

SPECTRA: Soil Processes and Ecological Services in the Karst Critical Zone of Southwest China



Brief Profile

Covering extensive parts of Southwest China, Karst is a key landscape that is exceptional because rapid and intensive land use change has caused severe ecosystem degradation within only the last 50 years. The rapid increase in environmental degradation due to rocky desertification in the Karst is comparable to that caused by the better known extreme rates of erosion of the sandy loess soils in North China. Therefore, establishment of a critical zone observatory (CZO) in the karst landscape of SW China along a dynamic perturbation gradient in varying states of transition between states of rocky desertification to natural forest would fill a significant gap in the current database and research effort. Furthermore, there is a socioeconomic imperative to establish a CZO in the karst landscapes of SW China. The population of 36 million are amongst the poorest in China, with regional GDP less than 50% of the national average, and sustainable solutions to land management, potentially including abandonment and economic compensation, will be integral to lifting the population out of poverty.

The SPECTRA programme seeks to enhance the sustainable development of one of the poorest regions of China, Guizhou, through cutting edge critical zone science undertaken by integrated, complementary and multidisciplinary teams of Chinese and UK scientists. The key question for management of the karst landscapes of SW China is "how can the highly heterogeneous critical zone resources be restored, to enable sustainable delivery of ecosystem services?"

The CZO was established in June 2016. We investigate the integrated geophysical-geochemical-ecological and social responses of the CZO to past perturbations, along a gradient from undisturbed natural vegetation through human perturbed landscapes at 4 levels of use – sloping farmland, recovery phase 1 (recently abandoned, within 5 years), recovery phase 2 (secondary forest, abandoned > 5 years) and primary forest. Using cutting-edge approaches the project team will integrate measurements of:

- the three-dimensional distribution of plants (including roots), soil, fungi, and microbes;
- rates of rock weathering, elemental release and soil formation processes;
- rates of erosion and soil redistribution; and,
- pools and fluxes of soil organic C (SOC), nitrogen (N) and phosphorus (P).

Knowledge Sharing and Mutual Learning 知识共享 互学互鉴

Partners

University of Exeter (UK, Lead Research Organisation); Peking University (China), Chinese Academy of Sciences, Tianjin University (China); Institute of Earth Physics IGP (France); Pennsylvania State University (US); University of California (US); University of Colorado at Boulder (US); Critical Zone Observatories (CZO); University of Arizona (US); Technical University of Crete.

Project web-link

<http://geography.exeter.ac.uk/spectra/partnership/>

Project status

On-going (2016-2018)

Outputs:

Song X, Gao Y, Green S.M., Dungait, J.A.J, Peng, T., Quine, T.A., Xiong, B., Wen, X. He, N. 2017. Nitrogen loss from karst area in China in recent 50 years: An in-situ simulated rainfall experiment's assessment. *Ecology and Evolution*, doi:10.1002/ece3.3502.

Moore, O.W, Buss, H., Green, S.M., Man, L., Song, Z. 2017. The importance of non-carbonate mineral weathering as a soil formation mechanism within a karst weathering profile in SPECTRA Critical Zone Observatory, Guizhou Province, China. *Acta Geochimica* DOI 10.1007/s11631-017-0237-4.

Quine, T., Guo, D., Green, S.M. et al. 2017. Ecosystem service delivery in Karst landscapes: anthropogenic perturbation and recovery. *Acta Geochimica* DOI: 10.1007/s11631-017-0180-4.

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Funder:

NERC/NNSF

