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ENVIRONMENTAL STUDY IN PARTS OF CANNANORE DISTRICT, KERALA, INDIA, AND ASSESSMENT OF ITS CAPACITY FOR DEVELOPMENT — A METHODOLOGICAL APPROACH

Srikumar Chattopadhyay, Bhaskara Krishnan Jayaprasad: Environmental Study in Parts of Cannanore District, Kerala, India, and Assessment of Its Capacity for Development — a Methodological Approach. Geogr. Čas., 37, 1985, 2—3; 8 figs, 13 tables, 3 refs.

A series of thematic maps depicting environmental parameters like morphology, landscape, flora and cultural features within a linear strip from the coast to the Western Ghats covering about 300 sq km in the southern part of Cannanore district, Kerala, have been prepared. Homogeneous units under each parameter are worked out and evaluated for different types of activities from the conservation point of view. Quality and fragility of different units with respect to the selected parameters are worked out. These maps are collated together as an integrated map based on which zones of restricted development, unrestricted development and conservation are identified. Further, integrated capacity of agricultural development has been assessed for each sg km of land. Finally a map depicting areas of conservation and development has been brought out.

This study is mainly undertaken to evolve an easily workable methodology of environmental study with special reference to landscape, which may be applied in other areas also.

1. INTRODUCTION

In recent years, environmental problems, created by the injudicious interference with different environmental elements to cater socio—economic needs, have become a matter of serious concern. Furthermore, the controversies amongst the different scientific communities and policy markers in the uses of polyfunctional potential regions have sometimes stalled different development projects. People have to sustain their economy by exploiting or using natural resources for which tempering of environmental elements to some degree cannot be avoided. But the rational use of the limited natural resources can save useful lands from various hazards in the long run. To achieve the rationality in the use of landscape a balanced and judicious land-use planning within the existing environmental framework must be conce-

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ived. It is thus necessary to evaluate the individual environmental parameters in order to understand its present status of evolution and also to integrate them towards an assessment of its capacity for development for a particular activity. Unfortunately, very little work has so far been done in this direction. One of the major drawbacks for carrying on this type of work is lack of proper methodologies. To develop a suitable methodology, studies are going on in different research institutions of the world. Environmental Analysis Group of Santander University, Spain (1980), Mazúr (1981) of the Slovak Academy of Sciences, Bratislava, Mader and Remson (1978) of Stanford University, U.S.A. have contributed significantly towards the methodological problems.

The present study also primarily concentrates on the methodological question of landscape evaluation with some information to delimit the areas most appropiate for different type of activities and uses. The whole exercise is based on the preparation of series of thematic maps from air photo, landsat and topographical sheets supported by field work in key-sectors.

1.1 *Study area*

The study area stretches from the coast to the Western Ghats covering an area of nearly 300 sq km along the latitude of 11°45′ N, just north of the Tellicherry town in the Cannanore district of Kerala. This area is quite interesting in its landscape system. The lateritic terrain intersected by alluvium along the rivers have supported diversified crop culture. Plantations in the hilly region along with terrace cultivation are also marked. The high population pressure and their dependence on agriculture and the relative back-wardness of the region certainly calls for judicious land use planning.

2. EVALUATION OF ENVIRONMENTAL PARAMETERS

2.1 *Environmental morphology*

The morphological units developed under different morphogenetic system have been depicted in the thematic map (Fig. 1). Altogether, five systems, namely, Bay—Estuarine system, Coastline system, Fluvial system, Land system and Manmade system are identified. These systems are marked by capital letters and under each system different units defined by numericals are worked out. Alluvial patches within the topographic systems are recognized by suffixing 'A' to the numericals. Altogether 28 units are depicted in the study area (Table 1).

These units are ranked from 1 to 5 representing minimum and maximum values respectively for supporting the activities of, i) Wet land agriculture (paddy), (ii) Tree crops, (iii) Settlement development and (iv) Scientific and cultural interest. Distribution of different units under different class value (1 to 5) for the above mentioned activities are given in Table 2i, 2ii, 2iii, 2iv.

In the next step, the fragility of each unit is considered and the units are arranged in the groups of high (3), of susceptibility (Table 3). The value for conservation can be assessed from the matrix given in Table 4.

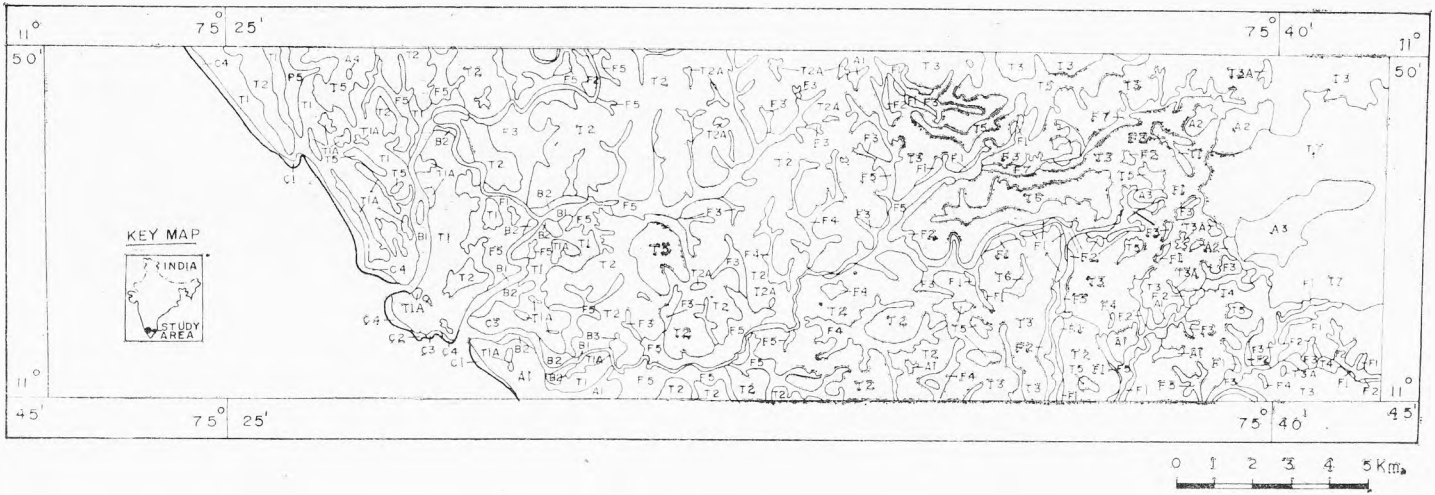

Fig. 1. Environmental morphology

A 1 Urban area (large concentrated settlement)
A 2 Terraced cultivable fields
A 3 Plantations
A 4 Quarries (man-made excavations)
B 1 Tidal channel
B 2 Tidal mud flats
B 3 Partially isolated brackish marsh
C 1 Coastal cliff
C 2 Artificial coast line
C 3 Natural coast line inside bay and estuaries
C 4 Sandy beaches
F 1 Slopes of fluvial valley (> 30 %)
F 2 Slopes of fluvial valley (< 30 %)
F 3 Terraces above flood plain
F 4 Alluvial flood plain away from the main fluvial channel
F 5 Low level flood plain
F 6 Fluvial channel
F 7 Flood plain developed in the elevated areas
T 1 Very gently rolling terrain (< 5° slope)
T 2 Low rolling terrain (5° — 15° slope)
T 3 High rolling terrain (> 15° slope)
T 1A Alluvial patch in T 1
T 2A Alluvial patch in T 2
T 3A Alluvial patch in T 3
T 4 Valley with a flat bottom
T 5 Isolated hill
T 6 Mesa
T 7 Highly dissected terrain

Table 1. Morphologic units

Bay and estuarine system
- B 1. Tidal channel
- B 2. Tidal mud flats
- B 3. Partially isolated brackish marsh

Coastline system.
- C 1. Coastal cliff
- C 2. Coastline with seawalls/Artificial coast line
- C 3. Natural coast line inside bays and estuaries
- C 4. Sandy beaches

Fluvial system.
- F 1. Major fluvial valley of > 30 % slope
- F 2. Major fluvial valley of < 30 % slope
- F 3. Terraces located at the levels above flood plain
- F 4. Alluvial flood plain slightly away from the main fluvial channel
- F 5. Low level flood plain
- F 6. Fluvial channel/Area covered by water during rainy season flow
- F 7. Flood plain developed in the elevated areas

Land system.
- T 1. Very gently rolling terrain (< 5° slope)
- T 2. Low rolling terrain (5°—15° slope)
- T 3. High rolling terrain (> 15° slope)
- T 4. Valley with a flat bottom
- T 5. Isolated hill
- T 6. Mesa
- T 7. Highly dissected terrain

Man-made system.
- A 1. Urban area / Large concentrated settlements
- A 2. Terraced cultivable fields
- A 3. Plantations
- A 4. Quarries / Man made excavations

In the present case, the class value of units with respect to scientific and cultural interests are considered to identify the values for conservation. The distribution of units under different class value for conservation are listed in Table 5.

The units of B 1, B 2, B 3, C 1, C 2, C 4 and A 4 have the highest value for conservation. In other words, these units must be preserved and no further activity is desirable as it will endanger their ecology. The Fig. 2 represents the unit of maximum value for each activity.

2.2 *Vegetation*

Deforestation is so widespread in the low and midlands of the area that only certain remnant patches are available to study their characteristics and ecological conditions. 17 units are marked and each of them is given a symbol for easy representation (Table 6).

Table 2. Suitability of the units for different types of activities

Table 2i. For wet land agriculture

Class	Units
1	B 1, B 3, C 1, C 2, C 3, C 4, F 6, F 1, T 6, T 1, A 1, A 3, A 4 T 1, A 1, A 3, A 4
2	B 2, F 7, T 1, T 2, T 3, T 7
3	F 2, T 4, A 2
4	F 5, T 3A
5	F 3, F 4, T 1A, T 2A

Table 2ii. For tree crops (coconut, arecanut etc.)

Class	Units
1	B 1, C 1, C 2, C 3, F 6, T 4, A 1, A 3, A 4
2	B 2, B 3, F 5, F 4, T 5, T 6, F 3, T 7
3	F 1, F 2, T 1A
4	T 3, T 2A, T 3A, A 2
5	T 1, T 2

Table 2iii. For settlement development

Class	Units
1	B 1, B 2, B 3, C 1, C 2, C 4, F 6, T 4, T 7, A 4, A 3
2	F 2, F 4, F 5, F 7, T 1A, T 2A, T 3A
3	F 1, F 3, T 5, T 6, A 2
4	T 3
5	T 1, T 2, A 1

Table 2iv. For scientific and cultural interest

Class	Units
1	C 3, F 1, F 2, F 5, T 1, T 2, T 3
2	F 3, T 1A
3	F 4, T 2A, A 3, A 1, T 7
4	B 2, C 2, F 7, F 6, T 4, T 3A, A 2
5	B 1, B 3, C 1, C 4, T 5, T 6, A 4

5 represents maximum value

1 represents minimum value

Table 3. Fragility of the units

Class	Units
Low (1)	T 1, T 2, T 3, F 1, F 2, C 3, T 1A, T 2A, T 5, T 6, F 3, F 4, F 5, A 1, A 3, T 4
Intermediate (2)	B 3, F 6, C 1, A 2, F 7, A 4, T 3A
High (3)	B 1, B 2, C 2, C 4, T 7

Table 4. Value for conservation

Class	Fragility		
	High (3)	Intermediate (2	Low (1)
5	5	5	4
4	5	4	3
3	3	3	2
2	3	2	1
1	1	1	1

5 represents optimum unit for conservation

1 represents comparatively less important for conservation

Table 5. Value for conservation

Class	Units
1	F 3, T 1A, T 1, T 2, T 3, F 1, F 2, F 5, C 3
2	F 4, T 2A, A 3, A 1
3	T 4
4	T 5, T 6, F 6, F 7, A 2, T 3A, T 7
5	B 1, C 4, B 2, C 2, C 1, B 3, A 4

Quality and singularity of these units are considered following different criteria. For quality the criteria are, (1) Proximity of the unit to the climax, (2) Present state of evolution and (3) Fragility. Singularity is defined through rarity and aesthetic value of each unit. Values of quality and singularity of each unit are given in Table 7.

Again by analysing a matrix of singularity a quality (Table 8) the values for conservation can be established. Analysing this matrix the conservation class for each unit is ascertained (Table 9).

The thematic map (Fig. 3) depicting quality and fragility is drawn based on which the conservation units are identified considering singularity also.

2.3 *Drainage*

The perennial and non-perennial channels are considered for the analysis. The distribution of source points and confluence of drainage channels of all

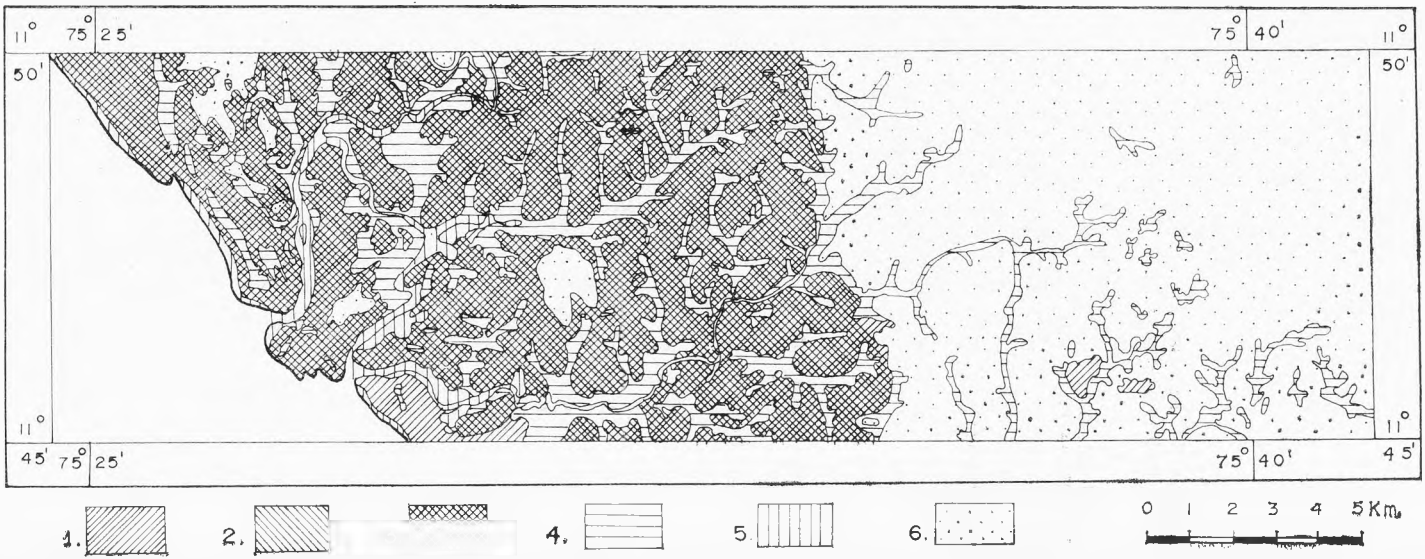

Fig. 2. Units of optimum value for different types of activities
1. Settlement
2. Agriculture (tree crops)
3. Settlement & agriculture (tree crops)
4. Agriculture (wet land)
5. Conservation
6. Forest (conservation)

Table 6. Vegetation units

Symbol	Units
B	Beach forest
C	Forest in the cliff area
S	Swampy vegetation
O	Open jungle — remnants of the forestland
Dj	Isolated dense jungle
Dc	Dense jungle mainly with cashew
Dmt	Dense mixed jungle mainly with teak
Dm	Dense mixed jungle
Cu	Cultivable land
Ur	Urban / concentrated settlement
Tcs	Tree crops with settlements
Pr	Rubber plantation
Pc	Coffee plantation
G	Grass land
Jr	Jungle with rock outcrops
Stc	Scattered tree crops
Bu	Bush

Table 7. Quality and singularity of the vegetation units

Unit	Quality	Singularity
B	3	2
C	4	3
S	3	2
O	3	3
Dj	3	3
Dc	3	3
Dmt	4	4
Dm	4	4
Cu	2	1
Ur	1	1
Tcs	3	2
Pr	3	3
Pc	3	3
G	4	4
Jr	3	4
Stc	3	1
Bu	3	4

5 represents maximum value
1 represents minimum value

the orders and their density distributions are marked. The thematic maps thus produced are superimposed on the maps showing slope and vegetation cover. Based on these, erosion prone areas are identified (Fig. 4). The high erosion prone areas are considered as fragile zones.

Table 8. Value for conservation

Singularity	Quality				
	1	2	3	4	5
1	1	2	3	4	5
2	1	2	2	3	3
3	2	2	3	4	4
4	2	3	4	5	5
5	3	4	5	5	5

5 needs protection, 1 no protection

Table 9. Units for conservation

Conservation class	Units
1	Cu, Ur
2	B, C, S, Tcs, Stc
3	O, Dj, Dc
4	Bu, Dj, Dc
5	Dmt, Dm, G, Jr

Table 10. Matrix for conservation

Fragility	Quality	
	High	Low
High	C	DRF
Low	DRQ	DWR

C	Total conservation
DRF	Restricted development (Fragility)
DRQ	Restricted development (Quality)
DWR	Development without restriction

2.4 *Cultural aspect*

In this map (Fig. 5), all the cultural features of archeological, historical, religious and aesthetic value are depicted. All these features are of maximum value for conservation.

3. INTEGRATION

Once the evalution of all the parameters is completed, the next step is to integrate them in a single map. The maps of fragility and quality of different units under different parameters are combined together and through superimposition four classes in terms of capacity for development are obtained. These are identified with the help of a metrix given in Table 10. This procedure is after the Environmental Analysis Group of Santander University.

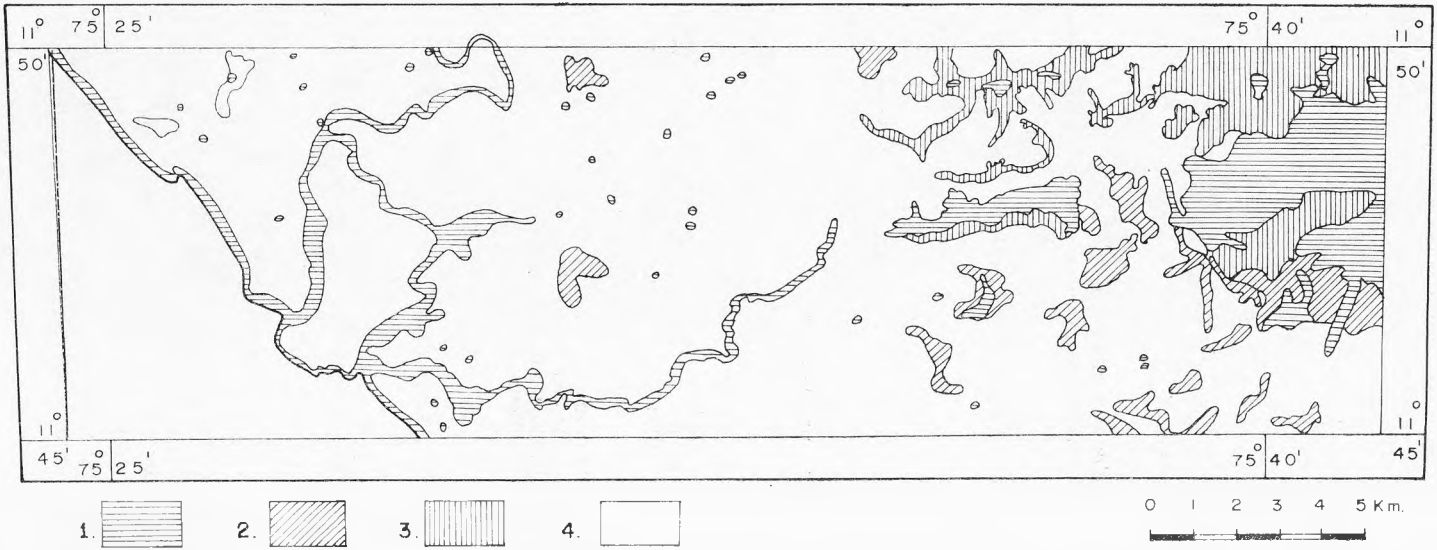

Fig. 3. Quality and fragility of vegetation units
1. Quality
2. Fragility
3. Quality and fragility

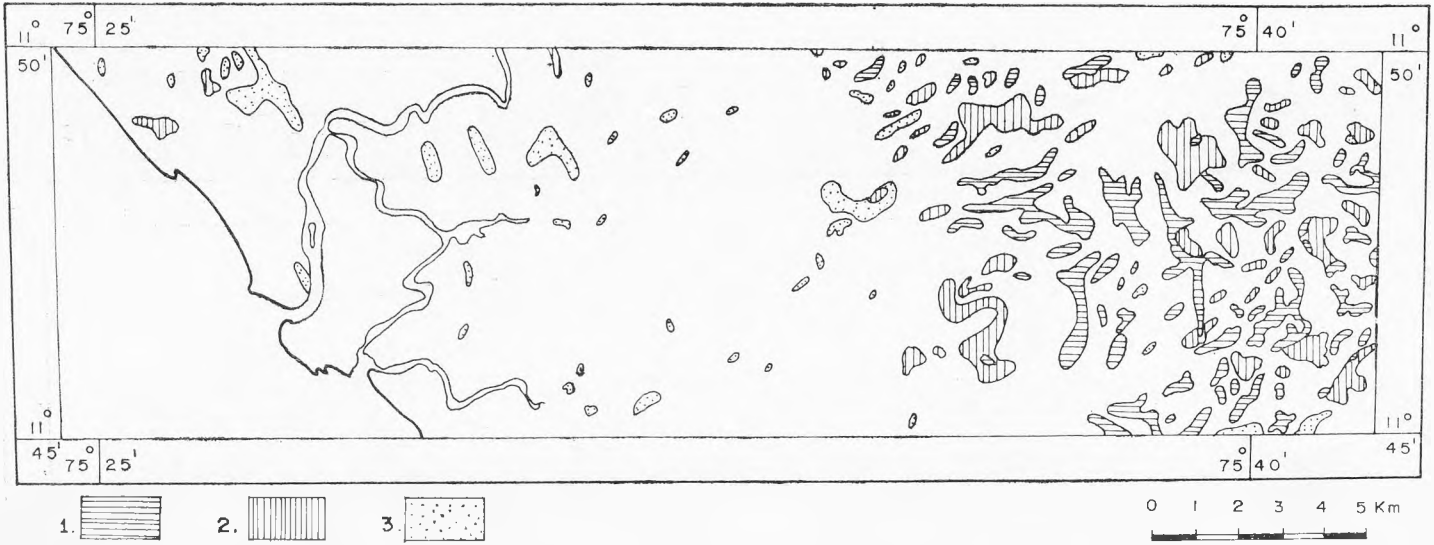

Fig. 4. Erosion proneness
1. High
2. Medium
3. Low

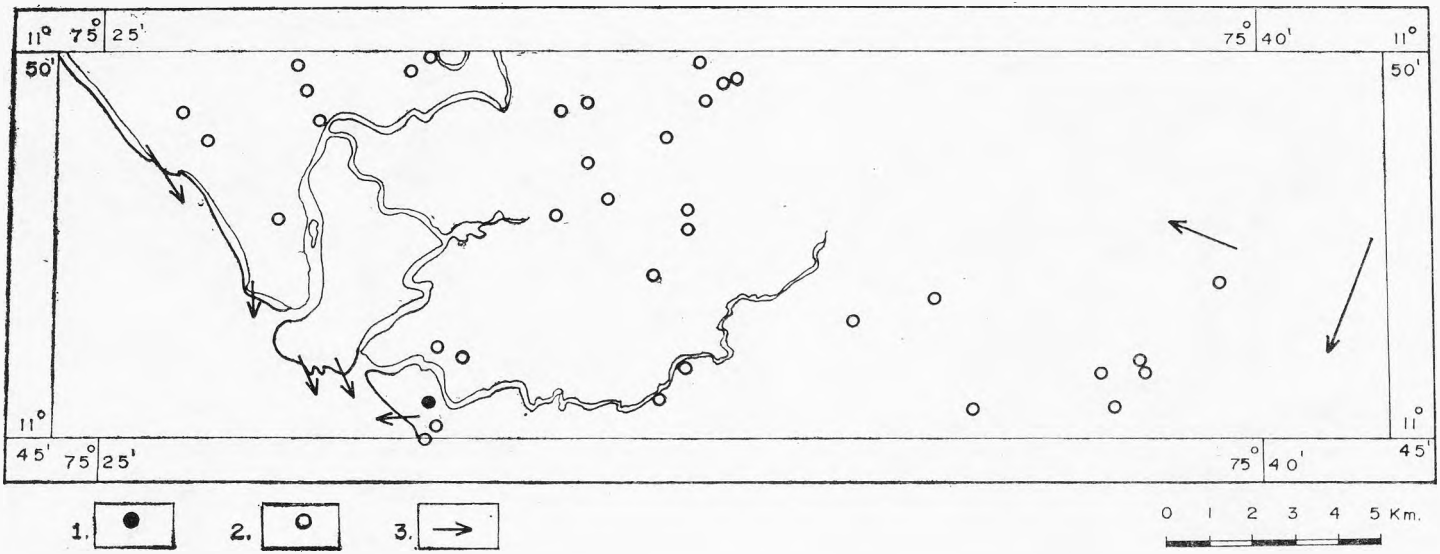

Fig. 5. Cultural and aesthetic features
1. Fort
2. Temple (church), mosque
3. Visual corridor

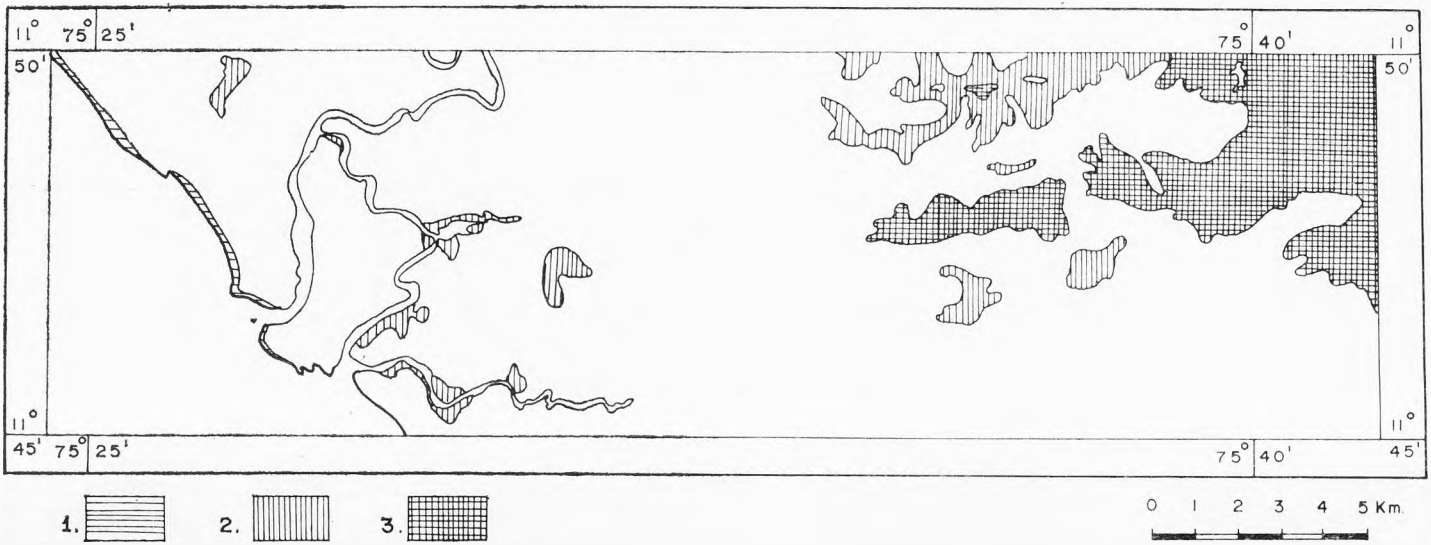

Fig. 6. Capacity for development
1. Conservation
2. Development with restriction for fragility (DRF)
3. Development with restriction for quality (DRQ)
4. Development without restriction (DWR)

Table 11. Factors for identifying environmental capacity for agricultural develepment

Factors	Weightage	Class	Value	Total
1. Average slope	5	< 5°	5	25
		5°—10°	4	20
		10°—15°	3	15
		15°—20°	2	10
		> 20°	1	5
2. Erosion	3	No erosion	5	15
		Low	4	12
		Medium	3	9
		High	1	3
3. Soil*	5	S 4	5	25
		S 5	4	20
		S 3	3	15
		S 2/S 1	1	5
4. Water availability	3	Within the centre of the square	5	15
		Presence of any perennial channel	4	12
		Presence of tidal channel	2	6
		Absence of channel	1	3
5. Topography	4	Flat basin type	5	20
		Very gently rolling	4	16
		Gently rolling	3	12
		Moderately undulated	2	8
		Highly undulated	1	4
6. Vegetative cover	2	No trace of natural vegetation	5	10
		¼th of the sq. covered by natural vegetation	4	8
		½th of the sq. covered	3	6
		¾th of the sq. covered	2	4
		Fully covered by natural vegetation	1	2
7. Landscape	2	Land surface without any significant feature.	5	10
		Terrace	4	8
		Marshy land/ waste land/ hilly land	2	4
		Urban/residential land	1	2
		Rock outcrop	0	0

Table 11.

Factors	Weightage	Class	Value	Total
8. Cultural and visual features	2	Devoid of any visual quality	5	10
		Presence of any feature in the square	3	6
		Presence of beach or cliff	1	2
9. Transport	3	Metalled road within the square	5	15
		Metalled road within the adjacent square	3	9
		Metalled road away from the adjacent square	1	3
10. Accessibility	1	Within 5 km from the market town	5	5
		Within 10 km "	4	4
		Within 10—15 km "	3	3
		Within 15—20 km "	2	2
		More than 20 km "	1	1

5 represents maximum capacity
0 represents no capacity

* Soil description

S_1 Deep to very deep, fine loamy to clayey soil, well drained, derived from laterized gneiss and colluvial deposits and occuring in the hill slopes.

S_2 Moderately deep to very deep, well drained gravelly, fine loamy to fine clay occuring in the slopes of high level dissected plateau.

S_3 Moderately deep well drained, fine loamy to clayey soils derived from laterite outwash and occuring on mound tops and slopes of low level dissected plateau.

S_4 Moderately deep to very deep fine loamy to clayey soils on granite slopes derived from alluvium and laterite outwash and occuring in the valleys on low level dissected plateau.

S_5 Shallow to deep, sandy to fine loamy soils of gentle to moderate slopes derived from alluvium and laterite outwash and occuring on mound tops and adjoining to coastal areas.

The final map (Fig. 6) demarcates the areas needing conservation and also areas where further development work can be done. This is indeed a fruitful exercise but in light of integrated environmental capacity for any type of development it remains without clarity. Hence another exercise is carried out as described below for identifying environmental capacity, the map resulting from which has been superimposed on the previous one and a final map is produced.

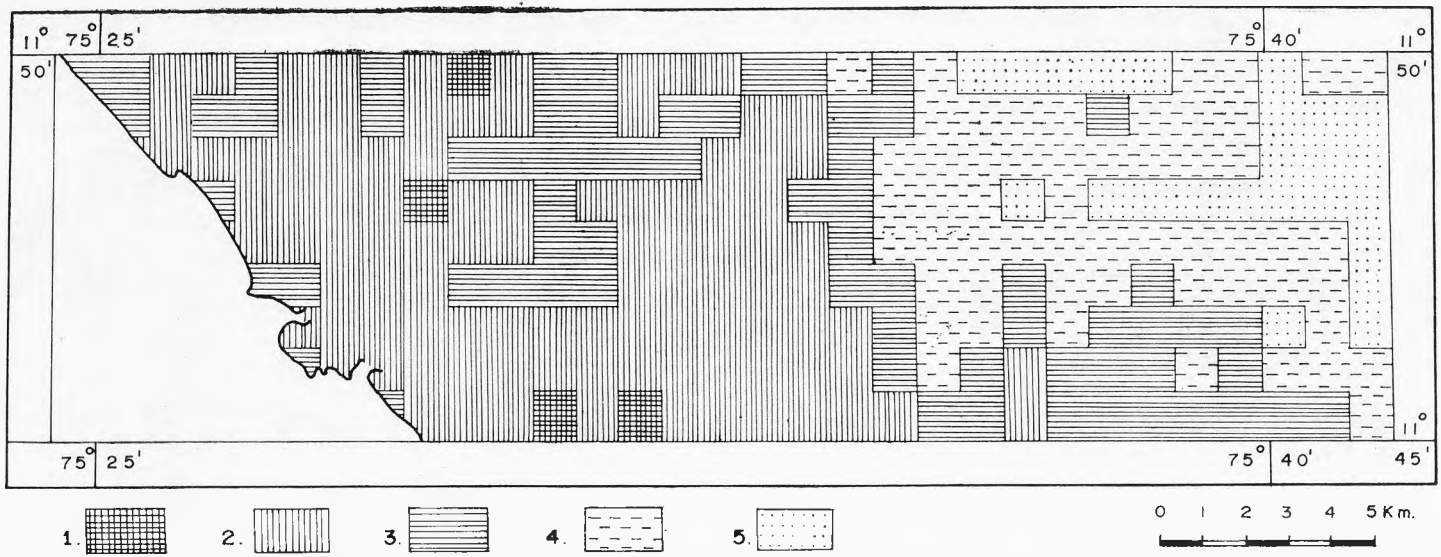

Fig. 7. Integrated environmental capacity for development (Wet land agriculture)

1. Very high	(	> 138.50)
2. High	(114.82	— 138.50)
3. Medium	(91.13	— 114.82)
4. Low	(67.45	— 91.13)
5. Very low	(	< 67.45)

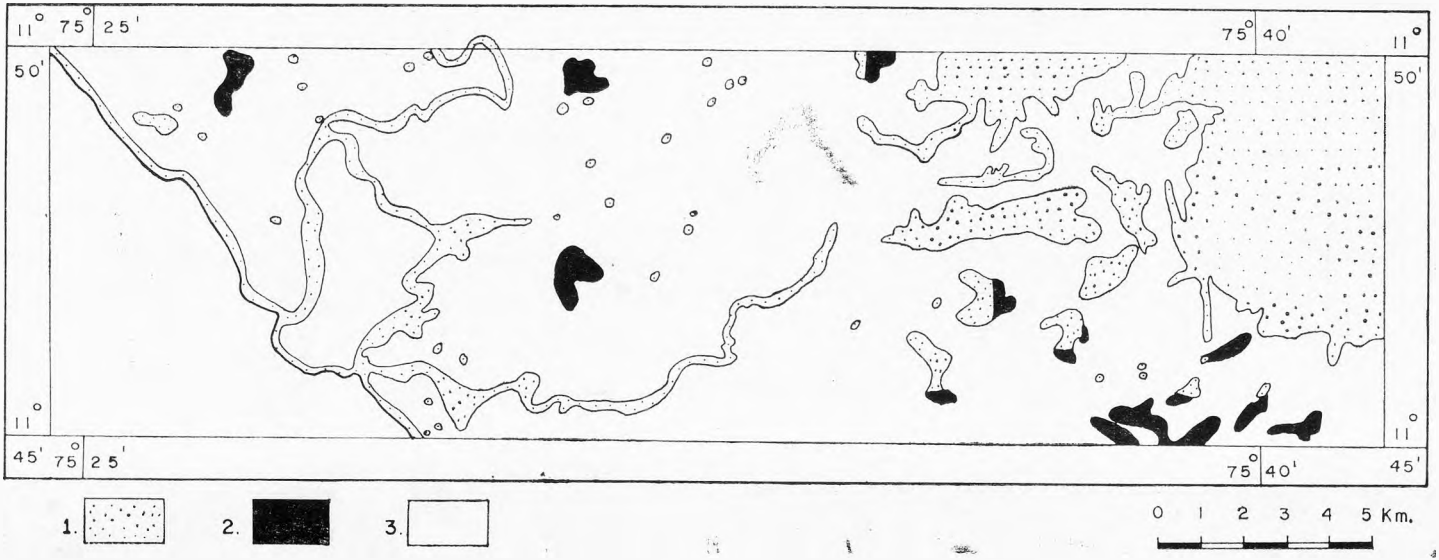

Fig. 8. Area of conservation and development
1. Conservation
2. Development with protective measure
3. Development

Table 12. Capacity class

Capacity zones	Value
Very high	> 138
High	115 — 138
Medium	91 — 114
Low	67 — 90
Very low	< 67

Table 13. Matrix for synthesis

Capacity for development	Integrated environmental capacity for agricultural development				
	Very high	High	Medium	Low	Very low
Conservation (C)	C	C	C	C	D
Development with restriction (fragility) (DRF)	DPM	DPM	DPM	C	C
Development with restriction (quality) (DRQ)	DPM	DPM	DPM	C	C
Development without restriction (DWR)	D	D	D	D	D

C Conservation, DPM Development with protective measure, D Development

4. IDENTIFICATION OF ENVIRONMENTAL CAPACITY FOR AGRICULTURAL DEVELOPMENT (WETLAND)

Agricultural land use of a region is a function of a large number of factors. But the contribution of different factors varies from place to place. Accordingly, their weightage/values also vary. For the present study, 10 factors, namely, average slope, erosion proneness, soil, water availability, topography, vegetation cover, landscape, cultural and visual features, transport and market accessibility have been identified, each of which is classified and given a rank (Table 11). For final value this rank value is multiplied by the weightage. Thus for any parcel of land 10 separate values are worked out and finally added together to arrive at a single value.

4.1 *Procedure*

The whole area is divided into a number of squares (in this case 254) of 1 sq km area. The value of the selected 10 factors for all the 1 sq km grid are calculated by using the method given in Table 11.

Value of any sq grid (G) can be determined from this table. In mathematical representation

$$\text{Value of } G = \sum_{1}^{10} F$$

1—10 — Stands for all the factors considered

The grid of minimum capacity is represented by the value of 33 and the grid of maximum capacity is denoted by the value of 150. For the present study area the maximum and minimum values are 140 and 43 respectively. Five capacity class (Table 12) are identified by using mean ($\bar{x}$) and standard deviation (a), which are depicted in the Fig. 7.

5. CONCLUSION

The two maps (Fig 6 & 7) representing development zones with respect to conservation, quality, fragility and integrated environmental value are superimposed and the areas of conservation are demarcated (Fig. 8) by following a matrix given in Table 13. The fragile area with high capacity for development is identified for maximum protective measure and so also for quality. Within rest of the area where development capacity is moderate and can be made effective without restriction, proper attention could be given.

This study is an attempt to evolve a methodology of integrated environmental study. The selection of factors and their weightage are primarily determined with due consideration to the study area. The researches should have their own assessment to suit their study area. The environment is dynamic and process bound. Hence the procedure of evaluating the value of a particular region might not be fruitful for another region.

However, the above exercise may provide some basic infrastructure to develop a more comprehensive methodology applicable throughout India.

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ŠTÚDIUM PROSTREDIA V ČASTIACH OKRESU CANNANORE, KERALA, INDIA A STANOVENIE ICH KAPACITY PRE HOSPODÁRSKY ROZVOJ — METODOLOGICKÝ PRÍSTUP

Rastúce problémy prostredia v dôsledku nadmerného alebo nesprávneho využívania prírodných zdrojov sa stali v posledných rokoch predmetom vážneho záujmu. Pociťujeme, že správne a vyvážené krajinné plánovanie by mohlo dosiahnuť racionalitu vo využívaní zdrojov. Pracovať v tomto smere, to značí nevyhnutnosť vyhodnocovať individuálne parametre prostredia, aby sme pochopili jeho stav, potom ich integrovať v smere na stanovenie jeho kapacity pre hospodársky rozvoj, pre jednotlivé aktivity a nakoniec vyčleniť územia, ktoré môžu byť hospodársky využité, a územia, ktoré treba ponechať pre ochranu.

V Indii už vypracovali vhodnú metodológiu pre takýto typ prác. Štúdie, ktoré pochádzajú z rôznych výskumných ústavov v Európe, možno však pri vhodných modifikáciách tiež úspešne aplikovať. Takým spôsobom je aj táto práca.

Skúmané územie siaha od pobrežia po Západné Chátske kopce a zaberá 300 km^2. Na základe morfológie prostredia sme identifikovali 28 jednotiek, ktoré patria do 5 morfogenetických systémov — zálivovo-estuárový, pobrežný, fluviálny, suchozemský a kultúrny. Každá z týchto jednotiek je začlenená od minima (1) po maximum (5) podľa únosnosti pre rôzne aktivity, napr. závlahové poľnohospodárstvo, sadovníctvo, výstavbu sídel, vedecký a kultúrny záujem. Ďalej sa určila odolnosť týchto jednotiek a podľa nej sa začlenili do 3 stupňov — vysoká (3), stredná (2), nízka (1). Jednotky s vysokou vedeckou a kultúrnou hodnotou sa určili pre ochranu.

Podobne sa určili kvalita, singularita a odolnosť pre vegetačné jednotky (17 jednotiek). Oblasti s náchylnosťou na eróziu sa vyčlenili podľa riečnej siete, sklonitosti a vegetačnej pokrývky. Všetky kultúrne objekty s archeologickou, historickou, sakrálnou a estetickou hodnotou sa vyčlenili pre ochranu.

Analytické mapy, ktoré sú výsledkom uvedených hodnotení, sa na seba nakladali a touto cestou sa pripravila syntetická mapa ukazujúca oblasti pre ochranu, pre hospodársky rozvoj s limitmi s ohľadom na kvalitu a odolnosť, ako aj oblasti pre hospodársky rozvoj bez akýchkoľvek limitov.

V ďalšom sa rozpracovala integrovaná kapacita prostredia pre poľnohospodársky rozvoj pre každý km^2. Zohľadnili sa faktory, ako priemerný sklon, erózia, pôda, použiteľná voda, reliéf, vegetačná pokrývka, fyziognómia krajiny, kultúrne a vizuálne črty, doprava a prístup na trhy. Každému km^2 sa pripísali hodnoty všetkých faktorov, z čoho sa vypočítala jedna charakterizujúca hodnota, ktorá sa člení podľa kapacity do 5 tried: veľmi vysoká, vysoká, stredná, nízka a veľmi nízka. Pri ďalšom sa na seba naložila mapa týchto kapacít a syntetická mapa. Výsledná mapa ukazuje 3 zóny — oblasti pre ochranu, oblasti pre hospodársky rozvoj a oblasti pre hospodársky rozvoj s ochrannými opatreniami. Tento prístup sa ukázal ako vhodný pre územné plánovanie.

Obr. 1. Morfológia prostredia
- A 1. urbánne oblasti (veľké koncentrované sídla),
- A 2. terasované kultivované polia,
- A 3. plantáže,
- A 4. kameňolomy (umelé vyhĺbeniny),
- B 1. kanály s prílivom a odlivom,
- B 2. blatnaté kanálové plochy,
- B 3. čiastočne izolované brakické marše,
- C 1. pobrežný klif,
- C 2. umelá pobrežná línia,

C 3. prirodzená pobrežná línia zálivov a estuárov,
C 4. pieskové pláže,
F 1. svahy riečnych dolín (do 30 %),
F 2. svahy riečnych dolín (nad 30 %),
F 3. terasy nad inundačnou rovinou,
F 4. aluviálna inundačná rovina mimo hlavného fluviálneho kanála,
F 5. nízka úroveň inundačnej roviny,
F 6. fluviálny kanál,
F 7. inundačná rovina na vyvýšených územiach,
T 1. veľmi mierne zvlnený terén (sklon do 5°),
T 2. mierne zvlnený terén (sklon 5—15°),
T 3. silne zvlnený terén (sklon nad 15°),
T 1A. aluviálna forma v T 1,
T 2A. aluviálna forma v T 2,
T 3A. aluviálna forma v T 3
T 4. dolina s rovným dnom,
T 5. izolovaný kopec,
T 6. mesa,
T 7. silne členitý terén.

Obr. 2. Jednotky s optimálnou hodnotou pre rôzne typy aktivít
1. sídla,
2. poľnohospodárstvo (sadovníctvo),
3. sídla a poľnohospodárstvo (sadovníctvo),
4. poľnohospodárstvo (závlahové),
5. ochrana,
6. les (ochrana).

Obr. 3. Kvalita a odolnosť vegetačných jednotiek
1. kvalita,
2. odolnosť,
3. kvalita a odolnosť.

Obr. 4. Náchylnosť na eróziu
1. vysoká,
2. stredná,
3. nízka.

Obr. 5. Kultúrne a estetické črty
1. pevnosť,
2. chrám (kostol), mešita,
3. vizuálny koridor.

Obr. 6. Kapacita pre hospoársky rozvoj
1. ochrana,
2. rozvoj s limitom vzhľadom na odolnosť (DRF),
3. rozvoj s limitom vzhľadom na kvalitu (DRQ),
4. rozvoj bez limitu (DWR).

Obr. 7. Integrovaná kapacita prostredia pre hospodársky rozvoj (závlahové poľnohospodárstvo)
1. veľmi vysoká (138,50),
2. vysoká (114,82—138,50),
3. stredná (91,13—114,82),
4. nízka (67,45—91,13),
5. veľmi nízka (67,45).

Obr. 8. Oblasti pre ochranu a hospodársky rozvoj
1. ochrana,
2. rozvoj s ochrannými opatreniami,
3. rozvoj.

Tab. 1. Morfologické jednotky.
Tab. 2. Vhodnosť jednotiek pre rôzne typy aktivít.
2.1 pre závlahové poľnohospodárstvo,
2.2 pre sadovníctvo,
2.3 pre výstavbu sídel,
2.4 pre vedecký a kultúrny záujem.
Tab. 3. Odolnosť jednotiek.
Tab. 4. Hodnota pre ochranu.
Tab. 5. Hodnota pre ochranu.
Tab. 6. Vegetačné jednotky.
Tab. 7. Kvalita a singularita vegetačných jednotiek.
Tab. 8. Hodnota pre ochranu.
Tab. 9. Jednotky pre ochranu.
Tab. 10. Matrica pre ochranu.
Tab. 11. Faktory identifikácie kapacity prostredia pre poľnohospodársky rozvoj.
Tab. 12. Triedy kapacity.
Tab. 13. Matrica pre syntézu.

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ИЗУЧЕНИЕ СРЕДЫ В ЧАСТЯХ РАЙОНА КАННАНОР, КЕРАЛА, ИНДИЯ И ОПРЕДЕЛЕНИЕ ИХ СПОСОБНОСТИ ДЛЯ ХОЗЯЙСТВЕННОГО РАЗВИТИЯ — МЕТОДОЛОГИЧЕСКИЙ ПОДХОД

Все возрастающие проблемы среды, появившиеся в результате чрезмерного или неправильного использования природных ресурсов, стали перед нами за последние годы в роли предмета серьезного интереса. Чувствуется, что правильное и уравновешенное ландшафтное планирование может вполне достичь рациональности при использовании (эксплуатации) ресурсов. Работать в этом направлении — это означает необходимость рассматривать индивидуальные параметры среды в целях понятийного освоения ее состояния, затем эти параметры интегрировать с целью определения способности среды для хозяйственного развития, для отдельных видов деятельности и, наконец, выделить территории, которые можно использовать в экономических целях, а также территории, которые нуждаются в охране.

В Индии уже разработана подходящая методология для такого рода работ. Однако, с некоторыми модификациями можно также успешно применять результаты исследований, полученные в разных научно-исследовательских институтах Европы. Попыткой такого рода и представляется настоящая статья.

Изучаемая территория распространяется от побережья до Западных Хатских холмов и занимает площадь 300 км^2. На основании морфологии среды нами выделено 28 единиц, относящихся к 5 морфогенетическим системам: подтопляемо-эстуарной, побережной, флювиальной, засушливо-почвенной и культурной. Каждая из этих единиц классифицирована по шкале от минимума [1] до максимума [5] в зависимости от нагрузки разными видами деятельности, как например, поливное сельское хозяйство, садоводство, строительство населенных пунктов, научные и культурные интересы. Далее определялась устойчивость этих единиц, причем различались 3 ступени: высокая (3), средняя (2) и низкая (1). Единицы с высоким значением научной и культурной ценности выделены для охраны.

Подобным образом определялись качество, сингулярность и устойчивость для растител-

ных единиц (17 единиц). Области подвергающиеся эрозии выделялись в зависимости от речной сети, угла наклона территории и растительного покрова. Все культурные объекты, имеющие археологическую, историческую, сакральную и эстетическую ценность, выделены для охраны.

Аналитические карты, являющиеся результатом приведенных выше оценок, накладывались на себя и этим путем подготовлена синтетическая карта, отображающая области охраны, области хозяйственного развития с лимитами, учитывающими качество и устойчивость, а также области хозяйственного развития без каких-либо лимитов.

Следующий шаг — это разработка интегрированной способности среды для сельскохозяйственного развития — для каждого км^2. Принимались во внимание факторы, как например, средний угол наклона территории, эрозия, почва, годная к употреблению вода, рельеф, растительный покров, физиономия ландшафта, культурные и визуальные черты, транспорт и доступность к рынкам. Каждому км^2 приписывались значения всех факторов. На этом основании вычислялось одно характеризующее значение величины, которая подразделяла способность на 5 классов: очень высокую, высокую, среднюю, низкую и очень низкую. Последующей операцией было наложение карты этих способностей на упоминавшую выше синтетическую карту. Полученная в результате карта отображает 3 зоны — области охраны, области хозяйственного развития и области хозяйственного развития нуждающиеся в мероприятиях по охране. Этот подход оказался подходящим для территориального планирования.

Рис. 1. Морфология среды

A 1 Урбанистическое области (крупные концентрированные населенные пункты)
A 2 Культивированные поля с террасами
A 3 Плантации
A 4 Каменоломни (искусственные выемки)
B 1 Каналы с приливом и отливом
B 2 Заболоченные участки с каналами
B 3 Частично изолированные бракические болотные поймы
C 1 Береговой уступ (клиф)
C 2 Искусственная береговая линия
C 3 Естественная береговая линия заливов и эстуариев
C 4 Песчаные пляжи
F 1 Склоны речных долин (до 30 %)
F 2 Склоны речных долин (более 30 %)
F 3 Террасы выше заливной равнины
F 4 Аллювиальная заливная равнина мимо главного флювиального канала
F 5 Низкий уровень заливной равнины
F 6 Флювиальный канал
F 7 Заливная равнина на возвышенной местности
T 1 Очень умеренно волнистый рельеф (угол наклона до 5°)
T 2 Умеренно волнистый рельеф (угол наклона 5—15°)
T 3 Очень волнистый рельеф (угол наклона свыше 15°)
T 1A Аллювиальная форма в T 1
T 2A Аллювиальная форма в T 2
T 3A Аллювиальная форма в T 3
T 4 Долина с плоским дном
T 5 Изолированный холм
T 6 Меса
T 7 Очень изрезанный рельеф

Рис. 2. Единицы с оптимальной ценностью для разных видов деятельности

1 — населенные пункты, *2* — сельское хозяйство (садоводство), *3* — населенные пункты и сельское хозяйство (садоводство), *4* — сельское хозяйство (поливное), *5* — охрана, *6* — лес (охрана)

Рис. 3. Качество и устойчивость растительных единиц
1 — качество, *2* — устойчивость, *3* — качество и устойчивость

Рис. 4. Предрасположенность к эрозии
1 — высокая, *2* — средняя, *3* — низкая

Рис. 5. Культурные и эстетические черты
1 — крепость, *2* — храм (церковь), мечеть, *3* — визуальный коридор

Рис. 6. Способность для хозяйственного развития
1 — охрана, *2* — развитие с лимитом учитывающим устойчивость (DRF), *3* — развитие с лимитом учитывающим качество (DRQ), *4* — развитие без лимита (DWR)

Рис. 7. Интегрированная способность среды для хозяйственного развития (поливное сельское хозяйство)
1 — очень высокая (138,50), *2* — высокая (114,82 — 138,50), *3* — средняя (91,13 — 114,82), *4* — низкая (67,45 — 91,13), *5* — очень низкая (67,45)

Рис. 8. Области охраны и хозяйственного развития
1 — охрана, *2* — развитие с мероприятиями по охране, *3* — развитие

Табл. 1. Морфологические единицы
Табл. 2. Единицы подходящие для разных видов деятельности
2.1 — для поливного сельского хозяйства, *2.2* — для садоводства, *2.3* — для строительства населенных пунктов, *2.4* — для научных и культурных интересов
Табл. 3. Устойчивость единиц
Табл. 4. Ценность для охраны
Табл. 5. Ценность для охраны
Табл. 6. Единицы растительности
Табл. 7. Качество и сингулярность единиц растительности
Табл. 8. Ценность для охраны
Табл. 9. Единицы для охраны
Табл. 10. Матрица для охраны
Табл. 11. Факторы идентификации способности среды для сельскохозяйственного развития
Табл. 12. Классы способности
Табл. 13. Матрица для синтеза

Перевод: Л. Правдова