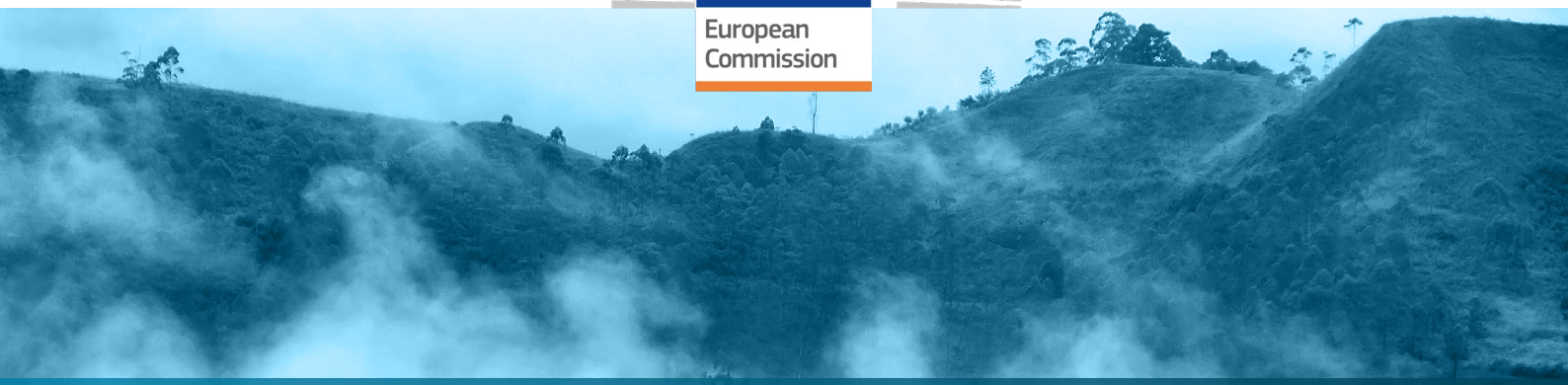

SCIENCE FOR ENVIRONMENT POLICY

A 'life zone' model of climate change predicts widespread ecosystem change

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Contact:
pelsen@wcs.org

Climate models are crucial to understanding likely future conditions under climate change, however, their implications for individual ecosystems are often unclear. This study uses high-resolution data to model areas with similar plant and animal communities – or 'life zones' – under historic, current and future scenarios, and to analyse change across these periods. The researchers report that with 'business as usual' carbon emissions, over 40% of the earth's land area could experience a change in life zone by 2080.

Climate change will significantly alter atmospheric conditions around the planet, with implications for biodiversity, food production and many other aspects of life. Detailed understanding of where and how conditions are likely to change is crucial for developing policies and effective and functional plans for the future and for anticipating adaptation requirements. Most climate models to date have focused on single climate variables such as temperature or rainfall, which provide limited insight into changes in ecosystems, vegetation structure, agricultural suitability and other practical issues.

This study presents a climate change model based on 'life zones', a classification scheme that describes areas with similar climate conditions – based on temperature and rainfall interactions – that could support certain types of natural environment, such as desert scrub, moist forest or wet tundra. The presence of these specific ecosystems is not guaranteed because natural features such as soil and slope, as well as human land use, can affect actual vegetation coverage. Nonetheless, life zones have been shown to produce accurate classifications of bio-geographic areas which align well with other systems such as the IUCN Global Ecosystem Typology and the ecoregion approach, which is commonly used for evaluating progress against Sustainable Development Goals.

European Commission

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A 'life zone' model of climate change predicts widespread ecosystem change (continued)

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The researchers used high resolution (1 square kilometre (km)) historical, current and projected climate data to map global terrestrial life zones in 1901–1920, 1979–2013 and 2061–2080. Future climate scenarios were based on averages from five different climate models, and were calculated for two emissions scenarios (representative concentration pathways – RCPs): RCP8.5, described as 'business as usual', and RCP4.5, considered an intermediate scenario. They then overlaid the historical and contemporary maps and the contemporary and future maps (for both RCP8.5 and RCP4.5) to produce a map of changes in life zone for transitions between the three time periods. These were evaluated with reference to the world's 847 ecoregions, based on the RESOLVE Ecosystems 2017 dataset, and 14 biomes (broad ecosystem types).

The researchers report that between the historical (1901–20) and current (1979–2013) periods, 18.3% of global land area changed from one life zone to another, whereas between the current and future (2061–80) periods, 28.4% of land changed under RCP4.5 and 42.6% changed under RCP8.5. The extent of life zone changes varied by biome, they say, with boreal forests particularly affected, experiencing life-zone change over 36.8% of their area between historical and contemporary conditions and 73.6% between current and projected RCP8.5 conditions. Under RCP4.5, they report, 13.5% of global ecoregions would experience life-zone change over more than half their land area compared with 3.5% from historical to current times; while under RCP8.5 nearly a third (33.2%) would be affected to this degree and seven ecoregions would see 100% of their area change life zone.

The results suggest that future changes will see life zones moving towards the poles and higher elevations, according to the researchers, predominantly driven by warmer conditions but also by wetter and warmer-and-wetter conditions in many cases. They suggest that changes are likely to be more pronounced in boreal and sub-tropical zones, with some extensive landscapes, such as the Sahara Desert and Amazon basin, expected to remain largely stable, in terms of their life zone, in the future, as they have in the past.

The researchers note that this life-zone analysis is likely to underestimate the scale of actual ecosystem change, which can also be driven by factors not included in the model, such as wildfire dynamics, soil conditions and human activities. They highlight the challenges that widespread life-zone changes will present for ecosystems, biodiversity conservation, agriculture and livelihoods, and the need to align policies and practices with anticipated changes in order to avoid poor outcomes and wasted resources.