



Analysis and Projection of Aquaculture Practice in Indian Bengal Delta, using Cellular Automata and Markov Chain: Whether policy restriction in transition probability can be useful for sustainable land management?

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Abstract:

Aquaculture is one of the major livelihood options for the inhabitants of the Indian Bengal Delta (IBD), since last three decades. Historically, people started cultivating the land after clearing the mangrove forest, where soil salinity was the difficulty for year-round agriculture practice. For those people used to depend on mono-cropping only during monsoon. The gradual rise in soil salinity and decreased productivity compelled people to find out other option for their sufficient living. Aquaculture has emerged as a lucrative practice due to high market demand with technological intervention and administrative support. As a result, there was a sharp rise in aquaculture practice in both the North and South 24 Parganas districts in IBD, with less regulatory control. This kind of unregulated practice always poses a severe impact on the sustainable land management. In this study satellite images from 1972 to 2017 (LANDSAT MSS, TM, OLI, and Sentinel) have been used to assess the change in aquaculture practice in IBD. A combination of NDWI and Object-Based Classification using multi-resolution segmentation has been applied to extract the areas under aquaculture in IBD to identify the dynamics of change. This study also identified the land conversion from agriculture to aquaculture in selected blocks of the two districts in IBD. A future projection beyond 20 and 50 years using Cellular Automata and Markov Chain model in 'business as usual' scenario shows a complete massacre in land management in this area, towards a massive land degradation. It is felt that a policy level intervention in the transition is strongly required to combat the land degradation, and within the model 'probability' has been incorporated to identify when and where the regulation can be applied to restrict this perilous growth of aquaculture. The result shows surprising co-existence of all the land cover classes, which leads to a necessary policy formulation and timely enforcement, can only ensure the sustainable land management.

Key Words: Aquaculture, Land Management, Cellular Automata and Markov Chain, transition probability, Indian Bengal Delta (IBD)