Govt. of Kerala
Department of Agriculture

IRTCBSF

International Research and Training Centre for Below Sea level Farming (IRTCBSF)
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Department of Agriculture & Farmers Welfare

FINAL REPORT

Innovative Approaches to Climate Resilient Farming: Biosaline Agriculture and Open Water Fish Farming in Munro Island, Kollam, Kerala

A Project Sponsored by

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INNOVATIVE APPROACHES TO CLIMATE RESILIENT FARMING: BIOSALINE AGRICULTURE AND OPEN WATER FISH FARMING IN MUNRO ISLAND, KOLLAM, KERALA

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FINAL REPORT

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Summary

Climate change profoundly affects the coastal wetlands with profound impacts on agriculture and the natural resource use.At the same time agricultural sector can be an important part of the solution to climate change as when effectively organized it can improve natural resource management.

The present study carried out at Munroe island, the sinking and shrinking island in Ashtamudi estuarine system reveals that salt water intrusion is a serious problem in such places owing to reduced riverine flow consequent to commissioning of the Kallada irrigation dam and changes in the sedimentation pattern that used to support the island land mass.Mangrove plantations have the ability to bind sediments and promote accretion, arrest shoreline erosion and can aid in protection of the island by holding the silt intact.

In the context of the persistent demand for structural protection of the island from erosion, the study underlines the essential need for build ups that allow long shore sediment transport, artificial enhancement of sediment supply through the permeable dams to trap sediment, or mud nourishment is a suggested measure.

Rather than sticking to a single solution approach, a remarkable shift that combine green, nature- based, approach with grey, engineered solutions or 'Building with Nature' approach is suggested. Apparently, coastal defenses that relies on mangroves, integrated with coastal engineering structures shall be the suggested strategy for integrated management of the land and water resources in Munroe island.

In the context that land based farming is impeded by saline intrusion occurring at an alarming pace in the estuarine system in Ashtamudi estuary, formation of mangrove shield with a buffer zone bordering the island is a strategy tried that helped deter salination to some extent. The study further revealed that pen fish culture or aqua- silvi culture in the buffer zone developed scientifically is a potential opportunity for enhancing livelihoods, that helped utilize the available estuarine resources most effectively. This might be of help to stabilize the withering island.

Popularization of aqua- silviculture as demonstrated in the study with least damage to environment especially mangroves shall be developed and promoted as an integrated program in a balanced way under a definite management plan. The study demonstrate that pen- fish culture in the buffer zone can not only play a major role in achieving higher fish production from the brackish water environment but is also an environment friendly farming practice suited to shallow water regions that can help generate employment, income and food security.

The high organic carbon values observed in mangrove sediments here indicate that mangroves hold exceptionally high carbon stocks and conversion of mangroves resulting from mangrove losses might contrary to sequestering green house gases might enhance emissions. In spite of their importance to people, mangroves remain consistently undervalued and continue to be destroyed in Munroe island. By learning from failed attempts, and building on previous successes, there is an urgent need to turn the knowledge generated into action, ensuring that remaining mangrove habitats in the island are sustainably managed and wisely protected.

The study by documenting the best practices provides a valuable database for devising policy options at local level for conservation and restoration of mangroves in Munro island through effective participatory management strategies. The present study thus not only present empirical evidences on the value and importance of mangroves to people in the Munro island but also indicates that there is still time to 'turn the tide' so that management attempts for restoration planting of mangroves shall be made possible with local participation.

There is ample scope to up scaling the initiatives through environmental recovery programs by identifying potential funding sources from Government sector, Global Green Climate Fund or from CSR schemes of stake holder organizations viz, port authorities, recreational service providers, sea food industries etc.

This study indicate that cage fish farming in open waters has great potential not only for augmenting fish production but also for enhancing coastal livelihoods and emphasizes the need for institutional linkages for financial inclusion. The tremendous potential of open water farming for livelihood enhancement and for enhancing fish production in the state is highlighted and demonstrated. The demonstration and popularization of cage culture technology of 'Karimeen' the signature species of this lake in partnership with local inhabitants shall has open up a ray of hope for planners, policy makers,officials of state department, fishers, entrepreneurs etc. for ensuring nutritional security, tourism promotion and employment generation.

It is hoped that the study will generate renewed interest in mangroves to safeguard the island and this essential yet undervalued ecosystem. The key messages from this study is clear a mangrove based livelihood system that call for recognizing the important and critical role of mangroves in supporting human well-being viz., climate regulation, food security and poverty reduction.

In practical terms, there is a dire need for local, regional, and National Governments to establish regulatory policy and frameworks that will help develop open water aquaculture as the most climate adaptive and resilient pathway for food fish production.There is a dire need to sensitize entrepreneurs to avoid excessive accumulation of uneaten feeds as the discharge of nutrients from the fish feed and excretions which could lead to changes in the ecosystem. However Guidelines for regulations in stocking density, cage farm management and water quality shall be insisted. Immediate action is needed to realize the potentials of agro-aqua tourism and aqua sylviculture in the mangrove zones as a suggested strategy for enhancing the livelihoods of the local people that can help arrest the alarming tide of climate induced human migrations out of the island.

Conclusion

In the present study, we have demonstrated that mangroves can be effectively employed to protect coastal islands from tidal surges, floods, and cyclones etc as it help mitigate effects of tidal waves and minimize damage to property. The role of mangroves in coastal protection to minimize the impacts of natural disasters has been demonstrated.

A procedure to establish 'bio-shield' by planting selected mangroves species viz, Rhizophora mucronata in high density by close planting of the species was standardised. By planting mangrove at specific distance, from the coastline a buffer zone could be created around the island which was used for mangrove based open water pen fish farming. Pen construction by using gabion fixing, a novel approach was demonstrated which ensured effective protection of the fish stocks in the culture system. Formation of earthen ridges using kayal silt, and development of mangrove belt, fixation of pens etc were taken through community participation.A comparison of the environmental attributes of Ashtamudi estuary, a Ramsar site indicate that the environmental conditions are far superior here as compared to Vembanad lake.

Although the study attempted methods to enhance the productivity of farming systems by demonstrating bio saline agriculture, freshwater storage, open water farming etc to benefit the inhabitants, the mangrove based aquaculture strategy has been the most successful approach in the Munro island, as it helped to boost income and employment to the inhabitants. For the first time, integration of pen fish aquaculture in the buffer zone created by forming mangroves shields was demonstrated which helped for enhancement of small scale fisheries in the open lake is this mangrove dominated floodplain.

The study established the superiority of ecosystem-based aquaculture system and economic feasibility of pen culture in the buffer zones created around the island. By planting mangrove at a safe distance and formation of buffer zones between the bio shield . and settlement zones, the water area thus formed was demonstrated ideal for pen fish culture.Open water cage culture of endemic fish, kanjirottu kaaya lkarimeen the signature species in this Munro island, due to its very superior production rates, and niche market, was established as an economically viable venture for livelihood enhancement in the study.

We could demonstrate the carbon sequestration potentials of mangroves with soils functioning as blue carbon storage as testified through the organic carbon enrichment. Thus we have established that mangroves not only help stabilize the shores, protect the shores and prevent erosion but also help store large quantities of carbon in the soil as an effective ‘blue carbon sink’. The enhanced soil organic status and ecological function indicators are testimony to this. Mangroves naturally enhanced soil organic carbon and blue carbon pool and were thus demonstrated to help compensate for the greenhouse gases released by human activities.The challenge of climate change-induced tidal waves pumping saline sea water into the interior was partly vitiated by the planted mangrove belt, with its physiological or anatomical adaptations to survive in a hyper-saline tidal environment. However, total protection of the freshwater source interior, was not effective due to over topping of storage ponds by occasional tidal floods, This calls for formation of more effective and high embankment bunds. The fringe zone that retained the majority of sediment entering the coastal wetland and mangrove belt played a significant role as sediment traps. The study demonstrate that pen fish culture in the shallow waters is not only a potential economic venture but also help enhance sedimentation.

Fish species Encountered in Ashtamudi estuary (Estuarine/ Marine / Freshwater)

Sl No	**Fish species**	**Family**	**Habitat**
1	*Etroplus suratensis*	Cichlidae	*E*
2	*Etroplus maculatus*	Cichlidae	*E*
3	*Gerres setifer*	*Gerridae*	*E*
4	*Engraulis indicus*	*Engraulidae*	*E*
5	*Arius caelatus*	*Aridae*	*E*
6	*Oligolepis acutipinnus*	*Oxudercidae*	*E*
7	*Liza parsia*	*Mugilidae*	*E*
8	*Arius dussumeri*	*Ariidae*	*E*
9	*Epinephelus malabaricus*	*Serranidae*	*E*
10	*Euryglosus orientalis*	*Soleidae*	*E*
11	*Megalops cyprinoides*	*Megalopidae*	*E*
12	*Mystus gulio*	*Bagridae*	*E*
13	*Parambasis thomassi*	*Chandidae*	*E*
14	*Parambasis dayi*	*Chandidae*	*E*
15	*Pelates quadrilineatus*	*Theraponidae*	*E*
16	*Ehirava fluviatillis Deraniyagala*	*Clupeidae*	*E*
17	*Stolephorus indicus*	*Engraulidae*	*E*
18	*Stolephorus commersonii*	*Engraulidae*	*E*
19	*Thryssa setirostris*	*Engraulidae*	*E*
20	*Thryssa purava*	*Engraulidae*	*E*
21	*Thryssa mystax*	*Engraulidae*	*E*
22	*Thryssa malabarica*	*Engraulidae*	*E*
23	*Zenarchopterus dispar*	*Zenarchopteridae*	*E*
24	*Zenarchopterus buffonis*	*Zenarchopteridae*	*E*
25	*Megalops cyprinoides*	*Megalopidae*	*E*
26	*Tachysurus maculatus*	*Bagridae*	*E*
27	*Puntius filamentosus*	*Cyprinidae*	*F*
28	*Puntius mahecola*	*Cyprinidae*	*F*
29	*Xenentodon cancila*	*Belonitae*	*F*
30	*Anabas testudinius*	*Anabantidae*	*F*
31	*Channa punctata*	*Channidae*	*F*

32	*Channa striatus*	*Channidae*	*F*
33	*Devario aequipinnatus*	*Cyprinidae*	*F*
34	*Rasbora daniconius*	*Cyprinidae*	*F*
35	*Aplocheilus lineatus*	*Aplocheilidae*	*F*
36	*Clarius batracus*	*Claridae*	*F*
37	*Channa marulis*	*Chandidae*	*F*
38	*Mystus keletius*	*Bagridae*	*F*
39	*Macropodus cupanus*	*Macropodidae*	*F*
40	*Punitus amphibius*	*Cyprinidae*	*F*
41	*Puntius vittatus*	*Cyprinidae*	*F*
42	*Panchax lineatus*	*Cyprinodontidae*	*F*
43	*Danio malabaricus*	*Cyprinidae*	*F*
44	*Mastacembalus armatus*	*Mastacembilidae*	***F***
45	*Ompok bimaculatus*	*Siluridae*	*F*
46	*Puntius malampyx*	*Cyprinidae*	*F*
47	*Puntius ticto*	*Cyprinidae*	*F*
48	*Aplocheilus panchax*	*Aplocheilidae*	*F*
49	*Rasbora daniconius*	*Cyprinidae*	*F*
50	*Caranx nobilis*	*Carangidae*	*M*
51	*Sillago sihama*	*Sillaginidae*	*M*
52	*Arius maculates*	*Ariidae*	*M*
53	*Johnius dussumeri*	*Sciaenidae*	*M*
54	*Anodontostoma chacunda*	*Dorosomatidae*	*M*
55	*Strongylura strongylura*	*Belonidae*	*M*
56	*Tylosurus strongylurus*	*Belonidae*	*M*
57	*Epinephelus diacanthus*	*Serranidae*	*M*
58	*Synaptura zebra*	*Soleidae*	*M*
59	*Caranx affinis*	*carangidae*	*M*
60	*Acanthopagrus berda*	*Sparidae*	*M*
61	*Mugil cephalus*	*Mugilidae*	*ME*
62	*Chanos chanos*	*Chanidae*	*ME*

63	*Scatophagus argus*	*Scatophagidae*	*ME*
64	*Hyporhamphus limbatus*	*Hemiramphidae*	*ME*
65	*Leiognathus equulus*	*Leiognathidae*	*ME*
66	*Gerres oyena*	*Gerridae*	*ME*
67	*Gerres filamaentosus*	*Gerridae*	*ME*
68	*Hyporhamphus xanthopterus*	*Hemiramphidae*	*ME*
69	*Sigarnus oramin*	*Siganidae*	*ME*
70	*Therepon jarbua*	*Theroponidae*	*ME*
71	*Tetradon maculatus*	*Tetradondidae*	*ME*
72	*Arius jella*	*Aridae*	*ME*
73	*Platycephalus indicus*	*Platycephalidae*	*ME*
74	*Lates calcarifer*	*Centropomidae*	*ME*
75	*Valamugil cunnesius*	*Mugilidae*	*ME*
76	*Osteomugil cunnesius*	*Mugilidae*	*ME*
77	*Pseudorhombus malayanus*	*Paralichthyidae*	*ME*
78	*Caranx carangaus*	*Carangidae*	*EM*
79	*Cynoglossus lingua*	*Cynoglossidae*	*EM*
80	*Ambassis ambassis*	*Ambassidae*	*EF*
81	*Ambassis gymnocephalus*	*Ambassidae*	*EF*
82	*Glossogobius giurus*	*Gobiidae*	*EF*
83	*Eleotris fusca*	*Eleotridae*	*EF*
84	*Liza macrolepis*	*Mugilidae*	*EF*
85	*Ambasis commersoni*	*Ambassidae*	*EF*
86	*Dorichthys cunculus*	*Syngnathidae*	*EF*
87	*Puntius sarana subnasulus*	*Cyprinidae*	*EF*
88	*Heteropneustes fossilis*	*Heteropneustidae*	*EF*
89	*Oreochromis mossabicus*	*Cichlidae*	*EF*
90	*Liza tade*	*Mugilidae*	*MEF*
91	*Lutjanus argentimaculatus*	*Lutjanidae*	*MEF*

92	*Lutjanus fluviflamma*	*Lutjanidae*	*MEF*
93	*Anguilla bicolor bicolor*	*Anguillidae*	*MEF*
94	*Valamugil buchanani*	*Mugilidae*	*MEF*

Crustaceans		
1	*Penaeus monodon*	*Penaeidae*
2	*Metapenaeus affinis*	*Penaeidae*
3	*Metapenaeus dobsoni*	*Penaeidae*
4	*Metapenaeus monoceros*	*Penaeidae*
5	*Fenneropenaeus indicus*	*Penaeidae*
Crabs		
1	*Scylla serrata*	*Portunidae*
2	*Portunus pelagicus*	*Portunidae*
3	*Charybdis feriata*	*Portunidae*
4	*Portunus sanguinolentus*	*Portunidae*
Mollusks		
1	*Villorita cyprinoides*	*Cyrenidae*
2	*Perna viridis*	*Mytilidae*
3	*Marcia opima*	*Veneridae*
4	*Saccostrea cucullata*	*Ostreidae*
5	*Meritrix casta*	*Veneridae*
6	*Protapes gallus*	*Veneridae*
7	*Mytella strigata*	*Mytilidae*

As salinity spikes, Munroe Thuruthu switches gear

Project integrating bio-saline agriculture and cage aquaculture to tide over eco issues

NAVAMY SUDHISH
KOLLAM

Farmers of Munroe Thuruthu, who have been facing a slew of problems such as tidal ingress and saline intrusion due to the island's fragile ecological features, will soon switch to a new and sustainable system.

A project integrating bio-saline agriculture and cage aquaculture developed by the International Research and Training Centre for Below Sea Level Farming (IRTCBSF), Kuttanad, will help them in protecting their crops from the adverse effects of environmental degradation.

"Earlier, we used to cultivate rice and coconut in abundance, but with the salinity levels going up all those farms are lying idle. Fish farmers are also suffering as there is a considerable dip in the catch from Ashtamudi Lake. This project, funded by the Directorate of Environment and Climate Change, has been conceived as a measure to survive environment-related issues and improve the ecology of the island," says Munroe Thuruthu grama panchayat president Binu Karunakaran.

The project aims to introduce a sustainable and innovative land use model by implementing multi-commodity farming and the first model farm at Peringalam will be inaugurated on Saturday.

A way emerges: The integrated farming project being implemented by the International Research and Training Centre for Below Sea Level Farming at Munroe Thuruthu.

A Kuttanad touch

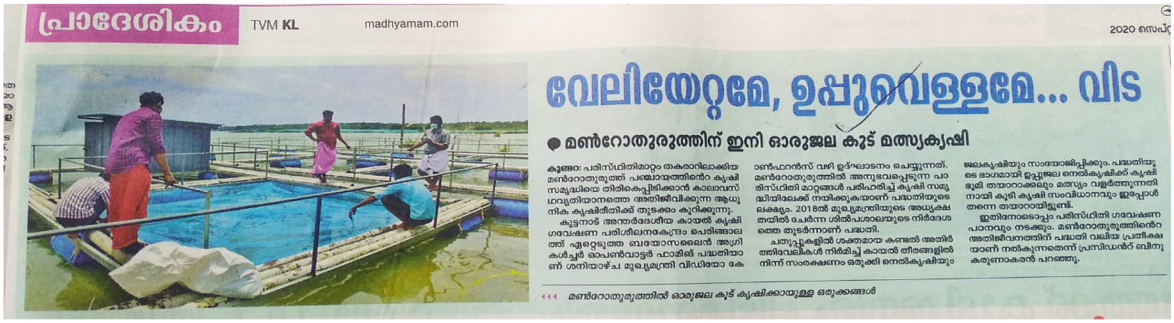
Rice varieties such as pokkali with high salinity tolerance will be used for farming while fish and duck will be raised along, emulating a method in Kuttanad polders.

"The polders and ponds will be protected by a thick bio-belt of mangroves, which will also help in shoreline protection and soil stabilisation. Residents were cooperative when we put forward the idea of a bio-wall and fence farming will be done in some parts. It is a comprehensive project of adaptive farming as some of the dykes will also be used for rainwater harvesting," says K.G. Padmakumar, principal investigator of the project.

Since Munroe Thuruthu is a wetland strewn with lagoons and canals, it is an ideal location for aquaculture. Open water-cage farming will be carried out and the fish will be fed with commercial pellets instead of the traditional methods as part of the project.

"Munroe Thuruthu residents are the first set of climate refugees from our land and since land is a scarce resource on the island, the focus will be more on aquaculture. Due to its high commercial value, pearl spot will be raised in designated areas in the backwater adjoining the island. Seeds of Kanjirottu kaayal karimeen, the most-relished pearl spot variety, will be ranched," says Mr.Padmakumar.

Fisher self-help groups in the ward will be responsible for cage maintenance, feeding, marketing, and monitoring the environment under the guidance of experts.


പ്രാദേശികം TVM KL madhyamam.com 2020 സെപ്

വേലിയേറ്റമേ, ഉപ്പുവെള്ളമേ... വിട

മൺറോതുരുത്തിന് ഇനി ഓരുജല കൂട് മത്സ്യകൃഷി

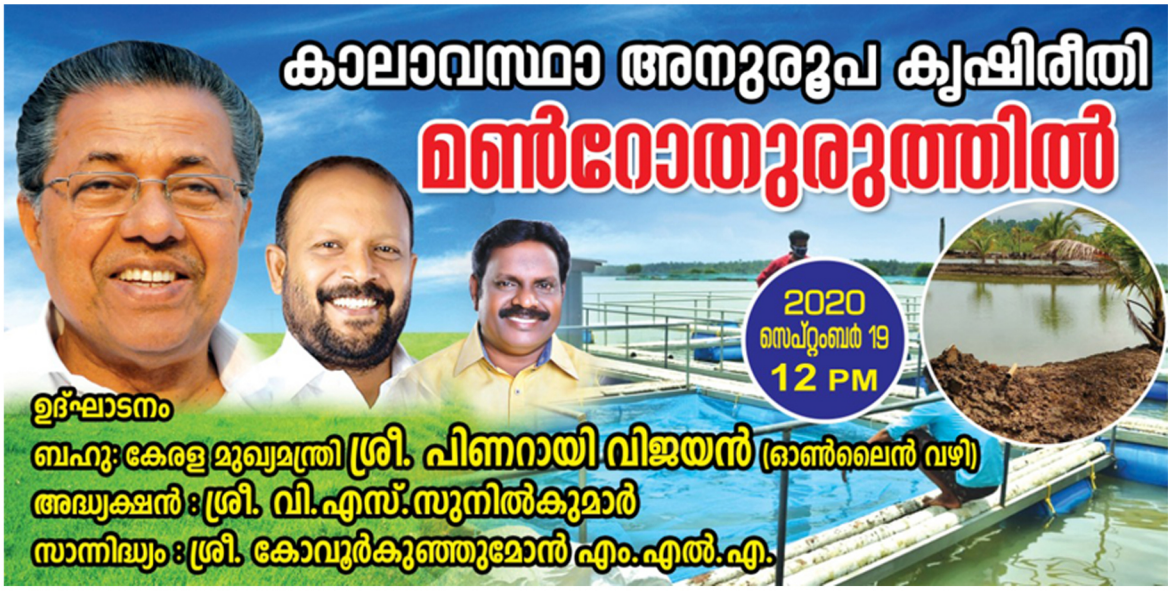
കുണ്ടറ: പരിസ്ഥിതിമാറ്റം തകരാറിലാക്കിയ മൺറോതുരുത്ത് പഞ്ചായത്തിന്റെ കൃഷി സമ്പ്രദായത്തിൽ തിരികെപ്പിടിക്കാൻ കാലാവസ്ഥാവ്യതിയാനത്തെ അതിജീവിക്കുന്ന ആധുനിക കൃഷിരീതിക്ക് തുടക്കം കുറിക്കുന്നു.

കുടുംബശ്രീ അന്തർദേശീയ കായൽ കൃഷി ഗവേഷണ പരിശീലനകേന്ദ്രം പെരിങ്ങാലത്ത് ഏറ്റെടുത്ത ബയോസൈൻ അഗ്രികൾച്ചർ ഫൊൺവാട്ടർ ഫാമിൽ പദ്ധതിയാണ് ശനിയാഴ്ച മുഖ്യമന്ത്രി വിഡിയോ കോൺഫറൻസ് വഴി ഉദ്ഘാടനം ചെയ്യുന്നത്. മൺറോതുരുത്തിൽ അനുഭവപ്പെടുന്ന പാരിസ്ഥിതി മാറ്റങ്ങൾ പരിഹരിച്ച് കൃഷി സാധ്യതിലേക്ക് നയിക്കുകയാണ് പദ്ധതിയുടെ ലക്ഷ്യം. 2018ൽ മുഖ്യമന്ത്രിയുടെ അധ്യക്ഷതയിൽ ചേർന്ന ശിൽപശാലയുടെ നിർദേശത്തെ തുടർന്നാണ് പദ്ധതി.

ചതുപ്പുകളിൽ ശക്തമായ കണ്ടൽ അതിർത്തിവലികൾ നിർമിച്ച് കായൽ തീരങ്ങളിൽ നിന്ന് സംരക്ഷണം ഒരുക്കി നെൽകൃഷിയും ജലകൃഷിയും സംയോജിപ്പിക്കും. പദ്ധതിയുടെ ഭാഗമായി ഉപ്പുജല നെൽകൃഷിക്ക് കൃഷി മുക്തി നഷ്ടമായതും മത്സ്യം വളർത്തുന്നതിനായി കുടി കൃഷി സംവിധാനവും ഇപ്പോൾ തന്നെ തയാറായിട്ടുണ്ട്.

ഇതിനോടൊപ്പം പരിസ്ഥിതി ഗവേഷണ പഠനവും നടക്കും. മൺറോതുരുത്തിന്റെ അതിജീവനത്തിന് പദ്ധതി വലിയ പ്രതീക്ഷയാണ് നൽകുന്നതെന്ന് പ്രസിഡന്റ് ബിനു കരുണാകരൻ പറഞ്ഞു.

‹‹‹ മൺറോതുരുത്തിൽ ഓരുജല കൂട് കൃഷിക്കായുള്ള ഒരുക്കങ്ങൾ



മൺറോതുരുത്തിൽ കാലാവസ്ഥാ അനുരൂപ കൃഷിക്ക് തുടക്കം

സ്വന്തം ലേഖകൻ

കൊല്ലം

കാർഷിക കേരളത്തിന്റെ സമഗ്രവികസനം ലക്ഷ്യമാക്കിയുള്ള പദ്ധതികൾ സമയബന്ധിതമായി പൂർത്തിയാക്കുമെന്ന് മുഖ്യമന്ത്രി പിണറായി വിജയൻ. കാലാവസ്ഥാ വ്യതിയാനത്തിന്റെ ദൂഷ്യവശങ്ങൾ അതിജീവിക്കാനായി മൺറോതുരുത്തിൽ നടപ്പാക്കിയ കാലാവസ്ഥാ അനുരൂപ കൃഷി വീഡിയോ കോൺഫറൻസിലൂടെ ഉദ്ഘാടനംചെയ്യുകയായിരുന്നു മുഖ്യമന്ത്രി.

മൺറോതുരുത്തിലെ പാരിസ്ഥിതിക പ്രശ്നങ്ങൾ പരിഹരിക്കുക എന്നത് സർക്കാരിന്റെ നിശ്ചയദാർഢ്യമാണ്. ഇതിന്റെ ഫലമാണ് പദ്ധതി. പദ്ധതിപ്രകാരം ഓരുജല നെൽക്കൃഷി ഉൾപ്പെടെ പുനരാരംഭിച്ചു. തദ്ദേശീയരുടെ ഭക്ഷ്യസുരക്ഷയും ജീവനോപാധിയും മെച്ചപ്പെടുത്താൻ ഇതിലൂടെ സാധിക്കുമെന്നും മുഖ്യമന്ത്രി പറഞ്ഞു.

മൺറോതുരുത്തിലെ കാലാവസ്ഥാ അനുരൂപ കൃഷി വീഡിയോ കോൺഫറൻസിലൂടെ മുഖ്യമന്ത്രി പിണറായി വിജയൻ ഉദ്ഘാടനംചെയ്യുന്നു

കൃഷിമന്ത്രി വി എസ് സുനിൽകുമാർ അധ്യക്ഷനായി. പരിസ്ഥിതി വകുപ്പ് പ്രിൻസിപ്പൽ സെക്രട്ടറി ഉഷാ ടൈറ്റസ്, പരിസ്ഥിതി കാലാവസ്ഥ വ്യതിയാന കേന്ദ്രം ഡയറക്ടർ മീർ മുഹമ്മദ് അലി തുടങ്ങിയവർ വീഡിയോ കോൺഫറൻസിൽ പങ്കെടുത്തു.

ഓരുജല നെൽക്കൃഷി, തദ്ദേശ ഇനം മത്സ്യങ്ങളെ ഉപയോഗിച്ചുള്ള കൂട് മത്സ്യക്കൃഷി, മത്സ്യക്കൃഷിക്കായി നിലമൊരുക്കൽ, സംയോജിതമായി കണ്ടൽ വളർത്തൽ, കക്കക്കൃഷി, താറാവ് വളർത്തൽ തുടങ്ങിയവ ഉൾപ്പെടുന്ന സംയോജിത സുസ്ഥിര ഭൂവിനിയോഗകാർഷിക മാതൃകയാണ് കാലാവസ്ഥ അനുരൂപ കൃഷി.

പെരുങ്ങാലത്തു നടന്ന ചടങ്ങിൽ കോവൂർ കുഞ്ഞുമോൻ എംഎൽഎ, പഞ്ചായത്ത് പ്രസിഡന്റ് ബിനു കരുണാകരൻ, അന്തർദേശീയ കായൽക്കൃഷി ഗവേഷണ പരിശീലന കേന്ദ്രം ഡയറക്ടർ കെ ജി പത്മകുമാർ തുടങ്ങിയവർ പങ്കെടുത്തു.

ദേശാഭിമാനി Sun, 20 September 2020
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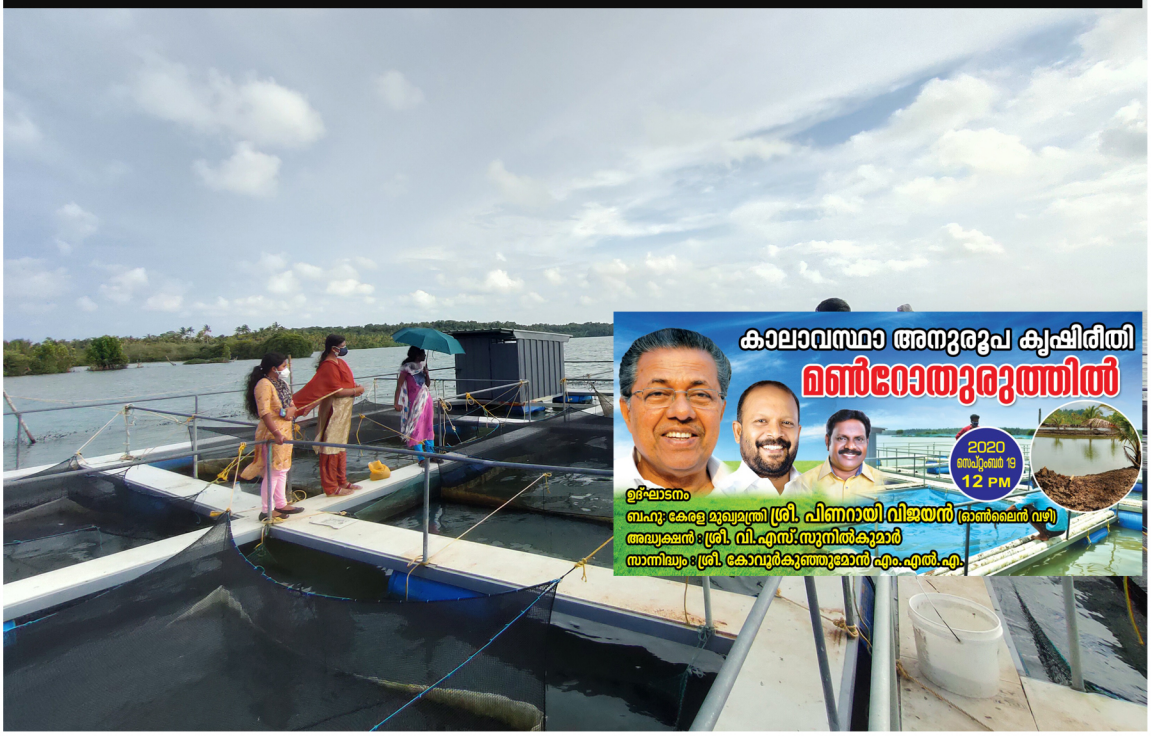

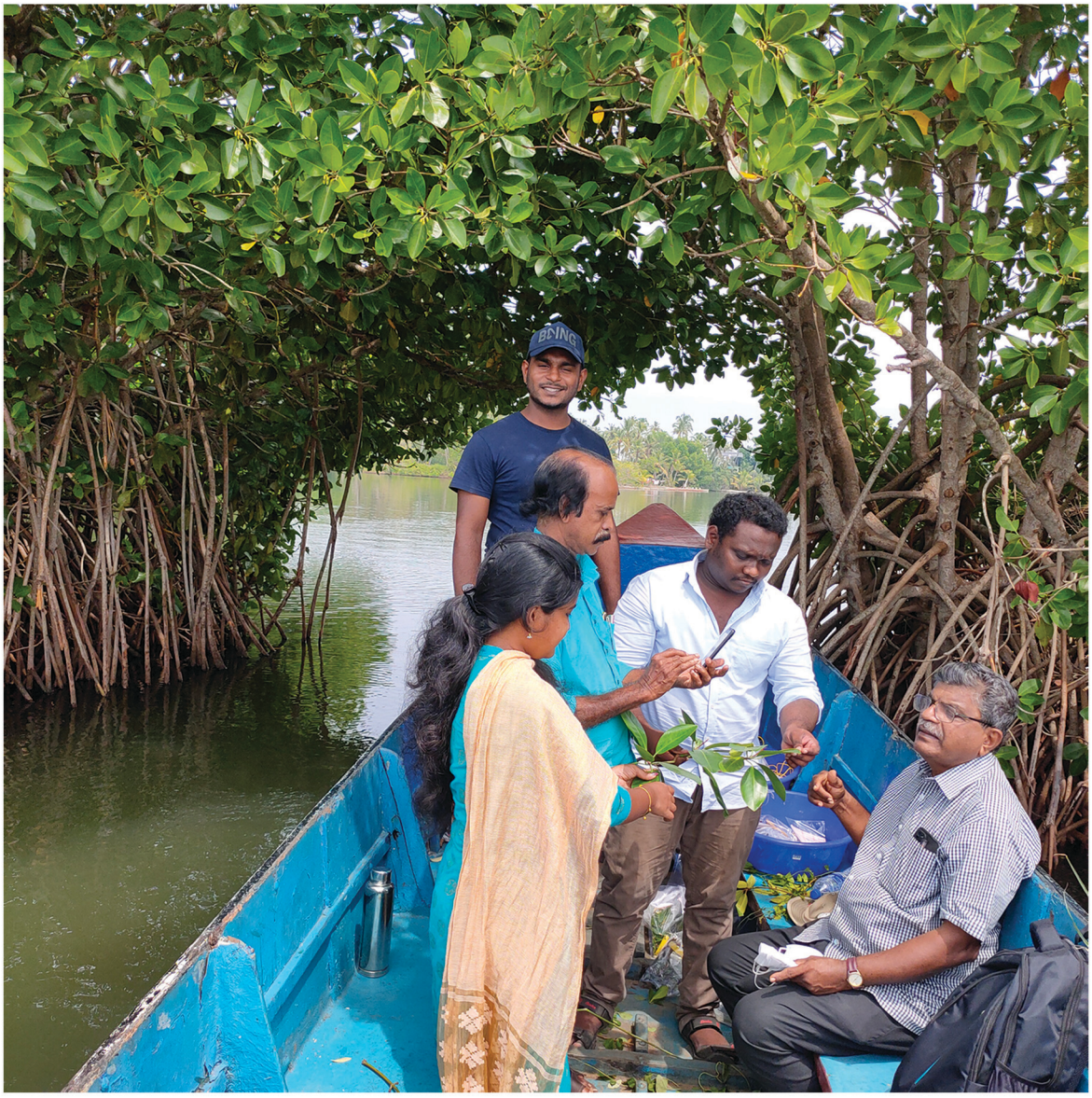

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