Desertification in Italy: Legal Responses Among EU Influence, National Regulation and Differentiated Regionalism

Micaela Falcone(✉)

Polytechnic University of Bari, Via Orabona 4, 70125 Bari, Italy
micaela.falcone@poliba.it

Abstract. The article examines the desertification within the Italian legal order on the background of international law, European Union law and domestic implementation, with a specific focus on the southern regions of Apulia and Sicily. The phenomenon is not governed by a single coherent body of rules, but through a fragmented set of legal instruments crossing soil protection, water governance, spatial planning, agricultural policies and climate adaptation. The analysis combines a multi-level legal-institutional approach with the examination of planning tools, programming documents and financial instruments, in order to assess how far international and EU guidance has been translated into effective measures at national and regional levels. Particular attention is devoted to territorial asymmetries between North and South Italy where formal unity of the legal framework coexists with differentiated implementation capacities and uneven use of available resources. The case studies of Apulia and Sicily show two distinct regional patterns: integration of desertification into broader environmental southern regions and landscape planning, on the one hand, and the adoption of an explicit regional strategy backed by dedicated cartography and projects, on the other. The article further considers the growing relevance of recent EU developments, especially Directive (EU) 2025/2360 on soil monitoring and resilience and Regulation (EU) 2024/1991 on nature restoration, which may strengthen the binding dimension of desertification-related obligations. In this perspective, desertification emerges as a advantageous point of view to understand the relationship among EU influence, national regulation and differentiated regionalism in contemporary environmental law.

Keywords: Desertification · Italy · Italian Region · European Union Law Environment

1 Introduction

The phenomenon of desertification represents a growing environmental threat for Italy, most severe in southern regions, where soil degradation processes affect a significant share of the national territory, as shown by the most recent ISPRA data and by UNCCD and European assessments of soil-related risks [1–3]. In a context of accelerated climate

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change, it produces significant impacts on biodiversity, agricultural productivity and sustainable development, with structural repercussions on local economies and natural systems.

This contribution builds on the analysis carried out in relation to European legislation on desertification [4], highlighting the absence of a specific EU regulatory framework and, conversely, the existence of a complex set of sectoral regulatory and financial instruments, whose implementation so far produced uneven results.

On this basis, the article focuses on the national and regional levels in Italy, with the aim of assessing the extent to which international and European guidelines have been effectively translated into domestic law and, above all, into its territorial articulations. The underlying assumption is that, in the Italian experience, the desertification process is not yet governed by a single self-standing body of rules, but rather emerges as a point of convergence among soil policies, water governance, climate adaptation, river basin planning, rural development and financial programming instruments. As a consequence, the influence of the "European matrix" does not emerge through a concentrated reception in a single legislative act, but through a diffuse and sectoral transposition, entrusted to heterogeneous sources, planning methods and coordination mechanisms between the State and the Region.

The analysis adopts a multi-level legal-institutional approach, focusing on international, European and national sources and on their repercussions in regional law. It combines the examination of legal norms with the analysis of planning acts, programming documents and key financial instruments, in order to verify whether, and to what extent, the objectives of preventing soil degradation are translated into coherent and territorially differentiated measures.

From this perspective, the article pursues two main aims: first, to reconstruct critically the evolution of Italian legislation in this field; second, to assess whether regionalism has enabled closer adaptation to diverse territorial vulnerabilities or, on the contrary, has exacerbated fragmentation, uneven implementation and dependence on programs and financial instruments, with particularly evident effects in the divide between North and South. The focus on the *Mezzogiorno* is grounded not only in empirical evidence, reflecting the greater exposure of these territories to the phenomena of aridity, erosion, salinization and water stress, but also fulfils a systemic function: in this light, the case studies on Apulia and Sicily southern regions serve to test the robustness of the national model in two highly vulnerable contexts, which differ in their administrative structures, regional instruments and capacity to mobilise programming and financial leverage.

The paper seeks to show that in the current evolutionary phase of environmental law, the desertification provides a particularly significant test case for assessing the relationship among the European integration, the complexity of domestic competences and the adequacy of administrative responses. In the absence of a structured national legislative framework devoted to the desertification phenomenon, the problem concerns not only the quantity of measures adopted, but also their systemic coherence, their standard-setting capacity and the possibility to unify interventions currently dispersed across multiple regulatory sectors and various levels of government.

2 International and European Framework: An Overview

The measures adopted by Italy to combat soil desertification lie within the framework of international obligations arising from the 1994 United Nations Convention to Combat Desertification (UNCCD) and a European context which, although for a long time lacking a unified set of rules expressly devoted to the phenomenon, has undergone a progressive normative densification, further strengthened by the regulatory agenda of the European Green Deal [5–9].

In EU law, desertification continues to emerge primarily through sectoral instruments that contribute to soil protection, ecosystem resilience and climate adaptation. From this perspective, particular importance attaches, to the recent Directive (EU) 2025/2360 on soil monitoring and resilience, which introduced a harmonised framework for monitoring and assessing soil health, soil resilience and the management of contaminated sites, which requires Member States to transpose it by 17 December 2028 [10–13]. On the other hand, Regulation (EU) 2024/1991 on nature restoration lays down binding targets to restore nature on at least 20% of the Union's land and sea areas by 2030 [14].

In addition, Regulation (EU) 2023/839 amends Regulation (EU) 2018/841 on land use, land-use change and forestry (LULUCF) as part of the *Fit for 55* package, thereby strengthening the contribution to the Union's climate objectives [15, 16].

More generally, Regulation (EU) 2021/1119 (the European Climate Law) consolidates the centrality of clime adaptation in EU law, within a framework where soil degradation and desertification increasingly manifest the territorial vulnerability [17].

Also relevant, as indirect instruments for implementing soil protection, are the 2023–2027 European Agricultural Policy and Regulation (EU) 2021/2115 on CAP Strategic Plans [18] financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) measures, under which eco-schemes, agri-environment-climate measures and rural development tools may all contribute to prevent land degradation [19].

Closely connected with soil protection and the fight against desertification are also the rules on air quality, the management and protection of water resources, the Floods Directive and the rules on deforestation. All these measures are sustained and supported by a complex set of financial instruments contributing to soil prevention and protection, as already analysed.

It follows that the European framework can no longer be regarded as a mere collection of sectoral interventions, but rather as an increasingly integrated body of rules in which the prevention of land degradation, the restoration of ecosystems and soil monitoring jointly steer national legal orders to a greater extent.

On this background, the Italian legal framework on soil desertification must be examined in order to assess how far these European and international impulses have been translated into a coherent domestic regime, notwithstanding a context marked by strong sectoral fragmentation and differentiated regional implementation.

3 Italian Law on Desertification Among the NAP, the NRRP and Sectoral Legislation

The Italian regulatory framework on soil desertification yelds a multi-level legal and administrative system where the implementation of obligations arising from the UNCCD and from the reception of EU guidance do occur through a plurality of sectoral sources, programming acts and financial instruments.

The first cornerstone of this architecture is the National Action Programme to Combat Drought and Desertification (NAP), adopted by the Resolution of the Interministerial Committee for Economic Planning (CIPE) of 21 December 1999, no. 299. It provided domestic implementation of Italy's commitments under the UNCCD through a strategy centred on preventing soil degradation, managing water resources, reducing productive pressures and identifying the most vulnerable territorial areas.

However, NAP's legal nature is essentially a programming instrument. While constituting the national strategic reference document, it not established a self-standing legislative regime nor introduced uniform standards, specific obligations or enforcement mechanisms directly targeting the desertification problem [20].

As a result, the Italian system continues to rely on a technique of indirect integration, whereby desertification is addressed as the outcome of a plurality of legal regimes concerning soil, water, climate adaptation and spatial planning.

The normative core of this construction remains the Legislative Decree 3 April 2006, no. 152 (Environmental Code). Its Part III - devoted to soil protection, desertification fight, water pollution prevention and water resources management – approaches the phenomenon of the desertification within an integrated logic of territorial governance. In particular, Article 53 expressly includes the fight against desertification among the objectives of the legislation, while the transposition of Directive 2000/60/EC on water management is implemented, inter alia, through the river basin district planning and the institutional framework for River Basin District Authorities.

This systematic choice represents, at the same time, the strength and the limitation of the Italian model: it allows reliance on already consolidated planning and management tools, but, it deprives also desertification of an autonomous legislative definition.

Additional sectoral sources affecting indirectly the drivers of Italy's desertification include Legislative Decree 18 May 2001 no.227 on forestry matters, Legislative Decree 22 January 2004 no.42 on landscape protection and Law 28 December 2015 no.221 that strengthened the integration of environmental and sustainability criteria into public policies. Altogether, these instruments form a fragmented set of rules where soil protection and the prevention of territorial degradation emerge primarily through functional connections rather than through a unified legislative regime.

A major responsibility for State-level coordination lies with the Ministry of the Environment and Energy Security (MASE), which leads national climate adaptation policies and translates European and international guidance into domestic planning instruments. In parallel, ISPRA performs a central technical-scientific function by providing support for monitoring soil degradation, assessing territorial vulnerability and building the knowledge base required for administrative action. According to ISPRA, almost 30% of the Italian territory shows clear signs of soil degradation and desertification, with a higher concentration in southern regions.

Many sectoral initiatives now converge in the National Climate Change Adaptation Plan (PNACC), approved by Ministerial Decree 21 December 2023 no.434, which strengthens the integration of adaptation measures into national, regional and local policies. Although missing legislative status, the PNACC carries on an important coordinating function, linking EU climate law, national planning and the management of territorial risks, including water resources, agriculture and hydrogeological instability among the sectors considered.

Along legal sources and planning desertification's fight, the financial dimension is also crucial. In particular, the National Recovery and Resilience Plan (NRRP) – although not containing a component exclusively devoted to desertification – finances measures that directly affect its structural drivers, especially under Mission 2, Component 4, concerning the protection of land and water resources [21].

For the investment line coordinated by the Civil Protection Department, the overall allocation amounts to 1.2 billion €, of which 800 M€ are earmarked for new projects, with a minimum share of 40% reserved to the *Mezzogiorno*. Among the official allocations, 63.7 M€ are assigned to Sicily and 50.6 M€ to Apulia regions [22].

In addition, Investment 4.3 of the NRRP, entrusted to the Ministry of Agriculture, Food Sovereignty and Forestry (MASAF), concerns the resilience of irrigated agro-eco-systems, with a budget of 880 M€ aimed at improving the efficiency of irrigation networks and the management of water resources in agriculture [23].

A similar supporting role is played by the 2023–2027 Common Agricultural Policy, implemented through Regulation (EU) 2021/2115 on national Strategic Plans and interventions financed by the European Agricultural Guarantee Fund (EAGF) and the European Agricultural Fund for Rural Development (EAFRD) measures. In this framework, eco-schemes fall under Article 31, while, pursuant to Article 93, at least 35% of EAFRD resources must be devoted to interventions with environmental, climate and animal-welfare objectives, with significant implications for soil protection, sustainable water management and conservation-oriented agricultural practices.

However, the national system effectiveness depends crucially on Italian regionalism. The interplay between the State's exclusive competence for environmental protection under Article 117 of the Constitution and the relevant regional competences in agriculture, spatial planning and landscape planning requires a model of cooperative regionalism based on political-institutional coordination. As stated authoritatively: "Environmental protection operates less as a narrow legislative field and more as a transversal value, allowing the State to set uniform minimum standards, without excluding regional competence to pursue functionally related interests" (Constitutional Court judgment no. 407/2002) [24].

From this perspective, the State-Regions Conference plays a central coordinating role, while, at procedural level, the Conference of Services (governed by Articles 14 et seq. of Law 7 August 1990 no.241) constitutes one of the main instruments for reconciling the public interests involved in complex environmental planning and projects.

Constitutional case-law has also recognised that, in special-statute regions like Sicily, the power over spatial planning, public waters and landscape protection acquires particular relevance in shaping the regional scope for environmental action, still complying with State-level standards (Constitutional Court judgment no.380/2007) [25].

The result is a form of cooperative regionalism weakly oriented towards common and measurable objectives in the field of soil degradation, explaining the pronounced territorial disparities in the implementation of policies against desertification.

From a broader perspective, the Italian system is characterised by its ability to integrate legal sources, planning instruments and funding mechanisms, while its weakness remains the absence of an organic statute capable of turning these plural tools into a uniform framework of definitions, standards and responsibilities. Such tension between integration and functional normative fragmentation underpins Italy's territorial asymmetries between North and South, where the differing regional implementation capacities weakens the environmental law effectiveness.

4 Territorial Asymmetry and Different Implementation: The North–South Divide in Efforts to Combat Desertification

The divide between North and South Italy in the fight against desertification is legally and administratively significant. It highlights the different capacities of territories to implement - within a formally unified regulatory framework - the instruments for soil protection, water resource management and climate adaptation. Territorial differences are not limited to greater or lesser environmental exposure, reducing the efficacy of planning operations, the effectiveness of inter-institutional coordination and the allocation of public financial resources.

Official data from Italy's National System for Environmental Protection show that the *Mezzogiorno* concentrates the most vulnerable areas. According to SNPA/ISPRA, 10% of Italian territory is classified "highly vulnerable", with Sicily the most critical case with 42.9% of its overall surface vulnerable, followed by Apulia (28%), Molise (24.4%), Basilicata (24.4%) and Sardinia (19.1%) regions [26].

The relevance of this asymmetry emerges from the national rules on soil and water. When regulating soil protection, fight against desertification, protection of waters and management of water resources, Part III of the Environmental Code establishes a unified environmental protection framework applicable to the whole national territory. However, its real operativity depends on river basin district planning and on the action of territorial administrations, pursuant in particular to Articles 63 and 64 of the Code. It follows that, although the uniform regulatory basis, the effectiveness of the measures is conditioned by regional capacity for programming, coordination and implementation.

Another significant indicator of territorial differentiation is offered by the governance of the National Recovery and Resilience Plan. The article 2(6-bis) of Law 29 July 2021 no.108 states that at least 40% of the available financial resources must be allocated to the *Mezzogiorno*, expliciting the normative prominence to territorial rebalancing.

Such provision is consistent with Regulation (EU) 2021/241, which establishes the Recovery and Resilience Facility also with a view to strengthen economic, social and territorial cohesion [27]. Italy's North *vs.* South dualism, therefore, provides a criterion for guiding the administrative action and financial programming. This approach is implemented in Mission 2, Component 4 of the NRRP, which also concerns the restoration of (infra)structures damaged by natural disasters and the reduction of hydrogeological risk. Institutional documents of the Civil Protection Department indicate a total investment

of 1.2 billion €, with 800 million € allocated to new projects, with a minimum share of 40% still reserved to the *Mezzogiorno*. From a legal perspective, this is relevant not only for the amount of resources involved, but also for their implementation, governed by formal allocation criteria and by agreements with the Regions and Autonomous Provinces, according to Article 15 of Law 7 August 1990, no.241, that regulates responsibilities, monitoring and reporting.

It follows that, in the more exposed Italian southern regions, the fight against soil degradation is largely carried out through forms of cooperative administration and integrated financial instruments rather than through special legislation expressly devoted to desertification. Case-law likewise confirms, albeit indirectly, this approach. The most significant references do not stem from litigation explicitly centred on desertification, but from constitutional and administrative case-law on water protection and soil conservation. In particular, the judgment no.254/2009 of Constitutional Court stated that the provisions of Part III of the Environmental Code fall within the field of environmental protection, which is reserved to State competence [28], while in a 2022 judgment the Regional Administrative Court for Liguria assessed the jurisdiction of the Higher Water Tribunal over planning acts that affect significantly the public waters regime [29]. This approach makes it possible to construe the territorial divide not in terms of full-blown normative pluralism, but as an issue of differentiated implementation of a unitary environmental protection framework, wherein cooperation between the State and the Region plays a central role.

Taken as a whole, the *Mezzogiorno* is the area where both the territorial vulnerability and the intensity of planning and financing intervention are most clearly concentrated. It follows that the North–South divide, in the field under consideration, does not concern only the geographical distribution of risk, but also the degree of effectiveness of environmental law, the administrative capacity of territorial levels of government and the functionality of multi-level coordination mechanisms (Tables 1 and 2).

Table 1. Land degradation in Southern Italy

Region	Vulnerable area and main issues	Institutional response capacity/framework	Source
Sicily	42.9% – Erosion, salinization, drought	Regional desertification strategy; strong dependence on PNRR "Water package"	ISPRA-SNPA, *Focus Sicily* 2020–2024
Basilicata	24.4% – Arid/semi-arid degradation, erosion	Measures within rural development and soil protection plans; limited administrative capacity	ISPRA Reports 2020–2024
Sardinia	19.1% – Habitat loss, soil sealing	Integration within landscape and forestry planning	SNPA Webinar 2022; 2024 analysis

(*continued*)

Table 1. (*continued*)

Region	Vulnerable area and main issues	Institutional response capacity/framework	Source
Apulia (Puglia)	28% – Salinization of agricultural soils	Territorial and agricultural planning tools; targeted use of CAP/RDP funds	ISPRA 2022–2024, regional fact sheets
Calabria	Significant (Southern focus) – Coastal erosion, rural degradation	Fragmented interventions between coastal defense and rural development	ISPRA-SNPA, *Southern Reports* 2024–2025
Campania	Vulnerable area included within the 18% of national degraded land – Soil compaction, contamination	Actions within land reclamation and urban plans; attention to soil consumption	ISPRA 2024; *Desertification in Italy* analysis
Molise	High – Widespread agricultural degradation	Measures included in agricultural/RDP instruments; limited regional structure	SNPA/ISPRA, *Focus Molise* 2020–2024

Table 2. Main initiatives against soil desertification in Southern Italy

Measure/Initiative	Regions involved	Main objectives (ISPRA data)	Funding and legal framework	Status (2026)
PAN 2021–2030	Apulia, Sicily, Sardinia, Calabria, Campania	Monitoring land degradation (17.4% of national soil)	Ministerial Decree 21/12/2000; UNCCD; Legislative Decree 152/2006	Under implementation; ISPRA Report 2025
PNRR – Mission 2	Entire Southern Italy	Hydrogeological resilience against erosion/salinization	PNRR (Ministerial Decree 31/12/2021); €15.5 billion	60% completed
RDP (EAFRD) – CAP 2023–2027	Apulia, Sicily, Sardinia	Anti-degradation eco-schemes (28% of southern territory at risk)	Regulation (EU) 2021/2115; Regional RDPs	Payments ongoing (2024–2025)
PNACC (updated 2023)	Sicily, Sardinia	Adaptation; dams for drought control (Sicily 42.9% vulnerable)	Prime Minister's Decree 12/03/2015; Legislative Decree 36/2023	Dams: 2/3 operational

(*continued*)

Table 2. (*continued*)

Measure/Initiative	Regions involved	Main objectives (ISPRA data)	Funding and legal framework	Status (2026)
LIFE Desert-Adapt	Apulia, Sicily	Restoration of arid habitats	LIFE20 CCM/IT/001665	In progress (until 2026)
FSC 2021–2027	Calabria, Campania, Basilicata	Soil recovery (Basilicata 24.4% at risk)	FSC Ministerial Decree 20/02/2022; €40 billion	30% spent
LULUCF Italy	National (Southern focus)	Carbon sink vs. degradation	Regulation (EU) 2023/839	2030 target: + 10 Mt CO_2eq/year

5 The Apulia Region Between Soil Protection and Regulatory Instruments

Within southern Italian regions (*Mezzogiorno*) exposed to soil degradation, Apulia is particularly interesting because the desertification issue enters the regional legal order not through a dedicated statute, but through a range of acts on soil, landscape and vulnerable areas. Accordingly, the Region has gradually brought the problem within environmental programming and spatial planning at local level rather than by an autonomous set of rules dedicated to the desertification.

A first Apulian reference is the Regional Government Resolution of 18 September 2007, no.1464, that approved the programme agreement with the Ministry of the Environment and the National Committee to Combat Drought and/or Desertification [30]. The agreement implemented the National Action Programme at regional level through a pilot project for the mapping and delimitation of areas at risk, the definition of interventions and an experimental action of prevention and mitigation accompanied by information activities. In this context falls the Action Programme to Combat Drought and Desertification in Apulia, based on the MEDALUS methodology for assessing sensitivity to desertification and classifying Apulian territorial units [31]. These instruments have produced an advanced knowledge base, but miss the adoption of a regional framework law on soil degradation as well as the systematic integration of the mapping results into the main sectoral regimes.

A second line of intervention is planning the landscape. The Apulian Regional Law 7 October 2009, no.20 (Landscape planning) assigns to Regional Territorial Landscape Plan (PPTR) the function of protecting environmental values and sustainable development. Although not expressly regulating the desertification, this line places the protection of territorial balances within a unified regulatory framework, with the result that soil degradation is legally approached through the PPTR rather than by one autonomous category.

The centrality accorded to the PPTR in governing the land use also emerges from administrative case-law, which subjects to close scrutiny the delineation of landscape

restrictions and the classification of land, in the light of historical changes in land conditions, (TAR Puglia, Bari, 25 February 2025, no.272). In a complementary way, case-law used the PPTR as a benchmark for assessing the effects of irreversible transformations of agricultural land – in particular for ground-installed photovoltaic plants – in terms of land coverage, rural landscape alteration and impairment of ecological functionality (TAR Puglia, Lecce, 10 February 2022, no.248).

To account for more recent evolution of the Apulian framework, it is also appropriate to recall the 2025 initiatives on the renaturalization of degraded and yet degrading soils. Apulia Region recently launched a call for proposals addressed to local authorities for projects to restore degraded land to be used as public green areas, under the National Fund for Combating Land Take [32]. Although not specifically aimed to desertification, also this measure reinforces soil protection and restoration policies.

In Apulia these dynamics are also intertwined with the devastating effects of the unbeatable spread of the *Xylella fastidiosa* bacterium (classified in the EPPO Alert List A2 of UE Reg. 2019/1702), causing one of the most severe agricolture disasters in Europe, with essiccation yet of over 21M olive grove trees in Apulia in the last 10 years. Started in Salento province, this ongoing tragedy has contributed to the depreciation of 40% of overall agricultural areas and still increases the risks of land abandonment, landscape alteration and soil vulnerability [33, 34].

Alongside this framework, rural development policy plays an important role. Under the 2023–2027 CAP Strategic Plan, the Rural Development Complement (CSR) of the Apulia Region has a total budget over 1.18 billion €, with agri-climate-environmental calls which, in the 2024, for 11 area-based interventions, attracted around 18,430 applications for 131 M€ in requested aid *vs.* a total annual allocation of 96 M€. A significant share of interventions addressed sustainable soil and water management (conservation practices, organic farming, more efficient irrigation etc.), contributing, at least potentially, to mitigate degradation and salinization processes that make Apulia one of the most exposed Italian regions to soil desertification.

As a whole, the Apulian experience presents a fragmented, but broadly coherent, picture: there is no specific statute and no unified legal category devoted to soil desertification, but there is a set of instruments that permits to bring soil degradation within regional law on land use, landscape and soil protection, although with a limited capacity to create specific obligations, monitoring and accountability mechanisms specifically calibrated to desertification.

6 The Sicily Region Between Special Autonomy and Territorial Governance

Within the Italian context, Sicily has a distinctive profile because soil desertification falls within a regional legal order with a special Statute, endowed with exclusive or shared legislative powers in fields such as agriculture, forestry, land reclamation, urban planning, public works and public waters, closely linked to soil degradation and management of territorial resources [35]. Although not amounting to full environmental competence yet, such Statute makes Sicily a particularly suitable context for observing how special autonomy can be utilised in building its own instruments to combat soil desertification.

The central pillar is the Regional Action Strategy to Combat Desertification, drawn up by the River Basin Authority of the Hydrographic District of Sicily in June 2019 as a strategic programmation act [36]. The strategy refers to the UNCCD, to CIPE Resolution of 21 December 1999, no. 299 and to Legislative Decree no. 152/2006, underlining the need for unified governance of sectoral measures and placing soil desertification at the centre of a framework that links programs, plans and intervention priorities. Implementing CIPE Resolution, the strategy transfers at regional level the task of identifying vulnerable areas associable with programmes of measures, without taking the form of a real statute, but organising administrative action within the national and river-basin frameworks [37].

The knowledge basis of this Strategy includes the Map of Sensitivity to Desertification and the Desertification Sensitivity Index in Sicily (both available by the regional geo-portal and linked to the Urban Planning Department and to the Department for Territory and Environment) as well as the MEDALUS model and the Sensitive Areas to Desertification Index [38, 39]. Although lacking regulatory force, these instruments provide a legally-relevant function that make it possible to locate the most exposed areas, to set priorities and to guide measures.

Alongside the Strategy, there are various projects and technical-scientific initiatives: Sicily's ARPA promoted pilot projects to monitor soil desertification phenomena at basin and at farm scale and in 2024 launched jointly with the Region, SNPA and ISPRA a study on desertification and coastal erosion, indicating an integrated reading of territorial risks [40, 41].

Another reference is the LIFE DESERT-ADAPT project (LIFE16 CCA/IT/000011), funded under the LIFE Program, aimed at preparing areas at risk of desertification for increasing climate impacts through an integrated territorial adaptive management model (Desert Adaptation Model, DAM). Tested in particular in Sicily – among other places, in agricultural areas of Caltanissetta and Catania provinces and in the small islands of Lampedusa and Linosa – the project involved farms and local authorities in testing agroforestry practices, regenerative agriculture and soil and water management systems capable of increasing the resilience of Mediterranean soils [42].

From a financial perspective, Sicily also benefits of substantial NRRP resources for the protection of land and water infrastructures. The 2023–2027 Rural Development Complement (CSR) for Sicily, under the CAP Strategic Plan, finances interventions aimed at sustainable soil management to prevent soil erosion and to efficient water use, with conservation practices, agroforestry and the upgrading of irrigation systems that contribute to contrast desertification processes [43, 44].

Although not expressly focused on desertification, Sicily's Regional Law 13 August no.19/2020 on territorial governance updates the framework of spatial planning, where soil protection and degradation prevention policies are also situated, offering a potential point of regulatory linkage for implementing the Strategy [45].

Taken as a whole, the Sicilian case shows a more explicit legal emergence of the problem than in other regional contexts: the Region uses its autonomy by developping a dedicated Strategy whit official cartography and monitoring and funding instruments. Nevertheless, the response concerns primarily the strategic-programmatic as well as the

cartographic and financial planes, while an organic regional statute specifically devoted to soil desertification as an autonomous field is still lacking.

The comparison between Apulia and Sicily shows two partially different regional modalities of legal emergence of the problem of soil desertification. In Apulia, the phenomenon is contrasted mainly through acts implementing the National Action Programme, landscape-planning instruments and, more recently, with special measures to restore degraded soils; in Sicily, by contrast, desertification is the object of an explicit regional strategy developed within the framework of the River Basin Authority and backed by an official knowledge-base more explicitly devoted to the phenomenon.

The difference is due not only to the varying intensity of territorial risk, but also to the different institutional configuration of the two regional legal orders. Indeed, while Apulia operates within the ordinary model of cooperative regionalism, Sicily can anchor its action to a special statute that grants exclusive powers in areas such as agriculture and forestry, land reclamation, urban planning, public works and public waters, i.e., in fields closely connected with the prevention of soil degradation.

The Apulian case is particularly significant as an example of integration between environmental programming and spatial planning, whereas the Sicilian case is closer to the regional recognition of soil desertification as an issue to be addressed through a dedicated strategy. In both cases, however, a common limit persists: the regional response remains predominantly entrusted to programming, planning, monitoring and sectoral intervention instruments, rather than to an organic and autonomous legislative framework on soil desertification.

7 Conclusions: Legal Challenges and Future Prospects

The analysis conducted shows that soil desertification occupies a legally significant, yet still unfinished, position in the Italian legal order. The phenomenon is expressly referred in the Environmental Code, appearing in national and regional programs and addressing a variety of financial and planning instruments. Nevertheless, it continues to be regulated in a fragmented manner, without an organic framework capable to unify its concept, preconditions, intervention standards and criteria of public responsibility.

A first issue hence concerns the regulation. In the Italian experience, soil desertification is not treated as an autonomous field, but as a point of intersection among soil and water protection, spatial planning, agricultural policies, climate adaptation and environmental restoration. This approach has the advantage of fostering integration, but it also produces normative dispersion, since the phenomenon is constantly absorbed into broader regulatory regimes and ultimately lacks its own legal parameters, specific obligations and clear instruments for monitoring its prevention and reduction.

A further aspect deserving attention addresses the relationship between the unity of environmental protection and the territorial differentiation of implementation. Constitutional case-law clarified that the provisions contained in Part III of Italy's Environmental Code fall within the field of environmental protection, reserved to the exclusive competence of the State, although intersecting areas wherein the Regions retain significant administrative and programming functions. However, in the fight against desertification the gap between a unitary regulatory framework and territorial effectiveness proves particularly pronounced: State intervention defines the general perimeter, but the real impact

of measures depends on regional capacity to produce risk maps and programme interventions, to use the available funds and to coordinate the different administrative levels. It follows that the problem is not only the allocation of competences and resources, but the more substantive issue of equal implementation of environmental law across the national territory.

A third dimension concerns the legal value of programming instruments. Both the NAP and many of the regional initiatives examined – from the 2019 Sicilian Strategy to the Apulian pilot projects and the more recent measures for the renaturalisation of degraded soils – show that the Italian system rather relies predominantly on strategic documents, agreements, plans and calls for proposals.

In this perspective, initiatives such as the Life Desert Adapt project - that tested an integrated adaptive land-management model in Sicily and other Mediterranean areas, involving farms, local authorities and networks of actors in southern Italy - also offer important operational indications for translating European and national objectives to figth soil desertification into more effective practices. These instruments are undoubtedly important to lead administrative action. However, they often lack a sufficiently determinate framework of obligations, controls and consequences in cases of inertia or non-compliance, thereby raising the issue of the gap between planning capacity and binding force.

It is precisely on this ground, however, that the gap between planning capacity and binding force becomes apparent: the multiplication of strategies, plans and projects tends to lie on the borderline between "soft" and "weak" law, producing a surplus of programmatic statements and a deficit of legally enforceable responsibility, particularly in the most fragile territorial contexts. This gives rise to a structural tension between the role of planning as a technique for integrating sectoral policies and the difficulty of translating such instruments into verifiable operational obligations, supported by effective monitoring mechanisms, forms of conditionality in the use of financial resources and legal consequences in cases of inertia or non-compliance.

It is in this context that European Union law seems destined to play an increasingly decisive role. Whereas in the past the impact of the EU on this issue occurred itself mainly indirectly, through rules on climate, water, agriculture and biodiversity, the most recent developments in EU soil law and ecological restoration appear to steer the system towards a more intense legalisation of the field. Directive (EU) 2025/2360 on soil monitoring and resilience and Regulation (EU) 2024/1991 on nature restoration can, in this respect, be seen as potential factors in strengthening the binding dimension of the subject, insofar as they require more structured monitoring, more clearly defined targets and tighter linkages among scientific knowledge, planned and expected results.

Yet the question remains: whether are these developments actually capable to reduce reliance on predominantly non-binding planning or whether, on the contrary, they risk to fuel additional layers of planning deprived of adequate enforcement tools?

The challenge does not seem to lie so much in drafting new strategic documents rather than linking existing and future ones to common minimum standards for soil protection. Monitoring obligations, comparable reporting among the Regions and stricter access to financial resources may prevent territorial differentiation from turning into structural inequalities in the actual levels of soil protection.

In the light of these developments, it seems possible to argue that the main issue is not the absence of a legal references to soil desertification rather than the still dispersed and uneven character of its regulation. In other words, the problem does not seem to lie in a lack of instruments, but in the difficulty to bring them within a framework sufficiently coherent, measurable and coordinated, capable to ensure a minimum degree of uniformity in the soil protection standards while at the same time adequately taking account of territorial specificities.

From this perspective, soil desertification is also of interest for a broader consideration on national and European environmental law. The issue shows, first, how difficult is to keep the traditional fields of soil, water, landscape, agriculture and climate separately. It further highlights the growing centrality of knowledge-building and mapping as the prerequisites for public action. Finally, it suggests that environmental protection has to contend increasingly not only with the definition of competences, but also with the quality of the coordination tools, the monitoring systems and the criteria for assessing the effectiveness of the measures adopted.

It may hence be concluded that soil desertification represents a particularly significant vantage point from which to grasp current tensions among the unity of environmental protection, the plurality of levels of government and the growing influence of EU law. For this reason, that phenomenon seems destined to acquire increasing importance not only for public action, but also for the legal system's capacity to build more mature forms of integration among Science, Administration and Regulation.

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