Georgia | Impacts of Climate Change and Adaptation in Agriculture I

Find the underlying analysis in the sectoral policy brief "Georgia: Economy-wide Effects of Adaptation in Agriculture" and in the report "Supporting climate resilient economic development in Georgia"

Annual changes in % are between a climate change scenario without adaptation (SCC) and a climate change scenario with adaptation (SCCA).

Georgia's agriculture is vulnerable to climate change

Heatwaves can cause **harvest losses** (e.g., grapes) and **damages to irrigation systems**.

Extreme precipitation may result in **crop losses** due to flooded fields.

Heavy wind removes and transports soil material & causes land degradation (wind erosion), which can lead to **crop losses**.

Negative impacts on agriculture can lead to **lower growth in other sectors, lower GDP** and **employment.**

Exemplary adaptation measures for reducing vulnerability to heavy wind and droughts

Windbreaks

Restoring windbreaks such as trees and bushes can **reduce the negative** direct **impacts** of wind erosion due to climate change. As a result, investments in windbreaks may on average lead to about **18% higher crop yields per year** than without this adaptation measure (Moore n.d., Geostat 2020).

Irrigation Systems

Modernizing and rehabilitating irrigation systems can **sustain high yields** of Georgia's **horticultural crop production** in the future despite rising temperatures and great variation in precipitation patterns. Investing in irrigation systems may on average lead to about **15% higher crop yields per year** than without this adaptation measure (MoA 2017).

Economy-wide benefits of windbreaks and irrigations systems

Economy-wide effects of windbreaks (SACC compared to SCC)

Macroeconomic modelling allows for **long-term assessment of economy-wide effects** of adaptation measures.

→ Investments in the restoration of **windbreaks** can result in up to **1.4% higher GDP** (resp. GEL 747 million) and **up to 0.7% higher employment corresponding to more than 12,000 additional jobs** per year (SACC compared to SCC).

→ Investments in **windbreaks** have **positive sectoral linkages** leading to **increased wage levels** and **higher consumption expenditure** of **up to 1.1% p.a.** (SACC compared to SCC).

→ Similarly, to windbreak investments, investments in irrigation systems can lead to **annual GDP increases of up to 1%** and up to **0.6% higher employment** per year **corresponding to more than 10,000 additional jobs** (SACC compared to SCC).

References
Geostat (2020): Agriculture of Georgia 2019. Preliminary data on plant growing. National Statistics Office of Georgia. Tbilisi.
MoA (2017): Irrigation Strategy for Georgia 2017-2025. Ministry of Agriculture. Tbilisi.
Moore, L. (n.d.): Economics of Windbreaks. USDA-NRCS.

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Georgia | Impacts of Climate Change and Adaptation in Agriculture II

Find the underlying analysis in the report "Economy-wide Impacts of Climate Change and Adaptation in Georgia" (2025)

Annual changes in % are between a climate change scenario without adaptation (SCC) and a climate change scenario with adaptation (SCCA).

Georgia's agriculture is vulnerable to climate change

Crop losses due to **heavy winds,** wind erosion, **heavy rain** and **flooding**

Crop losses due to water scarcity caused by **droughts** and **heatwaves**.

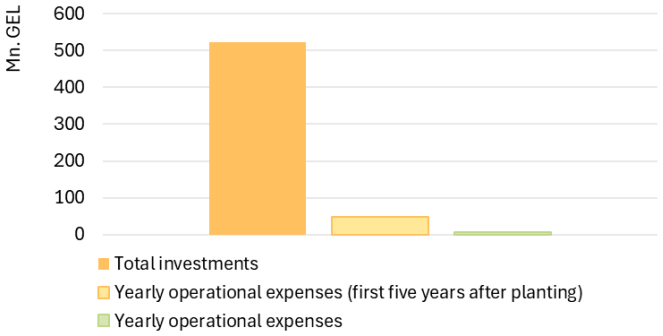
The **productivity of people working outside** as e.g. in the agriculture sector may decrease during **heatwaves**.

Grapes burn due to **heat** and **drought** (loss of harvest or reduction in quality)

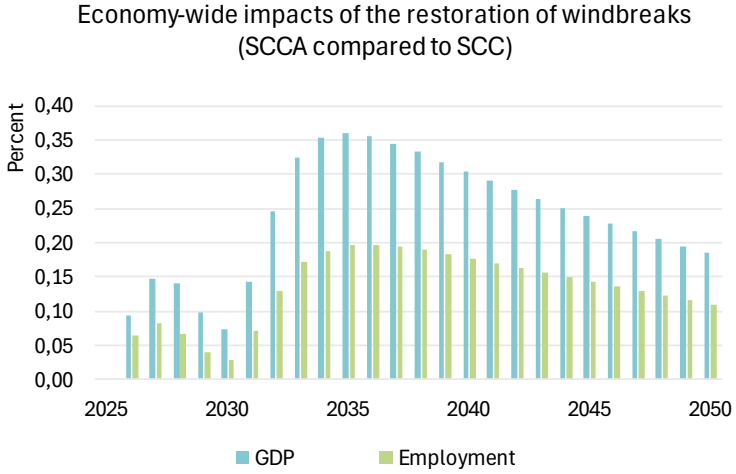
Exemplary adaptation measure for reducing vulnerability to climate change: enhanced windbreaks

The restoration of **windbreaks** reduces the vulnerability to climate change, in particular the decline in crops yields due to wind erosion and heavy winds.

It is expected that the reduction of crop losses amount to 16%, that 20% of the irrigation costs can be saved, and that the land value increases by 1%.



Economy-wide impacts of the restoration of windbreaks



Macroeconomic modelling allows for **long-term assessment of economy-wide effects** of adaptation measures.

→ Investments in windbreaks result annually in up to **0.36% higher GDP** (resp. 449 mln. GEL) and **up to 0.2% higher employment** corresponding to more than 4,300 additional jobs (SCCA compared to SCC).

→ The measure is beneficial for agriculture due reduced crop losses and less irrigation needed. Further benefits resulting from windbreaks, such as their potential for carbon storage and sequestration are currently not included in the modelling but could have an additional impact.

→ Especially in agriculture and services, but also in the manufacturing and construction sectors, there is an increase compared to the reference, on the one hand due to the additional investments and on the other hand due to the avoided damages in agriculture.

References
Flaute, M., Reuschel, S., Lutz, C., Banning, M. & Hohmann, F. (2022): Supporting Climate Resilient Economic Development in Georgia. Application of the e3.ge Model to analyze the Economy-wide Impacts of Climate Change Adaptation, Berlin.
Remissia (2025): CBA elements for windbreaks, internal documentation.

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Georgia | Impacts of Climate Change and Adaptation in Tourism and Infrastructure

Find the underlying analysis in the sectoral policy brief "Georgia: Economy-wide Effects of Adaptation in Tourism and Road Infrastructure" and in the report "Supporting climate resilient economic development in Georgia".

Annual changes in % are between a climate change scenario without adaptation (SCC) and a climate change scenario with adaptation (SCCA).

Georgia's infrastructure and tourism sectors are vulnerable to climate change

Sea level rise threatens tourism infrastructure, often located near beaches, and can thereby affect tourism flows.

Extreme precipitation can damage infrastructure, which then needs to be reconstructed.

Heavy wind may damage infrastructure, followed by the need to repair or rebuild the affected infrastructure.

Negative impacts on infrastructure and tourism can cause **lower growth in other sectors, lower GDP** and **employment.**

Exemplary adaptation measures for reducing vulnerability to sea level rise and heavy rain

(Re-)Construction of Coastline Protection

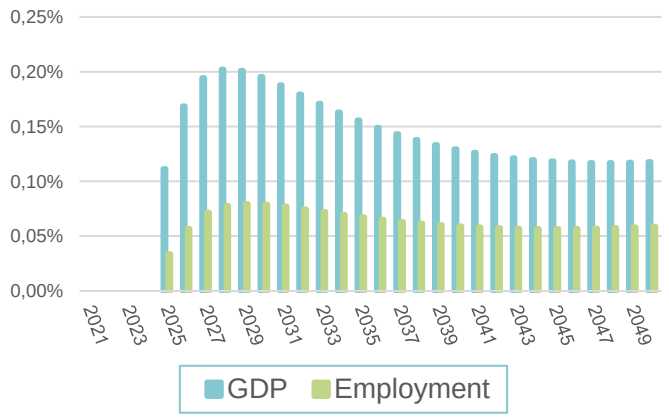
To retain the commercially important beaches for the tourism sector and to protect the infrastructure located on the coastline, it needs to be stabilized (see CZ-NAP 2020), e.g., by **(re)construction measures** like building sea walls. The additional investment may result in higher number of tourists and benefits for tourism-related economic sectors (accommodation, transportation, arts and entertainment).

Climate Resilient Roads and Bridges

By reinforcing and updating road infrastructure, roads and bridges can be made more resilient to climate change impacts and thereby the negative impacts of damaged infrastructure could be reduced. As an example, changing the composition of road surfaces can make them resilient to high temperatures and extreme precipitation (see OECD 2018).

Economy-wide benefits of coastline protection and climate resilient roads and bridges

Economy-wide impacts of investment in coastline protection (SCCA compared to SCC)



Macroeconomic modelling allows for **long-term assessment of economy-wide effects** of adaptation measures.

→ Investments in the **(re-)construction of coastline protection** can result in up to **0.2%** higher **GDP (170 million GEL)** and **up to 0.08% higher employment** per year **corresponding to more than 1,200 additional jobs** (SCCA compared to SCC).

→ Investments in **coastline protection** have **positive sectoral linkages** leading to **increased household consumption expenditure** of up to 0.19% p.a. (SCCA compared to SCC).

→ Similarly to coastline protection, investments in **climate resilient roads and bridges** can lead to **annual GDP increases of up to 0.17%** and up to **0.05% higher employment** per year, **corresponding to more than 1,000 additional jobs** (SCCA compared to SCC).

References
CZ-NAP (2020): National Action Plan for Adapting to Climate Change Impacts in the Black Sea Coastal Zone. Tbilisi, 2020.
OECD (2018): Climate-resilient Infrastructure. Policy perspectives. OECD Environment Policy Paper No. 14. Paris,

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Georgia | Impacts of Climate Change and Adaptation – Floods and flood protection

Find the underlying analysis in the report "Economy-wide Impacts of Climate Change and Adaptation in Georgia" (2025)

Annual changes in % are between a climate change scenario without adaptation (SCC) and a climate change scenario with adaptation (SCCA).

Georgia's infrastructure and agriculture is vulnerable to climate change

Damages to buildings and household goods

Damages to transport, water and energy infrastructures

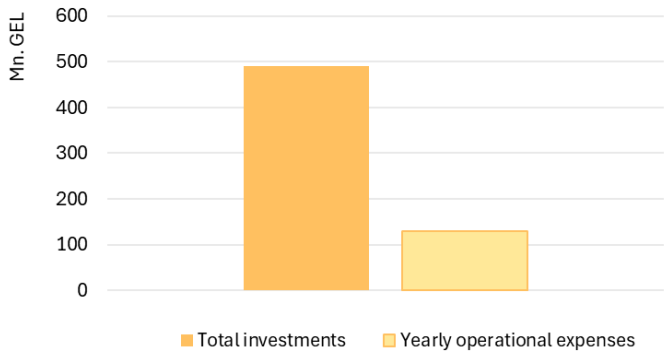
Crop losses due to **heavy rain** and **flooding**

Losses in production due to power transmission failures

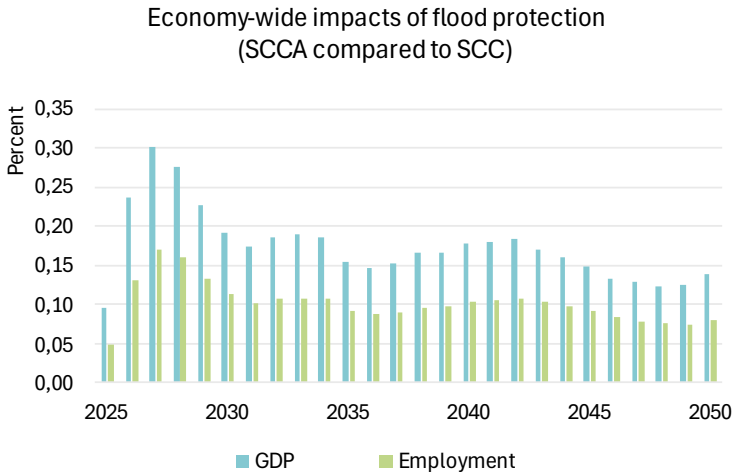
Exemplary adaptation measure for reducing vulnerability to climate change: flood protection

Flood protection includes measures such as flood risk zoning, introduction of flood resistance building code, Early Warning Systems, insurance schemes for buildings and agriculture, and flood proofing of infrastructure.

It is expected that losses of buildings and infrastructures can be reduced by 70% and losses in agriculture can be reduced by 50%.



Economy-wide impacts of flood protection



Macroeconomic modelling allows for **long-term assessment of economy-wide effects** of adaptation measures.

→ Investments in flood protection result annually in up to **0.3% higher GDP** (resp. 261 mln. GEL) and **up to 0.17% higher employment** corresponding to more than 3,700 additional jobs (SCCA compared to SCC).

→ The measures reduce damages, have positive effects on agricultural production and reduce power transmission failures.

→ In the first years especially the construction and manufacturing sectors are positively affected as they are needed for flood protection measures. Services sectors benefit over the whole period due to operating.

References
GIZ (2025). Water-related climate hazards and adaptation measures in Georgia [Brundell, F., Lüttringhaus, S.] GIZ, Berlin.
Remissia (2025): CBA for floods – Rioni and Mtkvari, internal documentation
GFDRR, Government of Georgia, UN Development Programme & The World Bank (2015): Tbilisi Disaster Needs Assessment 2015. Tbilisi, 2015

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Georgia | Impacts of Climate Change and Adaptation in Forestry

Find the underlying analysis in the report "Economy-wide Impacts of Climate Change and Adaptation in Georgia" (2025)

Annual changes in % are between a climate change scenario without adaptation (SCC) and a climate change scenario with adaptation (SCCA).

Georgia's forests are vulnerable to climate change

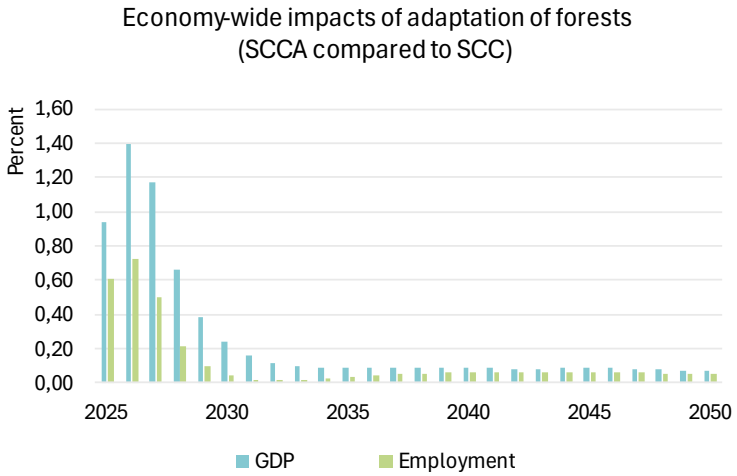
Climate hazards like **rising temperatures, changes in precipitation patterns** and extreme weather events like **heatwaves, droughts** and **floods** have a direct impact on forests. Climate change is particularly increasing the risk of **forest fires** and the outbreak of **diseases.**

Exemplary adaptation measures against forest fires and forest diseases

Adaptation measures such as a weather monitoring system, development of fire-protective roads, construction of water ponds against **forest fires** and a weather monitoring system, the establishment of a phytopathological and bio-laboratory, and capacity building initiatives against **forest diseases** reduces the vulnerability to climate change. Rehabilitation of previously damaged areas is also part of the adaptation scenario.

It is expected that losses can be reduced by 70%.

Economy-wide impacts of flood protection measures



Macroeconomic modelling allows for **long-term assessment of economy-wide effects** of adaptation measures.

- → Investments in windbreaks result annually in up to **1.4% higher GDP** (resp. 1.142 mln. GEL) and **up to 0.7% higher employment** corresponding to more than 15,400 additional jobs (SCCA compared to SCC).
- → The measures increase resilience to forest fires and diseases**.**
- → Especially in the agriculture, forestry and fishing sector and in the services sectors, but also in the manufacturing and construction sectors, there is an increase compared to the reference, on the one hand due to the additional investments and on the other hand due to the avoided damages

References
GIZ (2025). Water-related climate hazards and adaptation measures in Georgia [Brundell, F., Lüttringhaus, S.] GIZ, Berlin.
Remissia (2025a): CBA for Forest Fires, internal documentation.
Remissia (2025b): CBA for Forest Diseases, internal documentation

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