

Monitoring Global Coffee Drought Risk in Near-Real Time with SPEI

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Introduction

- Climate change is intensifying drought risk for global coffee production, threatening yield stability and supply reliability.
- Drought impacts are telecoupled: climate anomalies in key producing regions affect prices and thereby distant livelihoods and food security.
- Improved insight into the spatial and temporal prevalence of drought is essential for agronomic management and financial risk mitigation.

Objective

- Build a globally consistent, near-real-time monitoring framework that quantifies drought characteristics across major coffee-producing regions using the Standardized Precipitation-Evapotranspiration Index (SPEI).

Methods

- Map coffee-growing areas**
Spatially disaggregate FAOSTAT national production statistics using subnational harvested-area data, probabilistic agroecological suitability masks and land-cover constraints.
- Compute the drought index**
Calculate SPEI at 3-, 6- and 12-month timescales for the 2001 - 2025 baseline, aligned with region-specific rainy-season calendars. Climate inputs come from Copernicus' AgERA5 reanalysis (near-real-time updates).
- Build the drought index (GCDI)**
Global Coffee Drought Index = area-weighted sum of drought intensity (SPEI < -1) across all coffee-growing regions — updated monthly.

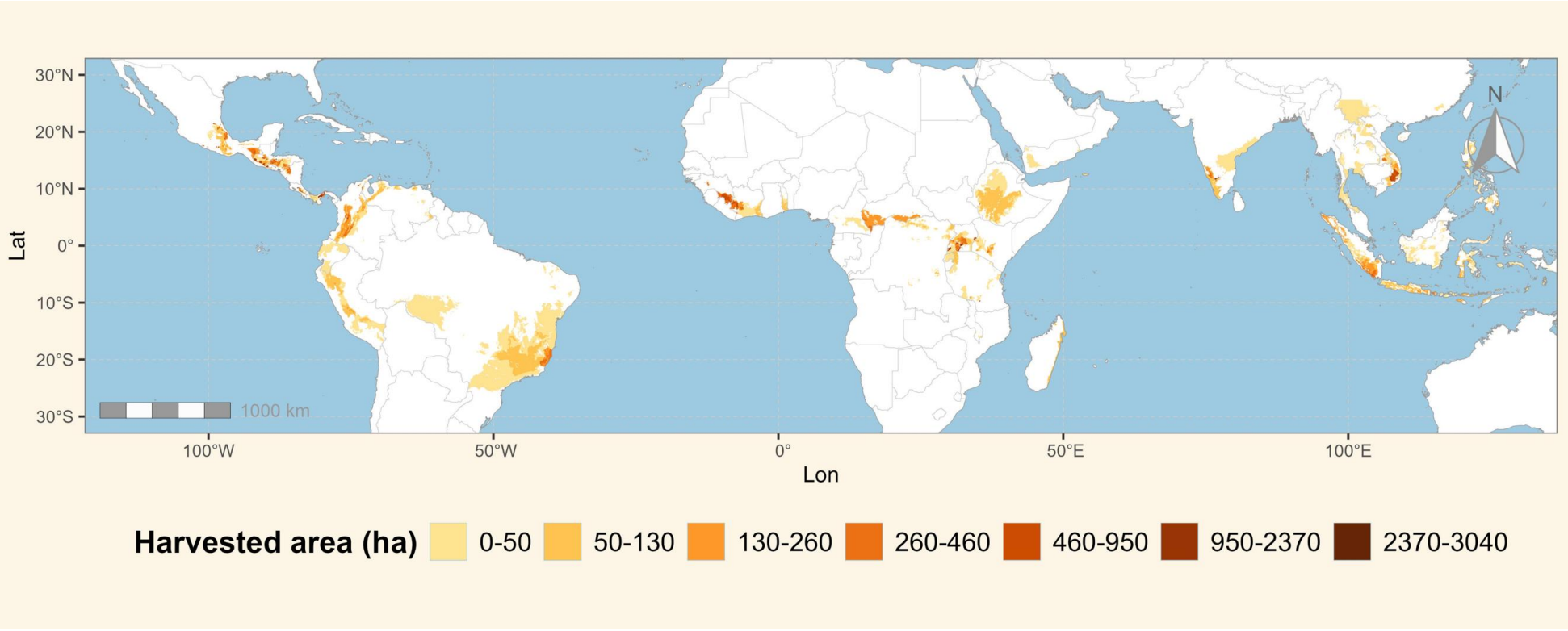


Fig. 1 Estimated global coffee harvested area (ha) used to spatially disaggregate national statistics. Source: own calculation based on FAOSTAT and subnational harvested-area data.

Key data inputs

- FAOSTAT national coffee production & harvested area
- Copernicus AgERA5 near-real-time climate reanalysis
- SPEI baseline period: 2001 - 2025
- Precipitation climatologies to estimate on-/off-season

Results

The Global Coffee Drought Index (GCDI) provides a monthly-updated, globally consistent indicator of the share of coffee-growing area affected by water deficits (SPEI < -1).

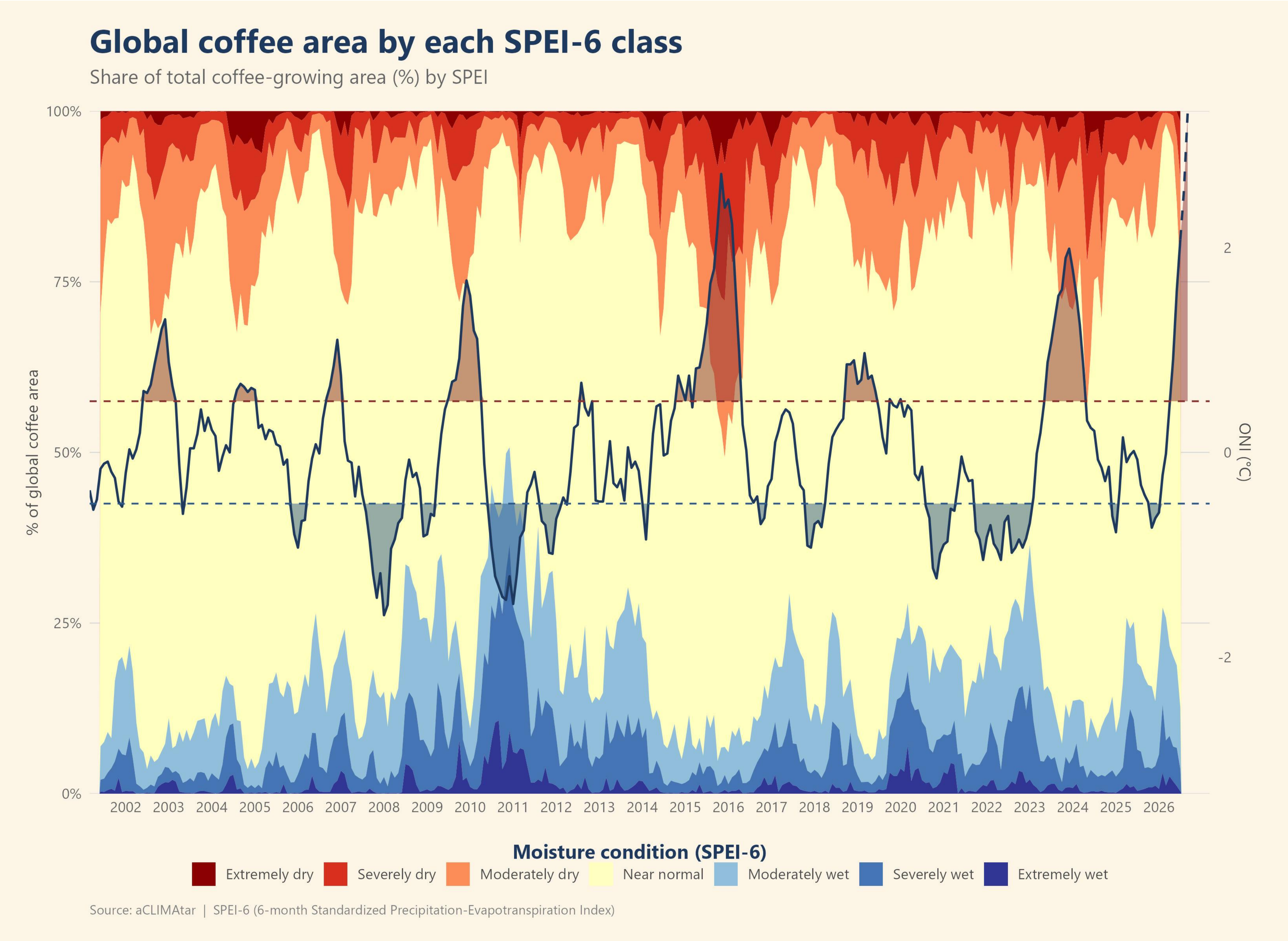


Fig. 2 Share of global coffee-growing area by SPEI-6 moisture class, 2001-2026, with the Oceanic Niño Index (ONI). Recurrent extreme-to-severe drought episodes (dark red / orange) coincide with strong El Niño events - most recently in 2023/24 and again into 2026 (Recent projection as dashed line. Source: aCLIMAtar, TheClimateBrink).

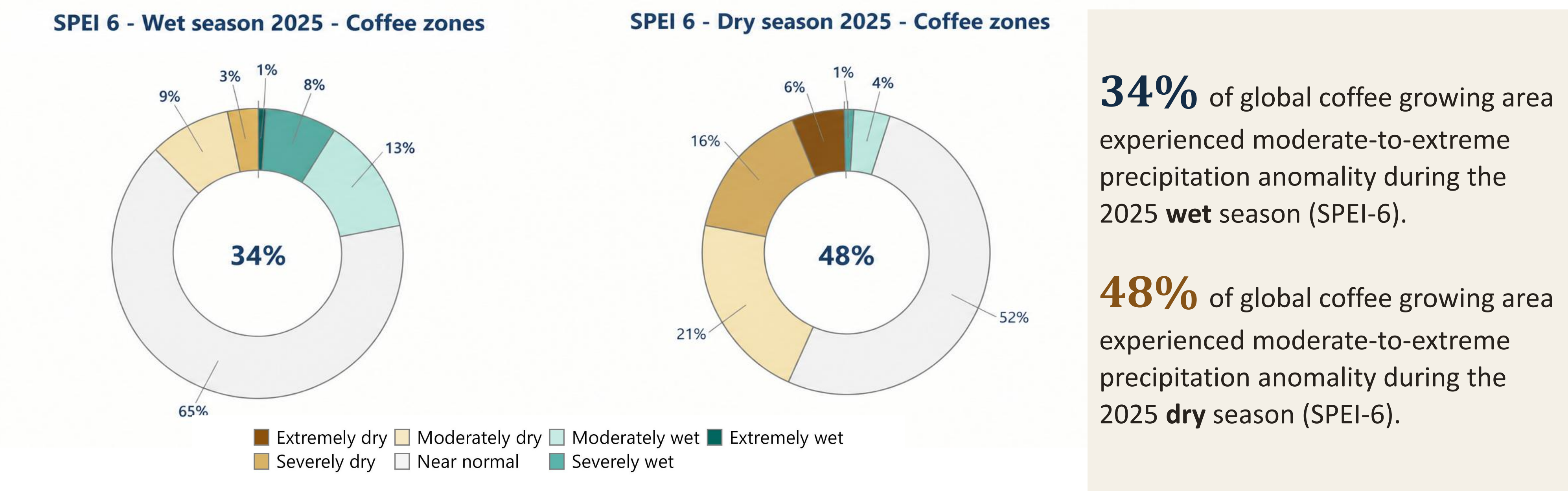


Fig. 3 SPEI-6 classification of global coffee growing area during the 2025 dry and wet season; center values show the share in any SPEI class (extremely wet to extremely dry).

Conclusions & Outlook

- Near-real-time, globally consistent monitoring of coffee drought risk is now possible by combining spatial disaggregation of production statistics with multi-timescale SPEI.
- The GCDI condenses complex climate data into a single, monthly-updated indicator of the coffee area currently affected by water deficits.
- Actionable for producers, traders and policymakers - supporting adaptive management, financial planning and targeted interventions.
- Recurrent, intense droughts - amplified by El Niño - are increasingly affecting major producing regions such as Brazil, with direct consequences for global supply and prices.
- Outlook: integrate the GCDI into early-warning platforms for producers, traders and policymakers.
- Outlook: extend the framework to sub-seasonal forecasts to further increase lead time for interventions.

Acknowledgements

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Literature

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