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INTEGRATED ASSESSMENT OF NATURAL POTENTIAL FOR SUSTAINABLE DEVELOPMENT IN THE EA SÚP SEMI-PLAIN

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INTRODUCTION

1. RATIONALE FOR THE RESEARCH

Natural conditions and resources underpin livelihoods and socioeconomic activities. Their improper use may degrade ecosystems and exceed the natural capacity for regeneration. Integrated assessment of the potential and constraints of natural territories is therefore necessary to guide sustainable resource use.

The Ea Súp semi-plain is a distinctive natural territory on the western margin of Vietnam's Central Highlands. It is characterized by low erosional surfaces interspersed with residual hills, a tropical monsoon climate with a prolonged dry season, and extensive dry dipterocarp forests. Interactions among relief, climate, soils, hydrology, and vegetation create spatially differentiated natural potential, while also imposing constraints on resource use, especially dry-season water shortages, land degradation, and the risk of forest decline.

Previous regionalization studies and investigations of terrain, climate, soils, and forests provide valuable knowledge of the Central Highlands. However, integrated landscape assessment for the entire Ea Súp semi-plain, delineated by natural boundaries and mapped in detail at 1:100,000, has remained limited.

Under increasing pressure from land-use changes, climatic variability, and the demand for environmental protection, a landscape-based approach can clarify the suitability and constraints of individual territorial units and support development directions that respect ecological functions. This is the rationale for the present dissertation.

2. RESEARCH OBJECTIVES AND TASKS

The objective is to establish a scientific basis for integrated assessment of natural potential from a landscape perspective, thereby supporting

proposals for the spatial organization of land use toward sustainable development in the Ea Súp semi-plain.

– To systematize the theoretical and methodological foundations for integrated assessment of natural potential from a landscape perspective.

– To analyze landscape-forming factors and compile landscape and landscape-regionalization maps at a scale of 1:100,000.

– To clarify landscape structure, functions, dynamics, and spatial differentiation within the study area.

– To assess the suitability, priorities, and natural limitations of landscape units for selected agricultural and forestry uses, and the ecotourism potential of Yok Đôn National Park.

– To propose sustainable spatial land-use orientations by integrating assessment results with actual land use, related plans, and conservation requirements.

3. SCOPE OF THE RESEARCH

The study covers the western part of the Ea Súp semi-plain, delineated primarily by natural boundaries, between 12°25′–13°45′ N and 107°25′–108°05′ E, with an area of approximately 4,778 km². Under the administrative boundaries effective from 1 July 2025, it extends across Gia Lai, Đắk Lắk, and Lâm Đồng provinces; its natural boundaries do not coincide exactly with commune boundaries.

The object of research is the landscape system and the natural potential of its constituent landscape units. Landscape types are the basic assessment units, with results aggregated by landscape subregion. Applications focus on agriculture, forestry, and ecotourism in Yok Đôn National Park. The proposed orientations provide a natural and landscape-based evidence base; they do not replace statutory land-use plans or a comprehensive assessment of the economic, social, and environmental pillars of sustainability.

4. MAIN THESES DEFENDED

Thesis 1. The Ea Súp semi-plain has distinctive landscapes arising from its combination of semi-plain relief and soils with a prolonged dry season, exemplified by extensive dry dipterocarp forests. Its landscapes comprise two classes, three subclasses, three vegetation-based formation types, and 60 landscape types, grouped into two landscape regions and five subregions.

Thesis 2. The identification of criteria and weights, together with suitability and priority assessments at the landscape-type level, provides a scientific basis for sustainable spatial orientations for agriculture, forestry, and ecotourism.

5. NEW FINDINGS OF THE DISSERTATION

– First, building on natural regionalization of the Central Highlands at 1:500,000, the dissertation studies the Ea Súp semi-plain in greater detail, using natural boundaries and a scale of 1:100,000. It clarifies distinctive characteristics, dominant factors, and internal patterns of differentiation, and delineates 60 landscape types, two regions, and five subregions.

– Second, it develops a system of assessment criteria, suitability classes, and weights tailored to the area's pronounced dry-season water stress. It clarifies the roles of water availability, soils, and terrain in landscape suitability for annual and perennial crops, representative crops, and forestry functions.

– Third, by integrating assessment results with land use, relevant plans, and conservation requirements, it proposes spatial priorities for agriculture, forestry, and ecotourism, identifies ecological constraints in Yok Đôn National Park, and highlights the need for resource management across administrative boundaries.

6. SCIENTIFIC AND PRACTICAL SIGNIFICANCE

Scientific significance: the dissertation develops an integrated landscape-based evidence base for identifying natural potential, revealing

spatial differentiation, and linking ecological functions to suitable land uses in a distinctive semi-plain territory.

Practical significance: landscape maps, suitability assessment, and subregional orientations can support land-use planning, forest conservation, water-resource management, and ecotourism organization, subject to current land status, local regulations, and environmental safeguards.

7. STRUCTURE OF THE DISSERTATION

Besides the Introduction, Conclusions and Recommendations, References, and Appendices, the dissertation comprises three chapters:

Chapter 1. Theoretical foundations of integrated natural-potential assessment using a landscape approach.

Chapter 2. Landscape characteristics of the Ea Súp semi-plain.

Chapter 3. Landscape assessment for sustainable development in the Ea Súp semi-plain.

CHAPTER 1
THEORETICAL FOUNDATIONS OF INTEGRATED NATURAL-POTENTIAL ASSESSMENT USING A LANDSCAPE APPROACH

1.1. OVERVIEW OF RESEARCH RELATED TO THE DISSERTATION APPROACH

International research on natural potential has gradually shifted from evaluating individual factors to integrated territorial approaches, treating landscapes as systems of interacting natural components. The FAO land-evaluation framework, multicriteria analysis, geographic information systems (GIS), and remote sensing help identify the suitability of territories for different uses. More recently, studies have also emphasized ecological functions, ecosystem services, and environmental constraints.

Vietnamese landscape studies have developed classification, regionalization, and suitability-assessment methods for agriculture, forestry, biodiversity conservation, and tourism. Integrating landscape theory with field observations, geographic information systems, and spatial analysis has increasingly supported evidence-based territorial planning. However, assessments differ in scale and may be limited by insufficient detail concerning local ecological constraints.

Work on the Central Highlands has established the region's natural boundaries and provided important geomorphological, bioclimatic, soil, hydrological, and dry dipterocarp forest data. Nevertheless, these studies either address the wider Central Highlands or individual natural components. The dissertation develops a more detailed and integrated assessment for the Ea Súp semi-plain as a distinct natural territorial unit.

1.2. THEORETICAL FOUNDATIONS OF INTEGRATED NATURAL-POTENTIAL ASSESSMENT FOR SUSTAINABLE DEVELOPMENT

Natural conditions refer to the features that occur objectively within a territory; natural resources are natural components and values that can be used or exploited; natural potential expresses the ability of the combined conditions and resources to support particular purposes. Natural potential is therefore not equivalent to actual exploitable capacity: it must be considered in relation to use requirements, available techniques, and ecological limits.

1.3. THEORETICAL FOUNDATIONS OF LANDSCAPE RESEARCH AND ASSESSMENT

Integrated natural-potential assessment using a landscape approach is based on the systematic interrelationships among geology, terrain, climate, hydrology, soils, organisms, and human impacts. Integration means more than adding separate indicators; it requires assessing them within spatially differentiated territorial units with specific structures and functions. At 1:100,000, landscape types provide the base units for scoring and suitability classification, whereas subregions are used to aggregate results and identify priority functions. In this dissertation, sustainable development is approached through the compatibility of land uses with landscape potential, functions, and natural limits, while considering existing land use, plans, and environmental protection. The assessment thus provides a natural and landscape-based foundation for spatial orientation, rather than a full evaluation of economic and social indicators.

1.4. RESEARCH PERSPECTIVES, METHODS AND PROCEDURE

Five research perspectives are applied: integrated, systems-based, territorial, historical–prospective, and sustainable-development approaches. They inform the delineation of natural boundaries, integration of natural

components, examination of landscape structure, functions, and dynamics, and selection of appropriate land uses.

The principal methods include: (i) statistical processing, analysis, and synthesis of documents and data; (ii) field surveys along two main routes and at selected sites to examine soils, relief, vegetation, and land use; (iii) cartographic and GIS methods to standardize, overlay, and edit spatial layers and produce maps at 1:100,000; (iv) landscape classification, transect analysis, regionalization, and ecological suitability assessment; and (v) climate statistics to estimate potential evapotranspiration (PET) using Thornthwaite, the aridity index K, and the Tourism Climate Index (TCI). Assessment criteria are selected according to the ecological requirements of each target land use and the territory's differentiation. Suitability or priority is assigned to three classes. A triangular comparison matrix is used for pairwise comparisons of criteria and calculation of weights. Weighted composite scores are then used to classify landscape types by intended use; maps are prepared through the spatial analysis of these data and field evidence. To determine the spatial distribution of bioclimatic conditions, station observations are interpreted in relation to elevation, landforms, and slope aspect, rather than by mechanically applying geostatistical interpolation algorithms. The aridity index K is calculated as PET/P to identify seasonal moisture deficits at observation stations. Because PET is estimated by the Thornthwaite method, the K thresholds in Circular No. 11/2024/TT-BTNMT serve as reference values for relative classification and are not methodologically identical to the index specified in that Circular. TCI is calculated using data from Buôn Ma Thuột station to examine tourism seasonality, with due consideration of local climatic differences when applying the results to Yok Đôn.

The research follows three linked stages: (i) identifying the research problem, objectives, and methodological framework; (ii) collecting and

standardizing data, conducting field surveys, and producing landscape classification and regionalization maps; and (iii) assessing suitability and land-use constraints, synthesizing results by subregion, and proposing spatial orientations. Each stage contributes to progressing from the identification of natural characteristics to the application of assessment findings.

CHAPTER 1 SUMMARY

A landscape approach allows natural components and their interactions to be assessed together within identifiable territorial units. The dissertation uses landscape types for suitability assessment and landscape subregions for synthesizing spatial orientations. GIS integration, fieldwork, climatic analysis, and weighted assessment methods provide continuity between theory, evidence, and research objectives.

CHAPTER 2

LANDSCAPE CHARACTERISTICS OF THE EA SÚP SEMI-PLAIN

2.1. LANDSCAPE-FORMING FACTORS OF THE EA SÚP SEMI-PLAIN

The Ea Súp semi-plain lies on the western edge of the Central Highlands, extends to the Cambodian border, and belongs to the Sêrêpôk basin. Its transboundary geographical position is significant for natural resource management, ecological connectivity, local livelihoods, and border security.

The geological substrate consists largely of Jurassic sedimentary rocks, with locally exposed igneous rocks and basalt formations in the south. The dominant landform is a relatively low erosional semi-plain, mainly 140–300 m in elevation, interspersed with isolated hills and mountains. The landscape rises toward the Đắk Mil basalt plateau. Terrain and parent-material differences strongly influence soils, runoff, and landscape differentiation.

The tropical monsoon climate is characterized by high temperatures and rainfall concentrated between May and October, followed by a dry season from November to April. Moisture deficits are particularly pronounced on the lower semi-plain. The dry-season K index is 4.1 at both Chư Prông and Ea Súp, 3.6 at Bản Đôn, 2.9 at Cầu 14, and 1.5 at Đắk Mil. This strong seasonal contrast shapes water availability, soil-forming processes, and vegetation dynamics. Some depressions also experience localized flooding during the rainy season. Surface water resources include the Sêrêpôk, Ia Đrăng–Ia Lốp, and Ea H'leo rivers, together with the Ia Mơ, Ea Súp Thượng, and Ea Súp Hạ reservoirs and other impoundments. Irrigation infrastructure helps stabilize agricultural production but does not eliminate spatial and seasonal variation in water supply. Groundwater potential is generally limited; land allocation and crop selection must therefore consider the actual capacity of local water supplies. Six bioclimatic types are identified using temperature, rainfall, dry-season length and aridity, with terrain and slope aspect considered in the spatial interpretation.

Five major soil groups and 11 soil types are distinguished. Common types include light-yellow soils on sandstone (Fq), degraded grey soils (Xa), and red-yellow soils on shale (Fs); basalt-derived soils are more concentrated toward Đắk Mil, whereas alluvial soils occur along rivers and streams. Dry dipterocarp forest, the characteristic open, seasonally deciduous broadleaf tropical forest, forms the region's dominant ecological feature. Semi-deciduous closed forests and evergreen forests occur where moisture conditions are more favorable. Agricultural expansion, reservoir construction, infrastructure development, and forest protection both create anthropogenic land cover and influence landscape structure and dynamics.

2.2. LANDSCAPE CHARACTERISTICS OF THE EA SÚP SEMI-PLAIN

Drawing on established landscape-classification systems, particularly that used for the Landscape Map of Vietnam, and taking account of local natural differentiation, the dissertation develops a six-level classification system. Landscape classes and subclasses reflect terrain conditions; landscape formation types reflect bioclimatic and vegetation characteristics; and individual landscape types at the lowest classification level express specific combinations of soils and existing land cover, including human impacts. The landscape map at 1:100,000 identifies 60 landscape types and illustrates the transition from low mountains and basalt surfaces to the semi-plain, where grey and ferrallitic soils and dry dipterocarp forests predominate. A north–south landscape transect of approximately 130 km, crossing 20 landscape types between Ia Púch and Đức Lập, demonstrates relationships among changes in terrain, soils, and vegetation cover.

Table 2.1. Landscape classification system of the Ea Súp semi-plain

No.	Classification level	Landscape units
1	Landscape system	Humid tropical monsoon landscape system
2	Landscape subsystem	No cold winter; pronounced dry season
3	Landscape class (2)	Mountains; plateau and semi-plain
4	Landscape subclass (3)	Low mountains; plateau; semi-plain
5	Landscape formation type (3)	Evergreen closed forest; semi-deciduous closed forest; open dry dipterocarp forest
6	Landscape type (60)	60 types formed by combinations of 11 soil types and seven existing land-cover units

Vertical landscape structure reflects relationships among geology, relief, bioclimate, soils, and vegetation in each landscape unit. Horizontal structure reflects the spatial arrangement and boundaries between landscape units of the same rank, with clear differences between the lower Ia Mơ–Ea Súp–Yok Đôn semi-plain and the transitional Đắk Wil–Đắk Mil area. These structural features also explain differences in crop suitability and in the roles of landscapes in protection, production, and conservation.

In functional terms, the study area supports both natural functions (soil protection, water regulation, habitat maintenance, and biodiversity conservation) and socioeconomic functions (agriculture, forestry, settlement, services, and tourism). These groups are not mutually exclusive: a landscape unit may support production while retaining important ecological functions. Land-use orientation must therefore consider current land cover and conservation requirements, rather than suitability scores alone. Landscape dynamics are shaped by rainy–dry seasonal rhythms, erosion and deposition, forest fires, and human-driven land-cover change. The rainy season promotes biomass growth but can also generate runoff and localized inundation; the

prolonged dry season reduces soil moisture and increases fire risk. Seasonal leaf shedding in dry dipterocarp forests creates a distinctive landscape appearance while making these ecosystems sensitive to inappropriate use.

2.3. DISTINCTIVE LANDSCAPE CHARACTERISTICS AND DOMINANT FACTORS OF THE EA SÚP SEMI-PLAIN

The Ea Súp landscapes are distinctive because of their extensive, low erosional semi-plain surfaces, relatively nutrient-poor soils, and tropical monsoon climate with a prolonged dry season. Their dominant features are the prevalence of semi-plain terrain, pronounced seasonal aridity, and extensive dry dipterocarp forests. These features contrast with the typical basalt plateau landscapes found elsewhere in the Central Highlands. Bioclimatic differentiation reflects the interaction between monsoon circulation and topography. Low-lying areas away from windward slopes experience marked moisture shortages in the dry season, while higher surfaces and sites with better moisture retention can sustain semi-deciduous or evergreen vegetation. These patterns help determine landscape types and explain the spatial distribution of dry dipterocarp forests.

2.4. LANDSCAPE REGIONALIZATION OF THE EA SÚP SEMI-PLAIN

Landscape regionalization proceeds from lower to higher levels, based on common origins, structure, bioclimatic features, functions, and spatial continuity. Two landscape regions and five subregions are identified; each subregion has its own advantages and constraints for land use.

Region I covers the northern and central portions of the study area. It comprises three landscape subregions: I.1 (Ia Mơ), characterized by varied terrain, forest landscapes, and agricultural areas constrained by seasonal water shortages; I.2 (Ea Súp–Ea Wer), with relatively level terrain, irrigation infrastructure, and an integrated agriculture–forestry function; and I.3 (Yok

Đôn), where dry dipterocarp forests and biodiversity conservation are predominant.

Region II comprises the transitional southern territory. Subregion II.1 (Đắk Wil) retains natural forests and is important for soil and water protection and ecological connectivity. Subregion II.2 (Đắk Mil) contains basalt-derived soils and relatively favorable moisture conditions, providing potential for perennial crops, while requiring protection of forest remnants and sensitive slopes.

Table 2.2. Main characteristics of the five landscape subregions

Code	Landscape subregion	Area (ha) / %	Predominant role
I.1	Ia Mơ semi-plain	—	Forestry, agroforestry and conditional crop cultivation
I.2	Ea Súp–Ea Wer semi-plain	150,643 / 31.5	Integrated farming and forestry with water management
I.3	Yok Đôn semi-plain	115,545 / 24.2	Conservation of dry dipterocarp forests and biodiversity
II.1	Đắk Wil semi-plain	48,531 / 10.2	Forest recovery, protection and ecological connectivity
II.2	Đắk Mil plateau	39,326 / 8.2	Perennial crops on basalt soils; soil and water protection

CHAPTER 2 SUMMARY

The dissertation clarifies the factors and processes governing landscape structure in the Ea Súp semi-plain. It maps 60 landscape types and delineates two regions and five subregions at 1:100,000. These territorial units provide the basis for suitability assessment and spatial orientations for land, water, forest resources, and ecotourism.

CHAPTER 3
LANDSCAPE ASSESSMENT FOR SUSTAINABLE DEVELOPMENT IN THE EA SÚP SEMI-PLAIN

3.1. LANDSCAPE SUITABILITY ASSESSMENT FOR AGRICULTURAL DEVELOPMENT IN THE EA SÚP SEMI-PLAIN

Agricultural assessment covers annual and perennial crops, including wetland rice, sugarcane, and mango as representative uses. After excluding natural forests, open water, and steep landscapes, 32 of 60 landscape types are assessed. The criteria consider terrain, soils, rainfall, dry-season aridity, and irrigation. Irrigation and aridity are the most influential factors for annual crops (0.262 each). For perennial crops, aridity has a weight of 0.262 and irrigation 0.214.

Among the 32 types assessed, 23 are highly or moderately suitable for annual crops and 27 for perennial crops. Favorable annual-crop areas occur primarily near water infrastructure; perennial crops have advantages on deeper soils, particularly those derived from basalt.

Table 3.1. Suitability assessment for three representative crops

Crop	Suitability	No. of types	Area (ha) / %
Wetland rice	Highly suitable (L1)	12	34,018.9 / 7.12
	Moderately suitable (L2)	11	44,245.2 / 9.26
Sugarcane	Highly suitable (M1)	15	25,752.5 / 5.39
	Moderately suitable (M2)	12	49,712.8 / 10.40
Mango	Highly suitable (X1)	19	66,864.9 / 13.99
	Moderately suitable (X2)	10	66,917.9 / 14.01

Wetland rice requires level terrain, soils with adequate water retention, and reliable irrigation. Sugarcane needs deep soils and sufficient moisture

during active growth; commercial production also depends on processing and transport. Mango can benefit from a defined dry season but requires irrigation during sensitive growth stages.

Highly suitable rice landscapes occur mainly in irrigated alluvial valleys. Sugarcane should be located near suitable production and processing infrastructure. Mango is comparatively well suited to deep, well-drained basalt-derived soils, but ecological suitability does not justify converting all such land to mango.

3.2. LANDSCAPE ASSESSMENT FOR FORESTRY DEVELOPMENT IN THE EA SÚP SEMI-PLAIN

Protection forests are evaluated according to location, landform, slope, soil depth, and rainfall; location receives the highest weight (0.400). Production forests are assessed using six indicators; soil type has the highest weight (0.334), followed by vegetation cover (0.267) and slope (0.200). Special-use forests in Yok Đôn National Park are reserved for conservation and excluded from land available for protection- or production-forest reallocation.

Table 3.2. Landscape assessment results for protection and production forests

Forest type	Priority / suitability	No. of types	Area (ha) / %
Protection forest	High priority (P1)	6	17,479.3 / 3.66
	Medium priority (P2)	15	136,721.3 / 28.64
	Low priority (P3)	25	180,750.7 / 37.87
Production forest	Highly suitable (S1)	16	61,076.9 / 12.80
	Moderately suitable (S2)	26	265,857.8 / 55.70
	Marginally suitable (S3)	4	8,016.6 / 1.68

Of the 46 types evaluated for forestry, 21 have high or medium protection priority and 42 are highly or moderately suitable for production forests. Protection priorities concern borders, low mountains, headwaters, and erosion-sensitive locations. Forestry orientations must also follow legal forest categories, existing management arrangements, and conservation requirements.

3.3. ANALYSIS OF LANDSCAPE POTENTIAL FOR ECOTOURISM AT YOK ĐÔN NATIONAL PARK

Yok Đôn National Park (subregion I.3) covers approximately 115,545 ha and contains 14 landscape types. Its dry dipterocarp forests, Sêrêpôk River, seasonal pools, biodiversity and buffer-zone cultures provide opportunities for ecotourism and environmental education.

Ecotourism potential is assessed through access, landscape attractiveness, ecological sensitivity, and tourism climate. The study focuses on Yok Đôn rather than assigning tourism suitability classes to all 60 landscape types.

Tourism Climate Index (TCI) values calculated from Buôn Ma Thuột data for 1980–2020 indicate favorable conditions in January–April and November–December (65–95). Scores are 53–56 in May–August and 62–66 in September–October. These values do not replace site-specific assessments of fire and visitor safety.

Table 3.3. Seasonal suitability of the climate for outdoor tourism

Season / months	TCI range	Rating
Jan–Apr; Nov–Dec	65–95	Good to ideal
May–Aug	53–56	Acceptable
Sep–Oct	62–66	Good

Dry-season fire risk, seasonal pools used by wildlife, erosion of trails, and fluctuating river flows constrain tourism. Visitor groups should use established routes and comply with park zoning, with seasonal limits adjusted to habitat conditions and management capacity. The available data do not justify a single park-wide carrying-capacity estimate.

3.4. PRIORITY SPATIAL ORIENTATIONS FOR AGRICULTURE, FORESTRY AND ECOTOURISM IN THE EA SÚP SEMI-PLAIN

Based on suitability assessments, existing land use, local plans, and conservation requirements, the dissertation proposes a sequence of priorities: protect special-use forests and critical protective functions; maintain irrigated rice land; develop commercial crops where soils, water, and production linkages are favorable; and allocate the remaining suitable areas to production forests and agroforestry. The areas proposed on the orientation map are not equivalent to the total areas falling within the ecological suitability classes.

Annual crops are prioritized in landscapes with suitable terrain and water supplies, especially the Ea Súp–Ea Wer subregion. Wetland rice should be retained on low-lying and alluvial land where irrigation is already available. Sugarcane production should be linked to raw-material supply areas, transport, and processing facilities. Perennial crops are concentrated more strongly on basalt-derived soils and the Đắk Mil plateau, with conditional development on suitable land in Ia Mơ and transitional areas; any expansion must reflect water availability and actual land-use efficiency.

Land uses classified as highly suitable must not automatically be expanded. Recommendations must also account for conservation restrictions, existing farm productivity, irrigation capacity, and the risk of soil degradation. In particular, mango suitability should not be interpreted as a recommendation to convert every suitable area to mango.

Special-use forests within Yok Đôn National Park have priority for conservation. Protection forests should be maintained or restored along border areas, in headwaters, around conservation buffer zones, and in erosion-sensitive locations. Production forests should be organized on landscapes with suitable site conditions outside areas prioritized for conservation or protection, combining restoration of vegetation cover, local livelihoods, and watershed conservation. The mapped priorities do not replace the legal procedures for classifying forest categories or local planning decisions.

Table 3.4. Priority land-use areas in the spatial orientation map

Priority land use	Area (ha)	% of area
Annual crops	62,988.2	13.18
Perennial crops	64,640.5	13.53
Protection forests	42,233.7	8.84
Special-use forest (Yok Đôn)	115,545.0	24.18
Production forests	189,537.6	39.67

Subregional orientations integrate natural landscape potential, current land use, and the principal protection and production functions of each territory (Table 3.5).

Table 3.5. Priority land uses by landscape subregion

Code	Priority land-use and conservation orientations
I.1	Perennial crops where water is sufficient; agroforestry and production forests; rainfed expansion restricted
I.2	Irrigated rice and annual crops; agricultural processing linkages; forestry and protection of water resources
I.3	Strict conservation and restoration of Yok Đôn dry dipterocarp forests; carefully controlled ecotourism
II.1	Forest restoration, protection, and maintenance of ecological links with Yok Đôn
II.2	Perennial crops on basalt soils; protect slopes, streams and forests

Proposed ecotourism orientations for Yok Đôn National Park reflect landscape differentiation, functional zoning, and seasonal rhythms. They include controlled use of dry dipterocarp forest trails, the Sêrêpôk river and rapids, low mountains, and buffer-zone ecological and cultural sites. Small groups and existing trails should be favored; access to wildlife congregation sites should be restricted, and tour frequency adjusted when fire danger or weather conditions are unfavorable. Monitoring visitor numbers, waste, trail erosion, water quality, and habitat disturbance will provide a basis for adapting activities to actual environmental carrying capacity.

CHAPTER 3 SUMMARY

Landscape assessment reveals uneven agricultural and forestry potential among landscape types and subregions, with water availability, the dry season, and soil properties acting as major constraints. Combining assessment results with current land use and ecological functions enables the identification of spatial priorities without equating ecologically suitable land with land recommended for conversion. Yok Đôn National Park has distinctive ecotourism potential, but activities must operate within conservation limits and seasonal constraints.

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS

1. The dissertation clarifies the characteristics, structure, functions, dynamics, and differentiation of landscapes in the Ea Súp semi-plain. The combination of low erosional semi-plain relief, a prolonged dry season, distinctive soils, and dry dipterocarp forests gives the territory its characteristic landscape identity. Dry-season water scarcity, poor soils, and the risk of forest decline are major constraints on land use.

2. Building on natural regionalization of the Central Highlands and applying a 1:100,000 scale, the dissertation establishes a classification system comprising one landscape system, one subsystem, two classes, three subclasses, three formation types, and 60 landscape types. It divides the study area into two landscape regions and five subregions, thereby clarifying internal differentiation within a natural territory that crosses administrative boundaries.

3. The dissertation develops criteria and weights for different land uses, evaluates 32 landscape types for annual and perennial crop groups and 46 for protection and production forests, and assesses wetland rice, sugarcane, and mango separately. It identifies 23 landscape types as at least moderately suitable for annual crops and 27 for perennial crops; 21 landscape types have high or medium protection-forest priority, while 42 are at least moderately suitable for production forests.

4. By integrating suitability results with existing land use, plans, and conservation requirements, the dissertation proposes priority areas for five land-use groups and orientations for five landscape subregions. Priorities reflect landscape functions and water supply; highly suitable land should not be converted mechanically to production where important conservation or protection functions remain.

5. Yok Đôn National Park, which contains 14 landscape types and characteristic dry dipterocarp forests, has substantial potential for ecotourism organized by routes, sites, and seasons. However, habitat conservation, wildfire control, and management of carrying capacity must take precedence over growth in visitor numbers. The dissertation provides a natural and landscape-based scientific foundation for sound resource use; it does not replace detailed statutory planning or a complete socioeconomic impact assessment.

2. RECOMMENDATIONS

First, as the Ea Súp semi-plain is delineated by natural boundaries but now extends across Gia Lai, Đắk Lắk, and Lâm Đồng provinces, greater interprovincial and intersectoral coordination is needed in the management of water, dry dipterocarp forests, soils, and interconnected ecological spaces. Landscape-map findings should inform the preparation and review of land-use and sectoral plans while remaining consistent with legal land status, socioeconomic conditions, and actual conservation functions.

Second, protect and restore natural forests, especially dry dipterocarp habitats in Yok Đôn; allocate crops according to soil suitability, drought conditions, and reliable water supplies. Ecotourism must follow functional zoning and seasonal ecological limits. Further application of the results should update spatial and field data and investigate socioeconomic impacts, landscape changes, and site-specific visitor carrying capacity when adequate data are available.

LIST OF PUBLICATIONS RELATED TO THE DISSERTATION

1. Nguyen Ngoc Anh, Hoang Ngoc Khac, Tran Thi Ngoc Lam, Vu Thi Thuy Ngan (2023). Drought monitoring using MODIS data and the Google Earth Engine platform: Case study in Dak Lak province. In Proceedings of the International Conference GIS-IDEAS 2023: Geospatial Integrated Technologies for Natural Hazards and Environmental Problems. Publishing House for Science and Technology.

2. Nguyễn Ngọc Ánh (2024). Đặc điểm các nhân tố thành tạo cảnh quan và ý nghĩa cho định hướng phát triển bền vững vùng bán bình nguyên Ea Súp [Landscape-forming factors and their implications for sustainable-development orientations in the Ea Súp semi-plain]. Tạp chí Khoa học Tài nguyên và Môi trường.

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