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Rapid Environmental Impact Assessment of Eco-tourism in Pookote Lake, Wayanad

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Abstract - *Ecotourism is inherent desire of human beings, which developed with the progress of human civilization. The mountains, hills, valleys, lakes, trees, birds, butterflies etc have become important attractions for the eco-tourists. A detailed environmental impact assessment is unavoidable to study the effects due to an existing project. Since the assessment of the magnitude and potential of most of the impacts is purely subjective, RIAM technique has been applied for the EIA of ecotourism in Pookote lake, Wayanad. From the RIAM output, it was found that the negative impacts is more significant than the positive impacts. Suitable mitigation measures were suggested in order to reduce the adverse impacts in future so as to create a sustainable environment.*

Key Words: Rapid environmental impact assessment, Eco-tourism, Pookote lake, RIAM

1. INTRODUCTION

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. It is a process by which the likely effects of a project or development on the environment are identified, assessed and then taken into account by the competent authority in the decision making process.
To overcome the drawbacks in the execution and reporting of EIA, the Rapid Impact Assessment Matrix (RIAM) was developed by Pastakia, 1998 and Ijas *et. al*, 2008. This process seeks to overcome the problems of recording subjective judgments by defining the criteria and scales against which these judgments are to be made; and by placing results in a simple matrix that allows for a permanent record of the arguments in the judgment process.

The lake with its clear cut boundary, is one of the best defined natural ecosystems on earth. It is comparable with an island in that the natural system within its shoreline is fairly independent of related outside systems. Hence if the lakes are sufficiently old geologically, they tend to have highly specialized biota containing a number of indigenous species. Each lake has a unique relationship with people and society. Some lakes provide fishing opportunities, recreational opportunities while others a source of drinking water or a route for transportation. Thus every lake possesses its own ecological conditions, and people have utilized or developed the lake environment in relation to its ecological and historical conditions.

2. OBJECTIVES

(i) To identify, predict, and evaluate various impacts on environment in Pookote lake area
(ii) To scientifically assess the magnitude of positive and negative impacts of tourism by Rapid Impact Assessment Matrix (RIAM) Method
(iii) To suggest remedial measures to mitigate the probable negative impacts

3. LITERATURE REVIEW

Hakanson et. al (2003), identified there are close relationships between catchments area characteristics and lake characteristics. The other important factors lake characteristics as per their observations are climate change, changes in epilimnetic temperatures and increased variations in lake temperature. They used Lake Web model to quantify such changes for key functional organisms and food web structures.
Gulati and Donk (2002), identified fresh water deterioration as a challenging problem in industrialized Western Europe, especially in countries with intensive agricultural practices as well as animal husbandry. Two main criteria for good water quality which they identified were, a decrease in phytoplankton biomass and improvement in the under water light climate.
Rabalais (2002), after a detailed investigation of the nitrogen input in aquatic systems by human activities found that nitrogen in water has increased over the last one and a half centuries. The accumulation of it in reservoirs alters many ecological processes in them, which may differ with latitude, temperature and season and, the overall global dynamics are as yet unpredictable.
Gelda and Effler (2002), reported that day-to-day differences in the dissolved oxygen concentration of lake waters are mostly due to variations in wind. Su and Jassby (2000), investigated Lake Inle, in southern Myanmar for analyzing several environmental problems affecting the Lake basin.

They revealed a long-term decrease in Lake area over the last 30 years, due to the siltation and climate change.
Based on RIAM output in terms of relative figures and tables, the comparative statement of various components of impact over an environment was developed and presented in this paper.

4. STUDY AREA

The state of Kerala (India) has a large number of man-made lakes situated in its mid-land and high-land regions. But there are very few natural lakes in Kerala's high-altitude lands. Pookote is one such lake situated in the midst of the Western Ghats.

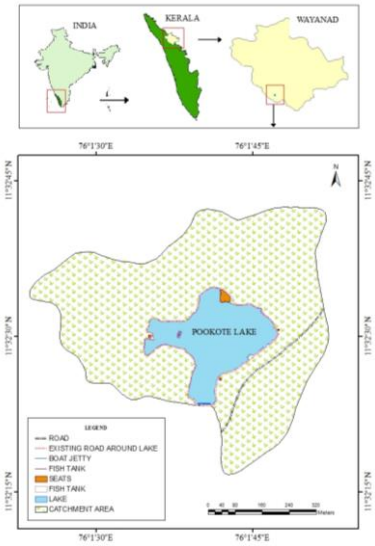

Fig. 1 Location map of Pookote lake

Pookote Lake is a rain fed, perennial, natural, fresh water lake surrounded by a chain of hills, rising to the order of 800 m above the mean sea level. The lake has the shape of India's map. The lake has an area of about 6.1 ha and has a maximum depth of 6.01 m.

Fig. 2 Scenic View of Pookote Lake

This lake is located in Kunnnathidavaka village between 11° 32'39.13'' N and 11° 32'24.96'' N latitude and between 76° 01'32.59'' E and 76° 01'44.89'' E longitude in the Vythiri taluk of Wayanad district, 16 km towards the west of Kalpetta – the district headquarters.The lake is surrounded by a broadleaved mixed temperate forest, and has a catchment area of 40 ha with 31 households and 120 people living in it.

5. METHODOLOGY

In the evaluation process, positive and negative impacts of Pookote lake for tourism promotion was assessed based on the results of various studies conducted and field survey data . Rapid Impact Assessment Matrix (RIAM) method (Modified Pastakia, 1998; Ijas et. al, 2008) seeks to overcome the problems of recording subjective judgments by defining the criteria and scales against which these judgments are to be made; and by placing the results in a simple matrix that allows for a permanent record of the arguments in the judgment process.

5.1 Assessment criteria

The judgments on each component are made in accordance with the criteria and scales shown in Table 6.1. The important assessment criteria fall into two groups :

(i) Group A: Criteria that are of importance to the condition, and which can individually change the score obtained.
(ii) Group B: Criteria that are of value to the situation, but should not be individually capable of changing the score obtained.

Table-1: Impact assessment criteria group A (Source: Modified Pastakia, 1998; Ijas et. al, 2008)

Group	Category	Scale	Description
A Importance	a1 importance of condition	4	International importance
		3	National importance
		2	Outside of local condition
		1	Local condition
		0	Not important
	a2 Magnitude of change effect	(+)3	Major positive benefit
		(+)2	Significant improvement
		(+)1	Improvement in status quo
		0	No change / status quo
		(-)1	Negative change to status quo
		(-)2	Significant negative change
		(-)3	Major negative change

Table-2 : Impact assessment criteria group B (Source: Modified Pastakia, 1998; Ijas et. al, 2008)

Group	Category	Scale	Description
B Performance	b1 Permanance	4	Permanent
		3	Temporary and medium term impact
		2	Temporary and short term impact
		1	Not applicable
	b2 Reversibility	4	Irreversible impact
		3	Slowly reversible impact
		2	Reversible impact
		1	Not applicable
	b3 Cumulativity	4	Explicitly synergic impact
		3	Synergic impact
		2	Individual impact
		1	Not applicable
	b4 susceptibility	4	Extremely sensitive to change
		3	Sensitive to change
		2	Environment stable
		1	Not applicable

The value ascribed to each of these groups of criteria is determined by the use of a series of simple formulae. These formulae allow the scores for the individual components to be determined on a defined basis.

The process for the RIAM in its present form can be expressed:
If

$$(a1) * (a2) = aT$$

$$(b1) + (b2) + (b3) + (b4) = bT$$

Then $(aT) * (bT) = ES$

Where

- (a1) and (a2) are the individual criteria scores for group (A)
- (b1) , (b2) , (b3) and (b4) are the individual criteria scores for group (B)
- aT is the result of multiplication of all (A) scores
- bT is the result of summation of all (B) scores
- ES is the Environmental Score for the condition

5.2 Environmental components

RIAM requires specific assessment components to be defined through a process of scoping, and these environmental components fall into one of four categories, which are defined as follows:

(i) Physical/Chemical (PC) : Covering all physical and chemical aspects of the environment.
(ii) Biological/Ecological (BE) : Covering all biological aspects of the environment.
(iii) Sociological/Cultural (SC) : Covering all human aspects of the environment, including cultural aspects.
(iv) Economic/Operational (EO) : Qualitatively to identify the economic consequences of environmental change, both temporary and permanent.

To use the evaluation system described, a matrix is produced for each project option, comprising cells showing the criteria used, set against each defined component. Within each cell the individual criteria scores are set down. From the formulae given previously, ES number is calculated and recorded.

Table-3 : Conversion of Environmental Scores

Environmental score range band	Sustainability classification	Description
+192 to +108	D (+4)	Major positive impact
+107 to +54	C (+3)	Significant positive impact
+53 to +31	B (+2)	Moderate positive impact
+30 to +1	A (+1)	Slight positive impact
0	N (0)	No impact
-1 to -30	-A (-1)	Slight negative impact
-31 to -53	-B (-2)	Moderate negative impact
-54 to -107	-C (-3)	Significant negative impact
-108 to -192	-D (-4)	Major negative impact

No claim is made for the sensitivity of any ES value. To provide a more certain system of assessment, the individual ES scores are banded together into ranges where they can be compared. Ranges are defined by conditions that act as

markers for the change in bands. The full reasons for the setting of range bands is described by Pastakia, 1998; Ijas et. al, 2008.

Table 3 gives the ES values and range bands currently used in RIAM. The final assessment of each component is evaluated according to these range bands. Once the ES score is set into a range band, these can be shown individually or grouped according to component type and presented in whatever graphical or numerical form the presentation requires.

6. RESULTS AND DISCUSSIONS

This method is based on a standard definition of the important assessment criteria, as well as the means by which semi-quantitative values for each of these criteria can be collected to provide an accurate and independent score for each condition.

Here the impact of project activities is evaluated against the environmental components; and for each component a score is determined, which provides a measure of the impact expected from the component.

6.1 Application of RIAM

The impact components taken under PC category are impact on surface water(PC1), catchment land use(PC2), land stability and erosion(PC3), visual importance(PC4), sediments and heavy metals(PC5), soil characteristics(PC6).

Table-4 : Importance of RIAM criteria (PC)

Components	Sub components	a1	a2	aT	b1	b2	b3	b4	bT	ES	Range
PC	PC1	3	-1	-3	1	1	1	1	4	-12	-A(-1)
	PC2	3	-2	-4	1	1	2	3	7	-28	-A (-1)
	PC3	4	-1	-4	1	1	1	1	4	-16	-A(-1)
	PC4	1	-1	-1	1	1	1	1	4	-4	-A (-1)
	PC5	3	1	3	1	1	1	3	6	18	A (1)
	PC6	3	-3	-9	1	1	3	3	8	-72	-C (-3)

Those which are grouped under BE category are fish tanks(BE1), endangered species(BE2), ecological services(BE3), forests(BE4), birds and insects(BE5), aquatic weeds(BE6).

Table-5 : Importance of RIAM criteria (BE)

Components	Sub components	a1	a2	aT	b1	b2	b3	b4	bT	ES	Range
BE	BE1	2	-1	-2	2	2	3	3	10	-20	-A(-1)
	BE2	3	-2	-6	3	3	3	3	12	-72	-C(-3)
	BE3	1	1	1	1	1	1	1	4	4	A(1)
	BE4	4	-3	-12	4	4	3	4	14	-168	-D(-4)
	BE5	1	1	1	1	1	1	1	4	4	A(1)
	BE6	3	-3	-9	3	3	4	4	14	-126	-D(-4)

Those which come under SC category are protected reservations(SC1), income to locals(SC2), aesthetic importance(SC3), job opportunities(SC4), green spaces(SC5), overall security(SC6)

Table-6 : Importance of RIAM criteria (SC)

Components	Sub components	a1	a2	aT	b1	b2	b3	b4	bT	ES	Range
SC	SC1	3	-1	-3	1	1	1	1	4	-12	A(1)
	SC2	2	-1	-2	1	1	1	1	4	-8	-A(-1)
	SC3	3	1	3	1	1	1	1	4	12	A(1)
	SC4	2	-1	-2	1	1	1	1	4	-8	-A(-1)
	SC5	2	1	2	1	1	1	1	4	8	A(1)
	SC6	1	-1	-1	1	1	1	1	4	-4	-A(-1)

Those which come under EO category are impact on tourism attractions(EO1), parking facilities(EO2), employment opportunities(EO3), access roads(EO4), frequency of visitors(EO5), property value(EO6).

Table-7 : Importance of RIAM criteria (EO)

Components	Sub components	a1	a2	aT	b1	b2	b3	b4	bT	ES	Range
EO	EO1	3	1	3	1	1	1	1	4	12	A(1)
	EO2	3	-3	-9	3	3	2	1	9	-81	-C(-3)
	EO3	1	1	1	1	1	1	1	4	4	A(1)
	EO4	2	-2	-4	2	2	2	3	9	-36	-B(-2)
	EO5	4	1	4	1	1	1	1	4	16	A(1)
	EO6	1	-1	-1	1	1	1	1	4	-4	-A(-1)

The final result shows that there is 63 % negative impacts and 37% positive impacts associated with Pookote lake and its catchment at the current situation.

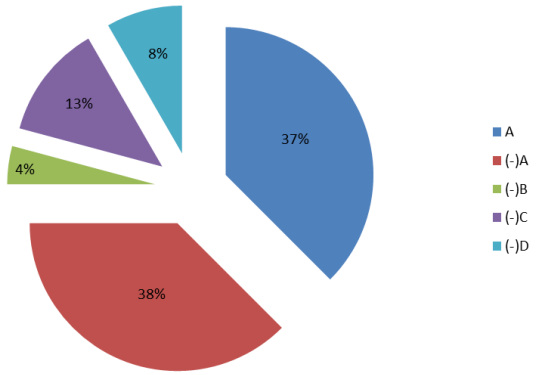

Fig. 2 : Comparison of total positive and negative impacts

The major positive and negative impacts of eco-tourism were identified from the Pookote lake and the catchment, using Rapid Environmental Impact Assessment method. By analyzing the present condition of the lake and the catchment, it is identified that negative impacts which are very harmful to the lake for its existence must be mitigated.

6.2 Mitigation measures

In order to improve the status of the lake as an eco-tourism site the negative impacts must be mitigated. The major threats identified were the excess weed growth, endangered species, weak boundary conditions of the lake, lack of parking facilities, excess cultivation of the plantation crops, deforestation of the catchment area, lack of providing job opportunities to the locals etc.

Cabomba furcata is the species of aquatic plant found in the lake. This is a type of Submerged plant in potable water supplies. Physical methods are ineffective for their mitigation process. Fragmentation increases the spread of cabomba furcata. There is a potential for biological control of the cabomba furcata in the Pookote lake. Weevil, whose scientific name is Hydrotimetesnatans Kolbe: Curculionidae have the host specific characteristics for this particular weed group is scientifically proven by the scientists from Australia. By introducing those species the excess weed growth can be reduced.

The weak boundary condition of the lake increases the soil deposition. It ultimately leads to the increased weed growth and grass growth near lake boundary. There are many methods for the mitigation of the soil coming into the lake, such as construction of rock filter dams, providing silt mats. Rock filter dams are the barriers made from rock and geotextile materials which allow the water to filter through, by trapping sediment load. Silt mats are products that can be placed on the boundary line of a lake to trap sediment as water flows over them.

Other mitigation measures to prevent lake from further eco-degradation includes :

(i) Afforest the catchment area with indigenous species of plants.
(ii) Discourage further cash crop plantation.
(iii) Discourage use of fertilizers and pesticides from the catchment area.
(iv) Conduct awareness program about the importance of Pookote lake.
(v) Create display boards and other visual aids to create awareness among visitors.
(vi) Promote the usage of paper bags in and around the lake proper.
(vii) Provide visual aids about the import of Wayanad and Pookote lake..
(viii) Provide job opportunities to the immediate residents.
(ix) Provide parking facilities near the lake.
(x) Introduce more eco-friendly activities as part of tourism.

7. CONCLUSIONS

In the Rapid Environmental Impact Assessment process, positive and negative impacts of Pookote lake for tourism promotion was assessed based on the results of various studies conducted and field survey. Rapid Impact Assessment Matrix (RIAM) method (Modified Pastakia, 1998; Ijas et. al, 2008) seeks to overcome the problems of recording subjective judgments by defining the criteria and scales against which these judgments are to be made. The final result shows that there is 63 % negative impacts and 37% positive impacts associated with Pookote lake and its

catchment at the current situation. The major threats identified were the excess weed growth, weak boundary conditions of the lake , excess cultivation of the plantation crops, deforestation of the catchment area etc. Suitable mitigation measures were also suggested for the major negative impacts.

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