Imagery Analysis of Socio – Bio Interactions in the Estuarine Environment

Dhanya, T.K.[1], Azeez, K.[2]* and Libeesh, N.K.[3]

[1]*Research and Development Centre, Bharathiar University, Coimbatore – 641 046.*
[2]*PSMO College, Tirurangadi, Malappuram, Kerala.*
[3]*The Gandhigram Rural Institute (DTBU), Dindigul – 624 302.*
*Email: drkazeez@gmail.com

Abstract

Estuary has a significant role in the bio environment due to its productivity. Kadalundi River is an important river in the Malappuram district, Kerala, India. Kadalundi River has two estuarine ecosystems, which have national importance with mangroves and a vast variety of species diversity. The present study is an endeavour to analyze the changes that occurred in the ecosystems with the human interactions through the Google earth image analysis to restrict the changes in the area. The Poorapuzha and Kadalundi are the two estuaries developed where the Kadalundi River meets the Arabian Sea. These areas have different socio-cultural and environmental statuses. Kadalundi has a well-developed social status, but Poorapuzha is in its progress. Analyzing the results from the various facts and figures identified that there are some common facts and need to pay attention to many more things for its better future. Image analysis reveals that Poorapuzha had a low mangrove density in 2002 but shows an increasing peak of density in recent years. Whereas in the case of Kadalundi, it's vice versa. So attention must be taken care of in many areas of conservation of mangroves.

Keywords: Estuarine ecosystem, Kadalundi, Poorapuzha, Image analysis

1. Introduction

Dependency made the evolution and growth of organisms (Standish, 1970). Estuaries have a productive ecosystem with a vast variety of flora and fauna (Ghajar *et al.*, 2018). Kadalundi River is one of the important rivers in Malappuram Dt., Kerala, India. Kadalundi River drains the northwest side of Malappuram district (Aarif *et al.*, 2017; Bindu & Jaypal, 2016). The river has two estuaries, namely, Kadalundi and Poorapuzha, with similar types of the ecosystem (Vinod et al., 2020). The Kadalundi have a national status regarding the mangroves availability and as a bird sanctuary, whereas Poorapuzha has not that much (Pillai & Harilal, 2018). The human interaction made a drastic change in the Kadalundi river basin and estuary (N. Rahees *et al.*, 2014). Many studies carried over here pointed out many issues in this environment and revealed its remedies (Jayasurya *et al.*, 2018). The Poorapuzha is not much explored than that of Kadalundi; identifying and analyzing the degradation that happened over the Kadalundi will help demarcate the future problems that arise in the Poorapuzha. This analysis will trigger the precautions that have to take care of in the future (Aarif & Prasadan, 2014). Image analysis is modern science that evolved from the advancement of the remote sensing field. The visible and infrared regions of the electromagnetic spectrum made the availability of data for better analysis (Jong *et al.*, 2007). Many studies capture and use Google earth images for change detection analysis (Gupta, 2003). The vast availability of data and acceptable spatial resolution have made this happen (Xue & Su, 2017). This study focused on the analysis of change detection that occurred in the Poorapuzha area due to different factors with the help of image analysis and field observations. Fig. 1 shows the study area map.

2. Materials and Methods

The literature was collected from different available sources. The study area has been finalized, and field visits were conducted to collect the field observations. Interviews were conducted with local people for collecting the field data. With this field data, Google earth images taken during 2002, 2010 and 2020 were collected to validate the details got from the interview. The data validation was taken place to identify the problems and remedies.

3. Results and Discussion

The lack of development in the Poorapuzha area remains it is unexplored (Aiyer, 2018). The field visit and the interaction made in the area conclude that the mangroves are considered a single type, and they are ignorant of the species diversity in mangroves and mangroves associated. It is included in the Avicenniaceae family named *Avicennia officinalis* L. (Fig. 2) and is locally named Orayi or Upptti (V. V. Rahees, 2015). In the past years, the counts of mangroves were less in the area, but in recent years it has been emerged more and expanded over 5 acres. Considering the details from the Kadalundi, degradation of mangroves was taken place due to human interaction, sand bar formation and population expansion (Babu, 2011; Mandal & Naskar, 2008). In the past, Kadalundi enriched with the same variety of species found in Poorapuzha, and now the species is less in number (Nayar *et al.*, 2008; Sreelekshmi *et al.*, 2018). The image analysis of Poorapuzha shows that the population is increasing in recent years, and care must be taken to conserve and clear plans should be adopted as remedies for the protection of these mangrove ecosystems.

The analysis of Google Earth Image of 2002, 2010 and 2020 in detail illustrates that in 2002 (Fig. 3), the
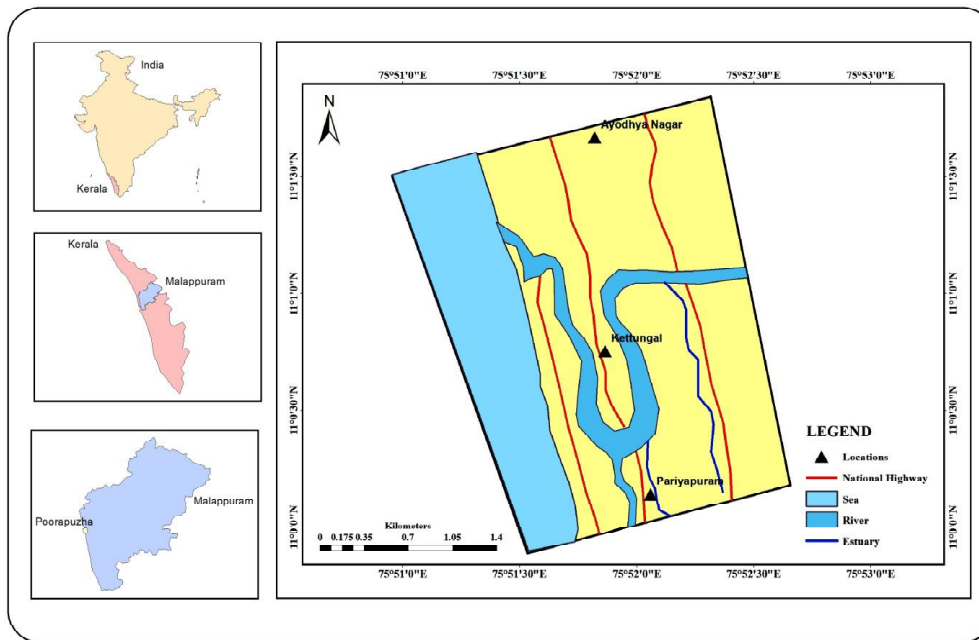
Fig. 1. Study area Map

Mangrove count was less and not much care is taken part of that. The population was also less during that time, and most of the area had been used to cultivate Cocos *nucifera* L (coconut tree). The sand deposition in the river banks is less at that time. In 2010 (Fig.4), the area had a moderate occurrence of mangroves with a low population. The cultivations are high, but mangroves are randomly spread over there. The area observed a sand deposition which is in the direction of the flow of the river. The cultivation is high during this time also. But the scenario in 2020 (Fig.5) is quite different in the case of mangroves. The count is very high compared to that of the previous years. The cultivation is less, and the population also increased. A new bridge is being constructed in the estuary; the same situation has happened in the Kadalundi area (Bindu & Jayapal, 2016; Gilman *et al*., 2008). After the bridge construction and due to the population expansion, the count and variety of mangroves were decreased (Mcleod & Salm, 2006; Syamjith & Ramani, 2015). So the same situations may happen shortly when validating with that of Kadalundi. The interaction with the local people concludes that they are aware of the conversation of Mangroves and the expansions of Mangroves in recent years in this area. So, making this sense, utilising local people's knowledge to conserve the mangroves is a better option as it succeeded in many areas. Considering the things in a well-planned manner, it is possible to increase the count of mangroves in huge numbers and make a good ecosystem at a low cost.

4. Conclusion

Kadalundi and Poorapuzha are two estuaries of the same river. Scio- economic statuses of both rivers are different. A dense patch of mangroves is found in both regions. Studies reveal that there are so many issues relevant to the degradation of the existing glory of Kadalundi, but no specific studies were conducted in the Poorapuzha estuary. Kadalundi is a national ecotone, and Poorapuzha is a local

ecotone. So the factors affecting the Kadalundi may also affect the Poorapuzha ecosystem in the nearest future, so care may be taken to conserve this precious developing mangrove ecosystem. The growth of Mangroves in the Poorapuzha is similar to that of Kadalundi, and there might be a possibility to arise the same problems that happened in the Kadalundi. Poorapuzha is a naturally formed mangrove ecosystem,. Implementing the successful programs to rejuvenate the Mangroves successfully done at Kadalundi can increase the count of naturally formed mangroves in this area too that helps in generating a natural and cost-effective ecosystem.

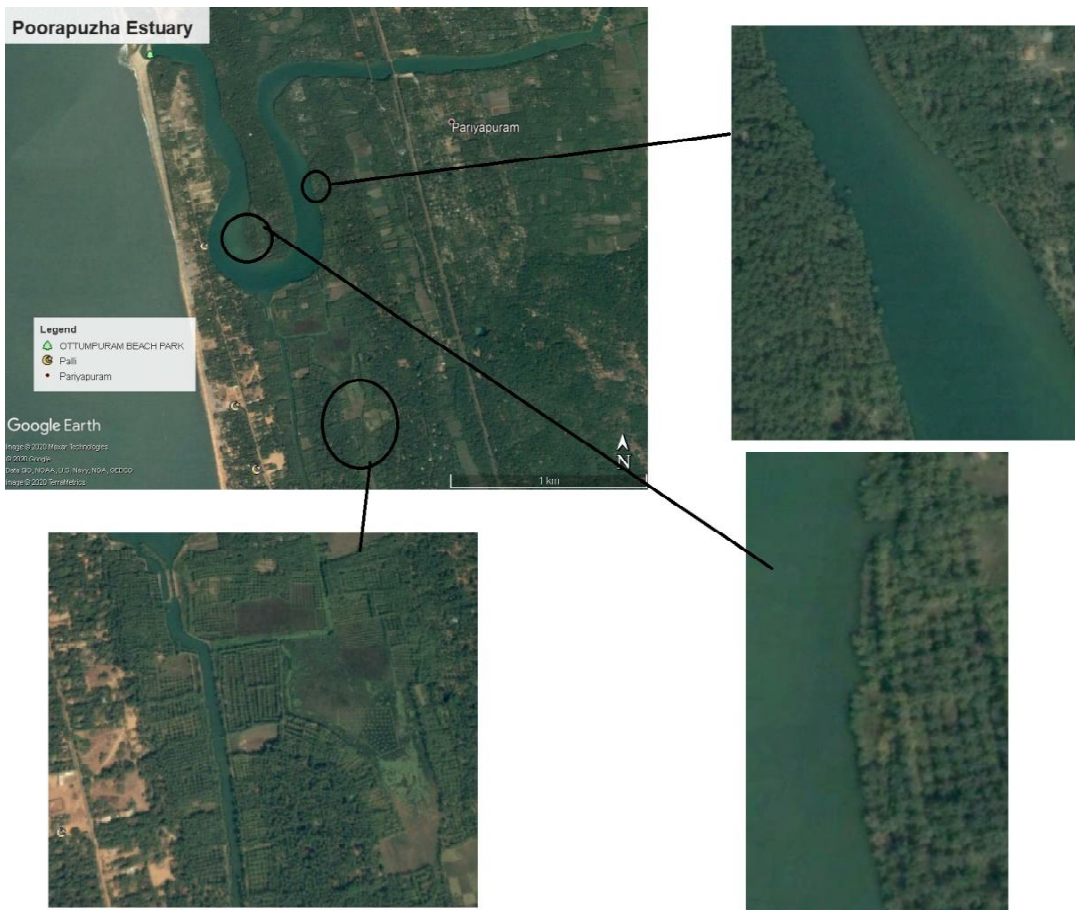**Fig. 2.** *Avicennia officinalis* L. in the area

Fig. 3. Google Earth Image of 2002. The Mangroves are less

Fig. 4. Google Earth Image of 2010. The growths of Mangroves are moderate

Fig. 5. Google Earth Image of 2020. The growths of Mangroves are high compared to previous years, as seen in light green colour

5. References

Aarif, K. M., & Prasadan, P. K. (2014). Conservation issues of KVCR, the wintering ground and stop-over site of migrant shorebirds in south-west coast of India. *Biosystematica*, *8*(December), 51–57.

Aarif, K. M., Prasadan, P. K., Abdul Hameed, S. V., & Ravindran, R. (2017). Avian fauna of Kadalundi-Vallikkunnnu Community Reserve, West Coast of India. *Stilt*, *2017*(71), 25–32.

Aiyer, H. (2018). Diversity analysis and present status of Mangroves from Kerala, West coast of India. *International Journal of Advanced and Innovative Research*, 7(6).

Babu, S. (2011). *Conservation significance of the Kadalundi – Vallikkunnu community reserve. 101*(6).

Bindu, K. B., & Jayapal, G. (2016). The Sand Bar Formation and Its Impact on the Mangrove Ecosystem: A Case Study of Kadalundi Estuary of Kadalundi River Basin in Kerala, India. *Current World Environment*, *11*(1), 65–71. https://doi.org/10.12944/cwe.11.1.08

Bindu, K. B., & Jaypal, G. (2016). Environmental Status of Kadalundi River Basin in Kerala – a Case Study of Kadalundi Estuary. *International Journal of Current Research*, *8*(8), 36430–36435.

Ghajar, A. J., Korea, M., K, M. P., K, S., Anitha, V., Mini Mohandas Lekshmy, S. T. R., Hema, I., & Kathiresan, K. (2018). The Conservation of Mangroves in Kerala/ : Economic and Ecological Linkages. *Kerala Forest Research Institute*, *3*(2007), 1–47. https://www.ijsr.net/archive/v3i11/U1VCMTQ0Mw==.pdf

Gilman, E. L., Ellison, J., Duke, N. C., & Field, C. (2008). Threats to mangroves from climate change and adaptation options: A review. *Aquatic Botany*, *89*(2), 237–250. https://doi.org/10.1016/j.aquabot.2007.12.009

Gupta, R. P. (2003). *Remote Sensing Geology*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-05283-9

Jayasurya, P. K., George, J. P., Prema, D., & Anantharajan, N. (2018). *Comparison of Wet and Dry pH Values in the Sediment Samples from the Sea Side Mangrove and River Side Stations at Kadalundi Region, Kozhikode District, Kerala, India. 10*, 1–3.

Jong, S. M. De, Meer, F. D. van der, & Clevers, J. G. P. W. (2007). *Chapter 1 Basics of Remote Sensing. June 2014*, 0–15. https://doi.org/10.1007/978-1-4020-2560-0

Mandal, R. N., & Naskar, K. R. (2008). Diversity and classification of Indian mangroves: A review. *Tropical Ecology*, *49*(2), 131–146.

Mcleod, E., & Salm, R. V. (2006). Managing Mangroves for Resilience to Climate Change IUCN Global Marine Programme. In *Iucn* (Issue 2). www.nature.org/marine.

Nayar, T. S., Sibi, M., Rasiya Beegam, A., Mohanan, N., & Rajkumar, G. (2008). Flowering plants of kerala: Status and statistics. *Rheedea*, *18*(2), 95–106.

Pillai, N. G., & Harilal, C. C. (2018). Mangroves – a Review. *International Journal of Recent Advances in Multidisciplinary Research*, *05*(08), 4035–4038.

Rahees, N., Kiran, M., & Vishal, V. (2014). Phytosociological analysis of Mangrove Forest At Kadalundi- Vallikkunnu Community Reserve, Kerala. *International Journal of Science, Environment*, *3*(6), 2154–2159.

Rahees, V. V. (2015). *Floristic Diversity and Structural Analysis of Mangrove. 7*(1958), 105–108.

Sreelekshmi, S., Preethy, C. M., Varghese, R., Joseph, P., Asha, C. V., Bijoy Nandan, S., & Radhakrishnan, C. K. (2018). Diversity, stand structure, and zonation pattern of mangroves in southwest coast of India. *Journal of Asia-Pacific Biodiversity*, *11*(4), 573–582. https://doi.org/10.1016/j.japb.2018.08.001

Standish, R. I. (1970). *Iucn 1970 yearbook*.

Syamjith, P. K., & Ramani, N. (2015). *Is Sand Bar Formation a Major Threat to Mangrove Ecosystems/ ? Is Sand Bar Formation a Major Threat to Mangrove Ecosystems/ ? 3*(November 2014), 2005–2011.

Vinod, K., Asoka, P. K., Joshi, K. K., Kumar, R. N., Zacharia, P. U., Varghese, M., A., S. J., Anasukoya, A., Koya, V. A. K., Ansar, C. P., Nikhiljith, M. K., Vallikunnu, V., Palot, M. J., Cheruvat, D., & A, G. (2020). *Glimpses of Kadalundi-Vallikunnu Community Reserve* (Issue 139). ISSN: 0972-2351 CMFRI Special Publication No. 139.

Xue, J., & Su, B. (2017). Significant Remote Sensing Vegetation Indices: A Review of Developments and Applications. *Journal of Sensors*, *2017*, 1–17. https://doi.org/10.1155/2017/1353691