

Annex 2: Tabular overview of most relevant studies, reports, and projects

CTCN Technical Assistance Azerbaijan - CRVA								
Existing knowledge (Activity/Module 1; Step 1)								
Title	Author/Org.	Year	Scope/Sectors	Hazards/Impacts	Climate Signals	Elements of Vulnerability / Exposure	Risks (tbd)	Remarks
Climate Change in the Southern Caucasus: Impacts on nature, people and society	WWF Norway	2008	Water	Flooding Drought Landslides	Current impacts of CC: - Increasing temperatures, shrinking glaciers, redistribution of river flow, decreasing snowfall, upwards shift of snowline - Greatest temperature increase (Azerbaijan) in Greater Caucasus and Kura-Aras lowlands - During last decades share of snow alimентация has rapidly decreased and seasonal snow line has risen from 1,300-1,500m to 1.800-2,000m asl (p.11) - More extreme weather events (described on p.13) Future impacts for CC (p.14), based on IPCC forecasts:	Mountains receive higher amounts of precipitation as compared to other regions		
			Agriculture	Erosion Forest fires		Food production mostly relies on irrigation, especially in dry and semidry regions		
			Tourism	Loss of biodiversity Avalanches Snow availability		Avalanche risk on south-west facing slopes		
Second National Communication to the UNFCCC	MENR	2010	Water	Wastewater pollution Increased evaporation	As for humidity, evaporation will likely rise by 15% over the baseline year level by 2050. However, because of the projected simultaneous rise of 10 to 20% in rainfall levels, a shortage of humidity experienced by plants during vegetation (climatic water balance) will be reduced by 85 to 260 mm, as compared to the baseline year. In 2071-2100 the level of precipitation is forecast to rise by 20 to 40% in most of the irrigated areas of the country. But because of the forecasted increase in the level of evaporation, the climatic water balance might rise 20-100mm during vegetation.	Freshwater is mainly derived from rivers. Most of these (69-72%) originate in surrounding countries.		
			Agriculture	Soil erosion and salinisation Desertification Soil degradation		Potential changes in agriculture will arise from increased temperatures (expansion of arable areas, increased productivity,...). However, these will be limited by conflicting land uses and are highly dependent on water supply.		
Assessment of CC Impact on Wheat	World Bank Eastern Europe (Future Water)	2012	Agriculture	Decreased agricultural yield Pests and diseases/ weeds (mentioned but not explored)	Changes in precipitation, changes in crop water demand, reduction in wheat yield up to 8% under the high climate change projection in 2040-2049, minimum yields can go down by 12%	Changes in irrigation applications Most of the wheat is grown under irrigation (Morgounov et al., 2001)		
CC and Agriculture Country Note	World Bank	2012	Agriculture	Soil degradation/erosion Salinisation of irrigated lands Flooding		39.7% employment in agriculture Heavy reliance on irrigation (80%)		
The First Biennial Updated Report of the Republic of Azerbaijan to the UNFCCC	Republic of Azerbaijan	2014	Tourism	Avalanches	Increase in temperatures and increase in extreme weather events	Vulnerabilities of tourism sector (e.g winter sports), vulnerability of infrastructure, safety and security of		
			Agriculture	Decreased agricultural yield Land loss				
			Water	Floods Landslides				
Building Resilience to CC in South Caucasus Agriculture	World Bank	2014	Agriculture	Decline in crop yields Direct effect of temperature and precipitation on crops	Potential decrease in precipitation in the Greater Caucasus (depending on scenario); Rainfall events are predicted to be more variable, with a high probability of daylong to multiday events being larger and less frequent; Seasonal distribution of temperature is more important for agricultural production than yearly averages. Greatest temperature increases occur during Aug-Oct, forecasted precipitation declines also estimated to be greatest in the key Apr-Oct period.			This study consulted with a variety of stakeholders (agriculture) in Shamakhi in March 2012, mostly for adaptation strategies.
			Water	Floods Flash floods Decreased water supply				
Final report on CC impact (incl. Social and economic impact) to local forest of Azerbaijan, as well on	Enpi-FLEG	2015	Forestry	Droughts Biodiversity loss	Decrease in precipitation in the summer season; Increased temperatures	Tree species not resistant to high temperatures		
Outlook on CC adaptation in the South Caucasus mountains	GRIDA	2015	Agriculture		General trend: warmer and wetter/drier; Annual increase (avg) 1.5-1.6° by 2021-2050 and 3-6° by 2070-2100; Max temperatures predicted to increase (47-53°C); Precipitation towards the end of the century: diverging predictions (UNFCCC: increase, UNDP decrease); While region is naturally prone to natural disasters, CC is expected to exacerbate the frequency, intensity and severity of such events; Increased flood and drought frequency is already visible	Droughts occur less frequently than floods but economic losses are generally higher than those associated with flooding.		
			Tourism	Avalanches		Seismic activity triggering avalanches		
			Water	Floods Droughts Mud & landslides		Floods are most prevalent on southern slopes of Greater Caucasus; Moderate to high seismic activity may trigger additional land & mudslides; Caucasus mountains are very flood prone.		
Third National Communication to the UNFCCC	AZ	2015	Water	Drought Floods Landslides Shortage of drinking water	Increase in temperatures and increase in extreme weather events	Water plays a major economic role. Annually 10,000-12,000 million m3 of water are taken from rivers for irrigation (5-20% of river flow). Problems of water availability: lack of water resources, non equal distribution, seasonal fluctuation. Shortage of water during drought periods but also floods during rainy season; Decrease in water resources, especially in winter precipitation and snow, as well as less spring precipitation leading to a decrease in both surface and ground water.	Damages to infrastructure	Shamakhi region has a well developed tourism infrastructure. Azerbaijan is one of the areas of the world with most floods, with most floods incidents occurring in the Greater and Lesser Caucasus mountain systems.
			Tourism	Loss of biodiversity Drying up of rivers and waterfalls		Reforestation is taking place in the Shamakhi region of the Greater Caucasus. This is helping to stabilize the mountain slopes that extend to the border with Georgia. Forests here mostly cover the mountainous parts of Ismayilli, Oghuz, Shaki, Gakh, and Balakani regions. The region is very attractive due to the range of tourism services and a well-developed tourism infrastructure		
			Agriculture	Water scarcity for irrigation Forest fires				

Quantitative assessment of 2014.2015 land-cover changes in Azerbaijan using object based classification of LANDSAT-8 timeseries	Bayramov et al.	2016	Agriculture		Increasing temperatures, intensive agricultural activities, growing industrial activities, overgrazing, shrinking glaciers, reduction and redistribution of river flows and decreasing rain and snowfalls	Increase in land cover of agricultural land, forest and built-up areas and decrease in grasslands driven by agricultural activities (between 2014-2015)		
Financing Climate Action in Azerbaijan	OECD Green action Programme	2016	Water	Water shortages	Lower precipitation increasing droughts (productivity) Heavy rainfall, heat stresses, early frosts and floods (yields)			The priority adaptation options identified include: (i) increasing the capacity and reach of extension services; (ii) ensuring that farmers have access to good quality hydro-meteorological information; (iii) investigating options for crop insurance, particularly for drought; and (iv) improving farmers' access to rural finance to enable them to access new technologies (World Bank, 2014).
			Agriculture	Damages to yields Decrease in productivity				
Azerbaijan Risk Profile	GFDRR/ World Bank	2017	Water	Flooding	The two provinces of interest are not at high risk of flooding as compared to other parts of the country.	Vulnerability expressed in terms of economic loss, strong correlation between population and GDP per		
CC and Security in the South Caucasus	OSCE/UNEP	2017	Water	Droughts Flooding and related hazards (p.80)		More than half of Azerbaijan's poor live in rural areas; AZB is prioritising forest protection, rehabilitation and reforestation, in some locations forest margins may move upwards by 50-200m; Greatest yield decline for cotton and potatoes; Risk management tools such as early warning systems and meteorological stations are out of date and unable to warn of critical water levels (p.76)		Migration from southern lowlands into pilot regions due to floods; The state programme on reliable food supply to the population in the AZB republic (2008-15) is a comprehensive sectoral policy document to address impacts of CC.
			Agriculture	Extreme weather events				
CC Risk Profile Azerbaijan	USAID	2017	Water	Mud- and landslides Floods	Increased temperatures, more variable precipitation, increased frequency and magnitude of flooding; Greater frequency and magnitude of flood events due to increased intensity of single rainfall events	The agriculture sector's vulnerability to climate change in Azerbaijan stems from high reliance on subsistence farming, with low productivity, high rates of soil degradation and limited land availability. Shortened ski season due to earlier snowmelt and/or upward shift of skiing regions, resulting in substantial cost increases for service providers and operators Tourism is an emerging industry in Azerbaijan, contributing more than 8 percent to national GDP in 2015. Climate change is likely to impact tourism as reduced snow limits ski resorts, where at least 20-30 cm of snowpack is required to operate; the growing number of mud- and landslides in mountain areas poses a risk to popular hiking destinations.	Decrease in agricultural productivity due to land degradation (erosion)	
			Agriculture	Land-degradation				
			Tourism	Mud and landslides Snow availability				
Second Biennium Update Report of the Republic of Azerbaijan to UNFCCC	Ministry of Ecology and Natural Resources (Republic of Azerbaijan)	2018						
The Greater Caucasus Glacier Inventory	Tielidze&Wheate	2018	Water / Tourism	Ice-debris flows; rock-ice avalanches; glacial mudflows	Glaciers in the eastern Greater Caucasus have decreased (0.98%/yr-1) more than in central and western sections (0.46 and 0.52, respectively). Southern glaciers have retreated more than northern ones.	Glacier hazards are relatively common in this region, leading to major loss of life; Economic importance as major tourist attraction (in Georgia at least)		
CC Adaptation in Europe and Central Asia	UNDP	2018	Water	Floods, mudflows Water stress	Heavy rainfall, over the past 15 years 10-fold multiplication of events; HOWEVER: water stress is predicted to increase	Physical vulnerability due to steep mountain slopes; Lack of monitoring network + lack of early warning systems, limited access to area during/after events due to damaged and affected infrastructure (roads); National flood and water supply management projects do not take into account long-term climate impacts		Full evaluation report available; Project took place very close to pilot regions (Turyanchay river basin); Ministry of Emergency Situations - potential stakeholder

Climate East Project Document	GEF_UNDP	2011-2015	Agriculture	Erosion	Subchapter 12. Climate Change and its Impacts on Forest and Pasture lands (p. 8 & 9); The highest rise in temperatures will be observed in the middle and higher mountainous zones of the Great Caucasus.	Critical ecosystem services sustained by forests and pastures include: supporting (nutrient cycling, soil formation); provisioning (food, fresh water, wood, fuel); regulating (climate & flood regulation), and cultural (aesthetic, educational, recreational) (p.5). Shamakhi: Most of the precipitation occurs from May to September. In December the maximum average thickness of snow cover is about 10 cm in the foothills, 20-25 cm in middle mountainous relief, and more than 70 cm in the high mountains. (p. 7) Currently poor management of pastures and forests (p. 8)	Land degradation/erosion from overgrazing and poor management (p. 5)	The project concentrates on the summer pastures of Ismayilli rayon, winter pastures of Shamakhi rayon and forest lands and river valleys of both rayons. Semi-arid areas dominate the lower elevation lands, forests dominate at mid-elevations, and summer pastures occur at the higher elevations. The Climate in the rayons varies from warm semi desert and dry steppes in the lower elevation plains, to warm subtropical climate to about 600 m and then a cold mountain environment at higher elevations. Shamakhi and Ismayilli rayons are dominated by a temperate continental forest ecoregion with smaller areas of temperate desert at lower elevations and a temperate mountain system at higher elevations. IPCC categorization places the rayons in the Warm Temperate Dry and Cool Temperate Dry and Cool Temperate Moist IPCC climate zones. The mean elevation for Ismayilli is 985 m (sd 628.1 m) and 883.6 m (s.d. 615.8 m) for Shamakhi rayon. The min. and max. elevations for Shamakhi are -13 m and 2,501 m, and for Ismayilli 1m and 3150m, respectively
Managing disaster risks and water under climate change in Central Asia and Caucasus	SDC	2019	Water	Natural hazards	Precipitation anomalies show general drying trends in the caucasus (p. 9); 20% less rain under the high-emission 4°C-scenario. Higher proportion of winter precipitation falls as rainfall (p.11) ; increase in snow line by about 150m/1°C; seasonality of snow melt will result in earlier runoff and reduced water availability in (late) summer. In parts of Azerbaijan existing water stress due to inefficient use, unequal distribution and seasonal fluctuations are already causing major concerns. Improved water use efficiency in irrigation, changing or rotating crop systems and water reuse might ease water stress and improve agriculture productivity (Aleksandrova et al. 2014)	Seasonal storage of freshwater as snow and inter-annual storage as glacier ice provides critical water reserves that supply agricultural and domestic water during dry summer seasons and replenishes groundwater reserves (p.10); reliance on irrigated agriculture, reliance on rain-fed agriculture; dependency on agriculture for food production (rural population) ; ageing infrastructures; population growth, increase in populatio living in hazard hotspots; increase in depamd for food, housing, water and energy (p14).	More frequent and longer drought periods; insufficient water resources to meet demand; heat stress during summer months; glacial lake outburst flooding; increased chance of mass movement	