

IMPACTS OF CLIMATE CHANGE AT 2°C WARMING

EVENT	IMPACT	REFERENCE
12) Warming and stratification of ocean: coral reefs	99% loss	O. Hoegh-Guldberg, D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K. Ebi, F. Engelbrecht, J. Guiot, Y. Hijikata, S. Mehrotra, A. Payne, S. I. Seneviratne, A. Thomas, R. Warren, G. Zhou, 2018, Impacts of 1.5°C global warming on natural and human systems. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty[V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla,A. Pirani, W. Moufouma-Okia, C.Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield(eds.)].In Press.
13) Economic damages from river flooding in the UK	Increase by 1219%	Alfieri, L. et al. (2016) Global projections of river flood risk in a warmer world, Earth's Future
14) Water scarcity	Population exposed: 388 million	Naumann, G. et al. (2018) Global Changes in Drought Conditions Under Different Levels of Warming, Geophysical Research Letters
15) Crop yield change	362 million people exposed (81 vulnerable)	Byers, E., Gidden, M., Leclère, D., Balkovic, J., Burek, P., Ebi, K., ... & Johnson, N. (2018). Global exposure and vulnerability to multi-sector development and climate change hotspots. Environmental Research Letters, 13(5), 055012.
Mean precipitation	Mean precipitation will decrease by 10-15% in central and southern Europe during the summer	Vautard, R., Gobiet, A., Sobolowski, S., Kjellström, E., Stegehuis, A., Watkiss, P., ... & Jacob, D. (2014). The European climate under a 2 C global warming. Environmental Research Letters, 9(3), 034006. doi:10.1088/1748-9326/9/3/034006
Heat waves	Peak temperature will reach 40°C every two years in South America, Eastern US, North Africa, South East Asia and Australia	Russo, S., Sillmann, J., & Sterl, A. (2017). Humid heat waves at different warming levels. Scientific reports, 7(1), 7477. https://doi.org/10.1038/s41598-017-07536-7
	Heatwaves like the 2018 over Europe will occur every year	Vogel, M. M., Zscheischler, J., Wartenburger, R., Dee, D., & Seneviratne, S. I. Concurrent 2018 hot extremes across Northern Hemisphere due to human-induced climate change. Earth's Future.
	36.9% of the world population will experience severe heatwaves every 5 years	Dosio, A., L. Mentaschi, E.M. Fischer, and K. Wyser, 2018: Extreme heat waves under 1.5°C and 2°C global warming. Environmental Research Letters,13(5), 054006, doi: 10.1088/1748-9326/aab827

	5986 million people exposed (1581 vulnerable)	Byers, E., Gidden, M., Leclère, D., Balkovic, J., Burek, P., Ebi, K., ... & Johnson, N. (2018). Global exposure and vulnerability to multi-sector development and climate change hotspots. <i>Environmental Research Letters</i> , 13(5), 055012.
Extreme precipitation	Increase of up to 20% over Central and Northern Europe in winter	Vautard, R., Gobiet, A., Sobolowski, S., Kjellström, E., Stegehuis, A., Watkiss, P., ... & Jacob, D. (2014). The European climate under a 2 C global warming. <i>Environmental Research Letters</i> , 9(3), 034006.
	Robust increase everywhere in Europe and in all seasons, except for Southern Europe in Summer	
Heavy precipitation	Increases in frequency, intensity and positive trends in several regions	O. Hoegh-Guldberg, D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K. Ebi, F. Engelbrecht, J. Guiot, Y. Hijikata, S. Mehrotra, A. Payne, S. I. Seneviratne, A. Thomas, R. Warren, G. Zhou, 2018, Impacts of 1.5°C global warming on natural and human systems. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty[V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla,A. Pirani, W. Moufouma-Okia, C.Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield(eds.)].In Press.
Habitat degradation	680 million people exposed (102 vulnerable)	Byers, E., Gidden, M., Leclère, D., Balkovic, J., Burek, P., Ebi, K., ... & Johnson, N. (2018). Global exposure and vulnerability to multi-sector development and climate change hotspots. <i>Environmental Research Letters</i> , 13(5), 055012.
Drought	410.7 ± 213.5 million, changes in urban population exposure to severe drought at the globe scale. Regions with increased risk: Central Europe, southern Europe, Mediterranean, West Africa, East and West Asia	O. Hoegh-Guldberg, D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K. Ebi, F. Engelbrecht, J. Guiot, Y. Hijikata, S. Mehrotra, A. Payne, S. I. Seneviratne, A. Thomas, R. Warren, G. Zhou, 2018, Impacts of 1.5°C global warming on natural and human systems. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty[V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla,A. Pirani, W. Moufouma-Okia, C.Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield(eds.)].In Press.
Species range loss	18% insects, 8% vertebrates, 16% plants. Specially in Amazon, Europe and Southern Africa	O. Hoegh-Guldberg, D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K. Ebi, F. Engelbrecht, J. Guiot, Y. Hijikata, S. Mehrotra, A. Payne, S. I. Seneviratne, A. Thomas, R. Warren, G. Zhou, 2018, Impacts of 1.5°C global warming on natural and human systems. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty[V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla,A. Pirani, W. Moufouma-Okia, C.Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield(eds.)].In Press.

Sea level rise	Area exposed = 590-613 km ² Population exposed = 141-151 million Population at risk accounting for defences= 15-53 million. Most affected: Asia, small islands and African nations.	O. Hoegh-Guldberg, D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K. Ebi, F. Engelbrecht, J. Guiot, Y. Hijikata, S. Mehrotra, A. Payne, S. I. Seneviratne, A. Thomas, R. Warren, G. Zhou, 2018, Impacts of 1.5°C global warming on natural and human systems. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty[V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield(eds.)].In Press.
Sea level rise	Total : 56cm Antarctic ice sheet :6 cm Greenland ice sheet: 8 cm Thermal expansion: 25 cm Glaciers and ice caps: 11cm Land water storage: 5 cm	Rasmussen, D. J. et al. (2018) Extreme sea level implications of 1.5C, 2.0C, and 2.5C temperature stabilization targets in the 21st and 22nd centuries, Environmental Research Letters
Arctic sea ice	Probability of an ice-free Arctic summer in any one year : 16%	Sigmond, M. et al. (2018) Ice-free Arctic projections under the Paris Agreement, Nature Climate Change
Rainfall extremes over land	Frequency increases by 36%	Betts, R. A. et al. (2018) Changes in climate extremes, fresh water availability and vulnerability to food insecurity projected at 1.5C and 2C global warming with a higher-resolution global climate model, Philosophical Transactions of the Royal Society A
Global population flooded in coastal areas	By 2055: 30millions/year By 2095: 72millions /year	Nicholls, R. J. et al. (2018) Stabilization of global temperature at 1.5C and 2.0C: Implications for coastal areas, Philosophical Transactions of the Royal Society A
Proportion of species losing >50% of their climatic range	Invertebrates: 18% Vertebrates: 8% Plants: 8% Insects: 16% Mammals: 18% Birds: 8% Butterflies and moths: 10% Dragonflies and damselflies: 2 %	Warren, R. et al. (2018) The projected effect on insects, vertebrates, and plants of limiting global warming to 1.5C rather than 2C, Science
Annual flood damage losses from sea level rise	\$11.7tn	Pretis, F. et al. (2018) Uncertain Impacts on Economic Growth When Stabilizing Global Temperatures at 1.5C or 2C Warming, Philosophical Transactions of the Royal Society A
Suitability for malaria transmission	17.5 % increase (averaged between 27% from drylands and 8% from humid lands)	Huang, J. et al. (2017) Drylands face potential threat under 2C global warming target, Nature Climate Change. Data provided by Jianping Huang of Lanzhou University

Annual hot days >30C per year in the British Isles	Increase by 1 day	Teichmann, C, et al. (2018) Avoiding extremes: Benefits of staying below +1.5C compared to +2.0C and +3.0C global warming, Atmosphere
Annual tropical nights (Tmin>20C) in British Isles	Increase by 1	Teichmann, C, et al. (2018) Avoiding extremes: Benefits of staying below +1.5C compared to +2.0C and +3.0C global warming, Atmosphere
Summer maximum daily temperature in B.I	Increase by 1.1C	Dosio, A. & Fischer, E. M. (2017) Will Half a Degree Make a Difference? Robust Projections of Indices of Mean and Extreme Climate in Europe Under 1.5C, 2C, and 3C Global Warming, Geophysical Research Letters
Winter frost days in B.I	Decrease by 9 days	Dosio, A. & Fischer, E. M. (2017) Will Half a Degree Make a Difference? Robust Projections of Indices of Mean and Extreme Climate in Europe Under 1.5C, 2C, and 3C Global Warming, Geophysical Research Letters
Winter minimum temperature in B.I	Increase by 1.9C	Dosio, A. & Fischer, E. M. (2017) Will Half a Degree Make a Difference? Robust Projections of Indices of Mean and Extreme Climate in Europe Under 1.5C, 2C, and 3C Global Warming, Geophysical Research Letters
		King, A. D. et al. (2018) Reduced heat exposure by limiting global warming to 1.5C, Nature Climate Change https://doi.org/10.1038/s41558-018-0191-0
Warm spell duration in Northern Europe	Increase by 24 days	King, A. D. & Karoly, D. J. (2017) Climate extremes in Europe at 1.5 and 2 degrees of global warming, Environmental Research Letters
Winter maximum daily rainfall increase over B.I.	7.00%	Dosio, A. & Fischer, E. M. (2017) Will Half a Degree Make a Difference? Robust Projections of Indices of Mean and Extreme Climate in Europe Under 1.5C, 2C, and 3C Global Warming, Geophysical Research Letters
Frequency of rainfall extremes over land in Northern Europe	Increases by 45%	Aerenson, T. et al. (2018) Changes in a suite of indicators of extreme temperature and precipitation under 1.5 and 2 degrees warming, Environmental Research Letters. Data provided by Claudia Tebaldi of the National Center for Atmospheric Research.
Population exposed to water scarcity in Northern Europe	Increase by 7 million	Naumann, G. et al. (2018) Global Changes in Drought Conditions Under Different Levels of Warming, Geophysical Research Letters
Area burned by wildfires in average Mediterranean summer	increase by 62%	Turco, M. et al. (2018) Exacerbated fires in Mediterranean Europe due to anthropogenic warming projected with nonstationary climate-fire models, Nature Communications. Data provided by Marco Turco of the University of Barcelona
Annual average number of excess summer heatwave deaths in London	Increase by 140	Mitchell, D. et al. (2018) Extreme heat-related mortality avoided under Paris Agreement goals, Nature Climate Change
Excess deaths due to heat in the UK	Increase BY 0.6%	Vicedo-Cabrera, A. M. et al. (2018) Temperature-related mortality impacts under and beyond Paris Agreement climate change scenarios, Climatic Change Letters. Data provided by Ana Maria Vicedo-Cabrera of the London School of Hygiene & Tropical Medicine

Population exposed to water scarcity in Central North America	Increase by 18 million	Liu, W. et al. (2018) Global Freshwater availability below normal conditions and population impact under 1.5C and 2C stabilization scenarios, Geophysical Research Letters
Annual cases of dengue fever in Latin America in year 2050	Increases by 6.7 million	Colón-González, F. J. et al. (2018) Limiting global-mean temperature increase to 1.5–2C could reduce the incidence and spatial spread of dengue fever in Latin America, PNAS
Population exposed to water scarcity (East +Southern Africa)	Increases by 32 million	Naumann, G. et al. (2018) Global Changes in Drought Conditions Under Different Levels of Warming, Geophysical Research Letters Liu, W. et al. (2018) Global Freshwater availability below normal conditions and population impact under 1.5C and 2C stabilization scenarios, Geophysical Research Letters
Glacier mass loss in the high mountains of Asia	36.00%	Kraaijenbrink, P. D. A. et al. (2018) Impact of a global temperature rise of 1.5 degrees Celsius on Asia's glaciers, Nature
Maximum population exposed to heatwaves in India	2050: x15, 2100:x93	Mishra, V. et al. (2017) Heat wave exposure in India in current, 1.5C, and 2.0C worlds, Environmental Research Letters
Population exposed to water scarcity (North Asia, West, Central, Tibetan Plateau, Eastern, Southern and South-eastern)	Increase by 210 million people	Liu, W. et al. (2018) Global Freshwater availability below normal conditions and population impact under 1.5C and 2C stabilization scenarios, Geophysical Research Letters
Population affected by river flooding in Bangladesh	Increase by 546%	Alfieri, L. et al. (2016) Global projections of river flood risk in a warmer world, Earth's Future