

FUTUROS DA ÁGUA
RESILIÊNCIA,
GOVERNAÇÃO
E ADAPTAÇÃO 

02

fevereiro
2026



FICHA TÉCNICA

AD ASTRA

REVISTA ONLINE DA UNIVERSIDADE ABERTA


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Divisão de Comunicação e Marketing da Universidade Aberta

ISSN

3051-6773

DOI

<https://doi.org/10.34627/adastra.v2i1>

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Nova cartografia de solos à escala 1:100 000 para Portugal Continental

A New Soil Cartography at 1:100,000 scale for mainland Portugal

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Resumo

A informação disponível sobre a classificação e cartografia dos solos em Portugal continua insuficiente, dispersa e heterogénea. Persistem lacunas na qualidade, atualidade e uniformidade dos dados, comprometendo a gestão ambiental e o ordenamento do território. As várias fontes apresentam sobreposições, metodologias distintas e deficiências de caracterização e classificação. A atual Carta Geral dos Solos (escala 1:1 000 000) revela-se desatualizada e pouco adequada às necessidades atuais. É assim, fundamental articular, uniformizar, atualizar e disponibilizar toda a informação cartográfica existente para o país, assegurando maior precisão, coerência e utilidade para a gestão integrada e sustentável do território nacional e europeu.

Palavras-chave: Solos; WRB, Cartografia, Compatibilização; Normalização.

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Abstract

The information available on soil classification and mapping in Portugal remains insufficient, scattered, and heterogeneous. Gaps persist in data quality, timeliness, and consistency, undermining environmental management and land-use planning. The various sources show overlaps, differing methodologies, and deficiencies in characterization and classification. The current General Soil Map (scale 1:1,000,000) is outdated and poorly suited to present needs. It is therefore essential to coordinate, standardize, update, and make all existing cartographic information available for the country, ensuring greater accuracy, coherence, and usefulness for the integrated and sustainable management of national and European territory.

Keywords: Soils; WRB; Mapping; Harmonization; Standardization.

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[0009-0009-8689-2137](#)

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[0000-0002-7228-6330](#)



Introduction

Portugal lacks comprehensive cartographic soil information coverage at a scale suitable for environmental management needs. Although various data sources exist (in addition to the numerous published soil maps), they are often inconsistent and insufficient to provide the general and rigorous information necessary to address, in a holistic manner, the challenges associated with soil governance within the framework of environmental policies. Furthermore, efforts to structure foundational information for the creation of new cartography based on previous maps and existing information repositories have also been reported.

The available cartographic information on soils (distribution and characterization) in Portugal has been produced by various institutions and covers the entirety of the mainland territory, presenting some overlaps. This information is scattered across several organizations and is heterogeneous regarding scale, methodologies (field and analytical) employed, information density, classification systems used, and cartographic publication formats, many of which are the result of analog-to-digital conversion. Additionally, it exhibits deficiencies or gaps in characterization and classification (partly stemming from the continuous evolution of knowledge about soil resources and approaches to their study) that need to be addressed.

Despite the acquisition of new data and knowledge, the current General Soil Map of Portugal at a scale of 1:1,000,000 – the sole tool supporting awareness-raising initiatives, spatial planning, thematic cartography at a national level, and the provision of more and better data for cartographic synthesis at the European Union and global scales – remains inadequate. This inadequacy stands in contrast to the situation regarding other foundational thematic cartographies that are relevant for integrated territorial management.

Thus, it is imperative to coordinate, standardize, and make the existing soil cartographic information of the country accessible, enhancing its quality and utility for various applications.

Data

The Soil Map of Portugal (*Carta dos Solos de Portugal*), at a 1:1,000,000 scale, published in 1971, employs a classification system that has not undergone the necessary updates and is now significantly outdated. Therefore, updating the map is essential, utilizing a universal classification system that meets current and future needs.

This article describes the work carried out to correct, harmonize, and validate soil cartography in Portugal at a 1:100,000 scale (covering the regions of Trás-os-Montes and Alto Douro, Entre Douro e Minho, and the Central Interior Zone) and at a 1:25,000 scale (mapping of Soil Series from the former SROA/CNROA, known as the Complementary Soil Maps). The latter includes regions south of the Tejo River, as well as parts of the Central Region and, to a lesser extent, the Northern Region. Due to numerous challenges in gathering information and/or the quality of the existing data, the harmonization process for the cartography at these two scales has been conducted in parallel, depending on the availability of data.

Methods

The operationalization of the aforementioned objectives necessarily requires the convergence of synergies and the involvement and participation of various institutions responsible for soil cartographic information, as well as others engaged in studies of diverse nature related to soil characterization. To this end, it is essential to ensure the organization and coordination of a broad and robust group of specialists with diverse and complementary expertise.

It is also crucial to include various entities (public or private) with a direct interest, at different scales, in the use of soil resource information.

Definition of the cartographic base

The organization of the aforementioned General Soil Map requires, from the outset, consideration of the various geological units (with the support of specialists with knowledge and sensitivity regarding the relationships between lithological differentiation and soil formation) and landforms, in order to globally segregate the different “homogeneous” morphological or physiographic units (in terms of lithology and relief). This necessarily requires support from the Digital Terrain Model (DTM) – as was, in fact, the methodology followed in some soil mapping programs developed in the North and Center of the country. Such differentiation is crucial to optimize the delimitation of soil cartographic units and their alignment with the two key factors in differentiating soil characteristics and their distribution in Mediterranean regions.

The General Soil Map should be based on a prior synthesis of relief and geological units, suggesting the use of the geological map at a scale of 1:500,000 (or larger when available and justifiable), the DTM, the Land Use Map (COS), the Landscape Unit Maps, and maps derived from indicators obtained from relevant thematic cartographic information as a diagnostic basis.

Reorganization and update of information

The organization of the General Soil Map must necessarily account for the diversity of information associated with scale, methodologies, density and quality of data, classification systems, and the publication format of previously produced cartographic documents. Therefore, two main areas of the mainland territory are schematically considered from the outset, to be addressed with differentiated approaches as explained below.

The regions of Trás-os-Montes e Alto Douro, Entre Douro e Minho, and Interior Centro

The reorganization and synthesis of the cartography for these regions are relatively facilitated by the fact that the existing soil cartography (at a scale of 1:100,000) was developed within the conceptual framework of land units, through the prior delineation of physiographic units that are homogeneous in terms of climate, geology, and relief. Furthermore, this cartography contains dense information regarding the morphological description of soil units and their basic analytical characterization, employing internationally standardized methodologies and globally recognized classification systems. Finally, the information from the reference soil profiles generally includes their respective locations and the specification of the parameters essential for their environmental contextualization.

However, the maps for these regions were published in different formats, and their legends exhibit some variation, ranging from the FAO Legend (1974) to the Revised FAO Legend (1988) and the WRB (1998 version). Therefore, to eliminate potential discrepancies and ensure uniformity of information, it is essential to:

- (i) First, proceed with the analog-to-digital conversion of the available thematic base cartography used to develop the Soil Map of Trás-os-Montes e Alto Douro and evaluate the internal consistency of the soil cartographic units with the homogeneous physiographic units;
- (ii) Harmonize the delineation of homogeneous physiographic units and adjacent soil cartographic units at the boundaries between each pair of these regions;

- (iii) Address the inconsistencies between the legends of the mentioned maps by creating equivalence tables and integrating them into an information transformation system for the WRB (2006 or 2014 version, or a more recent one), while ensuring compatibility with the Harmonized World Soil Database (HWSD) being developed by the International Network of Soil Information (INSII).

The regions of Algarve, Alentejo and Litoral Centro

In these regions, the existing cartography in georeferenced vector and raster formats was developed at a scale of 1:25,000 (the so-called Series Maps), which served as the basis for its publication on paper at a scale of 1:50,000. Its integration into the General Soil Map of Portugal (CGSP) is significantly more complex than in the previous case, as the cartography was not structured based on information obtained from a prior differentiation of basic or homogeneous physiographic units. As a result, the respective cartographic units are not sufficiently systematized according to the dominant factors of soil formation. This is further complicated by the fact that information on geological units was only sufficiently detailed at a later stage (Monteiro, 2004).

Additionally, the soil classification system used (Portuguese Soil Classification) has not undergone the necessary updates and alignment with global classification systems. At the same time, the methodological standardization system (field and laboratory) has gradually been diluted, leading to an increased number of soil units (included in the cartographic documents) that are either incompletely characterized or lack any characterization at all. Indeed, the information in the respective descriptive reports is sparse (incomplete), and many soil units were classified inconsistently, particularly those in the areas of the Central Coastal Zone, which are based exclusively on sedimentary rocks.

Conclusion

The update of the General Soil Map of Portugal (Carta Geral dos Solos de Portugal, CGSP) represents a significant opportunity to unify the classification (and communication) system and the various methodologies, organize information and general and thematic databases, address and mitigate characterization deficiencies, promote the improvement and reorganization of existing cartography, encourage the use of new technologies, and adapt information to better support land-use planning, soil degradation prevention, and the management and conservation of natural resources.

These are essential conditions for knowledge transfer, legislative support, integration of soil protection into other environmental and resource conservation policies, and for stimulating and guiding research. This initiative aims to foster the development of soil science by addressing identified gaps, priorities, and synergies, improving interactions between the scientific community involved in fundamental and applied I&D activities on soils and the end-user communities and stakeholders. Ultimately, it seeks to enhance impact through the adaptation and dissemination of developed knowledge and technologies.

Aknowledgements/Funding

This work has been developed under the Science4Policy 2024 (S4P-24), an annual Science for Policy Project call, an initiative promoted by Centre for Planning and Evaluation of Public Policies in partnership with the Foundation for Science and Technology, financed by Portugal's Recovery and Resilience Plan [2024.00178.S4P24].



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