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Source: Carrão, H., Naumann, G. & Barbosa, P. (2016). Mapping global patterns of drought risk: An empirical framework based on sub-national estimates of hazard, exposure and vulnerability. *Global Environmental Change*, 39: 108–124. DOI:10.1016/j.gloenvcha.2016.04.012.

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1. High-End cLimate Impacts and eXtremes (HELIX) was supported by the European Commission under the Seventh Framework Programme: www.helixclimate.eu/home

2. EUROCLIMA is a regional cooperation programme between the European Union and Latin America: www.euroclima.org/en

European Commission

Science for Environment Policy

A global map of drought risk aids future local assessments

A new methodology for mapping the global distribution of drought risk has been proposed, which should provide guidance on which locations should be further assessed to improve drought preparedness and management policies.

The European Commission estimates that the damage caused by drought in Europe over the past 30 years has cost at least €100 billion. Moreover, the European Environmental Agency has recorded a doubling of the annual average economic impact of droughts across the continent between 1976 and 1990 and between 1991 and 2006. Similar trends can be found around the world.

There is a developing movement to reduce this global threat by moving away from a reactive, crisis-management approach to drought and towards improved drought resilience. This has been supported by the United Nations (UN) and the World Meteorological Organization. In order to promote such resilience, it is necessary to identify the areas that are most at risk, so that resources can be targeted at improving infrastructure and general preparedness where it is most needed. A recent study presents a data-driven approach to mapping the global patterns of drought risk, with the intention of identifying regions that would benefit from more detailed local assessments. This endeavour was carried out under the EU-funded HELIX[1] project, as well as the EUROCLIMA[2] regional cooperation programme between the EU and Latin America.

The researchers characterise drought risk as the probability of negative outcomes arising from interactions between drought hazard (potential for occurrence of future drought events), exposure (the scale of the total populations and associated assets in areas prone to drought) and vulnerability (propensity for assets, etc. to be damaged by drought), and use the equation: **Risk = Hazard** × **Exposure** × **Vulnerability**.

Based on these three independent determinants, they produce a value of drought risk, which is then used to determine a risk ranking of the areas being assessed. First, in order to validate the outcomes of their approach, the team evaluated the performance of exposure and vulnerability models and assessed the spatial distribution of drought hazard and risk at a range of scales. They used numerous pre-processed data sets at different spatial resolutions, in total covering approximately 67% of the earth's total landmass and excluding particularly cold or arid areas, for which measures of drought are not useful.

The outcome is a global map of drought risk, calculated at a sub-national administrative level that allows for better coordination within and between different levels of government — from local to regional scales. The team then statistically evaluated the validity of their results by comparing their empirical performance with the outputs of alternative models, similar to the UN's Human Development Index. The results of the team's validation suggest that their proposed models of exposure and vulnerability are more robust, consistent, and stable than alternative composite measures. They, therefore, suggest that their map could represent an important tool for policymakers in implementing drought policy. Specifically, their findings indicate that the growth of regional exposure in recent years is the key driver of drought risk, with less significant roles being played by hazard and vulnerability. Climate change projections look set to intensify this problem.

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Drought risk appears to be higher for areas that are densely populated and exploited for crop production and livestock farming, such as Central Europe. The researchers suggest that regional drought-risk management in such areas would benefit from improvement of irrigation and water-harvesting systems, as well as from the diversification of regional economies, which would reduce their dependence on agriculture.

The researchers make it clear that their approach is top-down and data-driven, meaning it can be biased by uncertainties and errors in the global input values. They, therefore, emphasise that bottom-up risk studies in potentially drought-prone regions should be used to complement their top-down approach.