

Institutional support for management of agrobiodiversity in Kerala¹

Sunil Mani², S. M. Mohanakumar³, V. Santhakumar⁴ and T. Abhilash⁵

Centre for Development Studies
Trivandrum

Assess capacity gaps pertaining to agrobiodiversity and identify opportunities to mitigate impacts of current practices of agriculture and allied sectors on agrobiodiversity conservation, management and use.

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²Corresponding author, Centre for Development Studies, Trivandrum, mani@cds.edu

³Centre for Development Studies, Trivandrum, Kerala

⁴Azim Premji University, Bangalore

⁵Centre for Development Studies, Trivandrum, Kerala

Abstract

Kerala is one of the most biodiverse states in the Indian union. The state has put in place an elaborate network of policies and institutions to maintain and indeed promote agrobiodiversity in the state. The present paper undertakes a detailed review of these by evaluating the policies and laws that impact on agrobiodiversity either positively or negatively. It further considers the role of public research institutes that generate the requisite knowledge for maintaining biodiversity and the cases of a number of local self-governments which have been successful in promoting agrobiodiversity. The public research institutes and nongovernmental organizations have played an important role in not just generating newer plant varieties and but also play a very important role in conserving existing varieties. Based on the analysis, the study identifies a number of researchable issues that may be taken up in future, which will essentially contribute to the management of and mainstreaming of agrobiodiversity in the state. The ensuing analysis shows that while the state has a number of exemplary policies, laws and practices, its success at the level of local self-governments depends crucially on whether agrobiodiversity is tied to the livelihood strategies of ordinary people. Further, it also depends on the presence of certain key mentors or charismatic leaders within the local self-governments who can make a crucial difference. Merely relying on institutional forms such as Biodiversity Management Committees and People's Biodiversity Registers are unlikely to produce the desired results.

Abbreviations

AEC	Agro-Ecology Centre
AFOLU	Agriculture Forestry and Other Land Use
ASEAN	Association of Southeast Asian Nations
BD Act	Biological Diversity Act
BMC	Biodiversity Management Committee
CAbC	Community Agrobiodiversity Centre
CSOs	Civil Society Organizations
CTCRI	Central Tuber Crops Research Institute
FAO	Food and Agriculture Organization
FHC	Family Health Centre
FTA	Free Trade Agreements
GI	Geographical Indication
GIS	Geographic Information System
GRI	Government Research Institutes
IPRs	Intellectual Property Rights
JNTBGRI	Jawaharlal Nehru Tropical Botanic Garden and Research Institute
KAU	Kerala Agricultural University
KFRI	Kerala Forest Research Institute
KSBB	Kerala State Biodiversity Board
KSCSTE	Kerala State Council for Science, Technology and Environment
KTKA	Kerala Traditional Knowledge Authority
KVASU	Kerala Veterinary and Animal Sciences University
LEISA	Low External Input and Sustainable Agriculture
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MSSRF	M. S. Swaminathan Research Foundation
NARP	National Agricultural Research Programme
NBA	National Biodiversity Authority
NBPGR	National Bureau of Plant Genetic Resources
NBTs	National Biodiversity Targets
NGOs	Non Governmental Organizations
NSS	National Service Scheme
PBR	People's Biodiversity Register
PHC	Primary Health Centre
PRIs	Public Research Institutions
QR code	Quick Response Code
RARS	Regional Agricultural Research Station
RET	Rare Endangered and Threatened
SSLC	Secondary School Leaving Certificate
TBIC	Technology Business Incubation Centre

Contents

List of Tables and Figures _

Introduction	6
1.Main institutional mechanism for managing agrobiodiversity	
Biodiversity Management Committees and People’s Biodiversity Registers	9
2. Evaluation of policies and laws that have an impact on agrobiodiversity	11
2.1 Kerala State Biodiversity Strategy and Action Plan.....	11
2.2 The Kerala State Environment Policy, 2009	12
2.3 The Organic Farming Policy	12
2.4 Agricultural Development Policy	17
2.4.1 Major limitations of the Agricultural Development Policy	19
2.5. Laws on Intellectual Property Rights	19
2.6 Extent of Agrobiodiversity in Kerala	22
2.7 Some critical issues having a bearing on management of agrobiodiversity	23
2.7.1 Role of custodian farmers.....	24
2.7.2 Access Benefit Sharing.....	24
3.Public Research Institutions(PRIs) that support knowledge creation	
for agrobiodiversity	24
3.1 Central Tuber Crops Research Institute (CTCRI).....	25
3.2 Kerala Veterinary and Animal Sciences University (KVASU).....	26
3.2.1 Conservation of Indigenous Animals	27
3.3 Kerala Agricultural University (KAU).....	30
3.4 Regional Agricultural Research Station (RARS).....	31
3.5 National Bureau of Plant Genetic Resources (NBPGR).....	32
3.6 Non-Governmental Organizations	33
3.6.1 M S Swaminathan Research Foundation (MSSRF)	33
3.6.2 Thanal.....	35
3.7 PRIs dealing with biodiversity in general	36
3.7.1 Jawaharlal Nehru Tropical Botanical Garden Research Institute (JNTBGRI).....	36
3.7.2 Kerala Forest Research Institute (KFRI).....	38
3.8 Insights from the analysis of the role of PRIs and NGOs	39
4. The cases of 4 model Grama Panchayats	40
4.1 Kanjikuzhi Grama Panchayat	41
4.2 Eraviperoor Grama Panchayat.....	43
4.2.1 Varattar-Aadi Pamba rejuvenation.....	45
4.2.2 Food security	47
4.2.3 Environment	47
4.3 Meenangadi Grama Panchayat	48
4.3.1 Activities of BMC.....	49
4.4 Marancherry Grama Panchayat-	52
4.4.1 Activities of BMC.....	53
4.5 Insights from the four case studies	55
5. Potential areas for further research	57
6. Conclusions	58
References	60
Annexures	

List of Tables and Figures

List of Tables		
Table 1	PBR rate across states in India (as on 18/02/2019)	10
Table 2	Biodiversity Strategy and Action Plan and its relationship with National Biodiversity Authority Targets	11
Table 3	Positive and Negative implications of Agricultural Policy for Agrobiodiversity	17
Table 4	Geographical Indications granted to agricultural products from Kerala	19
Table 5	Plant Varieties Registered from Kerala	21
Table 6	PRIs and NGOs selected for in-depth examination	24
Table 7	NBPGR- Indigenous Collections from Kerala	32
Table 8	Crop varieties conserved at MSSRF	33
Table 9	Crop varieties conserved at Thanal	35
Table 10	Wild relatives of crops and Germplasms conserved by JNTBGRI	37
Table 11	Rationale for selecting the four cases for in-depth examination for this study	40
Table 12	Cropping pattern of Kanjikuzhi panchayat (as on March 31, 2019)	42
Table 13	Summary of major achievements of the grama panchayats	55
List of Figures		
Figure 1	Distribution of certified organic farming area in Kerala	16
Figure 2	Trends in Agrobiodiversity Index, 2007-08 and 2016-17	22
Figure 3	Changes in area under monocrops during 2007-08 and 2016-17	22
Figure 4	Cropping pattern of the state (as on March 31, 2018)	23

Introduction

Agrobiodiversity reflects the extent of diverse flora and fauna and also genetic diversity in the agricultural landscapes and waterscapes of a local community. Pascual et al. (2011: 191) use different sources to provide a more formal definition as follows:

‘Agrobiodiversity can be understood as the diversity within and among species found in an agro-ecosystem that contribute to food and agriculture, including planned (domesticated) biodiversity (i.e., the diversity of crops and livestock genetic resources), as well as all other plant and animal genetic resources (i.e. crop wild relatives)’.

In general, a higher level of diversity could be useful on three counts. There are three kinds of values of agrobiodiversity. First is the use-value – some of the diverse variety of flora, fauna and genes could be directly useful for people (including cultivators). For example, there could be different plants and animals that cultivators sustain as a source of subsistence or income. The agro-diversity might have served the function of a portfolio diversification to address risks in less developed societies which do not have formal institutions for insurance or risk minimisation (Kontoleon et al., 2009). In addition, there could be specific uses too. For example, there could be some plants in farms that may have a medicinal use for human beings or animals; there could be some others which can be used as organic or natural pesticides, and so on. All these are part of use-values. Second is the option value. Though some of the varieties are not known to be useful with the current information, some of these may turn out to be useful based on future knowledge. Hence there is a value in protecting it currently, even if these are not useful based on the current knowledge. The use of the genes in traditional or wild varieties of grains for enhancing the pest resistance of hybrid ones is an example in this regard. Third, there are also what can be called non-use values. Certain varieties though may not be useful currently or in future due to the availability of substitutes, may have certain heritage value. We may want our future generations to have a glimpse or exposure to such entities or practices which require these.

However, there is a need for a collective or state action for the protection of agrobiodiversity. Individuals (including the owners of land) may not have adequate incentives to protect agrobiodiversity. There could be a shift in agricultural production towards less diverse (sometime monocrop) systems. In certain cases, the productivity (in terms of the market value) of monocrop (or less diverse) system could be higher especially when some of the useful attributes of a diverse crop system may not have an appropriate market. Or the absence or thinness of market for certain products may aggravate the situation. For example, the absence of a market for hay encourages farmers to use shorter varieties of paddy or wheat. The economic attractiveness of less-diverse versus more-diverse farming systems depends on agro-ecological and market conditions.

Though there are an option and non-use values, each farmer may not internalise these in his/her decision on the use of agrobiodiversity. This too, can create a situation where the agrobiodiversity through the aggregation of private choices may not be adequate to meet the overall social requirement in this regard. Or there could be a mismatch between the private conservation costs and wider social benefits or the latter cannot be captured by private conservationists (Bellon, 2004). In other words, the conservation of agro-biodiversity has positive externalities, and the full benefits of these cannot be captured without state and/or collective action (Friis-Hansen, 1999). All these are part of the ‘market failure’. However, there can be government failures too. Some of the policies and programs of the government, instead of protecting agro-

biodiversity, may lead to its decline unintentionally. This could be due to the non-consideration of the impact of these policies and programs on agro-biodiversity. Subsidies provided as part of government schemes for the promotion of agriculture can distort private incentives to protect agro-biodiversity (Perrings, 2001). The breeding programs of the research organisations may favour the establishment of less-diverse farming systems (Gruere et al., 2009). For all these reasons; there is a need for informed collective and state actions for the protection of agro-biodiversity. Such a collective action can be at different levels and also facilitated by governmental and non-governmental organisations and concerned individuals.

There has been an increase in the awareness of the need to protect agro-biodiversity globally and also within countries like India. This has encouraged the national and state governments to take different steps for this purpose. However, the effectiveness of these steps depends on a number of contextual factors. There are studies which assess the effectiveness of such policies and programs in different contexts (for example, Nagarajan et al., 2007; Smale et al., 2008). This report assesses the effectiveness of the institutions (laws), programmes, and organisations to conserve agrobiodiversity in the Indian state of Kerala.

According to FAO⁶, experience and research have shown that agrobiodiversity can:

- Increase productivity, food security, and economic returns
- Reduce the pressure of agriculture on fragile areas, forests and endangered species
- Make farming systems more stable, robust, and sustainable
- Contribute to sound pest and disease management
- Conserve soil and increase natural soil fertility and health
- Contribute to sustainable intensification
- Diversify products and income opportunities
- Reduce or spread risks to individuals and nations
- Help maximize effective use of resources and the environment
- Reduce dependency on external inputs
- Improve human nutrition and provide sources of medicines and vitamins, and
- Conserve ecosystem structure and stability of species diversity.

Kerala is one of the most biodiverse states in the country. It is home to several kinds of flora and fauna and is situated in one of the 36-biodiversity hotspots, in the world, namely the Western Ghats. The people in the State grow 142 crop plants belonging to 104 genera and 43 families (Nayar, 2011).

Kerala is implementing the central Biological Diversity (BD) Act, 2002 and its Rules 2004, through state-level BD Rules, 2008. There is a State Biodiversity Board (SBB), and the SBB has been establishing Biodiversity Management Committees (BMCs) in all the Local Self Government (LSGs) beginning with the year 2008. By 2015, it managed to form BMCs in all its LSG Units. A report of the working group on biodiversity set up by the Kerala State Planning Board has recommended a comprehensive Biodiversity Strategy and Action Plan with funding for the 13th Five Year Plan (Kerala State Planning Board, 2017). The report advocates a participatory management system for the protection of fragile ecosystems such as hills and mountains, shola forests, laterite hills, mangroves, sacred groves and riparian habitats, and eco-restoration of degraded areas like abandoned quarries and ponds. The committee has

⁶See 'What is agrobiodiversity?', <http://www.fao.org/3/y5609e/y5609e01.htm> (accessed on July 8, 2019)

recommended mobile apps and crowd sourcing for ecosystem mapping. Local bodies have also been charged with the management of invasive species. Further, the committee has recommended the preparation of a city biodiversity index for Thiruvananthapuram, Kochi, and Kozhikode, afforestation of public land in urban areas, eco-restoration of water bodies and establishment of biodiversity parks. All these go on the way towards mainstreaming biodiversity in general at the state. Regarding agrobiodiversity, the working group recommended 14 suggestions⁷. These range from development of village level seed bank and a seed management committee, maintaining agrobiodiversity inventory at LSG level through PBR, maintenance of databases related to Traditional Knowledge, promotion of studies on diversity of natural pollinators and predators in the agroecosystem, more attention on the underutilized species as tubers, green leafy vegetables, revitalization of organic farming by employing the provisions of Participatory Guarantee Scheme (PGS), conservation of local varieties, encouraging boundary bund planting in paddy fields, rubber and coconut plantations etc. The Planning Board is in the process of implementing these suggestions.

The megafloods in several parts of Kerala in August 2018 seemed to have seriously affected the biodiversity of the state. The post-flood biodiversity impact study conducted by KSBB (Kerala State Biodiversity Board, 2018) has drawn up a three-pronged strategy to address the impact of the floods on the ecology and biodiversity of the State. The rapid assessment is to be followed by a chain study to understand how the disaster has affected various ecosystems. The third part of the strategy will focus on developing a long-term action plan for ecological restoration. Chapter 4 of the study documents the district-wise impact of mega floods and landslides on agrobiodiversity. The crop worst affected was paddy across 12 of the 14 districts. Overall in both India and Kerala, the share of agriculture in the nation and state's economy has been declining.

Objectives, methodology and data sources

The primary purpose of the study is to understand the policies and that institutions that Kerala state and India has put in place to successfully manage and conserve agrobiodiversity in the state. It also aims at identifying policy area which needs further careful attention and research. The study employs a mix of primary and secondary source material. Primary sources include a detailed survey of major public research institutions in the state which generate the formalised knowledge for maintaining agrobiodiversity. It has also covered some of the leading NGOs in the field. Further, we have surveyed some of the model BMCs in the state. Secondary source materials include a critical analysis of major policy documents dealing with agrobiodiversity both in a direct and indirect manner.

Organisation of the study

The paper is structured into six sections. Section 1 discusses the main institutional mechanism that is available for maintaining biodiversity in general and agrobiodiversity in particular at the level. This is basically the Biodiversity Management Committees and the People's Biodiversity Registers (PBRs). Section 2 evaluates the various laws policies that favour or hinder agrobiodiversity in the state. These range from the policy on biodiversity itself to the one on environment and the agricultural policy of the state to laws regarding Intellectual Property Rights (IPRs) in general. Section 3 maps out the range of public or government research institutes which generate the formalised knowledge and technology for maintaining biodiversity. Section 4, will analyse the cases of four specific local self-governments all of whom are acknowledged by either the State Biodiversity Board or the National Biodiversity Authority, formally, as

⁷See Kerala State Planning Board (2017), pp. 24-5

successful models from the point of view of managing and maintaining agrobiodiversity. An understanding of the specific strategies employed by these units will be helpful for other panchayats in their quest towards management of their agrobiodiversity. Section 5 identifies a number of potential areas for further research. Finally, Section 6 concludes the study.

1.Main institutional mechanism for managing agrobiodiversity- Biodiversity Management Committees and People's Biodiversity Registers

One of the most important components of the state's biodiversity strategy is the preparation of People's Biodiversity Registers (PBRs). Such local-level registers of information about varieties are seen as an instrument to protect agrobiodiversity globally (Smale et al., 2004). Although in Kerala tribal communities have their own institutional arrangements for managing agrobiodiversity (Padmanabhan, M, 2011). Her study documented collective efforts to halt genetic erosion in the state by looking at four case studies on institutional innovations in agrobiodiversity management and analyzing their performance from the perspective of gender equity. Negotiation over gendered rules is at the centre of this analysis. However, her study was conducted during the mid-2000s when BMCs and PBRs were yet to take shape.

PBRs document local community knowledge of status, uses, history, ongoing changes and forces driving changes in biodiversity resources, gainers and losers in these processes and people's perceptions of how these resources should be managed. A number of PBRs have been prepared in different parts of India beginning 1995 through initiatives of NGOs and educational institutions working with local communities and village councils. These attempts have been motivated by a desire to promote decentralised systems of management of natural resources and to create the basis for equitable sharing of benefits of commercial utilisation of local community knowledge of uses of biodiversity. Kerala has one of the best records with respect to preparation of PBRs as about 85 per cent of the BMCs have prepared PBRs. See Table 1.

According to the Kerala State Biodiversity Board (KSSB), all the LSGs having BMCs are required to prepare the PBRs. As per G.O.(Rt.) 2945/2013/LSGD dated 30.11.2013, the State Government has accorded sanction to incur an expenditure of Rs.1.25 lakhs for grama panchayats, Rs. 2.5 lakhs for municipalities and Rs.5 lakhs for corporations from the general sector development fund of the annual plan or own general-purpose fund for PBR preparation. It is mandatory, and all LSGs having BMCs are required to utilise this fund and complete the PBR preparation before 31.3.2017.

Nevertheless, according to the KSSB (as on July 11, 2019) 60 local self-governments are yet to prepare PBRs. The maximum numbers of panchayats not having prepared PBRs so far are in the districts of Palghat with 25 and Malappuram with 14, followed with Trichur 9, Kannur 9, Kozhikode, Kottayam and Trivandrum with 1 each. All the other 7 districts have all their local self-governments preparing their respective PBRs. This means that Kerala now (July 11, 2019) has the highest PBR rate at 94.19 per cent.

The BD Act stipulates that "the main function of the BMC is to prepare People's Biodiversity Register in consultation with local people. The PBR shall contain comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them." Although Kerala's LSGs have a good record in forming BMCs and preparing PBRs, it remains to be seen if the PBRs are properly framed and the data contained in PBRs are subjected to an annual review to see if the biodiversity that exists in an LSG is maintained.

Table 1: PBR rate across states in India (as on 18/02/2019)

	BMCs	PBRs	PBR Rate (%)
Andhra Pradesh	6031	100	1.66
Arunachal Pradesh	139	43	30.94
Assam	229	92	40.17
Bihar	Nil	Nil	0.00
Chhattisgarh	223	Nil	0.00
Goa	191	Nil	0.00
Gujarat	7661	1126	14.70
Haryana	Nil	Nil	0.00
Himachal Pradesh	609	6	0.99
Jharkhand	3384	14	0.41
Jammu & Kashmir	Nil	Nil	0.00
Karnataka	6228	1777	28.53
Kerala**	1034	974	94.19
Madhya Pradesh	23431	890	3.80
Maharashtra	23772	100	0.42
Manipur	95	22	23.16
Meghalaya	263	30	11.41
Mizoram	250	5	2.00
Nagaland	110	Nil	0.00
Odisha	1700	87	5.12
Rajasthan	74	Nil	0.00
Punjab	113	11	9.73
Sikkim	35	4	11.43
Tamil Nadu	385	Nil	0.00
Telangana	3200	220	6.88
Tripura	502	431	85.86
Uttarakhand	948	124	13.08
Uttar Pradesh	58782	325	0.55
West Bengal	433	150	34.64
Total	139831	6449	4.61

Note: ** as on July 11, 2019

Source: National Biodiversity Authority, <http://nbaindia.org/content/20/35/1/bmc.html>
<http://nbaindia.org/content/105/30/1/pbr.html> (accessed on July 18 2019)

It is for this reason, we have taken the case of Kerala for an in-depth examination of the role of government with respect to the promotion and maintenance of agrobiodiversity in the country. In this study, we are primarily concerned with evaluating the policies favouring agrobiodiversity in Kerala and then making an objective assessment of the degree to which Kerala is biodiverse in terms of its agriculture.

2. Evaluation of policies and laws that have an impact on agrobiodiversity

The state has put in place an elaborate network of rules, policies and laws impacting on the management of agrobiodiversity. We have divided them into three groups depending on whether they impact on agrobiodiversity in a direct or indirect manner and whether they contribute or affect knowledge generation in these areas. First, we list them, and subsequently, we evaluate their effectiveness or not in maintaining agrobiodiversity in the state.

a. Those dealing directly with agrobiodiversity:

- Kerala State Biodiversity Strategies and Action Plan which has several action points related to conservation of Agrobiodiversity
- Kerala Conservation of Paddy land and wetland Act 2008 and Amendments 2018- which had a major impact on paddy land conversion and loss of aquatic biodiversity
- Kerala Inland Fisheries and Aquaculture Act 2010 which has a direct bearing on Agrobiodiversity especially in the view of release of exotic species from Aquaculture farms, Nurseries and the leaching of chemicals as antibiotics used in farms
- Kerala State Breeding Policy 2008 which does not promote traditional breeds and therefore affects conservation in a negative manner
- Environment white paper 2018 which has also pointed out the impact of paddy land conversion on food security.
- Kerala State Organic Farming Policy, Strategy and Action Plan, 2007
- Agricultural Development Policy, 2015
- *Jaivam* 2017

b. Those dealing with agrobiodiversity in an indirect manner

- Kerala State Environment Policy, 2009
-

c. Knowledge related issues which have a bearing on agrobiodiversity:

- Intellectual Property Rights Policy for Kerala, 2008
- Protection of Plant Varieties and Farmers' Rights (PPV&FR) Act, 2001
- State experience with the Geographic Indications (GIs) of Goods Act, 1999
- Kerala's Traditional Knowledge Protection Bill, 2016
- State position on national laws, such as the proposed Seeds Bill

2.1 Kerala State Biodiversity Strategy and Action Plan

This is the framework policy for promoting agrobiodiversity in the state. There are three specific strategies that deal with agrobiodiversity management. See Table 2.

Table 2: Biodiversity Strategy and Action Plan and its relationship with National Biodiversity Authority Targets

Strategy	Description	Link to NBA targets
19	Develop a database of agrobiodiversity and domesticated biodiversity	Target 5
20	Promote conservation of indigenous varieties and their commercial production	Target 5
21	Prevent contamination of natural biodiversity of the	Target 5

	state from Genetically Modified Organisms (GMOs)	
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Source: Own compilation

We see that the three strategies deal with only one of the ten targets that are envisaged. In fact our discussions with experts reveal that of the three strategies only no. 20 seems to have been implemented. Of course, the PBRs can act as a database provided they are digitised and is available online. Since GMOs have not been authorised to be released in any of the agricultural crops excepting cotton which incidentally is not cultivated in Kerala⁸, no: 21 is yet to be relevant for Kerala.

2.2 The Kerala State Environment Policy, 2009

The environment policy has many provisions to maintain biodiversity in general and agrobiodiversity in particular. Section 11 has 17 such provisions. The most important of these is the formation, collection and record of local agrobiodiversity data in People's Biodiversity Registers (PBR) at the panchayat level and the discouraging of monocultures in cropping?

According to the data from the Biodiversity Board, only 7 districts out of 14 have completed the formation of PBRs in all the Panchayats within a district.

Further, the following comments could also be made:

- Though there are a number of strategies and action plans envisaged in Kerala State Environment Policy and also by the KSBB, the details on financial allocations for these actions and how these are being implemented are not clear. Hence, some of these strategies and action plans may be remaining as mere wish statements.
- There is a need to strategize the protection of biodiversity. How?
- Given the broad climatic characteristics of the state, the same plant species or variety may be prevalent in multiple locations. Some of these may be useful to individuals and households, and hence they may have the incentive to conserve it.
- However, private incentives may not be that high to conserve all kinds of plants, species and genetic diversity (and that is the need for public intervention in the form of the provision of subsidies or regulations).
- There is a resource-cost in both the provision of subsidies and also regulation. It is not clear whether such costs are estimated, and whether provisions are made to allocate public resources for this purpose.
- The attempt seems to be a wishful effort to protect agro-biodiversity in all places wherever these are available. This may not be a realistic target.
- If the enforcement effort of the state is going to be targeted to all such localities, then it may get diluted, and there could be land-use changes that may destroy biodiversity in many localities.
- It may be noted that agrobiodiversity prevails mostly in private lands, and the reach of the state is limited in such lands compared to forests which are owned by the government. Hence it may be desirable to have a prioritization of the agrobiodiversity to be protected.

2.3 The Organic Farming Policy

The stated purpose of this State policy is 'to protect its rich biodiversity and thus sustain various livelihoods dependent on this precious resource'. In that sense, the connection between the

⁸Cotton is grown in a small area in Attappadi in Palghat district.

protection of agrobiodiversity and organic farming is envisaged before the formulation of this policy. The policy was proposed and initiated by the KSBB.

- Though the preamble of the policy is written in a severely non-rigorous manner, it has certain positive implications for the protection of agrobiodiversity in Kerala.
- The policy notes the reality that the intensity of inorganic agriculture in Kerala is not that high, and hence has the potential to move towards organic farming. Further, the policy notes 'the positive side of agriculture in Kerala in terms of the already low levels of consumption of hazardous chemicals and, therefore, chances of redeeming farmers to organic agriculture are quite high' (p.5). The fact that farmers in Kerala use less pesticides and other chemicals in growing crops make them much more amenable for shifting to organic farming than farmers elsewhere.
- In the policy, a farmer is defined as 'Organic Farmer' 'provided he/she adheres to and practices the following three essentialities of organic farming: (1) a farmer who practices mixed farming including food crops; (2) a farmer who ensures the conservation of soil and water; (3) a farmer who conserves the biodiversity of the farmland'. This has interesting implications such as
 - The conventional idea of avoiding chemical fertilizers and pesticides as the core-focus of organic farming is given less importance here
 - The definition of organic farming itself is connected to the preservation of agrobiodiversity.
- The following strategies of organic farming policy can, in principle, help the conservation of agro-biodiversity
 - Ensure seed sovereignty of the farmers and the State
 - Strengthen soil and ensure water conservation measures (by following organic approaches)
 - Promote a mixed farming approach for livelihood security and ecological sustainability
 - Conserve and improve agrobiodiversity and undomesticated biodiversity
 - Ensure availability of quality organic manure to the farmers
 - Develop Model Sustainable Organic Farms in the State
- Model organic farms (to be) developed by the state as part of the organic farming policy can be used for the in-situ and live conservation of agro-biodiversity in different agro-climatic zones of Kerala.
- On the other hand, the organic farming policy in its present form has a number of limitations, and these may affect the achievement of the goal of protecting agrobiodiversity too.
 - It has not analyzed the economic incentives of the farmers to move towards organic farming policy
 - It has not outlined the ways by which the state has to encourage farmers to move towards organic farming overriding the economic incentives, if any, to continue with non-organic farming.
 - It has not assessed the costs that the government has to bear in facilitating the shift towards an organic policy.
 - It has not outlined the administrative mechanisms beyond outlining the nature of a state-level committee for the purpose.

- There could be a case where bio-diversity enhancing farming may become economically advantageous for certain farmers in Kerala. This is when we consider the opportunity cost of family labour, including that is needed for the supervision of farm operations. This is so since the conventional (chemical and mono-crop) agriculture may become economically unviable due to the increase in the cost of labour or the opportunity cost of family labour. Hence a Low External Input and Sustainable Agriculture (LEISA) may become the default option for a set of farmers.
- The organic farming policy has not analysed the existing state and central policies in agriculture that may work against the shift towards organic farming. These may include the subsidies for fertilizers. Some of these policies cannot be changed by the state government. Certain policies that prevail at the national level (say subsidy for fertilizers) may benefit Kerala too since it has to import food grains from other states which practice chemical agriculture. These ambiguities may reduce the effectiveness of an organic farming policy within Kerala and hence may work against the shift towards an agro-biodiversity enhancing agriculture within the state.
- The shift towards an organic farming policy also depends on the consumers or buyers of agricultural products. The analysis of this aspect and the strategies required in this domain are weak in the policy. It sees farming mostly from the perspective of supply. This is problematic when we see that a major part of the consumption of agricultural products within Kerala is imported from other states. There may be a possibility of developing an interest among Kerala consumers in organic products, but that may not be adequate. It may be that a part of the organic production in Kerala should be able to meet the needs of national/international markets. (In fact, the integration of Kerala's agriculture with the national and global markets is much higher compared to that of other states, and this has been the situation historically, and not due to the current phase of globalization.) There may be a need to use national and global markets to facilitate the shift towards organic farming within Kerala. This may not be facilitated by the rhetorical arguments for self-sufficiency and against trade given at the beginning of this policy. These too may add to the ambiguities of the policy and reduce its effectiveness in enhancing/protecting agro-biodiversity.

In the policy, a farmer is defined as 'Organic Farmer' `provided he/she adheres to and practices the following three essentialities of organic farming: (1) a farmer who practices mixed farming (namely diverse crops) including food crops; (2) a farmer who ensures the conservation of soil and water; (3) a farmer who conserves the biodiversity of the farmland'. The conventional idea of avoiding chemical fertilizers and pesticides as the core-focus of organic farming is given less importance here. The definition of organic farming itself is connected to the preservation of agrobiodiversity.

However, the organic farming policy has not analysed the economic incentives of the farmers to move towards organic farming policy. It has not outlined the ways by which the state has to encourage farmers to move towards organic farming overriding the economic incentives, if any, to continue with non-organic farming. It has not assessed the costs that the government has to bear in facilitating the shift towards an organic policy. It has not outlined the administrative mechanisms beyond outlining the nature of a state-level committee for the purpose.

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This may not be facilitated by the rhetorical arguments for self-sufficiency and against trade given at the beginning of this policy. These too may add to the ambiguities of the policy and reduce its effectiveness in enhancing/protecting agrobiodiversity. Any risk of organic monocultures, as against diversity in organic practices.

However, the actual implementation of the organic farming policy underwent considerable administrative delays. As experts say, "though there was huge enthusiasm about the policy at the political level, it was languishing at the office of the Agricultural Production Commissioner's (APCs) for nearly two years until it was implemented as an agricultural action plan in 2010. The policy was designed in such a fashion that each district principal agriculture officers should identify the blocks and each blocks are given target of area to be cultivated. Thereafter, the agriculture officer of the area was given the responsibility to initiate local action plans. Though it went fairly well for quite some time the regime change drastically altered the policy direction. Ultimately the financial allocations were moved from the district development blocks to Kasaragod district in the context of endosulfan calamities⁹. The entire course of this development shows the dysfunctional characteristics of the state machinery, because the agency that had undertaken the organic farming responsibility in Kasaragod district ended up returning the fund because they failed to fulfil the targets. Interestingly, the government seem to be interested in entrusting organic farming responsibility to private agencies rather than to state agencies, which are comparatively efficient, well-organised and regularly monitored. The current regime aims to involve agricultural university in the entire policy implementation. In short, the only time period the policy was implemented in the last ten years is merely nineteen months".¹⁰ Expert views reveals the crucial fact that contrary to its flamboyance, such policies are always connected to the vigor and interest of the incumbent as well as successive regimes

⁹ Kasaragod district in Kerala shot into global attention in the late nineties due to use of endosulfan—a highly toxic pesticide—in cashew nut plantations. The toxicity of endosulfan and health issues due to its bioaccumulation came under media public and government attention when health issues precipitated in the district.

¹⁰ Interview with Mr. C Jayakumar, Director, *Thanal*, NGO, who actively involved in the formulation of the organic farming policy of the Kerala state government.

and it is essential to have a permanent state agency initiate and implement and monitor the policy.

As far as considering the certified organic farming area in Kerala, an organic farmers' directory has been prepared by the Farm Information Bureau of department of agriculture and farmers' welfare, government of Kerala. The data contains the details of farmers with their contact details etc. for five districts of the state viz., Wayanad, Kottayam, Malappuram, Kozhikode, and Idukki. See Figure 1. As per this data the area under certified organic farming comes works out to only 0.18 per cent of the net sown area.

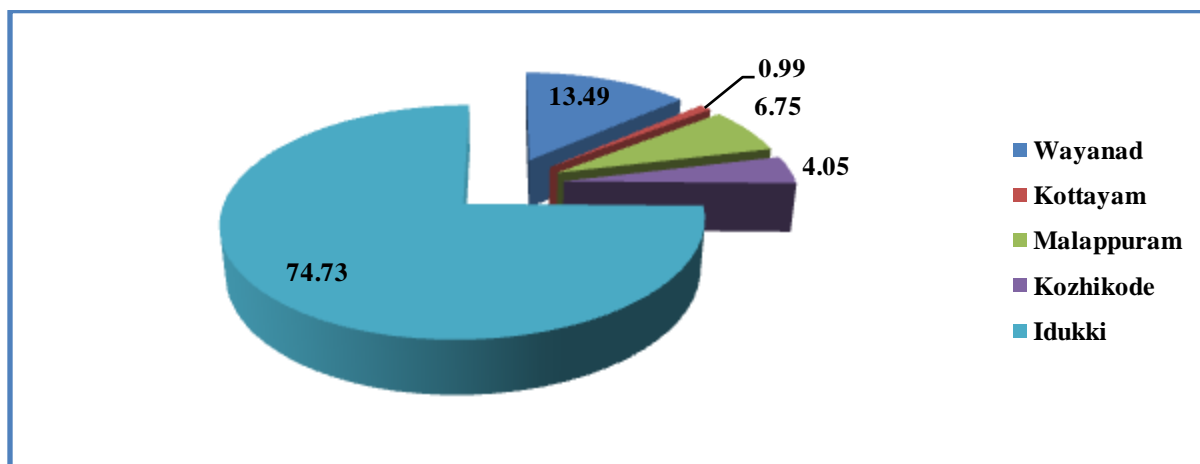


Figure 1: Distribution of certified organic farming area in Kerala

Source: State Information Bureau (undated), Organic Farmer's Directory, Government of Kerala, https://www.fibkerala.gov.in/index.php?option=com_content&task=view&id=609&Itemid=88&limit=1&limitstart=1 (accessed on August 21, 2019)

Although the policy on organic farming has defined an organic farmer, hitherto the state has not evolved any specific indicators or Standard Operating Procedures for organic and aquaculture farms. These needs to be evolved so that objective definition of an organic farmer and the area under organic farming can be computed and its diffusion in state's agriculture can easily be measured.

Jaivam, Mahatma Gandhi University(MGU)'s organic farm drive: This drive is for transforming one of the 14 districts, namely Kottayam district, into a 100 percent literate district in organic farming in cooperation with National Service Scheme, Kerala *JaivaKarshakaSamiti*, academic departments of the university and *Kudumbasree* units. The main aim of the project is to inform each family member of the district about organic farming. As part of this, the trained volunteers would visit 4,87,296 households in 71 panchayats and 6 municipalities in the district. The volunteers would interact with the 1.97 million people in the district to adopt ethical organic practices to enrich the soil and preserve the environment for a healthy generation. It was inaugurated on August 29, 2017. The project is implemented through the National Service Scheme (NSS) units in its affiliated colleges. However there is practically no data on how far this specific project has contributed to managing agrobiodiversity in the state. In any case, data from the Farm Information (undated) shows that the total area under certified organic farms in Kottayam district is only about 37 hectares- working out to an insignificant percentage of area under organic cultivation in the state.

2.4 Agricultural Development Policy

Another policy having a bearing on agrobiodiversity is the Agricultural Development Policy 2015 of the state. The policy has 46 sub-policies. Although none of these is specific to biodiversity despite the fact that one of the much-asserted objectives of the policy is to make “Kerala a biodiversity paradise”. However, the CDSteam has identified 10 sub-policies that have the potential to either support agrobiodiversity or have a negative impact on it. Of the 19, 9 have a positive impact, and 1 may have a negative impact.

The suggested policies in Agricultural Development Policy, 2015, which may have an impact on the protection of agrobiodiversity, are listed in Table 3.

Table 3: Positive and Negative implications of Agricultural Policy for Agrobiodiversity

Policies	Possible Positive Impact	Possible Negative Impact	Link to Relevant NBT
Policy 1: The farmlands are to be protected and should not be put for any other use than farming activities	This may help agrobiodiversity if the use of farmland for non-agricultural purposes is a main cause for the reduction of agrobiodiversity		Target 5
Policy 4: Cultivable wastes should be brought under plough with immediate effect for augmenting the food production.	.	This may work against agrobiodiversity if such wasteland sustains such diversity, and bringing these into cultivation would lead to mono-cropping	Target 5
Policy 13: Farm ponds and <i>Thalakkualams</i> needs to be promoted and protected.	This may promote aqua bio-diversity		Target 3
Policy 20: Bio-Manure production is to be enhanced for reviving the soil health and should be one of the primary activities of the Department of Agriculture.	This may help sustaining agrobiodiversity		Target 3

Policy 29: Optimize the ecological load on the natural systems as well as building up the State's economy while minimizing environmental degradation.	This may help minimizing the reduction of agrobiodiversity		
Policy 122: Homestead farming of vegetables and popularisation of vegetable gardens in schools proved the impact on the increased vegetable production in the state and the programmes should continue.	This may indirectly benefit the sustenance of agrobiodiversity		Target 7
Policy 126: Kerala is well known for some traditional mango varieties and the germplasm of them are to be protected and a research station under KAU should be set up for mango at Muthalamada.	This is directly helpful for agro biodiversity		Target 7
Policy 141: If measures are not initiated soon, Cochin ginger and Alleppey turmeric will soon be crops of the past.	Supports the protection of agrobiodiversity		Target 7
Policy 162: New avenues like contract farming and forest farming are to be explored as a sustainable way to ensure the steady and constant supply of quality raw materials for drugs.		Negative	Target 5

Policy 179: The farmers of the State may be allowed to rear indigenous and accepted breeds of cattle for conservation purpose with guidelines from the Department of Animal Husbandry.	Support agrobiodiversity		Targets 5 and 7
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Source: Own compilation

2.4.1 Major limitations of the Agricultural Development Policy

Though there is an organic farming policy, we do not see that getting reflected in the Agricultural Development Policy, 2015. It is mentioned in only one place. (Policy 245: Kerala is having a well-defined policy on 'Organic Farming', and on this light, organic pesticides are to be made freely available, and the recent technology developed by CTCRI needs an intensified production.) The focus of the latter seems to be on the mainstream input-intensive agriculture. This shows how different policies can be at cross-purposes with respect to mainstreaming agrobiodiversity.

Most of the policy statements in Kerala Agricultural Development Policy, 2015, are wish statements, without thinking about the costs and mechanisms for their enforcement.

2.5. Laws on Intellectual Property Rights

Another policy having a bearing on agrobiodiversity is the Intellectual Property Rights (IPR) Policy of the state. This policy is formulated in consonance with the provisions of the Indian Patents Act and the Biological Diversity Act, 2002. However, the focus is on what it calls 'traditional knowledge'. The main purpose of the policy is to create legal property rights on such knowledge to avoid 'misappropriation' by corporate and capitalist enterprises and can lead to the creation of a knowledge commons. We need to think theoretically about the potential of such a 'legal right' on traditional knowledge on the conservation of agrobiodiversity. It may be better to compare a 'with' and 'without' situation here. We may consider a legal right to the farmer useful for the protection of agrobiodiversity, if there is an actual or probable under-use of traditional knowledge, and a decline in the use of the diverse variety of genetic, plants and animal varieties, and hence there is a decline in the effort to conserve/protect these varieties, in the absence of the legal right, and if the newly instituted right can reverse the trend. We need to evaluate the 'Intellectual Property Rights Policy of Kerala' with such a perspective. Tables 4 and 5 summarises the grant of two IPR laws, namely geographical indications (GIs) granted and Plant Variety Protection (PVP) registered in Kerala since 2005.

Based on this perspective, CDS sees only one clause (No.6) directly contributing to the conservation of agrobiodiversity. This is the one which entrusts with the Kerala Traditional Knowledge Authority (KTKA) with the responsibility to carry out promotional activities such as the formation of 'traditional knowledge cooperatives in order to enable such users to access larger markets for their practices and products'. The policy also gives a strong role to the SBB. Such access to larger markets may enhance the incentives to use traditional knowledge and hence preserve agro-biodiversity (as long as it is required for the use of such knowledge).

Table 4: Geographical Indications granted to agricultural products from Kerala

Sl.No	Geographical Indications	Goods
From April 2004 – March 2005		
1	<i>AranmulaKannadi</i>	Handicraft
From April 2005- March 2006		
	NIL	
From April 2006-March 2007		
	NIL	
From April 2007- March 2008		
2	Alleppey Coir	Handicraft
3	<i>Navara</i> Rice	Agricultural
4	<i>PalakkadanMatta</i> Rice	Agricultural
5	Malabar Pepper	Agricultural
6	Spices – Alleppey Green Cardamom	Agricultural
From April 2008- March 2009		
7	<i>Maddalam</i> of Palakkad	Handicraft
8	Screw Pine Craft of Kerala	Handicraft
9	Brass Broidered Coconut Shell Crafts of Kerala	Handicraft
10	Pokkali Rice	Agricultural
From April 2009- March 2010		
11	Vazhakulam Pineapple	Agricultural
12	Cannanore Home Furnishings	Handicraft
13	BalaramapuramSarees and Fine Cotton Fabrics	Handicraft
From April 2010 March 2011		
14	Kasaragod Sarees	Handicraft
15	Kuthampully Sarees	Handicraft
16	Central Travancore Jaggery	Agricultural
17	Wayanad <i>Jeerakasala</i> Rice	Agricultural
18	Wayanad <i>Gandhakasala</i> Rice	Agricultural
19	Payyannur Pavithra Ring	Handicraft
From April 2011- March 2012		
20	Chendamangalam <i>Dhoties & SetMundu</i>	Handicraft
From April 2012 March 2013		
	NIL	
From April 2013- March 2014		
21	Kaipad Rice	Agricultural
From April 2014- March 2015		
22	<i>ChengalikodanNendran</i> Banana	Agricultural
From April 2015- March 2016		
23	Kuthampally <i>Dhoties & Set Mundu</i>	Handicraft
24	<i>Maddalam</i> of Palakkad (Logo)	Handicraft
25	Brass Broidered Coconut Shell	Handicraft

	Craft of Kerala (Logo)	
26	Screw Pine Craft of Kerala (Logo)	
From April 2016- March 2017		
	NIL	
From April 2017- March 2018		
27	Nilambur Teak	Agricultural

Source: Patent Information Centre, Kerala State Council for Science, Technology and Environment

Table 5: Plant Varieties Registered from Kerala

Chennellu

Reg. No. : 56 of 2013 Crop Name: Rice Botanical Name: *Oryza sativa* L. Date of Grant: 26.03.2013 Applicant Details: SEED CARE, C/o M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Pothoorvayal, P.O. Kalpetta, Wayanad, Kerala, 673577 Specific characters: Short stem length.

Ghandhakasala

Reg. No. : 57 of 2013 Crop Name: Rice Botanical Name: *Oryza sativa* L. Date of Grant: 26.03.2013 Applicant Details: SEED CARE, C/o M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Pothoorvayal, P.O. Kalpetta, Wayanad, Kerala, 673577 Specific characters: Well exerted panicles and narrow width

Chomala

Reg. No. : 58 of 2013 Crop Name: Rice Botanical Name: *Oryza sativa* L. Date of Grant: 26.03.2013 Applicant Details: SEED CARE, C/o M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Pothoorvayal, P.O. Kalpetta, Wayanad, Kerala, 673577 Specific characters: absence of awns, well-exerted panicles, straw colour of sterile lemma and short, bold decorticated grains.

Jeerakasala

Reg. No. : 59 of 2013 Crop Name: Rice Botanical Name: *Oryza sativa* L. Date of Grant: 26.03.2013 Applicant Details: SEED CARE, C/o M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Pothoorvayal, P.O. Kalpetta, Wayanad, Kerala, 673577 Specific characters: Short stem length, short panicle length of main axis, well-exerted panicle and aromatic decorticated grains.

Veliyan

Reg. No. : 60 of 2013 Crop Name: Rice Botanical Name: *Oryza sativa* L. Date of Grant: 26.03.2013 Applicant Details: SEED CARE, C/o M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Pothoorvayal, P.O. Kalpetta, Wayanad, Kerala, 673577 Specific characters: Purple colour of stigma, and awns absent.

Thondi

Reg. No. : 61 of 2013 Crop Name: Rice Botanical Name: *Oryza sativa* L. Date of Grant: 26.03.2013 Applicant Details: SEED CARE, C/o M.S. Swaminathan Research Foundation Community Agrobiodiversity Centre, Pothoorvayal, P.O. Kalpetta, Wayanad, Kerala, 673577 Specific characters: Medium amylose content in endosperm

Source: Patent Information Centre, Kerala State Council for Science, Technology and Environment

It remains to be seen whether GIs and PVP have led to increased cultivation of these crops. This is an area where future research is required.

2.6 Extent of Agrobiodiversity in Kerala

It is essential that we have a summary measure to quantify the extent of agro biodiversity and its changes over time. Ideally speaking, it should be constructed at the level of the BMC. But detailed data for such quantification at the BMC level is hard to come by, but the KSBB may develop it. As a first step, we compute the area of those agricultural crops that allow intercropping with other crops. The share of the area under such bio-diverse crops in the total cropped area is computed. It shows that about 77 per cent of the cropped area in the states is under bio-diverse crops in 2016-17, although it has shown some slight reduction in 2016-17 compared to 2007-08 (Figure 2). This is essentially due to the fact that – Natural Rubber- one of the primary commodities and the main mono-crops in the state has increased its share of cropped area (Figure 3), although all other monocrops have reduced their area. However, Natural Rubber continues to occupy an important position in the cropping pattern of the state (Figure 4).

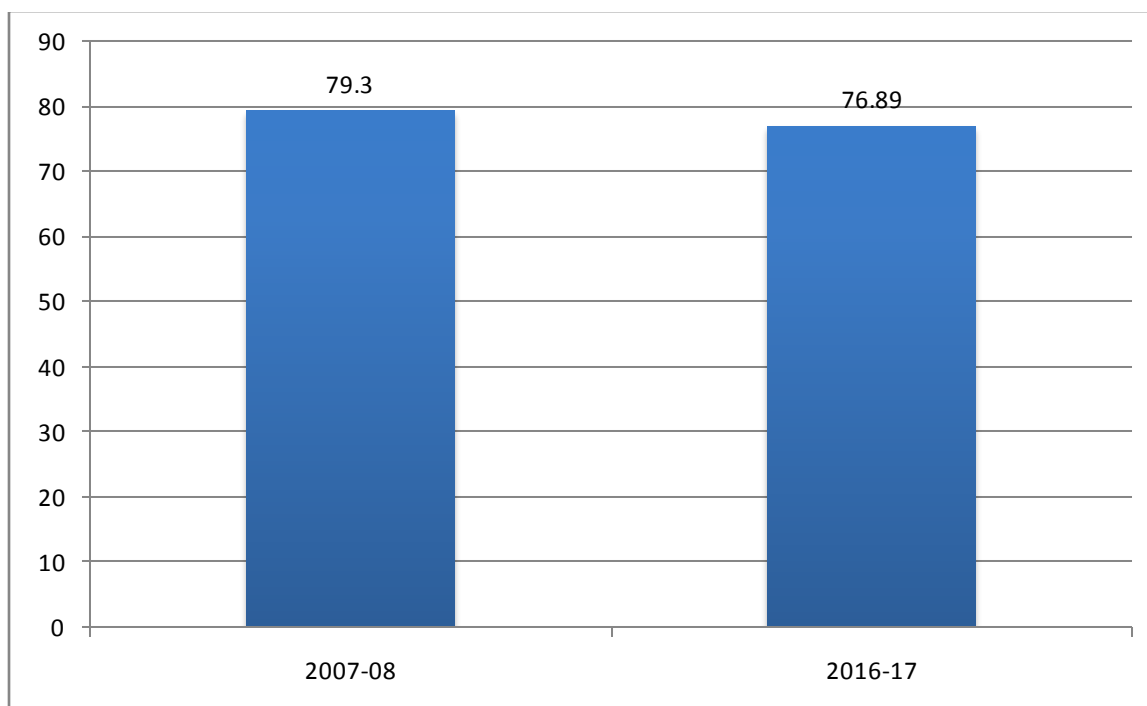


Figure 2: Trends in Agrobiodiversity Index, 2007-08 and 2016-17

Source: Based on data contained in Economic Review, Kerala State Planning Board (various issues)

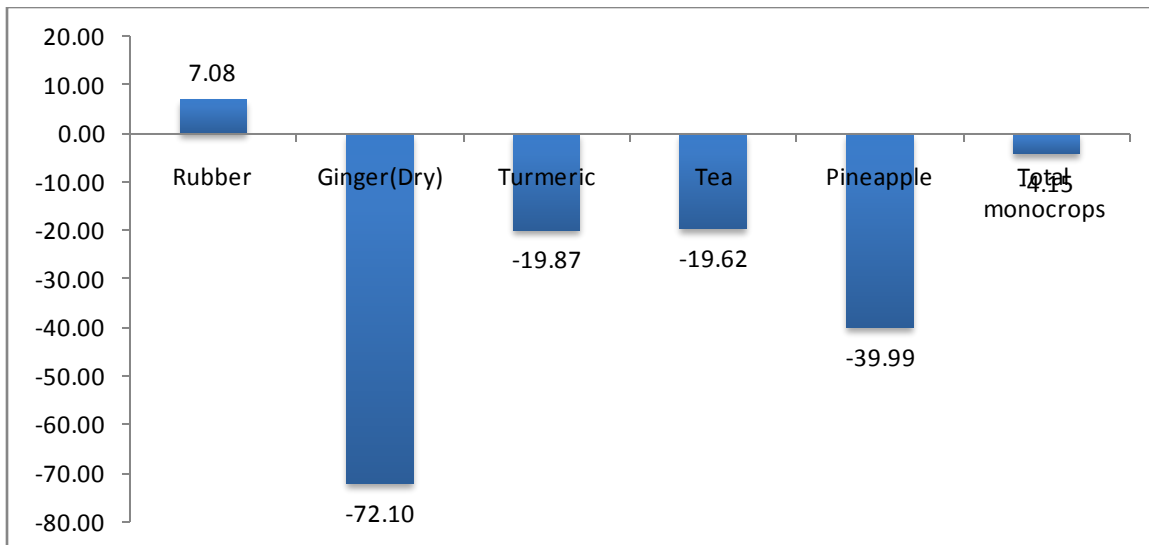


Figure 3: Changes in area under monocrops during 2007-08 and 2016-17

Source: Based on data contained in Economic Review, Kerala State Planning Board (various issues)

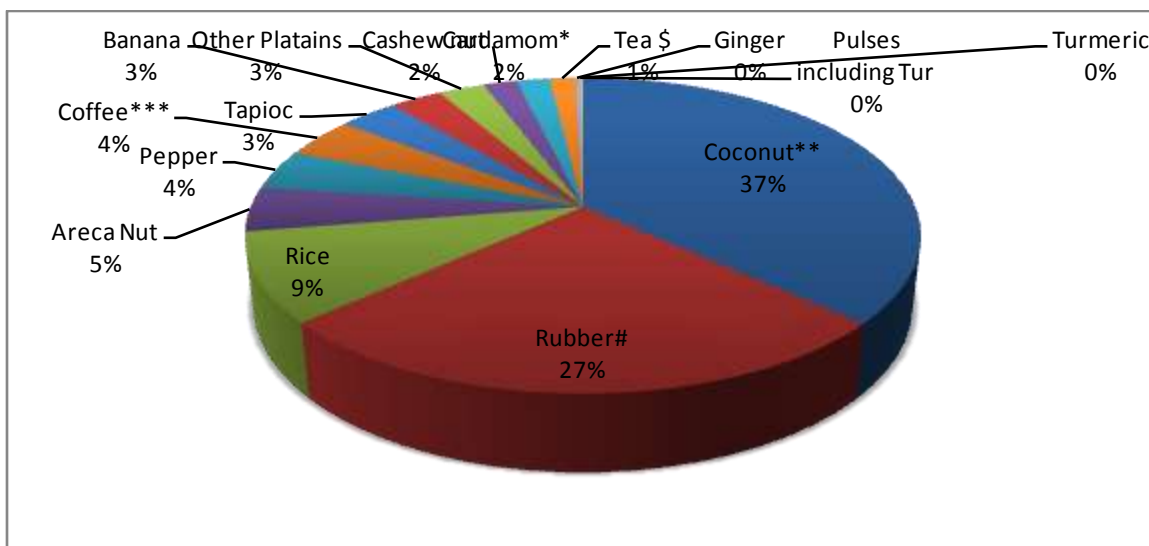


Figure 4: Cropping pattern of the state (as on March 31, 2018)

Source: Based on data contained in Economic Review, Kerala State Planning Board (various issues)

However considerable gaps exist in our knowledge of genetic diversity of crops. The annual data on agricultural area and output brought by the State's Department of agriculture does not reveal agrobiodiversity. Hence we recommend that the agricultural statistics may include varietal diversity of at least the major agricultural crops to enable better conservation of Agrobiodiversity.

2.7 Some critical issues having a bearing on management of agrobiodiversity

Here we discuss two specific issues that have a bearing on management of agrobiodiversity in Kerala. These are the role of custodian farmers and Access Benefit Sharing. These are discussed in some detail below:

2.7.1 Role of custodian farmers

Biodiversity international, a CGIAR research Centre defines custodian farmers as “Custodian farmers are defined as “those farmers (men and women) who actively maintain, adapt and disseminate agricultural biodiversity and related knowledge, over time and space, at farm and community levels and are recognized by community members for it”. Given the fact that existing gene banks and other ex-situ conservation measures are not sufficient enough to conserve agrobiodiversity, it is recommended that custodian farmers should be the main focus of agrobiodiversity conservation as they are functioning as a farmer-cultivators as well as farmer-conservator. So the policy on agrobiodiversity management must include identification, support and promotion of custodian farmers. Examples of custodian farmers include, *Chruvayal Raman* or Ramettan-a Kurichiya tribe farmer by birth, is leading a battle to preserve age-old traditions of cultivation that were prevalent among the Adivasis of Wayanad. N. M. Shaji, who is conserving a wide spectrum of tuber crops, including wild tubers, paddy, and vegetables using organic cultivation methods, is another notable custodian farmer: he had also won the national Plant Genome Saviour Award in 2015.

2.7.2 Access Benefit Sharing

The Nagoya protocol on Biodiversity emphasizes the access to the genetic resources and its fair and equitable benefit sharing of genetic resources. This is known as Access Benefit Sharing (ABS). As per Section 7 of Biodiversity Act 2002 and Section 16 of Kerala Biological Diversity Rule, 2008, any Indian citizen or body corporate or association or registered organization should seek approval of the KSBBS for access to collection of biological resources in Kerala for commercial utilization. The transition to an ABS regime is a priority area identified by the State Planning Board, in its working group report on biodiversity for the 13th Five Year Plan (Kerala State Planning Board, 2017). Chapter 9 of the working group report deals with ABS. It proposes a statewide scheme for documenting commercially tradable bio resources and industries utilising the resources. The report calls for equipping panchayat-level Biodiversity Management Committees (BMCs) with negotiating skills to maximise the returns from trade in bioresources under the ABS regime. The BMC would be authorised to levy collection fee for accessing biological resources for commercial purposes. The levy would be deposited in a local biodiversity fund and utilised for conservation activities. According to press reports¹¹, the KSBBS had identified 2,694 industrial units including Ayurvedic drug companies, tea and coffee manufacturers, agro-based units, food and fruit processing centres, leather, cashew, textiles, paper, rubber, coir, spices, wood and bamboo-based industries and exporters of these products that were liable to pay a part of their sales revenue for access to bioresources and associated traditional knowledge into a fund to be denoted as *Local Biodiversity Fund*. We could not find out whether fund has actually been created and whether the rules for operationalising the fund have been created. This is one of the policy instruments for agrobiodiversity management that needs immediate attention.

3. Public Research Institutions (PRIs) that support knowledge creation for agrobiodiversity

Kerala has a wide network of public research institutes which have been engaged in the generation of formalised knowledge for ensuring agrobiodiversity. These are owned by the central and state governments. Further, there are a limited number of NGOs which are diffusing knowledge on agrobiodiversity. Of these, 5 PRIs (national and state level) and 2 NGOs which are actively engaged in the promotion of agrobiodiversity have been selected. The CDSteam also

¹¹See Nandakumar T (2017)

selected 2 more PRIs that are active in promotion of biodiversity in general as well. The activities and interventions of these institutions in these areas have also been assessed.

Table 6: PRIs and NGOs selected for in-depth examination

Sl. No	Institutions	Benefitted Area
1.	Central Tuber Crops Research Institute(CTCRI) Thiruvananthapuram	Agrobiodiversity
2.	Kerala Veterinary and Animal Sciences University (KVASU) Pookode, Wayanad	Agrobiodiversity
3.	Kerala Agricultural University (KAU), Thrissur	Agrobiodiversity
4.	Regional Agricultural Research Station(RARS), Pattambi	Agrobiodiversity
5.	National Bureau of Plant Genetic Resources (NBPGR), Thrissur	Agrobiodiversity
6.	M. S. Swaminathan Research Foundation (MSSRF) Wayanad (NGO)	Agrobiodiversity
7.	THANAL (NGO), Thiruvananthapuram	Agrobiodiversity
8.	Jawaharlal Nehru Tropical Botanic Garden and Research Institute(JNTBGRI) Palode, Thiruvananthapuram	Biodiversity
9.	Kerala Forest Research Institute(KFRI),Peechi, Thrissur	Biodiversity

3.1 Central Tuber Crops Research Institute (CTCRI)

CTCRI is a national-level institute coming under Indian Council of Agricultural Research (ICAR) to undertake basic, strategic and applied research for generating technologies to enhance productivity and utilization potential of tuber crops other than potato. The key areas are genetic resource management, crop improvement, sustainable production and utilization of tropical tuber crops. It acts as a national repository of scientific information on tuber crops and transferring tuber crops technology through consultancy, outreach programmes and linkage with developmental agencies. The activities of CTCRI have been executed through five divisions i.e., Crop Improvement, Crop Production, Crop Protection, Crop Utilisation and Extension and Social Sciences. The collection of germplasm of different tuber crops from different parts of the world and conserving it in field gene bank has been carrying out under crop improvement division. The development of new varieties of tuber crops with higher yield and other attributes suitable for industrial applications as well as for food purpose is another important activity of this division. The development of new agro techniques for tropical tuber crops in different agro-climatic regions is being monitored under crop production division. The development of strategies and products for managing pests and diseases, which are affecting tropical tuber crops is being monitored under crop protection division. Crop utilization division concentrates its activities on value addition and post-harvest processing of tropical tuber crops. Transferring the technologies of CTCRI to its clientele and introducing farmers' supporting schemes come under the extension and social sciences division.

Generally, tuber crops are considered as the third most important food crop. In present global scenario of climate change, tuber crops are gaining visibility as Future Smart Crops for climate resilience, low input cost and also for being rich in calorie, dietary fibers, minerals, vitamins and anti-oxidants (Research Highlights-2017-18, CTCRI). CTCRI is carrying out the development of tuber crops to ensure nutritional food and livelihood enhancement for the rural people. The Centre organizes awareness training programmes, technical assistance, an incubator facility for the production of value-added products from tuber crops to farmers,

entrepreneurs, etc., The Centre also strives to popularize various kinds of tuber cultivation among the farmers. New varieties of tubers of high yield and disease-resistant have been developed.

The centre is conserving 15 species of tubers including cassava, sweet potato, yam, taro etc. The centre is also maintaining related species like 13 species of Greater yam, Lesser yam, Potato yam, 6 species of Taro, 8 species of Elephant yam, 4 species of Chinese potato, 8 species of Minor arrowroot, one species of minor wild tubers and one species of Asparagus. A total of 5570 accessions comprising 1211 cassava, 1124 sweet potato, 1110 yams, 683 edible aroids, 200 minor tuber crops and 1242 collections from Regional Centre (RC) were maintained and conserved in the field gene bank of CTCRI. It is reported that new collections were added to the existing germplasm from various sources in sweet potato (20), yams (3), edible aroids (1) and minor tuber crops (15).

The centre developed 67 new varieties of various kinds of tubers. It includes 19 Cassava varieties, 21 Sweet Potato, 9 Greater yam, 5 White yam, 2 Lesser yam, 8 Edible aroids, 2 Elephant foot yam, and one Chinese potato varieties. Cassava varieties i.e., *SreeAthulya* and *Sree Apoorva* with higher yield and high extractable starch have been developed in CTCRI, Trivandrum has been registered in ICAR-NBPGR. Sweet potato varieties, i.e., *BhuSona*, *Bhu Krishna*, *Bhu Swami* have been developed in RC, ICAR-CTCRI Bhubaneswar has also been registered in ICAR-NBPGR.

CTCRI developed biopesticides from cassava leaves which are popular in the state, namely *Namma*, *Sreya* and *Menma*. It is effective for preventing Pseudostem weevil attack and Rhizome weevil attack in banana cultivation. There is immense scope for promoting these biopesticides in the state, especially since a lot of farmers are cultivating banana as compared to paddy.

Organic farming network project is being carried out by the Centre. It is reported that standardised organic farming practices for all major tuber crops are being promoted. Mobile app, namely 'Tuber Guru' has been developed for getting information related to the tropical tuber crops for the public both in English and Malayalam languages. Algorithm for Variety Identification Tool (VIT) app to identify varieties of tuber crops based on their morphological attributes like colour, shape, leaf, etc., has also been developed. On the front of the promotion of agro biodiversity, CTCRI plays a pivotal role in the conservation of tuber crops' diversity.

Previously, the KSBB had proposed a tuber germplasm conservation programme in Onattukara panchayat in Alappuzha district. However we could not find any update on this programme.

3.2 Kerala Veterinary and Animal Sciences University (KVASU)

Kerala Veterinary and Animal Sciences University (KVASU) was established in 2010 by the Government of Kerala to provide education, research and extension services in the field of Veterinary and Animal Sciences. The university occupies 100 acres of land at Pookode in Wayanad district, which was allotted from the land belonging to the Pookode Dairy Tribal Welfare Project of Government of Kerala. The University comprises of three major areas: Veterinary and animal sciences, Dairy Science and Poultry Science. The 8 constituent colleges functioning under the university are College of Veterinary and Animal Sciences located at Mannuthy and Pookodu, College of Dairy Science and Technology located at Mannuthy, Pookode, Chettachal, Kolahalamedu, College of Avian Sciences and Management Thiruvazhamkunnu, College of Food Technology, Thumburmuzhy, etc. The University has a wide network of instructional and research farms spread throughout the state.

Various institutions under the university contribute to research and extension services in the fields of veterinary, dairy, poultry, etc. The Directorate of Entrepreneurship with headquarters at Pookode, Wayanad focuses on capacity building of farmers, entrepreneurs and extend services through outreach programmes, developing model farms, supporting self-help groups in improving production and productivity of livestock. The Directorate plays a vital role in commercializing new ideas and raising productivity and employment in all sectors, especially benefitting the farming community. The College of Dairy Science and Technology, is focussing on the value addition of milk, establishment and commissioning of dairy plants throughout the state, assuring safe and quality products for the public, designing kits and tests for quality analysis of milk and milk products, maintaining active link between the field level farmers and scientific community, in-depth knowledge of farm animal practices etc. Centre for Advanced Studies in Poultry Science which is located at Mannuthy mainly focuses on academic and research on poultry science. It also conducts training programmes for farmers, conserving poultry germplasm, selection and breeding of egg production, etc.

Wayanad district is rich in forests and wildlife. The human-wildlife conflict is a serious issue while considering agricultural practice in high ranges. Farmers are suffering from attacks of wild animals as it damages crops and other consequences. Centre for Wildlife Studies of the university is focusing on carrying out research in the areas of forest and biodiversity of the Western Ghats region, human-wildlife conflicts etc. To conduct research on climate change adaptation and mitigation strategies in the field of Animal Agriculture, a Centre for Animal Adaptation to Environment and Climate Change Studies has been established.

3.2.1 Conservation of Indigenous Animals

Vechur Cow

Vechur Cattle Conservation Project is running under the KVASU for increasing the reproduction and conservation of indigenous cattle. Vechur cattle are indigenous, disease resistant and suitable for Kerala's climate. The average height for Vechur cows is three feet only, and the cost of feeding and rearing is less compared to the hybrids. Milk production may not be as high as hybrids, but the quality of Vechur milk is very high. A large Vechur farm under KVASU comprising 120 cows is functioning in Mannuthy by applying scientific reproductive methods. Other Vechur farms are functioning in Thiruvazhamkunnu, Thumburmuzhy and Pookode. There is a huge demand for Vechur cow from the farmers. KVASU is supplying cattle based on priority only, and it is unable to meet the increased demand from farmers. Semen of Vechur bulls has been collected and protected as chilled semen through scientific methods for supplying to the farmers. It is reported that the regular supply of chilled semen to the already sold cows, their progeny and other registered cows are continuing from the project.



Vechur Cows

Source: <http://vechur.org/>

The cattle conservation project is also aiming at the conservation of Kasaragode dwarf, which is another indigenous variety. Conservation, scientific reproduction methods, and meeting demands of farmers for Kasaragode dwarf cattle are being encouraged. The project also aims to make people aware about the genetic diversity of indigenous cattle and to extend the low-cost livestock rearing to the rural areas.

In addition to the role of KVASU, the Vechur Conservation Trust has played an important role in conserving the indigenous animals. One of the main difficulties in diffusing indigenous cows like the Vechur cow is the dairy policy of the state which lay emphasis on hybridisation of cows to improve milk yield.

Pigs, Goats and other Animals

KVASU is conserving indigenous Angamali pigs and maintaining farms. Centre for Pig Production and Research under KVASU is functioning at Mannuthy. A pig breeding farm has also been maintaining there. The major objective of the centre is to, conduct research on different aspects of pig production, to operate as an instructional farm to students, to function as a demonstration unit to farmers, to maintain purebred nuclear stock of animals for the supply of quality piglets to farmers. A new crossbred pig, namely 'Mannuthy White' has been developed and released on 8th February 2017. The centre is functioning with the objective to study the performance of indigenous pigs and their crosses with Large White Yorkshire for the efficiency of feed conversion, production and reproduction. The Centre for Pig Production and Research Mannuthy has been providing purebred and crossbred piglets to farmers for starting breeding units all over Kerala and many parts of south India. The centre provides training, technical advice and support to establish pig farms, etc. to the farmers.

A Goat and Sheep Farm is functioning at Mannuthy. Supply of kids to farmers, technical and managerial advice to farmers about goat farming, breeding, etc. have been going on. Conservation of indigenous 'Malabari Goat' in its native tract, supply of superior breeding bucks to the field centres for breeding purpose are in progress under the Goat Improvement Scheme. KVASU has identified farmers for indigenous goat rearing and provides all support to them. A Rabbit farm is also maintained, with a supply of rabbits, to provide technical advice to the needy farmers.

Poultry

A Poultry farm consisting of 34 varieties is being systematically maintained under the university. Varieties of indigenous and other egg fowls which include *Gramasree*, *GramaLekshmi*, *Athulya*, *Desicross*, *Giriraja*, *Australorp*, *Rhode Island Red*, *New Hampshire*, *Thellichery*, *Aseel*, *Kuttanadu duck*, *Kadakhnath* etc., are conserved in the farm. Other poultries including ducks, quails, ornamental poultries, etc., are also conserved in the farm. Schemes like *Aiswarya* have been introduced to propagate poultry to increase egg production in the state.

Gothra Mission

Being the largest institute for higher education in Wayanad and the only university of the district, KVASU has taken a responsibility to participate in the efforts of the Government of Kerala to work for the upliftment of tribal people. A new project, namely '*Gothra Mission*' has been introduced in this respect. *Gothra Mission* was formally inaugurated by the Hon. Governor of Kerala on 6th April, 2019. Today, tribes lead a marginalized life, far from the freedom they once enjoyed in nature, forced to live in restricted spaces under extreme poverty and exploitation, having to depend on settlers for subsistence mostly as agricultural labourers. Poor education and alcoholism are serious concerns among them.

It is reported that KVASU having 100 acres of land, a large number of students and teaching faculty with expertise in all areas associated with animal husbandry and allied areas, including courses, training programmes and infrastructure suitable for training tribal youth for alternate livelihood activities, are the advantages in tribal welfare work.

Salient features of Gothra Mission

Presently ninety tribal students belonging to the Paniya community who are most vulnerable among tribes, are being trained for six months under the KVASU certificate course titled '*Multiskill Development Programme in Integrated Resource Management Centred on Livestock and Poultry*'. All of the students are dropouts from school; none has completed SSLC, working as daily wage labourers. Most of them come from landless families of Narangakandy Tribal Colony, Kalpetta. KVASU provides a stipend of Rs. 500.00 per day for 5 days a week during the six months course from the Scheduled Tribes Development Department (Integrated Tribal Development Project, Kalpetta) for each student. Training in vegetable cultivation, poultry farming, rabbit rearing, ornamental fish rearing, aquarium and pond making, poultry keeping, beekeeping, mushroom cultivation, animal cage industrial fabrication, orchid and anthurium cultivation, dog keeping for breeding, ornamental bird breeding, etc. have been provided. Production units of each of these activities have been established in 2 acres of land at the university campus.

Display units of '*I farm*', is a novel method introduced by KVASU Centre for Wildlife Studies, established under the *Gothra Mission*. These units allow the integrated rearing of poultry, vegetables, fish, etc., in human-wildlife conflict areas. It is reported that these units are being managed by the tribal students and they are also trained in the manufacture of "*I farm*" units.

Students are being supported to continue school education under '*Thulyatha*' scheme. Now the students started earning money already from the sale of chicken eggs, vegetables, etc., at the university campus. The tribal students are being organized into a co-operative that will function under the continuous guidance of the university, and other tribal people will also be included. Produces, value-added products and services of the co-operative will be made available to the public through the facilities of the university, including its sales counters. It is reported that landless tribal members can undertake income-generating activities at the unused parts of the university campus. Members who own land can undertake income-generating activities under

the continuous guidance of the university. Ninety-five percent of the income from sales will be divided among the members of the co-operative that participate in the activities, 5% of income will be transferred to university for the sustainability of the project.

A start-up company is being registered with the Technology Business Incubation Centre (TBIC) of the university by a fraternity of the alumni of various graduate and postgraduate courses of the university under the leadership of alumni of the Master of Science (Wildlife Studies), course being run under the KVASU Centre for Wildlife Studies. The company will be responsible for publicizing and sales of the produce, value-added products and services of the co-operative, including the “I farm” units, using online and other marketing methods at a national and international level, this will allow more demand and sustainability for the income-generating activities of the co-operatives.

Conducting research for further development, extension activities by making a link between scientists and farmers, providing training to the farmers, creating model farms, knowledge transfer for scientific livestock rearing etc., have been carried out by the various institutions in the fields of veterinary, dairy, poultry under the university. The university strives to extend its research outcomes to the farmers by providing training, scientific methods for livestock rearing, conserving traditional varieties of animals and poultry, etc. The brand name of the university is a crucial factor among the farmers and people, and it can be utilised to disseminate its activities. The *Gothra* Mission initiative of KVASU is a unique attempt to uplift the tribes by providing livelihood opportunities through agricultural and livestock practices. This is contributing to the promotion of agrobiodiversity as well.

3.3 Kerala Agricultural University (KAU)

Kerala Agricultural University (KAU) was established in 1971 with the aim of excellence in agricultural education, research and extension for sustainable agricultural development and livelihood security of the farming community. The headquarters of KAU is located at Mannuthy, Thrissur. The University has seven colleges, six Regional Agricultural Research Stations (RARS), other Research Stations and Research and Extension Units. In addition, an Academy on Climate Change Adaptation and an Institute of Agricultural Technology are also functioning in KAU. KAU is providing quality education in agriculture, horticulture, co-operation, forestry, agricultural engineering, home science and other allied disciplines through its various institutions. KAU is also rendering the support to increase the productivity of crops in the agricultural sector by means of research initiatives.

The state has been divided into six agro-ecological zones by KAU to carry out research and extension of various crops based on location specificity. The zones are northern, high range, central, special zone for problem areas, Onattukara and southern zone. Two research stations are functioning in the Northern Zone for coconut and pepper. Regional Agricultural Research Station (RARS), Pilicode maintains a unique collection of coconut germplasm consisting of 35 exotic and 40 indigenous types and the research on hybridisation for getting high yield are being carried out. Pepper Research Station, Panniyur has released five varieties of pepper, viz. Panniyur-1, Panniyur-2, Panniyur-3, Panniyur-4 and Panniyur-5 through their research and all are well received by the farmers. Two research stations are functioning to provide research support for agriculture in the High Range zone (Wayanad and Idukki districts and Nelliampathy area of Palakkad district). RARS, Ambalavayal (Wayanadu) concentrates on rice, spices and vegetables and serves as a major hub for the supply of seeds and planting materials of various crops. Cardamom Research Station, Pampadumpara is a substation of RARS

Ambalavayal and the station is maintaining a germplasm bank of 77 cultivated and 14 wild types of cardamom. In central zone, nine research stations are functioning for providing research and extension services for rice, banana, cashew, vegetables, medicinal plants, pineapple, passion fruit etc. Various crop varieties including banana, cashew has been released for cultivation through these centres. There are also functioning four stations in a special zone for problem areas to carry out research on rice, pokkali rice etc., and to address the problems of Kuttanadu and Onattukara regions. In Onattukara zone one station is functioning for conducting research on Onattukara coconut. In southern zone four stations are functioning for various crop improvement, research and extension services.

3.4 Regional Agricultural Research Station (RARS)

Regional Agricultural Research Station comes under the Kerala Agricultural University and is located at Pattambi, Palakkad district. The lead function of the station is to conduct research mainly on rice, pulses, horticultural crops and rice-based farming systems. The institute aims at sustainable food production by providing technology backup for better production and safe production practices. It also aims at rendering basic knowledge and practical experience in the field to the youngsters who are interested in agriculture through its academic programmes. The station was upgraded as Regional Agricultural Research Station for Central Zone comprising of Ernakulam, Thrissur, Palakkad and Malappuram districts under the National Agricultural Research Programme (NARP) in 1981. The first high yielding hybrid derivative variety of rice of South-East Asia “*Annapoorna (Ptb-35)*” was released for cultivation by this station in 1966.

RARS is concentrating on the collection and conservation of rice diversity in the state, which is the most important crop of Kerala. There were three major seasons in Kerala for paddy cultivation i.e., *Virippu* (April-May to September-October), *Mundakan* (July-August to February-March) and *Puncha* (January-February to April-May). More than thousands of rice varieties, which were in cultivation during different seasons, have been collected and conserved in a well maintained deep-freeze laboratory. Traditional varieties of paddy were well suited for the different agro-climatic conditions in the state. The conservation of such varieties without losing its traits has been maintained in the centre. The RARS is providing traditional varieties of rice to farmers who are interested in their cultivation. Such varieties can be considered as parent seeds for breeding purposes for getting new traits and advantages through the research. The RARS is maintaining acres of paddy land for the cultivation of rice varieties to get their new seeds for the purpose of conservation. Based on different rice varieties, there are different time periods.

Among the traditional varieties of rice, some of them have special characteristics also. The 13 rice varieties which have resistance to salinity (*seven types of pokkali, four types grown in the saline land of Pannanikole wet land, and two types of Kaippadu land*) have been identified. Ten drought-resistant varieties and 12 flood-resistant varieties have also been identified. Seven types of scented rice varieties (*like jeerakasala, gandhakasala, neycheera* etc.), seventeen varieties with medicinal value (*navara, nallachennellu, rakthasali* etc.), and three types of good cooking quality have been characterised as special traditional varieties.

The traditional rice varieties have been donors for various traits in the rice breeding programmes worldwide. The rice improvement efforts had been made in the station in earlier times before the green revolution and resulted in the popularisation of various rice varieties. Pattambi rice varieties are internationally acclaimed for their performance and accepted as international donors for biotic and a-biotic stress breeding (75 years of research, RARS, Pattambi-2002). A lot of new varieties have been developed considering the high yielding possibilities and different agro-climatic situations in Kerala. The varieties with disease-resistant, pest resistant, survival capacity of climate conditions, etc., have been developed by the station. It is reported that the yield of

traditional varieties will be lower, but the traits will be higher. The farmers are interested in cultivating high yielding varieties because of the expectation of profitability of cultivation. Now the area under paddy cultivation is going to come down due to high cost of cultivation, fear of loss etc. Though, some farmers who are interested in cultivation of paddy as a passion are approaching the station for collecting such rice varieties. Outlets of the RARS are functioning for the public to distribute paddy seeds. Farmer support programmes, awareness campaigns are also being conducted. Supply of rice varieties in association with agricultural departments is also going on. RARS is functioning as a promoting agency for rice cultivation under Kerala Agricultural University, which is fostering the rice diversity in the state.

3.5 National Bureau of Plant Genetic Resources (NBPGR)

NBPGR is an institute coming under the Indian Council of Agricultural Research for the Management and promotion of sustainable use of plant genetic and genomic resources of agricultural crop and carries out related research. The establishment of the Bureau coincided with the advent of the Green Revolution and was in response to the realisation of perceived effects of the Green Revolution on agrobiodiversity. The NBPGR played a pivotal role in the improvement of various crop plants, diversification and development of agriculture in India through germplasm introduction from various institutes located in foreign countries and also from within the country. Headquarter of NBPGR is located at New Delhi, and the regional centre of Kerala is located at Thrissur.

NBPGR is a major institute which exclusively functions for the conservation of agrobiodiversity. NBPGR is conserving indigenous plant genetic diversity at the national level. A gene bank for indigenous and exotic collections, wild crop relatives, etc., has been maintained and the details of it have been made available on the PGR database. It is the only source of plant genetic diversity that imparts valuable traits needed for meeting the challenges of adapting crop varieties. Considering the future needs to address changing climatic conditions or disease of crops, all plant genetic diversity has its own relevance and NBPGR is keeping it in a systematic way. NBPGR, Thrissur is maintaining 10.4 ha. farm area for cultivating various crop varieties to get new seeds for the conservation purposes based on the particular time periods which depends on the characteristics of the crop varieties. A scientific laboratory has been well maintained for the conservation. Seeds are being well packed and coded and stored in the deep freeze laboratory. The mandate of the centre is augmentation, characterisation, evaluation, maintenance, regeneration, conservation, documentation and distribution of plant genetic resources in South India. Jurisdiction of this centre is Kerala, Tamil Nadu, Karnataka, Goa, Union Territories of Puducherry, Lakshadweep and the Andaman and Nicobar Islands.

As per the gene bank database of NBPGR indigenous collections from Kerala is 4333 which includes 1833 cereals, 972 vegetables, 204 medicinal and aromatic plants, 146 Pseudo cereals etc. (Table-7). Out of the 1833 cereals, 1825 is rice varieties, and the rest is maize and wheat.

Table 7:NBPGR- Indigenous Collections from Kerala

Sl.No	Crop Group	Number of Accessions
1.	Agroforestry	16
2.	Cereals	1833
3.	Fibre	116
4.	Forages	51
5.	Fruits & Nuts	7

6.	Grain legumes	665
7.	Medicinal & Aromatic plants	204
8.	Millets	127
9.	Oilseeds	181
10.	Ornamental	3
11.	Pseudo cereals	146
12.	Spices, Condiments and Flavour	12
13.	Vegetables	972
	Total	4333

Source: <http://genebank.nbpgr.ernet.in>

NBPGR initiated to popularise the potential crops (like non-bitter type of Aloe Vera, Dwarf Burmese fishtail palm collected from Andaman Islands, Chop-Chopa- a good monsoon season fruit, Sweet gourd and teasel gourd etc.) among the farmers, tribes as vegetables and economic plants for food and livelihood security. As far as germplasm conservation is concerned a total of 8306 accessions comprising 74 crops and their wild relatives and other economic plants are maintained (in field gene bank and medium-term storage), and 18680 accessions were sent to National Gene Bank for long term storage (as per the documents of NBPGR). Germplasm collections of different perennial horticultural crops have been transferred to various crop-based institutions like CTCRI Trivandrum, IISR Kozhikode etc. Also, it has been supplied to the various user agencies, government institutes under Material Transfer Agreement (MTA).

It is reported that Kerala Agricultural University has released seven varieties using germplasm of NBPGR. The released varieties are Brinjal-*Neelima* (having high yield potential and disease resistant), Chinese Potato-*Nidhi* (having high yield, large tubers, good cooking quality and suitable as a short duration vegetable crop in Kerala), Greater Yam-*Indu*, Okra-*Salkeerthi*, *Aruna*, *Manjima* (having high yield potential), and Yard-long Bean-*Kairali*. Eight accessions with unique traits were registered by the ICAR-Plant Germplasm Registration Committee based on the evaluation and characterisation of germplasm. NBPGR conducts exhibitions, Biodiversity Fairs for awareness generation, training for farmers etc.

NBPGR is a major institution for the conservation of plant genetic resources from all geographical regions of the nation. Regeneration, conservation, augmentation, characterisation and evaluation of plants are being operated successfully in connection with agrobiodiversity conservation. The extension possibilities are limited, though they are supplying seeds to the needy farmers and conducting training and awareness programmes.

3.6 Non-Governmental Organizations

3.6.1 M S Swaminathan Research Foundation (MSSRF)

MSSRF was established in 1988 as a non-profit trust. It is an NGO which actively engages in the area of agrobiodiversity and aims at accelerating the use of modern science and technology for agricultural and rural development for improving the lives of communities. MSSRF Chennai has established a regional centre at Wayanad in 1997 namely Community Agrobiodiversity Centre (CAbC) to promote community conservation systems of rural and tribal people through research, extension and advocacy. Centre actively works for sustainable agricultural and rural development with the partnership of rural and farming communities. The activities of MSSRF are designed as pro-nature, pro-poor, pro-woman and pro-livelihood orientation.

The Centre works with an objective of delivering the necessary means and methods required for the on-farm management of agrobiodiversity in Wayanad region –a Biodiversity and poverty

hotspot in the Western Ghats. The Centre, since its establishment, has been working in partnership with local community families with an integrated approach of conservation, cultivation, consumption and enhancing commercial prospects of community biodiversity management. Establishment and evaluation of crop Germplasm is an important area in agrobiodiversity conservation. MSSRF has taken efforts to establish a food crop Germplasm including components like root tuber crops, leguminous crops and spices. The details of collections at the centre and the community level conservation sites are given in the table below :

Table 8: Crop varieties conserved at MSSRF

Crop varieties	No. of crop varieties conserved at CABc Germplasm	
	No. of species	No. of Varieties/collections
Cultivated Yam (Dioscorea)	3	15
Wild Yam (Dioscorea)	9	17
Taros	3	13
Other tubers	5	7
Legumes	10	35
Black pepper (cultivated)	1	23
Black pepper (wild)	4	4
Ginger (cultivated)	1	9
Ginger (wild)	6	6
Citrus	6	17
Banana/plantain	3	21
Cucurbits	12	26
Brinjal	1	6

Source: MSSRF

Recognising the importance of rice from the point of view of agrobiodiversity, MSSRF initiated traditional rice conservation programme in the year 1998 in Wayanad. Initial activities on rice conservation were restricted to sensitization of farmers about the importance of rice ecosystems and production and distribution of quality seeds of traditional rice varieties. MSSRF worked in close collaboration with farmer groups in different parts of the district. Participatory plant breeding programme was also initiated on medicinal rice like *Navara*. Cultivation of *Navara* and other speciality rice varieties like *Gandhakasala* and *Jeerakasala* were promoted to exploit its market potential to generate profit from rice cultivation. The yield from traditional rice varieties is less, but the properties will be higher. People are generally not willing to cultivate traditional varieties because of low yield and fear of loss. The fact is that tribes are cultivating traditional varieties only. Propagating traditional varieties among the farmers is a challenge even though it has been undertaken by the centre.

In the promotion of agrobiodiversity MSSRF is actively concentrating on promotion of community-oriented agro farming, particularly in rice cultivation. Also, the centre provides training to farmers to conserve traditional crops. It renders support and technical assistance to enhance the traditional agricultural production in rice and tubers for ensuring sustainable and profitable agricultural practices, especially among tribes.

In view of biodiversity conservation, they are maintaining a botanical garden full of endemic floral species, medicinal plants and Rare Endangered and Threatened (RET) plants etc. Floristic wealth of Wayanad district has been explored with special emphasis on endemic and threatened flowering plant species. A total of 2,034 plant species were documented from 2136 sq. km area, 26 new taxa were discovered, 2 plant species were rediscovered after long gaps since their last report, 184 wild edible species, 244 medicinal species and 165 orchids were documented. A total of 190 threatened plant species of Western Ghats (more than 1.8 lakh seedlings) are being conserved through an integrated approach (in-situ, ex-situ & on farm). Recovery plan for RET species is also being conducted through identification of natural population of threatened species, along with study of the ecology and biology of threatened species, large scale multiplication of prioritized species, and reintroduction/introduction into natural/suitable habitats.

MSSRF is maintaining good relations with the local governments in the areas of natural resource management, livelihood improvement, biodiversity conservation, climate change adaptation/mitigation. All support has been provided for the creation of artificial forest, and conducted a floristic study at Pathirippara, in association with Meenangadi grama panchayat. MSSRF is also participating in their carbon-neutral further programmes. MSSRF has a close association with Pozhuthana panchayat in implementing medicinal plants conservation programs, river protection programmes etc. Earlier MSSRF has worked with Padinjarathara panchayat in establishing a bio-village program. It is reported that MSSRF has established 20 rice seed villages across Wayanad, in which many panchayats are associated. A noticeable point is that MSSRF was actively involved in providing assistance in the preparation of PBR of local governments like Pozhuthana grama panchayat and Kalpetta municipality.

MSSRF- CABc is one of the most important institutions in the state, which closely associates with the promotion of agrobiodiversity. Great importance is attached to the environment conservation activities of MSSRF, particularly in the biodiversity hotspot district Wayanad.

3.6.2 Thanal

Thanal is an NGO functioning from 1986 in the field of environment conservation. The head office of Thanal is located at Thiruvananthapuram. The key areas of the institution are the promotion of organic farming, agroecology, zero waste, policy advocacy, climate change, circular economy, break free from plastics, living ecosystems and agrobiodiversity conservation. Thanal was actively involved in the environment campaigns against the rise in pesticide use like Endosulfan. Thanal successfully facilitated zero waste campaigns, which include initiatives like zero waste Himalayas.

Thanal has been managing the Agro-Ecology Centre (AEC), a field centre at Panavally in Wayanad since 2010. The centre is dedicated to the conservation of indigenous crop diversity of paddy, tubers, turmeric, ginger and uncultivated wild leafy vegetables. It conducts seed festival every year and also rice field days for students, farmers and *Kudumbasree* groups. The centre is also a research and education centre affiliated to International People's Agroecology Multiversity offering programmes in which farmers are lead faculties. The centre is interacting with academics and practitioners of organic farming to contribute to knowledge generation on Agroecology.

Training in organic farming, organic input preparation and preparation of organic pest repellents are being provided for farmers. Promotion of organic products and organic farming techniques is an important activity. Conducting awareness campaigns for ecosystem protection, conducting research on biodiversity conservation are the other major activities. Thanal is promoting organic

farming since 1990 and is practising in Thanal AEC. The manures are prepared organically using cow dung, cow urine etc. (Thanal keeps its cows in the centre itself). Also, fence compost is being maintained in the centre. The centre provides training to the farmers in organic farming since 2003 and has been helping them to market their products through the Organic Bazaar. Thanal so far has trained more than 200 master trainers for organic farming training and runs three facilities in the state to train farmers and youth on organic farming.

The Save our Rice Campaign, which is a national movement, was organised by Thanal in Kerala to revive the paddy diversity of the farming system. It is reported that thousands of farmers in five states are adopting ecological farming practices, conserving and cultivating traditional varieties of high-quality seeds, and ensuring the supply of organic rice to consumers across these states. Conservation of traditional paddy varieties in Rice Diversity Block has been established as part of Save our Rice Campaign.

Thanal is conserving several crop species including 336 traditional varieties of rice, 16 vegetables, 25 uncultivated vegetables, 7 ginger etc. (Table9). Thanal is managing on-farm conservation of 336 traditional varieties of rice. Organising seed festival and exchange of traditional seeds without monetising and trading is another initiative.

Table9: Crop varieties conserved at Thanal

Sl.No.	Crops	Number
1	Traditional Paddy varieties	336
2	Ginger	7
3	Pepper	2
4	Turmeric	2
5	Tubers	25
6	Trees	35
7	Uncultivated Vegetables	25
8	Vegetables	16

Source: Thanal

In association with Meenangadi grama panchayat, Wayanad, a carbon-neutral study has been conducted. It was a unique attempt to assess the carbon emission in the panchayat area particularly in Wayanad district which has ecological significance. Carbon emission was estimated from transportation, energy, waste, Agriculture Forestry and Other Land Use (AFOLU). This has motivated other grama panchayats to assess carbon emission to address climate change.

It could thus be seen that the two non-governmental organizations are playing a very important role in diffusing technology to farmers and also in conserving a number of crop species thereby saving it from extinction and (re)introducing them into everyday use.

3.7 PRIs dealing with biodiversity in general

3.7.1 Jawaharlal Nehru Tropical Botanical Garden Research Institute (JNTBGRI)

JNTBGRI was established in 1979 under Government of Kerala as an autonomous institution and located at Palode, foothills of the Western Ghats, Thiruvananthapuram. It has become a part of the Kerala State Council for Science, Technology and Environment in 2003. The institute was envisioned to conserve and provide sustainable utilisation of the plant biodiversity of the Western Ghats for the well being of the people. The key areas of the centre are Ex-situ

conservation and management of plant wealth of the country, biodiversity documentation, bioprospecting, documentation of indigenous knowledge, education, extension, training on conservation and sustainable utilisation of plants etc.

JNTBGRI is renowned for its well maintained Botanical Garden spread over 300 acres. The garden system of JNTBGRI is reckoned as the biggest conservatory garden in Asia with over 50,000 accessions belonging to about 5,000 species. The Garden system is managed by the Garden Management Education, Information and Technology Division and the Plant Genetic Resources Division. These divisions manage the live plants of the Garden. The institute is systematically conserving medicinal plants, orchids and other flowering plants, bamboos, various rare species of flora from other parts of India, agricultural crops, spices etc. Exploring the traits of plant wealth of Western Ghats region for the well being of people through research is a distinctive effort.

JNTBGRI is actively engaged in developing effective regeneration protocols for many species to help conservation, eco-rehabilitation and sustainable utilization through biotechnological approach. Thrust areas of the centre are conservation, biotechnology, bioproduction of plant-specific compounds and bio-prospecting. Bio-technology based cultivation of endangered plant taxa became a reality in India largely through the work done in the laboratories of the centre. The institute played a great role in biodiversity management through assessing the status of selected species, bio-prospecting of selected species and also through multiplication and popularisation of important plants. RET plants in the Western Ghats region have been identified and conserved properly. It is reported that a database of RET species is being prepared. Conservation and re-introduction of selected RET species are being carried out in the institute. New varieties of Orchids and Bamboos have been developed through hybridisation. The institute strives to develop disease-resistant plants through hybridisation which is a significant effort in the context of agrobiodiversity promotion. The institute is providing technical support, mentoring local governments for biodiversity conservation, natural resource management etc. Several achievements have been made through the research effort of the institute. JEEVANI, a novel herbal formulation for health promotion, has been developed and the technology was transferred to Arya Vaidya Pharmacy (Coimbatore) Ltd. Kanjikode, Kerala, for commercial production. SISAIROSP as an anti-psoriatic and antidandruff herbal formulation and the technology was transferred to a Madhya Pradesh based company, Jhawar Chemicals Pvt.Ltd. A considerable income has been generated to the institute by transferring technologies of both of these two herbal drugs (JEEVANI and SISAIROSP). Also, five Plant-based databases have been developed by the institute. Eighteen patents in the fields of biotechnology, ethnopharmacology and bio-prospecting have been filed, of which seven have been granted.

Being a large conservatory garden in the country, JNTBGRI disseminates the message on the significance of plant diversity among a vast group of its visitors. Also, the institute is regularly conducting exhibitions, training programmes and public interactions. Publications like handouts and brochures also help to spread the message on the relevance of conservation. Popularisation of plant species among the public is an important activity of the institute. JNTBGRI is conserving biodiversity through the protection of various species of plant wealth (Table 10), developing new varieties, re-introduction of species, maintaining the biggest conservatory garden in Asia.

Table 10: Wild relatives of crops and Germplasms conserved by JNTBGRI

Wild Relatives of Crops Conserved (Indigenous)	
1.	Pepper-12 species of <i>piper</i>
2.	Turmeric-11 species of <i>curcuma</i>
3.	Ginger-5 species of <i>Zingiber</i>
4.	Nutmeg- 4 species of <i>Myristica</i>
5.	Garcinia-9 species of <i>Garcinia</i>
6.	Yam-7 species of <i>Dioscorea</i>
7.	Mango – 2 species, and 20 cultivars of <i>Mangifera</i>
8	Banana-2 species and 2 varieties of <i>Musa</i>
.9.	Jasmine-20 species and 3 varieties of <i>Jasminum</i>
10.	Sugarcane – 2 species of <i>Sacharum</i>
11.	Cardamom – 1 species, 1 variety of <i>Elettaria</i>
12.	Large cardamom- 2 cultivars of <i>Amomum subulatum</i>
13.	Betel vine- 2 cultivars of <i>piper betle</i>
Germplasm Accessions in Ex Situ Collections (Indigenous)	
1.	Medicinal plants: 800 species-1500 accessions
2.	Orchids : 550species – 800 accessions
3.	Bamboo and reeds: 71 species and 1050 accessions
4.	Carnivorous plants: 3 species and 5 accessions

Source: Annexure-1

3.7.2Kerala Forest Research Institute (KFRI)

KFRI was founded by Government of Kerala in 1975 to conduct research on tropical forests and forestry. Institute has become part of Kerala State Council for Science, Technology and Environment (KSCSTE) in 2003. The main campus of the institute is located at Peechi, Thrissur. A sub-centre is functioning at Nilamboor with laboratory facilities and field trial plots of several tree species. A Field Research Centre is functioning under KFRI at Velupadam, Thrissur with a nursery of forest plant species. KFRI is functioning for the conservation of forest ecosystem and sustainable utilisation of natural resources for ensuring benefits to the society. The institute is conducting multi-disciplinary research on tropical forestry including wildlife management, indigenous knowledge, value addition of forest product etc. KFRI has 17 research departments grouped under 9 Programme Divisions. KFRI is managing research and other activities through these divisions.

KFRI is maintaining Arboretum of a wide variety of evergreen and moist deciduous trees, Bamboo garden, a Butterfly garden with micro habitats for attracting rare, endemic and endangered butterflies. They are also maintaining a Central nursery, Herbarium with an extensive collection of flowering plants, Bioresources Nature Park at Nilamboor, Medicinal plants garden, Soil museum, Kerala Forest Seed Centre etc. The Central nursery has a collection of about 120 species of timber (that are high in demand) and also fruit-bearing and medicinal plants. The nursery ensures timely availability of planting material to the farmers, the general public and other agencies. Kerala Forest Seed Centre established as a joint venture in 2003 with Kerala Forest & Wildlife Department for gathering forest seeds of superior trees and distributing certified seeds to the other government departments, NGOs, and farmers.

KFRI collects the diversity of forest soil and mineral resources in the state which is kept in the soil museum. The museum has the collection of 15 soil monoliths featuring the soils in different types of forests like shoal, evergreen, semi-evergreen, moist and dry deciduous etc.

In view of biodiversity conservation KFRI intervenes through the research efforts in the areas of silviculture and soil science, genetics and tree breeding, forest ecology, ecosystem and landscape analysis, rehabilitation and restoration, population ecology, biodiversity evaluation and conservation of RET species of flora etc. Apart from this KFRI looks into various aspects of microbes, insects and weeds in the forest ecosystem, developing appropriate technologies for the value-added commercial utilization of timbers, conducting interdisciplinary research into human behaviours in natural environments, providing fully-fledged training and extension facility for imparting training in tropical forestry, mapping forest cover and biodiversity by using GIS and remote sensing etc.

KFRI is actively involved in the area of Agroforestry, which is a land use management system combining benefits of both agriculture and forestry. Agroforestry has great importance in the state because it is dependent on the Western Ghats region blessed with abundant natural resources. In agroforestry perspective, KFRI puts forward different crop based homestead models based on different structures of home gardens in various agro-climatic zones in the state for benefitting the farmers. Tree species are being proposed to provide indirect benefits and also ensure self-sufficiency in case of food, fuel, wood, fodder, fruit yields, good quality timber and considerable good returns from the cash crops. It also promotes a mixed pattern of agriculture with selected plants for getting considerable income to the farmers. Developing sustainable models of agroforestry system through farmer-participatory approach for each agro-ecological zone is a major intervention of KFRI.

Creation of a Butterfly garden is another initiative to conserve biodiversity. The institute is creating a garden of particular selected plant species based on specificities of location for attracting butterflies in schools, hospitals, public institutions etc., as per the demand. Also, regular monitoring has been ensured. The butterfly garden helps to improve the ecosystem around as butterflies help in pollination of plants, increasing floral richness.

KFRI is propagating scientific models for the sustainable use of natural resources like soil, water, various species of plants, trees, ecologically sound land use pattern etc. The institute is also supplying plants, providing technical support, conservation methods, to the agencies, local governments, NGOs, farmers etc. The role of this institute is precious in front of conservation of biodiversity, particularly in forestry resources of the state, which is closely associated with the Western Ghats.

3.8 Insights from the analysis of the role of PRIs and NGOs

1. Institutions are maintaining germplasm conservation of various kinds of crops, including traditional varieties with the vision of future needs.
2. New varieties have been developed through crop improvement for high yield, disease resistance, etc.
3. Institutions are facing challenges and limitations in the extension services. Only passionate farmers or interested agencies are utilising the services of these institutions. Lack of proper knowledge about these institutions and the importance of agricultural practices among the public are serious concerns.
4. In view of the extension possibilities, NGOs are seen to be performing better as compared to the government institutions, by collaborating with local governments and

intervention at grassroots level through community mobilisation. Collaboration with local governments is more significant in the promotion of agrobiodiversity.

5. Absence of a central monitoring system in order to promote agrobiodiversity in the state, to coordinate all the research outputs from the public research institutions has been noticed.

4. The cases of 4 model Grama Panchayats

In this section, we analyse the role of four local self-governments from across Kerala who can justifiably be termed as model grama panchayats as far as the appreciation and maintenance of agrobiodiversity and indeed biodiversity, in general, is concerned. Our selection of these panchayats has been guided by the fact that they have either been selected as the best BMC either by the National Biodiversity Authority or the Kerala State Biodiversity Board (Table 11)¹². Besides, one of the four has been hailed as a model panchayat for organic vegetable cultivation and has a long history of being the only panchayat in the whole state of Kerala that is self-sufficient in vegetable cultivation. The purpose of conducting these case studies is to understand and place on the table those practical points that other panchayats can emulate. It is also seen that all the four panchayats have adopted a different strategy towards agrobiodiversity thus bringing home the point that there is no one model that fits all. Each of the panchayats have improvised strategies that are specific to the needs of respective panchayats. These range from rejuvenation and maintenance of water bodies to vegetable cultivation to maintenance of forest cover. We also see that success in the maintenance of agrobiodiversity is linked to the presence of two important factors. These are: (i) a strategy for agrobiodiversity is basically a function of whether it is inexorably linked to a livelihood strategy. If it is, then there can be widespread acceptance of management of agrobiodiversity as it can bring in immediate tangible benefits to the inhabitants of those villages. Otherwise, the notion of agrobiodiversity can remain as a theoretical concept, the benefits of which are understood only by a few people who are environmentally oriented. Such individuals are, unfortunately, short in supply; and (ii) successful implementation of the agrobiodiversity strategy requires the presence of a charismatic mentor whose leadership is widely accepted and who is extremely resourceful. It is very often the presence of such individuals who make a big difference to the successful implementation of agrobiodiversity policies and not other institutional mechanisms such as the BMCs. This, of course, has the danger of the whole strategy fizzling out with the eclipse of this mentor from the horizon.

Table 11: Rationale for selecting the four cases for in-depth examination for this study

Sl.No	Grama Panchayat	Rationale for selecting Grama panchayats
1.	Kanjikuzhi	<ul style="list-style-type: none"> • Self-sufficient in organic vegetable production and promoting agro-biodiversity.
2.	Eraviperoor	<ul style="list-style-type: none"> • Selected for the Best BMC award from National Biodiversity Authority in 2018
3.	Meenangadi	<ul style="list-style-type: none"> • Selected for the best BMC award from the Kerala State Biodiversity Board in 2018 • Received Special Mention from the National Biodiversity Authority in 2018

¹²The questionnaire that we used for interviewing key officials of the gramapanchayats are presented in Annexure-2

4.	Marancherry	<ul style="list-style-type: none"> Selected for the Best BMC award from the Kerala State Biodiversity Board in 2019
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Source: Own compilation

Against this background, this section of the study discusses the four cases. The case studies are structured as follows. We first provide a brief profile of the panchayat. This is followed by a discussion and evaluation of the formal institutional mechanism for maintaining agrobiodiversity, namely the formation of a BMC and the existence of a PBR. Subsequently, we distil out the specific strategies adopted by the villages. The common insights that we could learn from the four are summarised and presented in this section as well.

4.1 Kanjikkuzhi Grama Panchayat- Agrobiodiversity through livelihood strategies



Profile: Kanjikkuzhigrama panchayat is situated in Kanjikkuzhiblock panchayat of Alappuzha district bounded by Mannancherry, Muhamma, Thanneermukkam and Mararikkulamgrama panchayats. The total geographical area of the grama panchayat is 16.62 sq.kms. The panchayat has 8516 families across 18 wards and the total population is 29951 persons¹³. Beginning from 1994 Kanjikkuzhi surpassed its geographical deficit of being sand-like soil-deprived region which was not suitable for vegetable cultivation with the collective effort of panchayat and government. The panchayat decided to come up with different policies and programmes that would encourage farmers to initiate organic farming with utmost dedication. In fact, twenty years down the line it is the only panchayat in the state that is self-sufficient in vegetable cultivation. The panchayat has a diverse cropping pattern (see Table 12).

BMC

BMC was formed in 2008, consisting of 8 members as per the guidelines. In 2011 BMC prepared People's Biodiversity Register (PBR). The BMC was reconstituted in 2015, but the minutes of the meeting are not available. After the reconstitution of the BMC, it has not been active, and no meeting has been conducted so far. The technical assistance and financial support from the State Biodiversity Board (SBB) have been received for the preparation of PBR. The BMC reported that they have participated in various training programmes conducted by the KSBB. It is reported that after the preparation of PBR, BMC is actively involved in the protection of 'kaavu' and afforestation activities by utilising MGNREGS labourers.

The Panchayat is associated with *Kudumbasree* and *Harithakeralam* Mission to implement an eco-friendly waste management system. Plastic waste is being collected from the houses and

¹³Data taken from Development Report of Kanjikkuzhi Grama Panchayat

institutions every month by *KudumbasreeHarithakarmaSena* at the rate of Rs.30/- per household. *Harithakeralam* Mission collects this waste for recycling purpose.

PBR

The PBR was prepared in 2011 July as per the instructions of KSBB. BMC members reported that the survey team comprising of *Kudumbasree* members, local people (who had traditional knowledge), students etc. have been deputed for each ward to collect the data. Each team consisted of nearly 20 people who are actively involved in the survey. They have collected information from the ward level and then consolidated it as per the guidance from the KSSB coordinators. The coordinators of KSBB have visited the Panchayat and have given orientation training to the survey team. The preparation of PBR was completed within three months. Yearly updation of the PBR seems to be missing in this panchayat. Therefore, verification of the biodiversity and species mentioned in the PBR was not possible. Moreover, the BMC was not active after this exercise. In 2015, BMC was reconstituted by the Panchayat but no Action Plan has been formulated since then. The PBR is not updated and it is reported that they have not received any clear order from KSBB for the updation of PBR. Annual review of PBR has not been conducted so far.

Agrobiodiversity of the Panchayat is significant as per the PBR. In the Panchayat 120 species of various crops are being cultivated. It includes 10 varieties of paddy and coconut, 41 varieties of 12 vegetables, 8 varieties of tapioca, 9 varieties of yam and 18 varieties of other tubers. Forty-seven varieties of medicinal plants were identified, and most of them come under the RET category. In the case of wild plants, 81 varieties of medicinal plants, 15 wild crops and 52 wild trees were also identified. As per the PBR 47 varieties of livestock and pets are being reared in the Panchayat. As far as ecosystem diversity is concerned, 44 *kaavu* and 22 wet lands have been identified. The cropping pattern of the panchayat is presented in Table 12.

It is reported that Panchayat is protecting ponds and water bodies by using geo-textiles (*coir bhoovasthram*) on the walls of ponds and canals with the help of MGNREGS workers. Cleaning of these water bodies has also been completed by utilising this scheme effectively. Planting trees, construction of bio fencing (*jaivaveli*), were the major activities of the Panchayat to protect *Illathukaavu*. *Illathukaavu* is popular with endemic species of wild plants like *calophyllumcalaba* locally known as *cherupunna*). But in the field visit, bio fencing was not seen anywhere in the *kaavu* and it was demolished and the premises of *kaavu* was being utilised as a playground. Lack of proper fencing and protection literally turned the *kaavu* into a littering ground. Only the fallen trees are not been taken away mainly because that is forbidden as per the local belief. A temple is still functioning in the middle of the *kaavu*. Such temples may be part of this entire *kaavu* ecology, but the question is how to protect the flora and fauna with the existence of a temple and activity around it. The panchayat is yet evolving a reasonable strategy to conserve this sacred place because, it seems, the existing mechanism will adversely affect the health and existence of the *kaavu* in the long run.

The primary function of the BMC is to maintain a document on local biological resources and associated traditional knowledge. Conservation, sustainable use, and documentation of biodiversity and equitable sharing of benefits, arising from its use, are also coming under the mandate of BMC. Generally, most of the Biodiversity Management Committees (BMC) in all local self-government institutions is not functional after the preparation of PBR and have failed to exercise their power and responsibility mainly due to the lack of awareness. Kanjikuzhi panchayat is also an example of this.

The panchayat has been very successful in maintaining agrobiodiversity in the panchayat by linking it to livelihood strategy and this appears to be working well as the people are deriving a continuous source of income. Although the formal institutional mechanism for managing agrobiodiversity exists in the panchayat, these have been invoked very rarely. The experience of the panchayat though worthy of emulation has not even been followed by neighbouring panchayats.

Table 12: Cropping pattern of Kanjikuzhi panchayat (as on March 31, 2019)

Sl.No.	Crops	Area under cultivation (in hectare)
1.	Paddy	110
2.	Coconut	1025
3.	Vegetables	300
4.	Areca nut	12
5.	Tapioca	60
6.	Tubers	90
7.	Pepper	30
8.	Banana	70
9.	Cashew nut	50
10.	Betel vine	10
11.	Jasmine, marigold	10
	Total	1767

Source: Kanjikuzhi Panchayat

4.2 EraviperoorGrama Panchayat



Profile: Eraviperoor grama panchayat is a part of Koipram block panchayat of Pathanamthitta district. It shares its boundary with Chengannur Municipality, Koipram, Kuttoorgrama panchayats and the Manimala river. The total geographical area of the panchayat is 18.64 sq.kms, and the total population as per the census 2011 is 25200 persons only across its 17 wards¹⁴. Eraviperoor the place has become economically prosperous due to large migration to the foreign countries. The place is renowned for different religious cultures and socio-cultural reformations.

¹⁴Data taken from Development Report of Eraviperoor Grama Panchayat

Eraviperoor grama panchayat is notable for its good governance and effective service delivery. Eraviperoor has become the first grama panchayat in the country to receive a national award for public administration. Moreover, this is also the maiden public administration award received by an institution or individual from Kerala. Eraviperoor grama panchayat has been recognised and awarded from several times for its excellence in the service delivery and now it becomes Eraviperoor model, which is replicating 12 States.

In 2013, Eraviperoor was selected for the award for biodiversity conservation instituted by the State Biodiversity Board and the Sanitation Award of the State Sanitation Mission. In the same year, the state Horticulture Department selected the village as a model hi-tech green village on account of banana plantations by 42 women groups who cooperated with each other to earn profits not just for themselves, but also for the village. This is the only panchayat in the state has received ISO-9001 certification for its Primary Health Centre (PHC). It has also won the state government's Health Award and Pain and Palliative Care Award for 2014-15. Now the PHC is converted as Family Health Centre (FHC) under *Aardram* Mission of Government of Kerala. FHC is functioning with ample facilities of Yoga, Fitness Centres etc. with the integration of the *Ayush* project. As far as the activities of Biodiversity Management Committee (BMC) are concerned, the panchayat was chosen for the award for Best BMC from National Biodiversity Authority in 2018.

Eraviperoor became the first grama panchayat in the country to provide free Wi-Fi to the general public. Villagers can access free Wi-Fi facility within a one-kilometre radius of five different panchayat institutions. Besides this, the panchayat has touch screen kiosks for the public to locate their files in ultra-modern Panchayat record rooms. The panchayat has given priority to e-governance at the grassroots level. It is reported that the panchayat is planning to implement 'Panchayat to People Kiosks' programme under its own risk. People can access the services of panchayat within their locality through these Kiosks. Software has been developed to implement this programme.

BMC

BMC was initially constituted on 10/12/2010 and reconstituted on 18/01/2015 with a chairperson, convenor, secretary and seven members. The major mandate of the BMC was the preparation of Peoples Biodiversity Register (PBR) in the beginning period; it was prepared on February 2011. The panchayat officials reported that BMC is functioning with three major areas, i.e., water conservation, food security and protection of the environment.

Water conservation

The panchayat constructed 1.45 lakhs rain pits for groundwater recharging under the monitoring of BMC. Protection and reformation of traditional water bodies, and mini drinking water projects, *Sujalam* drinking water project in association with the M S Swaminathan Foundation are the other projects implementing underwater conservation.

PBR

BMC reported that technical supports and capacity building had been received from state Biodiversity Board in the initial period for the preparation of PBR. Within the one year period, the whole process of preparation of PBR had been completed. The survey group for each ward had been formulated comprising of *Kudumbashree* members, local people and students to collect data. Total of 63 persons had been engaged in the survey for all wards. The survey had been completed within two months. There was no delay in preparation of PBR. Eraviperoor became the first grama panchayat in Pathanamthitta district in preparation of PBR. Financial support

from KSBB has been received by the panchayat for the preparation of PBR, creation of Star Forest and Carbon Neutral Project.

BMC has prepared a project as part of its Action Plan for the construction of organic fertiliser unit. This unit will collect all type of organic waste from the panchayat area for the processing of fertiliser. It is expected to avoid chemical fertilisers from the agricultural sector by supplying this organic fertiliser for the cultivation of Eraviperoor Rice and other agricultural crops. Organic farming has been promoting in the agricultural sector, especially for vegetables, but farmers are using chemical fertilisers in the paddy cultivation (Eraviperoor rice) extensively.

There was no separate scheme prepared for the protection of *Kaavu*,-wetland ecosystems. Annual review of PBR has not been conducted so far. As far as protection of natural resources is concerned, BMC is planning to implement 'Tree Pledging instead of Cutting' Project, Varattar Protection Scheme, Implementation of user fee for the houses having tiled courtyard etc.

As per the PBR data, nearly 140 varieties of agricultural crops have been cultivated including food crops, cash crops, spices, vegetables and tubers. Out of this 35 varieties of vegetables and 40 varieties of tubers had been identified. In the PBR, 104 varieties of medicinal plants, 76 wild animals, 10 items of flora and 15 items of fauna in the water bodies, had been recorded. Only 24 varieties of livestock and pets are being reared in the Panchayat. Two rivers (Varattar and Manimala), one canal and 4 *thodu* (water streams) and 2 ponds (under private custody) have been identified as water bodies within the panchayat area. BMC reported that PBR has to be updated and digitalised by adding up of new data based on the new survey. It is expected to be achieved within a short period of time.

From the field level observation, Eraviperoor panchayat is ensuring the involvement of BMC in the process of implementation of several conventional projects of grama panchayats also like construction of rain pits, agricultural promotion, providing drinking water etc., given these projects are related to environment assets. Rejuvenation of Varattar river, efforts for removing encroachments, etc., were the outstanding measures in front of the environment protection. A notable point is that conducting Eco-Grama Sabha in all wards was a unique attempt of Eraviperoor grama panchayat and it generated environmental awareness among the people. It also encouraged disclosing more suggestions and ensuring the participation of people in environment conservation.

4.2.1 Varattar-Aadi Pamba rejuvenation

The most important activity of BMC was the rejuvenation of a river - -Varattar and Aadi Pamba. Varattaar is a tributary of Aadi Pamba and it reaches Manimala River. Varattar was the main source of water for hundreds of households in its earlier period. This river had a natural importance that acted as a natural flood control mechanism between Pamba and Manimala rivers, carrying the excess water from both ways. Due to the land encroachment and sand mining, it became a drought river for the last 35 years, and some people were using the banks of this area for cultivation purpose. The grama panchayat has taken initiatives to sketch out the boundaries of the river using land records. It is reported that there were many hurdles that had to be faced in the initial time. BMC prepared an action plan under MGNREGS to rejuvenate the river, and the activities started in 2013-14. The rejuvenation activities were implemented with the people's participation. All obstructions towards the natural pathway of the river were removed by cleaning and chopping away of branches of trees by MGNREGS workers and local people, and removal culverts across the river.



Creation of river pathway

(Photo is taken from Panchayat records-PPT slides)

13.5 acres of riverbank has been regained with the magnificent efforts of the panchayat. The DPR is prepared and submitted to the *Haritha Keralam* Mission. The first stage has been completed within 3 months without any government aid, but Rs.80 crore has been announced for the rejuvenation by the state government in the second stage.

Varattar is flowing through the nearest local governments of Eraviperoor, i.e. Koippram and Kuttoor panchayats and Chengannoor municipality. Eraviperoor panchayat has triggered actions at the beginning for the rejuvenation of Varattar. It generated a compulsion to participate in other nearest local governments which are sharing the banks of Varattar. The rejuvenation of the river programme has become the major environmental conservation programme of nearest panchayats and Chengannoor municipality along with Eraviperoor panchayat with the support of district administration and *Haritha Keralam* Mission.

Varatte...Aaru.....(Let river come) Riverwalk campaign was organised by the local governments and hundreds of people gathered on the banks of Varattar river including political leaders, ministers and MLAs. It was a noticeable campaign, and it created awareness among the local people about the importance to rejuvenate the river. The river rejuvenation programme comes under the purview of state recognised River Rejuvenation Scheme now.



Riverwalk campaign

The flowing river

(Photos are taken from Panchayat records-PPT slides)

The grama panchayat has taken measures to remove all obstructions in the beginning part of the Varattar that connects with Aadi Pamba. This connecting point of Varattar with Aadi Pamba is a crucial place to ensure the water flow of Varattar from Aadi Pamba. The major efforts of river rejuvenation process of Eraviperoor grama panchayat have been executed in this area. The river started flowing through its forgotten path once the path was almost cleared by the abundant monsoon rain. The boat race has been conducted in the river Aadi Pamba with the initiatives of grama panchayat. This was a true festival for the people and they had celebrated immensely.

But Varattar has dried up now due to the scorching summer. Water flow can be seen only in a few places of the river. Sand wall and other types of blockages have been restricting the natural flow of Varattar. It is expected that the water flow will be restored after the monsoon. According to the Panchayat, more action is needed again to revive the river with the participation of nearest local governments. The present condition of Varattar is a dried river as shown below.



Present condition of Varattaar
(Photo is taken during our field visit)

4.2.2 Food security

Eraviperoor panchayat introduced a scheme for paddy cultivation with an aim to achieve self-sufficiency in rice production. The panchayat has identified 40-hectare fallow lands and has taken from the owners on the basis of lease and handed over to the farmers for the cultivation. An agreement has been executed by the panchayat with landowners. Seed, fertilisers and other infrastructures have been provided by the panchayat in association with Krishi Bhavan. Panchayat has created irrigation facilities for the paddy cultivation in the fallow land using MGNREGS workers. A fifteen-member *Kudumbasree* entrepreneur group named as '*Swadesabhimani*' procure paddy from the farmers at the support price fixed by the government with the fostering of the panchayat. After processing, the rice is packed in 5 kg and 10 kg cloth bags and sold to the needy people in the brand name of '*Eraviperoor Rice*'. A cloth bag unit is also functioning with the financial support of the panchayat. The subsidies for the procurement and marketing have been provided by the panchayat with the help of *Kudumbasree* Mission in the initial time. It is reported that *Kudumbasree* unit has now become profitable, and they are actively engaged in procurement, processing and marketing. The *Kudumbasree* members reported that panchayat is monitoring the functions of the unit and providing all kinds of necessary supports. In the absence of rice processing mill in the panchayat area, they depend on the nearest district for the paddy processing. Therefore panchayat is planning to establish their own rice processing mill with modern facilities, and it is expected to reduce the production cost of Eraviperoor Rice.

4.2.3 Environment

Eraviperoor grama panchayat has organised a special grama sabha- 'Eco-grama sabha'- in all the wards for environment conservation. It was the best method to spread environment awareness to the people. All suggestions emerged from the grama sabha have been recorded and formulated in an action plan based on it. Waste management is one of the important activities of the panchayat. A plastic shredding unit has been functioning in the panchayat, and it is also providing employment to a few women. Plastic waste is being collected from the houses and institutions every month by *Kudumbasree Harithakarma Sena* at the rate of Rs.30/- per household. These plastics are dumped into the plastic shredding unit for the processing. After shredding process, the plastics are handed over for the use of road tarring. It is reported that people from

outsidethepanchayat area are also collecting these processed plastics for road tarring purpose,therebygeneratinga reasonable income. Panchayat officials have reported that the maintenance cost of the road can be reduced through the promotion of plastic tarring roads. As per the records, 6714.5 kg plastics havebeen collected during the period from 2012-13 to 2017-18, out of it 5284 kg was used for road tarring and generated Rs.60650/- as income.¹⁵ A scheme for construction of compost pits in all households is also introduced for the processing of organic waste.

Varieties of trees have been planted in the panchayat area through the afforestation activity by utilising MGNREGS labourers. Medicinal plants are also planted in the premises of Family Health Centre. The QR code has been created for each plant and placed in it to get all information related to each plant. Lakhs of Areca nut tree have been planted in Aadipamba – Varattar area. Panchayat has released all encroachments in this area and planted Areca nut tree with the aim of getting Areca nut leaves (*paala*- local name) for the famous Hindu cultural festival ‘*padayani*’. Arecanut tree and its leaves- *paala* is an important item for the *Padayani* festival. Planting trees and medicinal plants and its conservation is an important activity of the panchayat in keeping with environment protection which is monitored by the BMC. The President of the panchayat said that littering waste and chopping trees are punishable in the panchayat area. A camera has been installed in important places, and panchayat will impose fine as per the recommendations of BMC.

Reducing street light billing to zero is another mission of BMC by fixing solar panels over panchayat and transferred offices. BMC reported that an effort had been taken to digitalise the PBR. BMC is planning to collect biodiversity data once again for the digitalisation. Along with this carbon-neutral study is ongoing now. The survey has been conducted in some wards of the panchayat to get the information related to the volume of carbon emission from each household and institution. A special grama sabha for carbon-neutral has been organised. The panchayat aims to become carbon-neutral village in 2020-21 by planting trees, reducing plastics and all type of pollutions.

4.3 Meenangadi Grama Panchayat- Creation of an artificial forest and becoming the first carbon-neutral panchayat in India



Profile:Meenangadi grama panchayat (GP) is located 1022 meter above the sea level and belongs to Sultan Battery Block Panchayat of Wayanadu district. The total area is 53.51 sq.km

¹⁵Data from panchayat records (PPT slides)

and having 19 wards and 8199 families. According to the Census 2011, the total population of the Panchayat is 33450. The average rainfall is 221 mm¹⁶. The major occupation of the people is agriculture and livestock rearing. The total agriculture area is 4919 ha., and major crops cultivated in the area are paddy, coffee, pepper, plantains, coconut, rubber, areca nut, ginger, turmeric, tapioca, elephant foot yam, great yam, taro root etc. The Panchayat is prosperous with four rivers i.e., Nurasipuzha, Purakkadipuzha, Chundalipuzha, Kuttirayinpuzha and 23 streams. The forest area is 2.7 percent of the total area of the Panchayat. A lot of public institutions are functioning in the Panchayat area. The public infrastructure comprising road connectivity, drinking water, electricity is also good. Besides this, the National Highway NH 766 (212), and State Highway pass through the panchayat area.

BMC

BMC of Meenangadi GP was formed in 2008. This is one of the first GPs in Wayanad who prepared People's Biodiversity Register (PBR). BMC was reconstituted on 14/11/2016. The Panchayat has appointed an active environmentalist Shri.Pavithran Master who is a retired government School headmaster, as the convenor of BMC. BMC has been functioning very actively and an Action Plan for environment conservation has been formulated since then. BMC is actively involved in the environment preservation activities apart from the preparation of PBR, which include conducting carbon-neutral study, the formation of Manikavu Bamboo Park, conducting biodiversity study- Kolagappara, *Kavukal*, seed bank, School level club activities, PBR updation etc. The immense support from active NGOs like MSSRF has been noted as crucial in the activities of BMC.

In 2018 Meenangadi won the best BMC award from the State Biodiversity Board and received a special mention from the National Biodiversity Authority. The BMC is functioning systematically in Meenangadi GP. The BMC meetings are organised every three months and minutes are maintained in the office. A separate office room is provided for the functions of BMC. The Rapid Assessment of Biodiversity loss due to floods and landslides has been completed with the support of MSSRF recently.

4.3.1 Activities of BMC

Carbon-Neutral Panchayat-More actions have been taken by Meenangadi with the aim of becoming India's first carbon-neutral panchayat. Carbon emission was estimated from transportation, energy, waste, Agriculture Forestry and Other Land Use (AFOLU). Meenangadi has conducted a waste audit and energy audit in households and institutions to measure the quantities of waste generation and energy emissions. Similarly, the emission from transportation has also been calculated. The carbon-neutral study has been conducted with the support of experts and NGO-ThanaL. Further actions have been coordinated by BMC with the frequent consultation with eminent experts, IIT researchers, experts from leading universities etc. based on the recommendations of the study. The efforts of Meenangadi are valuable and effectual in the context of Wayanad, which is one of the districts in the state that are labelled climate change hotspots.

Punyavanam – It is an artificial forest engendered by BMC in 44 acres of land. It has been conserved as a forest with the support of MSSRF, Social forestry and MGNREGS since 2005. MSSRF was the key player from 2005; later the panchayat and BMC have been involved actively from 2012 to create an artificial forest with the support of MGNREGS and social

¹⁶Data taken from Development Report of Meenangadi Grama Panchayat

forestry. Trees belong to 115 species of the Western Ghats region have been planted in *Punyavanam*, and now it became a forest having varieties of trees, birds and animals.

Pathirippara-Conservation and studies about biodiversity-A study has been conducted on the biodiversity system in Pathirippara under the monitoring of BMC with the support of MSSRF. The floristic study conducted by MSSRF, documented a total number of 142 taxa of flowering plants belonging to 123 genera and 54 families from this area. Dicotyledons dominate with 123 Species belonging to 108 genera 45 families constitute 86.6 percent of total flora and monocotyledons have 19 species 15 genera from 8 families constitute 13.4 percent of floristic richness in this rocky area¹⁷. This area has been conserving and protecting from rock mining and unauthorised human interventions. The panchayat is planning to explore this area for an eco-tourism point.

Protection of Kaavu and Keni- BMC conducted studies on 48 *Kaavu* and traditional *Keni* protecting by tribes. Protection of 48 *Kaavu* and promotion of traditional knowledge sharing is one of the major activities of BMC.

Traditional *Keni* (small water well constructed by tribes having crystal clear water) is an important water source of tribes, and they are considering this as holy water. A day of tribe family starts with this holy water, and it has natural and cultural importance. The water level of these *Kenis* will not change even in the drought situation.

Conversion of Barren land into cultivable land-Panchayat has identified acres of barren land after cutting teak which was distributed by the government to the tribes for their housing and livelihood in accordance with the Forest Right Act. This area was completely barren and isolated; nothing can be cultivated. The panchayat has taken a mission to implement livelihood agricultural project i.e., Agro root and Agro veg in this area. Tribes were not interested in living in this area because of the isolation and uncultivable barren land. Panchayat implemented Agro root project (supplying various kinds of tubers seeds for cultivation) with the labour support from MGNREGS. Tribes of this area are also included in the MGNREGS scheme so that they had cultivated in their own land with the government wage. This kind of support of panchayat created motivation for cultivation and attracted tribes to live there. Similarly, Agro veg project (supplying various kinds of vegetable seeds for cultivation) was implemented. Apart from this, various kinds of trees have been planted through afforestation activities in this area. There was no well water in earlier times. Six water wells are functioning now in this area after creating rain pits and greenery. Tribes are cultivating various kinds of vegetables and tubers and rearing live stocks in this area for their needs and selling purpose. Now the area can be seen as a normal greenery living place with the fabulous and exemplary attempts of panchayat and BMC.

Community Seed Bank-The measures have been taken for the conservation and extension of traditional varieties of crops especially paddy, pepper and tubers. The panchayat has identified farmers who have been cultivating the traditional crops and created a directory of farmers. The technical assistance, awareness, public recognition, seed fest, subsidies for cultivation etc. have been provided for them.

Attakkolli Biodiversity park-Conservation of screw pine plants and bamboo in the banks of the pond was a major activity of BMC. Screwpine has an exceptional capacity for the protection of the banks of rivers and canals from erosion. Its fibrous root system also helps in keeping the

¹⁷As per the data of floristic study conducted at Pathirippara by MSSRF

alluvial soil intact and maintaining the water-holding capacity of the soil. Premises of pond are beautifully maintained as a park with a tiled walkway and flowering plants.

Biodiversity clubs –BMC has formulated biodiversity clubs in the government, aided and un-aided schools. This is creating environmental awareness among the students.

Biodiversity Bamboo Park at Manikavu -All varieties of bamboos in the Western Ghats area will be protected in this park.

Other activities

BMC is conducting Biodiversity awareness campaigns frequently. Planting and conserving medicinal plants in the premises of the Ayurveda hospital and school garden is another activity of BMC. BMC has identified premises of school land for planting various species of plants by utilising the labour force of MGNREGS. A bamboo park consisting of various types of bamboo in a school has been designed and planted by BMC, which is a more attractive one and creates eco-friendly educational atmosphere. Planting highly Rare, Endangered and Threatened (RET) endemic plants of 45 species in the Purakkadi Devaswam land with the support of MSSRF (highly RET garden in four acres of land) is another project of BMC. It aims at all endemic highly RET species in the Western Ghats area of Wayanad which can meet at a single place. It is reported that an agreement has to be executed with the Devaswam Board to use their land for the planting of RET species. Discussions are ongoing to implement this project soon.

For protecting eco system BMC is actively involved in the conservation of traditional natural resources as mentioned above. BMC conducted studies on 48 *Kaavu* protecting by tribes, traditional *Keni* (small water well constructed by tribes), Pathirippara etc., Preservation of Attakkolly Jaiva Park, Maalikavu Bamboo Park, creation of artificial forest, conserving RET garden are the major activities of BMC taking into account of the protection of natural resources. A plastic shredding unit has been constructed to establish an eco-friendly waste management system. The panchayat is promoting door to door collection of plastic waste every two weeks in a month with the help of *Kudumbasree Harithakarma Sena* members. This waste is dumped into the shredding unit for further processing. The pipe compost units are also be given to the houses for biodegradable waste processing.

PBR

The PBR was prepared in 2012 as per the instructions of KSBB. The survey team had been formulated for each ward of the panchayat. Each team had 10 people comprising of experts, teachers, students and ward members. All data of biological resources have been collected and recorded. Training and supports, technical advice and financial assistance from the State Biodiversity Board have been utilised. As per the PBR, Meenangadi has 156 types of agricultural crops in cultivation including 71 types of paddy, 20 types of vegetables, 23 types of tubers, 41 types of cash crops and one type of *Ragi*. Considering the fruit crops, 52 types were cultivated. A lot of wild plants had been identified which included 88 types of wild medicinal plants. The total number of floral species was recorded as 572. The total number of faunal species was 327, which included 272 wild animals.

Paddy, various tubers, vegetables, *ragi*, plantains, mango tree, jackfruit, lemon, etc., have been identified as the agro biological resources in the panchayat area. Meenangadi GP introduced the seed bank programme to protect these resources by providing technical assistance, awareness programmes, public recognition, seed fest etc., to the identified farmers to cultivate the traditional crops. Organic vegetable cultivation is being promoted by the GP. It is ongoing in 67

acres of land. These organic cultivated vegetables are sold through *Kudumbasree* fest, *Onam* fest, *Vishu* fest etc., and through the selling outlet run by *Kudumbasree*.

The PBR was prepared seven years back. It is reported that the data is almost collected again for the updation of PBR. An NGO has been identified by the panchayat to digitalise the PBR and the advance amount of money has been transferred already. BMC reported that it has been informed from the State Biodiversity Board that the digitalisation process has to be ensured by using the official software. But the software of Bio-Diversity Board is in developing stage only. Therefore the updation of PBR is pending.

From the field level evaluation of BMC of Meenangadi grama panchayat, it is observed that there is no separate fund for the programmes of BMC. Such paucity of funds of BMC was overcome by the panchayat through its splendid efforts of discerning allocation strategy. Some of the projects implemented by the panchayat are directly or indirectly related to the environmental assets. The panchayat is able to allocate enough funds in the budget to implement such projects. Panchayat officials reported that consultation with BMC members has been ensured in the process of implementation of projects which are directly or indirectly related to environmental assets. Therefore such projects can be implemented in accordance with the action plan of BMC. Effective use of MGNREGS and coordination of other schemes are the key factors of the success of Meenangadi. Moreover, measures of Meenangadi to become India's first carbon-neutral panchayat are the exemplary efforts and valuable in the context of biodiversity conservation.

4.4 Marancherry Grama Panchayat-Maintenance of *Kole* Wetland



Profile: Marancherry grama panchayat is located at Perumbadappu block panchayat of Malappuram district. The total geographical area of the panchayat is 20.47 sq.kms, and the total population is 35360 persons across its 19 wards¹⁸. Marancherry is nearest of Ponnani Municipality and Veliyamcodu, Edappal grama panchayats and bounded with rivers, canals and Biyyam Lake. The majority of people depend on agriculture. Coconut is the major crop in cultivation. A large number of water bodies, canals, and small water streams are flowing through Marancherry village.

¹⁸Data taken from Development Report of Marancherry Grama Panchayat

BMC

BMC was initially constituted in 2011 as per the government order. But it was not active until 2015. The BMC has embarked on its activities after its reconstitution in 2015. BMC has been conducting meetings every three months, and the minutes of the meetings are recorded properly. An Action Plan has been formulated for the activities of BMC which includes water conservation, mangrove conservation, wetland conservation, creation of *Nakshathravanam* (Star Forest) project etc. Guidance and training from State Bio-Diversity Board has triggered the smooth functioning of BMC. It is reported that the grama panchayat allocated one lakh rupees for preparing PBR. SBB sanctioned an amount of Rs.4.5 lakhs considering it as a model BMC, for further activities, mainly for the creation of *Nakshathravanam* (Star Forest). In the furtherance of creating environmental awareness, BMC had conducted an exhibition cum symposium. In 2019, Marancherry has been selected for the best BMC award of Kerala State Biodiversity Board.

4.4.1 Activities of BMC

a) *Water conservation*

A lot of water bodies like canals, streams (*thodu*), ponds, rivers, and Biyyam lake is flowing through the panchayat area. Protection of these water bodies is one of the major activities of the panchayat. It is reported that 7.2 kms of new streams/*thodu* has been constructed and more than 15 kms of old streams have been rejuvenated. New ponds have been constructed in the private lands as per the needs of the farmers/individuals under MGNREGS scheme. It will also be amplified groundwater recharging. Cleaning of water bodies, construction of sidewall, paving geotextiles, are also implemented through this scheme. The panchayat has taken initiatives for planting bamboos in the river and canal sides through MGNREGS under the monitoring of BMC to prevent soil erosion.

b) *Mangrove and Bamboo planting/conservation*

Natural mangrove forest can be seen in some areas of the panchayat. The panchayat has taken measures to conserve these mangroves and replanting new mangroves in the river and lakesides. BMC officials reported that more than thousand new mangroves have been planted in the lakesides by the applying labour force of MGNREGS. Moreover, various kinds of bamboo have been planted in the river and canal sides.



Mangrove Bamboo

(Photos are taken from field visit)

c) *Plastic processing unit*

A plastic processing unit has been functioning in the panchayat area. This unit is managing by the panchayat to ensure eco-friendly waste management system. This unit is also providing employment to a few people and the wages met by the panchayat. Plastic waste is being collected from the houses and institutions every month by *KudumbasreeHarithakarmaSena* at the rate of Rs.30/- per household. These plastics are dumped into the plastic processing unit. After sorting, the plastics carry bags are put into

the processing machine for liquefying by electric heating. The liquid form of plastics will be turned into dry pieces which are sold to private companies for the manufacturing of tarpaulin sheets and other value-added products. Panchayat officials reported that plastics from nearest local governments are being brought to this unit for processing. It is reported that the environment pollution clearance has been accredited already by the Pollution Control Board. With regard to biodegradable waste processing, biogas and pipe compost units are also being promoted.

d) Biodiversity documentation

MarancherryKole wetland is one of the key biodiversity areas which has been identified by the State Biodiversity Board. The Kole wetlands are low lying fields located 0.5 to 1m below Mean Sea Level. The Kole Wetlands is one of largest, highly productive and threatened wetlands in Kerala. The Kole lands are faunal rich and support a large number of birds including endangered and migratory birds. It also provides services such as flood control, groundwater recharge, and acts as a carbon sink.

The biodiversity in MarancherryKole wetland has been documented with the astonishing support of panchayat. The biodiversity richness of Kole wetland has been documented systematically which includes 144 floral species, 21 species of mammals, 14 species of reptiles, 06 species of amphibians, and 244 species of birds. This was a remarkable effort of the panchayat for the conservation of Kole wetland area.

e) Exhibition cum symposium

An exhibition cum symposium had been conducted to generate environmental awareness among the public. Many experts, teachers, stakeholders, NGOs, etc., had participated in the symposium.

f) Promotion of paddy cultivation /endemic species of tubers

Panchayat officials reported that a project for promoting paddy cultivation in 5 acres of land had been implemented with the support of Youth Clubs. It is expected to create a passion for paddy cultivation among the youths. All other supports, i.e., seeds, fertilisers, subsidies, etc., have been supplied to the farmers. Furthermore, endemic species of tubers have been identified, and its seeds have also been supplied to the individuals for the promotion of endemic tuber production.

g) Nakshathravanam

Nakshathravanam (Star Forest) project aims at planting trees based on the birth star of the people. Each birth star has its own tree as envisioned in the concept of Hindu religion and belief. State Biodiversity Board sanctioned Rs. 4.5 lakhs for the creation of *Nakshathravanam*. The panchayat is planning to create *Nakshathravanam* near to the public crematorium.

PBR

Marancherry faced delay in preparation of PBR because of BMC was not active in the initial period. The PBR was prepared in 2018 as per the instructions of State Biodiversity Board. The State Bio-Diversity Board has provided training, guidance and support for the preparation of PBR. The grama panchayat allocated one lakh rupees for preparing PBR. The survey team comprising of 2 people for each ward was formulated. The support and participation of teachers, students and ward members was used by the survey team. It is reported that all possible biological resources have been documented properly because Marancherry prepared PBR very

recently. The process of preparation of PBR has been completed within one-year. A project is prepared now for the digitalisation of PBR.

As per the PBR, 23 varieties of food grains particularly paddy have been identified. Along with this, 36 varieties of vegetables, 13 tubers and 12 varieties of cash crops have also been identified. Forty varieties of medicinal plants, 28 varieties of wild medicinal plants, 19 items of livestock and pets and 25 wild fish wealth items have also been recorded in the PBR. There are existing 80 watersheds, including streams/*thodu* and ponds.

As far as the conservation of RET species is concerned, panchayat is planting and protecting mangroves. Panchayat is implementing several schemes for protecting ecosystem like wetlands, mangroves and *kaavu*. Biodiversity Clubs are functioning well in the schools. A local survey has been conducted by NGOs with the monitoring of panchayat for assessing carbon emission to address the issues of climate change.

Marancherry grama panchayat is a notable village in the case of natural resources like mangroves, canals, ponds, lake, rivers, *Kole* wetlands, *kaavus* etc. The panchayat is implementing several schemes considering its ecological importance. Most of the schemes are implemented through MGNREGS. Activities of MGNREGS based on the environment assets generally come under the purview of BMC. The convenor of BMC is very active in monitoring all the activities which have natural importance. Therefore, it can be projected as the activities of BMC for the protection of the environment. On the basis of such tasks of BMC which includes conservation of traditional water bodies, creation of new ponds and streams, biodiversity documentation of *Kole* wetland, planting bamboos and mangroves in the canal and lakeside, eco-friendly waste management system, symposiums for environmental awareness building etc., Marancherry has been awarded by the State Biodiversity Board as the best BMC in 2019.

4.5 Insights from the four case studies

Table 13: Summary of major achievements of the grama panchayats

Sl.No	Grama panchayat	Major Achievements
1.	Kanjikuzhi	<ul style="list-style-type: none"> • Only panchayat in Kerala that is self-sufficient in organic vegetable production • Promoting livelihood opportunities through vegetable cultivation
2.	Eraviperoor	<ul style="list-style-type: none"> • Rejuvenation of Varattar river • Conducted Eco-Gramasabha for environment protection • Promoting Eraviperoor Rice to meet the local needs
3.	Meenangadi	<ul style="list-style-type: none"> • Conducted carbon-neutral study to become India's first carbon-neutral panchayat • Created an artificial forest • Conserving biodiversity spots in Kolagappara hill, tribal areas etc.
4.	Marancherry	<ul style="list-style-type: none"> • Biodiversity richness of <i>Kole</i> wetland has been documented • Conserving water bodies by planting bamboos and mangroves

Source: Own compilation

- PBR is prepared in all selected grama panchayats. Eraviperoor and Kanjikkuzhi prepared PBR in 2011, Meenangadi in 2012 and Marancherry prepared in 2018.
- The way of preparation of PBR was more or less similar in all selected panchayats in reliance on the guidance of the State Biodiversity Board.
- The updation and digitalisation of PBR is the next task of all BMCs. The initial works already started.
- All grama panchayats are keeping minutes of the meeting of BMC except Kanjikkuzhi.
- BMCs in all selected panchayats have been reconstituted once.
- Separate office room for BMC has been seen in Meenangadi gramapanchayat only.
- Plastic shredding units are functioning in all selected panchayats except Kanjikkuzhi for ensuring eco-friendly waste management system. In Kanjikkuzhi, *Harithakeralam* Mission collects plastic waste for recycling purpose.
- Normally there is no separate fund for the Action Plans of BMC except special funds from State Biodiversity Board for model BMCs. Such paucity of funds of BMC was overcome by the panchayats by integrating selected conventional projects of panchayats which are directly or indirectly related to environment assets into the Action Plan of BMC.
- Effective use of MGNREGS is a pivotal factor for the best performance in the selected four grama panchayats. Majority of the heads under MGNREGS like afforestation, water conservation, drought proofing, and renovation of water bodies etc., which are direct benefits to the environment conservation. Therefore, MGNREGS can be considered as a scheme which contributes to the environment protection at the local level along with the employment generation. These grama panchayats ensure the monitoring of BMCs in the implementation of such projects. In other words, the majority of the activities of BMCs in accordance with the Action Plan have been implemented through MGNREGS.
- Effective integration of various schemes, i.e., schemes of transferred institutions like Krishibhavan, departmental schemes, centrally sponsored schemes (MGNREGS), etc., have been brought out in line with the plan formulation in selected panchayats. For instance, an attempt has been made by these panchayats to enhance the paddy cultivation was by using labour force of MGNREGS and seeds, fertilisers and other supports from Krishibhavan.
- Measures of Meenangadi to become India's first carbon-neutral panchayat and creation of artificial forest, efforts of Eraviperoor in the rejuvenation of Varattar river, conducting Eco-Gramasabha and promoting Eraviperoor Rice, attempts of Marancherry in the conservation *Kole* wetland have been observed as exemplary steps in the context of biodiversity conservation.
- Kanjikkuzhi grama panchayat is renowned for the vegetable cultivation and it has been observed as a life culture of the people of Kanjikkuzhi. Providing seeds and all other supports to promote vegetable cultivation in all households, identifying barren land to cultivate vegetables by using MGNREGS labourers under the monitoring of panchayat, maintaining vegetable shops to promote marketing, are the major activities of Kanjikkuzhi grama panchayat in this context. The attempt of Kanjikkuzhi grama panchayat to promote vegetable cultivation can be considered as a unique in the context of agrobiodiversity promotion.
- Role of NGOs, stakeholders, activists, etc., is very crucial and inevitable for local development, particularly in environment conservation. Active involvement of such groups was significant in selected grama panchayats, and it was the backbone for the best performance of these panchayats.

- An approach of grama panchayats to identify NGOs, stakeholders etc., in connection with the particular focussed area and to make a platform to involve them can be considered as a foremost step in the development process. It has been witnessed in selected grama panchayats.
- Political coordination in the development of grama panchayat has been noticed as a vital factor for the best performance.

5. Potential areas for further research

The study has thrown up a number of possible areas for further inquiry and research. All these are important from the public policy point of view.

Role of Local Self Government Units in promoting agrobiodiversity in their panchayat:

The current mode is through the formation of Biodiversity Management Committees and the documentation of biodiversity at a particular point in time through the preparation of People's Biodiversity Registers (PBRs). During our field research in four model panchayats we found that this was not working at all. Most of the BMCs have been dysfunctional, and PBRs once framed are never updated. It must be digitised and annual auditing by an accredited agency should be encouraged. It is important that the state government put in place some financial incentive schemes for proper functioning of the BMCs. The proposed research should focus on the type and size of this financial incentive scheme.

In this context, although the government has constituted a 13th working group on environment, biodiversity and climate change with BMC as members, their role has remained merely advisory and so far no funds have been allocated to them as well.

Role of Government Research Institutes in developing knowledge for mainstreaming agrobiodiversity:

There are a number of public research institutes in the state focusing on agrobiodiversity. However, they have been functioning in a vacuum, often doing research without any coordination with the Biodiversity Board. This coordination could be achieved by linking these institutes to the Kerala State Biodiversity Board so that an annual research plan be made and a consortium be formed to develop the requisite knowledge.

Strengthening the role of the Kerala State Biodiversity Board specifically in the area of agrobiodiversity:

The board has to be strengthened both financially and in terms of human resource so that it can play its coordinating role much more effectively than now. The precise ways in which the board may be strengthened will form the focus of this research. The working relations of KSBB with all the institutions in the state working on agriculture is to be strengthened. The role of KSBB at the district level requires special attention.

Assessing the fiscal support for agrobiodiversity management: Of the total budget allocation for agriculture only a miniscule amount is allocated for agrobiodiversity management. A higher allocation is to be made after making a detailed study of the budgetary requirements.

Role of NGOs/CSOS in the diffusion of knowledge on agrobiodiversity: Since NGOs work with local communities, they can build effective bridges between GRIs and local self-governments. The research here should focus on these specific ways in which this bridge-building can be effected.

Documenting success stories from Panchayats and BMCs: There are a limited number of panchayats that have been very successful. However, each of these has adopted a different

strategy for maintaining agrobiodiversity. Some have taken to vegetable cultivation and linked it with livelihoods; others have been focusing on the planting of different species of trees while still others have been improving waterbodies and thereby the supply of water for irrigation. These stories need to be written up so that other panchayats which are laggards can learn from the successful ones.

Role of IPRs in promoting agrobiodiversity: A number of IPRs such as GI and Plant Varieties have been issued recently. It can have two possible effects. For instance, by having different varieties of rice (for instance, having a GI for *Navara* rice may enthrall farmers to have it cultivated) will certainly contribute to the maintenance of agrobiodiversity. On the contrary, having a GI tag can also result in monocropping

Impact of Free Trade Agreements (FTAs) on agrobiodiversity: There are about 9 FTAs that are in force, and three more are in various stages of negotiation. One of the impacts of these free imports of agricultural goods can have a deleterious effect on agricultural crops and thereby on agrobiodiversity. However, it is also possible that such free imports can also affect certain monocrops more adversely than in its place a more diverse vegetation can spring up. The area under most of the monocrops has shown a steady decline.

The extent to which the BD Act in the state meet the National Biodiversity Action Plan and the National Biodiversity Targets (NBTs); This is an area which requires constant monitoring and mid-course correction. The KSBB may be equipped to carry out this annual monitoring. It is a kind of action research that we are suggesting.

Identification of major physical threats to agrobiodiversity: It is generally recognised that invasive species is one of the major threats. A regulatory mechanism for controlling the introduction of invasive species as exotic flora and fauna needs to be designed.

Impact of climate change on agrobiodiversity: Extreme weather events such as severe floods and drought are now occurring, unfortunately rather regularly leading to a deleterious effect on agrobiodiversity. A study on possible ways ameliorating the negative effects of these extreme weather events is essential.

6. Conclusions

It looks that there is an awareness of the importance of protecting agrobiodiversity at the state level and also among a number of non-governmental and civil society stakeholders. However none of the LSGs that we studied had any intimate knowledge of NBAP and NBTs. The state has also put in place a number of legal and policy instruments aimed at protecting biodiversity in general (which include agrobiodiversity too). There is also an organisational mechanism (Kerala State Biodiversity Board) to steer the agenda in this regard. The research institutes are by and large aware of the impact of their actions on biodiversity. A significant share of local governments has completed the formal requirement of preparing PBR as advocated by the KSBB. A few of them consider the conservation of local biodiversity as an important agenda and take different steps in this direction.

The other important aspect in Kerala is that a more-diverse cropping system seems to be economically attractive compared to a less-diverse or mono-cropping system. This could be due to agro-climatic and economic conditions. The latter include the need for more labour for monocropping systems, which makes it less attractive in Kerala where the cost of labour is higher, and where there are possibilities of nurturing profitable multi-crop systems. This gives certain economic incentives to the farmers and land-owners to sustain a relatively diverse farming system, which in turn helps the conservation of agrobiodiversity.

However, there are a number of limitations or challenges too. These include :

Though there are legal and policy instruments, there is not enough clarity on the mobilization of resources and mechanisms for their enforcement. Hence, some of these legal/policy provisions remain as wish statements. One can interpret this as an outcome of a situation where there is an awareness on the need to protect agrobiodiversity at the state level, but that is not translating into workable strategies for its protection due to other constraints of the state government.

To some extent, this is true with regard to the Kerala State Biodiversity Board too. On paper, it has a number of responsibilities and if these are undertaken, can go a long way in protecting the biodiversity. However, it does not have adequate financial resources and authority for this purpose.

Kerala is yet to put in place a system of auditing all policies which can have potential negative impacts on agrobiodiversity. These include the policies and programmes for the promotion of agriculture and plantation crops in general. However growth in area of most of the plantation crops in the state has been limited by adverse market conditions.

Though PBR is the main instrument and a major share of local governments has prepared it, it is seen as more of a task to be completed at a point of time. It is not seen as a basis for building up agro-biodiversity by most local governments. This may be seen as an outcome of a top-down approach towards conservation where the awareness at the state level has not translated to the level of local governments and communities.

It can be seen that the use of PBR and other actions for the purpose of protecting agro-biodiversity are notable in the case of certain local governments. The role of one or a few people is crucial in this regard. This shows that the success of the local-level collective action requires the presence of a few well-informed and active individuals. This is not unusual considering the status of collective action which is taken to address the market failure in other domains too in countries such as ours.

It looks that there is an awareness of the importance of protecting agrobiodiversity at the state level and also among a number of non-governmental and civil society stakeholders. The state has also put in place a number of legal and policy instruments aimed at protecting biodiversity in general (which include agrobiodiversity too). There is also an organisational mechanism (Kerala State Biodiversity Board) to steer the agenda in this regard. The research institutes are by and large aware of the impact of their actions on biodiversity. A significant share of local governments has completed the formal requirement of preparing PBR as advocated by the KSBB. A few of them consider the conservation of local biodiversity as an important agenda and take different steps in this direction.

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Annexure 1

Questionnaire for PRIs

Centre for Development Studies
Thiruvananthapuram

Agrobiodiversity Project

Name of Institution	
Key Areas	
Year of established	
<u>Contact Details</u> Address	
Phone: Email: Website:	

i) Major Activities

Sl.No.	ACTIVITIES

ii) Major Achievements

Sl.No.	ACHIEVEMENTS

iii) Biodiversity

a) How does the work of the institute affect/promote biodiversity?.....

.....
.....
.....
.....

b) How long the institute has been working in this front?

c) How do you consider the impact on biodiversity while designing your project/program?.....

.....
.....
.....
.....

d) What are the initiatives taken for the bio diversity conservation?.....

.....
.....
.....

.....
.....

e) How many species are preserving/maintaining by the institute?

Sl.No.	Species	Remarks

f) Have you identified Rare Endangered and Threatened (RET) species? Yes /No

g) If yes, do you have database of RET species? Yes /No

h) What are the steps taken for the conservation of RET?

.....
.....
.....
.....

i) Do you have developed new varieties? Yes /No

j) If yes, give details.....

.....
.....
.....

k) Role of institute in the development of Agro bio diversity?.....

.....
.....
.....

l) Are you promoting organic farming? Yes /No

m) If yes, give details.....

.....
.....

iv) **Natural resource management**

Sl.No.	Activities	Result/outcome

v) **Relations with Local Governments**

a) Do you have link/association with local governments? Yes /no

b) If yes, answer the following.

Sl.No.	Particulars		Remarks
1.	Name of local government		
2.	Type of relationship		
4.	Financial support	Yes /no	
5.	Project Implementation level	Yes /no	
6.	Natural resource management	Yes /no	
7.	Bio diversity conservation	Yes /no	
8.	Livelihood enhancement	Yes /no	
9.	Community mobilisation	Yes /no	
10.	Others (specify.....)	Yes /no	

c) Do you contribute information for the preparation of People's Bio diversity Register (PBR)of the Local Government? Yes /no

Give

details.....

.....

.....

Annexure 2

Questionnaire for LSGIs

Centre for Development Studies
Thiruvananthapuram

Agrobiodiversity Project

District:

Taluk

Name of Block Panchayat:

Name of Grama Panchayat :

Date

Contact Details

Address of GramaPanchayat office :

Telephone number :

Name of the President :

Telephone number of the President :

I Biodiversity Management Committee (BMC)

Sl. No.	General Information	
1.	Formation date	
2.	Number of members (SC/Women/Gen.)	
3.	Did you reconstitute BMC?	Yes/no
4.	If yes, how many times?	Once/ twice/thrice
5.	Meeting of BMC	Once or twice/Monthly/every 3 months /6months/yearly/Nil
6.	How many times BMC meeting is conducted after preparation of PBR?	
7.	Are you keeping minutes of the meeting	Yes/no
8.	Do you have prepared an Action Plan	Yes/no
9.	Give details of Action Plan
10.	Did you get guidance from Technical Support Group (TSG) for formulating Action Plan?	Yes/no
11.	Did you get capacity building/skill development from Bio Diversity Board?	Yes/no
14.	Sources of fund	NBA/ SBB/Line dept./LGfund/others
16.	How much allocated for PBR preparation?	Rs.....
17.	How much you spent for the PBR preparation?	Rs.....
18.	What are the activities undertaken except PBR?	
19.	Did you participate in Rapid Assessment of Biodiversity loss due to floods and landslides at local level recently?	Yes/no
20.	Give details.
21.	Did you get any BMC award? or applied ?	Yes/no, if yes, year.....

II. Peoples Bio diversity Register (PBR)

1. In which year PBR is prepared?
2. How many days are taken to prepare PBR?
3. How many people are engaged to prepare PBR?
4. Details of survey team.....
.....
.....
5. Did you cover all data of biological resources in your area? Yes /No
6. If No why? Reasons.....
.....
.....
.....
7. Have you faced delay in preparation of PBR? Yes /No
8. If yes Give details.....
.....
.....
9. Have you got training to prepare PBR? Yes /No
Give details.....
.....
10. What are the assistance/support got from the Bio Diversity Board?.....
11. Total number of floral species and individuals identified in your area?.....
12. Total number of faunal species and individuals identified in your area?.....
13. What are the initiatives taken to conserve these resources?.....
.....
.....
14. Have you identified Agro Biological Resources in PBR? Yes /No
15. If yes what are the resources?.....
.....
16. What are the actions taken to protect these resources?.....
.....
.....
.....
17. What are the activities undertaken for the organic farming, conservation and marketing for the traditional agricultural crops?.....
.....
.....

18. What are activities carried out for sustainable use of biological resources?.....

.....

19. Did you identify any medicinal plants in your area? Yes /No

20. If yes, what are the initiatives taken?.....

.....

21. Are you identified any Endemic Species of flora and fauna in your area? Yes /No
 (If yes, answer Q.22 & 23)

22. Provide the details of major endemic species

Sl.No	Floral species	Faunal species
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

23. What are the steps taken to conserve the Endemic Species?.....

.....

24. Have you identified Rare Endangered and Threatened (RET) species? Yes /No
 (If yes, answer Q.25 & 26)

25. Provide the details of major RET species

Sl.No	RET floral species	RET faunal species

26. What are the steps taken to conserve the RET species?.....

.....

.....

27. What are the activities undertaken for protecting eco system (wetland, mangroves, *kaavu* etc. if existing)?.....

28. Do you update PBR ? Yes /No
29. If no, what are the problems in the updation of PBR?.....

30. Do you get instructions/guidance for updating of PBR from SBB Yes /No
31. Have you conducted annual review of the PBR? Yes /No
32. If no, give reasons.....
33. Do you have Bio Diversity Clubs? Yes /No
34. Did you organise or participate '*santhisthal*' project of Bio Diversity Board in your area?
 Yes /No
35. If yes, give details.....

36. Do you have eco-friendly waste management system? Yes /No
37. Do you have any local action to survive the climate change? Yes /No
38. Did you plan any further action for protecting the natural resources? Yes /No
39. Give details.....

40. What are the suggestions for revamping BMC.....

41. Do you aware about the policies related to the biodiversity? Yes /No
42. If yes, list them.....

Annexure 3

Select bibliography on agrobiodiversity in Kerala

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