PLANAPP Centro de Planeamento e de Avaliação de Políticas Públicas
Em parceria com: fct Fundação para a Ciência e a Tecnologia
PRR Plano de Recuperação e Resiliência | REPÚBLICA PORTUGUESA | Financiado pela União Europeia NextGenerationEU

POLICY BRIEF 2026

SCIENCE4POLICY
CONCURSO DE ESTUDOS DE CIÊNCIA PARA AS POLÍTICAS PÚBLICAS

Xévora: Drought resilience and desertification

Emanuel Dutra, Patricia Pereira, Rui Rodrigues, Graça Pereira & Rita Costa
Instituto Português do Mar e Atmosfera, Laboratório Nacional de Engenharia Civil e Instituto Nacional de Investigação Agrária e Veterinária

Executive Summary

The Xévora River basin, shared between Portugal and Spain, faces increasing risks of desertification and drought due to climate change, with rising temperatures and decreasing precipitation. Despite stable land use, climate variability demands more efficient management of water and agricultural resources, supported by the integration of hydrometeorological, satellite, and reanalysis data.

It is recommended to strengthen local hydrometeorological monitoring, expand integrated data platforms, and adopt predictive tools to anticipate droughts. These measures aim to enhance regional resilience, promote sustainable management, and support decision-making.

Recommendations

- Strengthen hydrometeorological monitoring.
- Integrate multiple data sources.
- Use predictive tools to support decision-making.

Policy Brief Recipients

Direcção-Geral de Agricultura e Desenvolvimento Rural (DGADR), Agência Poruguesa do Ambiente (APA), , Confederación Hidrográfica del Guadiana, Comissão Permanente da Seca, Autoridade Nacional de Emergência e Proteção Civil (ANEPC).

PLANAPP-S4P-6589/2024/ENG

Introduction and Problem Statement

Desertification and drought are increasingly frequent and disturbing environmental phenomena, with significant impacts on agricultural production, ecosystems, and rural communities. According to the United Nations, by 2050, land degradation could displace millions of people, a direct result of climate change and unsustainable land management. In Portugal, there is a marked increase in areas classified as semi-arid and dry sub-humid, highlighting the intensification of these processes.

Drought, beyond being a hydrometeorological phenomenon, also triggers social, political, and economic crises, exposing vulnerabilities in agricultural systems and potable water supply, underscoring the need to develop resilient adaptation strategies. The diversity of affected sectors, geographic and temporal variability, as well as increasing water demand for human use limit the universal definition and quantification of drought, making it essential to develop standardized and nationally and internationally recognized indicators and methodologies for monitoring and managing these risks.

In the context of the Xévora River Basin, located in a region prone to desertification and drought and shared between Portugal and Spain, the choice of this area for the study aims not only to meet the Iberian scale requirements of public policy programs but also to support the assessment of the feasibility of an Iberian Action Plan to Fight Desertification and Drought. The Xévora basin is transboundary, crossing the border between the two countries multiple times, and includes agricultural and water systems of high ecological and socioeconomic relevance.

Analysis / Key Findings

The characterization of the transboundary Xévora River basin revealed a stable landscape over the past three decades, with a predominance of agricultural land (about 56–60%) and natural areas (approximately 39–41%), and a residual presence of urban zones. This stability suggests that, despite environmental pressures, the region's agricultural and natural systems have remained largely unchanged, although the analysis does not allow for identification of more detailed changes in land use or agricultural systems.

Meteorological data from local stations, complemented by satellite products and reanalysis, show a clear warming trend in the region, with statistically significant increases in minimum and maximum temperatures in recent decades. Precipitation patterns show a general decrease in annual totals, especially in Elvas, except for an increase in autumn precipitation in Portalegre. These results reflect increasing climate variability and intensification of drought risk, directly impacting water resource management and agricultural planning.

The hydrometeorological assessment integrated meteorological, satellite, and local observation data to analyse water availability and drought impacts. Strong correlations were identified between soil moisture, precipitation indices, and vegetation status, demonstrating the value of integrating multiple data sources for robust drought monitoring. The analysis of stored volumes in reservoirs and river flows highlighted the importance of monitoring both inflows and outflows, with the Abrilongo reservoir being a critical indicator of drought severity and system resilience. The absence of direct flow measurements on the Portuguese section was partially addressed by extrapolating data from Spanish stations, though this limitation should be considered in future management.

Recognizing gaps in the monitoring network, the report recommends reactivating and expanding local meteorological and hydrometric stations, especially for monitoring soil moisture and inflowing river flows. The potential developed in an internal IPMA visualisation platform is relevant and capable of integrating satellite-derived parameters and real-time hydrometeorological data, as an essential tool for operational decision support and early warning systems.

Long-term projections, based on ensemble climatological methods, show that accumulated precipitation over the hydrological year is a reliable indicator for anticipating droughts and has potential to support water management decisions. Predictive models show high accuracy from December onwards, allowing decision-makers to confidently estimate the probability of dry or wet years. This quantitative approach strengthens the region's potential capacity for proactive planning in agriculture, reservoir management, and climate risk mitigation.

The development of assessment indicators and indices is crucial to guide drought management and prevention process. These are decision-support tools that enable drought monitoring, guiding response timing and levels, and being essential for the developments of management plans.

Policy Options and Recommendations

The work performed highlights the need for an integrated, data-driven approach to support decision-making and strengthen community resilience. The main policy options and recommendations include the following three points:

1. **Strengthening Hydrometeorological Monitoring**

It is essential to invest in the reactivation and expansion of the local meteorological and hydrometric station network, with special attention to monitoring soil moisture and river discharge. High-quality data collection is crucial for calibrating and validating climate products, supporting early warning systems, and improving operational water resource management.

2. Integration of Multiple Data Sources

The combined use of local observations, satellite data, and reanalyses allows for a more robust and coherent characterisation of hydrometeorological conditions, facilitating the identification of drought episodes and the assessment of water availability. Given the high volume and complexity of data to be processed, this approach should be consolidated and expanded, promoting the development of visualisation and analysis platforms accessible to decision-makers.

3. Use of Predictive Tools for Decision Support

Accumulated precipitation over the hydrological year has proven to be a reliable indicator for anticipating droughts and guiding water management decisions. The application of probabilistic forecasting methodologies should be promoted, allowing for confident estimation of the probability of dry or wet years and strengthening early warning systems for the agricultural and water resource sectors.

These recommendations aim to strengthen the region's response capacity to climate challenges, promoting integrated, sustainable, and evidence-based management.

Conclusions

The results of the technical report show that the Xévora River basin region faces rising temperatures and a general reduction in annual precipitation in recent decades, highlighting the effects of climate change and the intensification of drought risk. Despite stable land occupation, with a predominance of agricultural land and natural areas, increasing climate variability requires more efficient management of water and agricultural resources.

The integration of meteorological stations, satellite, and reanalysis data has proven fundamental for robustly characterising hydrometeorological conditions and identifying drought episodes, reinforcing the potential of these tools for monitoring and early warning systems. The operation of the irrigation network and investment in more sustainable agricultural practices are identified as key strategies to increase the region's resilience.

Monitoring stored volumes in reservoirs and using probabilistic forecasts based on accumulated precipitation over the hydrological year as the potential to allow drought anticipation and support strategic decisions in water management, agricultural planning, and climate risk mitigation.

References

Dutra, E., Pereira, P., Rodrigues R., & Costa R. (2026). Relatório Técnico Final: Impactos da desertificação e seca na Bacia transfronteiriça do Rio Xévora. Definição de metodologias e de instrumentos de recolha de dados para apoio à tomada de decisão.

HOW TO CITE THIS DOCUMENT

Dutra, E., Pereira, P., Rodrigues R., & Costa R. (2026). *Xévora: Drought resilience and desertification*. S4P-24 Policy Brief 6589/2024. PLANAPP – Centro de Planeamento e de Avaliação de Políticas Públicas.

CONTACT

science4policy@planapp.gov.pt

Ciência para as políticas públicas
PLANAPP
Newsletter
PLANAPP
@planapp_
PLANAPP podcasts

This policy brief was developed under the Science4Policy 2024 (S4P-24): annual science for policy project calls, an initiative by the Centre for Planning and Evaluation of Public Polices (PLANAPP) in partnership with the Foundation for Science and Technology (FCT), financed by Portugal´s Recovery and Resilience Plan. Thematic line S4P-24/16: Climate change and resource sustainability / Startegies to combat desertification, land degradation and drought (Iberian scale).