Algaculture in Inundated Coastal Cornfields: A pro-poor climate adaptive intervention

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Since climate change mitigation and poverty alleviation is a prime focal area for South Asian Forum for Environment (SAFE), it envisaged the CAPaBLE programme supported by Asia Pacific Network for Global Change Research (APN-GCR), as a capacity building and action research initiative to promote algaculture as a community based adaptive mitigation strategy for sustainable alternative livelihood in coastal villages of *Sundarbans* in India. The underlying principle was to demonstrate algaculture integrated with fisheries in brackish and trapped storm surge waters in inundated coastal areas as a promotional capacity building programme for marginal farmers, who have lost their farmland in saline water ingress owing to sea level rise. Another important rationale behind the programme was to disseminate this cultivation technology amongst local stakeholders and enrich scientific knowledge in regard to carbon sequestration potential of alga as a strategic mitigation measure for climate change resilience. The programme envisioned the development of a scientific aptitude in abating climate change impact with low cost conservation paradigm and place-based restoration of habitat through community intervention. This goal was achieved by hands on training on low-cost *in-vivo* aquafarming, management and monitoring of algaculture, harvesting of algal biomass and its commercial usage in a capacity building module for technology transfer. The areas covered in this intervention span 28 hectares over Jharkhali, Kumirmari, Sagar and Satljelia islands of Sunderbans. The population of this region is socioeconomically challenged and ecologically vulnerable. The native farmers practice age-old farming of paddy and fish, often being victims of environmental hazards and forced migration as environmental refugees.

Setting up experimental designs, selection of demonstration sites and identification of beneficiaries were done through participatory planning in village camps held in Sundarbans. Ecological survey and habitat evaluation was conducted in all selected sites following standard methods. Natural habitats of local algal flora that are economically important were identified from field and seed stocking were made in Jhorkhali village. Two climate adaptive infrastructural models, namely 'U-Lock and Fish-bone Model' were incorporated for the algaculture along with free floating culture trays. On completion of the earthwork, seeds of three algal species were inoculated to cultivation beds in all three types of models. The first harvest was reaped in mid-week of November 2013, which recorded an astonishing 'Daily Growth Rate' percent (DGR%) as 22-27% in a highly saline water stock (18ppm). A total of 17.5 metric tons of dried alga could be harvested from an area that had shown 'No-green' in last three years. Assessed market value of reap was nearly 2000 USD.

The community awareness campaign wherein general concepts and working knowledge on aquafarming and algaculture were shared with the community members. Capacity building workshops were conducted in sites to carry out identification the algal species, pond preparation and cultivation management. The beneficiaries enjoyed these learning experiences. Mr Kartik Sardar, a tribal farmer exclaimed with awe, "I have often seen these algae growing in the wilderness, but never knew that they can be so useful for us, poor". Mrs Bimala Gorui, expressed with relief, "…Now I can even feed my cattle in odd days with this (algae). I am really thankful for this insight.

Yield and growth were calculated and compared to infer that growth rates, seasonal changes in carbon mitigation etc. can show maximum optimistic CO_2 fixation capacity of 147 Metric Tons per hectare per year. This estimate is drastically higher than carbon fixation capacity of terrestrial plants. It was therefore obvious that the accrued biomass through algal growth is a direct evidence of carbon capture by aquatic flora in inundated waters. Ecological impact, as expected eventually improved the habitat condition, restored coastal biodiversity and now has also a big potential as a carbon harvesting application in rural areas.

The programme has been very successful with 250 odd smallholders having positive measurable impacts and has been accepted by the beneficiaries as an alternative economic opportunity that can support livelihood in climate vulnerable coastal areas. Economic impacts show increased per capita income and resource recovery, financial inclusion and inclusive growth in the villages. This program has proved to be sustainable in every possible way. Human potential in terms of learning new methods has been enhanced. Knowledge of locals regarding this cultivation has not only improved their economic status by giving them a new source of livelihood but also empowered them socially. The positive attitude and societal cohesion due to combined efforts of the members of the community has ensured the sustainability of the programme.The financial gain and the basic revolution in terms of per capita income which has been entirely all-encompassing covering every member of the community has ensured its sustainability.