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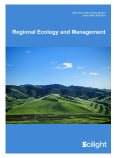

Article

Zoning of Non Timber Forest Products Especially Medicinal Plants in Proposed China Nepal Railway Corridor

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Abstract: Medicinal and aromatic plants (MAPs) are a critical livelihood resource for rural communities in Nepal, yet most species continue to be harvested unsustainably from the wild and traded in raw form with limited local value addition. To support ecological conservation and promote commercial cultivation, this study assesses land suitability for MAP cultivation along the proposed China Nepal Railway corridor, covering Kathmandu, Nuwakot and Rasuwa districts. A multi criteria evaluation framework integrating land use, accessibility, land system, protected area boundaries and elevation was implemented using the Analytical Hierarchy Process (AHP) and GIS based weighted overlay modeling. Four high value species *Gaultheria fragrantissima*, *Paris polyphylla*, *Taxus wallichiana*, and *Rhododendron anthopogon* were further examined by overlaying their ecological elevation ranges. Results indicate 31,056.50 ha of high suitability land and 36,811.30 ha of moderately suitable land across the corridor, with Nuwakot contributing the largest share. Species-wise suitability reveal distinct cultivation clusters aligned with district-level ecological gradients. The study provides region specific zoning and identifies intact habitats that could be designated as priority zones to promote commercial MAP cultivation, reduce pressure on wild harvesting, and guide future investment and policy planning under Nepal's "Make in Nepal" initiative.

Keywords: medicinal and aromatic plants (MAPs); Non Timber Forest Products (NTFPs); Nepal; AHP; suitability

1. Introduction

Medicinal and aromatic plants (MAPs) play a critical role in traditional healthcare systems and rural livelihoods throughout the Himalayan region [1,2]. Nepal hosts more than 6500 flowering plant species [3], of which over 2300 are reported to have medicinal value [4,5]. Despite this biological richness, the MAP sector [6] remains characterized by unsustainable wild harvesting, limited domestic processing capacity, weak market linkages, and high dependence on raw exports to India and China [7–9]. These challenges contribute to ecosystem degradation and restrict economic returns for harvesting communities [10].

Previous studies have highlighted concerns regarding overharvesting, habitat degradation [11–13], value chains [14], medicinal values [6,15], and trades [16]; however, informed cultivation planning requires spatially explicit assessments [17] that integrate ecological suitability, land-use constraints, accessibility, and conservation priorities [18]. Although GIS-based land suitability analyses have been applied to agricultural zoning [19] and conservation planning in Nepal, few studies have focused specifically on MAP species [20], and none have examined cultivation opportunities along a major infrastructure development corridor.

The proposed China–Nepal Railway corridor represents a potentially transformative development for Nepal's natural-products sector by enhancing cross-border connectivity, reducing transaction costs, and improving access to international markets [21]. Identifying ecologically suitable sites for MAP cultivation along this corridor is therefore crucial for guiding investment, supporting value-chain development, and minimizing unsustainable extraction of wild plant resources.

This study applies a GIS-based multi-criteria evaluation approach using the Analytical Hierarchy Process (AHP) [22] to identify potential cultivation zones for priority MAP species like *Gaultheria fragrantissima*, *Paris polyphylla*, *Taxus wallichiana*, and *Rhododendron anthopogon* across Kathmandu, Nuwakot, and Rasuwa districts. By integrating topographic, land-use, land-system, accessibility, and conservation layers with species-specific ecological filtering, the research aims to: (i) delineate highly suitable and moderately suitable cultivation zones; (ii) evaluate spatial differences in suitability among districts and species; and (iii) identify priority MAP cultivation zones that can support sustainable MAP-based enterprise development. The results provide practical planning tools to support regional forest management strategies and contribute to policy initiatives such as Nepal's "Make in Nepal" campaign.

2. Materials and Method

2.1. Study Area

This study was conducted in the proposed China Nepal Railway corridor. It consists of three districts Rasuwa located between 27°55′ and 28°25′ N–85°00′ and 85°50′ E.; Nuwakot located between 27°45′ and 28°20′ N–85°00′ and 85°45′ E. and Kathmandu located between 27°27′ and 27°49′ N–85°10′ and 85°32′ E. of Bagmati province, Nepal (Figure 1). The proposed China-Nepal Railway represents a revolutionary infrastructure project with the potential to significantly enhance trade, connectivity, and economic growth between Nepal and China. This project presents Nepal with an economic alternative to its conventional reliance on India for infrastructure development and trade [21]. It is anticipated that the China-Nepal Railway project will improve Nepal's access to international markets, draw in foreign capital, and encourage economic stability [23,24]. Better transportation networks and trade corridors will probably lower logistical costs and promote cross-border trade, which will support Nepal's economic development [25]. This corridor is strategically important due to its potential to improve connectivity with Chinese markets, expand high-value agricultural trade, and facilitate rapid transport to perishable or sensitive natural products, including medicinal and aromatic plants (MAPs). The selected districts span diverse topographic, climatic, and land-use gradietns, making them ecologically suitable for identifying spatially explicit MAP cultivation zones.

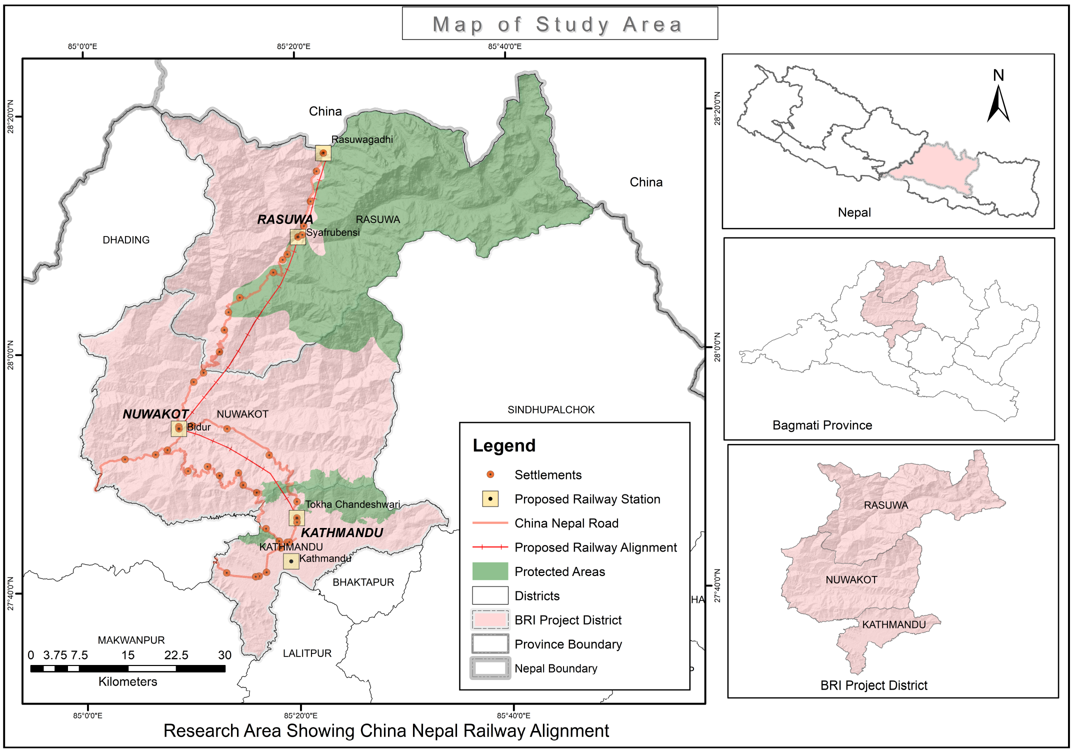

Figure 1. Map of study area.

2.2. Prioritized Species

The Government of Nepal has prioritized 33 important medicinal plants [26] (Table S1) for the purpose of their research and management. Among those, 13 plants were selected for agro-technology [27] (Table S2). The species are prioritized based on 8 principal criteria [28]: (i) Widely-sold commercial sps (ii) species having high market price (iii) potential for domestic value addition (iv) species available over wide geographical range (v) species harvestable in short rotation period (vi) land fertility requirement for species (vii) species importance in local ethnobotany and (viii) species conservation status.

2.3. Species Selection for Study

Gaultheria fragrantissima, Paris polyphylla, Taxus wallichiana falls under 33 priority medicinal plants for research and development and *Rhododendron anthopogan* which is highly valuable medicinal plants in this region. These species are selected on consultation with chief of Divisional Forest Office and officials of Department of Plant Resources (DPR) and Ministry of Forests and Environment and other stakeholders. They were selected using the following criteria; high commercial demand and market value, feasibility of domestication and value addition, ecological suitability for cultivation within mid to high altitude in the corridor. Additionally, the common and scientific name, distribution range of species are given in (Table 1).

Table 1. Selected species and their distribution range in study Area.

S. No.	Common Name	Scientific Name	Distribution Range (m)	Source
1	Dhasingare	*Gaultheria fragrantissima*	1200–2600	Efloras.org
2	Satuwa	*Paris polyphylla*	1800–3000	DPR
3	Sunapati	*Rhododendron anthopogon*	3300–5100	NEHHPA, 2017
4	Lothsallo	*Taxus wallichiana*	1800–3000	DPR

2.4. Research Design

Natural and anthropogenic factors influence land suitability for commercial NFTP/MAP farming. Natural characteristics such as slope and elevation limit accessibility, whereas manmade factors such as land cover, protected area systems, and accessibility influence whether or not commercial farming is feasible (Figure 2).

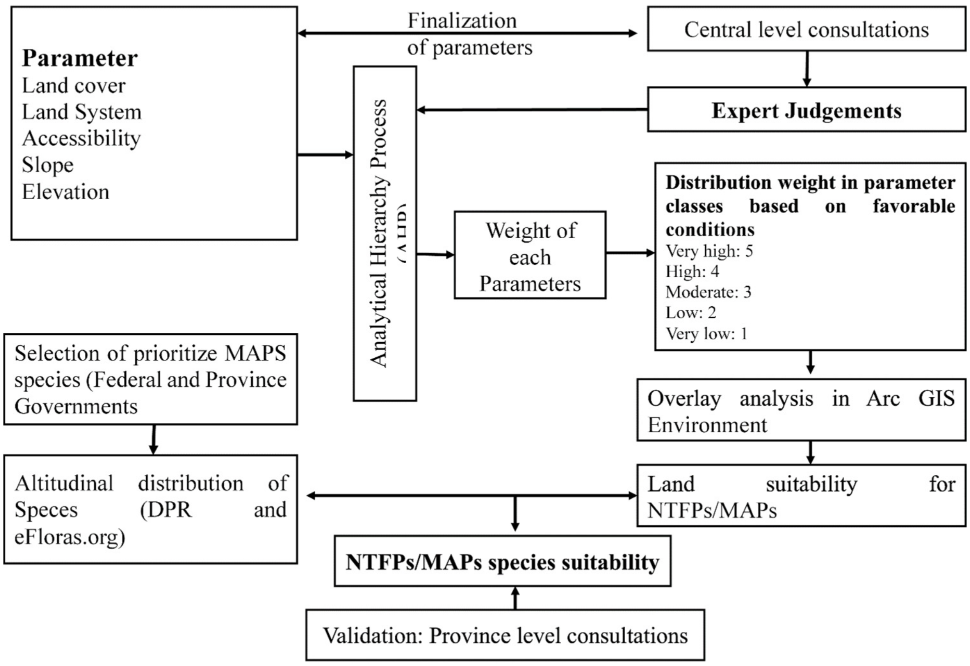

Figure 2. Flow chart of study.

In a complex context, the land system reflects both natural landforms and human involvement encompassing all processes and activities related to the human use of land, including socioeconomic, technological, and organizational investments and arrangements, as well as the benefits gained and unintended social and ecological outcomes [29]. Based on central level consultation at the Department of Plant Resources (DPR), six parameters were considered for suitability study. The Analytical Hierarchy Process (AHP) was used to assess the importance of each parameter and its weight, which was then assigned to classes depending on their preference. Following that, in ArcMap 10.8, a suitability map was constructed utilizing the weighted by sum through overlay analysis.

2.5. Selection of the Parameters and Data Preparation

2.5.1. Land Use

The current and historical trend of land use (Figure 3a) is the most important factor in evaluating the prospective area for medicinal plant development [30]. The Normalized Difference Vegetation Index (NDVI) was applied to distinguish dense from sparse forest based on canopy cover. Forest areas with canopy coverage above 60% typically show NDVI values greater than 0.3; therefore, regions with NDVI > 0.3 were classified as dense forest, while those with NDVI < 0.3 were categorized as sparse forest [31]. Intraclass weights for various land uses were set through a consultative process at the Department of Plant Resources (DPR) and confirmed in the presence of officials tasked with line agencies at the provincial and district levels. The land use types' scores varied from 0 to 5, with 0 indicating the least favorable land use type and 5 indicating the most favorable land use type, indicating that the favorable condition improves as the number of land use types increases (Table 2). The 1993 land-use data from the Department of Survey (DoS) was manually updated in QGIS using Google imagery and validated with ground-truth data collected in the field. The resulting classification achieved a producer accuracy of 86.5% and a user accuracy of 83.3%.

Table 2. AHP weights for study parameters.

Important Land Use Types and Their Weights		**Elevation Ranges and Their Weights**	
Land cover	Weight	Elevation range (m)	Weight
Builtup area	0	<4000	5
Cultivated land	3	>4000	0
Dense forest	0		
Sparse forest	5	Slope classes and their weights	
Shrub/bushes	4	Slope classes	Weight
Grassland	4	<10	2
River	0	I0– 20	3
Pond/Lake	0	20–30	5
Bare land	2	30–40	4
Snow/Glacier	0	>40	0
Barren land	2		
Orchard/Plantation	3	Accessibility for the farmers	
		Accessibility	Weight
Protected area systems and their weights		<1 Km	5
Protected Area	Weight	>1 Km	0
National Parks (NP) and Wildlife Reserves (WR)	0		
Conservation Areas (CA)	3		
Buffer Zones (BZ)	4		
Outside Protected Areas (PAs)	5		

2.5.2. Elevation

Elevation is a key factor (Figure 3b) in determining local eco-climatic diversity in Nepal [32]. The average snow line in Nepal is 5000 m; 4500–5000 m in the Western and Central parts (average 4750 m) and 5000–5500 m in the Eastern part (average 5250 m), whereas it varies from 4000–6000 m depending on precipitation and other climatic variables [33,34]. Permanent traditional communities have been found up to 3900 m (e.g., Khumjung) [35]. This means that any type of development must be focused up to 4000 m (Table 2).

2.5.3. Slope

Terrain roughness denotes a change in slope, as well as undulation or relief variation [36]. In a mountainous country like Nepal, slope (Figure 3c) effects land productivity in two ways [37]. It is difficult to develop commercial farming products in areas with slopes greater than 40 degrees, hence such areas must be preserved. The land with a lower slope, which is primarily low land area near the river or inner river valley with or likely area for irrigation, should be retained as cultivated land, which is also important from the perspective of food security, and the allocated weight is the smallest (Table 2).

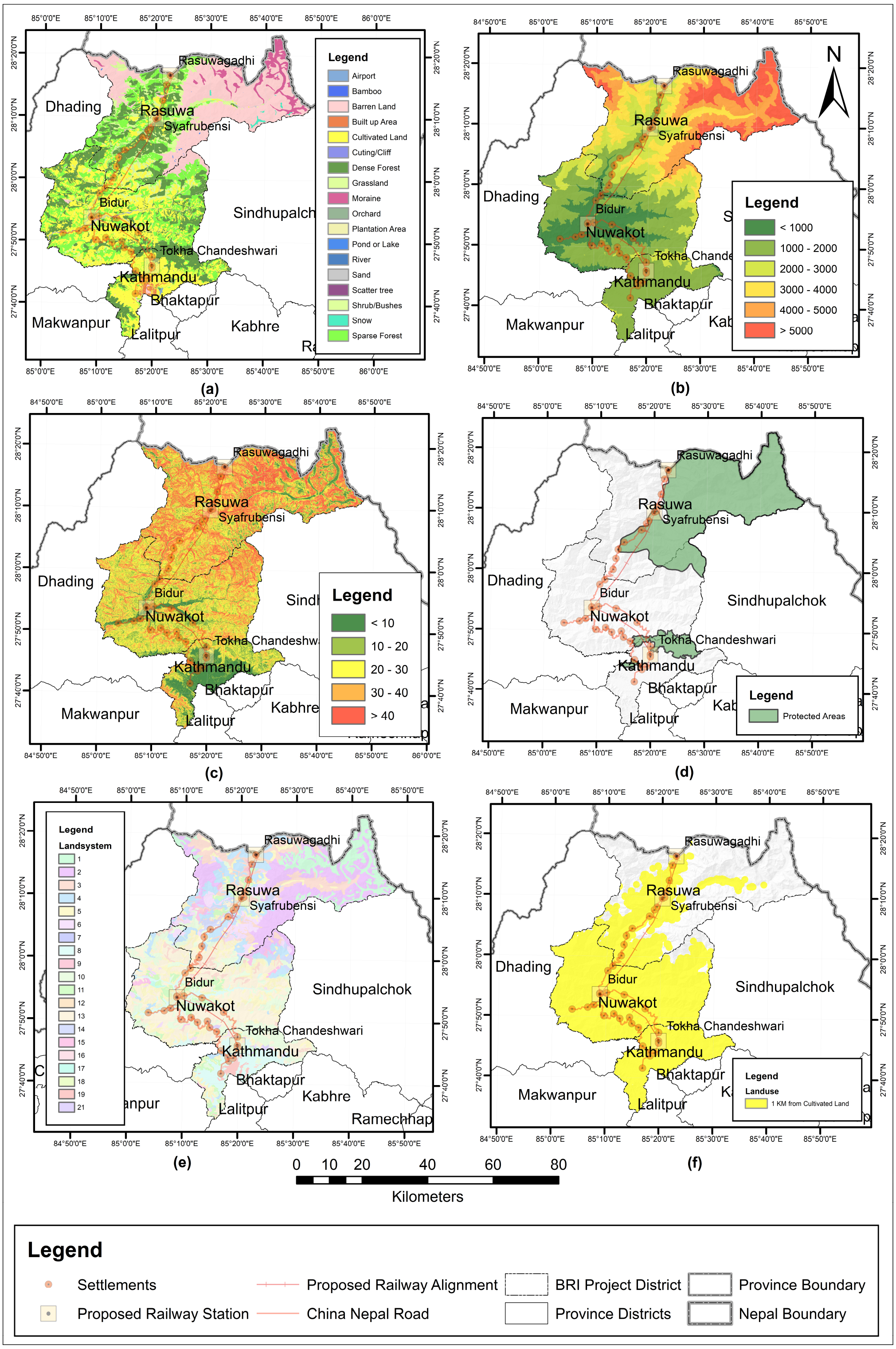

Figure 3. Map of parameter used in study (**a**) Land Cover (**b**) Elevation (**c**) Slope (**d**) Protected area (**e**) Landsystem (For legend details refer to Table S3) (**f**) Accessibility.

2.5.4. Protected Area

Since 1973, the Government of Nepal has built a network of 20 protected areas (PAs) (Figure 3d), which includes 12 national parks, 1 wildlife reserve, 6 conservation areas, and 1 hunting reserve. Protected areas (PAs) have been established to provide ecosystems, biological processes, and species with a level of protection [38,39]. In recognition of the rules and regulation of protected areas for the public, following weight was assigned as in (Table 2).

2.5.5. Land System

Land systems, in essence, provide processes and activities associated to both natural landforms and human land use, such as economical, technological, and potential land capability, as well as social and ecological inputs [29] (Table S3). Valley farming with irrigation, for example, is existing or economically viable to install irrigation. This is territory where commercial agriculture is feasible (Figure 3e).

2.5.6. Accessibility

Commercial cultivation of NTFPs is influenced by their proximity to settlements [40]; therefore, areas within 1 km (Figure 3f) of existing cultivated land were identified as suitable for commercial NTFP farming (Table 2).

High-resolution datasets for soil type, soil moisture, microclimatic variation, disturbance history, and habitat-specific ecological processes were not consistently available for the three districts at the spatial resolution required for plantation-scale suitability analysis. As a result, the model relies on elevation, terrain, land-use structure, and accessibility as primary determinants of cultivation feasibility. This approach aligns with several MAP-focused suitability studies conducted in the Himalayan region, where altitudinal range and broad land-system characteristics function as reliable proxies for ecological tolerance [41]. We acknowledge that the absence of microhabitat and soil-based variables may under-represent fine-scale ecological variation, and this has been explicitly noted as a limitation in the discussion.

2.6. Analytical Procedures and Weight Calculation

The importance of the characteristics for various decision-making purposes was evaluated using the AHP (Analytical Hierarchy Process) method introduced by Saaty in 1980 [22]. This method is also applied in natural resource management projects all over the world [42,43]. AHP assesses options for decision-making in a methodical way, comparing them pair by pair under each criterion or attribute (Table S4). The comparison input values are based on expert judgments, whereas the result is derived via a systematic mathematical formula. In a pair wise comparison matrix, two factors are compared in terms of relevance one at a time. The comparisons are made using a scale of absolute judgments that represents, how much or more one element dominates another with respect to a given attribute (Tables 3 and 4).

To separate the importance of the criterion, the first step in computing the AHP is to set criteria priorities or relative weights (Reciprocal matrix) [44]. The pairwise comparison matrix was then normalized to determine weights [45]. Finally, using the following ratio, a consistency ratio is computed for the pairwise comparison matrix to verify the degree of believability of the relative weights [44].

$$CR = CI/RI \tag{1}$$

where (*RI*) is the random consistency index for n (parameters) = 19, *RI* = 1.65 [46].

The consistency index (*CI*) is determined using the following equation [47].

$$CI = (\lambda\text{max} - \text{n})/\ \text{n} - 1 \tag{2}$$

where *λ*max is the maximum value of eigen vector, and (n) is the criteria number.

If the value of consistency rate (*CR*) is above (0.10), then there are inconsistencies in the evaluation process, but if the (*CR*) value is less than (0.10) indicating the consistency in evaluation process.

Table 3. Comparative matrix.

	Land Use with Forest Density	Elevation	Slope	Protected Area	Land System	Accessibility
Land use with forest density	1	3	2	2	2	3
Elevation	0.3	1	0.5	1	1	1
Slope	0.5	2	1	2	2	2
Protected area	0.5	1	0.5	1	0.5	1
Land system	0.5	1	0.5	2	1	1
Accessibility	0.333	1	0.5	1	1	1
	3.17	9.00	5.00	9.00	7.50	9.00

Table 4. Normalized matrix.

	Land Use with Forest Density	Elevation	Slope	Protected Area	Land System	Accessibility	Average	Weight
Land use with forest density	0.32	0.33	0.40	0.22	0.27	0.33	0.31	31
Elevation	0.11	0.11	0.10	0.11	0.13	0.11	0.11	11
Slope	0.16	0.22	0.20	0.22	0.27	0.22	0.22	22
Protected area	0.16	0.11	0.10	0.11	0.07	0.11	0.11	11
Land system	0.16	0.11	0.10	0.22	0.13	0.11	0.14	14
Accessibility	0.11	0.11	0.10	0.11	0.13	0.11	0.11	11

Eigen vector—6.15; *CI*—0.03; *RI*—1.09; *CR*—0.03.

2.7. Analysis of Suitable Area

A composite appropriateness index was created by integrating all layers of standardized criteria using weighted overlay analysis. Three appropriateness classes were created by reclassifying the resultant values: Low suitability (scores < 0.30), moderate suitability (scores 0.30–0.70), and high suitability (scores ≥ 0.70). Sites in legally limited core protected areas and areas higher than 4000 m were not taken into account for cultivation.

3. Results

3.1. Overall Land Suitability across the Corridor

A total area of 312,590 ha across the three study districts was evaluated for MAP cultivation suitability. The weighted overlay analysis identified 31,056.50 ha (9.9%) as highly suitable and 36,811.3 ha (11.80%) as moderately suitable, together representing approximately 21.7% of the corridor landscape suitable for potential MAP cultivation (Table 5). Remaining areas were excluded primarily due to steep terrain, urban land cover, conservation restrictions, or limited accessibility.

Table 5. District wise high suitability area in hectare for NTFPs and MAPs in China Nepal Railway corridor.

District	High (hectare)	Moderate (hectare)
Kathmandu	1787.50	2739.20
Nuwakot	19,695.20	18,172.30
Rasuwa	9573.80	15,899.80
Grand Total Area	31,056.50	36,811.30

District-level contributions to highly suitable land differed markedly. Nuwakot district contained the largest share with 19,695.20 ha (63.40%), followed by Rasuwa district with 9573.80 ha (30.80%). Kathmandu district accounted for only 1787.50 ha (5.80%), reflecting intense urbanization and unfavorable slope conditions (Figure 4).

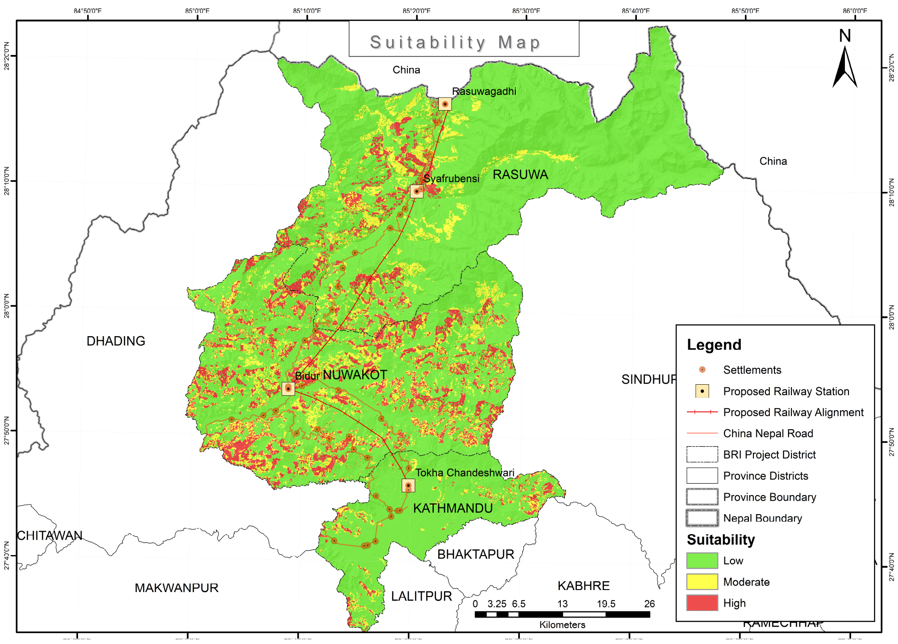

Figure 4. District wise high suitability area.

3.2. Species-Specific Suitability Patterns

Species-level filtering using ecological elevation ranges resulted in distinct suitability patterns across the corridor (Table 6)

Table 6. Area of Different MAPs Cultivation area in hectare.

Name of Districts	Area in Hectare							
	Gaultheria fragrantissima		*Paris polyphylla*		*Taxus wallichiana*		*Rhododendron anthopogan*	
	High	**Moderate**	**High**	**Moderate**	**High**	**Moderate**	**High**	**Moderate**
Kathmandu	1081.40	1369.90	325.50	230.30	325.50	230.30		
Nuwakot	7595.30	5804.60	4036.40	2738.60	4036.40	2738.60	36.51	28.54
Rasuwa	4939.20	5523.40	4855.70	5954.20	4855.70	5954.20	1008.08	3028.01
Grand Total	13615.90	12697.90	9217.60	8923.10	9217.60	8923.10	1044.59	3056.55

Gaultheria fragrantissima exhibited the highest suitability coverage, with approximately 13,615.90 ha of high-suitability land, primarily concentrated in mid-elevation forested slopes of Nuwakot and southern Rasuwa. *Paris polyphylla* and *Taxus wallichiana* each demonstrated suitability across roughly 9217.60 ha, largely overlapping in temperate forests and mixed land systems of central and northern Nuwakot and lower Rasuwa. *Rhododendron anthopogon* showed the most restricted suitability extent, with only 1044.60 ha classified as highly suitable, mostly confined to alpine shrubland and subalpine landscapes of upper Rasuwa. These contrasts reflect known ecological tolerances, with lower- and mid-altitude species showing broader cultivation potential than alpine taxa limited by extreme climatic conditions (Figure 5).

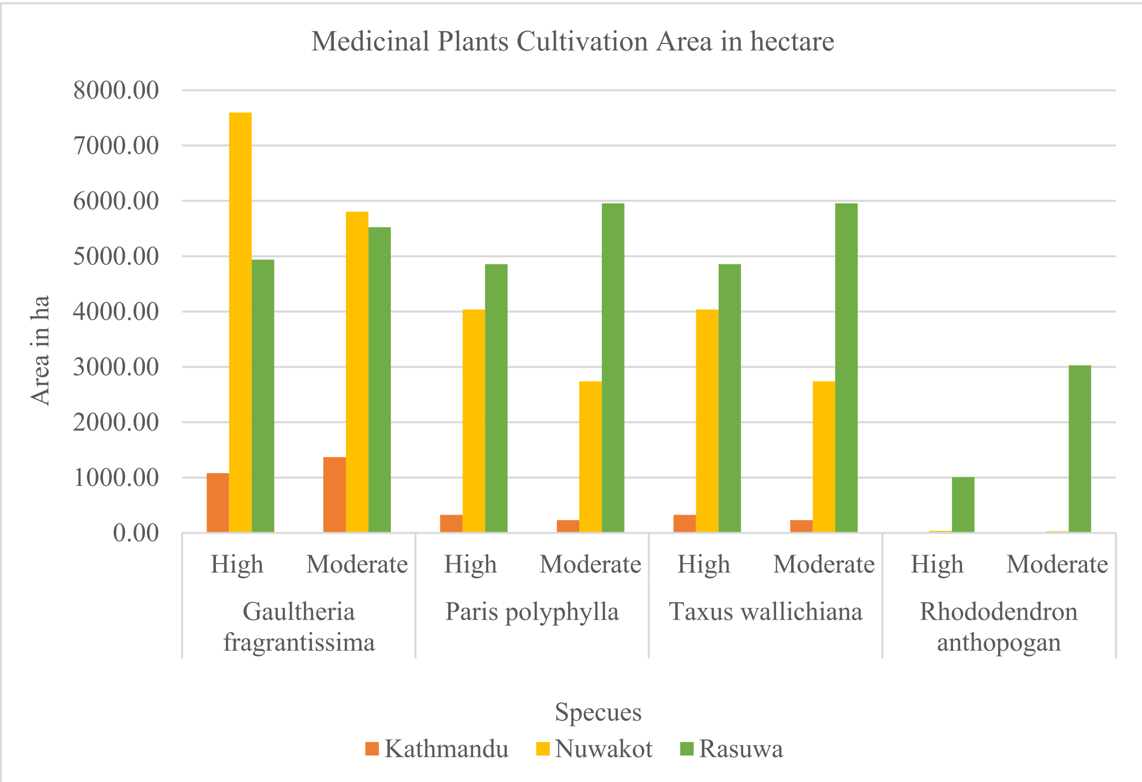

Figure 5. Area suitable for culativation of *Gaultheria fragrantissima*, *Paris polyphylla*, *Taxus wallichiana* and *Rhododendron anthopogan*.

3.3. Spatial Differentiation among Districts

Spatial analyses revealed strong ecological and infrastructural contrasts among districts. Kathmandu district exhibited minimal suitable land availability due to dense urban coverage and steep terrain. Suitable areas were fragmented and isolated, limiting commercial cultivation feasibility. Nuwakot district provided the most favorable cultivation conditions, characterized by moderate slopes, mixed agricultural forest landscapes, lower settlement pressure, and strong road connectivity. These landscape attributes resulted in large continuous high-suitability clusters and several designated priority zones. Rasuwa district was marked by elevated topography and extensive protected areas. While total suitable area was lower than in Nuwakot, this district dominated suitability for high-altitude species such as *R. anthopogon*. Access constraints and conservation regulations, however, substantially limit development potential in some regions (Figure 6).

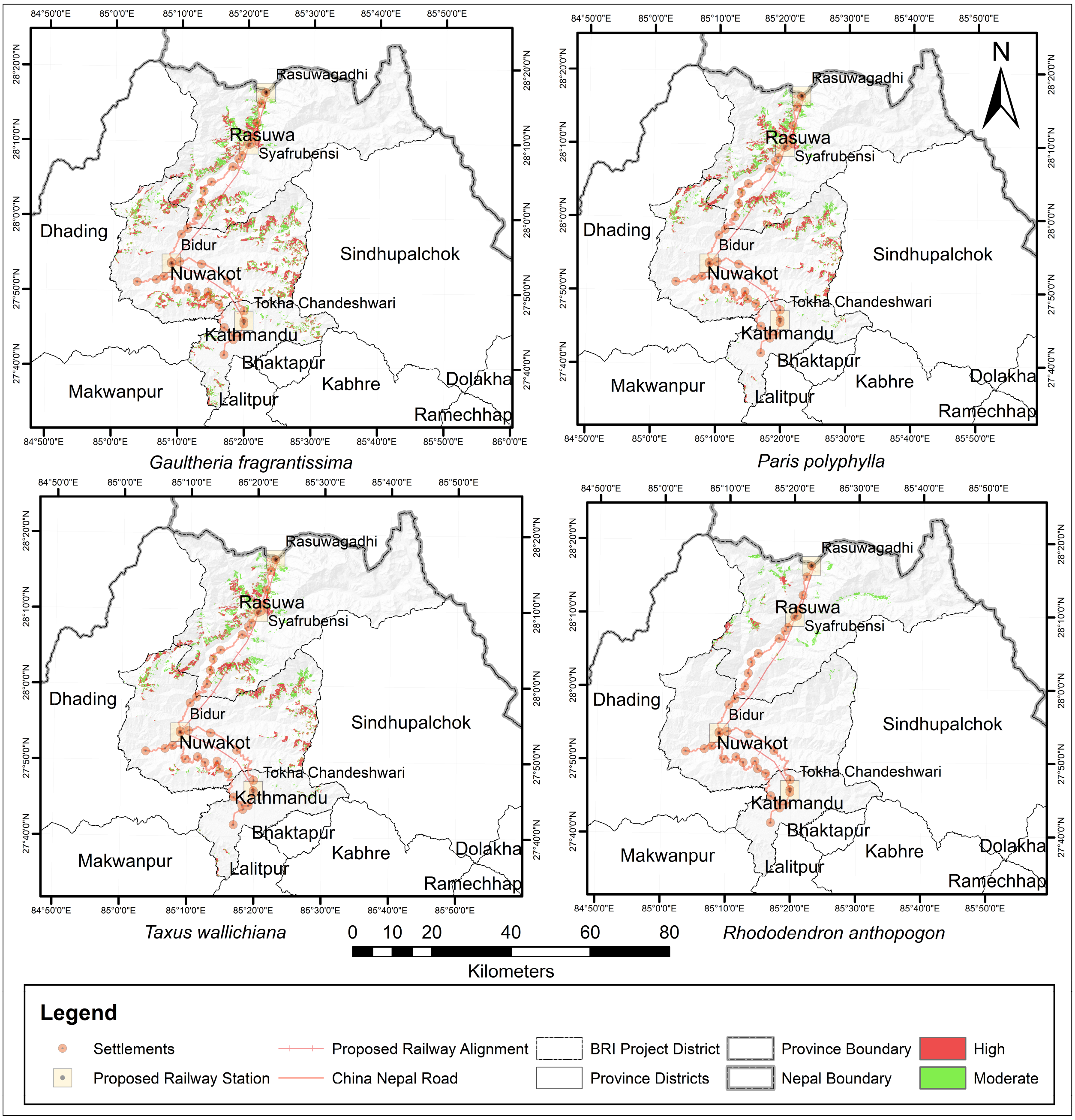

Figure 6. High suitability area for *Gaultheria fragrantissima*, *Paris polyphylla*, *Taxus wallichiana* and *Rhododendron anthopogan*.

3.4. Zone Identification

All standardized criteria layers were integrated using the mean suitability value across species to generate a composite suitability index. The resulting values were reclassified into three suitability classes: High suitability (scores ≥ 0.70); Moderate suitability (scores 0.30–0.70); Low suitability (scores ≤ 0.30). Areas above 4000 m elevation and sites located within legally restricted core protected areas were excluded from cultivation consideration. The largest zone was located in central Nuwakot, followed by mixed-elevation zones spanning southern Rasuwa–northern Nuwakot and a smaller alpine-focused zone in upper Rasuwa. These zonation outputs provide spatially explicit planning units for targeted MAP enterprise development, nursery establishment, infrastructure investment, and conservation oversight.

4. Discussion

Previous studies in Nepal and across the Himalayan region have emphasized the importance of MAP cultivation as a strategy to reduce pressure on wild plant harvests while improving rural livelihoods [7,9]. However, most research has primarily focused on trade flows, harvesting practices, or species ecology rather than spatial planning [40]. GIS-based [45] cultivation zoning remains limited, particularly at district or infrastructure-corridor scales. Our study addresses this gap by integrating multi-criteria land assessment with species-specific ecological filtering to provide an operational spatial framework for MAP promotion along an emerging cross-border transport corridor.

Compared to broader national-scale assessments, our corridor-focused approach reveals substantial inter-district variation in cultivation potential driven by differences in topography, settlement density, infrastructure connectivity, and conservation coverage. These findings underscore the importance of applying geographically targeted rather than generalized cultivation strategies.

The three districts exhibit stark contrasts in MAP cultivation capacity. Nuwakot's dominance in both extent and continuity of suitable land reflects its moderate elevation range, manageable slopes, and mixed forest–agricultural land systems that are well suited for domesticated MAP production. Kathmandu's minimal cultivation potential is primarily explained by competing urban land uses and steep terrain, which severely constrain opportunities for large-scale planting. Rasuwa's suitability is ecologically significant for alpine species such as *Rhododendron anthopogon*, yet development potential is constrained by altitude-related accessibility barriers and overlapping protected areas.

Species-level differences further illustrate ecological constraints. Lower-elevation and mid-altitude species (*Gaultheria fragrantissima*, *Paris polyphylla*, and *Taxus wallichiana*) displayed substantially greater cultivation potential compared to *R. anthopogon*, which is restricted to high-altitude habitats susceptible to climatic extremes. These patterns suggest that domestication programs should prioritize mid-hill species for near-term development, while alpine taxa may require highly targeted and conservation-sensitive management approaches.

Expanded MAP cultivation presents both ecological opportunities and risks. Potential benefits include reduced dependence on destructive wild harvesting, diversification of agroforestry systems, increased vegetative ground cover, and enhanced pollinator habitat within mosaic agricultural landscapes. Understory MAP cultivation integrated with community forestry practices could further support biodiversity retention while promoting sustainable income generation.

Conversely, poorly regulated expansion may drive forest encroachment, slope destabilization, or monoculture development, particularly on steep terrain. These risks highlight the need for agro ecological management guidelines, zoning enforcement, and extension services to support sustainable cultivation practices. Species selection should favor non-destructive harvest techniques wherever possible to minimize plant mortality and maintain ecosystem function.

The delineated cultivation zones provide strategic guidance for investment placement, nursery development, and processing clusters under Nepal's "Make in Nepal" initiative. These spatial outputs can support district development plans, private-sector engagement, and donor-funded livelihood programs seeking to link ecological sustainability with commercial development. Aligning infrastructure investments associated with the China–Nepal Railway corridor with MAP value-chain development may further enhance local employment and promote regional trade integration.

Several limitations should be acknowledged. First, altitudinal range was used as the primary species-specific ecological filter due to the limited availability of fine-resolution soil, moisture, and microclimatic datasets for Nepal. Consequently, some habitat variables influencing detailed species performance (e.g., soil texture, nutrient status, frost regimes, disturbance history) were not explicitly modeled. Second, the AHP weighting process, while supported by expert consultation and validated by consistency testing, retains an element of subjectivity inherent to multi-criteria decision approaches. Third, classification accuracy assessments for updated land-cover maps were constrained by limited field-validation data.

Future work employing species distribution models, high-resolution climate surfaces, soil datasets, and field-based validation would substantially enhance ecological precision and improve policy reliability.

5. Conclusions

This study provides a spatially explicit assessment of cultivation potential for priority medicinal and aromatic plant species along the proposed China–Nepal Railway corridor using a GIS-based multi-criteria evaluation framework integrated with species-specific ecological filtering. The identification of 31,056.50 ha of highly suitable land and 36,811.30 ha of moderately suitable land demonstrates substantial opportunity for expanding MAP cultivation across mid-hill and lower alpine landscapes, particularly within Nuwakot and Rasuwa districts.

The zoning analysis developed from this study offers an operational planning tool to guide government agencies, community forestry groups, private investors, and development partners in directing cultivation expansion toward ecologically suitable and logistically accessible areas. Strategic deployment of nurseries, farmer training programs, and processing facilities within these zones could enhance local value addition, support rural livelihoods, and decrease reliance on wild harvesting of native medicinal plants.

At the policy level, integrating MAP development planning with emerging transport infrastructure initiatives including the China–Nepal Railway corridor presents a unique opportunity to link ecological sustainability with regional economic growth. Clearly defined cultivation targets, sustainable harvesting guidelines, and incentive mechanisms for agroforestry integration will be essential to ensure that expanded MAP production contributes to biodiversity conservation rather than ecosystem degradation.

Future research should refine these assessments using species distribution modeling, soil and micro climatic datasets, climate change projections, and economic feasibility analyses to further strengthen cultivation zoning strategy and implementation effectiveness. Together, these steps could help establish Nepal as a competitive, ecologically responsible producer of high-quality medicinal plant products within regional and global markets.

Supplementary Materials

The additional data and information can be downloaded at: https://media.sciltp.com/articles/others/2602061112550647/REM-25100024-SM-FC-done1.pdf. Table S1. List of prioritized species. Table S2. The list of Medicinal Plants prioritized for agro-technology development are. Table S3. Land system and their properties of Nepal. Table S4. The fundamental scale of absolute numbers.

Author Contributions

M.K.K.: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing original draft, Writing review & editing, Visualization; N.T.: Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing review & editing, Visualization; M.D.J.: Conceptualization, Investigation, Writing review & editing, K.R.B.: Writing review & editing; Z.Z.: Conceptualization, Investigation, Resources, Writing review & editing, Supervision. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The datasets generated during this study are available from the corresponding author upon reasonable request and within the framework of cooperation agreements and scientific research projects.

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Conflicts of Interest

The authors declare no conflicts of interest. Given their editorial roles, Zhiming Zhang (Editorial Board Member) and Madan Kumar Khadka (Youth Editorial Board Member) had no involvement in the peer review of this paper and had no access to information regarding its peer review process. Full responsibility for the editorial process of this paper was delegated to another editor of the journal.

Use of AI and AI-Assisted Technologies

No AI tools were utilized for this paper.

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