CASE STUDY: Transforming climate resilience in tea production in China and the UK

Executive Summary: The Tea-CUP (Co-developing Useful Predictions) project under the Climate Science for Service Partnership (CSSP) China, is helping tea producers in China and the UK become more resilient to climate change by co-developing climate services that provide tailored information on weather, climate risks, crop suitability, and adaptation options. By combining scientific research with local expertise and stakeholder engagement, the project is improving decision-making, supporting sustainable tea production and food security, and creating a model for climate-resilient agricultural services that can be applied to other crops and regions.

The Challenge: Tea is one of the world's most widely consumed beverages, second only to water. It is also a major global commodity cultivated across many regions worldwide. Tea isn't just a drink and very much considered a way of life in many cultures across the world, bringing relaxation, spirituality, tradition and pleasure, and is particularly synonymous with Chinese and British culture, with over 160 million cups being drunk in the UK every day. China is the world's largest tea-producing country, with 2.8 million tons annually, accounting for more than 43% of total global tea production. This crop is now also expanding in the UK, with several sites successfully cultivating and manufacturing tea. Both the quality and quantity of tea production are highly sensitive to variations in climatic conditions, including the effects of changing temperature and rainfall patterns and extreme weather. Climate change therefore poses significant challenges to the tea industry and tailored sectoral climate information is vital for informing effective adaptation decision-making.



Green tea plantation in the mountains at sunrise in Hangzhou, China

The Approach: Under the Climate Science for Service Partnership (CSSP) China, the Tea-CUP project is building on long-standing CSSP China relationships and close engagement with Chinese institutions and sectoral stakeholders in the UK and China to make significant progress in advancing climate services for the tea industry. It is co-developing new services with users, including tea growers, businesses and tea experts, with the aim of delivering timely and relevant climate information for the tea growing community in China and the UK. Scientists from the Met Office, University of Exeter and China

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(Yunnan University of Finance and Economics, Beijing Normal University, and the Institute of Atmospheric Physics, Chinese Academy of Sciences) have been working with tea experts and local farmers in Yunnan Province and across the UK to understand what seasonal and climate information they need to better inform adaptation measures.

Pathway to Impact: The project team has used this local information to help establish climatic suitability for tea cultivation and improve understanding of how climate variability influences plant health, growth and tea flavour profiles, quality and price. The findings are also being used to investigate whether there is seasonal forecast skill in predicting climate metrics in tea-growing areas which could enable tea growers to plan for the coming months as well as adapt to future climate scenarios. Agricultural decision-making calendars have also been co-developed with tea growers to act as structured engagement tools that capture growers' decision-making processes across monthly to seasonal timescales, explicitly linking routine operations with key climate hazards, associated risks, and the adaptation measures that are either already in place or under consideration. Exploratory work has examined the role of pests and diseases, recognising these as critical factors in climate risk and adaptation discussions for tea production. The project featured as part of a documentary created and produced by Advances in Atmospheric Science and the Chinese Academy of Sciences. The documentary "A Cup Full of Hope" celebrates the incredible collaboration between UK and China-based scientists and highlights our joint efforts to research the impact of climate change on tea growing and support farmers in making climate-informed decisions.

The project's inclusive approach ensures that services are tailored to the specific needs of users, considering factors beyond scientific evidence, such as cultural values and social norms. The stakeholder analysis framework developed under the project can be used as a template for user engagement more broadly across sectors and countries internationally, including different crops. Scoping work is underway to apply to the coffee and sugarcane growing sectors in China and exploring potential applications to further crops to support decision-making. This work is linked to food security which is an essential contributor towards the foundations of a stable economy, a key milestone in the UK Government's Plan for Change. This will contribute towards ensuring the United Kingdom remains resilient and responsive in the face of potential future shocks.



Examples of the engagement products developed under the Tea-CUP project

The exchange of knowledge and experiences between the UK and China has enriched our scientific understanding and highlighted the benefits of a multidisciplinary approach to climate services development

and also contributed towards strengthening collaborations between research institutions and Government agencies in the UK and China.



Met Office researchers involved in the Tea-CUP project (from left: Amy Waterson, Stacey New and Nicola Golding) during an engagement activity with Dartmoor Estate Tea, UK

Dr Stacey New, an applied climate scientist at the Met Office, said: *"The collaborative approach between the UK and China has demonstrated that integrating scientific knowledge with local expertise has the potential to enhance the resilience of the tea sector to climate variability and change, and develop more effective climate adaptation strategies for the tea industry."*

Professor Shaojuan Li, another member of the research team, from Yunnan University of Finance and Economics said: *"In Yunnan, we have gathered multiple types of data on various timescales, such as tea yield, plantation area, tea price, temperature and precipitation, and used them to construct models that reveal the interactive effects of climate variation on tea production*."

The project has recently published a paper in the scientific journal Advances in Atmospheric Sciences: New et al. (2024), Towards a Climate Service for the Tea Industry: A Collaborative Approach between the UK and China (https://lnkd.in/e9Yzb6SC).