MANAGEMENT OPTIONS FOR THE *KOLE* WETLAND ECOSYSTEM THROUGH STAKEHOLDER STUDIES

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THESIS

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DECLARATION

I hereby declare that this thesis entitled **"Management options for the *kole* wetland ecosystem through stakeholder studies"**is a bonafide record of research work done by me during the course of research and that it has not been previously formed the basis for the award to me of any degree, diploma, fellowship or other similar title, of any other University or Society.

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CERTIFICATE

Certified that this thesis entitled **"Management options for the *kole* wetland ecosystem through stakeholder studies"**is a record of research work done independently by **Ms. V. Lakshmi Shilpa** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma or fellowship to her.

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INTRODUCTION

1. INTRODUCTION

The *kole* land of Kerala is a complex ecological system which lies submerged under water for about six months in a year rendering it the properties of both terrestrial and aquatic ecosystems and generates substantial benefits to the society. This region lies 0.5 to 1.5 meters below the mean sea level. The word '*kole*' in the regional language means bumper harvest in favorable conditions and refers to the high productivity of the system (Sivaperuman and Jayson 2000).

The *kole* land, one of the rice granaries of Kerala, is a unique wetland ecosystem down South of India. It is part of Vembanad-Kole wetland system spread across 1,51,250 ha and is the largest wetland system from India included as a Ramsar site in 2002. Geologically, *kole* is a low lying area with rich alluvium deposits brought along by Kechery and Karuvannur rivers. As per the official estimates, the *kole* rice fields are low lying tracts located at 0.5 to 1 m below mean sea level extending to an area of 13632 ha, spread over Thrissur and Malappuram districts of Kerala.The west coast of Kerala is remarkable for the presence of a string of backwaters, estuaries, and lagoon barrier complexes. *Kole* lands lie between Bharathapuzha in the north and Chalakudy River in the south. It is located between 10^0 20' and $10^0$40' north latitudes and 75^0 58' and 76^0 11' east longitudes. Karuvannur and Keecheri rivers drain the *kole* lands and finally discharge into the Arabian Sea. *Kole* lands are divided into two divisions namely the Thrissur *kole* and the Ponnani *kole*. The Karuvannur river divides the Thrissur *kole* land in to North and South *kole*. It also acts as the flood basin for these rivers. Water level rises up to 5.5 meters during the southwest monsoon. The wetland area comes under the administration of civil authorities of Mukundapuram, Chavakkad, Thrissur and Thalappilly taluks of Thrissur district and Ponnani taluk of Malappuram district (Johnkutty and Venugopal, 1993).

Rice is a major crop cultivated in this region after dewatering of fields. High yielding varieties of rice are cultivated here. The *kole* lands have a network of canals and zonal system of cultivation in which flood water is managed in an interesting way in this system. Zonal cultivation is unique system of cultivation practiced in *kole* lands in which cultivation starts from zone 1 which is in a higher

elevation area and flood water from that zone is collected in zone 2, a lower elevation area followed by zone 3, much low lying region. *Kole* rice farms are organised under an institutional arrangement called *Padasekharams*, which is a cluster of farms. Co-operative and collective action is taken by farmers in the *kole* lands in all the cultural operations. Fish farming is another important economic activity carried out in the *kole* land. Fishes are cultivated after rice harvest when the fields are flooded. In some of the *kole* farms, rice and fish are cultivated alternatively. Besides rice and fish farming there are other uses from *kole* lands such as duck rearing, lotus farming etc. Off late, efforts were taken up to use the canal network of the *kole* land for promoting water tourism. The *kole* land provides a number of non-marketed goods and services apart from marketable goods and services. The *kole* lands support a large number of birds including endangered and migratory birds. It also provides other important onsite and offsite goods and services such as flood control, ground water recharge, apart from acting as a carbon sink. This fragile ecosystem is dwindling as tracts of the *kole* land were also converted to housing sites and non- agricultural uses (Srinivasan, 2011).

Although *kole* land is providing innumerable benefits to the society, it faces several anthropogenic pressures which result not only in the loss of ecosystem characteristics and services but also pose serious challenges to sustaining rice production. Infrastructural developments in the *kole* land helped the movements of various inputs, but it accentuated the conversion of *kole* land farms to non-agricultural uses apart from facilitating mining and other activities which in turn have led to the transformation of the ecosystem. All such developments tend to adversely affect the flow of ecosystem services and thereby the very sustainability of the ecosystem. Moreover, the *kole* rice farms are either marginal or small in nature and pose several challenges in cultivation (Srinivasan, 2011).

The designation of *kole* wetland system as a Ramsar site has elevated the status of *kole* lands and they have been considered a separate high value

biodiveristy area. There are institutional arrangements like *Padasekharam* Committees (*Kole* Padavu Committee) specific to each *kole,* District *Kole Padavu* Committee for each district headed by the District Collector and some other efforts from the government like the *Kole* Land Development Agency (KDA), Kerala Land Development Corporation (KLDC), Peechi Irrigation Committee, working for the development of *kole* lands. Schemes have been put forward for the enhancement of agricultural/ fishery production, productivity, infrastructure development and farmer incentives but a combined focus on conservation and sustainability of the natural resources as areas for food production, water storage and recreation is lacking.. The means and reach of all the institutions and co-operatives do not have a profound impact on the *kole* lands. So far no serious attempts have been made to project the perspectives of the marginalised and voiceless stakeholders towards their unique ecosystem as well as on the long - term impacts of the change on the ecology, food and water security of the people of the locality. The stakeholders otherwise would lose their interests with no one to project them. The ecological concerns are also a matter of high regard to prevent the declining trend of the resources. At this point, a study that covers the interests of the stakeholders and their ecological concerns is apparently necessary.

Any study aimed at the betterment of an ecosystem proves useless unless, the voices of the stakeholders are heard and considered, because they are the people whose lives are inextricably associated with that particular system (Reed *et al.,* 2009). Hence, stakeholders' opinions, interests, needs are to be known which can be compiled and further subjected to ranking following suitable methods and procedures to arrive with clusters of stakeholders' preferences regarding *kole* lands. The study mainly aimed at learning the perceptions of the different stakeholders who have their lives either directly or indirectly associated with the *kole* lands. This study also enabled us coming out with suggestions and management options for the unique *kole* land ecosystem.

The present study therefore was an attempt in this direction to study the perspectives of the stakeholders with regard to the *kole* land and to suggest the various suitable management options for the *kole* wetland ecosystem.

1.1 Scope and importance of the study

The study would help in identifying the potential stakeholders of the *kole* land, their level of understanding on ecosystem services rendered and knowing the stakeholders' perspectives with regard to the *kole* lands. All these would help in suggesting management options and suggestions for policy making for the conservation based development of the *kole* lands. Hence the present study entitled **"Management options for the *kole* wetland ecosystem through stakeholder studies"** has been designed with the following objectives:

(1) Identification of the stakeholders in relation to *kole* wetlands and analysing the structural and functional relationships among them

(2) Analyse the societys' understanding on the different ecosystem services rendered by the *kole* wetlands with relative importance of each

(3) To examine the stakeholder preferences about resource use of *kole* and arrive at policy suggestions for conservation based economic development.

1.2. Limitations of the study

1. With time and resources being the major constraints, the study has been restricted to only six panchayats, three from each of the Thrissur and Ponnani *koles* they are namely Arimbur, Parlam, and Thanniyam, Kattakampal of Thrissur district and Perumpadappu and Nannamukku of the Malappuram district

2. Although *kole* lands are more or less similar to any wetlands in its physical, chemical and biological properties and the psychological and socio-economic interests of the stakeholders, the institutional arrangements differ from region to region hence the results of the study can not be generalized as such for other wetlands.

There is a need for further exploring the complex interface between agricultural practices and the fragile wetland ecosystems like the *kole* land, so that appropriate measures for their wise use can be taken up.

1.3. Organization of the present study

The study has been organized under the following five chapters

CHAPTER 1: INTRODUCTION: Explains the importance of the topic, objectives, scope and limitations of the study.

CHAPTER 2: REVIEW OF LITERATURE: Deals with review of relevant literature and conceptual model framed on the basis of reviews enumerated.

CHAPTER 3: RESEARCH METHODOLOGY: Describes the sampling design, the study area, measurement of dependent and independent variables, tools for data collection and statistical tools used.

CHAPTER 4: FINDINGS AND DISCUSSION: Discusses the results of the study to draw specific inferences.

CHAPTER 5: SUMMARY AND CONCLUSION: Briefly summarizes the work done, salient findings and explains the implications based on the results of the study.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The prime focus of this chapter is to analyse the theoretical and empirical information concerning the present study. Review of available literature is essential as it provides a strong foundation for scientific investigation. An acquaintance with earlier pertinent studies has been felt necessary to develop good understanding of the present study and to formulate appropriate research methodology. It paves way for better understanding of the present study and provides ideas for interpreting the findings.

2.1. Wetlands and wetland ecosystem

2.2. Wetland management

2.3. *Kole* wetlands of Kerala

2.4. Stakeholder studies

2.5. Constraints to conservation based development of wetlands

2.1. Wetlands:

The Ramsar convention of 1971 on wetlands of international importance in its article 1.1 defines wetlands as "areas of marsh, fen, peat land or water whether natural or artificial, permanent or seasonal with water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six metres."

According to the article 2.1 of the Ramsar convention of 1971 "wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands".

Cowardin *et al.*,(1979) define wetlands as "the lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water". This includes three attributes

that help to delineate a wetland: (i) the area must be permanently or periodically inundated or water must be present for at least seven successive days during the growing season, (ii) the area must support hydrophytic vegetation and (iii) the substrate is predominantly hydric soils that are saturated or flooded for a sufficiently long period to become anaerobic in their upper layers.

A wetland can be defined as land subject to excessive wetness, to the extent that the wet conditions influence the possible land uses (Andriesse, 1986).

Wetlands are defined as 'lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitsch and Gosselink, 1986).

Wet lands are lands inundated or saturated by surface or groundwater at a frequency and for duration sufficient to support, and which under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturated soils(Smith *et al.*, 1995).

Popularly known as the "kidneys of the Earth", wetlands perform a wide array of functions ranging from reducing soil erosion to acting as natural water purifiers and from conserving migratory birds' habitats to mitigating extreme climate change (Schweiger *et al.*, 2002).

Wetlands are ecotones or transitional zones that occupy an intermediate position between dry land and open water. Wetland ecosystems are dominated by the influence of water and they possess characteristics of both terrestrial and aquatic ecosystems and properties that are uniquely of their own. Wetlands support a wide array of flora and fauna and deliver many ecological, climatic and societal functions (Freyfogle, 2007).

According to the Millennium Ecosystem Assessment, wetlands are the habitat that has been most affected by development and are being lost more rapidly than any other habitat in the world (Moses, 2008).

Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water. Once treated as transitional habitats or serial stages in succession from open water to land, the wetlands are now considered to be distinct ecosystems with specific ecological characteristics, functions and values. Wetlands, natural and manmade, freshwater or brackish, provide numerous ecological services. The density of birds is an accurate indication of the ecological health of a particular wetland. However, unsustainable use of wetlands without reckoning of their assimilative capacity constitutes major threat to the conservation and management of these vital biodiversity rich areas. It restricts the prospects of future generation to utilize the benefits of the ecosystem services provided by these wetlands (NWCP, 2009).

Wetlands are highly productive ecosystems that provide a number of "life-supporting" services of significant value to mankind. Flood control, groundwater replenishment, sediment retention, water purification, recreation, as well as climate change mitigation and adaptation, are just a few of the many valuable ecosystem services that wetlands provide (Verma and Negandhi, 2011).

Wetlands are among the most important and yet most threatened eco-systems in India. They are a precious part of our cultural and natural heritage, providing and extremely important resource for many human interest and activities, as well as habitats that support a rich diversity of animal and plant life (Biswasroy *et al.*, 2011).

Wetlands occur where the water table is at or near the surface of the land, or where the land is covered by water. Wetlands occur at all latitudes, from the polar

areas to the tropics, and occur in most countries. The UNEP-World Conservation Monitoring Centre has suggested an estimate of about 570 million hectares (5.7 million km^2), roughly 6% of the Earth's land surface, of which 2% are lakes, 30% bogs, 26% fens, 20% swamps, and 15% floodplains. They cover about 6% of the earth's surface. Ramsar convention of 1971 encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity. Once designated, these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites. Five major wetland types are generally recognized:

- Marine (coastal wetlands including coastal lagoons, rocky shores, and coral reefs);
- Estuarine (including deltas, tidal marshes, and mangrove swamps);
- Lacustrine (wetlands associated with lakes);
- Riverine (wetlands along rivers and streams); and
- Palustrine (meaning "marshy" - marshes, swamps and bogs)

In addition, there are human-made wetlands such as fish and shrimp ponds, farm ponds, irrigated agricultural land, salt pans, reservoirs, gravel pits, sewage farms and canals. The Ramsar Convention has adopted a Ramsar Classification of Wetland Type which includes 42 types, grouped into three categories as Marine and Coastal Wetlands, Inland Wetlands, and Human-made Wetlands. So far 2,114 sites as have been designated as Ramsar sites internationally of which 26 sites are from India covering an area of 6,89,131 ha. (Panigrahy *et al.*,2011).

Despite the benefits, wetlands are the first target of human interference and are among the most threatened of all natural resources. Around 50% of the earth's wetlands are estimated to already have disappeared worldwide over the last hundred years through conversion to industrial, agricultural and residential developments. Even though the ecosystem services provided by wetlands are better understood degradation and conversion of wetlands continues. This is

largely due to the fact that the 'full value' of ecosystem functions is often ignored in policy-making, plans and corporate evaluations of development project(Kiran and Ramachandriah, 1999).

2.1.2. Wetland ecosystem:

A system is a group of parts that interact through one or more processes (Odum,1983). The term ecosystem was introduced and defined by Tansley (1935), who defined it as "a fundamental organizational unit of the natural world that includes both organisms and their spatial environment." Ecosystems have since been defined in various ways at different spatial and temporal scales. Ecosystems are defined on the basis of numerous aspects like biotic organisms, communities, populations and physical, chemical, biological, abiotic processes and characteristics etc., In the applied world of regulation, planning, management, wetlands are usually defined keeping in mind of their physical, chemical, biological characteristics such as hydrologic regime, soil type, and plant species composition (Smith *et al.*, 1995).

Wetlands are dynamic and hence are influenced by both natural and manmade activities. In India, wetlands are most valuable ecosystems and the total estimated wetland area of the country is about 15.260 Mha, which is around 4.63 per cent of the geographic area of the country. Wetlands are distributed in different geographical regions. As per the definition of wetland, diverse types of classes get included like lagoon, beach, mangrove, coral reef, salt pan, aquaculture pond, waterlogged, ox-bow lake reservoir, lake, tank inter-tidal mudflat etc. IUCN (International Union for Conservation of Nature) /RAMSAR based classification system is used to categorize the wetlands. This classification categorises inland and coastal wetlands at level-I followed by natural and man-made wetlands as level-II, which were further categorised into 19 types of wetlands. The major wetland types in inland category are river/stream, reservoir, tank/pond and lake/pond. In coastal wetland category major types are inter-tidal mudflat, lagoon,

and creek. India has also some of the unique wetlands like mangrove and coral reef. Among all the wetland types river/stream is the major type, occupying 5.26 Mha area (34.46%). Reservoirs occupy 2.48 Mha (16.26%), inter-tidal mudflat occupy 2.41 Mha (15.82%), tanks/ponds occupy 1.31 Mha area (8.6%) and lakes/ponds occupy 0.71 Mha area(4.78%)(Panigrahy *et al.*,2011).

Wet lands of Kerala include estuaries, deltas, mangroves, coastal lagoons, freshwater lakes, swamp forests, rivers, streams, ponds and non-managed systems such as rice fields and reservoirs. *Kole* wetland is one of the largest and most important wetlands of Kerala, covering an area of 13,632 ha. spread over Thrissur and Malappuram district, extending from the northern bank of Chalakkudy river in the south to the southern bank of Bharathapuzha river in the north. *Kole* wetland is of substantial economic and cultural value and is regarded as the 'rice bowl' of central Kerala. The economic value of ecosystem of the *kole* wetland is estimated as $278 million (Nikhil Raj and Azeez, 2009), while Nameer (2011) has estimated the socioeconomic value of *kole* wetland to the tune of $66.91 million. They also estimated that *kole* Wetlands generated 2.5 million man-days of employment annually from four land use practices such as agriculture, fisheries, animal husbandry and poultry.

The Millennium Ecosystem Assessment estimates conservatively that wetlands cover seven percent of the earth's surface and deliver 45% of the world's natural productivity and ecosystem services of which the benefits are estimated at $20 trillion a year (Murthy *et al.*,2011). The Millennium Assessment (MA) uses the following typology to categorize ecosystem services:

Provisioning services: The resources/ products provided by ecosystems such as food, raw materials (wood), genetic resources, medicinal resources, ornamental resources (skin, shells, flowers).

Regulating services: Ecosystems maintain the essential ecological processes and life support systems, like gas and climate regulation, water supply and regulation, waste treatment, pollination, etc.

Cultural and Amenity services: Ecosystems are a source of inspiration to human culture and education throughout recreation, cultural, artistic, spiritual and historic information, science and education.

Supporting services: Ecosystems provide habitat for flora and fauna in order to maintain biological and genetic diversity.

2.2. Wetland management

Wetland management programme generally involves activities to protect, restore, manipulate and provide for the functions and values emphasizing both quality and acreage alongside advocating sustainable use of them (Kiran and Ramachandraiah, 1999).

Management of wetland ecosystem means manipulating to ensure maintenance of all functions and characteristics of the specific wetland type. The loss or impairment of a wetland ecosystem is usually accompanied by irreversible loss in both the valuable environmental functions and amenities important to the society (Zentner, 1988). Appropriate management and restoration mechanisms need to be implemented in order to regain and protect the physical, chemical and biological integrity of wetland ecosystems. Hence a detailed study of wetland management and socioeconomic implications is required from biological and hydrological perspectives (Ramachandra, 2001).

Management of wetland ecosystem requires an intense monitoring, increased interaction and co-operation among various agencies (state departments concerned with environment, soil, natural resource management, public interest groups, citizen groups, agriculture, forestry, urban planning and development, research institutions, government, policy makers etc.,). Such management strategies should not only involve buffering of wetlands from any direct human pressures, but also in maintaining important natural processes that operate on them which may be altered by human activities. Wetland management has to be

an integrated approach in terms of planning, execution and monitoring requiring effective knowledge on a variety of subjects like ecology, economics, watershed management planning and decision making etc., They also require collaborated research involving natural, social, and inter-disciplinary study aimed at understanding the various component, such as monitoring of water quality, socio-economic dependency, biodiversity and other activities, as an indispensable tool for formulating long term conservation strategies. All these would help in understanding wetlands better for long term conservation and management strategies (Kiran and Ramachandraiah, 1999).

The greatest sources of stress on wetlands include: changes in land use with habitat loss and fragmentation; resource extraction; drainage and reclamation and pollution. Various international agreements exist to protect wetlands and their dependent species, but despite this, many wetlands over the world are under threat. Soderqvist *et al.,* (2000) identified four main reasons for this: (1) market failures due to the public good nature of wetlands; (2) externalities caused by economic activities such as agriculture, industry and water abstraction; (3) lack of understanding of the many values associated with wetlands due to the complexity and 'invisibility' of spatial relationships among groundwater, surface water and wetland species; and (4) frequent failure of policy intervention and land use planning due to inconsistent treatment of wetlands by economic, agriculture, environmental and nature protection policies (Gilbert *et al.,* 2004).

The primary direct drivers of inland wetlands degradation and loss include land conversion, infrastructure development, water withdrawal, pollution, the introduction of invasive alien species and overexploitation. Degradation of many of the world's wetland systems is still increasing and more and more of them are converted to agricultural use. Conversion of wetlands can be considered synonymous with complete loss of natural wetland functions and benefits in areas where water is scarce, such as in semi-arid zones, wetlands are particularly

sensitive to water quality degradation due to the reduced capacity for waste dilution (Cohen-Shacham, 2009).

Under the conservation of wetlands in India, numbers of wetlands have been recognized as a part of National Parks and Sanctuaries. Twenty-five wetlands have been declared as Ramsar Sites. Various types of sanctuaries and parks like bird, wildlife, marine and education have been notified in the country (Panigrahy *et al.*,2011).

2.3. *Kole* wetlands of kerala

Kerala is well known for its wetlands. These wetlands provided livelihood to the residents in the area in the forms of agricultural produce, fish, fuel, fiber, fodder and a host of other day-to-day necessities. Kerala, despite being a small land area of 38864 km^2,is bestowed with a vast network of backwaters, lagoons, natural lakes, rivers and canals. Occurrence of the two distinct rainfall seasons i.e., south west and north east monsoons results in near water-logged conditions in almost 20% of the total geographic area of the state. Thus, as much as one fifth of the total landmass here is wetlands (Freyfogle, 2007).

On the other side with the rising population, pressure on land has increased by human interventions for agriculture, aquaculture, urban expansion etc. Direct interventions include mining of wetlands, construction of dams and check dams for flood control, discharge of sewage, pesticide and weedicide residues degrading the wetland to a larger extent. Indirect threat includes increased siltation due to unscientific land use practices in the catchment area, mining, oil exploration etc., apart from these natural causes like eutrophication, erosion, storm damage, drought, biotic interferences other than anthropogenic etc. All these will lead to destruction of wetlands either partly or totally (Kokkal *et al.*, 2008).

Wetlands in Kerala come under Central Asian – Indian Flyway. Hence *kole* wetland is one such area with high importance. The name "*Kole*" refers to a peculiar type of cultivation carried out during the months from December to May. This word originates from Malayalam language which means a bumper yield of high returns. During June to November, i.e., for a period of almost six months a major portion of this land lies submerged under water. These lands were formerly shallow lagoons, that got silted up gradually. Kechery and Karuvannur are the two rivers which bring flood water into the area and finally it is emptied into the Arabian Sea. The *Kole* wetlands cover an area of 11,000 ha. Spread over two districts, Thrissur and Malappuram, extending from northern banks of Chalakudy River to the sothern banks of Bharathapuza River in the north. The area lies between 10^0 20' and10^0 40' N latitudes and $75^0$58' and $76^0$11' E longitudes. The wetland is a low lying tract, located about 0.5 to 1 m. below the mean sea level (Sivaperuman and Jayson, 2000).

The *Kole* land of Kerala is a flood plain of Karuvanoor and Kechery rivers. It is an important Ramsar wetland. It is a complex ecological system and the submergence under water for half of the year giving it both the properties of terrestrial and water generating substantial benefits to the society. Different regions of the *kole* are connected to the rivers by a network of canal system which is also serving as a good drainage system. Rice cultivation is carried out in the *kole* after the mansoon season. Nearly ninety five percent of the farmers are cultivating rice in a single crop season. Farmers in the *kole* are arranged under an institutional arrangement called *Padasekharams* which is a cluster of farms. In Southern *kole* land during 1975-76, the total area under rice was 8.76 lakh hectares which was declined to 2.29 lakh hectares by 2007-2008. There was staggering decline of 73.86 percent over a span of 32 years. As against the general trend observed, the loss of rice is comparatively low in *kole* lands largely owing to its submergence for almost six months in a year. Rice which was accounting for about 46.66 percent of the total *kole* area in 1981 and consistently declined to about 35 percent by 2007. Similar trend has been observed in the northern

*kole*land also. But the area under mixed crop showed a consistent increase from 49 percent in 1981 to 55 percent of the total area by 2007. The trends observed are similar across both the northern and southern *kole* lands (Srinivasan, 2011).

Thrissur Municipal Corporation is a city corporation which covers an area of 101.42 km^2 and is having a population of 3,17,526 with a density of 3031/km^2. The city doesn't have a systematic and planned drainage facility to dispose the waste water and excess water during monsoons. Most of the drainage canals are connected to the irrigation canals of *kole* wetland. The drinking water source of the city and the surrounding areas, is largely depending on the *kole* wetland due to the ground water recharge properties of the same. As the local paddy fields of Thrissur Corporation have been reclaimed for residential and industrial purposes due to increasing population pressure, the wetland became essential for the urban society to drain its waste water and excess water during the heavy monsoon months. During the summer, the water presence in the wetland helps to retain the groundwater level to a great extent. According to the reports, the water levels in the representative sample wells from Thrissur maintained an average water level of 6.32 meters in the 12 years period from 1996 to 2007. Even though in these years the consumption of water has increased manifold, due to the increase in the population level of Thrissur and the expansion of the city, the ground water level has remained almost same. This can be attributed to the ground water recharge property of the wetland (Binilkumar and Ramanathan, 2009).

The major part of *kole* wetland is paddy field. It forms the 'rice granary' of Thrissur and Malappuram districts. "*Kole*" is a term in Malayalam (a regional language in India) which means bumper crops. The whole *kole* paddy fields were reclaimed from the lake by putting up temporary earthen bunds and cultivation of rice was done during summer period from December to May. Due to profitability factor farmers stick to single crop cultivation in the wetland though two dams were constructed to support irrigation facilities in the summer months. The water from the fields will be pumped out and stored in a network of canals interspersed

throughout the area and which is connected to Arabian Sea and protected with barrages in order to avoid saline water intrusion from the sea. Fishing is one of the important livelihood options available in *kole* wetland particularly during monsoon months. Many varieties of indigenous fish species are available in *kole* wetland. Inland fishing community namely "Dheevara" is engaged in this activity together with some local community members. Recently, aquaculture was also started in the wetlands particularly during monsoon months when the paddy fields were flooded with water.

Kole wetland is endowed with the natural beauty with a long stretch of backwater zone which has opening to the Arabian Sea. Its paddy fields also attract tourists with its dense greenery and water filled canals interspersed through the paddy fields. There are many areas in the wetland with high potential for development as recreational sites. The canals constructed through the paddy fields can be modified to enable inland water transportation (Binilkumar *et al.*, 2010).

2.4. Stakeholder studies

Stakeholders are the people who are affected by the decisions and actions taken by the decision makers and they have the power to influence their outcome. Thus public participation is becoming increasingly embedded in national and international environmental policy decision making (Freeman, 1984).

Stakeholder analysis in development and natural resource management projects has often focused on inclusivity, being used to empower marginal groups, such as women, those without access to well established social networks, the under-privileged, or the socially disadvantaged, and those who are not easily accessible, because for example they live far away from main roads (Johnson *et al.*, 2004). In the absence of stakeholder analysis, there is a danger that particularly powerful and well-connected stakeholders can have a greater influence on decision-making outcomes than more marginalised groups, a

problem that is especially acute in development projects (Chambers, 1994). Having said this, depending on the underlying agenda of those convening the process, stakeholder analysis can be abused to empower or marginalise certain groups. In these disciplines, stakeholder analysis has developed in parallel with and been enriched by the development of participatory methods for project design and planning, for example, through rapid and participatory appraisal, action research, social forestry, and land-use planning (Grimble and Wellard, 1997).

Stakeholder analysis recognizes the different interest groups involved in the utilization and conservation of natural resources and provides tools that help to identify and resolve trade-offs and conflicts of interest. Stakeholder analysis has considerable value in assisting researchers to take account of potentially conflicting objectives of efficiency, equity and sustainability. These conflicts are fundamental in the management of natural resources, particularly where there is increasing resource scarcity and where common property resources are concerned. Therefore Stakeholder analysis is likely to be of use to researchers in two main ways by improving the selection and design of research projects and addressing better the distributional, social and political impacts of research projects (Grimble, 1998).

Stakeholder studies can be said to look at how those who will be affected by change are equipped to deal with it. They are often undertaken at the local or regional level, as it has been suggested that they are best carried out on this scale which reveals the specific adaptation options among particular actors. Stakeholder studies are seen as contributing knowledge beyond that provided by scientists or other specialists and that relates to everyday life and work in the area in question, and they are a common part of integrated Assessments (Durrenberger *et al.*, 1999).

Ukaga (2001) argues that "to promote sustainable development, it is essential that as many stakeholders as possible participate actively in assessing the given situation and in determining how to improve it".

Identification of stakeholder values is an important objective for any evaluation work since it provides a simple, accessible tool for providing insight about the key trade-offs to citizens and to decision makers to help link these values to specific resource-management actions (Gregory and Wellman, 2001).

Stakeholder studies may be seen as one part of a movement to democratise decision-making processes by developing knowledge of priorities and problems in areas from the perspectives of broad arrays of stakeholders and to create outreach mechanisms between different bodies (Carina, 2004).

Wetlands play an important role in livelihood activities of many rural communities and these activities in turn have an impact on wetland ecosystems and its functions. Numerous stakeholders of wetlands with different interests lay claims on the wetlands' water and lands that do not always coincide, for example, stakeholders include direct extensive users, who directly harvest wetland goods in an unsustainable way, agricultural producers that drain and convert wetlands to agricultural land, indirect users that benefit from indirect wetland services, such as storm abatement and flood mitigation, nature conservation and amenity groups, whose objective is to conserve nature and enjoy the presence of plant and animal species, and even non users that may attribute an intrinsic value to wetlands" (Schuyt, 2005).

Involvement and participation of the community constituting the stakeholders in the management of natural resources is a condition of their sustainable use. In the case of wetlands, they are recognized as fundamental principles of wise use by the Ramsar Convention.

Stakeholders can be defined as the people who either (i) will be potentially affected by the management of wetlands; (ii) will be involved by one way or another in the implementation of management activities; or (iii) who are likely to support or oppose the research or development project or the policy at stake.

Usually, the expected outcomes of stakeholder involvement in natural resources management are

(i) A better understanding of people concerns leading to solutions more adapted to their needs

(ii) An assessment of their knowledge about the wetland system, the integration of this knowledge in management options and a better targeting of awareness and education activities

(iii) Ownership of the project and support to its implementation

(iv) Reduction of potential conflicts among stakeholders

(v) Improved communication and coordination of actions and stronger working relationships among stakeholders (Darradi *et al.*, 2006).

2.5. Constraints to conservation based development of wetlands

In the Indian subcontinent due to rice culture, there has been a loss in the spatial extent of wetlands. Due to captured precipitation for fishpond aquaculture in the catchment areas and rice-farms occupying areas that are not wetlands, water is deprived to the downstream natural wetlands. Around 1.6 million hectares of freshwater are covered by freshwater fishponds in India. Rice-fields and fishponds come under wetlands, but they rarely function like natural wetlands. Of the estimated 58.2 million hectares of wetlands in India, 40.9 million hectares are under rice cultivation (Anon, 1993).

Acidity, salinity, poor drainage and presence of toxic salts are the characteristics of the *Kole* lands. Therefore the cost of cultivation in these lands is quite high. Shortage of labourers at peak season constitutes a major problem

(Pillai, 2004). The group-farming method of cultivation followed in *Kole* lands facilitates the use of agricultural machinery on a profitable basis for tillage, transplanting, harvesting, and threshing.

The needs of agriculture for flat, fertile land with a ready supply of water mean that wetlands are often a potentially valuable agricultural resource. In many arid and semi-arid regions, the capacity of wetlands to retain moisture for long periods, and sometimes throughout the year, has meant that their use for cultivation is widespread and a long-established land-use practice (Gitay, 2011).

The major constraints to the cropping systems in the wet lands are abundance of water and its management, weed, disease and pest control and poor yielding crop varieties, especially rice. Uncontrolled flooding water is the major cause of the erosion of fine clay particles and organic matter and loss of plant nutrients from the colloidal complex and fixed N. Consequently, lack of water management may be one among the most important factors causing sustained low yields in wetland agriculture, besides there are other factors like low inherent fertility and sweeping away of mineralized nutrients in the area. Another factor of low yields is unimproved crops with low yielding potentials (Ogban *et al.*, 2011).

The interactions between agriculture and wetlands assume considerable importance in view of the growing demand for food production which in turn exerts enormous pressures on wetlands. Intensification of agricultural production turned out to be a major pressure on the *kole* land over time. Several engineering interventions aimed at improvement of drainage and water management system have been carried out. Although construction of farm roads has helped the movement of machinery and reduced the costs, it has accentuated the conversion of *kole* land farms into non- agricultural uses apart from facilitating mining and other activities. Increase in acidic content of soils, decline in soil quality, water logging due to faulty designs of bunds and canals, presence of water hyacinth etc., are some constraints (Srinivasan, 2011).

Loss of biodiversity was also reported. Impacts of the state of ecosystem changes are diverse and vary across different types of users. Intensive agricultural practices followed by rice farmers have adversely affected communities that were dependant entirely on fisheries. Shift in the fisheries from subsistence oriented to commercial and contract based one, when the *kole* lands remain flooded, has affected the livelihoods of traditional fishing communities. On the other side mining activities have given rise to unhealthy competition with respect to resource exploitation and the subsequent social conflicts with other users because of undue claims over the available resource. All these drivers and pressures, state changes and impacts are largely focused on *kole* cultivation.

A study focused on sustainable use of wetlands conducted by Dixon and Wood (2003) in Eastern Africa observed that, wetlands have come under extreme pressure as governmental policies, socio-economic change and population pressure have a stimulated a need for more agriculturally productive land. They observed that although wetland drainage and cultivation can make a key contribution to food and livelihood security in the short term, in the long term there are concerns over sustainability of this utilization and maintenance of wetland benefits.

Ever-increasing population and the consequent urbanization and industrialization have mounted serious environmental pressures on the wetland ecosystems and have affected them to a greater extent that their benefits have declined significantly. Wetlands are estimated to occupy around 8.6 million sq km(6.4 %) of the earth's surface, out of which about 4.8 million sq km are found in the tropics and sub-tropics. This estimation when it was compared with estimates in the 19th century, it was found that approximately 50% of the world's wetlands have been lost in the past century alone. The major activities responsible for wetlands loss are urbanization, drainage for agriculture and water system regulation (Shine and De Klemm, 1999). Development activities, like excavation,

filling, draining and so forth are the major destructive methods resulting in significant losses of wetland spatial spread throughout the country.

RESERARCH METHODOLOGY

2. RESEARCH METHODOLOGY

Research methodology is an important component of any systemic research because it determines the validity and quality of the study. Methodology is the description and justification of various methods of conducting the research. Detailed description of the methods and procedure followed in conducting research is furnished in the following headings.

3.1 Research design

3.2 Locale of the study

3.3 Selection of respondents

3.4 Selection and operationalization of variables

3.5 Methods of data collection

3.6 Statistical tools used

3.1 Research design

The objectives of the study and the outline of the project necessitate the adoption of the research design viz., *ex post facto* research design. Kerlinger (1973) defined *ex post facto* research design as the systematic empirical inquiry in which the researcher does not have direct control over the independent variables because their manifestations have already occurred or because they are inherently not manipulated. As the chance for manipulation of variables is not possible, the *ex post facto* research design was considered due to the reason that all observations to be taken as per objectives of the study have been already happened in the research study area.

3.2 Locale of the study

The study was conducted in Thrissur and Malappuram districts of Kerala. Two *kole* lands viz., Thrissur and Ponnani were purposively selected for the study for the reason that they best bear a resemblance and have active *kole* cultivation with well-functioning *padavu* committees. From these two *kole* areas, the lists of panchayaths were collected by using the random sampling procedure, three panchayaths under each *kole* area were selected. The selected panchayats representing Thrissur *kole* were Arimpur, Paralam and Thanniyam and

Kattakampal, Perumpadappu and Nannamukku from Ponnani area. Thus, six panchayaths were selected equally representing two *kole* areas.

3.3 Selection of respondents

As shown in the figure 1, from each panchayth, ten respondents were selected. The respondents were selected by using the method of snow ball technique. It is a non-probability sampling technique with a multi-step process in which more and more people are added to the sample with each step. Typically, the initial step involves identifying a group of individuals who are known members of the population to create a "seed". One or two respondents were selected first and from this group next units were identified and so on until the sample size is met. As a result, the size of the respondent group increases gradually until no new respondent is identified.

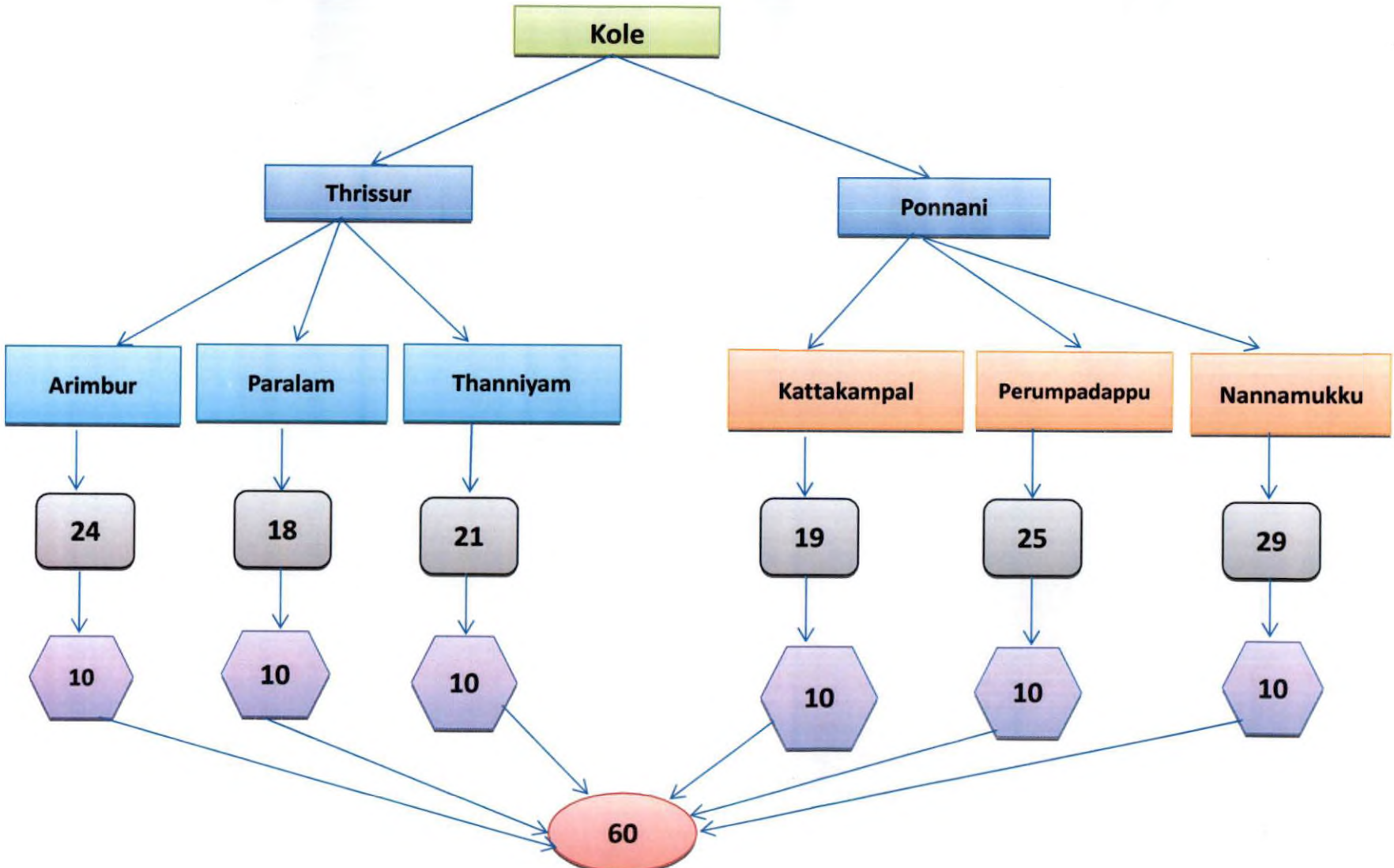
The snow ball method was followed in selecting the respondents for study. Initially one / two persons who could become a potential stakeholder of *kole* area were identified by consulting the *krishi bhavan* officers in each panchayath. The selected/identified respondents were asked to mention somebody who they think as a stakeholder of *kole* and this went on until no new member is added to this group. Thus a list of stakeholders was prepared and 10 members were selected from each group by random sampling procedure. Thus 60 respondents were selected from six panchayaths representing 10 members each from a panchayath.

3.4. Selection and operationalization of variables

Based on the objectives of the study, review of related literatures and discussion with experts, a list of variables were identified. The final selection of the variables was based on the suggestions of the Advisory Committee and the following variables were selected for the study.

1. Awareness
2. Preferences
3. Socio economic characteristics
    a. Age
    b. Education
    c. Economic Class

Figure 1.Selection of the respondents



d. Occupation
e. Economic Motivation
f. Information Source Utilization
g. Social Participation

3.4.1. Awareness of the respondents regarding ecosystem services provided by the *kole* wetlands

Awareness is conceptualized as the respondent's knowhow about the various ecosystem service provided by the *kole* wet lands.

The ecosystem services were identified through a thorough review of literature and discussion with experts like social scientists, agronomists, environmentalists, stakeholders of the *kole* area. Thus seven number of ecosystem service categories were identified and subsequently list of services under each category were listed. By this way, 49 eco system services were identified under seven categories of eco system services (Appendix-I).

The aforesaid services were constructed in an interview schedule and instructed to the respondents to express whether they know/hear about the services listed with responses of yes for 'know/hear' and No for 'not know/hear'. These responses were counted and a frequency table with percentage analysis was done to interpret the results.

3.4.2. Stakeholder preferences about the resource uses of *kole* lands

The preferences of stakeholders regarding the resource uses of *kole* land were identified by the following procedures.

Resource uses of *kole* land: Ecosystems provide umpteen numbers of services that were underrepresented or absent in most economic development decisions but, these services contribute to development objectives and to realizing quality of life goals. Identifying and understanding preferences of the stakeholders about the resource use of wetlands can provide more information to decision makers, which may help to prevent unintended consequences from development decisions. Preferences of the stakeholder were assessed by including a set of questions enlisting fourteen resource uses of *kole* land and these resources uses were

obtained from review of literature, focused group interviews with experts and stakeholders (Appendix-I). These fourteen resource uses were presented to respondents through the questionnaire and instructed to give their responses in a four point continuum ranging from 'most important', 'important', 'important to a smaller extent', and 'unimportant' with scores 4, 3, 2 and 1 respectively. Thus a cumulative preferential score was obtained for each resource use and the preference score of more than 50 per cent as retained and the remaining resource uses were deleted for interpreting the results. The consistency among the respondents in preferring the resource use was tested by administering the Kendall's coefficient of concordance test.

3.4.3. Age

Age is operationally defined as the number of chronological years completed at the time of study since birth. In this study, the respondents were categorized as follows.

Age group	score
Less than 35 years	1
35-50 years	2
More than 50 years	3

3.4.4. Educational status

Educational status is operationally defined as the extent of formal schooling successfully completed by the respondents at the time of investigation, their ability to read and write and literacy. The educational status of the respondents was classified as follows and the frequency and percentage analysis were done to interpret the results was measured by adopting scoring system followed in the socio economic status scale of Trivedi (1963) with slightest modifications and indicated below.

Educational status	Score
Illiterate	1
Literate	2
Upper primary level	3
High school	4
Collegiate level	5

3.4.5. Occupation

Occupation was operationalized as the main vocation and other additional vocations that the respondents were engaged in at the time of interview. The classification of different categories of occupation was done by counting the number of occurrence and percentage analysis was done. Scoring procedure followed in this study is depicted below.

Categories of Occupation of the respondents	score
Agriculture alone	1
Agriculture + private employment	2
Agriculture + government employment	3

3.4.6. Economic motivation

Economic motivation was operationalized as the extent to which a beneficiary was oriented towards profit maximization and the relative value he or she placed on monetary gains.

In this study, economic motivation of the beneficiaries was measured using the scale developed by Supe (1969) with slight modifications. The scale consists of seven items against a four point continuum measuring 'strongly agree', 'agree', 'disagree' and 'strongly disagree' with scores 4, 3, 2, and 1 for positive items and 1, 2, 3, and 4 for negative items respectively. The scores on individual items were summed up to get the total score.

The scores obtained on the variable were grouped by using mean +/-SD of the scores obtained by the respondents viz., high, medium, and low.

3.4.7. Information source utilization

Information source utilization was operationally defined as the use of various sources of information by the respondent in order to get information on agricultural technology. Here the 'source,' 'individual', and 'channels' were collectively used as "information sources," since for practical purposes there is no clear-cut demarcation that could be made between 'source' and 'channel'. Sajin (2003) identified various sources of information utilized by farmers and

categorized them under mass media sources, personal sources, personal cosmopolite sources and personal localite sources. The procedure adopted by Ramachandran (1992), Govind (1992) and Manoj (1998) was followed with slight modifications. The respondents were asked to indicate the frequency of use of these sources on a three point continuum viz., regularly, occasionally and never with scores of 3, 2, and 1 respectively. For extent of information a three point continuum viz., adequate, somewhat adequate and inadequate with score of 3, 2, and 1 respectively were scored by respondents. The cumulative score of each respondents was subjected to statistical analysis and found mean and SD. By using Mean +/- SD, it was categorized as high, medium and low.

3.4.8 Social participation

Sadamate (1978) defined social participation of the respondent as participation in social institution as a member or as an office bearer. Social participation was operationalized in the study as the extent of degree of involvement of beneficiaries in formal or informal social organization in terms of membership, office holding and frequency of participation in meetings and other organizational activities.

The procedure followed by Kamarudeen (1981) was adopted for the measurement of social participation. The scoring procedure is as follows:

a. Membership in organization

Category	Score
Membership in one organization	1
Membership in more than one organization	2
Office bearer in one organization	3
Office bearer in more than one organization	4
Distinctive features (Ward member, MLA, MP etc.)	5

. Frequency of attending meetings

Category	Score
Regularly attend meetings	3
Occasionally attend meetings	2
Never attend any meetings	1

The cumulative scores of the respondents were tabulated and by using mean and SD, the classification was made as high, medium and low.

3.5. Methods of data collection

In the study we have used both primary and secondary data.

3.5.1. Primary data:

The primary data for this study was of qualitative and quantitative in nature. In order to best record both, stakeholder seminars were conducted in six locations covering three padavus from Thrissur and Ponnani kole. Three panchayats each representing Thrissur kole and Ponnani kole were randomly selected for this, which were Arimpur, Paralam and Thanniyam from Thrissur kole and Kattakampal, Perumpadappu and Nannamukku from Ponnani kole. During these seminars, farmer discussion sessions were kept, in which farmers freely expressed their opinions and later they were interviewed by the researcher personally, using the distributive schedule prepared exclusively for the study. (Appendix I)

3.5.2. Secondary data:

The published data and the data collected in the past or by other parties is called secondary data. Secondary data has been collected from various sources like *KrishiBhavan* records, research articles, journals, text books, magazines, and internet sources.

3.6. Statistical tools used

Various statistical tools used in this study are

3.6.1 Correlation: the correlation analysis was done to find the relationship between socio-economic characteristics and awareness of the respondents regarding the ecosystem services provided by the *kole* land

3.6.2 Analysis of stakeholder preferences using Multivariate Analysis – Multidimensional scaling (MDS) for finding the proximity of perspectives of the respondents. For doing this, the four categories of perspectives (Appendix II) of the stakeholders were presented to the judges. The judges ranked the perspectives according to what they perceive would be important for the stakeholders. As per

the ranks obtained to each category of perspectives, ranked matrices were prepared individually for each category of perspective. The ranks thus obtained were scored and ranked matrices were prepared out of them. The ranked matrices were used to do the MDS analysis.

3.6.3 Kendall's W test: was administered to find the consistency among the stakeholders in preferring the resource uses.

3.6.4 Percentage analysis was done to explain the socio-economic characteristics of the respondents.

Plate 3.Stakeholder interface seminar at Nannamukkupanchayat

Plate 4Stakeholder interface seminar at Paralampanchayat

Plate 1.Stakeholder interface seminar at Arimburpanchayat

Plate 2.Stakeholder interface seminar at Perumpadappupanchayat

RESULTS

4. RESULTS

In this chapter, the results of the study are presented after careful compilation of data in master table. Based on the objectives and observations to be made and for a meaningful statistical analysis, the data were subjected to statistical tests and the results of the study are presented under the following sub heads:

4.1 Identification of stakeholder groups.

4.2 Structural and functional relationships among stakeholder groups.

4.3 Awareness levels of the stakeholders regarding ecosystem services provided by *kole* lands.

4.4 Stakeholders' preferences of the resource uses of *kole* wetlands.

4.5 Socio-economic characteristics of the primary stakeholders.

4.6 Correlation of socioeconomic variables with the awareness levels of the respondents.

4.7 Multidimensional scaling to arrive at preferences of the stakeholders regarding perspectives of the*kole* lands.

4.1 Identification of stakeholder groups

The results revealed different categories of stakeholders of *kole* with different types of individuals / groups in each category. The classification of stakeholder categories and types was presented in the table 1. It was represented diagrammatically also in figure 1. From this broad classification of stakeholder categories and types as shown in figure 1, seven types of stakeholder categories were identified. They are as given below:

1. Farmers
2. Government departments
3. Input agencies
4. Co-operatives
5. Marketing agencies
6. Agricultural labourers
7. NGOs

Table 1.Stakeholder categories and types

Broad category	Sub-category	Types of Individuals/Groups
Those who exert any influence	Those involved in delivery of goods and services	Ministry of Environment and Forests, Government of India
		Ministry of Water Resources, Government of India
		Ministry of Agriculture, Government of India
		Ministry of Tourism, Government of India
		Ministry of Social Justice, Government of India
		Central Wetlands Regulatory Authority
		State Wetlands Regulatory Authority, State Government of Kerala
		The District Wetlands Regulatory Authority
		National biodiversity authority
		Kerala State biodiversity Board
	Those who determine the context	Experts in the field of Marine Biology, Limnology, Ornithology, Wetland management, Ecology, Hydrology , Environmental Education
		Appraisal committees of Central, State and District wetlands regulatory authority
		Representative from village panchayats
		Representatives from Non Governmental Organizations / non official stakeholders
Those who are affected by the system	Directly affected	Farmers , Fishermen, duck farmers
		Vegetable growers and vendors
		Padasekharam committee members
		Urban and rural civilians
		Land owners
		Input dealers and service providers
		Migrated labour from other states
	Indirectly affected	Tourists
		Local clay and construction industry
		Co-operative banks
		Other rural primary institutions
Others who may be interested		Environmental/social campaigning organisations, Researchers/ Academics Media Potential users/clients

Among the seven categories, the first and foremost category was farmers comprising rice, crops like coconut, vegetables, fish, duck and lotus farmers. The government departments includes Agriculture, Water resources, Environment, Biodiversity, local panchayaths, KAU, financial institutions etc., The third category was input agencies like fertilizer, pesticide, seeds, machinery suppliers etc., The Cooperatives like service societies, credit societies, harvest procurers were identified. The fifth categories comprise marketing agencies *viz.*, marketing federation and other local marketing agencies. The sixth category identified were Non-Governmental Organisations (NGOs). The last but not least important stakeholder is agricultural labourers. The result clearly and well markedly listed the actual stakeholders participating in the *kole*.

4.2 Structural and functional relationships among stakeholder groups

The results of structural and functional relationships of the stakeholders of the *kole* lands is depicted in the figure 2 which shows the structure of the *Kole Padavu* Committee and their structural and functional relationships with others.

4.2.1. Structural relationship among the stakeholder groups

As far as the structure is concerned, there is formal and informal type of organizational relationship existing among the stakeholder groups with the *Kole Padavu* Committee.

***Kole padavu*committee:** The *Kole Padavu* Committee is non-statutory i.e., this committee is not having permanent members and every year the committee is changed. Hence it is shown in the diagram with dotted lines. The *Kole Padavu* Committee consists of *Kole* Land Development Agency (KDA), District *Kole* Padavu Committee and Peechi Irrigation Committee.

District *Kole Padavu* Committe: The District *Kole Padavu* Committee is having the members as district collector as the head, co-ordinator as principle agricultural officer and two representatives from each *kole padavu* committee and other ex-officio members. Based on the decision of this District *Kole Padavu* Commitee, the two representatives of the District *Kole Padavu* Committee will be taking decisions with all other stakeholders.

Figure 2.Framework of structural and functional relationships among the stakeholders of wetlands

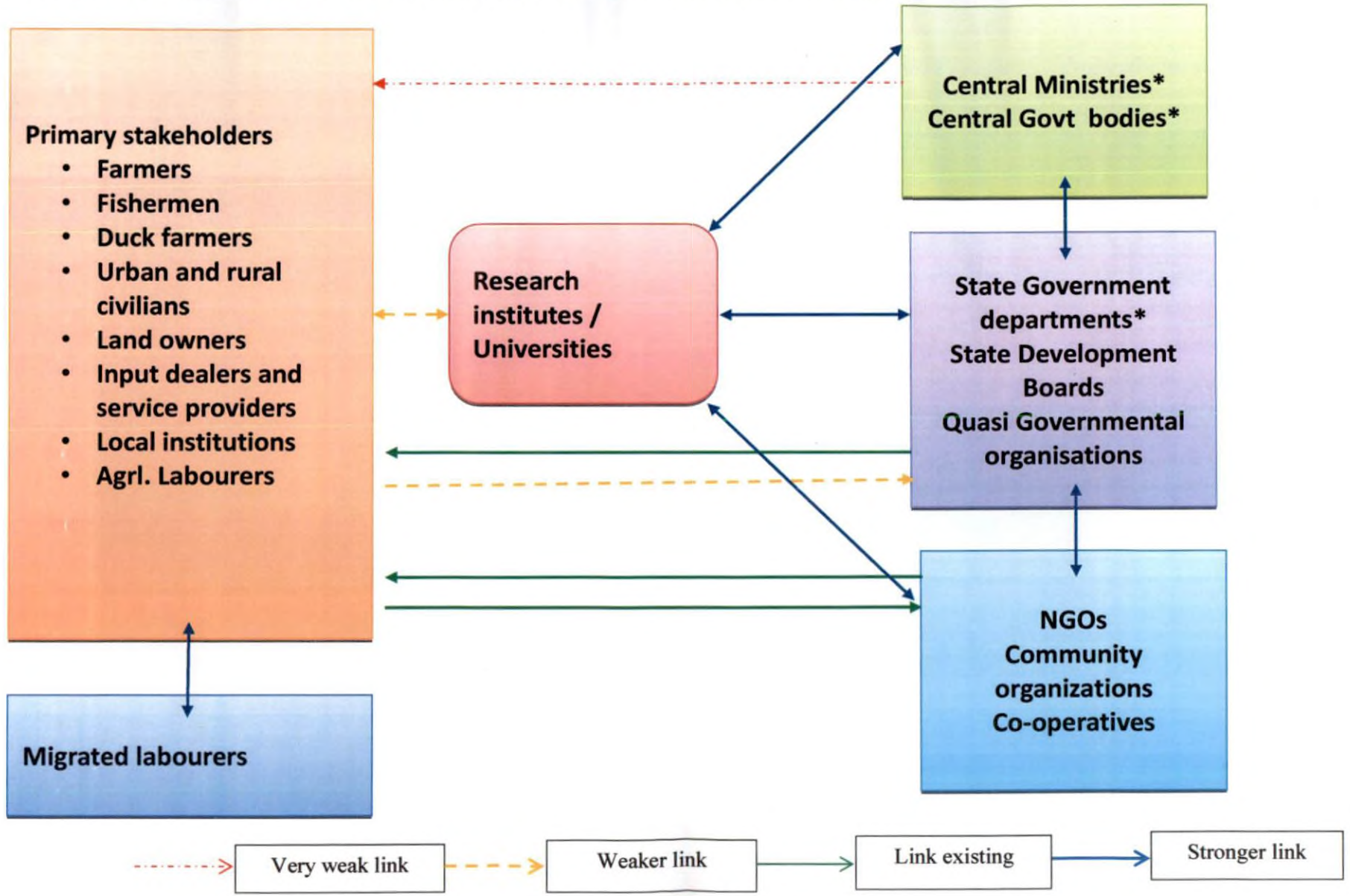
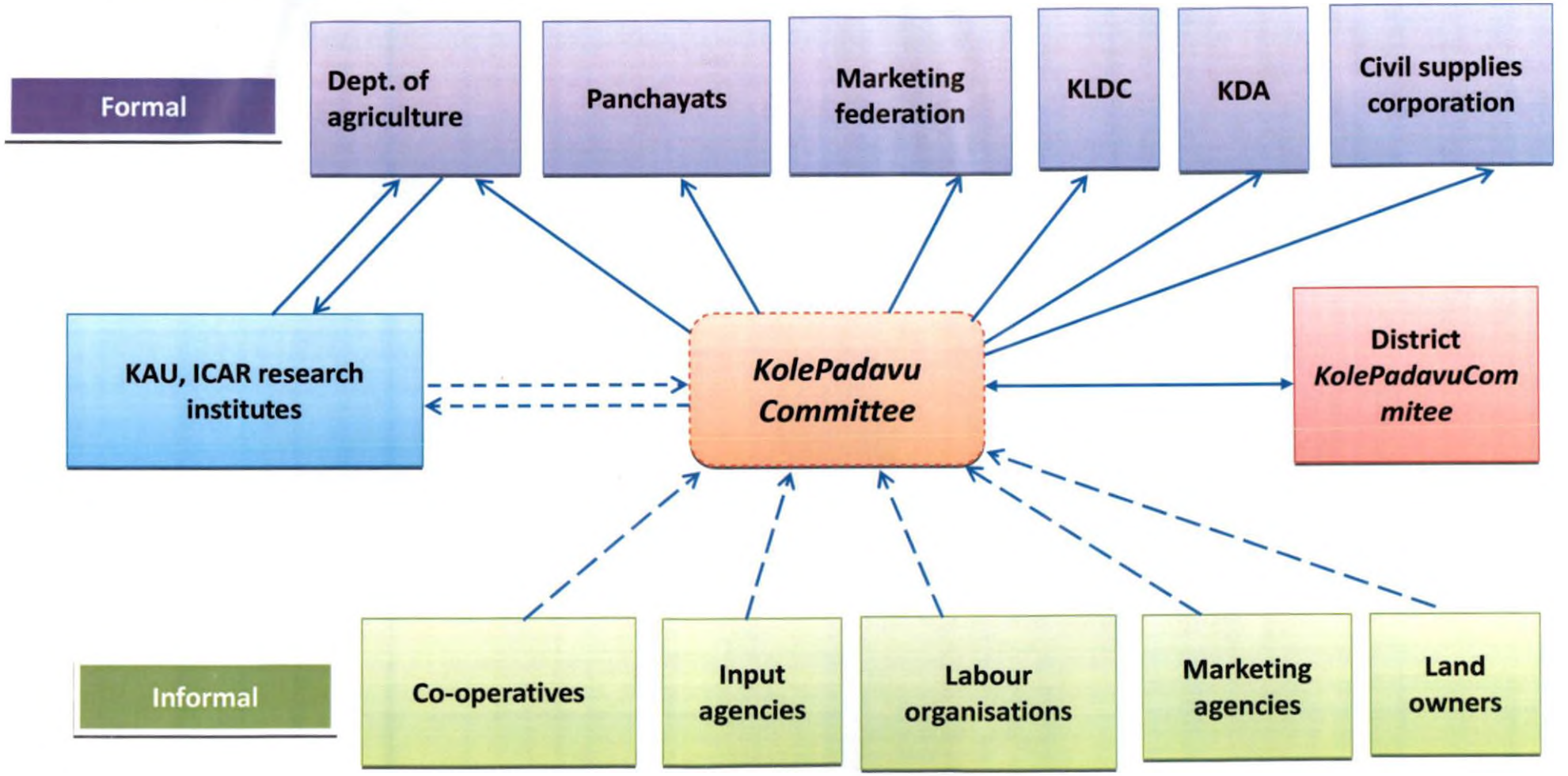


Figure 3.Framework of structural and functional relationships among the stakeholders



The formal institutes include Dept. of agriculture, the panchayats representing particular *kole* lands, marketing federation, Kerala Land Development Corporation (KLDC), *Kole* Land Development Agency (KDA), Kerala Agricultural University and ICAR research institutes. With these structural relationship denoted as bold line arrows.

Whereas the informal institutes include co-operatives, input agencies, labour agencies, marketing agencies and land owners of *kole* land. So in a nut shell the *Kole Padavu* Committee is the part and parcel of District *Kole Padavu* Committee.

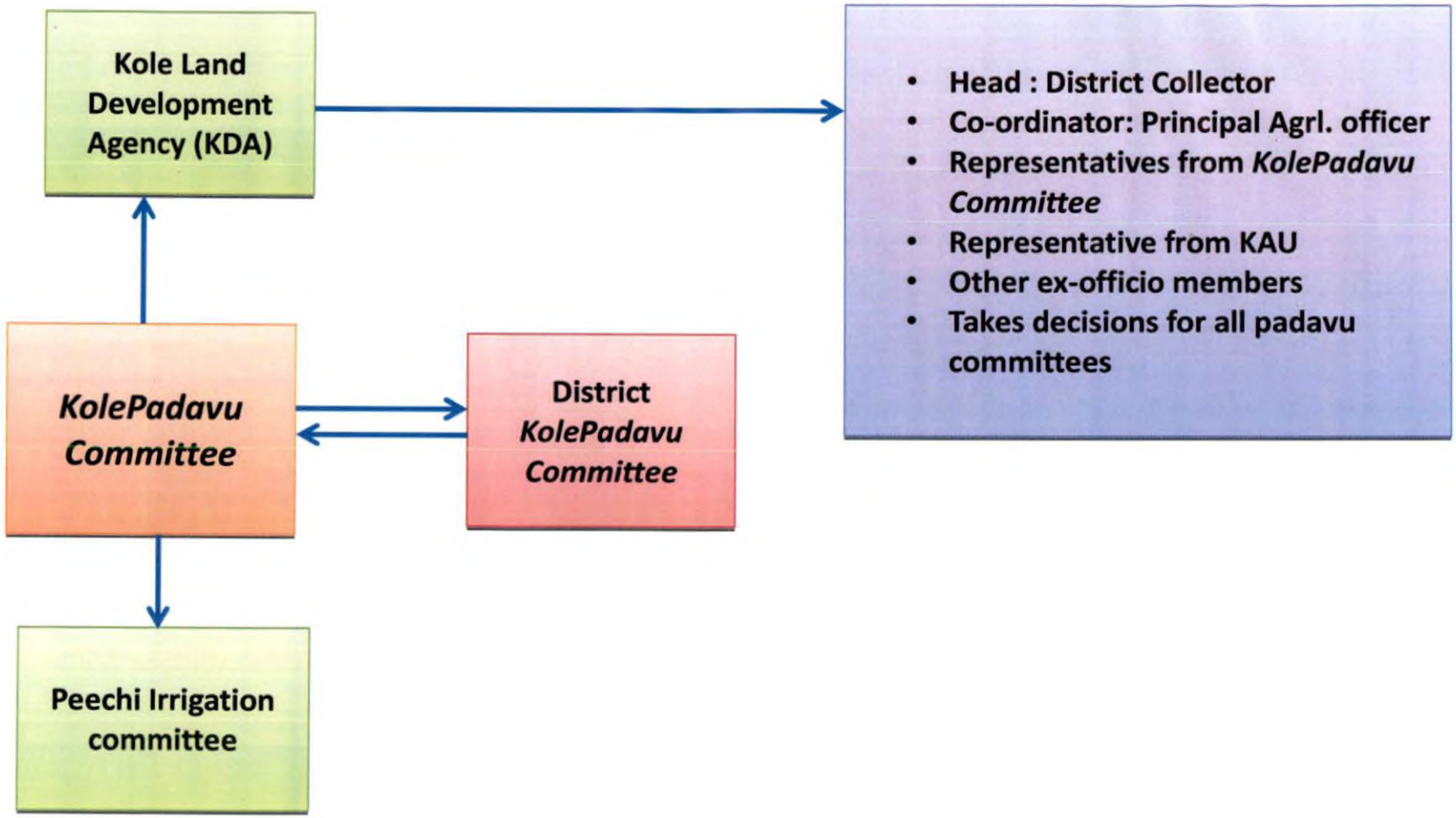
4.2.2. Functional relationship among the stakeholder groups

As far as the functions are concerned, the two representatives from the respective *Kole Padavu* Committee representing District *Kole Padavu* Committee will explain and implement the decisions taken in the District *Kole Padavu* Committee as a main ajenda of *kole* land cultivation in that particular season.

The formal institutions like Dept. of Agriculture will extend technical support to the cultivation of the *kole* land. The panchayat will give administrative solutions and financial sanctions for the explanation of the scheme. The marketing federations will arrange for the procurement of the paddy and fix the price ahead of the harvest. Kerala Land Development Corporation is concerned about solving irrigation problems, waterlogging and canals and they are responsible for construction of permanent bunds and widening of the canals. The *Kole* Land Development Agency looks for the overall development of *kole* areas and this will co-ordinate the activities of different government agencies. Further the KDA is responsible for providing engine sheds, dewatering equipment, construction of bunds and canals and farm roads. The Civil Supplies Corporation also takes responsibility of procuring paddy in the *kole* areas.

The KAU and ICAR research institutes take up research projects in order to solve the problems as well as evolve technologies suitable to *kole* areas. Here the function is mutual. Either the KAU and ICAR research institutes can formulate studies of their own regarding *kole* cultivation or *kole padavu*committee can request research institutes to conduct research for solving their problems.

Figure 4.Functioning of the *KolePadadvu Committee*



Informal institutions like co-operatives and marketing agencies will arrange supply of needed inputs, credits and marketing the produce for *kole* cultivation. The input agencies will supply seed, fertilizers, machinery etc., and labour organizations deal with the problems of labourers in the *kole* areas. The land owners will either cultivate or lease out the land for cultivation so that the *kole* area is cultivated as a contiguous plot.

The result of structural and functional relationships of the stakeholders of the *kole* lands is depicted in the figure 2 that shows the structure of the *kole padavu* committee and their structural and functional relationships with others.

4.3 Awareness levels of the stakeholders regarding ecosystem services provided by *kole* lands

4.3.1. Hydrological functions

Awareness of the stakeholders was more than 70% regarding the hydrological functions like 'water recharge', 'storage and supply' in both Thrissur and Ponnani *kole* areas. The 'runoff control' function was comparatively less known for Ponnani (43%) to Thrissur (67%). Hence it is inferred that most of the stakeholders were aware of the services like 'water storage', 'water supply', and 'water recharge'.

Table 2.Distribution of stakeholders according to their awareness of hydrological functions(n=60)

Hydrological functions	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Water recharge	22	73	23	77
Control runoff	20	67	13	43
Water storage	24	80	25	83
Water supply	22	73	23	77

4.3.2. Chemical functions

Regarding chemical functions more than the half of the respondent of Thrissur and Ponnani were aware of the ecosystem service like 'soil formation', whereas more of Ponnani stakeholders were aware of 'water purification' (60%) and 'sediment trapping' (67%). Less than half of the respondents of Ponnani stakeholders were aware of 'adsorption of heavy metal' and 'toxic retention' where as their counterparts were not aware of 'sediment trapping', 'adsorption of heavy metals' and 'toxic retention'.

Table 3.Distribution of stakeholders according to their awarenessof chemical functions (n=60)

Chemical functions	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Soil formation	15	**50**	17	**57**
Water purification	14	**47**	18	**60**
Sediment trapping	-	-	20	**67**
Adsorption of heavy metals	-	-	14	**47**
Toxic retention	-	-	14	**47**

4.3.3. Recreational functions

As far as recreational functions are concerned more than 50% of the stakeholders in Thrissurwere aware of 'fishing' and 'bird watching'. Whereas, in Ponnani counterpart stakeholders were aware of 'fishing (53%) alone. Less than half (47%) of the stakeholders from Thrissur knew that wetland ecosystem supports the recreational service 'boating' and their counterparts knew about the function 'aesthetic attraction' provided by *kole* lands.

Table 4.Distribution of stakeholders according to their awarenessof recreational functions (n=60)

Recreational functions	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Fishing	22	**73**	16	**53**
Bird watching	17	**57**	-	-
Boating	14	**47**	-	-
Aesthetic attraction	-	-	13	**43**

4.3.4. Biological functions

Most of the stakeholders of Thrissur and Ponnani were aware of rice cultivation and fish rearing whereas more than 50% of them were aware of the support provided for medicinal plants cultivation. Nearly two third of stakeholders were aware of duck rearing and fuel wood supply services in Thrissur *kole* and around three fourth of them in Ponnani were aware of the ecosystem service provision of fertile land for agriculture.

Table 5.Distribution of stakeholders according to their awareness of biological functions (n=60)

Biological	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Rice cultivation	28	**93**	29	**97**
Fish rearing	24	**80**	18	**60**
Duck rearing	18	**60**	-	-
Medicinal plants cultivation	17	**57**	15	**50**
Fertile land for agriculture	14	**47**	22	**73**
Fuel wood supply	20	**67**	13	**43**
Support flora &fauna	8	**27**	13	**43**

4.3.5. Environmental functions

More than two third of Thrissur stakeholders were aware of 'climatic regulation' and 'flood control', whereas in the Ponnani, more than half of counter parts were aware of services *viz.*, 'climatic regulation' and 'reduction in damage of wind and wave action'.

Table 6.Distribution of stakeholders according to their awareness of environmental functions (n=60)

Environmental functions	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Climate regulation	22	73	16	53
Flood control	20	67	12	40
Reduction in damage of wind and wave action	-	-	15	50

4.3.6. Socio-economic functions

More than three forth of Ponnani stakeholders were aware of 'livelihood function' and provision of drinking water, fodder, fuel *etc.,* More than half of the respondents of Ponnani were aware of recreation function 'uniqueness to culture' and 'employment opportunity', whereas in Thrissur only two third of respondents were aware of 'livelihood' function.

Table 7.Distribution of stakeholders according to their awarenessof socio-economic functions (n=60)

Socio-economic	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Livelihood for local people	19	63	24	80
Provide drinking water, fodder, fuel	-	-	26	87
Offer recreation to society	-	-	16	53
Uniqueness to culture	-	-	16	53
Employment opportunity	-	-	16	53

4.3.7. Other functions

Nearly one third of the respondents of both Thrissur and Ponnani stakeholders were aware that the rich biodiversity of flora, fauna and unique ecosystem qualities facilitate study and research works in *kole* lands.

Table 8.Distribution of stakeholders according to their awarenessof the other functions (n=60)

Other functions	Thrissur		Ponnani	
Type	N= 30	%	N= 30	%
Study and research purpose	14	47	10	33

4.3.8. Categorization of services with respect to the stakeholders' level of awareness

Ecosystem services provided by the *kole* lands have been categorized into four depending on the percentage of awareness of the respondents on them, as highly aware, aware, moderately aware and slightly aware. Services that scored above 75% were regarded as highly aware, 50- 75% as aware, 25 – 50% as moderately aware and below 25% as slightly aware.

Table9.Distribution of stakeholders highly aware of ecosystem services (n=60)

Highly aware	Number	Above 75%
Rice ecosystem	57	95
Water supply	52	86.66
Water storage	49	81.66

Table10.Distribution of stakeholders aware of ecosystem services (n=60)

Aware	Number	50 - 75%
Water recharge	45	75
Livelihood for local people	43	71.66
Fish rearing	42	70
Fertile land for agriculture	36	60
Fishing	38	63.33
Climate regulation	38	63.33
Provide drinking water, fodder, fuel	37	61.66

Runoff control	33	55
Soil formation	33	55
Fuel wood supply	33	55
Medicinal plants cultivation	32	53.33
Flood control	32	53.33
Sediment trapping	32	53.33
Water purification	32	53.33
Flood prevention	30	50
Sediment removal	30	50
Employment opportunity	30	50

Table11.Distribution of stakeholders moderately aware of ecosystem services (n=60)

Moderately aware	**Number**	**25 - 50%**
Duck rearing	29	48.33
Support plantation crops	29	48.33
Erosion control	27	45
Maintenance of stream flow	25	41.66
Hunting	24	40
Aesthetic attraction	24	40
Storm protection	24	40
Reduce damage of wind and wave action	24	40
Study and research purpose	24	40
Boating	23	38.33
Seasonal habitat	23	38.33
Bird watching	22	36.66
Reeds supply	22	36.66
Shoreline stabilization	22	36.66
Wildlife habitat	22	36.66
Support flora &fauna	21	35

Toxic retention	20	33.33
Timber supply	20	33.33
Offer recreation to society	20	33.33
Uniqueness to culture	20	33.33
Acts as a carbon sink	17	28.33
Sand and clay mining	17	28.33
Biomass export and import	16	26.66
Removal of dissolved nutrients	16	26.66
Adsorbs heavy metals	16	26.66
Prevents eutrophication	16	26.66
Supports lotus farming	15	25

Table12.Distribution of stakeholders slightly aware of ecosystem services (n=60)

Slightly aware	**Number**	**Below 25%**
Resting place of migratory birds	14	23.33
Tourism	14	23.33

4.3.9. Over all awareness levels of the stakeholders

Over all awareness level of the stakeholders was measured and the results showed that there were 50 percent of the respondents with low level of awareness, 20 percent of the respondents are with high levels of awareness and 30 percent of the respondents are with medium levels of awareness regarding ecosystem services provided by *kole* lands.

Table 13.Distribution of the stakeholders according their level of awareness (n=60)

Awareness	**Number**	**Percentage (%)**
High	12	20
Medium	18	30
Low	30	50

4.4 Stakeholders' preferences of the resource uses of *kole* wetlands

Out of the fourteen types of resources only seven types of resource uses were isolated based on the mean rank. The type of resource uses were 'livelihood provision', 'food production', 'water conservation', 'natural resource base provision', 'water storage', 'soil nutrient regulation' and 'provision of leisure activities' in that order of rank.

Table 14.Stakeholders' preferences of the resource uses of *kole* wetlands (n=60)

S.No	Type of resource use	Mean Rank
1.	Livelihood provision	11.28
2.	Food production	10.79
3.	Water conservation	10.62
4.	Natural resource base	9.34
5.	Water storage	9.15
6.	Soil nutrient regulation	8.14
7.	Provision of leisure activities	7.32

4.5. Socio economic characteristics of stakeholders

Socio economic characteristics of the stakeholders were analysed in order to find their influence on the awareness of the stakeholders regarding the ecosystem services provided by the *kole* land.

4.5.1. Age profile of the respondents

Table 15.Distribution of stakeholders according to their age (n=60)

Age	Number	Percentage (%)
Young	1	2
Middle	19	32
Senior	40	67

Out of the total 67 per cent of the respondents were seniors i.e., who have 50 years and above and 32 per cent were middle aged people who were in the age between 35 to 50 years and 2 per cent of young people whose age was less than 15 years.

4.5.2. Educational Status of the respondents

Table 16.Distribution of stakeholders according to their educational status (n=60)

Education	Percentage (%)
Illiterate	0
Functional literate	5
Upper primary level	11
High school level	47
Collegiate	37

Distribution of the stakeholders based on the educational status revealed the following results. There were no illiterates, 5% of them were only functional literates and 11% of them had schooling up to upper primary level. Around half i.e., 47% of the respondents had education up to the high school level and 37% stakeholders were educated till college level.

4.5.3. Economic class:

Distribution of the stakeholders in the economic classes is as given below

Table 17.Distribution of stakeholders according to their economic class (n=60)

Economic class	Number	Percentage (%)
Poor	5	8
Lower middle class	8	13
Middle class	39	65
Upper middle class	8	13
Affluent class	0	0

Analysis of economic class of the stakeholdersrevealed that, out of the total 65 per cent were middle class people, 13% were upper middle class people, 13% were lower middle class people and 8% of were poor people and there was no affluent class among the stakeholders.

4.5.4. Occupation

Stakeholders were divided into various categories as given below according to their type of occupation

Table 18.Distribution of stakeholders according to their occupation (n=60)

Occupation	Number	Percentage(%)
Agriculture alone	33	55
Agriculture plus private employment	22	36.66
Agriculture plus government employment	5	8.33

Out of the totalstakeholders55 per cent respondents were farmers who had their main occupation as agriculture alone, 37 per cent stakeholders had their occupation as agriculture along with other private employement and only 8 per cet of the stakeholders were having both agriculture and government job to earn a living.

4.5.5. Economic motivation:

Economic motivation of the stakeholders was divided into three categories and the results are given below

Table 19.Distribution ofstakeholders according to their level economic motivation (n=60)

Economic motivation	Number	Percentage (%)
High	17	28
Medium	32	54
Low	11	18

From the results obtained, it was visible that 54 per cent of the stakeholders were with medium level of economic motivation, 28 per cent

stakeholders were with high motivation and 18 per cent had low economic motivation.

4.5.6. Information source utilization:

Stakeholders were categorized into three types according their level information sources utilization

Table 20.Distribution of stakeholders according to their information source utilization (n= 60)

Information source	Number	Percentage (%)
High level	12	20
Medium level	39	65
Low level	9	15

From the results it was observed that 65 per cent of the stakeholders utilized the information sources to medium level , 20 per cent of them utilized to high level and 15 per cent made very little use of information sources.

4.5.7. Social participation

Table 21.Distribution of stakeholders according to their social participation status (n=60)

Social participation	Number	Percentage (%)
High	13	22
Medium	35	58
Low	12	20

From the table 21 it is evident that there were 58 per cent of the stakeholders werewith medium level of social participation, 22 per cent of the stakeholders with high level of social participation and 20 per cent with low level of social participation.

4.6 Relation of socioeconomic variables with the awareness levels of the stakeholders

Table 22.Correlation values of the socio-economic characteristics of stakeholders with their awareness

Category	Correlation value
Age	-0.065
Educational Status	0.155
Occupation	0.115
Economic class	0.140
Information source utilization	0.268**
Economic motivation	-0.012
Social participation	0.320**

**** Significant at 5% level**

When the seven socio-economic characteristics *viz.*,age, educational status, occupation, economic class, information source utilisation, economic motivation and social participation were correlated with the awareness level of the stakeholders, it yielded positive results with onlytwo of them. Table 22 shows that the awareness level has shown significant values with socio-economic characteristics of the stakeholders like information source utilization and social participation at five percent level of significance. The correlation coefficient values were 0.268 and 0.320 with information source utilization and social participation respectively. With other variables it didn't show any significance.

4.7 Multidimensional scaling to arrive at preferences of the stakeholders regarding perspectives of the *kole* lands

Interpretation of the stakeholders' views expressed through the open ended question in the interview schedule as well the open discussions of the stakeholders yielded a number of statements. These statements represent the perspectives of stakeholders regarding the *kole* wetlands. The statements have been edited to project clear ideas by deleting repetitive ideas and keeping important ones without

modifying the meaning of the perspectives. At the end resulting statements have been further classified into four categories as follows (Appendix II).

4.6.1. Production perspectives

4.6.2. Environmental perspectives

4.6.3. Socioeconomic perspectives

4.6.4. Perspectives on ancillary services.

The MDS analysis has thrown light on the different perspectives of stakeholders. Each category of perspectives is subjected to analysis using the statistical tool multidimensional scaling. As a result of the analysis clusters were evolved. Each cluster depicts the proximity or similarity among the ideas comprised in that particular cluster. Based on the proximity value for different perspectives , different factors were identified and grouped and a suitable name has been coined as per the perspectives included in the cluster.

4.6.1. Production perspectives

Production perspectives were grouped into three clusters namely 'time', 'culture' and 'resource factors'.

Table 23.Cluster 1 of production perspectives

S. No	Perspective	Proximity value
S1	Precise time of planting for bumper yield of rice	1.312
S11	Fish farming delays planting of rice crop	1.050
S4	Dewatering machinery to be developed to dewater at precise times	0.933

Table 24.Scored matrix on production perspectives

	Rank1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10	Rank 11	Rank 12	Rank 13
1st Perspective	13	5	1	1	0	1	2	0	0	1	0	0	0
2nd p	3	2	0	2	3	1	2	1	9	1	1	0	1
3rd P	0	1	2	1	4	3	3	1	2	2	1	2	0
4th P	0	2	0	3	1	2	0	8	0	0	0	1	2
5th P	0	3	2	2	0	0	1	1	5	3	0	0	0
6th P	4	0	4	2	1	2	2	2	1	2	1	1	2
7th P	1	2	4	3	1	1	1	1	1	1	6	2	0
8th P	0	1	0	0	4	2	5	2	0	2	2	2	2
9th P	1	0	1	2	1	0	0	0	0	5	2	2	1
10th p	0	0	1	0	1	0	0	0	0	0	0	3	2
11th P	0	0	1	2	0	0	0	0	1	1	0	1	1
12th P	2	1	3	2	1	1	0	2	0	0	1	2	0
13th P	0	1	2	1	2	2	1	0	5	1	0	0	1
14th P	0	0	1	1	1	1	0	1	0	1	0	1	0
15th P	0	1	0	1	3	2	0	7	2	1	2	0	0
16th P	0	0	0	3	1	3	1	2	1	0	1	1	1
17th p	3	1	1	1	1	1	0	4	2	0	0	3	2
18th p	0	1	0	0	0	2	5	1	2	3	0	0	2
19th P	0	0	1	1	1	2	4	2	1	2	2	1	0
20th P	1	2	1	1	1	2	1	1	1	1	2	3	0
21st P	0	0	0	0	1	0	0	0	0	1	1	0	1
22nd P	0	1	0	2	0	0	0	0	2	2	5	0	0
23rd P	0	0	1	0	1	0	1	1	1	1	0	1	3
24th P	1	0	2	0	0	1	0	0	0	3	0	2	2
25th P	1	1	0	1	2	0	1	0	0	0	0	4	4

Table 24.Scored matrix on production perspectives

	Rank14	Rank 15	Rank 16	Rank 17	Rank 18	Rank 19	Rank 20	Rank 21	Rank 22	Rank 23	Rank 24	Rank 25
1st Perspective	1	0	0	0	0	1	1	0	0	0	1	2
2ndp	0	0	0	0	1	0	0	1	0	0	1	1
3rdP	0	1	4	0	0	1	0	0	0	1	0	1
4thP	1	2	0	1	1	0	0	0	0	0	2	4
5thP	2	4	0	4	1	0	0	0	2	0	0	0
6thP	1	0	1	0	0	0	2	1	0	0	1	0
7thP	1	0	0	2	0	0	1	1	0	0	0	1
8thP	3	0	1	1	1	0	0	1	1	0	0	0
9thP	1	1	2	0	3	0	2	1	1	3	0	1
10thp	2	1	3	2	4	6	3	0	1	0	1	0
11thP	1	0	1	1	1	0	0	2	2	0	8	7
12th P	0	3	0	0	4	2	1	1	2	0	1	1
13th P	0	0	1	1	0	2	1	3	1	1	4	0
14th P	1	3	2	2	0	2	2	1	4	3	1	2
15th P	1	0	3	2	1	1	1	1	1	0	0	0
16th P	1	2	6	2	1	0	1	0	0	2	0	1
17th p	5	1	0	0	0	1	0	2	0	2	0	0
18thp	0	1	1	1	2	0	1	0	2	2	2	2
19th P	2	0	1	0	1	2	3	1	2	0	1	0
20th P	1	0	1	0	1	3	3	1	2	1	0	0
21st P	2	3	1	4	1	3	1	2	3	3	2	1
22ndP	0	0	0	0	3	1	1	4	3	2	3	1
23rd P	3	5	2	4	0	1	1	1	2	1	0	0
24th P	2	1	1	1	1	1	1	2	3	3	2	1
25th P	0	3	0	1	1	2	2	2	1	3	0	1

This cluster comprised close proximity values from 0.312 to 0.933. The perspectives that were commonly grouped in this cluster were 'precise time of planting for bumper yield of rice', 'fish farming delays planting of rice crop' and'dewatering machinery to be developed to dewater at precise times'. As these three perspectives were oriented to time consciousness, this factor was named as 'time factor'.

Table 25. Cluster 2 of production perspectives

S. No	Perspective	Proximity value
S5	Wild rice is a serious problem	0.776
S2	Key operations to be done according to traditional meteorological calendar	0.734
S10	Plenty of straw is obtained	0.727

The proximity values in this cluster ranged from 0.776 to 0.727. The perspectives grouped in this cluster were 'Wild rice is a serious problem', 'Key operations to be done according to traditional meteorological calendar' and 'plenty of straw is obtained from *kole* lands'. As these perspectives more resembled the cultural operations, it was named as 'cultural factor'.

Table 26.Cluster 3 of production perspectives

S. No	Perspective	Proximity value
S15	Fish farming is being accepted as a new income generating enterprise	0.680
S7	New seed to be supplied at least once in three years	0.658
S13	Both fish and rice farming have equal importance	0.573
S23	Increase in pests and weeds necessitates increased application of chemicals	0.524
S21	Decrease in yield observed after commissioning of KLDC canal	0.509
S6	Need for research to increase the number of crops	0.505

Proximity value in the cluster 3 was ranging from 0.680 to 0.505 including the perspectives 'fish farming is being accepted as a new income generating enterprise', 'new seed to be supplied at least once in three years', 'both fish and rice farming have equal importance', 'increase in pests and weeds necessitates increased application of chemicals', 'decrease in yield observed after commissioning of KLDC canal' and 'need for research to increase the number of crops'. As all these perspectives were related to different resources essential for *kole* cultivation, it was named as 'resource factor'.

4.6.2. Environmental perspectives

Environmental perspectives were grouped into three clusters namely 'pollution factor', 'resource protection factor', 'resource use factor

Table 27.Scored matrix on environmental perspectives

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10	Rank 11	Rank 12	Rank 13
1st Perspective	3	2	3	0	1	1	1	0	1	1	0	0	0
2ndp	8	7	1	1	4	1	0	1	0	1	2	1	1
3rdP	8	4	4	1	1	3	0	0	1	3	3	0	1
4thP	3	2	2	4	8	0	0	0	0	0	0	4	0
5thP	1	3	3	4	0	1	1	1	0	0	0	3	3
6thP	0	2	0	0	0	2	1	2	2	1	1	0	2
7thP	1	1	5	3	3	0	3	0	1	0	1	1	3
8thP	1	1	1	3	4	6	3	1	4	0	1	0	0
9thP	0	0	1	1	1	0	3	3	3	0	0	0	1
10thp	0	0	0	1	3	2	1	4	0	0	0	0	0
11thP	0	0	1	1	2	3	4	1	1	1	0	1	2
12th P	0	0	1	3	2	2	3	3	0	2	2	1	1
13th P	0	0	2	0	0	2	0	2	2	1	1	1	0
14th P	0	1	1	1	0	0	0	5	4	4	1	1	0
15th P	0	0	0	0	1	2	1	0	4	1	2	0	0
16th P	1	1	1	4	2	3	1	1	1	3	4	0	3
17th p	1	1	0	1	0	0	0	0	0	1	2	5	2
18thp	0	0	0	0	0	0	1	2	1	3	0	1	1
19th P	0	2	2	0	1	0	0	1	1	1	0	0	3
20th P	0	0	0	0	0	0	1	0	1	2	3	0	1
21st P	0	0	0	1	0	0	1	1	0	1	0	4	0
22ndP	1	0	0	0	0	0	2	1	0	0	3	0	2
23rd P	2	0	1	0	0	1	1	0	1	1	1	1	1
24th P	0	2	1	0	0	0	0	0	0	1	1	1	1
25th P	1	1	1	0	2	0	1	1	0	0	2	5	2

Table 27.Scored matrix on environmental perspectives

	Rank14	Rank 15	Rank 16	Rank 17	Rank 18	Rank 19	Rank 20	Rank 21	Rank 22	Rank 23	Rank 24	Rank 25
1st Perspective	0	1	1	1	0	1	1	1	0	2	3	6
2ndp	0	0	0	1	0	0	0	0	0	0	0	1
3rdP	0	0	0	0	0	1	0	0	0	0	0	0
4thP	0	1	2	2	1	0	1	0	0	0	0	0
5thP	0	2	0	1	2	2	0	1	0	0	1	1
6thP	3	1	1	2	3	1	2	1	1	0	1	1
7thP	3	1	1	1	0	0	1	0	0	0	0	1
8thP	2	0	0	1	1	0	0	0	0	0	0	1
9thP	1	3	1	1	2	1	2	2	2	2	0	0
10thp	1	1	2	1	0	1	2	4	4	1	1	1
11thP	1	0	1	1	0	1	0	2	2	4	1	0
12th P	0	1	2	2	0	0	0	1	0	2	0	2
13th P	1	0	1	0	4	2	2	0	7	1	1	0
14th P	1	2	0	1	0	2	2	1	2	0	1	0
15th P	0	2	2	0	1	0	4	4	1	1	3	1
16th P	1	1	1	0	0	0	1	0	1	0	0	0
17th p	0	2	1	0	3	1	1	3	1	1	2	2
18thp	2	2	2	2	5	3	0	1	2	0	0	2
19th P	4	1	0	1	1	2	0	2	5	1	1	1
20th P	1	0	2	1	0	4	5	2	0	1	1	5
21st P	3	1	1	2	2	1	5	1	1	2	1	2
22ndP	1	3	3	1	1	2	1	1	2	5	1	0
23rd P	2	2	2	6	1	1	0	1	0	2	3	0
24th P	2	2	2	6	1	2	1	2	0	2	0	3
25th P	3	1	3	2	2	1	0	0	0	1	0	1

Table 28.Cluster 1 of environmental perspectives

S. No	Perspective	Proximity value
S2	*Kole* area generates good amount of fresh air	1.092
S3	Increased chemical usage causing environmental pollution and depletion of fresh air	0.937

This cluster included proximity values that ranged between the values 1.092 to 0.937. This cluster comprised the perspectives like '*kole* area generates good amount of fresh air' and 'increased chemical usage causing environmental pollution and depletion of fresh air'. As the perspectives in this cluster expressed concern for pollution, accordingly it was labelled as 'pollution factor'.

Table 29.Cluster 2 of environmental perspectives

S. No	Perspective	Proximity value
S4	Check land fillings in *kole* lands	0.752
S8	Maintenance of topography	0.795
S13	To retain water in the *kole*, instead of pumping out	0.755

The range of proximity values in this cluster was 0.752 to 0.795. It included perspectives like 'check land fillings in *kole* lands', 'to retain water in the *kole*, instead of pumping out' and 'maintenance of topography'. As the perspectives included in this cluster were related to protection of the available resources, this cluster was named as 'resource protection factor'.

Table 30.Cluster 3 of environmental perspectives

S. No	Perspective	Proximity value
S22	Organic manure can be prepared from weeds	0.646
S24	Explore the possibility of electricity generation	0.634
S17	Climate change makes agriculture unpredictable	0.625
S7	Cleaning up of KLDC canal	0.526
S15	Reduction in the number of birds visiting *koles*	0.598
S25	Proper drainage measures to be taken	0.543
S10	Need to recycle water	0.530
S20	*Kole* land destruction leads to exhaustion of drinking and irrigation water	0.515
S18	Provision of protection to the hereditary value of *kole*	0.502

This cluster included the proximity values from 0.646 to 0.502. The cluster comprised the following perspectives in it *viz.*, 'organic manure can be prepared from weeds', 'explore the possibility of electricity generation', 'climate change makes agriculture unpredictable', '*kole* land destruction leads to exhaustion of drinking and irrigation water', 'reduction in the number of birds visiting *koles'*, 'proper drainage measures to be taken', 'need to recycle water', 'cleaning up of KLDC canal' and 'provision of protection to the hereditary value of *kole'*. This cluster was named as 'resource use factor' according to the nature of meaning conveyed from the perspectives included in this cluster.

4.6.3. Socio-economic perspectives

Socio-economic perspectives had three cluster, they were 'sustenance factor', 'supportive factor' and 'livelihood factor'.

Table 31.Cluster 1 of socio-economic perspectives

S. No	Perspective	Proximity value
S3	Harvest should be procured in time at a reasonable price considering the periodic hike in cost of production	1.031
S1	Social status of the farmer is disadvantageous	0.949
S2	Farmers deserve respect in the society	0.915

This cluster included proximity values ranged from 1.031 to 0.915. The perspectives included in this cluster were 'harvest should be procured in time at a reasonable price considering the periodic hike in cost of production', 'social status of the farmer is disadvantageous', 'farmers deserve respect in the society'. As the perspectives included in this cluster were related to the concept sustenance, this cluster was named after them as 'sustenance factor'.

Table 32.Scored matrix on socio-economic perspectives

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10	Rank 11	Rank 12	Rank 13
1st Perspective	9	5	5	1	0	0	2	0	2	1	0	0	0
2ndp	4	10	0	1	2	4	0	2	3	0	0	0	0
3rdP	8	5	1	5	1	0	1	3	2	0	0	1	0
4thP	2	2	6	4	6	0	0	1	1	1	1	1	0
5thP	1	1	7	3	2	1	0	2	0	1	0	0	1
6thP	3	3	1	1	3	3	0	0	1	1	1	1	1
7thP	0	0	2	2	3	1	1	2	0	1	2	2	0
8thP	2	1	1	3	4	4	3	1	1	0	2	2	2
9thP	0	0	1	2	0	4	4	2	1	4	0	0	0
10thp	1	0	2	2	1	1	4	1	1	0	2	0	0
11thP	0	0	1	1	0	1	2	1	2	3	1	0	0
12th P	0	0	1	1	1	2	2	1	1	1	1	1	2
13th P	0	0	1	0	0	1	3	7	4	0	2	2	2
14th P	0	1	0	0	0	1	2	1	4	2	2	2	3
15th P	0	0	0	0	0	2	0	0	0	2	1	4	2
16th P	0	0	2	1	0	1	1	0	2	1	0	1	0
17th p	0	0	0	1	0	0	0	1	0	2	5	1	1
18thp	0	0	0	0	0	0	1	0	1	2	4	2	2
19th P	0	0	0	0	2	1	0	2	1	1	0	3	4
20th P	0	0	0	0	0	0	1	0	1	0	0	1	3
21st P	0	0	0	1	0	1	3	1	2	0	0	2	4
22ndP	0	1	0	0	1	0	0	0	0	1	4	0	1
23rd P	0	0	3	0	0	1	0	0	0	0	3	3	0
24th P	0	0	0	0	0	0	0	1	0	3	1	0	0
25th P	1	0	0	1	2	2	1	1	0	3	0	0	3

Table 32.Scored matrix on socio-economic perspectives

	Rank14	Rank 15	Rank 16	Rank 17	Rank 18	Rank 19	Rank 20	Rank 21	Rank 22	Rank 23	Rank 24	Rank 25
1st Perspective	1	0	0	0	0	0	2	0	0	0	0	2
2ndp	1	1	0	0	0	0	0	1	0	1	0	0
3rdP	0	0	1	0	0	0	0	0	1	0	1	0
4thP	0	2	1	0	1	1	0	0	0	0	0	0
5thP	1	0	1	1	0	0	0	2	2	3	0	1
6thP	2	2	2	2	1	0	0	0	0	1	0	1
7thP	1	0	1	1	3	3	1	0	1	1	2	0
8thP	0	0	0	1	1	0	1	0	0	0	0	1
9thP	1	1	2	1	1	0	1	3	0	0	2	0
10thp	1	0	0	0	1	0	2	0	3	3	3	2
11thP	1	1	1	2	3	1	1	1	1	1	1	4
12th P	2	1	1	2	1	4	1	1	1	1	0	1
13th P	1	1	0	0	2	1	0	2	0	0	0	1
14th P	1	2	1	1	3	1	0	0	1	0	0	1
15th P	4	2	0	1	0	0	2	1	2	2	4	1
16th P	0	0	2	1	1	1	3	2	3	2	3	3
17th p	1	1	2	3	2	2	0	2	0	1	4	1
18thp	2	1	1	3	4	4	0	1	1	1	0	0
19th P	2	1	1	0	1	1	1	0	3	3	3	0
20th P	3	5	2	2	2	0	1	2	3	1	1	2
21st P	2	1	2	2	3	0	1	2	1	1	0	1
22ndP	2	0	3	1	0	6	2	3	4	0	1	0
23rd P	2	4	3	2	0	0	3	3	0	4	1	0
24th P	1	2	2	3	0	2	7	1	2	2	1	2
25th P	0	2	1	2	1	0	1	3	2	2	0	2

Table 33. Cluster 2 of socio-economic perspectives

S. No	Perspective	Proximity value
S22	Agriculture being less remunerative is driving away farmers from cultivation	0.892
S13	Need to clearly understand proper usage of seed and fertilizer	0.832
S4	Fund allotted to *kole* as a Ramsar site to be distributed among the farmers	0.704

Proximity values of the perspectives included in this cluster ranged from 0.892 to 0.704. The perspectives included in this cluster were 'agriculture being less remunerative is driving away farmers from cultivation', 'need to clearly understand proper usage of seed and fertilizer' and 'fund allotted to the*kole* as a Ramsar site to be distributed among the farmers'. Since the perspectives in this cluster expressed the support that is required for the *kole* lands, this cluster was labelled as 'supportive factor'.

Table 34.Cluster 3 of socio-economic perspectives

S. No	Perspective	Proximity value
S17	Amenities in *kole* lands should be long lasting	0.640
S5	Cost of cultivation is regularly increasing	0.633
S24	Usage of traditional *petti* and *para* is convenient	0.618
S18	Educational tours, classes and refresher classes have to be conducted for farmers	0.609

S15	For rice *insitu* procurement facility should be created	0.564
S9	Exploitation of farmers by companies by procuring rice in bulk after the harvest	0.536

This cluster was named as 'livelihood factor'. The proximity values of perspectives ranged from 0.640 to 0.536. The perspectives included in this cluster were 'amenities in *kole* lands should be long lasting', 'cost of cultivation is regularly increasing', 'for dewatering usage of traditional *petti* and *para* is convenient', 'educational tours, classes and refresher classes have to be conducted for farmers', 'for rice *insitu* procurement facility should be created' and 'exploitation of farmers by companies by procuring rice in bulk after the harvest'. This cluster was named suitably as 'livelihood factor' based on the perspectives grouped in it.

4.6.4. Ancillary services

From the perspectives based on ancillary services provided by the *kole* lands, two clusters namely 'supply factor' and 'service factor' were formed.

Table 35.Cluster 1 of perspectives on other ancillary services

S. No	Perspective	Proximity value
S14	Intermediaries create problems to ordinary farmers in acquiring machinery at reasonable prices	1.031
S1	Farmers do not want any subsidy from banks	0.949
S2	Integration of all farming activities required	0.915

The range of proximity values of perspectives in this cluster was 1.031 to 0.915. The perspectives included were 'intermediaries create problems to ordinary

farmers in acquiring machinery at reasonable prices', 'farmers do not want any subsidy from banks', 'integration of all farming activities required'. This cluster was named as 'supply factor' as the perspectives included in this cluster conveyed the demand for the supply requirements of the *kole* land.

Table 36.Cluster 2 of perspectives on ancillary services

S. No	Perspective	Proximity value
S12	Government should extend support to *kole* cultivation	0.842
S3	Measures to be taken to overcome water shortage for summer crop	0.681
S5	Proposal for a canal at higher level from ground	0.679

The proximity values of the perspectives included in this cluster ranged from 0.842 to 0.679. Perspectives included in this cluster were 'government should extend support to *kole* cultivation', 'measures to be taken to overcome water shortage for summer crop' and 'proposal for a canal at higher level from ground'. All the perspectives expressed in this cluster represented the need of the stakeholders for services expressed above. Hence this cluster was suitably named as 'service factor'.

Table 37.Scored matrix for perspectives on ancillary services

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank10	Rank11	Rank12	Rank13	Rank 14
1st Perspective	1	0	2	4	0	1	1	1	0	2	0	2	6	10
2ndp	8	3	1	0	1	2	3	3	2	5	0	0	2	0
3rdP	6	4	1	1	2	2	1	1	5	3	1	0	1	2
4thP	1	1	2	1	2	0	1	2	1	4	2	6	5	2
5thP	0	0	0	0	0	2	2	1	3	1	7	6	4	4
6thP	0	2	3	2	6	4	1	3	3	1	1	1	2	1
7thP	1	0	4	3	1	2	6	4	2	1	4	0	1	1
8thP	1	3	1	5	3	2	6	0	2	2	2	1	2	0
9thP	1	2	1	5	2	3	1	0	0	4	5	2	3	1
10th	4	5	0	0	2	3	1	0	0	4	5	2	3	1
11thP	1	1	2	1	4	3	4	2	3	0	0	4	4	1
12th P	3	3	5	3	5	1	1	5	0	0	1	1	0	2
13th P	2	5	1	2	0	3	2	4	3	0	3	2	2	1
14th P	1	1	2	1	2	2	1	1	6	5	3	3	0	2

DISCUSSION

5. DISCUSSION

The discussion of the results and findings regarding present study is explained under the following headings

5.1 Identification of stakeholders

5.2 Structural and functional relationships among stakeholder groups

5.3 Awareness levels of the stakeholders regarding ecosystem services provided by the *kole*

5.4 Stakeholder's preferences of the resource uses of *kole* wetlands

5.5Socio-economic characteristics of the stakeholders

5.6 Correlation of awareness level with the profile characteristics of the respondents

5.7 Multidimensional scaling to arrive at preferences of the stakeholders regarding perspectives of the *kole* lands

5.8. Policy suggestions for conservation based economic development in the *kole* lands

5.1 Identification of stakeholders

Stakeholder groups were identified using the three techniques such as data review, observation and snow ball sampling technique. It helped to know who the project stakeholders were, and their key groupings and sub-groupings. This process enabled to take a more in-depth look at stakeholder group interests, how they would be affected and to what degree, and what influence they could have on the final decisions. The stakeholder groups were broadly classified into two, those who affect the decisions and those who are affected by the decisions and others who had interest in the project. All stakeholders in a particular group or sub-group may differ in their opinions or priorities, but in the end come to collective decisions.

Identification of these stakeholder groups addressed the issues that were characterized by interlinked systems like social, economic, administrative and political boundaries and stakeholder interests would affect a large number of different stakeholders at local, regional and national levels with different agendas and sets of interests.

Seven types of primary stakeholder categories identified were farmers, government departments, input agencies, co-operatives, marketing agencies and agricultural labourers. They were said to be primary, as they were being affected by the decisions taken at the level of *kole* lands.

The stakeholder group of farmers comprise of rice, coconut, vegetables, fish, duck and lotus farmers. They were said to be the most important group among the seven categories as they depend directly on the *kole* land for earning their livelihood. Any development decision taken would positively or negatively impact the farming community. Giving them a role in decision making makes the efforts taken for *kole* land development more fruitful.

The second category, government departments included Agriculture, Water resources, Environment, Biodiversity, Kerala Agricultural University, local self-government or panchayath, financial institutions like banks *etc*. This group of stakeholders affects all other stakeholder groups by its decisions. They are in a position to design a program or package of practices suitable for the *kole* land by consulting the expert groups of all departments concerned.

The third group of stakeholders were input agencies like fertilizer, pesticide, seed, machinery suppliers *etc*. The decisions taken at higher level decide the range of inputs suitable for farming for a particular season or situation. As a result demand varies and the input suppliers plan accordingly and supply them timely. The cooperatives like service societies, credit societies, harvest procurers etc were identified as the next category. Here farmers and other stakeholders had come closer and formed co-operative societies to make needed arrangements concerning farming, irrigation, credit, inputs, harvesting and marketing on a collective basis. *Padasekharam* committee was also one such co-operative institutional arrangement actively functioning in the society that facilitates farming in *kole* land.

The fifth category comprised marketing agencies *viz*., marketing federation and other local marketing agencies. They facilitate marketing of the produce in the local market, envisage linkage and also provision and diffusion of market information to the primary stakeholders. The sixth category identified was Non-

Governmental Organisations (NGOs). There were also some NGOs functioning in the *kole* lands. The last but not least important stake holder was agricultural labourers. The result clearly and well markedly listed the actual stakeholders participating in the *kole*.

5.2 Structural and functional relationships among stakeholder groups

This framework of structural and functional relationships constituted different stakeholder groups that differ in a host of characteristics ranging from individual farmers, input agencies, civilians and other direct beneficiaries of the *kole* land resources including the co-operatives, departments of government, development planners and administrators in government. Power possession and flow could be easily understood by drawing a structural and functional framework among the stakeholders.

Some of the various central government agencies that may be indirectly making decisions which affect wetlands are the Department of Fisheries, the Ministry of Agriculture, the Ministry of Water Resources, the Ministry of Surface Transport, the Ministry of Power, the Ministry of Tourism, the Department of Ocean Development *etc.*,

In Kerala state , the land owners in *kole* areas form themselves into groups to form a *padasekhara* committee / *kole padavu* committee which is formulated in a democratic way under section 7 A of the Kerala Land Development Act, 1964 and registered under the Societies Act. The decisions on when to start dewatering and agricultural operations are decided by the *Padasekhara* committees in consultation with the individual farmers and in some places also with the representatives of the co-operative banks who advances loans for the common agricultural operations like dewatering, bunding, cleaning of canals etc., The District Administration through the District *kole padavu* committee in consultation with the *kole padavu* committees prepares guidelines to carry out various farming activities particularly focussing on water management issues. The important responses from the state are in providing various infrastructural facilities and financial support by way of various subsidies to carry out cultivation in the *kole* farms. To solve the problem of irrigation, construction of permanent

bunds and widening of *kole* canals to prevent *kole* lands from water logging was undertaken by the Kerala Land Devlopment Corporation(KLDC). Punja Special Office was also set up as per the Kerala Irrigation Works (Execution of Joint Labour) Act 1967 in order to look after pumping in and out of water from *kole* fields for facilitating cultivation (Srinivasan, 2011b).

As all these agencies have been acting independently, *Kole* land Development Agency (KDA) was set up in 1992 for the overall development of the *kole* areas by coordinating activities of different government departments and agencies engaged in *kole* development. The major activities of the agency included improvement of the infrastructural facilities like construction of permanent bunds, canals, providing engine sheds, irrigation and dewatering equipments like *petty* and *para*, construction of regulators, farm roads *etc.*, but the wetlands perspective was not given much emphasis in the activities of *Kole* Land Development Agency (Srinivasan, 2011b).

The decisions taken at the centre and state level regarding the *kole* lands were not directly influenced by the opinions of the primary stakeholders. They have no say in the decisions taken by the nodal agencies. The research institutes lack strong linkages with the primary stakeholders and universities should strive to bridge the existing gap. To have policies and programs reflecting and addressing the burning issues of the *kole* lands, these links should be strengthened and also the primary stakeholder groups should be given more opportunities to partner in local level planning processes.

5.3 Awareness levels of the stakeholders regarding ecosystem services provided by *kole* lands

From the results it was evident that out of the 49 listed services of the kole lands, some were known to the stakeholders of the both Thrissur and Ponnani *koles*, some of them were known to either of the *kole* stakeholders and some were known to neither of them. Awareness means individual comes to know of something which is related to one's own need or arouses the need. This implies that the services of which stakeholders lack awareness were neither felt by them nor realised by them in the due course of time. All the services rendered by the

kole lands have importance in their own way. Hence steps may be taken to build their knowledge regarding these services.

When the overall awareness of the stakeholders was studied, stakeholders awareness level varied with services. It was classified as highly aware, aware, moderately aware and slightly aware.

5.3.1. Services that the stakeholders are highly aware of

Highly aware services meant that stakeholders either felt the need of those services or heard of them more frequently in the past time. All important hydrological functions like rice cultivation, water supply, storage which are presumed to be basic functions of *kole* lands fell in this category. All the functions that were identified as highly aware were the primary and basic services of *kole* lands. Hence stakeholders' awareness about these services was very high.

5.3.2. Services that the stakeholders are aware of

Among all the services, those that score between 50-75% were aware to the stakeholders. Among them, 'water recharge' function was significant in maintaining the water table and hence it was known to a good number of people. As a 'livelihood provider' for the local people it is a means of earning for the local people and provides opportunities to local people with associated functions that support livelihood like 'fish rearing' and 'fertile land for agriculture'. Some services *viz.*,'drinking water provision', 'fish catch', supplier of 'fodder', 'fuel wood', 'water purification', 'medicinal herbs' and 'employment opportunity' support day to day life in a number of ways and hence they were also known to a good number of people. Climate change effects being experienced lately , people started recognising the importance of wetlands' services such as 'regulating the climate', 'flood prevention', 'control runoff', 'soil formation' and 'sediment trapping and removal'. Since more than half of the respondents knew about these services, it may be considered that the usefulness of these services provided by the *kole* land were felt and recognized by the stakeholders.

5.3.3. Services that the stakeholders are moderately aware of

Most of the services*i.e.*, 27 (55%) number out of 49 were moderately aware to the stakeholders. Services like 'duck rearing', 'support for plantation

crops', 'support for lotus farming', 'reeds supply' and 'timber supply' although are provisioning services that support livelihood they got very trivial value as compared to other provisioning services. Hence they were moderately aware to the stakeholders. Some services like 'hunting', 'boating', 'bird watching', 'aesthetic attraction', 'study and research purpose', 'offering recreation to society' and 'uniqueness to culture' were slightly aware to the public as they do not provide any direct economic benefits. 'Support to wildlife habitat', 'support to flora &fauna' are the functions that indicate the health of wetlands, but people were less aware of them. Stakeholders can be educated about the importance of maintaining the health of the ecosystem. Other important services like 'biomass export and import', 'erosion control', 'maintenance of stream flow', 'reduction of damage of wind and wave action', 'storm protection', 'shoreline stabilization', 'toxic retention', 'function as a carbon sink;, 'removal of dissolved nutrients', 'adsorption of heavy metals', 'prevention of eutrophication' etc are very importance chemical functions, but in contrast stakeholder's awareness was only moderate. Hence efforts may be put to increase their awareness for those functions and the benefits obtained from those. None among been the aforesaid functions can be weighed against other, because all of them carry more or less same value in the maintenance of the ecosystem significance. Therefore, there is a need to build and strengthen the stakeholders' knowledge about moderately aware services.

Sand and clay mining is an activity that began in 1970s where deposits of clay and sand were found. Mining has now been emerged as a major non-agricultural activity on *kole* lands that is adversely affecting the ecosystem. Stakeholders' awareness about this function was also moderate. Hence the local people must be educated about the ill effects of sand and clay mining and beneficial effects of the other important chemical functions, which maintain the health of the *kole* as well the surrounding areas around it. Though the recreational functions don't pay directly, they have the potential to draw tourism attraction to the place and add on the revenue flow.

5.3.4. Services that the stakeholders are slightly aware of:

'Resting place for migratory birds' and 'tourism' were the two functions that were slightly aware to the stakeholders. Both are very important functions, yet surprisinglystakeholders had very poor awareness. Number of migratory birds indicates the health of wetland and its level of awareness among the stakeholders implicated the poor knowledge of people about this fact. It is also worth noting that tourism is one of the many important services that wetlands deliver. Ensuring well-managed tourism practices in and around wetlands and educating tourists on the value of wetlands contribute to their health and the long-term benefits that wetlands provide to people, wildlife, economy, and biodiversity.

5.4 Stakeholders' preferences of the resource uses of *kole* wetlands

Out of the fourteen types of resources, only seven types of resource uses were isolated based on the mean rank. 'Livelihood' which means securing the basic necessities like food and water was placed at the top when ranked. Hence it was considered the most important resource use by the stakeholders of the *kole* land and it was consistent with the general attitude of the farmers. Second preferred resource use was 'food production'. Food production implies support provided by the *kole* land for food crops especially rice – staple food of the local people. Next priorities were given to 'water conservation', 'natural resource base provision', 'water storage', 'soil nutrient regulation' and 'provision of leisure activities'. Food security is more important to the stakeholders than other resource uses. This implies that the stakeholders can risk forgoing resource uses which were in the next order for seeking food security although not much difference was observed among the mean ranks. It could be substantiated from the evidences of current farming practices in the *kole* lands *viz.*, excessive drainaging of fields for cultivation of rice and application of high doses of agricultural chemicals which would deteriorate the soil health in long run. Although the resource use 'provision of leisure activities' was given less priority in comparison to the first six uses, it was not the last preference of the stakeholders. That was of no surprise as leisure activities could be enjoyed only when the primary goals of an individual were satisfied. Hence, technological interventions could be made to strike a balance

between sustainable production and conservation of natural resources without causing much harm to the natural assets of the *kole* land.

5.5 Socio economic characteristics of stakeholders

Socio economic characteristics of the stakeholders were analysed in order to find its influence on the awareness of the stakeholders regarding the ecosystem services provided by the *kole* land.

5.5.1. Age Profile of the respondents

Most of the respondents were seniors who had enough experience to provide the accurate and necessary information. Less than one third of the respondents were middle aged and only one respondent was young aged. From the results, it could be deduced that interest of the youth in farming activity was being reduced and they were not viewing it as guaranteed income generating opportunity. If this is not noticed, there are possibilities that the future generations may with draw from agriculture.

5.5.2. Educational Status of the respondents

From the results it was observed that around half of the respondents had education up to the high school level and one third had education till college level. Kerala being a state with 100% literacy rate no respondent from selected *kole*s was reported as illiterate. Education imparts knowledge, so it may be assumed that, though education had no significant effect on the awareness of the farmers, it might have had its impact on the other sociological aspects like urge for social participation and information source utilization.

5.5.3. Economic class:

Analysis of economic class of the respondents revealed that most (65%) of the respondents were middle class people, equal percentage (13%) of respondents were of upper and lower middle class people, very few of them were poor people. It could be implied that majority of the *kole* beneficiaries could be in a state to satisfy their basic needs but they don't have resources in excess or deficit. Hence they may find it difficult to take decisions in challenging or risky situations especially when financial matters are concerned. Collective decision making would be a better choice for them. Institutional arrangements like

*padasekharam*committees would suit their situation more if similar group of people are included in the groups. Even though the poor class people were few in number, they may be encouraged with some incentives to keep them in farming.

5.5.4. Occupation

More than half (55%) of the respondents had agriculture alone as their occupation followed by 37 percentage of respondents who had their occupation as agriculture along with private employement. 8% of them had both agriculture and government job. It could be implied that majority of the people who entered farming business had no other private or government employment. But some of them were able to manage both farming and private empolyment. It implied that income from farming alone was not sufficient to meet the household expenses and also from farming alone, regular and guaranteed income was not obtained. Very few of them were able to manage both farming and govenrment employment, the reason could be the lack of abilty to pay full attention to farming.

5.5.5. Economic motivation:

Majority of the farmers had medium level of economic motivation from which it could be assumed that farmers had reasonable interest towards economic benefits. People with medium level of economic motivation struck a note of balance between economic benefits and morals in farming. They don't stick themselves to a particular thing and hence they are flexible. It is easy to deal with such kind of people while advocating any change in the farming practices. As much as 28 per cent of them had high economic motivation, which means that their interests towards profits are far above anything in farming business. They don't adopt new methods unless it is very profitable. A few people had low level of economic motivation. They may attach less importance to the economic benefits. They are more concerned about the sustainability aspect.

5.5.6. Information source utilization:

From the analysis of the information source utilization levels we can conclude majority of the people were with medium and high levels of information source utilization and there were less number of people whose information source utilization levels were very low. Information source use became a critical input

for effective social functioning. It had a positive and significant influence on the awareness of the stakeholders regarding ecosystem services provided by the wetlands. Information when paid more interest and attention becomes awareness. Stakeholders' utilization of information sources is therefore directly related to their level of awareness. Hence information channels may be more strengthened to raise the level of farmers' knowledge regarding *kole* land and its services and resource uses.

5.5.7. Social participation

From the analysis of result we could understand that majority of the respondents were with medium level of social participation and people with low and high social participation character were few in number. It determines the ability of an individual to socialize with others. This indicates the level involvement of people in activities they undertake with a group. From the above results it could be presumed that local people are fairly good at socializing and have interest towards involvement in group activities.

5.6 Correlation of socioeconomic variables with the awareness levels of the respondents

When the seven independent variables such as age, educational status, occupation, economic class, information source utilisation, economic motivation and social participation were correlated with dependent variable "awareness level of the stakeholders,it yielded positive results with information source utilisation and social participation. The dependent variable awareness level has shown significant values when it was correlated to the independent variables information source utilization and social participation at five percent level of significance. With other variables it didn't show any significance. Awareness occurs when information is reinforced and information spreads when participation occurs. Hence it implicates that awareness is positively related to both level of information source utilisation and social participation.

5.7 Multidimensional scaling to arrive at preferences of the stakeholders regarding perspectives of the *kole* lands

5.7.1 Production perspectives

5.7.1.1. Cluster 1 of production perspectives

Stakeholders' opinions like " bumper yield required precise time of planting', fish farming delayed planting of rice crop and need to develop dewatering machinery to dewater at precise times emphasis the need for timely undertaking of cultural operations, supply of inputs and dewatering of fields as they mean a lot to high yields. Untimely application of these would prove useless. Hence the name 'time factor' is given to this cluster.

5.7.1.2.Cluster 2 of production perspectives

In this cluster named 'cultural factor', the first perspective explained the need to eradicate the weed wild rice which has become a threat and affecting the yields visibly. The second opinion said that in order to guarantee the yields planting is to be done according to the traditional meteorological calendar only as there were problems of weeds, drainage and others that would adversely affect the yields. Last perspective expressed that from the *kole* land, plenty of straw and healthy vegetative growth were obtained with little cultural operations owing to the fertile nature of *kole* land. Hence it was named as 'cultural factor'.

5.7.1.3.Cluster 3 of production perspectives

From the results obtained with MDS of perspectives it was observed that farmers in *kole* lands were accepting fish farming as a new income generating enterprise apart from the traditional rice growing. They also expressed the need for the input resource new seed at least once in three years as the old one lost its vigour and vitality with time and hence badly affected the yield. Stakeholders viewed fish and rice farming equally as both seemed promising for assured income. *Kole* land was highly infested with pests and weeds, which necessitated increased application of agrichemicals, and these inputs were high in cost, hence they may be supplied on subsidy basis through co-operatives. They also opined that there was decrease in yield after commissioning of KLDC canal which was due to the diversion of water from the *kole* land to KLDC canal which

made summer cultivation almost impossible here. Problems like reduction in the number of crops can be addressed by increasing *kole* region specific research. As all these perspectives were related to different resources essential for boosting the productivity from *kole* cultivation, it was named as 'resource factor'.

5.7.2. Environmental perspectives

5.7.2.1. Cluster 1 of environmental perspectives

According to the perspectives that fell in 'pollution factor' cluster, stakeholders of the *kole* land believed that *kole* land generates a good amount of clean and fresh air which was unique to the ecosystem and thus played a vital role in maintaining and promoting the health of the surroundings. They also opined that now-a-days, increased chemical usage was causing environmental pollution and depletion of fresh air in this unique ecosystem. Hence measures should be taken to reduce the usage of chemicals by resorting to bio-remedial measures.

5.7.2.2.Cluster 2 of environmental perspectives

This cluster was named as 'resource protection factor' as the perspectives included expressed demand for the protection of the natural resources of the *kole* land. The first among them was to check land fillings in *kole* land which became a severe threat to the very existence of the *kole* land. One of the major reasons for this was the alarming reclamations of *kole* land for various purposes. Strict enforcement of the existing acts and laws itself would make much difference in this context. Second one was to retain water in the *kole*, instead of pumping it out. This concern might be expressed because of the shortfall of water for taking up a summer crop and the frequent occurrence of water crisis in the Thrissur district. The third perspective was the need for maintenance of topography. As the stakeholders were of the opinion that there was overexploitation of resources and felt there was a need for their protection. Hence this cluster was named as 'resource protection' factor.

5.7.2.3. Cluster 3 of environmental perspectives

In this cluster more concerns expressed by the stakeholders were gathered, some of them were probing in nature and some were suggestions. One among them was to examine the possibility of organic manure preparation from the

weeds. After the removal, safe disposal of weeds was a big problem and this difficulty gave rise to the thought preparation of organic manure from the weeds which can be explored further. Another such concern was to explore the possibility of electricity generation. The perspective climate change made agriculture unpredictable was expressed because of the recent evidences of climate change experienced by the farmers. The perspective *kole* land destruction lead to exhaustion of drinking and irrigation water could be substantiated by the maintenance of water table of Thrissur at the same level even under water stress situation when compared to the regions which was mainly due to the presence of the *kole* wetland in this area. The health of a wetland ecosystem is measured by the number of migratory birds visiting them. But, recently there was reduction in the number of birds visiting *koles* which indicated that the health of the *kole* land was declining. The perspective proper 'drainage measures to be taken' was in contrast the previous idea 'there should not be pumping out of water from *kole* land', which conveyed differed views of the stakeholders. In such cases the results of both views should be outweighed and the one with more satisfying results should be considered. With increased concerns over depleting water resources, perspectives like 'need to recycle water' and 'cleaning up of KLDC canal' were expressed. Some stakeholders strongly believed that there was a need to protect the hereditary value of *kole.* The stakeholders of the study, most of them having senior citizen cadre seen the *kole* for years and wanted to see the hereditary value of *kole* protected for the coming years. As the perspectives in this cluster mostly expressed concerns about resource uses of the *kole* it was named as 'resource use factor'.

5.7.3. Socio-economic perspectives

5.7.3.1. Cluster 1 of socio-economic perspectives

The cluster was named as 'sustenance factor' as per the perspectives included in this cluster. The first one among them was that the need for procurement of the harvest in time at a reasonable price considering the periodic hike in cost of production. As the cost of production was increasing persistently farmers demanded for a support price for their harvest which would be timely.

The second one was that the social status of the farmer was disadvantageous. It implied that their resources were limited and meagre. So they were not in a position to take in time decisions and this is making the situation worse. Hence government must initiate farmer oriented programs and schemes to empower them with resources so as to enable them to take right decisions in right time. The third perspective was that farmers deserved respect in the society. Farmers are the people who produce food to all sections of the society and they must be respected by all. As the perspectives included in this cluster indicated their need for one or other form of subsistence, this cluster was named as sustenance factor.

5.7.3.2. Cluster 2 of socio-economic perspectives

In this cluster the perspectives grouped were called as 'supportive factor'. The first among them was "agriculture being less remunerative was driving away farmers from cultivation". It explained that the expenditure and income were not matching and was rendering agriculture less attractive. The second perspective was 'need to clearly understand proper usage of seed and fertilizer' and the third one was "distribution of funds allotted to the*kole* as a Ramsar site among the farmers". Supporting the famers with useful technology, conducting demonstration classes, distribution of the funds due to them would address the issues associated with this factor to a large extent.

5.7.3.3. Cluster 3 of socio-economic perspectives

In this cluster, from the perspective 'amenities in *kole* lands should be long lasting' stakeholders meant that the longevity of the facilities presently available for cultivation in the *kole* land should be maintained to reap benefits. They also felt that the cost of cultivation was consistently increasing but the procurement price was almost at the same level, which was not justifiable. Other two perspectives expressed like '*insitu* procurement facility should be created for rice' and 'exploitation of farmers by companies by procuring rice in bulk after the harvest' also supported the above statement. The stakeholders opined that for dewatering of fields, usage of traditional *petti* and *para* was more convenient as they can operate it on their own without relying on other sources. They also felt the need for educational tours, classes and refresher classes as it would help them

in updating their existing knowledge and would provide them with an opportunity to get exposure to new experiences and technology. All the perspectives expressed the needs that were in support of the livelihood of the farmers. Hence this cluster was named suitably as 'livelihood factor'.

5.7.4. Perspectives on ancillary services

5.7.4.1. Cluster 1 of perspectives on other ancillary services

The first perspective expressed the concern that intermediaries created problems to ordinary farmers in acquiring machinery at reasonable prices, which meant that farmers were facing problems in acquiring what they rightfully deserve. Hence maintenance of transparency is essential to ensure that such schemes would be properly implemented. Farmers opined that they did not want any subsidy from banks, instead they wanted subsidies to be provided by the government in support of *kole* cultivation. Concern expressed by the third perspective was that all the farming activities have to be integrated.Crops like rice, vegetables, coconut and fish farming were being cultivated in *kole* lands. Now farmers wanted to do integrated farming for which they wanted technical support from extension. This cluster was named as 'supply factor' as the perspectives included in this cluster conveyed the supply requirements of the *kole* farmers.

5.7.1.2. Cluster 2 of perspectives on other ancillary services

This cluster was named as 'service factor' according to the perspectives found in this cluster. First among them was sthat, government should extend support to *kole* cultivation. Stakeholders felt that the support extended by government was not sufficient as it was not up to their felt needs. The next two perspectives were 'measures should be taken to overcome water shortage for summer crop' and 'proposal for a canal at higher level from ground'. Both expressed the same concern that was occurrence of water shortage for summer cultivation and hence they demanded for a canal at higher level to ensure availability of water during summer season which would assure irrigation and would make cultivation possible during summer.

SUMMARY

6. SUMMARY

The study was conducted in the Department of Agricultural Extension, College of Horticulture during a period of three months from August - October 2012. The work was carried out in the selected *kole* areas of Thrissur and Ponnani with a set of objectives. First objective was to identify the stakeholders in relation to *kole* wetlands and analyse the structural and functional relationships among them. Second objective was to know the stakeholder's understanding on the different ecosystem services rendered by the *kole* wetlands. The third objective was to examine the stakeholder preferences about resource use of the *kole*and to finally arrive at policy suggestions for conservation based economic development. The results of the study were summarized below.

Stakeholders of the *kole* lands were identified by reviewing the data, personal observations and snowball sampling technique. The stakeholder groups were broadly classified into two, those who affect the decisions and those who are affected by the decisions and others who had interest in the project. Among those primary stakeholders identified were farmers, government departments, input agencies, co-operatives, marketing agencies and agricultural labourers including the migratory labourers. The structural and functional relationships existing among the stakeholder groups were analysed. Keeping the *kole padavu* committee at the centre , its relationship with other formal and informal institutes was explained. The formal institutions identified were Dept. of Agriculture, the panchayats representing particular *kole* lands, Marketing Federation, Kerala Land Development Corporation (KLDC), *Kole* land Development Agency (KDA). Kerala Agricultural University and ICAR institutes. Whereas the informal institutes included co-operatives, input agencies, labour agencies, marketing agencies and land owners of *kole* land.

Kole lands provide a number of ecosystem services and 49 of them were listed in and were used to know the awareness of the stakeholders. These ecosystem services were classified into seven categories as hydrological, chemical, recreational, biological, socio-economic and others.

Among the hydrological functions, most of the stakeholders (70%) of both Thrissur and Ponnani were aware of the services like water storage, water supply and water recharge.The runoff control function was comparatively less known for Ponnani (43%) to Thrissur (67%). More than the half of the respondents of Thrissur and Ponnani were aware of the chemical functions like soil formation, whereas more of Ponnani stakeholders were aware of water purification (60%) and sediment trapping (67%). Less than half of the stakeholders of Ponnani were aware of adsorption of heavy metal and toxic retention.

As far as recreational functions are concerned more than 50 per cent of the stakeholders in Thrssur were aware of thefishing and bird watching function, whereas in Ponnani counterpart stakeholders were aware of fishing (53%) alone. Less than half (47%) of the stakeholders from Thrissur knew that wetland ecosystem supports the recreational service like boating. Most of the stakeholders of Thrissur and Ponnani were aware of the biological functions *viz.*, rice cultivation resource, fish rearing resource, whereas more than 50 per cent of them were aware of the service as habitat for medicinal plants. Nearly two third of stakeholders were aware of duck rearing and fuel wood supply services in Thrissur *kole* and only three fourth of them in Ponnani were aware of the ecosystem service of provision of fertile land for agriculture.

More than two third of Thrissur stakeholders were aware of environmental functions like climatic regulation and flood control, whereas in the Ponnani more than half of the counter parts were aware of the services climatic regulation ,reduction in damage of wind and wave action. Among the socio-economic functions, more than three forth of Ponnani stakeholders were aware of livelihood function and provision of drinking water, fodder, fuel *etc.,* More than half of the respondents of Ponnani were aware of services like recreation function, uniqueness to culture and employment opportunity, whereas in Thrissur only two third of stakeholders were aware of livelihood function. Nearly one third of stakeholders of both Thrissur and Ponnani were aware of the other category function study and research purpose.

Ecosystem services provided by the *kole* lands have been categorized into four depending on the percentage of awareness of the respondents on them, as highly aware, aware, moderately aware and slightly aware. Services that scored above 75 per centwere regarded as highly aware, 50- 75 per cent as aware, 25 – 50 per cent as moderately aware and below 25 per cent as slightly aware.

Over all awareness level of the respondents was measured and the results showed that there were 50 per cent of the respondents with low level of awareness and 20 per cent of the respondents were with high level of awareness and 30 per cent of the respondents were with medium level of awareness regarding ecosystem services provided by *kole* lands.

Stakeholders' preference was known for 14 resource uses of *kole* lands. Out of the fourteen types of resources, only seven types of resource uses were isolated based on the mean rank. They were livelihood provision (11.28), food production (10.79), water conservation (10.62), natural resource base (9.34), water storage (9.15), soil nutrient regulation (8.14) and provision of leisure activities (7.32).

Distribution of stakeholders based on age revealed that 67 per cent of them respondents were seniors who had 50 years and above and 32 per cent were middle aged in between 35 and 50 years. Distribution of the stakeholders based on the educational status revealed that there were no illiterates, 5 per cent of them were only functional literates and 11 percent of them had schooling up to upper primary level. Around half (47%) of the stakeholders had education up to the high school level and 37 per cent were educated till college level. Analysis of economic class of the stakeholdersrevealed that, out of the total respondents, 65 per cent were middle class people. 54 per cent of the respondents were with medium level of economic motivation and 28 per cent were with high motivation. Distribution of stakeholders based on the level of information source utilization revealed that majority (65%) of the respondents utilized the information sources to medium level and 20 per cent of them utilized to high level. Social participation status of the stakeholders indicated that 58 per cent of them were with medium

level of social participation and 22 per cent were with high levels of social participation.

The socio-economic characteristics of the stakeholders when correlated with the awareness level of the stakeholders', only information source utilization and social participation characteristics had positive influence on the awareness at five percent level of significance.

Stakeholders' seminars were conducted in all the six locations. During these seminars, farmer discussion sessions were kept, in which farmers freely expressed their opinions and later they were interviewed by the researcher personally, using the distributive questionnaire prepared exclusively for the study. Interpretation of the stakeholders' views yielded a number of statements which represented the perspectives of stakeholders regarding the *kole* wetlands.They have been edited to project clear ideas by deleting repetitive ideas and keeping important ones. At the end resulting statements have been further classified into four categories production, ecological, socio-economic and perspectives on ancillary services.

Multidimensional scaling was used for finding the proximity of perspectives of the respondents. For doing this the four categories of perspectives of the stakeholders were presented to the judges. The judges ranked the perspectives according to what they perceive would be important for the stakeholders. As per the ranks obtained to each category of perspectives, ranked matrices were prepared individually for each category of perspective. The ranks thus obtained were scored and ranked matrices were prepared out of them. The ranked matrices were used to do the MDS analysis.

The first cluster of production perspectives comprised the close proximity values of 0.312 to 0.933. The perspectives that were commonly grouped in this cluster were 'precise time of planting for bumper yield of rice', 'fish farming delays planting of rice crop' and'dewatering machinery to be developed to dewater at precise times'. As these three perspectives were oriented to time consciousness, this factor was named as 'time factor'. The proximity values of the cluster ranged from 0.776 to 0.727. The perspectives grouped in this cluster were

'wild rice is a serious problem ', 'key operation to be done according to traditional meteorological calendar' and 'plenty of straw is obtained from *kole* lands'. As these perspectives more resembled the cultural operations, it was named as 'cultural factor'. Proximity value in the cluster 3 was ranging from 0.680 to 0.505 including the perspectives 'fish farming is being accepted as a new income generating enterprise', 'new seed to be supplied at least once in three years', 'both fish and rice farming have equal importance', 'increase in pests and weeds necessitates increased application of chemicals', 'decrease in yield observed after commissioning of KLDC canal' and 'need for research to increase the number of crops'. As all these perspectives are related to different resources essential for *kole* cultivation, it was named as 'resource factor'.

In environmental perspectives first cluster included proximity values from 1.092 to 0.937. This cluster comprised the perspectives like '*kole* area generates good amount of fresh air' and 'increased chemical usage causing environmental pollution and depletion of fresh air'. As the perspectives in the cluster expressed concern for pollution, accordingly it was labelled as 'pollution factor'. The range of proximity values of the second cluster was 0.752 to 0.795. It included perspectives like 'check land fillings in *kole* lands', 'to retain water in the *kole*, instead of pumping out' and 'maintenance of topography'. As the perspectives included in this cluster were related to protection of the available resources, this cluster was named as 'resource protection factor'. The third cluster included the proximity values from 0.646 to 0.502. The cluster comprised the following perspectives in it *viz.*, 'organic manure can be prepared from weeds', 'explore the possibility of electricity generation', 'climate change makes agriculture unpredictable', '*kole* land destruction leads to exhaustion of drinking and irrigation water', 'reduction in the number of birds visiting *koles'*, 'proper drainage measures to be taken', 'need to recycle water', 'cleaning up of KLDC canal' and 'provision of protection to the hereditary value of *kole'*. This cluster is named as 'resource use factor' according to the nature of meaning conveyed from the perspectives included in this cluster.

Socio-perspectives were the third category of perspective. First cluster among them included proximity values from 1.031 to 0.915. The perspectives included in this cluster were 'harvest should be procured in time at a reasonable price considering the periodic hike in cost of production', 'social status of the farmer is disadvantageous'and 'farmers deserve respect in the society'. As the perspectives included in this cluster were related to the concept sustenance, this cluster was named after them as 'sustenance factor'. Proximity values of the perspectives included in the second cluster range from 0.892 to 0.704. The perspectives included in this were 'agriculture being less remunerative is driving away farmers from cultivation', 'need to clearly understand proper usage of seed and fertilizer' and 'fund allotted to the*kole* as a Ramsar site to be distributed among the farmers'. Since the factors express the support that is required for the *kole* lands, this cluster is labelled as 'supportive factor'. The third one was named as 'livelihood factor'. The proximity values of perspectives lie between 0.640 and 0.536. The perspectives included in this cluster were 'amenities in *kole* lands should be long lasting', 'cost of cultivation is regularly increasing', 'for dewatering usage of traditional *petti* and *para* is convenient', 'educational tours, classes and refresher classes have to be conducted for farmers', 'for rice *insitu* procurement facility should be created' and 'exploitation of farmers by companies by procuring rice in bulk after the harvest'. This cluster is named suitably as 'livelihood factor' based on the perspectives grouped in it.

The cluster 1 of perspectives on ancillary services has a range of proximity values 1.031 to 0.915. The perspectives included were 'intermediaries create problems to ordinary farmers in acquiring machinery at reasonable prices', 'farmers do not want any subsidy from banks' and 'integration of all farming activities required'. This cluster was named as 'supply factor' as the perspectives included in this cluster conveyed the supply requirements of the *kole* land.The proximity values of the perspectives included in the second cluster range from 0.842 to 0.679. Perspectives included in this cluster were 'government should extend support to *kole* cultivation', 'measures to be taken to overcome water shortage for summer crop' and 'proposal for a canal at higher level from ground'.

All the perspectives expressed in this cluster represent the need of services mentioned above , hence this cluster was suitably named as 'service factor'.

Management options based on analysis done

As per the results obtained and analysis of the perspectives of stakeholders done, some management options for conservation based development of *kole* lands have been suggested. They were

1. Promotion of more than one crop in the *kole*areas.
2. Integrated farming by planting seasonal crops on bunds along with the main crops on field
3. Promote mixed farming options – coconut, paddy, fish, prawn, duck, dairy and poultry
4. Clearing and regular maintenance of waterways
5. Promotion of organic measures as far as possible
6. Technology refinement and dissemination for efficient weed management strategies for *kole* farmer
7. Use of better and efficient machinery for dewatering, harvesting and drying
8. Labour promotion through self-help groups and NGOs
9. Widening and strengthening of bunds – creation of permanent bunds
10. Education of all farmers on need and methodology of water conservation

Policy recommendations

1. Land filling and mining activities need to be strictly checked
2. Ensure procurement arrangements with reasonable price
3. Ensuring timely availability of inputs for *kole* cultivation
4. Rapid mechanisation measures
5. Eco tourism may be developed for employment and additional income generation
6. Developing and inculcating clubs like bird watching, fishing, boating, native medicines and health clubs
7. Encourage educated youth to promote community and social forestry

Conclusions

1. As of now the major problems faced by *kole* lands are pollution, eutrophication, industrial and residential encroachments,reclamations, species and biodiversity loss.

2. Lack of awareness regarding the qualitative services provided by the *kole* lands is a major reason for the continued exploitation of the *kole* lands

3. Promote environment friendly farming practices taking into account both health and food safety aspects

4. Development activities undertaken at the *kole* lands should reflect the wise use concept of the Ramsar

5. Ensuring stakeholder participation and decision making with the involvement of local governments and NGOs in the effective planning and implementation of development programmes.

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APPENDICES

APPENDIX I

Management options for *kole* wetland ecosystem through stakeholder services

Interview schedule

1.Name:

2. Gender: **Female / Male**

3. Address :

4. Phone No:

5. Age:

Sl. No:	Category	Age group	Response	Score
1.	Young	Less than 35 years		1
2.	Middle aged	35-50 years		2
3.	Old	More than 50 years		3

6. Educational qualification:

Sl. No:	Category	Response	Score
1.	Illiterate		1
2.	Can read only		2
3.	Functionally literate (can read and write)		3
4.	Lower primary level		4
5.	Upper primary level		5
6.	High school level		6
7.	Pre-degree equivalent		7
8.	Degree or equivalent		8
9.	Post graduate degree and above		9

7. Occupation:

Category occupation	Response	Score
Agriculture alone		1
Agriculture + private employment		2
Agriculture + government employment		3

8. Economic class

Sl. No.	Category	Score
1.	Poor	1
2.	Lower middle class	2
3.	Middle class	3
4.	Upper middle class	4
5.	Affluent class	5

9. Information source utilization

Information source	Frequency			Extent of information		
	Regular	Occasionally	Never	Adequate	Some what adequate	Inadequate
A. Mass media sources						
Radio						
Television						
News paper and farm publication						
Research journal						
B. Formal personal sources						
Agricultural assistant						
University assistant						
C. Informal personal sources						
Friends and relatives						
Fellow farmers						
Progressive farmers						
Local leaders						
D. Commercial sources						
Fertilizer dealers						
Pesticide dealers						
Bank personnel						
Other Non Governmental service providers (specify)						
Cooperative officials						
E. Other sources						
Exhibitions or melas						
Group meetings						
Trainings						
Demonstrations						
Seminar						

10.Economic motivation:

Sl. No	Statement	*SA	A	DA	SDA
1.	A farmer should work towards large yield and economic profit				
2.	The most successful farmer is the one who makes more profit				
3.	A farmer should grow cash crops to increase monetary profits in comparison to growing food crops for home consumption				
4.	It is difficult for the farmers to make good start unless he provided with economic assistance				
5.	A farmer should try any farming idea which may earn him more money				
6.	A farmer must earn his living but the most important thing in life can't be defined in economic terms				
7.	Integrated or mixed farming gives more benefit when compared to mixed cropping alone				

(* SA – strongly agree, A – agree, DA – disagree, SDA – strongly disagree)

11. Social participation:

a.) membership in organization

Sl. No.	**Category**	**Score**
1.	Membership in one organization	1
2.	Membership in more than one organization	2
3.	Office bearer in one organization	3
4.	Office bearer in more than one organization	4
5.	Distinctive features (Ward member, MLA, MP etc.)	5

b.) Frequency of attending meetings

Sl. No.	**Category**	**Response**
1.	Regularly attend meetings	
2.	Occasionally attend meetings	
3.	Never attend any meetings	

13. Awareness of the farmers regarding the ecosystem services provided by the *kole* wetlands

a.) Hydrological functions

Sl. No	Type of service	Awareness (Yes / No)
1.	Recharge of ground water	
2.	Control runoff rate	
3.	Buffer shorelines against erosion	
4.	Prevent floods	
5.	Maintain stream flow	
6.	Water storage	
7.	Water supply	
8.	Removal of sediment load	

b.) Chemical functions

Sl. No.	Type of service	Awareness (Yes / No)
1.	Soil formation	
2	Water quality improvement by water purification	
3.	Sediment trapping	
4.	Acts as a carbon sink	
5.	Removes dissolved nutrients	
6.	Adsorbs heavy metals	
7.	Prevents eutrophication	
8.	Toxic or sediment retention	

c.) Recreational functions

Sl. No.	Type of service	Awareness (yes/ No)
1.	Hunting	
2.	Fishing	
3.	Bird watching	
4.	Boating	
5.	Aesthetic attraction	
6.	Tourism	

d.) Biological functions

Sl. No.	Productivity related functions	Awareness (Yes / No)
1.	Rice cultivation	
2.	Fish rearing	
3.	Duck rearing	
4.	Lotus farming	
5.	Timber	
6.	Housing materials such as reeds	
7.	Medicinal plants	
8.	Fertile land for agriculture	
9.	Support cultivation of garden crops like coconut, arecanut, plantain	

10.	Fuel wood supply	
	Biodiversity related functions	
11.	support survival of flora and fauna	
12.	Resting place for migratory birds and water fowls	
13.	Biomass export and import	

e.) Environmental functions:

Sl. No	Type of service	Awareness (yes/ No)
1.	Climate regulation	
2.	Storm protection	
3.	Food control	
4.	Reduce damage of wind and wave action	
5.	Erosion control and shoreline stabilization	
6.	Seasonal habitat	
7.	Wildlife habitat	

f.) Socio- economic functions

Sl.No	Type of service	Awareness (yes/ No)
1.	Livelihood for local people	
2.	serve to provide drinking water, fish , fodder, fuel	
3.	Offer recreation to the society	
4.	Uniqueness to the culture / society	
5.	Employment opportunity	

g.) Others

Sl. No	Type of service	Awareness (yes/ No)
1.	Study and research purpose	
2.	Sand and clay mining	

12. Stakeholders preferences of the resource uses of *kole* wetland

Sl. No.	Type of use	Most important	Important	Important to a smaller extent	Unimportant
1.	Livelihood provider				
2.	Food production				
3.	Natural resource base				
4.	Ware storage				
5.	Water conservation				
6.	Soil nutrient regulator				
7.	Provision of leisure activities				
8.	Rich land resource				

9.	Asset value				
10.	Recreational value				
11.	Fish and aquatic resources				
12.	Traditional heritage value				
13.	Proximity to urban area				
14.	Convenience for life				

13. What are you preferences with the *kole* lands?

14. Do you have any constraints in the maintenance of the *kole* wetlands?

APPENDIX II

Ranking of the farmers' perspectives regarding *kole* lands

S.No	Production perspectives	Rank
1.	Precise time of planting is essential for bumper yield of rice	
2.	Planting and key operations done according to traditional meteorological calendar will lead to high yields and pest control	
3.	Fish farming, duck farming and rearing of milch animals are necessary to enhance production and productivity	
4.	Modern dewatering machinery should be developed to dewater at precise times	
5.	Wild rice is a serious problem – A permanent solution should come up for its eradication	
6.	Research should be there to increase the number of crops in the *kole* lands which is now reduced to one crop due to many reasons	
7.	Farmers should get pure seed to replace old seed at least every three years	
8.	The bunds of *kole* lands can be utilized for cultivation of coconut, flowering plants, medicinal plants and dwarf mango varieties	
9.	Obstructing elements in the water channels like water hyacinth, water weeds restrict the smooth flow of water	
10.	Good amount of straw is obtained	
11.	Fish farming is the main reason for poor productivity of the *kole* lands as it delays planting of rice crop	
12.	Watershed area, hence summer cultivation is possible	
13.	Both rice and fish are encouraged equally in *kole* lands	
14.	Planting bunds with trees increase the number of migratory birds arriving	
15.	Fish farming is a new income generating enterprise	
16.	*Kole* land cultivation not only gives good yield, but effort that goes in is also less	
17.	*Kole* land cultivation fetches more income than upland cultivation	
18.	After the cultivation of rice the land may be utilized for growing vegetables	
19.	Irrigation channels should be deepened and weeds should be destroyed	
20.	For reaping more profits from *kole* lands suitable farming practices should be practiced	

21.	There is decrease in yield after KLDC bund has come	
22.	Uma variety of rice seems more suitable	
23.	Now more chemicals have to be applied due to increase in incidence of pests and weeds	
24.	Use of traps for insects has to be encouraged	
25.	Many farmers open the bunds after harvest leading to gravel getting into the fields with rain water	

S.No	Ecological and environmental perspectives	Rank
1.	Lies about 1 - 2½m below the MSL	
2.	*Kole* land is an area that naturally generates maximum amount of oxygen and fresh air	
3.	Use of chemical pesticides lead to environmental pollution and depletion of fresh air	
4.	There should not be any land filling in *kole* lands	
5.	Terrestrial and aquatic weeds make farming difficult	
6.	Fertility loss due to advent of machinery in cultivation leading to only one crop	
7.	Destruction of *kole* lands will lead to exhausting of drinking and irrigation water	
8.	Water should not be pumped out or lead to the sea, should be retained in the padavus	
9.	Wind and early rains are problems	
10.	Water should be recycled	
11.	Alternative farming is critically necessary	
12.	There were lots of ponds previously – not anymore now	
13.	Topography should be maintained	
14.	Increase in acidity due to excessive fertilizers and pesticides - Causes harm to fish	
15.	Number birds visiting *koles* has reduced	
16.	Biodiversity of indigenous fish has reduced	
17.	Climate change brings unexpected changes for agricultural operations	
18.	The hereditary value of *kole* lands should be protected, conserved and sustained as such.	
19.	Bio remedial measures should be adopted to replace chemicals	
20.	KLDC canal need to be cleaned up	
21.	It is the duty of the public to protect the *kole* lands	
22.	Organic manure should be prepared from the weeds of *kole* lands	
23.	Conservation of fresh water in nearby areas leads to water availability to summer crop	
24.	Look for possibility of electricity generation	
25.	Proper drainage measures should be followed	

S.No	Socio economic perspectives	Rank
1.	Poor social status of the farmer	
2.	Farmers, who generate food for every section in the society should have a basic respectability in the society	
3.	Considering the periodical hike in the cost of production farmer should get a reasonable price for his produce and that should be obtained in time	
4.	The assistance allotted to *kole* lands as a Ramsar site should be distributed among farmers	
5.	*Kole* lands provide livelihood to vast number of farmers	
6.	Scarcity of labour occur due to NREGS leading to high wage rates	
7.	Since farmers do operations on a combined basis, some farmers have to harvest their crops during heavy rains. It is very difficult	
8.	Cost of cultivation increases consistently every year, which is not affordable to farmers	
9.	Exploitation of farmers by companies procuring rice 'en masse' after harvest	
10.	Food is produced by farmers alone, electronic media cannot do it	
11.	Organic fertilizer is very scarce	
12.	Enough fertilizer is not obtained	
13.	There should be clear understanding about proper use of fertilizers and seed	
14.	*Kole* farmers should not confine to farming alone	
15.	Rice produced in one area should be procured there itself	
16.	New varieties are not available due to lack of newer research	
17.	Basic amenities for cultivation in *kole* lands should be made permanent	
18.	For *kole* farmers classes, educational tours and refreshers classes have be conducted	
19.	Need of demonstration of zero budget farming in kole lands	
20.	Expenditure incurred towards transportation is very high	
21.	Availability of viable seed is an important criterion	
22.	Agriculture being less remunerative in nature encourages to choose alternative options	
23.	Padasekharam committees and Government should come together to take collective decisions	
24.	Usage of traditional 'petti and para' for dewatering is good	
25.	Fish farming should be encouraged	

S. No	Perspectives on ancillary services	Rank
1.	Avoid subsidy offered by the banks	
2.	Integration of all farming activities required	
3.	Measures to be taken to overcome water shortage during summer crop cultivation	
	Negligence of irrigation department	
4.	Proposal for a canal at a higher level from the ground	
5.	There is a need for zero interest loans for farming as well as farm machinery in kole lands	
6.	Demand for equal investment by government and farmers to ensure labour availability from NREGS	
7.	*Kole* farmers are in need of fertilizers, weedicides, pesticides, tricho cards, pseudomonas and they should be made available timely	
8.	Farmer pension scheme should be implemented	
9.	Efforts from government are required to avoid repetitive costs	
10.	Crop insurance should be made available	
11.	Agricultural machinery should be improved periodically and should be made available at affordable rates to farmers	
12.	Government should encourage *kole* cultivation by providing support price and new technology	
13.	Intermediaries make it difficult for ordinary farmers to get machinery at reasonable rates	

MANAGEMENT OPTIONS FOR THE *KOLE* WETLAND ECOSYSTEM THROUGH STAKEHOLDER STUDIES

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ABSTRACT OF THE THESIS

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ABSTRACT

Wetland management strategy is not very scientifically drawn in India. In Kerala, state policies do not reflect the conservation element. The *kole* wetlands are central Kerala's unique rice production ecosystem. The ecosystem significance of the area is evidenced by its inclusion as a Ramsar site, and recently, they have been considered a separate high value biodiversity area. The development policies so far do not uphold the provisions for ecosystem protection of the wetlands. Covering visible interests of the stakeholders, policy makers touch the politically correct options alone. The marginalised and voiceless stakeholders mostly lose their interests and so do the ecological concerns, with no one to project them. This study aimed to come out with policy suggestions as to how wetland conservation without sacrificing the human economic activity can be carried out which will inform management plans for the wetlands in the long run.

The study has been conducted in six randomly selected panchayats, three from each of Thrissur *kole* and Ponnani *kole*, which were Arimpur, Paralam and Thanniyam from Thrissur *kole* and Kattakampal, Perumpadappu and Nannamukku from Ponnani *kole*. Major Stakeholder groups were identified using the snow ball sampling technique. The major stakeholder groups identified were farmers, government departments, agricultural labourers, input agencies, co-operatives, marketing agencies and NGOs. Stakeholder interactions and information from secondary data led to the development of structural and functional relationships among the stakeholder groups.

Farmers' awareness regarding various ecosystem services provided by the *kole* lands was studied. The ecosystem functions provided by the *kole* lands have been categorised into seven such as hydrological, chemical, recreational, biological, environmental, socio-economic and other functions. Awareness of the respondents of the Thrissur and Ponnani *koles* was analysed and stakeholders from both *kole*s were commonly aware of 14 services.

Preferences of the stakeholders regarding resource use of the *kole* lands were studied using a five point continuum. The major preferences lay in the premises of livelihood provision, food production, water conservation, role as a natural resource base, water storage, soil nutrient regulation and provision of leisure activities.

Stakeholders' perspectives were elaborately studied by concept mapping procedure. The perspectives were classified into production, environmental, socio-economic and ancillary services. Multidimensional scaling was used to develop a map where each perspective is a point on the map. Proximity values of the perspectives were considered to interpret the output. As a result similar perspectives were grouped into one cluster. Concepts in the clusters were suitably labelled.

Based on all the analyses done, management options for the *kole* lands were developed. The important ones were needeeds for promotion of more than one crop in *kole*, need for integrated farming, proper maintenance of water ways, promotion of organic measures, education of farmers on water conservation measures and the like. The study points towards the need for extensive measures for problem identification and management in *kole* lands to sustain them as a major rice producing area in Kerala.