Chinese Materia Medica and Other Herbal Medicines – the Impact of Climate Change and Rising Global Demands on Sustainability Sourcing

Michael Heinrich,*[,1,2] Banaz Jalil,[1] Inggritha Takubessi,[1] Olha Mykhailenko[1,3,4]

[1] Pharmacognosy and Phytotherapy Group, UCL School of Pharmacy WC 1N 1AX, United Kingdom
[2] Chinese Medicine Research Centre, College of Chinese Medicine, China Medical University, Taichung, Taiwan
[3] National University of Pharmacy, Kharkiv, Ukraine;
[4] Department of Pharmaceutical Biology, Kiel University, Kiel, Germany
* E-mail: m.heinrich@ucl.ac.uk

Abstract

Climate change and human activities severely impact plants and ecosystems, threatening biodiversity, healthcare resources, and sustainable development of plant-based products. Medicinal plants, including Chinese materia medica, are widely traded and provide key ecosystem services, but face increasing risks to their long-term viability. However, these species are also relevant for ecosystem services including climate mitigation, and for their socio-economic role.

Recently, we proposed a new framework for assessing the impact of climate change and more generally the sustainable sourcing of natural products and herbal medicines (Mykhailenko et al 2025), including the main factors to better understand and address the vulnerability of a species, hence mitigate the impact of climate change. Biotic and abiotic (ecosystem) determinants affect species distribution and long-term survival, which in turn influence the quality of plants used as herbal medicines and other high-value products. Four research priorities emerge: climate effects, bioeconomic drivers, habitat conditions (incl. human pressure), and reproductive success.

In a scoping review we are currently assessing the state of research on how climate change affects medicinal plants, focusing on ecological shifts, traditional uses, changes in secondary metabolites, and adaptation strategies (Takubessi et al., n.d.). Research output has rapidly expanded, dominated by studies on Asian resources, especially China, with limited coverage of Africa, Europe, and South America. So far, 357 species have been assessed, including climate-sensitive high-altitude taxa. Shifts in secondary metabolite production, linked to stress factors such as drought, indicate a need for new analytical methods.

Conservation gaps remain severe: 40.6% of species are classified as threatened by IUCN, while 59.4% remain unevaluated. Species Distribution Modeling (SDM), especially MaxEnt, is the main tool for vulnerability assessment.

Climate change is reshaping both ecology and pharmacological value of medicinal plants. This requires refocused research, sustainable sourcing, and better regulation of which products—such as supplements or cosmetics—can be safely commercialised.

Keywords: TCM; Endangered medicinal plants; Ecosystem factors; Climate change; Natural compounds