



MetLink
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Climate Zones

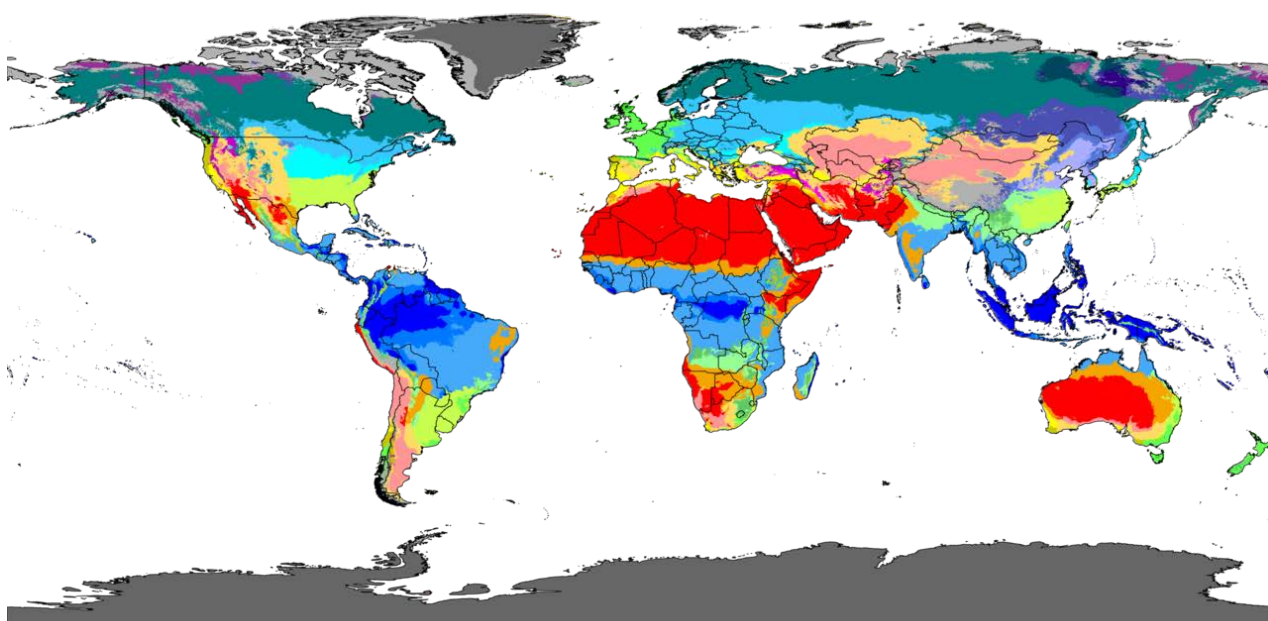


Background Information for Teachers

Classifying Climate

The Köppen-Geiger classification system is the most commonly used system for categorizing climates. It divides the world into five main climate groups depending on the seasonal temperature and precipitation patterns: A (tropical), B (dry), C (temperate), D (continental) and E (polar). Because it takes into account not only annual temperature and precipitation patterns but also the annual cycles of both, it is usefully linked to biome distribution.

Köppen-Geiger climate classification map (1980-2016)

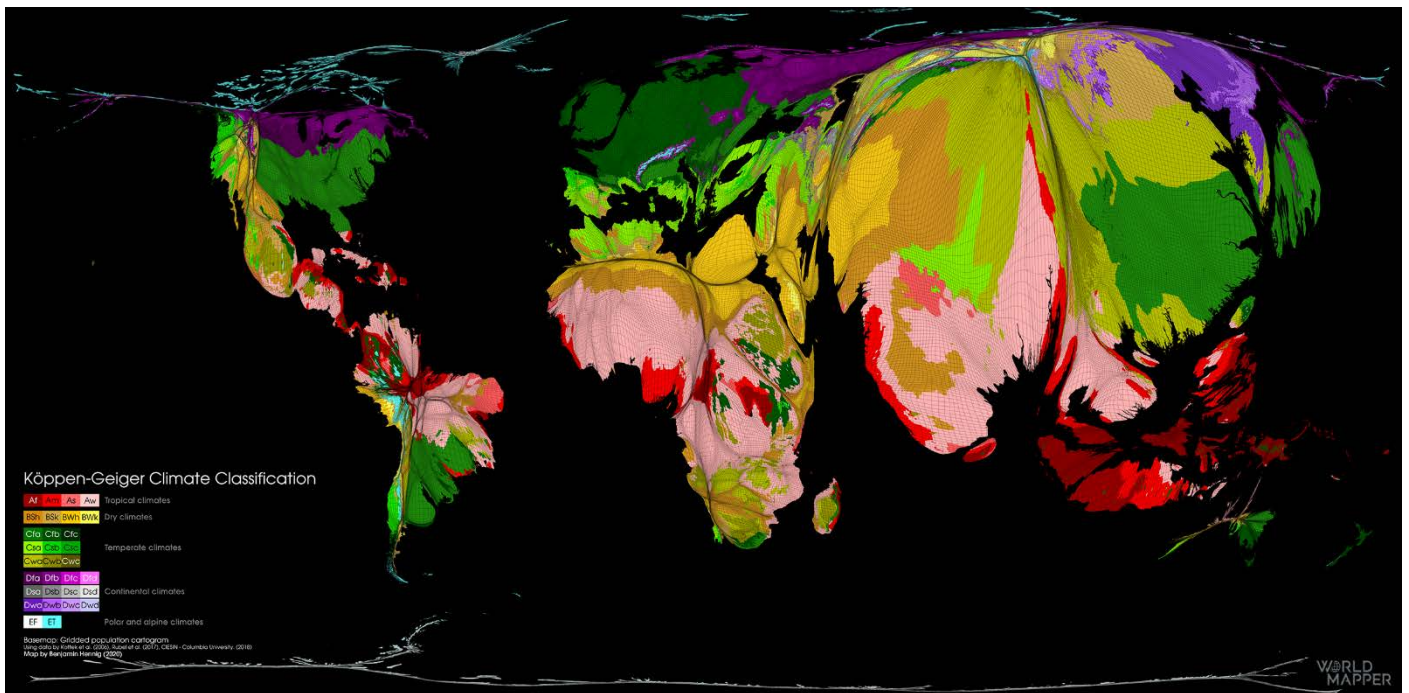


Source: Beck et al.: Present and future Köppen-Geiger climate classification maps at 1-km resolution, *Scientific Data* 5:180214, doi:10.1038/sdata.2018.214 (2018)

An updated Köppen-Geiger climate map^[1]

Af	Am	Aw/As	BWh	BWk	BSh	BSk	Csa	Csb	Csc						
Cwa	Cwb	Cwc	Cfa	Cfb	Cfc	Dsa	Dsb	Dsc	Dsd	Dwa	Dwb	Dwc	Dwd	Dfa	Dfb
Dfc	Dfd	ET	EF												

Beck, H.E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. - "Present and future Köppen-Geiger climate classification maps at 1-km resolution". *Nature Scientific Data*. DOI:10.1038/sdata.2018.214. CC BY 4.0

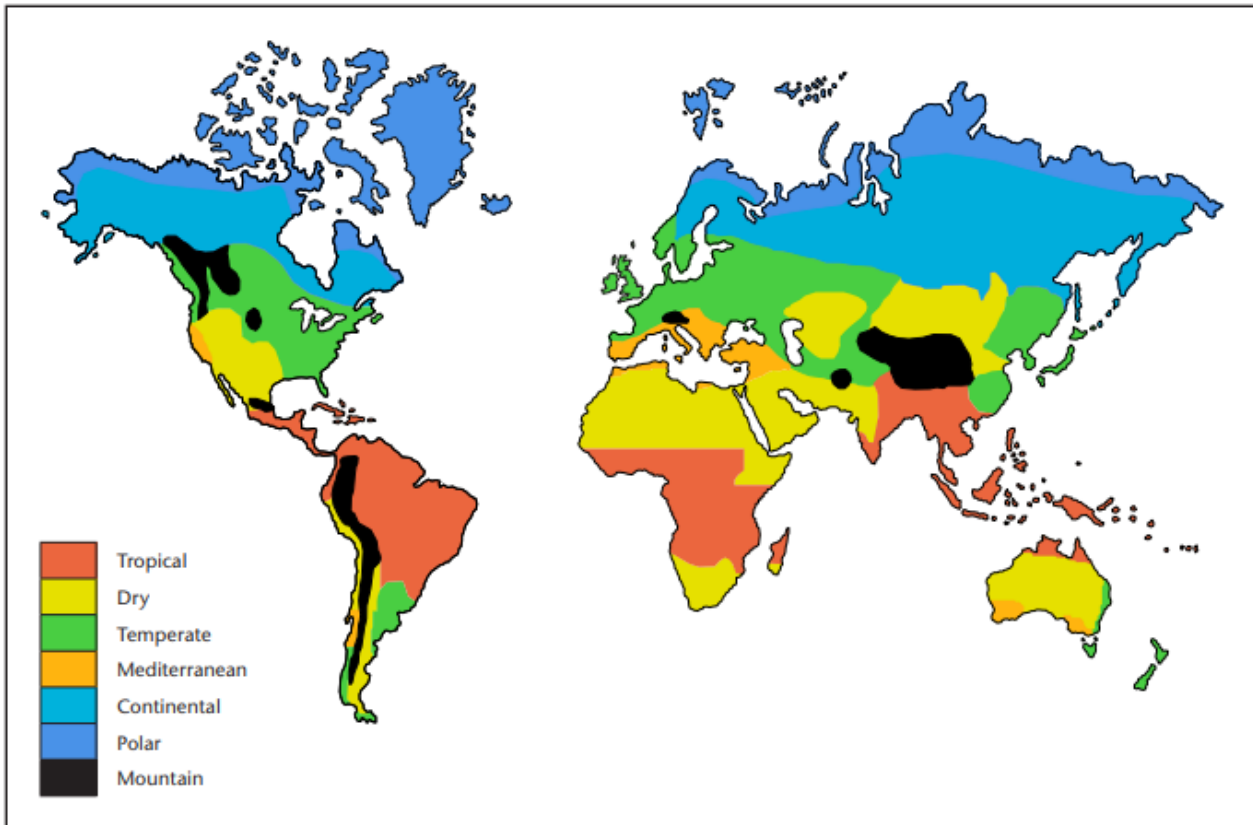


A world map showing the countries classified according to Köppen-Geiger classification but resized according to the population size of the country. This clearly shows which climate types support the greatest populations.

The climate zones themselves are closely linked to the Global Atmospheric Circulation (see chapter 4).

For a full definition of the classification system see, for example, https://en.wikipedia.org/wiki/Köppen_climate_classification

Focussing on the 5 main groups with the addition of a Mountain category, the diagram can be simplified into:



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Tropical

Tropical or Equatorial climates are home to the world's rainforests, where rainfall and humidity are high. Temperatures are generally 25-35 °C and vary little through the year.

Dry

The dry or arid regions are linked to the High pressure, cloud free belts at the edges of the Hadley cells. Cold ocean currents can contribute to reduced availability of rainfall. The temperature range in sub-tropical deserts can be large, regularly exceeding 45 °C by day in summer and often falling to below freezing overnight in winter.

Mediterranean

Mediterranean climates vary seasonally and are linked to the descending air at the edges of the Hadley cells in summer and to the westerlies of the Ferrel cells in winter. This gives hot dry summers and cooler, wetter winters.

Continental

Far from the ameliorating effect of the oceans, continental climates are characteristic of the interior of large land masses of mid latitudes; the main distinguishing features are large annual and diurnal ranges of air temperature and low rainfall.

Polar

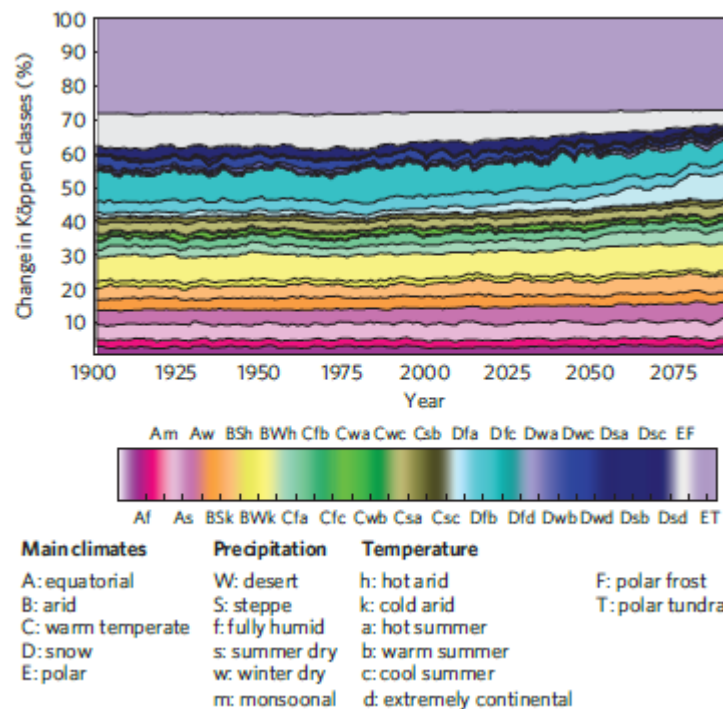
Linked to the Polar Cell, polar climates can be subdivided into Tundra and ice cap/ frost depending on whether the mean temperature of the warmest month is above or below 0°C. The Arctic climate is moderated by the relatively warm Atlantic Ocean. In the Antarctic, the distance from the ocean and a source of water vapour can mean that it is truly too cold to snow.

Temperate

Temperate climate zones lie between the tropics and the polar circles in the westerlies of the Ferrel cell. The changes in these regions between summer and winter are generally subtle, warm or cool, rather than extreme, burning hot or freezing cold, but all temperate regions have four distinct seasons. However, a temperate climate can have very highly variable weather. One day it may be sunny, the next it may be raining. Temperate climate can have a maritime influence.

Climate Zones and Climate Change

Whereas climate change will not mean that that all the climate zones will simply shift polewards, they will of course change with a changing climate. Large shifts in the global distribution of Köppen-Geiger climate zones have been projected by the end of the century.



Pace of Shifts in Climate Regions Increases with Global Temperature Figure 2, 2013, Mahlstein et al. DOI: 10.1038/NCLIMATE1876. This graph does not show whether the location of these climates has shifted over the globe.

A 2013 paper in Nature Climate Change suggested that for the initial 2°C of warming, about 5% of Earth's land area shifts to a new climate zone. The rate at which climate zones shift is about the same as the rate at which global temperatures increase – both of which are projected to become more rapid.

The paper predicted that over the 21st Century

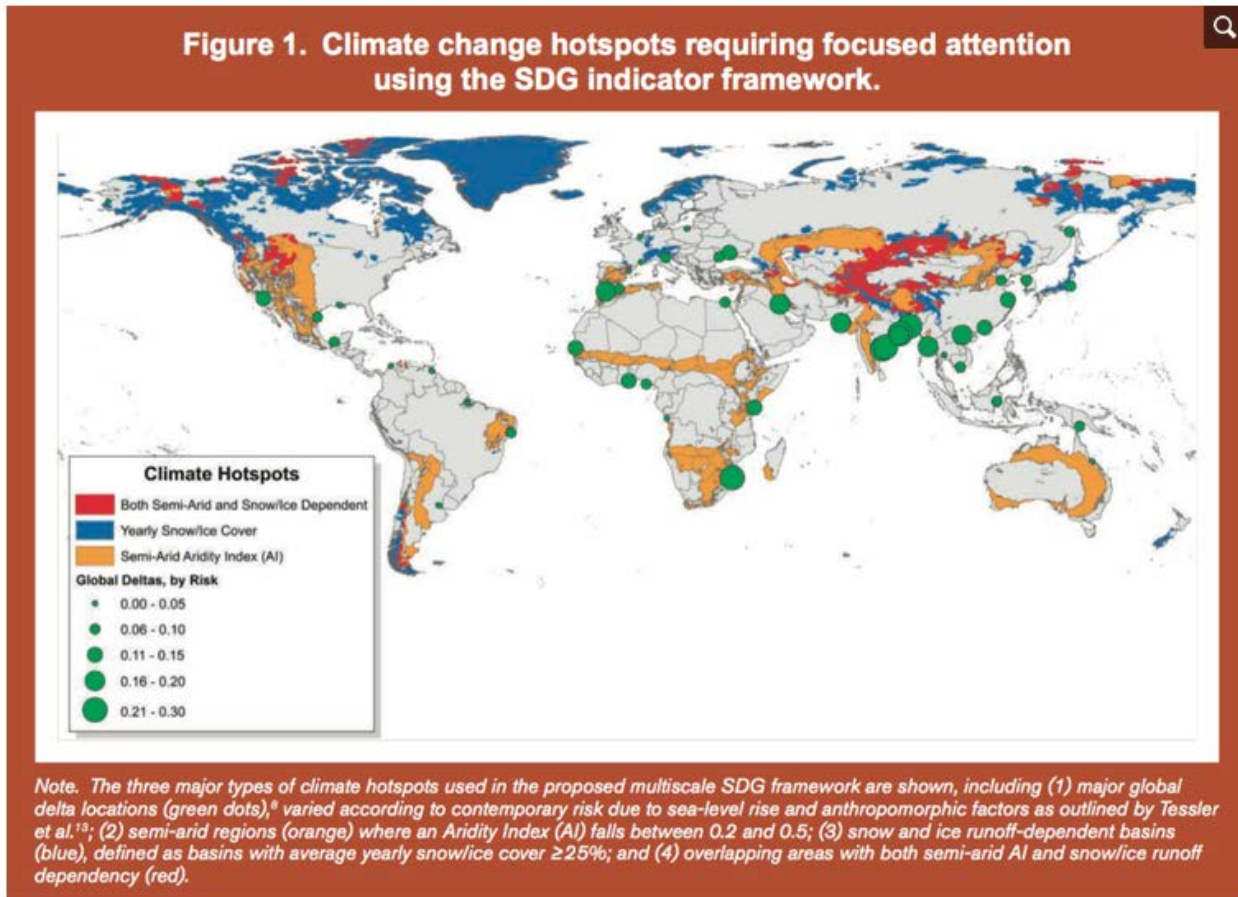
- Frost climates largely decrease
- Some arid regions increase
- A large fraction of land area changes from cool summers to hot summers
- Most northern mid-latitudes and polar latitudes undergo climate zone shifts
- There is less change in tropical regions, except in mountain regions where there are projected changes in precipitation.

The scientists also suggested that temperature changes have a greater impact on climate zone changes than precipitation changes.

The lead author, Mahlstein, said "A shift in the climate zone is probably a better measure of 'reality' for living systems, more so than changing temperature by a degree or precipitation by a centimetre". As the speed of climate zone shift increases, the ability of species to adapt reduces and more extinctions can be expected.

Further reading: <https://e360.yale.edu/features/redrawing-the-map-how-the-worlds-climate-zones-are-shifting>

Some climate zones – particularly semi-arid ones, have been designated climate change hot spots. These so-called “hotspots” are areas where strong physical and ecological effects of climate change come together with large numbers of vulnerable and poor people and communities.



Making SDGs work for climate change hot spots, Szabo et al, 2016, Sourced from <https://www.tandfonline.com/doi/full/10.1080/00139157.2016.1209016?journalCode=venv20&scroll=top&nedAccess=true>

Sources of Information

Climate data <https://en.climate-data.org>

Global maps of vegetation and climate <https://earthobservatory.nasa.gov/global-maps>

Full climate graphs and other information for the climate zones may be found at https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/library-and-archive/library/publications/factsheets/factsheet_16-world-climates.pdf