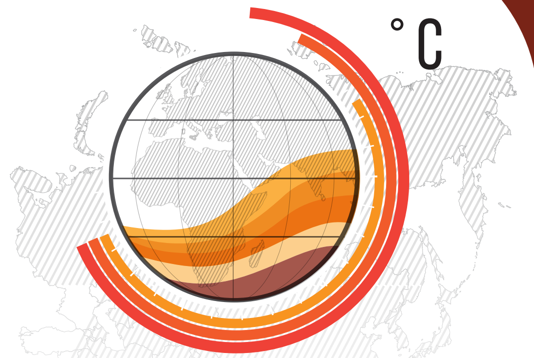
WHAT GLOBAL WARMING OF 1.5°C AND HIGHER MEANS FOR ETHIOPIA



The Paris Agreement has a goal of limiting global warming well below 2°C, ideally 1.5°C. Understanding the local-level impacts of these global temperature targets is crucial for informing climate change adaptation needs and actions. To date, mitigation pledges by nations fall far short of what is needed, with the world on track to warm by 3.2°C by the end of the century[1].

For Ethiopia, local warming will be greater than the global average. Even a 1.5°C increase in global temperature will severely affect agriculture, health, and other vulnerable sectors. Under an increasing emissions trajectory, the 1.5°C threshold could be breached within the next decade, and the 2°C threshold the decade after[2]. This means there is an urgent need to accelerate Ethiopia's adaptation responses to support its development agenda.

GLOBAL WARMING ABOVE PRE-INDUSTRIAL LEVELS

LOCAL IMPACTS IN ETHIOPIA			1.5°C	VS 2°C	VS 2.5°C	VS 3°C
Projected climate changes[3]	CLIMATE	Mean temperature (°C)	▲ 1.8	▲ 2.3	▲ 2.9	▲ 3.5
		Heat waves (days)	▲ 84	▲ 139	▲ 189	▲ 218
		Annual rainfall	▲ 3%	▲ 4%	▲ 9%	▲ 12%
		Heavy rainfall (days)	▲ 1	▲ 1	▲ 2	▲ 3
		Dry spell length (days)	▲ 2	▲ 2	▲ 2	▲ 1
Estimated impacts[4]	WATER	Guder Catchment[5] (streamflow)	▲ 26%	▲ 32%	▲ 33%	▲ 30%
		Lake Tana Basin[6] (streamflow)	▲ 12%	▲ 13%	▲ 14%	▲ 17%
		Awash River[7] (streamflow)	▲ 3%[8]	▲ 4%	▲ 7%	▲ 10%[8]
		Baro River[7] (streamflow)	▼ 1%[8]	▼ 3%	▲ 1%[8]	▲ 2%[8]
		Genale River[7] (streamflow)	▲ 11%[8]	▲ 21%	▲ 23%	▲ 29%[8]
		Tekezé River[7] (streamflow)	▲ 1%[8]	▲ 6%	▲ 4%[8]	▲ 5%[8]
		Lake Ziway[9] (inflows)	▼ 24%	▼ 28%	▼ 19%	▼ 13%
	AGRICULTURE	Maize[10] (suitable land)	▼ 21%	▼ 18%	▼ 25%	▼ 33%
		Sorghum[10] (suitable land)	▼ 12%	▼ 3%	▼ 7%	▼ 9%[8]
		Teff[10] (suitable land)	▼ 12%	▼ 11%	▼ 17%	▼ 22%[8]
		Barley[10] (suitable land)	▼ 36%	▼ 37%	▼ 46%	▼ 63%[8]
	HEALTH	Malaria[11] (months of risk)	▲ 76%[8]	▲ 120%[8]	▲ 149%	▲ 231%
		Heat stress[12] (days of exposure)	▲ 153	▲ 153	▲ 229	▲ 341

[1] Climate Action Tracker. https://climateactiontracker.org/global/cat-thermometer.

[2] Nkemelang, T., et al. 2018. Determining what global warming of 1.5°C and higher means for the semi-arid regions of Botswana, Namibia, Ghana, Mali, Kenya and Ethiopia: A description of ASSAR's methods of analysis. https://bit.ly/2yHbWPf.

[3] Based on climate modelling by T. Nkemelang. University of Cape Town, South Africa.

[4] Based on data analysis by R. Bouwer. University of Cape Town, South Africa.

[5] Fentaw, F., Mekuria, B. and Arega, A. 2018. Impacts of climate change on the water resources of Guder Catchment, Upper Blue Nile, Ethiopia. *Waters*. http://dx.doi.org/10.31058/j.water.2018.11002.

[6] Melke, A. and Abegaz, F. 2017. Impact of climate change on hydrological responses of Gumara catchment, in the Lake Tana Basin - Upper Blue Nile Basin of Ethiopia. *International Journal of Water Resources and Environmental Engineering*. https://doi.org/10.5897/IJWREE2016.0658.

[7] Gizaw, M.S. et al., 2017. Potential impact of climate change on streamflow of major Ethiopian rivers. *Climatic Change*. https://doi.org/10.1007/s10584-017-2021-1.

[8] Interpolated assuming a linear regression with no threshold being reached.

[9] Zeray, L., Roehrig, J. and Chekol, D.A. 2006. Climate change impact on Lake Ziway watershed water availability, Ethiopia. www.uni-siegen.de/zew/publikationen/volume0607/zeray.pdf.

[10] Evangelista, P., Young, N. and Burnett, J. 2013. How will climate change spatially affect agriculture production in Ethiopia? Case studies of important cereal crops. *Climatic Change*. https://doi.org/10.1007/s10584-013-0776-6.

[11] Tanser, F.C., Sharp, B. and le Sueur, D. 2003. Potential effect of climate change on malaria transmission in Africa. *The Lancet*. https://doi.org/10.1016/S0140-6736(03)14898-2.

[12] Garland, R.M. et al. 2015. Regional projections of extreme apparent temperature days in Africa and the related potential risk to human health. *International Journal of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph121012577.

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Adaptation at Scale in Semi-Arid Regions

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IMPACTS OF GLOBAL WARMING THRESHOLDS ON ETHIOPIA'S CLIMATIC ZONES

	ARID SOUTH				ARID NORTH				SEMI-ARID SOUTH				SEMI-ARID NORTH				HUMID EAST				HUMID WEST				ETHIOPIA OVERALL			
	1.5°C	2°C	2.5°C	3°C	1.5°C	2°C	2.5°C	3°C	1.5°C	2°C	2.5°C	3°C	1.5°C	2°C	2.5°C	3°C	1.5°C	2°C	2.5°C	3°C	1.5°C	2°C	2.5°C	3°C	1.5°C	2°C	2.5°C	3°C
Annual rainfall (%)	+9	+11	+17	+23	+2	+3	+6	+10	+5	+9	+12	+13	+1	0	+3	+7	+2	+4	+7	+8	+3	+3	+6	+6	+3	+4	+9	+12
Duration of dry spells (days)	+3	+2	+1	+1	+5	+5	+5	+6	0	-1	-1	-2	+2	+3	+2	+4	0	0	-2	-2	+1	+2	+3	+1	+1	+2	+2	+1
Duration of wet spells (days)	+1	+1	+1	+1	-1	0	0	0	0	0	0	-1	-1	-2	-2	-1	-1	-1	-2	-2	-4	-5	-5	-6	-1	-1	-2	-2
Heavy rainfall days (>10mm/day)	+1	+1	+2	+3	0	0	+1	+1	+1	+1	+2	+3	0	0	+1	+1	+1	+1	+2	+3	0	0	+2	+3	+1	+1	+2	+3
Extreme heavy rainfall days (>20mm/day)	0	+1	+1	+1	0	0	0	0	0	+1	+1	+1	0	0	+1	+1	0	+1	+1	+1	+1	+1	+2	+2	+1	+1	+1	+1
Amount of rain in heavy rainfall events (%)	+28	+39	+51	+77	+5	+21	+27	+37	+21	+38	+51	+58	+10	+16	+25	+32	+16	+33	+44	+52	+17	+31	+40	+48	+17	+30	+43	+56
Amount of rain in extremely heavy rainfall events (%)	+39	+57	+84	+108	+4	+26	+47	+51	+39	+61	+72	+94	+22	+40	+46	+69	+36	+76	+80	+110	+42	+58	+68	+89	+36	+61	+78	+100
Amount of rain in highest rainfall day (%)	+9	+11	+18	+21	+0	+5	+13	+17	+9	+16	+21	+25	+4	+7	+14	+18	+8	+17	+18	+25	+7	+12	+15	+22	+7	+12	+16	+22
Amount of rain in highest five consecutive rainfall days (%)	+8	+12	+14	+17	+3	+6	+13	+15	+8	+13	+15	+17	+3	+5	+10	+12	+5	+12	+16	+18	+5	+8	+11	+15	+6	+10	+9	+15
Temperature change (°C)	+1.7	+2.2	+2.8	+3.3	+1.8	+2.5	+3.1	+3.7	+1.7	+2.3	+2.9	+3.4	+1.9	+2.5	+3.1	+3.7	+1.8	+2.3	+2.9	+3.5	+1.8	+2.3	+2.9	+3.6	+1.8	+2.3	+2.9	+3.5
Number of hot days (>90th percentile)	+147	+192	+221	+239	+125	+171	+215	+245	+130	+175	+201	+221	+115	+156	+194	+219	+118	+164	+196	+217	+113	+157	+203	+228	+126	+173	+204	+226
Number of hot nights (>90th percentile)	+140	+191	+238	+275	+126	+173	+216	+248	+122	+175	+226	+259	+119	+173	+222	+252	+120	+173	+220	+252	+123	+173	+219	+250	+128	+183	+229	+258
Number of cold days (<10th percentile)	-34	-39	-43	-44	-33	-37	-41	-44	-32	-35	-39	-41	-31	-35	-39	-42	-31	-36	-40	-43	-32	-38	-42	-44	-32	-36	-40	-42
Number of cold nights (<10th percentile)	-53	-55	-56	-56	-50	-53	-54	-55	-54	-58	-60	-61	-49	-53	-56	-57	-55	-59	-62	-63	-53	-57	-59	-60	-55	-59	-61	-62
Duration of heat waves (days)	+106	+166	+206	+231	+97	+160	+201	+238	+85	+143	+189	+213	+83	+130	+178	+208	+79	+134	+170	+199	+72	+114	+163	+202	+84	+139	+189	+218