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Cultural Ecosystem Services in Rural Landscapes: A Regional Planning Perspective from Italy

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Abstract

This paper proposes an innovative methodological framework for integrating Cultural Ecosystem Services (CES) into landscape planning, with the aim of enhancing the conservation and adaptive management of rural historical landscapes. Grounded in the principles of the European Landscape Convention and the recent Nature Restoration Law, the study advocates for a shift from prescriptive and sectoral approaches toward performance-based and ecosystem-oriented models. The research focuses on the Marche Region (Italy), where the historical landscape shaped by the *mezzadria* (sharecropping) system provides a representative case for testing the proposed methodology. Six spatial layers have been selected as ecosystem-based indicators to identify new potential landscape CES' hotspots as agricultural landscape high-value areas, and to redefine protection and management strategies. The analysis integrates historical, ecological, and cultural dimensions to construct a spatially explicit value matrix, supporting the definition of differentiated management zones. Results reveal the persistence of high landscape and ecosystem values in mid- and upper-hill areas, contrasted by the progressive loss of structural and functional diversity in lowland and peri-urban contexts. The findings highlight the need for more adaptive and flexible planning models, capable of incorporating nature-based actions, climate-smart agriculture, and performance-oriented evaluation criteria. The proposed approach demonstrates potential for replicability and policy integration, providing a decision-support framework to align landscape planning with rural development strategies and climate adaptation objectives. Despite limitations related to data availability and model simplification, the methodology contributes to the ongoing paradigm shift toward dynamic, evidence-based, and transdisciplinary landscape governance across Mediterranean regions.

Keywords: cultural ecosystem services CES; landscape-based spatial planning; resilient agriculture

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1. Introduction

Agriculture has historically represented the economic, social, and symbolic foundation of territories and their communities. Since as early as the 8th century B.C., with the emergence and consolidation of the Greek polis model, land ownership was regarded not only as a means of subsistence but also as a fundamental component of civic identity and political power. Although institutional frameworks and territorial organization have profoundly evolved over the centuries, the relationship between land governance and agricultural use has remained central in many Mediterranean cultures. Consequently, agricultural activity has played a decisive role in shaping territorial morphology, settlement patterns, and the cultural values associated with them, as elements deeply embedded in

collective perception. This historical relationship between agriculture and landscape is further reinforced by the European Landscape Convention (ELC) [1], which redefines the concept of landscape beyond the traditional view as a mere outcome of human–nature interaction. The Convention emphasizes its central role in sustainable development and in safeguarding territorial identity. By asserting that "no people, no landscape," the ELC introduced a new vision of territorial governance, positioning the landscape, conceived as a part of the territory shaped by human action, as a key component of quality of life for local communities, in both urban and rural areas, and across degraded as well as exceptional environments [2].

The landscape thus emerges as a bearer of identity and intangible values, such as narratives, knowledge systems, and traditions, classified as Cultural Ecosystem Services (CES) [3]. This renewed conceptualization, combined with profound socio-ecological transformations intensified by climate change, underscores the urgent need for a paradigm shift in landscape planning and sustainable management across multiple scales, grounded in an inclusive, transdisciplinary approach. The Nature Restoration Law, recently adopted by the European Parliament [4], strengthens the strategic framework for climate action and biodiversity conservation within the EU Green Deal, setting the goal of restoring at least 20% of the EU's terrestrial and marine ecosystems by 2030. Within this framework, the ecological reinterpretation of spatial and urban planning redefines the landscape, an inherently interdisciplinary system integrating multiple ecosystem values [5], as a central component in strategies for the restoration, protection, and enhancement of natural, rural and human-made environments [6]. Achieving these objectives requires the development of more adaptive and flexible planning models than those traditionally adopted. Such models emphasize performance-based assessments of ecosystem functions [7], enabling planners to address the growing complexity of territorial transformation processes in which landscape systems are deeply intertwined [8].

This calls for a rethinking of two key dimensions:

(a) Spatial, through the definition of new value and quality criteria for landscape assessment, consistent with evolving economic, environmental, social and cultural conditions [9]; and (b) Regulatory, through the promotion of strategic and programmatic approaches over rigid prescriptive frameworks, facilitating the implementation of innovative planning and management tools, such as Nature-Based Solutions (NBS), to enhance the adaptability and resilience of urban and rural systems. Regarding both the ecological and productive dimensions of rural landscapes, ecosystem-based mapping of environmental, historical, cultural and identity-related values enables planners to: (a) detect spatial variations in landscape value based on newly defined criteria and indicators; (b) develop targeted strategies for conservation and enhancement; and (c) design restoration actions in degraded or low-value areas, turning them into opportunities for landscape regeneration and recomposition [10]. Working with a spatially localized value scale allows the formulation of management strategies that integrate nature-based interventions and climate-smart agricultural practices, both essential to reinforcing the resilience of complex agri-productive systems [11].

In high-value areas, the integration of traditional elements with innovative components is crucial to ensuring profitability, enhancing local production, maintaining human and social capital, and preserving the defining features of traditional landscapes in the face of increasingly frequent extreme events.

1.1. A New Approach to the Landscape Plan for the Marche Region: From PPAR 1989 (Piano Paesistico Ambientale Regionale) to PPR 2025 (New Landscape Plan—Piano Paesaggistico Regionale)

Following the entry into force of Regional Law No. 19/2023, the Marche Region (Figure 1) has initiated the revision of its Regional Environmental Landscape Plan [12] to develop the new Regional Landscape Plan (PPR).

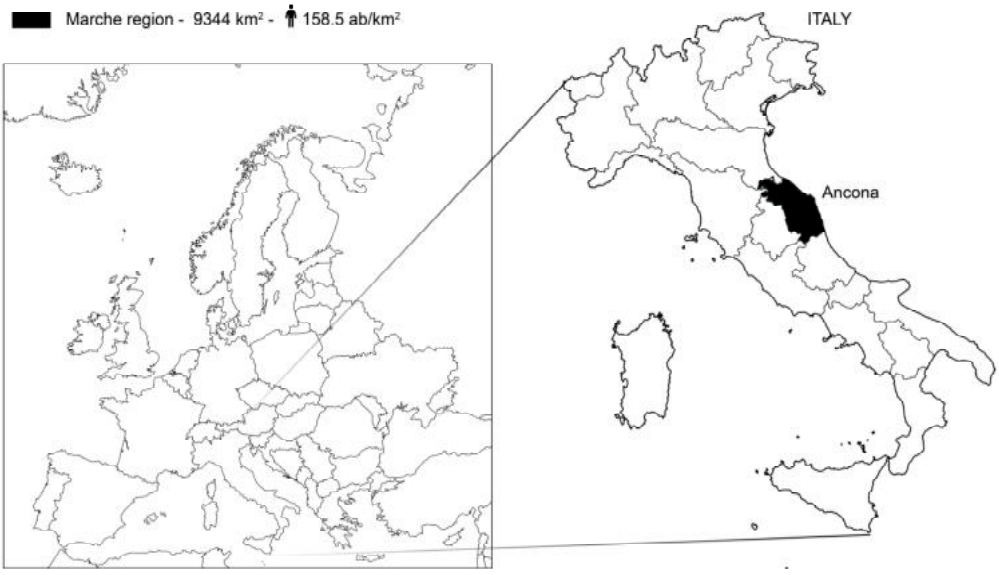

Figure 1. Geographic location of the Marche Region (case study area), Italy.

This update is driven by two main factors previously discussed: (a) the profound social and ecological transformations amplified by climate change, and (b) the conceptual evolution of landscape, starting from the preservation-oriented and defensive perspective of the 1922 Landscape Law to the inclusive vision introduced by the European Landscape Convention (2000) [1], which conceives landscape as both the outcome of human–nature interactions and a vital component of community identity and well-being.

The Cultural Heritage Code (Legislative Decree 42/2004), together with the recent Regional Law No. 19/2023, further consolidates this perspective, assigning the PPR the mandate to identify, safeguard, plan, and manage the regional landscape through an integrated and sustainability-oriented approach [13,14].

In this perspective, the new Plan defines 20 Landscape Units, establishes quality objectives and prescriptions, and introduces binding rules across all levels of spatial planning. It moves beyond the sectoral and thematic orientation of the previous plan (primarily aesthetic and regulatory in nature) which proved inadequate to address the increasing complexity of contemporary social, ecological, and territorial dynamics in which landscapes are embedded. By adopting a systemic and relational approach, the new PPR conceives the entire regional territory as a landscape to be recognized, managed, and enhanced. This shift lays the foundation for an integrated, multidisciplinary, and quality-oriented approach to landscape planning, supported by analytical and interpretive tools such as the Landscape Atlas, SWOT analysis, and the definition of new landscape quality objectives. Serving as a strategic reference for the forthcoming Regional Spatial Plan, the PPR plays a pivotal role in limiting land consumption, mitigating climate change, and promoting urban and territorial regeneration. Moreover, it contributes to strengthening both ecological and social resilience through a transdisciplinary integration of expertise spanning architecture, agronomy, ecology, sociology, and urban planning.

1.2. Scope and Objectives of the Research

Within this regulatory and operational framework, the paper presents the results of an experimental study developed as part of the technical–scientific support provided to the Marche Region for the drafting of the new Regional Landscape Plan (PPR).

Conducted by a multidisciplinary team comprising agronomists, botanists, and spatial planners, the research focuses on the revision of two key components of the regional historical rural landscape, which strengthen its structural framework, regulatory system, and guidelines for protection and enhancement. These components are represented through two spatial layers: (a) the agricultural landscape of historical and environmental interest (Article 51 of the Planning Regulations); and (b) the minor landscape features within the Landscape–Environmental Subsystem (Article 44 of the Planning Regulations). These correspond to the two fundamental landscape categories already established by the 1989 PPAR: the Historical–Cultural Subsystem and the Landscape–Environmental Subsystem.

Two major shortcomings were identified in the previous plan. The first concerned the lack of a structured knowledge base and a consistent methodological framework to support the identification and mapping of agricultural landscapes of cultural, historical, and identity relevance during the zoning phase. Consequently, the designated areas often failed to accurately reflect the traditional and identity-rich rural landscape of the Marche Region, unique in Italy for its diversity and for the mosaic of alternating cereal fields, vineyards, olive groves, and orchards that shape its rolling hills [15], alongside a dense network of rural farmhouses embodying the legacy of the *mezzadria* (sharecropping) system [16].

The second limitation related to the absence of georeferenced mapping and classification of minor landscape features within the agricultural landscape subsystem, such as hedgerows, riparian vegetation, mixed shrub formations, and isolated or linear tree features.

The lack of such spatial information resulted in an oversimplified regulatory framework, where uniform restrictions derived from the regional forestry law were generally applied to all categories of landscape features. This undifferentiated approach ultimately proved ineffective, constraining ordinary agricultural practices (e.g., pruning, selective thinning) and undermining the maintenance of their ecological, environmental, productive, and structural functions. In contrast, European studies and policy frameworks on green and landscape infrastructures highlight that context-specific management and targeted interventions are essential to preserve the diversity and complexity of the agrarian mosaic—core attributes of local rural landscape identity [17] and key contributors to biodiversity support [18,19]. From this perspective, outlining operational tools to support downscaling from the regional to the city-scale, and the design of differentiated management strategies is essential to preserve the diversity and complexity of the agrarian landscape matrix, as well as the structural components of local rural and peri-urban landscapes [20].

To address all these limitations, the main objective of this study is to develop and test an ecosystem-based methodology for integrating Cultural Ecosystem Services (CES) into regional landscape planning, by proposing a new set of ES-based indicators designed to enable a more coherent and spatially explicit assessment of cultural, historical, and heritage values of the regional agricultural landscape [21–23].

To this end, the study proposes and tests a method to identify, assess, and integrate into regional planning practice the cultural, historical, and heritage values of the traditional agrarian landscape of the Marche Region, interpreted as potentially offered Cultural Ecosystem Services (CES). The spatial model relies on six landscape indicators representing key components of the historical mezzadria (sharecropping) structure, conceptualized as potential CES supply according to the MEA and CICES 5.1 frameworks [3,24]. By assigning differentiated value levels based on the relative contribution of each indicator, the method

enables the identification of three ranges of ecosystem performance and the delineation of potential CES hotspots, corresponding to areas with the highest cultural and historical relevance.

By providing a replicable framework for differentiating management strategies, enhancing the assessment of social and cultural benefits, and supporting more participatory and socially inclusive approaches to landscape governance, this approach addresses a key gap in landscape planning research, specifically the limited operationalization of cultural and heritage values within spatial decision-support tools.

The main outcomes include: (a) the spatial definition of new CES' hotspots within the traditional hilly landscape shaped by the *mezzadria* system of the Marche Region, and (b) the redefinition of landscape protection levels, leading to the revision of both prescriptive measures and qualitative guidelines. The Discussion section critically examines the methodological strengths and limitations of the research, while the Conclusion outlines the main findings and future perspectives for the operational application of the proposed framework.

2. Materials and Methods

2.1. Case Study. The Marche Region's Mezzadria System: Key Elements

Known as "mezzadria", sharecropping in central Italy emerged in the thirteenth century as a unique partnership among landowners, tenants, and the labor force. This innovative arrangement quickly transformed agricultural practices and led to the development of a comprehensive territorial management model. It is a fascinating example of collaboration and resilience in farming history. Its expansion was primarily driven by urban elites, whose ownership and administrative control over rural land symbolized the consolidation of urban dominance across the countryside [25].

More than a mere mechanism for dividing agricultural yields equally between landlord and tenant, *mezzadria* represented an integrated socio-economic structure centered on the *podere*—a self-contained farmstead comprising a farmhouse inhabited by the tenant family. This organizational model fostered the development of a dense and finely articulated network of farms, initially characterized by large estates that gradually evolved into medium-sized holdings averaging approximately ten hectares. Each farm was managed by a sharecropping family whose composition and labor capacity were closely aligned with the productive requirements and spatial configuration of the holding (Figure 2).

Figure 2. Historical representations of the *mezzadria* landscape in the Marche Region, Italy.

In the Marche Region, this contractual and land management model became predominant between the fifteenth and sixteenth centuries, driven by several interrelated

factors: (a) economic efficiency, as it relied on family-based labor for the continuous management of agricultural holdings; (b) land value enhancement, associated with the process of appoderamento, the systematic parceling of land and construction of farmsteads; and (c) geo-pedological suitability, as it contributed to stabilizing clayey and erosion-prone soils through diversified cropping systems that required constant presence and labor, thereby promoting both territorial stewardship and soil conservation.

The *mezzadria* system, which persisted for centuries until its gradual dissolution in the mid-twentieth century, gave rise to a dense and finely articulated mosaic of farms.

Initially extensive, these holdings gradually decreased in size to an average of about ten hectares and were later fragmented into smaller plots ranging from three to five hectares. At the center of each *podere* stood the farmhouse, serving as both a productive and residential core, and connected by countyroads (strade bianche) to neighboring farmsteads and nearby villages. This long-standing management system, rooted in traditional agricultural practices, produced a distinctive rural landscape morphology along ridges and slopes: a complex, biodiverse eco-mosaic composed of multifunctional systems integrating croplands, hedgerows, tree rows, and small woodlots. The interplay between human activity and natural dynamics typical of *mezzadria* cultivation generated a distinctive mixed-farming landscape, characterized by alternating hydraulic and agricultural structures, small plots, crop rotations, and the prevalence of arable–vine systems.

This collective land management model produced, on the one hand, high ecological, landscape, and aesthetic resilience, but on the other, growing environmental fragility increasingly exposed to the effects of climate change.

Degradation processes such as erosion, landslides, and soil fertility loss, together with the decline of ecosystem services and the simplification of rural landscapes, call for a paradigm shift in landscape management, increasingly oriented toward risk and multi-hazard mitigation [26]. In such context, hill areas with slopes exceeding 10–15% results as the most vulnerable: abandonment or unsustainable management practices can trigger severe environmental impacts. These dynamics, exacerbated by falling agricultural prices, low economic valorization of hillside products, and the reduction in skilled labor, have led to landscape simplification and a progressive loss of structural and functional diversity, eroding historical landscape features.

2.2. Identifying the Potential Landscape CES Hotspots of the Traditional Landscape of the Marche Region

To address the objectives outlined, our methodological approach integrates two complementary frameworks: (a) ecosystem-based theories, concepts, and indicators commonly applied in spatial planning [27]; and (b) landscape evaluation methods derived from cultural landscape research [9,22].

This combined framework supports a systematic assessment of the cultural, historical, and heritage values embedded in the agricultural landscapes of the Marche Region. By considering the Marche agricultural landscape as the empirical case study, we designed a spatial modeling approach aimed at identifying physical areas and potential hotspots for the provision of "offered CES" [28]. The model operationalizes the current landscape structure through land-use configurations and incorporates a selection of six indicators representing key cultural landscape features. Established through a literature review and expert consultation, these indicators were translated into corresponding spatial layers. Together, they capture the essential structural elements that historically defined the sharecropping agrarian system and remain characteristic of the Marche hilly landscape (Table 1).

Table 1. Relationship between the key features of the Marche Region's traditional *mezzadria* landscape and the indicators of historical-identity rural landscapes. Indicators are defined by specific land-use categories, cross-compared within geodatabases progressively developed over time.

Landscape Plan's Thematical Systems	Landscape Features	Description	Spatial Layer Selected	Primary Databases	Source	Year
1.	Vegetation	Row of trees, such as oak trees, and cane ditches, as well as vineyards, divide the fields, adding to the structured appearance.	A. Small landscape features	Copernicus—Sentinel 1	https://land.copernicus.eu/en/products/high-resolution-layer-small-woody-features (accessed on 1 February 2025)	2018
2.	Rural Architecture	The landscape is dotted with farmhouses and small rural settlements that are integrated into the topography and often serve multiple functions for agricultural work and family life.	B. Farmhouses	Land Use Map. ISPRA elaboration on Copernicus data	https://groupware.sinanet.isprambiente.it/uso-copertura-e-consumo-di-suolo/library/copertura-del-suolo/carta-di-copertura-del-suolo (accessed on 1 March 2025)	2023
	Historical Context	The *mezzadria* system, which required tenant farmers to share their harvest with landowners, fostered intensive and meticulous cultivation.	C. Country roads	Land Use Map 1978–84. Marche Region elaboration	https://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica/Cartografia/Repertorio/Cartausosuolo10000_78-84 (accessed on 1 February 2025)	1984
3.	Hills and Fields Patchwork Effect	The landscape is dominated by rolling, green hills with a distinct geometry of rectangular and square fields. The mixed cultivation of crops like wheat, sunflowers, and legumes creates a vibrant patchwork, making the land appear like a well-tended garden.	D. Vineyards E. Olive groves	Carta della Natura. ISPRA elaboration on LANDSAT 7 ETM + data	https://www.isprambiente.gov.it/it/servizi/sistema-carta-della-natura/servizi-al-cittadino-1/modulo (accessed on 1 March 2025)	2022
	Anthropized Landscape	The result of centuries of human intervention, the landscape is a highly organized and cultivated environment, far from a purely wild state.	F. Mixed tree crops arable land 'seminativo arborato'	Land Use Map 1978–84. Marche Region elaboration	https://www.regione.marche.it/Regione-Utile/Paesaggio-Territorio-Urbanistica/Cartografia/Repertorio/Cartausosuolo10000_78-84 (accessed on 1 February 2025)	1984

Methodologically, the indicators correspond to landscape components already recognized by the Regional Landscape Plan (PPAR) and classified within three main thematic systems, as defined in Article 51 of the normative framework. Accordingly, our model considers: (1) the Natural System, including botanical and vegetational features—hedgerows, groves, isolated trees, riparian vegetation, and tree–shrub formations—that historically structured the cultivated hillscape; (2) the Anthropic System, including settlement patterns, the rural road network, and rural building ensembles, all of which constitute the spatial and identity-bearing invariants of the sharecropping territorial organization; and (3) the Productive Landscape System, represented by vineyards and olive groves forming traditional agricultural mosaics that have shaped slopes and ridgelines while sustaining high biocultural diversity.

Together, these components form the operational basis of the spatial model, enabling a replicable and transparent assessment of the offered CES within traditional agricultural landscapes.

The linkages between ecosystem features and the different non-material landscape values and cultural services provided by agricultural landscapes [23] underpinned the selection criteria. These characteristics are closely associated with cultural traditions, narratives, and skills that convey a sense of historical significance. Such attributes shape identity and place attachment, influencing how individuals relate to the surrounding environment. Together, these aspects define the cultural benefits of landscapes ([29], Table 2).

Table 2. CES evaluation potentially provided by the six landscape indicators identified in this study.

n.	Types of CES	Description	Associated Landscape Value
1.	Traditional knowledge	Understanding and transmitting historical land-use and management practices that integrate cultural, social, and ecological values, thereby shaping human–environment relationships.	Knowledge and information transfer, and science [3,24,30] related to cultural landscape dynamics and traditional management practices [31]
2.	Heritage [9]	Elements inherited from the past that express values, identities, affiliations, beliefs, knowledge, and traditions.	- Agricultural heritage, meaning the connection between agriculture, local traditions and identity, which reinforces the sense of place [23] - Historical value shaped by perception, cultural identity and place attachment [32,33]
3.	Symbolic and historical meaning of landscape feature	Contribution to shaping of community or area by providing icons and distinguishing it from others.	Landscape features as cultural symbols [34] and historical meanings that shape cultural identity, while attracting others to experience the cultural distinctiveness of an area [3,24]
4.	Sense of place	Elements forming a distinguished character as a reflection of a community, related to symbolic meaning and heritage.	Place attachment [3,30]; identity [35] and cultural distinctiveness

This synthesis provides an overview of the most relevant CES potentially supplied by agricultural landscapes, following the MEA and CICES 5.1 classifications [3,24,36]. In particular, the selected set of indicators was considered capable of influencing, or strongly determining, the benefits associated with four categories of CES: traditional knowledge, heritage values, symbolic and historical meanings of landscape features, and sense of place, all of which play a prominent role in agricultural landscape recognition [37]. Agricultural landscapes can provide multiple Cultural Ecosystem Services (CES), reflecting deep cultural significance and intangible values shaped by human–nature interactions, as acknowledged by the ELC. This capacity is particularly evident in rural areas characterized by multifunctionality, stability, and strong adaptation to local conditions. Traditional agricultural practices are especially relevant in this regard, as they have historically shaped complex and biodiverse landscape patterns, thereby supporting the provision of a wide range of CES [38]. The linkage between CES categories and landscape indicators was established through:

(a) Expert consultation in agricultural landscape management, agroecology, and traditional rural practices [39];
(b) The analysis of data from the Regional Landscape Plan; and;
(c) An extensive literature review [40,41].

In particular, several studies applying direct analysis of user perceptions of cultural services, often through crowdsourced data, were considered to validate the use of indirect measurement approaches [42–44].

This interpretative framework enables a more coherent and spatially explicit assessment of the rural landscape of the Marche Region, bridging tangible and intangible components through an ecosystem-based analytical perspective [45]. At this stage, the integration of spatial layers derived from the Regional Landscape Plan allowed the construction of a spatial model designed to support the prediction of CES provision and the assessment of landscape values. All data were integrated into a comprehensive digital dataset, and spatial analyses were carried out within a GIS environment (Figure 3).

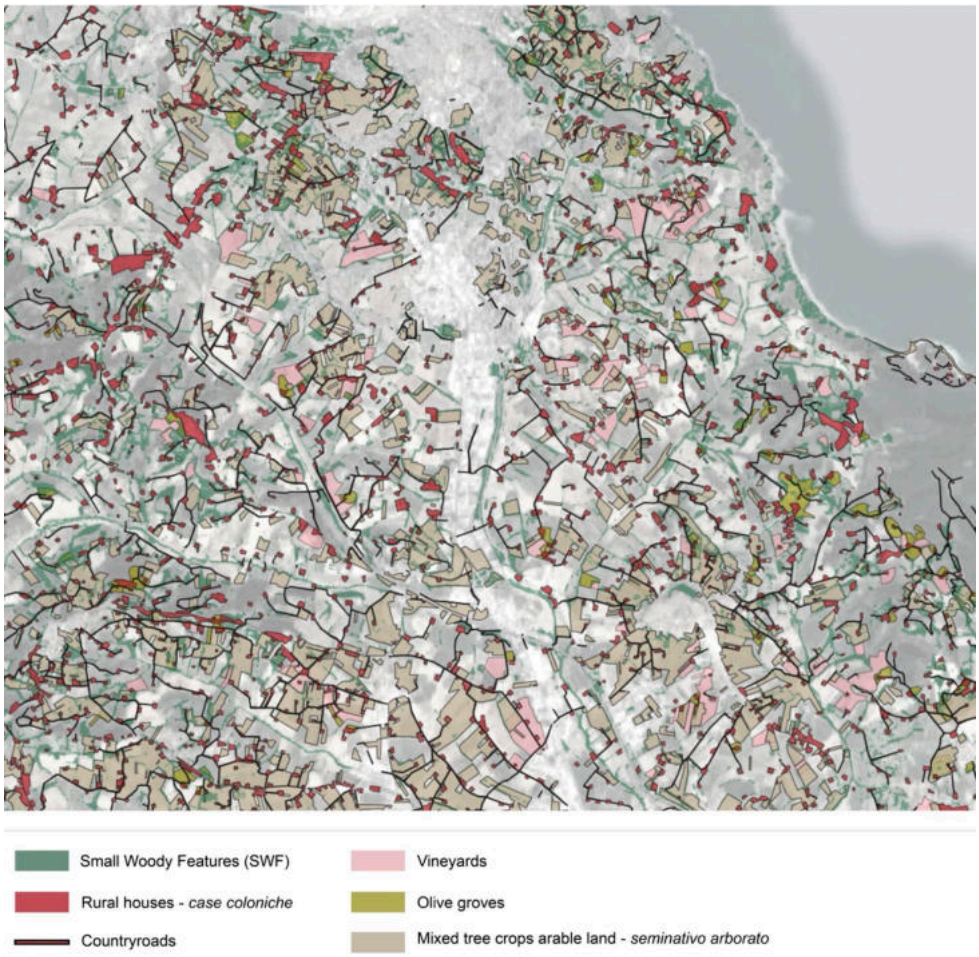

Figure 3. Spatial model based on the six agricultural landscape indicators selected.

To assess the distribution and concentration of point, linear and areal features belonging to both the rural and anthropic landscape, a regular square grid model was applied, corresponding to a surface area of 2 hectares. This dimension represents the minimum historical unit of the family-managed *mezzadrile podere*, traditionally designed to guarantee household subsistence. Historically, the size of these farm units varied between 2 and 10 hectares, depending on family composition and productive capacity, reproducing the traditional polycultural matrix that characterizes the region's historical rural landscape.

2.3. Description of Spatial Layers as Input Data (See Table 1)

A. Small Landscape Features (SLF)/minor landscape features within the agricultural landscape subsystem.

This category includes minor vegetational components structuring the agricultural landscape, such as woodlands, groves, riparian vegetation, hedgerows, and isolated trees—including mature or monumental specimens, as well as individual or clustered oaks. Anthropogenic vegetational features, such as rows of trees and roadside or field trees, were also incorporated when representative of historical or traditional planting forms (e.g., mulberries, olives, *folignate* systems).

Beyond their ecological functions—providing habitat, supporting biodiversity, sequestering carbon, and regulating hydrological and soil processes [24]—these features also possess significant aesthetic, cultural, and identity value, as integral components of traditional agricultural practices and the region's rural heritage. Their management is therefore

essential to safeguard and preserve the typological and historical–identity characteristics of traditional landscapes.

From a technical perspective, the dataset includes linear structures (hedgerows $\leq$ 30 m wide and $\geq$30 m long) and point or areal features (scattered trees and small woodlots) covering areas between 200 m^2 and 5000 m^2. Originally available as raster data with a 5 m spatial resolution, the dataset was converted into vector format through GIS-based geoprocessing, excluding urban and mountainous areas [46] (Figure 4).

Figure 4. Minor vegetational elements associated with drainage ditch management. Continuous belts of riparian vegetation, hedgerows, and small shrubs ensure the maintenance of multiple ecosystem functions and services. They contribute to the stabilization of slopes and the hydrogeological regulation of cultivated fields, reducing the risk of erosion, soil loss, and landslides. These elements are also essential for maintaining ecological connectivity and supporting biodiversity. Historically, the maintenance of hedgerows played a key role in providing rural households with firewood and supplementary food resources, thereby reinforcing the multifunctional character of traditional agricultural landscapes.

B. Farmhouses (*case coloniche*).

In Marche Region, the traditional farmhouses were considered multifunctional centers integrating production, storage, and domestic life within a single architectural unit. The sharecropping family represented both the social and economic core of the *podere*, embodying the self-sufficient model of the *mezzadria* system. During this period, farmhouses evolved into complex and adaptive structures supporting diversified agricultural and household activities. Their form reflected both the functional needs of mixed farming and the cultural identity of the rural landscape.

The size and layout of each farmhouse and its ancillary buildings were proportionate to the holding's extent and labor capacity [47]. The ratio between built-up area and

cultivated land ranged from 13 to 34 m^2/ha, depending primarily on productive efficiency, influenced by morpho-pedological conditions, management practices, and the performance of hydraulic–agricultural systems (Figure 5).

Figure 5. Traditional Marche farmhouses: typological features, architectural components, and integration within the hilly landscape. **Bottom right**: mid-slope farmhouse in Cesano di Senigallia. **Top right**: hilltop farmhouse with internal staircase in Castelvecchio di Monteporzio, Pesaro.

C. Country Roads (*viabilità poderale*/*strade bianche*).

The network of country roads (*strade bianche*), linking farmhouses to one another and to nearby villages, constitutes a fundamental component of the *appoderamento* system and of the territorial organization established under the *mezzadria* model. These routes structured the spatial and social relationships of the rural landscape, supporting both agricultural management and community interaction.

D. Vineyards; E. Olive Groves.

This category comprises permanent tree crops of vineyards and olive groves. In cases of intercropping with herbaceous species, the dominant cover type was used for classification.

The corresponding spatial layers were derived from the Habitat Map of the Marche Region, produced by ISPRA (Italian Institute for Environmental Protection and Research) in 2022 at a 1:25,000 scale [48].

Mapping was based on LANDSAT 7 ETM+ satellite imagery characterized by a pixel size of approximately 25 × 25 m, with a minimum cartographic unit of 1 hectare and exclusion of habitats narrower than 30 m. At the regional scale, photointerpretation identified approximately 15,000 hectares of vineyards and 13,100 hectares of olive groves, distributed across the entire Marche Region (Figure 6).

Figure 6. The Marche rural landscape characterized by alternating patterns of vineyards (**left**) and olive groves (**right**), forming the distinctive mosaic structure of the region's traditional agrarian landscape.

F. Mixed Tree Crops (*seminativo arborato*).

This category includes areas cultivated with annual herbaceous crops, intercropped with fruit trees, vines, or olives. Such mixed-cropping systems have historically shaped the spatial architecture and visual harmony of the Marche agrarian landscape, contributing to its ecological and cultural complexity [49]. Introduced as early as the sixteenth century to adapt to local geo-pedological constraints, these practices evolved during the eighteenth century into the characteristic *alberate* or *folignate* systems, where vines were trained on rows of trees such as elms or maples [50] (Figure 7).

Figure 7. Left: typical *folignata* near San Ginesio (Macerata Province), 1980s. **Right**: detail of a grapevine trained on a field maple, current photo. The term "folignata" refers to a traditional agroforestry practice in central Italy in which grapevines are trained to climb live trees, typically field maple or elm, forming a characteristic element of the historical mezzadria landscape.

At present, these defining components of the historical agrarian landscape have largely disappeared, including the former coexistence of olives, grapevines, cereals, and small woodland patches characteristic of the *mezzadria* system. Processes of land abandonment, agricultural intensification, and increasingly recurrent erosion events have become the primary drivers of structural degradation within the regional hilly landscape. These dynamics have resulted in a marked reduction in landscape diversity, thereby increasing the overall vulnerability of rural systems and contributing to their long-term decline functional and aesthetic quality.

2.4. Evaluation Method

Based on Table 3, each spatial dataset used as a landscape indicator was assigned both a percentage weight (0–100%) and a ranking score (1–5). This dual scoring system establishes a consistent methodological framework for comparing the spatial relevance and relative influence of each indicator within the predictive model.

Table 3. Three levels according to threshold index assigned to each spatial layer.

Level	Threshold	Weight (%)	Selected Spatial Layers
low	<1	<40	A, F
medium/high	≥1; <2.5	≥40; ≤80	B, C
high	≥2.5; ≤5	>80	D, E

The weighting procedure was refined through expert consultation. Lower weights were attributed to indicators that, although historically structural within the cultural agrarian matrix, have experienced significant transformations over time. As a result, their current contribution to CES linked to historical, cultural, and identity values is comparatively reduced [39].

Such evaluation has also been supported by a diachronic assessment of randomly selected sample areas across the region showed marked reductions in linear vegetational structures (hedgerows and riparian corridors) and a substantial loss of isolated tree elements within mixed croplands—features far more widespread prior to the 1950s (Figure 8). These changes are largely attributable to post-war mechanization and the progressive simplification of agricultural systems. Consequently, vegetational features corresponding to Levels A and F were assigned the lowest weights.

Figure 8. Diachronic survey and sample evaluation of landscape elements corresponding to Levels A and F. **Left**: 1954 aerial photograph; **Right**: overlay of the "Small Landscape Features" layer on the 2025 aerial map.

Indicators classified under Levels B and C (built landscape elements), belonging to the anthropic subsystem, are strongly associated with agricultural heritage and traditional knowledge. These features represent the foundational structure of the sharecropping landscape, shaping farm organization, land management practices, and long-term rural settlement patterns. Due to their continuity and their role in supporting cultural identity and CES provision, these indicators were assigned medium–high weights. This choice is further supported by the diachronic comparison of 1835, 1954, and current conditions, which confirms the persistence of the mezzadria spatial framework—most notably the rural road network and the dispersed farmhouse system (Figure 9).

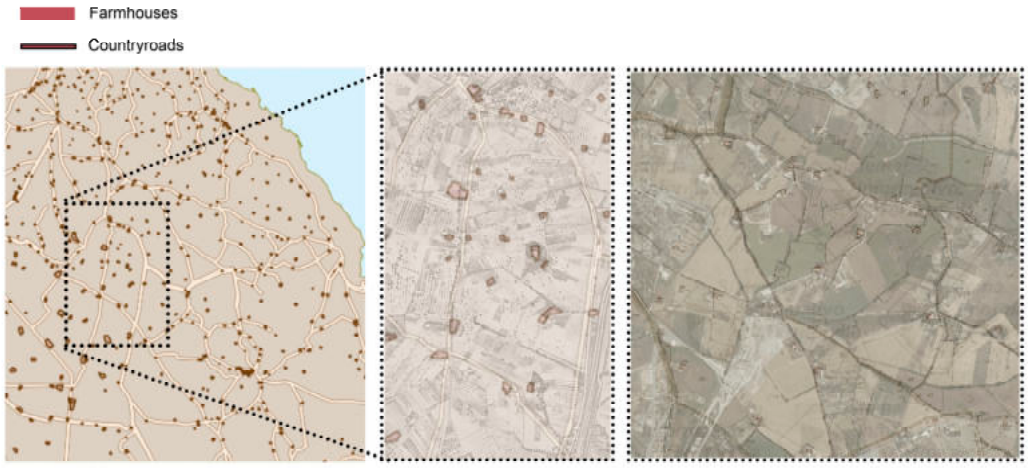

Figure 9. Map detail from the *Gregorian Cadastre* (1835, **left**) overlaid with the *GAI aerial survey* (1954, **center**), and the most recent aerial imagery (2025, **right**; https://www.provincia.ancona.it/Servizi-online/Web-Gis/Catasto-Gregoriano-1, accessed on 1 June 2025).

Levels D and E (cultivated elements) show a strong linkage with heritage values and traditional agrarian knowledge. Particularly, olive groves are widely recognized as the most representative components of the Mediterranean cultural landscape [36,51,52] and contribute aesthetic and identity-related value. Accordingly, these indicators were assigned the highest weights.

3. Results

Updating the Ecosystem Values of the Marche Region's Rural Landscape

The spatial distribution of the six indicators generated a gradient of localized ecosystem values across the reference grid (Figure 10a). By using a threshold-based classification, we identified new agricultural landscape CES "hotspots" across the regional agricultural landscape [22], corresponding to the highest value range.

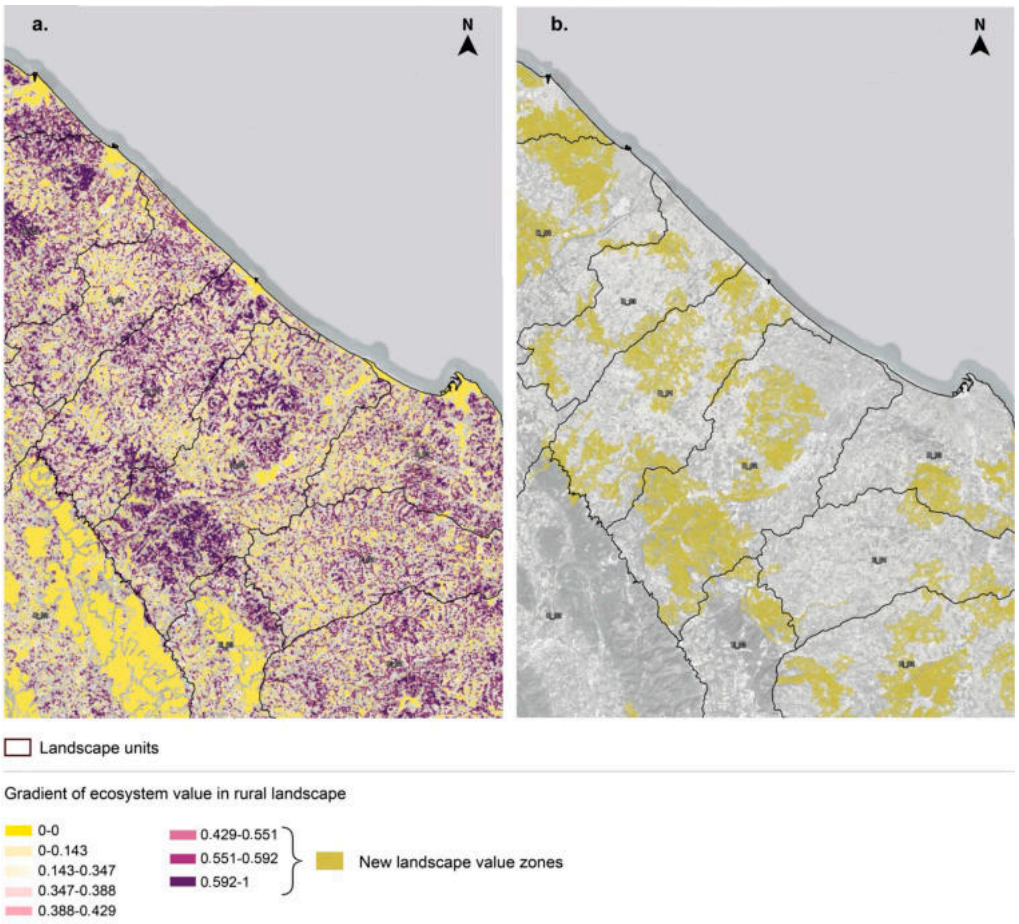

Figure 10. (**a**) Landscape value map based on the defined value gradient. (**b**) CES' hotspot of 'offered CES' within the regional landscape.

Based on agricultural landscape features and heritage assessments, these areas represent the major concentrations of CES and display a relatively homogeneous distribution throughout the region (Figure 10b). They also provide an updated interpretation of the traditional agrarian landscape historically shaped by the mezzadria system, highlighting its most significant cultural, ecological, and identity-related components within the Marche Region. Three levels of ecosystem performance have been associated with specific management objectives supporting the development of targeted strategies and policies and synthetize in Table 4. These strategies aim to balance economic and productive innovation with the active conservation of the region's landscape and environmental heritage.

Table 4. Correspondence between the three transformability levels and the related management strategies. High-value landscapes correspond to Level 3, marked by low transformability.

Color Range	Level	Value Range	Transformability Degree	Targeted Response Measures
	1	0–0.347	high	regeneration
	2	0.347–0.429	Medium-low	rebalancing
	3	0.429–1	low	Maintenance/valorization

The spatial model shows that potential hotspots appear widely distributed across the intermediate hilly belt, characterized by predominantly agricultural and productive land uses and located between valley floors and mountain areas (altitude > 600 m).

Higher concentrations are found in mid- to upper-hill areas, where the historical structure of the *poderi* system has been largely preserved. In contrast, mid- to low-hill

areas show evidence of progressive transformation, largely due to the loss of structural and functional diversity associated with agricultural intensification and land-use change.

To confirm this, the overlay analysis between the spatial layer representing the Historic Agrarian Landscape of Identity Value [12] and the newly identified CES hotspots reveal an underestimation of approximately 10% of the historical rural heritage in the previous plan, along with a limited spatial correspondence between the two datasets (Figure 11). The mismatch between landscape units and provincial administrative boundaries results in a fragmented regulatory and governance framework, generated limitations in the effective management of the rural landscape at the regional scale. A similar pattern emerges from the comparison with the geometries of the 20 regional landscape areas, designed according to the main geological, geomorphological, and hydrographic features (such as watercourses, valley systems, and slope patterns). In both cases, the analysis reveals that the absence of an intermediate administrative level constrains the coordination of local landscape management and the development of context-specific policies aimed at enhancing the multifunctionality and attractiveness of the rural territory.

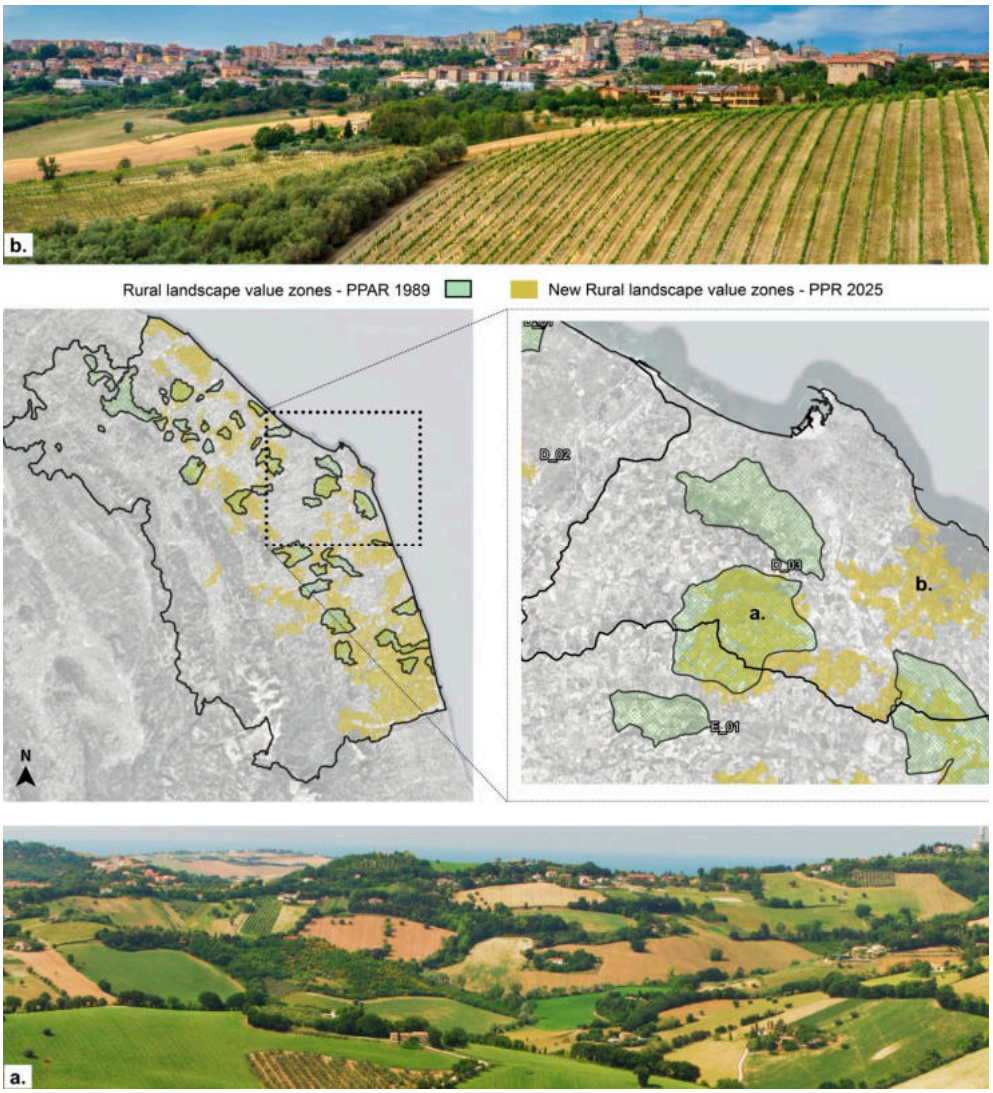

Figure 11. Top: View of Camerano and vineyards, Ancona province, Marche, Italy (**b**). **Center**: Spatial correspondence between high-value landscape areas and the Historic Agrarian Landscape of Identity Value spatial layer [12]. The overlay analysis highlights a partial mismatch, with an underestimation of approximately 10% of the historically recognized rural heritage, mainly concentrated in the mid- and upper-hill zones of the Marche Region. Bottom: Offagna Hills, Ancona Province (**a**).

From a quantitative perspective, the comparison between the new CES agrarian landscape hotspots (km^2) and those identified in 1989 shows a notable percentage increase in the historic rural landscapes of southern Marche, particularly within the provinces of Fermo and Ascoli Piceno. Specifically, the area F_03 (Ascoli Piceno) recorded a 44% increase, while E_03 (Dorsale di Cingoli e Alta Collina di S. Ginesio) expanded by 24%. These results confirm that the region's strong agricultural identity, reinforced by deep-rooted local traditions and a community-based rural culture, has played a decisive role in preserving the characteristic features and morphology of the traditional *mezzadria* landscape, thereby maintaining continuity in agricultural land use over time. Similarly, a 21% increase was observed in the landscapes of Macerata and Ancona, particularly in area D_02 (Jesi e la Vallesina), indicating a comparable persistence of traditional agricultural practices and territorial resilience.

Conversely, in the northern part of the region, a decrease in the historical agrarian landscapes areas equal to –26% in area A_02 (Urbinate e Alta Valle del Metauro) and –15% in area B_02 (Fanese e Valle del Metauro) was observed. These findings indicate a distinct landscape structure compared to the southern Marche: broader and more regular hill systems prevail, characterized by extensive crop cultivation and a less fragmented settlement pattern, in contrast to the mosaic of mixed crops and scattered settlements typical of the southern territories. In the central part of the region, a moderate decline was also recorded, with decreases of –14% in area D_03 (Paesaggio di Ancona) and –12% in E_01 (Loreto–Recanati e Val Musone, Table 5).

Table 5. Comparison between the 1989 and current spatial layers of traditional agricultural landscapes, classified by Landscape Units (a) and Province (b).

Abbreviation	**(a) Provinces (Name)**	**Area (km^2)**	**Rural Landscape Value Zones Year 1989 (km^2)**	**New Rural Landscape Value Zones Year 2025 (km^2)**	**Difference (%)**
PU	Pesaro Urbino	2510.82	239.03	234.49	−0.2
AN	Ancona	1963.21	278.10	278.10	6
MC	Macerata	2779.31	128.55	431.20	15
FM	Fermo	862.75	149.32	339.29	22
AP	Ascoli Piceno	1228.18	24.78	425.28	32
	Total	9344.29	819.8	1822.61	10
ID (*n.*)	(a) Landscape units (name)	Area (km^2)	Rural landscape value zones year 1989 (km^2)	New rural landscape value zones year 2025 (km^2)	Difference (%)
A_01	Il Monte Carpegna e le alte Valli del Conca e del Foglia	370.41	138.34	/	
A_02	L'Urbinate e l'Alta Valle del Metauro	520.37	137.73	1.28	−26
B_01	Il Pesarese	259.70	100.85	79.42	−8
B_02	Il Fanese e la Valle del Metauro	405.19	176.96	115.08	−15
B_03	La Valle del Cesano	238.32	59.83	56.06	−1
C_01	Cagli e le Valli del Candigliano ed alto Cesano	799.49	55.46	3.14	−6
C_02	Fabriano e l'Alto Esino	742.28	40.19	17.24	−3
C_03	Camerino e le Alte Valli del Potenza e del Chienti	610.74	-	5.98	0.9
D_01	Senigallia e la Valle del Misa	346.66	92.46	127.67	10
D_02	Jesi e la Vallesina	505.20	69.05	175.86	21
D_03	Il Paesaggio di Ancona	303.87	98.88	55.96	−14

Table 5. *Cont.*

Abbreviation	(a) Provinces (Name)	Area (km^2)	Rural Landscape Value Zones Year 1989 (km^2)	New Rural Landscape Value Zones Year 2025 (km^2)	Difference (%)
E_01	Loreto-Recanati e la Val Musone	343.00	85.10	40.84	−12
E_02	Le Colline del Maceratese	745.09	125.88	256.14	17
E_03	La Dorsale di Cingoli e l'Alta Collina di S. Ginesio	444.68	-	106.96	24
F_01	Fermo e la Vallata del Tenna	560.83	149.32	260.08	19
F_02	La Valle dell'Aso	275.12	98.41	219.73	44
F_03	Ascoli Piceno e la Città Lineare della Valle del Tronto	378.86	24.78	262.60	62
F_04	Il Monte dell'Ascensione e l'Alta Collina del Piceno	399.90	28.17	23.85	−1
G_01	I Monti Sibillini	749.12	-	2.18	0.2
G_02	I Monti della Laga e l'Alta Valle del Tronto	320.60	-	12.32	4

The observed differences can be attributed to the decline of the mezzadria sharecropping system, which began in the 1950s–1960s and subsequently enabled the rapid agricultural modernization of the region. This modernization process was considerably more intense in the hilly and lowland areas of northern Marche, particularly in the province of Pesaro.

A key factor explaining this divergence is the substantially lower incidence of mezzadria farm households in the northern portion of the region compared with the south, as evidenced by the provincial data from the 1936 agricultural census. These data indicate a markedly reduced presence of sharecropping families in northern Marche, which likely facilitated more extensive land consolidation and mechanization (Table 6).

Table 6. Extract from the 1936 Sharecroppers Map referring to the four provinces of the Marche Region.

Province	Resident Population (Year 1936)	Agricultural Household Members	Number of Sharecropper Households	Sharecropper Household Members	Rurality Index	Sharecropping Index	Sharecropping Index
	(1)	(2)	(3)	(4)	(2/1)	(4/1)	(4/2)
Ancona	365,940	181,987	15,547	121,382	0.50	0.33	0.67
Ascoli P.	300,218	190,540	15,502	117,891	0.63	0.39	0.62
Macerata	285,957	186,507	14,984	113,554	0.65	0.40	0.61
Pesaro	308,302	191,704	14,408	112,542	0.63	0.36	0.59

The detailed map of mezzadria distribution across central Italy confirms that the province of Pesaro exhibited the lowest sharecropping index among the regional provincial capitals, reinforcing the spatial disparity observed in the historical agrarian structure [53].

Moreover, intensive mechanization promoted the rapid expansion of extensive, easily mechanizable crops (e.g., cereals, sunflower, maize). These dynamics was accompanied by a progressive increase in farm size and the consequent consolidation of landholdings.

Such changes reflect the progressive loss of the fine-grained parcel subdivision that historically characterized the *mezzadria* system, resulting in more uniform and geometrically regular landscape patterns and a reduced expression of identity-rich cultural features.

These transformations were especially pronounced in the northern part of the region, where the combination of gentler topography, a more efficient infrastructural network, and geographical proximity to the highly modernized agricultural systems of northern Italy (such as Emilia-Romagna, Lombardy and Veneto) facilitated land consolidation and

structural simplification. The resulting patterns indicate a shift towards landscapes with lower configurational diversity [15,25,54].

Concerning the distribution of the traditional crops of vineyards and olive groves, the highest concentrations were recorded in areas F_03 (Ascoli Piceno e la Città Lineare della Valle del Tronto) and F_02 (Valle dell'Aso), with respective surface areas of approximately 6706 ha and 3811 ha, accounting for 17% and 13% of the total area. However, the relative incidence of these crops is higher in the northern historical–traditional landscapes (Urbino, Cagli) than in the southern ones (Fermo, Ascoli), where the overall landscape value remains more significant (Table 7). This finding confirms that, beyond the mere extent of land occupied by traditional arboreal crops, it is the configuration of the settlement landscape that plays the most significant role in shaping the landscape value matrix. The complex network of rural farmhouses, the widespread presence of agrarian features, and the system of country roads shaped by the mezzadria model together define the complex hilly morphology and represent the structural invariants that most strongly characterize the traditional landscape of the Marche Region (Figure 12a,b).

Table 7. Coverage of vineyard and olive grove areas across the 20 regional Landscape units.

ID (n.)	Landscape Units (Name)	Area (ha)	(a.) Vineyard (ha)	(b.) Olive Groves (ha)	Tree Crop (a. + b.) (ha)	Tree Crop/Total Surface (%)	Tree Crop/Landscape Value Zones (%)
A_01	Il Monte Carpegna e le alte Valli del Conca e del Foglia	37,041	53.6	24.5	78.2	0.2	/
A_02	L'Urbinate e l'Alta Valle del Metauro	52,037	74.5	26.9	101.5	0.2	78.7
B_01	Il Pesarese	25,970	437.3	741.4	1178.7	4.5	14.8
B_02	Il Fanese e la Valle del Metauro	40,519	585.0	989.2	1574.2	3.8	13.7
B_03	La Valle del Cesano	23,832	317.4	160.8	478.2	2.0	8.5
C_01	Cagli e le Valli del Candigliano ed alto Cesano	79,949	70.5	26.7	97.3	0.1	30.9
C_02	Fabriano e l'Alto Esino	74,228	405.6	82.8	488.5	0.6	28.3
C_03	Camerino e le Alte Valli del Potenza e del Chienti	61,074	121.0	144.1	265.2	0.4	44.3
D_01	Senigallia e la Valle del Misa	34,666	1118.6	666.3	1785	5.1	14.0
D_02	Jesi e la Vallesina	50,520	2588.6	1037.4	3626.1	7.1	20.6
D_03	Il Paesaggio di Ancona	30,387	637.4	306.0	943.5	3.1	16.9
E_01	Loreto-Recanati e la Val Musone	34,300	433.1	243.8	677	1.9	16.6
E_02	Le Colline del Maceratese	74,509	583.3	1541.3	2124.6	2.8	8.3
E_03	La Dorsale di Cingoli e l'Alta Collina di S. Ginesio	44,468	352.4	769	1121.5	2.5	10.5
F_01	Fermo e la Vallata del Tenna	56,083	761.6	1167.6	1929.3	3.4	7.4
F_02	La Valle dell'Aso	27,512	2442.2	1369.6	3811.8	13.8	17.3
F_03	Ascoli Piceno e la Città Lineare della Valle del Tronto	37,886	3712.0	2994	6706.1	17.7	25.5
F_04	Il Monte dell'Ascensione e l'Alta Collina del Piceno	39,990	357.1	330.7	687.9	1.7	28.8
G_01	I Monti Sibillini	74,912	7.69	159.2	166.9	0.2	76.5
G_02	I Monti della Laga e l'Alta Valle del Tronto	32,060	9.48	328.5	338	1.0	27.4

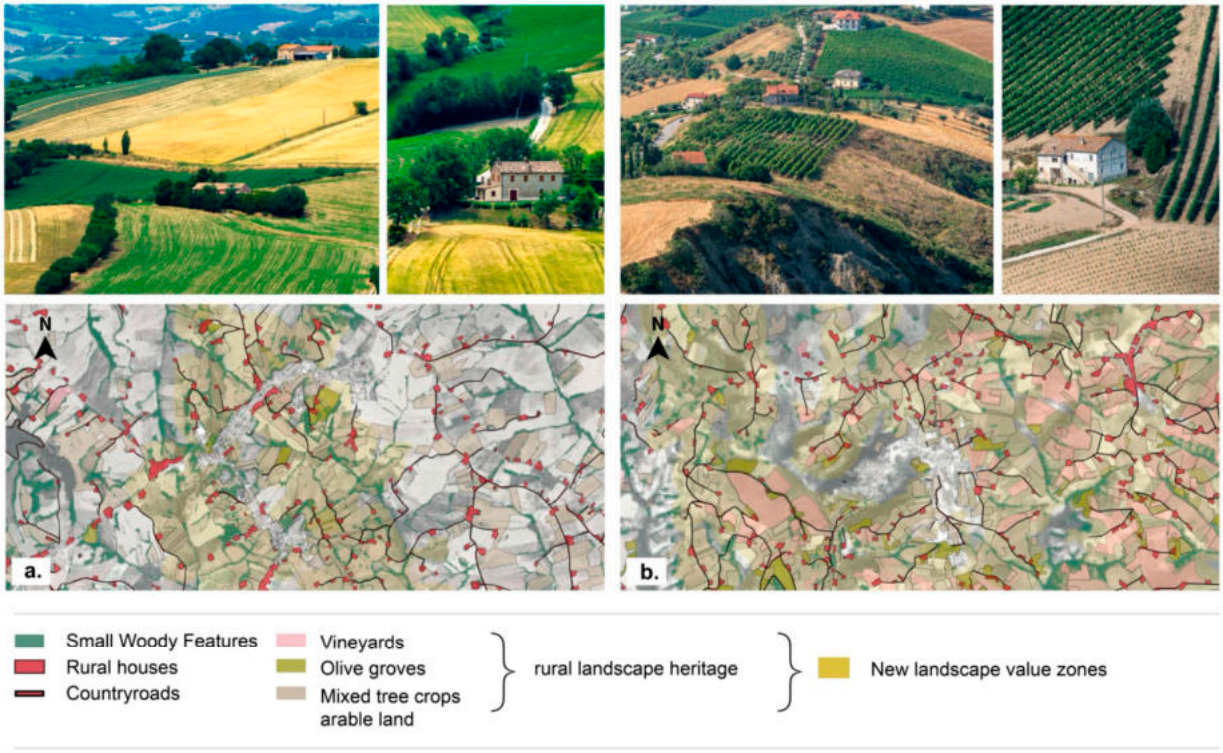

Figure 12. Rural landscapes of the Marche Region: (**a**) Fano–Mondavio road, Pesaro and Urbino Province (spring), characterized by extensive arable land and industrial crops (tobacco, sugar beet, maize) with scattered manor farms; (**b**) Ripatransone countryside, Ascoli Piceno Province (summer), showing the denser rural fabric typical of southern Marche landscape.

4. Discussion

Through the regional-scale case study of the Marche Region, this research advances an innovative methodological framework for landscape planning, centered on the definition of new ecological and landscape performance goals. These purposes emerge from an integrated interpretation of the historical, cultural, and ecological components embedded in rural areas, as well as from the relationships that connect them [22].

By integrating the predominantly qualitative and perceptual approaches, this study introduces a performance-based paradigm into landscape planning [55], that shift enables the subdivision of rural territories into value-based thresholds, defining distinct areas for the implementation of differentiated and context-specific management strategies. Performance analyses developed within an ecosystem-based framework thus become both disciplinary and strategic tools, integrated within the spatial planning system. They support ex-ante assessments of landscape quality and ex-post evaluations of transformation compatibility, providing a dynamic foundation for adaptive and evidence-based landscape governance.

From this perspective, the proposed methodology has the potential to evolve into an interactive decision-support system for municipal and regional planning. It can enhance the performance of landscape management and valorization through three main dimensions:

(a) The progressive implementation and improvement of knowledge frameworks, ensuring more detailed and continuously updated territorial information [56,57];
(b) The strengthening of regulatory coherence and effectiveness across planning levels;
(c) The support of new policy frameworks that promote nature-based actions and climate-adaptive agricultural practices, both essential for the long-term conservation and sustainability of traditional and identity-based rural landscapes (Table 8).

Table 8. Objectives and design strategies to foster climate-resilient agriculture within landscape planning. Action and measures of both categories could be applied distinctively, depending on the level of transformability (1-high, 2-medium low, 3-low).

Category	Objective	Level of Transformability	Targeted Response Measures	Actions/Measures
Conservation agriculture	Create a biodiverse, resource-conserving and resilient rural landscape	3—low 2—medium-low	maintenance/ valorization rebalancing	1. Climate-resilient crop and variety selection: promote cultivars resistant to drought, extreme temperatures, and other climate-related stresses; 2. Enhancement of soil ecosystem functions: improve water retention capacity, reduce erosion and soil loss risk, and increase soil fertility; 3. Restoration, recovery, and creation of minor agrarian landscape elements: hedgerows, tree rows, field trees, small watercourses, and terraced slopes; 4. Irrigation system efficiency: develop water storage systems (e.g., small hillside reservoirs) to supplement consortium water supplies.
Agro-technological Infrastructure	Enhance climate resilience, energy transition, and economic sustainability	2—medium-low 1—high	rebalancing regeneration	5. Active protection systems against abiotic stress: multifunctional nets (hail, wind, shading, rain, insect, photo-selective) to protect crops from extreme weather, pests, and diseases. 6. Agrivoltaics systems: integrate renewable energy production into agricultural landscapes.

The adoption of sustainable and climate-smart agricultural practices serves not only as a means of mitigating risk and supporting ecological transition but also as a driver for enhancing the multifunctionality of landscapes and local production systems. These practices reinforce the attractiveness of rural areas, particularly through the promotion of ecotourism [58].

Within this perspective, the landscape can be conceptualized as a distinctive territorial brand, capable of generating added value and supporting high-quality, identity-based agricultural products closely linked to the history and traditions of local contexts.

Accordingly, this study advocates for the adoption of an operational framework designed to foster synergy and alignment between rural development policies and landscape planning: despite the decentralized management of the Rural Development Plans (as key implementation tools of the Common Agricultural Policy, CAP) has facilitated the adaptation of interventions to local contexts by regional authorities, it has also limited the development of fully integrated policies for landscape enhancement.

Developing more flexible and adaptive planning tools, based on performance-oriented rather than merely quantitative–prescriptive principles, represents a crucial step toward strengthening networks and fostering synergies among beneficiaries, such as farms, consortia, and associations, and public institutions [59]. Such an approach would enable the consolidation of a shared vision that promotes the Marche landscape as both an identity-based and competitive territorial asset.

Regarding the limitations of this study, it should be emphasized that the spatial analyses developed are inherently dependent on the availability, resolution, and quality of spatial databases and territorial datasets, which may differ substantially across regions.

Consequently, while the proposed methodology is replicable in other contexts, its effective application requires adaptation to local knowledge frameworks and integration with existing planning instruments, including their specific strategic and regulatory settings [60].

In the case study of the Marche region, another limitation concerns the operational applicability of the model by municipal administrations in the preparation of the new General Urban Plans (PUGs), in accordance with Regional Law No. 19/2023. Effective implementation requires the availability of open-access databases and integrated infor-

mation systems that must be applied by managers proficient in geographical information systems [61]. Those conditions that are not yet consistently guaranteed within regional and local technical offices. Furthermore, the selection of high-value landscape areas was based on simplified analytical models, which necessarily abstract from the full complexity of real-world conditions and, to some extent, rely on expert evaluation (e.g., value assignment, threshold definition, and class subdivision). Although these choices were supported by analytical procedures designed to ensure the consistent use of spatial models, they nonetheless represent a potential source of partial bias [55].

Furthermore, the temporal dimension and the capacity to update and refine databases play a crucial role in maintaining interpretative coherence with ongoing territorial dynamics. This underscores the importance of developing an open, dynamic, and adaptive framework, capable of evolving in parallel with the transformations of local contexts and ensuring the long-term relevance of planning instruments [8,62].

Future developments should aim to enhance the adaptability and replicability of the method across different historical and cultural contexts by overlapping the main limitation of the present study, that consists in the lack of direct CES assessments potentially addressed through PGIS approaches and survey-based perception mapping. Integrating these bottom-up data with land-use-based CES hotspot identification would improve the evaluation of CES supply–demand trade-offs [63] and provide stronger support for landscape planning and policy-making.

Further refinement could also come from combining spatially modeled CES "supply" with user-generated data on CES value types. Incorporating social value mapping would allow for a more explicit consideration of differing social contexts and the variability of landscape values across socio-cultural groups [64].

The spatial model may be further strengthened through a combined top-down and bottom-up approach. The top-down component enables the identification of CES hotspots based on cultural landscape values and GIS-based indicators, while the bottom-up component incorporates user-derived perceptions collected through PGIS tools and structured surveys [65,66]. Integrating these data sources would allow for more robust CES value maps and a better understanding of social variability in landscape valuation.

Finally, embedding these outputs within the PPR policy framework and municipal planning guidelines would support the development of targeted measures and NBS B aimed at preserving, restoring, and enhancing key landscape features.

5. Conclusions

This paper has demonstrated how integrating Cultural Ecosystem Services (CES) into landscape planning can enhance both the conservation and valorization of rural historical landscapes [60]. Building on the European Landscape Convention and the recent Nature Restoration Law, the study advocates for a shift from prescriptive planning approaches toward more adaptive, ecosystem-based, and performance-oriented models.

The case study of the Marche Region, historically shaped by the *mezzadria* (sharecropping) system, served as an empirical setting for an innovative methodology grounded in georeferenced and ecosystem-based indicators. This approach enabled the identification of different value landscape areas, providing a more accurate representation of the region's cultural identity while establishing performance thresholds to support differentiated management strategies.

The findings highlight the resilience and cultural integrity of mid- to high-hill landscapes, alongside the increasing vulnerability of lowland and mid-hill areas affected by the gradual erosion of structural and functional diversity. Comparison with the previous Regional Landscape Plan [12] revealed both the expansion and underestimation of valuable

rural heritage areas, underscoring the need for updated and coherent territorial knowledge frameworks.

Despite limitations in data availability, model simplification, and the need for periodic updates, the methodology remains an effective and transferable tool when suitably adapted to different geographical and social contexts. Its integration can strengthen the alignment between landscape planning, rural development strategies, and climate-smart agricultural practices, while promoting the landscape as a distinctive territorial asset and identity brand.

Overall, the study advances a paradigm shift toward dynamic and performance-based landscape planning, offering transferable insights for Mediterranean regions where agriculture, culture, and identity remain deeply interconnected.

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Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

CES	Cultural Ecosystem Services
ELC	European Landscape Convention
PPR	New Regional Landscape Plan (*Piano Paesaggistico Regionale*)
PUGs	General Urban Plans (*Piano Urbanistico Generale*)
SLF	Small landscape features
CAP	Common Agricultural Policy

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