate-related risk in social systems reported is adverse health, followed by food insecurity and malnutrition and rural livelihoods and income loss.

Overall, the largest gap is found in adaptation priorities and measures in social systems aiming to reduce vulnerability and increase adaptive capacity in response to observed and/or projected rural livelihood and income loss (100 percent policy gap). Moderate policy alignment is observed in adaptation priorities and measures targeting food insecurity and nutrition and adverse health (50 percent gap, respectively).

MAJOR CLIMATE-RELATED RISK	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED RISK	POLICY GAP
RURAL LIVELIHOODS AND INCOME LOSS	 **20%**	

EASTERN EUROPE

In Eastern Europe, the most significant climate-related risks in social systems reported are the loss of productive infrastructure and assets and adverse health.

Overall, no policy gap in social systems is observed. Rather, very high policy alignment is found in adaptation priorities and measures aiming to reduce vulnerability and increase adaptive capacity in response to observed and/or projected adverse health (0 percent policy gap).

SOUTHERN EUROPE

In Southern Europe, the most significant climate-related risks in social systems are the loss of productive infrastructure and assets and adverse health.

Overall, the largest gap is found in adaptation priorities and measures in social systems aiming to reduce vulnerability and increase adaptive capacity in response to observed and/or projected loss of productive infrastructure and assets and adverse health (100 percent policy gap, respectively).

MAJOR CLIMATE-RELATED RISK	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED RISK	POLICY GAP
LOSS OF PRODUCTIVE INFRASTRUCTURE AND ASSETS	 **20%**	

MAJOR CLIMATE-RELATED RISK	NUMBER OF COUNTRIES WITH MAJOR CLIMATE-RELATED RISK	POLICY GAP
ADVERSE HEALTH	 **20%**	

3.3 OPPORTUNITIES FOR LEVERAGING SYNERGIES

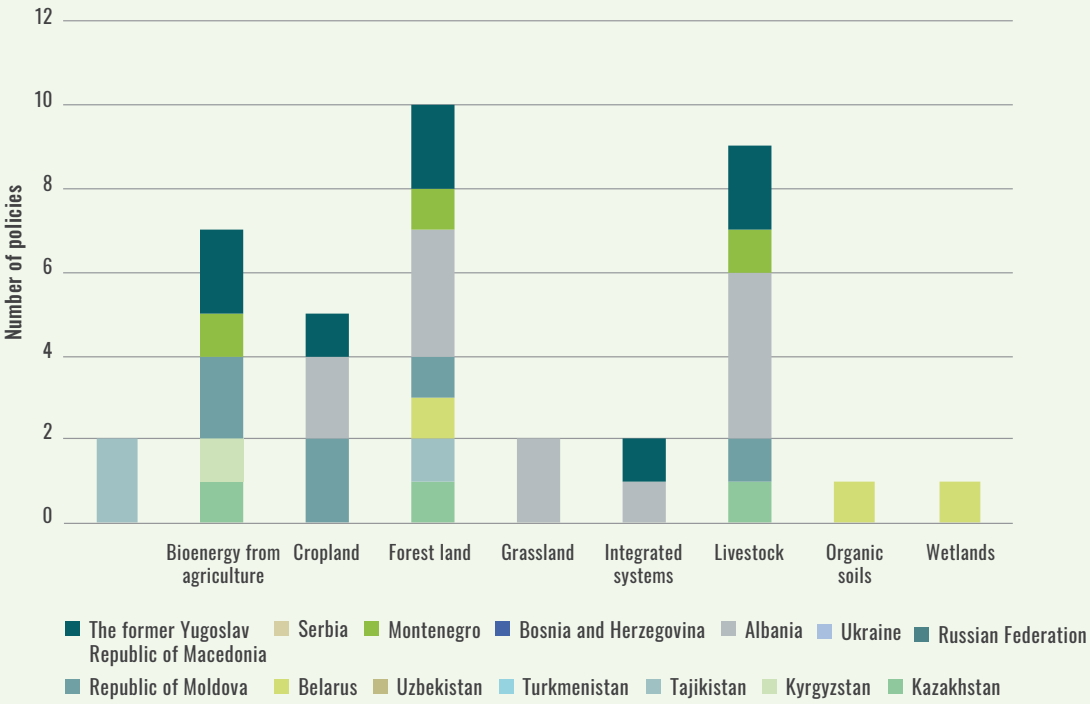
3.3.1 Mitigation and adaption co-benefits

Adaptation co-benefits of mitigation

Overall, the majority of countries include mitigation policies and measures with potential adaptation co-benefits related to forest land, livestock, and bioenergy production from agriculture and cropland management. Albania, the former Yugoslav Republic of Macedonia and the Republic of Moldova include the highest number of mitigation policies and measures with potential adaptation co-benefits. **Figure 26** presents the distribution of mitigation policies and measures with potential adaptation co-benefits across land use categories or agriculture sub-sectors.

FIGURE 26.

NUMBER OF MITIGATION POLICY AND MEASURES WITH ADAPTATION CO-BENEFITS, PER COUNTRY AND LAND USE/SUB-SECTOR CATEGORY



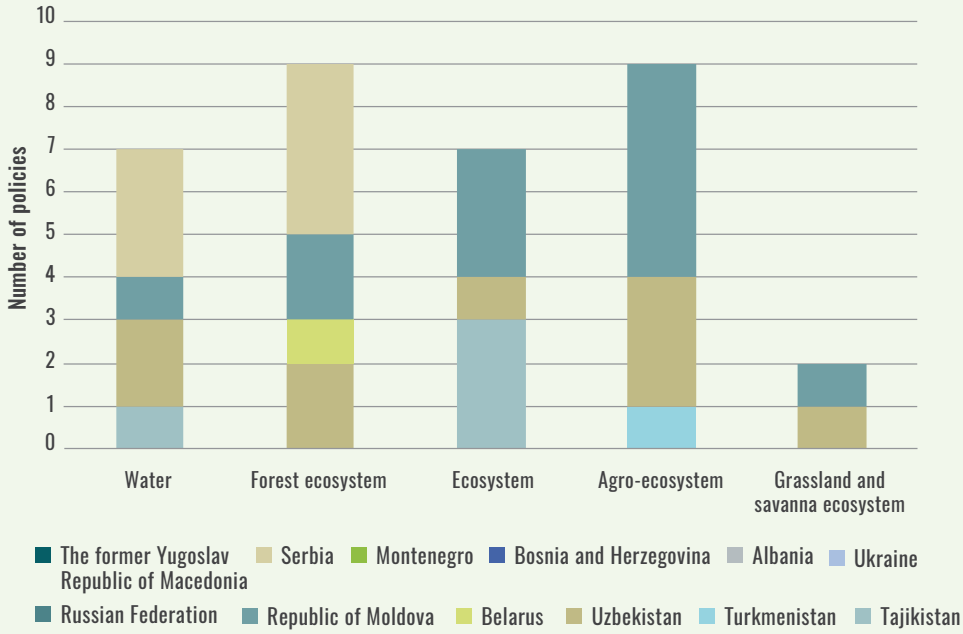
Afforestation/reforestation is the most frequently cited mitigation policy and measure with potential adaptation co-benefits found in country NDCs, followed by bioenergy production from agriculture, improved livestock manure management and improved livestock feeding practices, amongst others. Adaptation co-benefits of afforestation/reforestation, for instance, include forest ecosystem management, conservation and restoration and flood management.

Mitigation co-benefits of adaptation

Overall, the majority of countries include adaptation measures with potential mitigation co-benefits related to agro-ecosystems and forest ecosystems, followed by water resource use and management and grassland and savanna ecosystems management. The Republic of Moldova, Uzbekistan and Serbia include the highest number of adaptation measures with potential mitigation co-benefits. **Figure 27** presents the distribution of adaptation measures with potential mitigation co-benefits per ecosystem or natural resource management category.

FIGURE 27.

NUMBER OF ADAPTATION MEASURES WITH MITIGATION CO-BENEFITS, PER COUNTRY AND ECOSYSTEM/ NATURAL RESOURCE CATEGORY



Afforestation/reforestation is the most frequently cited adaptation measure with potential mitigation co-benefits found in country NDCs followed by irrigation and drainage, ecosystem management, conservation and restoration in forest ecosystems, nutrient and on-farm soil management and plant management, amongst others. Nutrient and on-farm soil management through reduced tillage, for instance, can contribute to enhanced residue retention, reduced nitrogen input into the soils and lower nitrous oxide emissions.

Mutual co-benefits of mitigation and adaptation

Few countries set forth mitigation and adaptation measures generating mutual co-benefits. A mutual co-benefit refers to when the co-benefit of one measure is equal or similar to the outcome of the other measure. Only Tajikistan and the Republic of Moldova present adaptation and mitigation measures with mutual co-benefits.

Reconciling mitigation and adaptation tradeoffs

The greatest potential adaptation tradeoff associated with mitigation policies and measures in the region is negative progress on reducing deforestation and forest conservation, as well as on nutrient and on-farm soil management, due to liquid biofuel production.

3.3.2 Farming-systems approach to climate action

Based on the results of the gap and opportunity analysis, a farming-system approach integrating mitigation and adaptation priorities across agro-ecosystems and rural livelihoods is proposed:

PASTORAL SYSTEMS

Pastoral farming systems are mainly found in the high mountainous areas or adjacent dry zones in Central Asia, covering one-fifth of land area and home to half of the population (FAO and WB, 2001; ORNL, 2010). Herd management is often characterized by overgrazing on mountain pastures due to excessive animal populations and poor pasture management, leading to deterioration of natural vegetation and soil erosion (FAO and WB, 2001). With managed soils and enteric fermentation representing a major GHG hotspot in the sub-region, mountain ecosystems constituting a major climate-related vulnerability and nutrient cycling and soil formation reported as one of the most impacted ecosystem services, improved pasture management could increase soil carbon stocks and reduce soil erosion, while mixed livestock-tree systems could reduce natural hazards, such as floods and landslides, while diversifying production options (IPCC 2014a). Ecosystem management, conservation and rehabilitation in mountain ecosystems could contribute to reducing vulnerability to climate change and enhancing adaptive capacity by preserving the resource base and enhancing the resilience of dependent livelihoods, particularly for the rural poor.

EXTENSIVE CEREAL-LIVESTOCK SYSTEMS

The extensive cereal-livestock system is mostly found in the semiarid agro-ecological zones of Central Asia and Eastern Europe, including the Russian Federation and Northern parts of Kazakhstan, Southern parts of Kazakhstan, Turkmenistan and Uzbekistan. These systems occupy one-fifth of total land area in the SEECA region and are home to one-third of its population (FAO and WB, 2001; ORNL, 2010). The traditional steppe-system, now converted to cropping, produces mainly rainfed wheat and barley, some hay and fodder, combined with cattle and sheep grazing. The major constraints to low-emission and climate-resilient agriculture in this system result from variable precipitation patterns combined with strong winds, generating wind erosion and reducing crop yields. Limited access to mineral fertilizers impedes productivity gains. While this system contributes little to emissions from chemical fertilizer use, the conversion to cropping is likely associated with land use emissions. In addition, inadequate and poor-quality equipment for storage, processing, transportation and product handling contributes to heavy post-harvest losses and low prices for producers (FAO and WB, 2001). With crop systems and food insecurity and nutrition reported most frequently amongst climate-related vulnerabilities, soil conservation practices that enable moisture retention during the winter, utilize summer precipitation efficiently, and address serious wind erosion is essential to improving the productivity of grain production. Alternative rotations would provide farmers with greater flexibility and protect the resource base. Given the high degree of vulnerability of agriculture to pest and disease incidence, integrated pest management should be prioritized amongst mitigation and adaptation measures. As an insufficient feed base and poor animal health drive enteric fermentation emissions and contribute to the loss of productive assets, improved livestock management measures, particularly improved feed and animal husbandry, are critical to reducing emission intensity per unit of production and enhancing livelihood strategies in these systems (IPCC, 2014a).

LARGE SCALE CEREAL-VEGETABLE SYSTEMS

The large scale cereal-vegetable system is mainly found in Eastern Europe, covering 6 percent of total land area and housing one-third of its population (FAO and WB, 2001; ORNL, 2010). This system is typical of the moist, sub-humid agro-ecological zones including parts of Ukraine, the southwest part of the Russian Federation and the Republic of Moldova. The main crops are wheat, barley, maize, sunflower, sugar beets and vegetables, with some cattle. While the soils are among the most fertile, crop yields are often constrained by drought, insufficient annual rainfall

and high temperatures during the grain-fill period. While snow and ice melt are the main way of watering in the spring time, early melt and reduction of glaciers will affect water flow and availability, especially in summer months. With a high share of emissions from cropland and managed soils, likely due to urea fertilizer application and conversion to cropland, and freshwater provision as one of the most frequently reported climate-related impacts on ecosystem services, land conservation and soil fertility management that balances water content, enhances soil organic matter and increases landscape biodiversity is critical to mitigation and adaptation in these systems. For instance, deep-rooting crops grown on deep, structurally robust and fertile soils are a highly efficient use of land in this system, as are land conservation schemes that incorporate leguminous crops and pastures with grazing cattle (FAO and WB, 2001).

IRRIGATED SYSTEMS

The irrigated farming system is scattered throughout the warmer areas of mostly Central Asia, including Uzbekistan, Turkmenistan and Southwestern Kazakhstan, where irrigation is largely used for cotton cultivation, and some rice. This system occupies 3 percent of total land area in Central Asia but is home to one-third of the population (FAO and WB, 2001; ORNL, 2010). Environmental degradation combined with the drying out of the Aral Sea has contributed to desertification and widespread salinization in these areas. Key to the mitigation and adaptation strategies in this system is improved water management, including water harvesting and storage and improvements in water use efficiency, as well as landscape approaches, including afforestation of the dried Aral Sea bottom.

SPARSE (COLD) SYSTEMS

The sparse (cold) farming system is predominantly found in Russia, occupied by a small agricultural population, where only a small amount of land has been cleared for cropping, interspersed with the tundra and the taiga forests. Agro-ecological and climatic conditions allow only limited cultivation of rye and oats, as well as of potatoes and some vegetables, supplemented by pig raising is some cases. This system is constrained by the short growing season, very low temperatures and poor soils, which are characterized by intense nutrient leaching and acidity (FAO and WB, 2001; ORNL, 2010). Key to mitigation and adaptation strategies in this system is improved crop residue and nutrient management practices that enhance soil organic carbon content, reduce nutrient losses and enhance fertility. With the provision of crops as one of the most frequently reported climate-related impacts on ecosystem services in the sub-region, combined with extensive poverty prevalence, social protection services are critical to safeguarding food security and nutrition in these systems.

HORTICULTURE MIXED SYSTEMS

Horticulture mixed farming systems cover almost 90 percent of land area in Southern Europe and are home to 80 percent of the population. The average farm size is small and has a diversified production pattern, including wheat, maize, oil crops, fruit and vegetables, combined with cattle, sheep and goats. Cultivation of fruit, nuts and vegetables, partly irrigated or produced in greenhouses, contributes significantly to the value of crop production and household income (FAO and WB, 2001; ORNL, 2010). With high shares of emissions from cropland, enteric fermentation and managed soils, combined with vulnerable cropping systems and pest incidence reported amongst climate-related impacts, key mitigation and adaptation strategies in these systems include better integrated system management by which the inputs and outputs amongst cropping and livestock systems feed into each other in a way that saves resources, increases biodiversity and contributes to the overall sustainability of the food system upon which rural livelihoods depend.

FOREST-BASED SYSTEMS

The forest-based farming systems are mostly found in the moist sub-humid agro-ecological zones of Eastern Europe, covering 3 percent of total land area and home to 10 percent of the population. Large farms are typical in Belarus, Ukraine and Northwest Russia, characterized by co-operative or corporate ownership, with production focused on fodder, hay, cereals, industrial crops and potatoes (FAO and WB, 2001; ORNL, 2010). With forest ecosystems amongst the most vulnerable and high shares of emissions from the burning of forest biomass, mitigation and adaptation strategies in this system include sustainable forest management, conservation of forest ecosystems and biodiversity and efforts to increase forest area combined with enhanced integration of cropping systems with trees.

3.3.3 NDC and SDG links

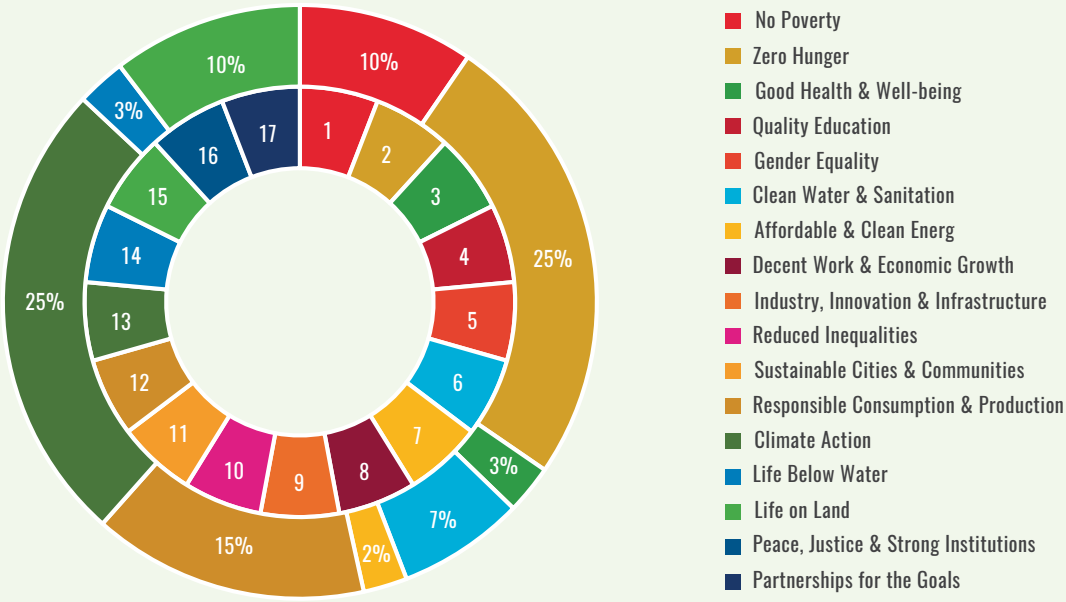
To understand the degree of convergence between "climate actions" in the agriculture sectors communicated by countries in their NDCs and the 17 goals and 169 targets of the 2030 Agenda for Sustainable Development, the sectoral climate actions in the NDCs were mapped against the SDG targets.

Overall, the greatest area of convergence between SEECA region climate actions in the agriculture sectors and the SDGs is found around, in descending order (**Figure 28**):

- SDG 13 Climate action;
- SDG 2 Zero Hunger;
- SDG 12 Responsible consumption and production;
- SDG 15 Life on Land;
- SDG 1 No Poverty;
- SDG 6 Clean water and sanitation;
- SDG 7 Affordable & Clean Energy;
- SDG 14 Life below water; and
- SDG 3 Good Health & Well-being.

FIGURE 28.

DEGREE OF ALIGNMENT BETWEEN CLIMATE ACTIONS IN THE AGRICULTURE SECTORS AND SDGS



Specifically, the greatest area of convergence is found around the following SDG targets, in descending order:

- SDG target 13.2 Integrate climate measures in policy making;
- SDG target 12.2 Efficient use of natural resources;
- SDG target 2.3 Assure agricultural productivity for marginalized;
- SDG target 2.4 Ensure sustainable agriculture systems for climate change;
- SDG target 13.1 Strengthen resilience and adaptive capacity;
- SDG target 1.5 Resilience of poor to climate events; and
- SDG target 15.2 Promote sustainable forests and halt deforestation.

The high degree of convergence between the climate and sustainable development agendas suggests that aligning their implementation provides a great opportunity to national and sub-national governments to accelerate progress across both agendas.

PART 4

PART

4

ENHANCING NDC AMBITION IN THE AGRICULTURE SECTORS

4.1 BASELINE AMBITION LEVELS

An NDC Ambition Index was developed to assess the comprehensiveness, measurability, comparability, transparency and ambition of the NDCs in the agriculture sectors across six main pillars of climate action: mitigation, adaptation, planning, monitoring, reporting and means of implementation. While the term "ambition" is often not associated with adaptation, as a country-driven process, the index scoring system aims to identify the opportunity for countries, as they enhance their NDCs, to update, strengthen, and/or elaborate their adaptation content.

The methodology includes a scoring procedure, whereby indicators are given scores from 2 to 10, converted from raw quantitative and qualitative data (see methodological notes). The scoring system matches the four levels of ambition: low, moderate, high and very high (**Table 5**). The country level results are aggregated to the sub-regional level. A radar chart is used to visualize the results for easy identification of potential NDC enhancement areas.

TABLE 5.

NDC AMBITION INDEX SCORE AND LEVEL

LEVEL	SCORE
LOW AMBITION	2-3.9
MODERATE AMBITION	4-5.9
HIGH AMBITION	6-7.9
VERY HIGH AMBITION	8-10

Overall, the average NDC ambition levels in the agriculture sectors are moderate in Central Asia and Eastern Asia and low in Southern Europe across all six pillars of climate action.

In Central Asia (**Figure 29**), the comprehensiveness, measurability, comparability, transparency and ambition of the adaptation component and national reporting processes rank high, while the mitigation contribution has a low score in the agriculture sectors. Moderate levels are observed across the means of implementation, planning and monitoring pillars.

In Eastern Europe (**Figure 30**), the mitigation contribution, adaptation component, and means of implementation rank moderately in terms of comprehensiveness, measurability, comparability and transparency and ambition in the agriculture sectors. On the other hand, national planning processes and monitoring mechanisms in place score low, while the national reporting processes ranks very high.

FIGURE 29.

NDC AMBITION INDEX RESULTS FOR CENTRAL ASIA, PER MAJOR PILLAR

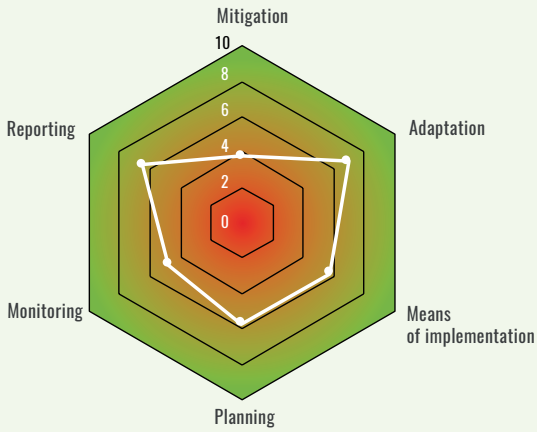
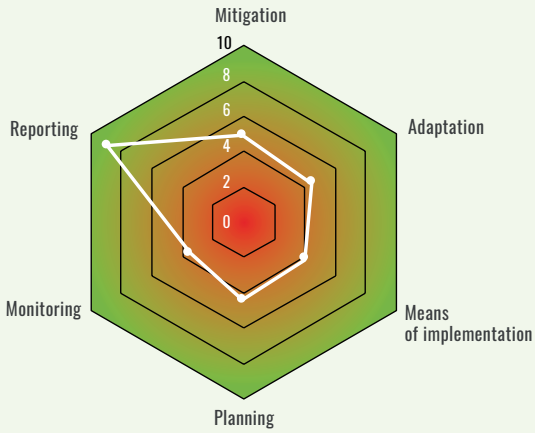


FIGURE 30.

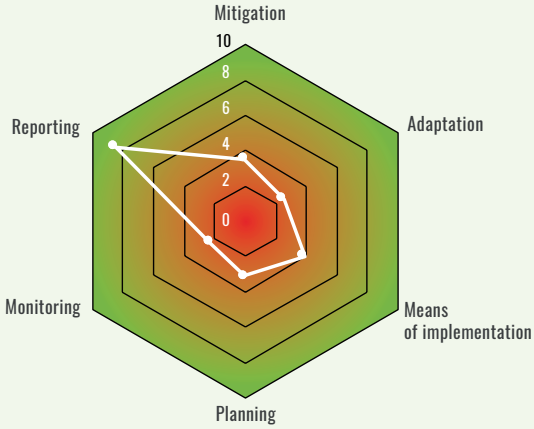
NDC AMBITION INDEX RESULTS FOR EASTERN EUROPE, PER MAJOR PILLAR



In Southern Europe (**Figure 31**), the comprehensiveness, measurability, comparability, transparency and ambition of the NDCs in the agriculture sector score low across all major pillars with the exception of the national reporting pillar, which ranks very high.

FIGURE 31.

NDC AMBITION INDEX RESULTS FOR SOUTHERN EUROPE, PER MAJOR PILLAR



4.2. OPTIONS FOR ENHANCING AMBITION

The NDC Ambition Index results can inform a country-driven process of NDC review and revision in line with the Paris Agreement's premise that climate action must be progressively enhanced in a virtuous cycle of ambition.

For each pillar, a brief summary of options for enhancing the NDCs in the agriculture sectors[47] is presented based on the identification of gaps in the previous sections (see detailed methodology in forthcoming FAO 2019). The menu of options presents approaches that countries can adopt to strengthen or realign the NDCs in the agriculture sectors with national circumstances, priorities and capacities. It can also serve as a framework for identifying country support options to ensure the NDCs are transparent, quantifiable, comparable and ambitious – since these documents will guide climate action for years to come.

[47] Elaboration of Fransen *et al.* (2017).

4.2.1 Building mitigation ambition

Mitigation lies at the heart of global efforts to achieve the long-term temperature goals set out in Article 2 of the Paris Agreement of holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C. Transforming the NDCs into a concrete set of quantifiable targets and policies is key for translating high-level commitments into actions on the ground.

The menu of options for building mitigation ambition in the agriculture sectors includes the strengthening or adding of a GHG target, non-GHG target, measurable policies and measures and a long-term goal in the agriculture sectors, amongst others. For instance, in Central Asia, areas of potential NDC enhancement are the inclusion of sectoral GHG targets and/or quantified mitigation policies and measures in the agriculture and/or LULUCF sectors. In Eastern Europe, an area of potential NDC enhancement is the inclusion of quantified mitigation policies and measures in the agriculture sector. In Southern Europe, areas of potential NDC enhancement are the inclusion of sectoral GHG targets and/or quantified mitigation policies and measures in the agriculture and/or LULUCF sectors.

4.2.2 Strengthening adaptation options

Adaptation is a key component of the long-term global response to climate change to protect people, livelihoods and ecosystems. Under Article 7.10 of the Paris Agreement, the NDCs present an opportunity for countries to communicate adaptation goals, priorities, actions and needs that are country-driven, gender-responsive, participatory and sensitive to vulnerable groups, communities and ecosystems. Adaptation options should be informed by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, accompanied with a forward-looking vision that integrates sectoral and cross-sectoral adaptation priorities into broader development policies and frameworks. While retaining flexibility of the country-driven process, the content of the adaptation component in the NDCs may often be strengthened to enhance adaptive capacity and resilience, and reduce vulnerability, contributing to the global goal on adaptation.

The menu of options for strengthening adaptation in the agriculture sectors includes conducting a vulnerability assessment and updating or adding climate-related impact information, adaptation priorities, measures and long-term goals, amongst others. In Central Asia, all countries exhibit high levels of adaptation ambition in their respective NDCs. In both Eastern and Southern Europe, areas of potential NDC enhancement are the inclusion of climate-related hazards, impacts and vulnerabilities, the integration of climate resilience and/or DRR/M strategies and approaches and the inclusion of adaptation measures in natural ecosystems and/or human systems.

4.2.3 Aligning national planning processes

Aligning climate change mitigation and adaptation priorities with existing sectoral and cross-sectoral policies and budgets, and vice versa, is necessary for formulating actionable policies and enabling the institutional environment for transformational change, as well as leveraging synergies with sustainable development objectives.

The menu of options for aligning national planning processes for NDC implementation includes the use of cost-benefit analysis for evidence-based policy making, the integration and/or alignment of sectoral and cross-sectoral National Adaptation Plans (NAPs), Nationally Appropriate Mitigation Actions (NAMAs)[48] and DRR/M strategies with the NDCs, and vice versa,

[48] Only relevant to developing countries. All SEECA countries are economies in transition.

the alignment of NDC planning and SDG localization processes, the setting of coordination mechanisms amongst key line ministries and aligning regulatory frameworks with the long-term goals of the Paris Agreement, amongst others. For instance, in all regions, areas of potential NDC enhancement are the mainstreaming of NAP processes and DRR/M frameworks within the NDC, and vice versa.

4.2.4 Monitoring mitigation and adaptation progress

Tracking information on GHG emissions and actions to reduce them, as well as on adaptation and on support needs, is a necessary step to ensuring that the knowledge and information gained during implementation can be fed back into a learning process that provides for more effective mitigation and adaptation efforts in the future.

The menu of options for monitoring mitigation and adaptation progress includes the improvement or setting up of a domestic monitoring and evaluation (M&E) and domestic measurement, reporting and verification (MRV) systems to track adaptation, mitigation and support needed and provided in the agriculture sectors, amongst others. For instance, in Central Asia, an area of potential NDC enhancement is the inclusion of vulnerability assessment information. In Southern and Eastern Europe, an area of potential NDC enhancement is the setting up of an M&E system to monitor adaptation progress over time.

4.2.5 Enhancing the transparency of reporting

The Enhanced Transparency Framework of the Paris Agreement is expected to build mutual trust and confidence, and to promote effective implementation by providing: i) a clear understanding of climate change action, including clarity and tracking of mitigation and adaptation progress; and ii) clarity on support provided and received. According to the Article 13 of the Paris Agreement, all Parties shall report National Greenhouse Gas Inventories (NGHGI) and progress made in implementing and achieving NDC, as well as all Parties should, as appropriate, report climate change impacts and adaptation. Also, other Parties that provided support should report the financial, technology transfer and capacity-building support provided. Under the same Articles, developing country Parties should report the financial, technology transfer and capacity-building support needed and received. The transparency framework shall provide flexibility in the implementation of the provisions of this Article to those developing country Parties that need it in the light of their capacities. The modalities, procedures and guidelines for the enhanced transparency framework is currently being negotiated under the Ad hoc Working Group on the Paris Agreement (item 5).

The menu of options for enhancing the transparency of NDC reporting includes updating the methodology used to report the NGHGI and mitigation progress, the inclusion of information on climate change impacts and adaptation progress, support needed and received and the alignment of NDC reporting and SDG follow-up and review processes, amongst others. For instance, in Central Asia, an area of potential NDC enhancement is the updating of the methodology used for reporting NGHGIs in the AFOLU sector. Both Southern and Eastern Europe exhibit very high ambition levels under this pillar.

4.2.6 Accelerating the means of implementation

The provision of financial, technological and capacity-building support to developing countries is necessary to enable and accelerate national climate action, particularly in the agriculture sectors where stakeholders are in the hundreds of millions and often the most vulnerable to climate change. Early evidence suggests that the provision of climate finance, technology transfer and capacity-building can enhance pre-2020 ambition levels and lay a solid foundation for enhanced post 2020 ambition (UNFCCC, 2018).

The menu of options for accelerating the provision of support includes the review and synthesis of capacity-building, technological and financial gaps and needs in the agriculture sectors and the alignment of sectoral investment plans and budgets with NDC support needs, amongst others. For instance, in Central Asia, an area of potential NDC enhancement is the disaggregation of finance needs by conditional/unconditional and mitigation/adaptation shares. In Eastern Europe, an area of potential NDC enhancement is the inclusion of support needs for NDC implementation. In Southern Europe, an area of potential NDC enhancement is the inclusion of finance needs for NDC implementation.

4.3 KEY FINDINGS AND CONCLUSION

The agriculture sectors in the region contribute to over 600 million tons of CO_2 eq per year to global GHG emissions, with the majority of emissions generated from land use in Eastern Europe and Central Asia. Amongst agricultural emissions, enteric fermentation and managed soils constitute the highest shares of sectoral emissions across all sub-regions. Similarly, the greatest shares of emissions from LULUCF are associated with conversion to cropland across all sub-regions, the burning of forest biomass in Central Asia and forest degradation in Southern Europe.

Without implementation of the NDCs, total baseline net emissions in 2030 are expected to double those reported in 2015. Even with implementation of the NDCs, net emissions are expected to increase by approximately 41 percent in 2030. Only one country (Republic of Moldova) and two countries (Republic of Moldova and Bosnia and Herzegovina) set GHG targets in the agriculture and LULUCF sectors, respectively. However, 79 percent and 57 percent of countries in the region are committed to mitigation in the agriculture and LULUCF sectors.

Identifying actions that co-deliver on mitigation and adaptation is critical to achieving climate action at scale, while ensuring that "no one is left behind." Overall, 88 percent of countries with adaptation prioritize the agriculture sectors within their adaptation component. Indeed, countries recognize the multiple transmission pathways by which climate change directly and indirectly impacts agricultural production, food systems and rural livelihoods.

Amongst observed and/or projected climate-related hazards and slow onset events, extreme heat, drought and water stress are most prevalent in the region, followed by floods and invasion by non-native species. The loss of ecosystem, biodiversity and ecosystem goods, functions and services is reported as the ecosystem service most affected by climate-induced physical and chemical changes, primarily in forest and mountain ecosystems.

Undermining the capacity to adapt are the non-climatic stressors driving vulnerability, particularly poverty and low levels of human development. When climate impacts combine with low adaptive capacity and high degrees of vulnerability, adverse health and food insecurity and malnutrition outcomes are most expected amongst climate-related risks in social systems.

The results of the gap and opportunity analysis point to a set of priority actions that can accelerate progress on both mitigation and adaptation in the agriculture sectors, leverage their synergies and deliver sustainable development co-benefits:

1. ENHANCE FOREST COVER AND MANAGE FORESTS SUSTAINABLY

Agro-ecosystems, particularly forestry and the crops sub-sector, are considered the most vulnerable to climate change. Almost 90 percent of countries in the region prioritize adaptation in the agriculture sectors, particularly around forestry. At the same time, 60 percent of countries prioritize mitigation options on forest land. Across mitigation and adaptation options, afforestation/reforestation is the most prevalent, as increases in above and below ground biomass can sequester carbon from the atmosphere on one hand and prevent erosion and reduce floods on the other. With floods and landslides amongst the most reported climate-related hazards in all sub-regions, as well as pest and disease incidence in forests amongst observed and/or expected climate impacts, it is not a surprise that ecosystem management, conservation and restoration activities in forest and woodland ecosystems is the most prioritized adaptation measure outside of farming systems. Enhancing forest cover in combination with sustainable forest management can address the GHG hotspots, climate-related vulnerabilities and policy gaps identified in the region, including forest degradation (Southern Europe), forest biomass burning (Eastern Europe), vulnerable forest ecosystems (all sub-regions) and pest and disease incidence in forest ecosystems (Southern Europe).

2. INCREASE SOIL ORGANIC MATTER AND REDUCE EROSION

Emissions from managed soils and cropland, primarily from synthetic fertilizers, manure left on pasture and land use change, constitute major GHG hotspots in all sub-regions. Constrained by salinization, contamination and soil organic matter decline (FAO, 2015), cropping systems are reported as the most vulnerable sub-sector to climate change, next to forestry. With soil erosion reported amongst climate-related slow onset risks and events in terrestrial ecosystems, particularly in Eastern Europe, along with changes in water availability on cropland reported amongst greatest impacts on ecosystem services, it is no surprise that land/soil management, restoration and rehabilitation is often prioritized amongst adaptation options. Critical to supplying clean water, preventing desertification and providing resilience to floods and drought, soil makes up the greatest pool of terrestrial organic carbon, contributing to climate change mitigation (FAO, 2018).

While deforestation and land use change, largely brought about by rising food needs, is a major cause of soil depletion and conversion to cropland around the world, FAO (2016d) demonstrated that increasing agricultural production does not have to come at the expense of forests. An integrated approach that places sustainable soil management principles within a broader landscape context can address the GHG hotspots, climate-related vulnerabilities and policy gaps identified in the region, including emissions from managed soils (all sub-regions), emissions from cropland conversion (all sub-regions), soil erosion (Eastern Europe) and the provision of crops at risk (Central Asia and Southern Europe).

3. PROTECT WATER RESOURCES AND COMBAT DESERTIFICATION

Water is reported as the most vulnerable natural resource to climate change in all ecosystems and particularly inland water ecosystems. Amongst climate-related slow onset events, water stress is reported the most and by all sub-regions, with desertification reported particularly in Central Asia. The provision of freshwater is considered the ecosystem service most vulnerable to climate change in the pastoral, mountain ecosystems upon which almost half the population of Central Asia depends for their sustenance and livelihoods. Early snow and ice melt is contributing to changes in hydrological flow and water availability, especially in the summer months. The majority of countries with adaptation include water resources amongst cross-sectoral adaptation priorities,

with irrigation and drainage as the most frequently promoted adaptation option. Improved water management practices can reduce nitrous oxide emissions from leaching and volatization and enhance water uptake ratios for better plant productivity, as improved storage and harvesting practices can reduce gendered burdens and enhance resilience to natural- and human-induced disasters. The sustainable management and development of water resources and the protection of aquatic biological resources can address the GHG hotspots, climate-related vulnerabilities and policy gaps identified, including water stress (all sub-regions), vulnerable inland water ecosystems (Central Asia) and desertification (Central Asia).

4. REDUCE ENTERIC METHANE AND IMPROVE PASTORAL LIVELIHOODS

Ruminants represent an important productive asset and livelihood strategy to smallholders throughout the region, as an integral part of all farming systems, mostly pastoral and extensive. At the same time, emissions from enteric fermentation constitute a major GHG hotspot across all sub-regions. While the livestock sector is prioritized most amongst mitigation options, particularly improved feeding practices, only Eastern Europe includes livestock amongst adaptation priorities. However, increased pest and disease incidence, particularly vector-borne diseases, are cited frequently amongst observed and/or projected climate-related impacts in agro-ecosystems.

Ruminant production systems with low productivity use more energy to produce each unit of animal product than those with high productivity. The strong correlation between increases in animal productivity and reductions in enteric methane emissions offers large opportunities for low-cost mitigation and widespread social and economic benefits (FAO, 2016f). Improving feed quality can be achieved through improved grassland management, improved pasture species, forage mix and greater use of supplements, preferably locally available, as animal health and husbandry and genetic breeding can contribute to the efficiency of livestock systems, while supporting food security and nutrition. Reducing overgrazing, restoring grasslands and caring to animal health can address the GHG hotspots, climate-related vulnerabilities and policy gaps identified in the region, including emissions from enteric fermentation and managed soils (all sub-regions), invasion of non-native species (all sub-regions) and vulnerable mountain ecosystems (Central Asia).

5. PROVIDE HEALTH INFORMATION AND SERVICES

Adverse health is reported as the greatest observed and/or expected climate-related risk in social systems. Climate extremes often directly affect human health through changes in temperature and precipitation and natural hazards, increasing the risk of disease. Disease interferes with the body´s ability to absorb nutrients, which can negatively affect the nutritional status of adults and children (FAO, 2018). Over 60 percent of countries with adaptation place health as the greatest cross-cutting adaptation priority in social systems. Promoting climate information services, early warning systems and research and development is critical to preventing hazards and ensuring food safety, as is better access to health care and services to manage infectious and non-communicable disease. Improved availability of and access to health and information services can address climate-related risks and policy gaps identified in the region, including adverse health risks (all sub-regions).

6. PROMOTE HEALTHIER DIETS

Wh**ile inadequate or unbalanced consumption patterns, lacking in macronutrients or essential micronutrients, fell between 2012 and 2017, one in four adults above 18 years of age in Eastern Europe are obese,** and one in five are obese in Southern Europe. However, only Central Asia references food insecurity and nutrition as a climate-related risk. Inexpensive, high-calorie, low-nutrition foods, combined with metabolic adaptation to food deprivation, contribute to overweight and obesity (FAO, 2018). When climate extremes and variability

combine with poverty, market instability, environmental degradation and migration, climate change threatens to exacerbate all forms of food insecurity and malnutrition. Integrating food security and nutrition considerations into broader climate, agriculture and development strategies is critical to addressing the climate-related risks and policy gaps identified in the region, including poverty (all sub-regions) and food insecurity and nutrition (Central Asia)

7. BUILD RESILIENCE AND PROMOTE GENDER EQUALITY

With economic dependence on agriculture and high levels of poverty amongst the key non-climatic drivers of vulnerability reported in the region, natural hazards and disasters threaten to impede progress on poverty, hunger and malnutrition reduction. Amongst governance and institutional adaptation measures in the region, DRR/M and policy mainstreaming and coherence are most prevalent, while knowledge and capacity-related adaptation measures focus on R&D and awareness raising. Improving access to knowledge, technologies and services for those most at risk, as well as enhancing institutional and technical capacities at all levels to deliver DRR is necessary to addressing the loss of productive infrastructure and assets observed in Southern Europe and rural livelihood and income losses projected in Central Asia under climate change. Bringing together multiple stakeholders from government services to local authorities to farmers and others, as well as integrating DRR/M in agricultural interventions, poverty reduction and climate change strategies, and strengthening the governance framework for early warning and action are key to tackling the underlying drivers of vulnerability and building adaptive capacities.

Gender equality and women empowerment play a major role in the region's approach to adaptation, as the most prioritized option for improving socio-economic situations and well-being. Priority actions for building resilience can address the multiple climate-related hazards, vulnerabilities and risks in ecosystems and social systems, and policy gaps, identified in the region, including floods, drought and water stress (all sub-regions), vulnerable agro-ecosystems (all sub-regions), poverty (Central Asia and Southern Europe), loss of productive infrastructure and assets (Southern Europe) and rural livelihood and income losses (Central Asia).

8. LEVERAGE CLIMATE ACTION SYNERGIES WITH THE SDGs

The high degree of convergence between the climate and sustainable development agendas suggests that aligning their implementation provides a great opportunity to national and sub-national governments to accelerate progress across both agendas. Overall, the greatest area of convergence between SEECA region climate actions in the agriculture sectors and the SDGs is found around SDG targets[49] 12.2, 2.3, 2.4, 1.5 and 15.2.

Conclusion

The agriculture sectors represent a unique opportunity for regional and national stakeholders to leverage the mitigation and adaptation potential of agriculture and land use, while accelerating progress on sustainable development. However, change will only come about if supported by enabling policies and institutional arrangements, capacity and knowledge gaps are closed, actors are engaged and investments are aligned. By highlighting the gaps in the coverage of mitigation and adaptation in the agriculture sectors, as well as illustrating opportunities for enhancing climate action ambitions in the next round of NDCs, this analysis can serve as an important roadmap for informing policies and directing future investments in support of low-emission, climate-resilient and inclusive agriculture and food systems in the region.

[49] After SDG 13 "Climate Action".

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