DAY AND NIGHT CANNOT DWELL TOGETHER

The human strand in the web of life

Loss of community knowledge and genetic resources

the negative impact of mainstream research and development policies

Volume 1

Community-based Biodiversity Management South Asia Programme, INDIA

GREEN Foundation in co-ordination with LI-BIRD, Nepal with funding support from The Development Fund, Norway

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Day and night cannot dwell together

The human strand in the web of life

A compilation of case studies on the loss of community knowledge and genetic resources due to the negative impact of mainstream research and development policies, and community-based biodiversity conservation strategies from the different agro-ecological regions of India

"Where is the life we have lost in living?

Where is the wisdom we have lost in knowledge?

Where is the knowledge we have lost in information?"

T. S. Eliot

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ABOUT CBM-SAP

LI-BIRD is diversifying choices and securing livelihoods in Nepal. It capitalises on local initiatives for sustainable management of renewable natural resources to improve the livelihoods of resource poor and marginalised people. Community-based Biodiversity Management – South Asia Programme (CBM-SAP) is an ongoing project of LI-BIRD's programme – Biodiversity for sustainable livelihoods.

http://www.libird.org

The Development Fund, Norway supports development projects through local partners in Asia, Africa and Latin America. DF believes that the fight against poverty must be based on sustainable management of natural resources. The Development Fund, Norway provides funding support to CBM-SAP.

http://www.utviklingsfondet.no

CBM-SAP is concerned with biodiversity conservation and use in South Asia. The regional co-ordinator is LI-BIRD, Nepal. Its main collaborators are Green Foundation, India; Green Movement of Sri Lanka, Sri Lanka; UBINIG, Bangladesh; and TAAAS, Tibet-China.

CBM-SAP, India has appointed GREEN Foundation as its national co-ordinator. It comprises a network of seven partners.

AGRAGAMEE adopts a rights-based approach to tribal empowerment. It uses integrated approaches to help tribal and poor communities to mobilise for self-sustainable development in remote pockets of Orissa.

http://www.agragamee.org

ANTHRA is an organisation of women veterinary scientists working on issues of livestock development in the wider context of sustainable natural resource use. Anthra is a resource centre offering training, research and advocacy initiatives in the areas of livestock, biodiversity and people's livelihood.

http://www.anthra.org

BAIF-MITTRA: BAIF Development Research Foundation is committed to sustainable rural development, food security and clean environment. Maharashtra Institute of Technology Transfer for Rural Areas (MITTRA), coordinates multidisciplinary development programmes in 26 districts of Maharashtra.

http://www.baif.org.in

GREEN Foundation is a community based organisation working with disadvantaged groups of small and marginal farmers, backward castes, tribals and dalits, especially women, in the semi-arid regions of South India, towards the conservation of agro biodiversity and the promotion of sustainable agriculture.

http://www.greenconserve.com

Keystone Foundation is a group for eco-development initiatives in the Nilgiris, working with indigenous communities to enhance the quality of life and the environment. Its integrated approach towards indigenous people addresses livelihood, conservation, organic market development, and culture and people.

http://keystone-foundation.org

Sahjeevan is reviving traditional economies and livelihoods with gender and conservation perspectives. It is empowering people with knowledge and environment friendly technologies in Kachchh district, Gujarat.

http://www.sahjeevan.org

Satvik provides farming families with access to sustainable organic farming practices. Its support for marketing of organic produce enables conservation of natural resources and a sustainable economy for farming families.

http://www.sahjeevan.org

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PREFACE

It was in 1992 when the United Nations Conference on the environment and development (UNCED) took place in Rio de Janeiro, the debate on whether it was saving the environment or pushing an unchartered development that was the future of this planet took a sharp note. This was followed by the popular slogan that many things were UNSAID at the UNCED. The sharp divide between the popular understanding and definition of development based on the premise that the earth's resources are infinite and can be ordered and re-ordered became the moot point of discussion between the developed and developing nations. The title of the book, Day and Night Cannot Dwell Together, follows this argument that "development" as defined today cannot co-exist with the conservation of the environment and natural resources.

The post-industrial revolution period though very short in comparison to the million odd years of evolution of life has dramatically turned the tide towards the destruction of life. The role of the human hand in it today cannot be undermined, though hitherto many cultures across the world have contributed to understanding the nuances of nature and the role that communities have played in enhancing the value of life.

Life on earth has been flourishing for aeons because nature has been efficiently cycling and recycling resources. The most sophisticated systems of nutrient recycling, water recycling, and the carbon, oxygen and hydrogen cycle have been supported by the vast biological diversity. This biodiversity is also the basis of the right of the communities to feed themselves and their families an adequate supply of healthful, nutrient-rich, toxin-free, culturally appropriate foods. It is in this context that the ethno-biologist Gary Paul Nabhan describes the phenomenon of food democracy.

Nabhan (2008)[1] quotes from Neil Hamilton, "The word 'democracy' comes from Greek words meaning 'people' and 'rule'. How then do we make the people

[1] Nabhan, Gary Paul, 2008, Where our food comes from: Retracing Nikolay Vavilov's quest to end famine, Island Press, Washington.

rule our food system? There are four essential pieces in the creation of a food democracy. The first is citizen's participation; all actors in the food system must have a choice, and the contribution and concerns of each group must be considered. Second, informed choices are necessary: questions, information and knowledge about how food is produced is key. Third, a number of choices are available to citizens." Although there are currently many types of food to choose from, most of the food is produced in the same faceless, industrial manner. "Fourth, participation in food democracy must happen at the local as well as national levels. One's food choices should be geared toward protection and development of the community whether this means buying from the community, farmer's markets or eating locally grown foods."

As is obvious, farming communities everywhere are faced with similar problems – market pressures, the fallout of industrial agriculture such as introduced pests and diseases, depleted soils and aquifers, increasing threats of drought, floods and other natural disasters .Given the varying agro-ecological conditions of a country like India, biodiversity plays an important role in providing the ecological security and the livelihood security for the people of the different regions.

Over the years, the survival of diversity has been wedged between the needs of the growing population and the consumptive development model. Today, we are witnessing what is called the sixth extinction, which, unlike the earlier five phases of extinction, is very much due to the human strand in the web of life.

It is well known that as many as seven thousand plant species have been collected or cultivated in human history. The world has gone through periods of transition from subsistence to settled agriculture. In early civilizations food was restricted to berries, shoots, leaves, roots and fruits that could be gathered. Communities living in areas bordering the forests such as the Kurumbas and Irulas of the Nilgiris continue to do so even now to the extent possible, sustained and nourished by the forest and subsistence agriculture. An understanding of the pharmacopoeia was developed through constant interaction with nature. Together with this, the choice of food was made according to social perceptions and cultural norms.

Over the years, this diversity has been shrinking to a precarious level. There is a drastic decline in both the diversity of crop species planted in agricultural systems and the genetic diversity within species referred to as genetic erosion. The decline has been estimated to be as much as 75 to 90 percent according to FAO.

The world's top ten crops (rice, wheat, maize, soybeans, sorghum, millets, potatoes, sugar cane, beet, and bananas) supply over three quarters of humanity's plant based calories and dominate the world's cultivated lands. The big three cereals - rice, wheat and maize accounting for more than half of all plant-based calories - form 84 percent of the total volume of world grain production (FAO 1992).

Diversity in agriculture has diminished over time with an impact on diets, health and culture in different agro-climatic regions. Historically, farmers have managed many varieties of seeds and breeds according to agronomic and culinary properties. Considering the need for a wide gene pool to improve and multiply genetic resources for food and agriculture, breeding requires access to seeds and breeds from the formal and informal sectors.

Native varieties suit the needs of quality, nutrition, resistance to droughts, pests and diseases and have a demonstrable yield. However, one of the popular myths in the wake of the Green Revolution is about the imminent need for genetically modified seeds to increase yields and provide food for the growing populations. Despite the Green Revolution that heralded the high yielding varieties by displacing the vast diversity that existed, and the large public distribution system, hunger has persisted for one-third of the population in India.

In the face of the threat to the lives and livelihoods of the vast numbers of small and marginal farmers and pastoralists; interventions to conserve biodiversity must be intertwined with the human strand in the web of life. Harnessing the nurturing potential of the human species is fundamental to conservation, as it is to ensuring food democracy, and survival as we deal with climate change. These are the concerns integrated into the community-based biodiversity management, South Asia programme, (CBM-SAP).

The objectives of CBM-SAP are to strengthen the capacity of farming communities in South Asia to conserve, utilise and benefit from their genetic resources through appropriate technical support, institutional mechanisms and policy interventions. The geographical coverage of the programme extends to Nepal, India, Bangladesh, Sri Lanka and Tibet-China. The CBM-SAP regional co-ordinator is Local Initiatives for Biodiversity, Research and Development (LI-BIRD), Pokhara, Nepal. The main collaborators in South Asia are GREEN Foundation, India; Green Movement of Sri Lanka, Sri Lanka; UBINIG, Bangladesh; and Tibet Academy of Agriculture and Animal Sciences (TAAAS), Tibet-China.

The concern for biodiversity conservation has brought together seven organisations as a network of CBM-SAP, India. The network partners are Agragamee, Anthra, BAIF-MITTRA, Keystone Foundation, Sahjeevan and Satvik co-ordinated by GREEN Foundation. Based in five agro-ecological regions of India, these organisations have a wide range of experiences that form a mosaic of knowledge and approaches to biodiversity conservation.

The understanding and interventions of the network organisations on biodiversity conservation entails the participation of indigenous, tribal communities, small and marginal farmers, and pastoralists on the conservation and use of plant and animal genetic resources. For instance, Agragamee and Keystone Foundation have been working with the tribals and indigenous communities in the forest and hill regions of Orissa and the Nilgiris of Tamil Nadu to revive their mixed cropping agricultural practices. BAIF-MITTRA has sought to conserve the rich diversity of paddy crops in Maharashtra while GREEN Foundation has been concerned with conserving the millet and dryland crops in Karnataka with the participation of farmers.

Anthra has sought to conserve the livestock diversity, especially, the Deccani sheep breed in the semi-arid tracts of Andhra Pradesh and Maharashtra, while Sahjeevan has worked with Maldhari pastoralists to conserve the Banni buffalo in the Banni grassland of Kachchh district, Gujarat.

The underlying tenet of the interventions has been to recover livelihoods based on biodiversity conservation and use, and to reclaim the lost and threatened genetic resources and biodiversity of the area, as well as the associated community knowledge and practice.

"Diverse portfolios of activities based on the contribution of agricultural biodiversity (e.g. crop cultivation, harvest of wild plant species, herding, fishing and hunting) and whole ecosystem management thus helps sustain rural livelihoods because they improve their long term resilience in the face of environmental change, adverse trends or shocks. In general, increased diversity promotes more flexibility. In this context, local organisations play a key role in co-ordinating such community-based adaptive responses to change." (Pimbert 2009) [2].

Dr. Vanaja Ramprasad
GREEN Foundation

[2] Pimbert, Michael, 2009, Towards food sovereignty: Reclaiming autonomous food systems, International Institute for Environment and Development (IIED).

INTRODUCTION

The earth's genetic pool has thinned at an alarming rate in the recent past. The diversity of genetic resources and biodiversity once expressed itself in terms of the varieties of plant and animal life, especially in the tropical regions. Agriculture and food production was an integrated enterprise that synchronised animal husbandry, crop cultivation and agro forestry. Ever since the industrialisation of agriculture, heavy external inputs have been used on the land in the form of chemical fertilisers to increase productivity.

In India, the last three or more decades have witnessed the introduction of the Green Revolution technologies and related agricultural policies. These have proved to be inimical to the conservation of agro-biodiversity and the interests of tribal communities, small and marginal farmers and pastoralists. The result has been an erosion of the plant and animal genetic resources, shrinking diversity in crop and livestock breeds, and the loss of related indigenous knowledge.

A variety of community and non-government organisations have been working with farming and pastoral communities on issues of biodiversity conservation and use. Thus, the Community-based Biodiversity Management, South Asia programme (CBM-SAP) was conceived to strengthen the capacities of farming communities in South Asia to conserve, utilise and benefit from their genetic resources through appropriate technical support, institutional mechanisms and policy interventions. The collaboration serves to promote the exchange of knowledge, experiences and genetic resources among organisations and farming/pastoral communities of South Asia.

Sharing is a first step towards learning, which gave birth to the idea of disseminating experiences as a set of published case studies. The attempt has been to address three broad questions:

- What are the main challenges to biodiversity conservation?
- How does one expand the existing community interventions/best practices in biodiversity conservation?
- What are the policy recommendations to mainstream the efforts to conserve biodiversity?

The case studies in this compendium comprising 2 volumes reflect on the policy and grassroots level factors that are leading to the shrinking of the diversity in species and within species. They highlight the interventions that have sought to promote biodiversity conservation and use through an increased reliance on broad-based ecological agriculture grounded in community knowledge, practice and livelihoods. The case studies cover the issues and experiences of community organisations and good practices pertaining to biodiversity conservation and use of plant and animal genetic resources in five agro-ecological regions of India:

- Eastern Plateau and Hills Region: Orissa – Agragamee;
- Gujarat Plains and Hill Region: Gujarat – Sahjeevan and Satvik, Kachchh district;
- Southern Plateau and Hills Region: Andhra Pradesh – Anthra; Karnataka – GREEN Foundation; Tamil Nadu – Keystone Foundation West Coast Plains and Ghat Region: Maharashtra – BAIF-MITTRA;
- Western Plateau and Hills Region: Maharashtra – Anthra.

Day and night cannot dwell together

Loss of community knowledge and genetic resources: The negative impact of mainstream research and development policies – Volume 1

Plant genetic resources

In the context of threats to biodiversity, and the lives and livelihoods of indigenous and tribal communities in the forest and hill regions of Orissa and Nilgiris, Tamil Nadu; Agragamee and Keystone Foundation have made valuable contributions to community and genetic diversity.

The denudation of forest cover and erratic rainfall patterns in recent decades, have caused rapid soil erosion in the hilly tribal areas of Orissa. It has made vast swathes of land unfit for the traditional practice of shifting agriculture. Commercial felling, plantation economy, dams and displacement have further added to the woes of the tribal farmers. However, the understanding that tribal agricultural practices, particularly mixed cropping, sustain biodiversity has informed Agragamee's interaction with tribal farmers in Orissa. Agragamee's

work with natural resource management has led it to develop strong tribal women's organisations that are active in processing and marketing agricultural as well as minor forest produce.

The shortcomings of government tribal development and natural resource management projects have led Agragamee to promote organic conservation agriculture which is in tune with traditional mixed cropping practices. Thus, Agragamee is working with the tribal communities to promote the farmers' varieties through seed mapping, characterisation, and cropping patterns and practices so as to promote food, income and ecological security.

Located in the Nilgiri hills of Tamil Nadu, Keystone Foundation traces the impact of the denudation of the forests on the lives, livelihoods and knowledge reserve of the Kurumba – a primitive tribal group of the area. Displacement due to development and ill-conceived resettlement policies have forced the Kurumba to abandon their mixed cropping millet farming practices as they struggle to eke out a living from untenable tea and coffee plantations. The impact of the tea and coffee growing on the Kurumba community has been manifold. They are increasingly dependent on the market and their lands require high labour inputs. Their food diversity, health and nutrition have been compromised. Poor soil conditions have resulted in poor yields. The shift to growing tea and coffee has resulted in an immense loss of cultural and agricultural knowledge and practices.

With the growing threat from the public sector which provides certified seeds and the recent entry of the private sector that has flooded the market with hybrids, a large proportion of the farmers' varieties have been sent into internal exile. Farmers who used to produce and exchange seeds have lost ground to the private sector. If the indigenous diversity, which is the bedrock of food security for the small and marginal farmers, has to survive, some immediate interventions are required.

Recognising the need of the hour, BAIF-MITTRA endeavoured to empower the farmers to recover the threatened and lost indigenous rice biodiversity in Maharashtra through action research on the traditional practices associated with indigenous paddy cultivation, the status on indigenous rice genetic biodiversity,

and the characteristics of paddy landraces. Their focus is on sustainable farming, rural livelihoods, food security, nutrition and health through conserving the threatened paddy biodiversity.

In the context of government policies, pest and disease attacks, and increasing fragmentation of land holdings all of which threaten indigenous rice biodiversity, BAIF-MITTRA has collaborated with farmers to save the endangered landraces. Their seed conservation initiative is centred on knowledgeable farmers, specifically their knowledge of seed selection, cultivation, storage and propagation of seeds.

Open pollinated seed varieties, which represent an important gene pool for resource-poor farmers living in marginalised and stress-prone areas, are rapidly vanishing. They are replaced by very few high-yielding varieties which require inputs that poor farmers can ill-afford and which entail dependence on large seed companies and irrigation, in contrast to the traditional rainfed farming in dryland areas. The role of open pollinated varieties in organic farming cannot be underestimated. There are a number of studies to show that it is possible to feed the world with organic farming.

GREEN Foundation has taken the debate beyond the narrow confines of farmers' varieties as low yielding and has played an important role in conserving farmers' varieties. GREEN Foundation's work emanated from the depth of indigenous knowledge and culture. The emphasis has been in understanding the weave that runs through culture and agriculture. Some of the festivals around seed during sowing and harvest are symbolic of the culture and knowledge that have evolved over generations of practice, observation and innovation. Women have played a major role in agriculture from seed saving, to decisions about what should be cultivated, to the entire process in providing food to the family. Thus, women have been instrumental in conserving the diversity on marginal lands and fragile ecosystems.

However, factors such as increasing industrialisation of agriculture and government policies that promote Green Revolution technologies and the interests of seed and fertiliser companies have undermined traditional agricultural practices. Declining cattle population has reduced availability of farmyard manure and increased dependence on chemical inputs that have led to deterioration of soil health, and emergence of new pests and

diseases. Changes in cropping patterns and changing lifestyles have impacted agricultural practices, increasing the dependence on the agricultural industry. It has impacted the food habits and health of farming communities.

Policies pertaining to plants, seeds and patents with their requirements for registration of varieties, benefit-sharing have impacted farmers and often disinherited them. The government policies have proved to be inimical to indigenous agricultural practices while favouring seed companies, fertiliser companies and moneylenders.

Animal genetic resources

The case study presented by Anthra on the loss of community knowledge of healing and its links to development policy is set among the Golla – the traditional shepherding community rearing the Deccani sheep breed in Warangal district, Andhra Pradesh. The case study highlights the immense knowledge of healing held by the older generation. The shepherds used simple remedies or sought the help of experienced traditional healers to treat their animals when they were sick; they needed no external medical help. The shrinking of the grazing lands has resulted in the disappearance of the rich diversity of grass and medicinal plants, emergence of new diseases and a shrinking of the flock size. The case study illustrates the threat faced by the community of shepherds in building on their community knowledge and practice, sustaining their livelihood and the health of their flock.

The human strand in the web of life

Community interventions as good practice in biodiversity conservation – Volume 2

Plant genetic resources

The Kurumba and Irula community attributed their poor health to poor nutrition due to the loss of their traditional mixed cropping agricultural practices that had ensured food security. The current scenario of tea and coffee growing in the Nilgiris provided some cash, even as it threatened their food sovereignty. It increased their dependence on rice available through the public distribution system, which was a huge shift from their staple diet rich in millets, vegetables and fruit. Keystone, therefore, explored a basket of options with the Kurumba community to restore their health and their livelihoods through a revival of

the traditional agricultural practices. The key community intervention has been integrated and organic farming through the propagation and provision of seeds, training on organic practices and market related support. It has sought to promote ecological, cultural and agricultural diversity, and most importantly food sovereignty and health of the community.

Seed is the basic life form which requires conservation. Rainfed areas, such as the desert region of Kachchh, are renowned for their drought tolerant and disease resistant seed varieties. However, under the onslaught of modern agriculture and rapidly changing lifestyles, the shrinking of traditional seed varieties is resulting in the loss of food-seed and nutritional securities. In this context, Satvik is seeking to promote ecological farming through collectives of local organic farmers. Its major efforts have been in the arena of seed mapping and seed storage. The revival of the kothar – an earthenware seed storage device and the recognition of women's role in this process is being promoted as a major seed and food conservation strategy in this drought prone area.

For centuries, farmers have relied upon the seeds that they saved. Until a few years ago, seed production in India was largely in the hands of farmers exchanging seeds amongst themselves. With the entry of industrial agriculture farmers reliance on their own seeds has diminished and availability of indigenous seeds/landraces has become rare. In its second case study, GREEN Foundation shares it experience of building on the erstwhile informal seed networks to establish community seed banks as people's institutions concerned with the conservation of agro-biodiversity while providing seed and food security to small and marginal farmers.

Animal genetic resources

The second case study presented by Anthra locates the community initiative among the sedentary and migratory shepherds of the Deccani sheep breed in Andhra Pradesh and Maharashtra. It highlights strategies such as the formation of a shepherd sangham to support the "keepers of the gene". The major efforts are to rebuild community capacities as well as linkages to the government system for the healthcare of the small ruminants. The case study examines the challenges to conserve the breed and spells out its efforts to build community capacities for community-based breed conservation. Deccani breed competitions from the village to the district level serve to celebrate the

diversity of the breed, develop breeding strategies, and improve the breed for its wool and meat purposes. Important strategies are to undertake research on the Deccani gene pool, replace the non-local with the Deccani sheep breed, revitalise wool-based livelihoods linked to local markets, and influence policy makers and researchers.

On similar lines, Sahjeevan is concerned with the community-based conservation of animal genetic resources, particularly the Banni buffalo breed tended to by the Maldharis in the desert region of Kachchh, Gujarat. It examines traditional breeding practices in the context of pastoralism. It highlights community interventions such as animal fairs to showcase and promote the sale/exchange of breeds. The sangathan of Maldhari animal breeders and rearers has become an important strategy to conserve the Banni buffalo breed, the Banni grasslands, and address issues pertaining to their traditional livelihoods.

The community interventions which the network organisations are supporting embody the concepts of biodiversity conservation and use, as well as "food sovereignty". The latter is the right of peoples, communities, and countries to define their own agricultural, labour, fishing, food and land policies, which are ecologically, socially, economically and culturally appropriate to their unique circumstances. It includes the true right to food and to produce food, which means that all people have the right to safe, nutritious and culturally appropriate food and to food-producing resources and the ability to sustain themselves and their societies.

Loss of genetic resources and community knowledge

Agro-climatic zones of India[1]	Type of cultivation	Loss of genetic resources	Loss of community knowledge
Southern Plateau and Hills Region • Semi-arid • Karnataka West Coast Plains and Ghat Region • Sub-humid, humid to perhumid • Karnataka, Maharashtra Gujarat Plains and Hill Region • Arid • Kachchh, Gujarat	• Mostly rainfed cultivation in arid, semi-arid, sub-humid and humid regions • Mixed cropping with millets/ paddy as the main crop intercropped with pulses, vegetables and oilseeds	• Millet varieties and area under cultivation shrinking in Karnataka • Paddy landraces under cultivation reduced from 300 to 4 in Maharashtra	Impact of Green Revolution (GR) technologies and policies on agricultural practices since 1990s • Crop diversification and food crops to monocropping and cash crops • Local seeds, farmyard manure and organic pest control to high-external inputs – HYVs, chemical fertilisers, pesticides and irrigation
Eastern Plateau and Hills Region • Warm and humid • Orissa Southern Plateau and Hills Region • Cool and humid • Tamil Nadu	• Rainfed, mixed cropping on upland, medium land, and lowland • Shifting cultivation on forest land and hill slopes to supplement non-timber forest produce • Tea and coffee plantations in the Nilgiris under a tribal resettlement package since 1960s	• Rice germplasm and millet cultivars shrinking • Wild and semi-wild foods disappearing	Impact of modern land ownership and land use patterns • Dams, plantations and development projects destroy forests and displace tribals • Tribal development/ resettlement projects devalue local knowledge, institutions, crop and forest diversity • Food-gatherers/producers to food purchasers
Gujarat Plains and Hill Region • Arid • Kachchh, Gujarat Southern Plateau and Hills Region • Semi-arid • Andhra Pradesh Western Plateau and Hills Region • Semi-arid • Maharashtra	• Banni buffalo rearing in the Banni grassland – sedentary and migratory • Deccani sheep rearing in Andhra Pradesh and Mahasrashtra – sedentary and migratory	• Banni bullock replaced by Banni buffalo • Degradation of Banni grassland • Cross-breeding of Deccani with Red Nellore and Madgyal sheep breeds • Mixed breeds are more susceptible to disease and less able to cope with harsh conditions • Shrinking of grazing lands, fodder grasses, and disappearance of medicinal plants	Impact of GR technologies and governmental policies: • Banni buffalo selected for adaptation to water stress conditions and saline grasses • Shepherds' knowledge of healing and medicinal plants disappearing • Irrational drug use for treatment of animals • Deccani replaced with less hardy, non-wool meat breeds • Deccani black wool and allied livelihoods and culture devalued

[1] http://agricoop.nic.in/STUDY%20Mech.%20pdf/contents.htm

Ecological and socio-economic benefits of community-based biodiversity conservation

Community	Type of community intervention	Ecological benefits	Socio-economic benefits
Small and marginal farmers – women and men	Seed conservation – grains, pulses and vegetables • Seed fairs • Seed mapping, characterisation of landraces • Community seed banks • Institutional seed banks • Traditional seed storage devices Low external input sustainable agriculture (LEISA) • In-situ, on-farm seed conservation and use • Kitchen gardens	• Indigenous landraces and local genetic resources, conserved • Indigenous seeds and cultivation techniques adapted to vagaries of nature, or drought, pest, disease-resistant promoted • Soil health restored	Seed conservation promotes • Food sovereignty through seed, food, nutrition, and fodder security • Community, organisational-level knowledge, institutions and networks to influence agricultural policy LEISA provides • Debt reduction due to reduced expenditure on external inputs • Risk cover for drought and famine
Forest and hill tribes	Biodiversity conservation– millets, pulses, fruit, vegetables, and forest produce • LEISA or organic conservation agriculture • Revival of traditional mixed cropping agricultural practices	• Soil organisms, pollinators increased • Soil erosion reduced • Pest and disease incidence reduced • Landraces selected to provide drought, pest and disease resistance	LEISA and mixed cropping enhances • Food sovereignty • Health and nutrition of the family • Fodder security • Livelihood security • Landrace selection for yield, fodder, nutritive and medicinal value, ritual significance
Pastoralists	Breed conservation – buffalo, sheep • Access to fodder and water • Access to indigenous and public veterinary health care services • Collective of pastoralists • Community fund for pastoralists • Animal fairs • Breed mapping • Dairy-based livelihoods • Revival of wool-based livelihoods	• Animal genetic resource pool built • Selection of breeds adapted to harsh, local ecological conditions • Symbiotic relationship between pastoralists and farmers provides pastoralists with grazing opportunities on migration, and farmers with animal manure in their farms that enriches their soil	• "Keepers of the gene" supported • Breed purity, health and value enhanced • Market developed/enhanced for animal products such as wool, milk, meat, etc. • Livelihood security of the pastoralists enhanced • Cultural-ritual significance of the breed preserved

Biodiversity and Tribal Agriculture
The Agragamee experience in Orissa

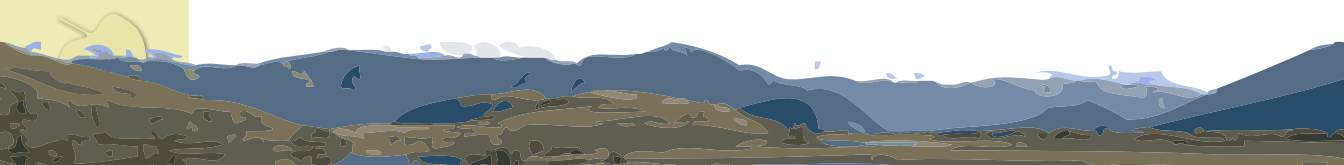
AGRAGAMEE

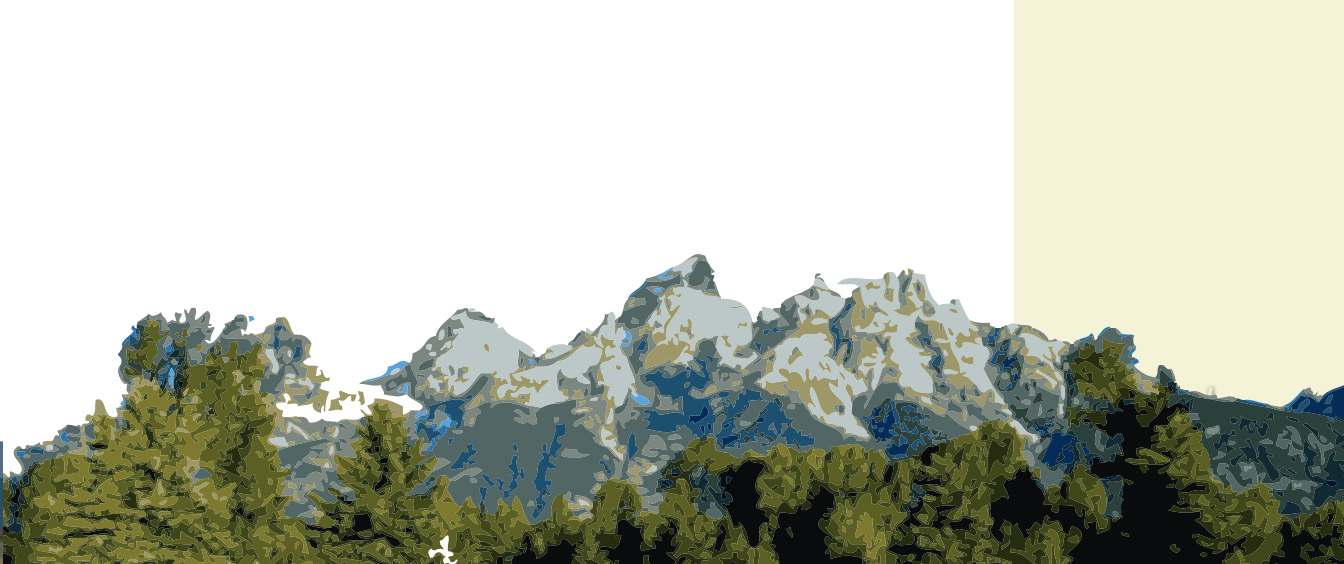
Orissa

Vidhya Das

This case study examines the role of tribal agriculture in sustaining biodiversity. It explores the factors that threaten biodiversity leading to a loss of community knowledge and genetic resources. It looks at government programmes for development in the context of natural resource management. It concludes with its efforts to partner the community in organic conservation agriculture.

CONTENTS

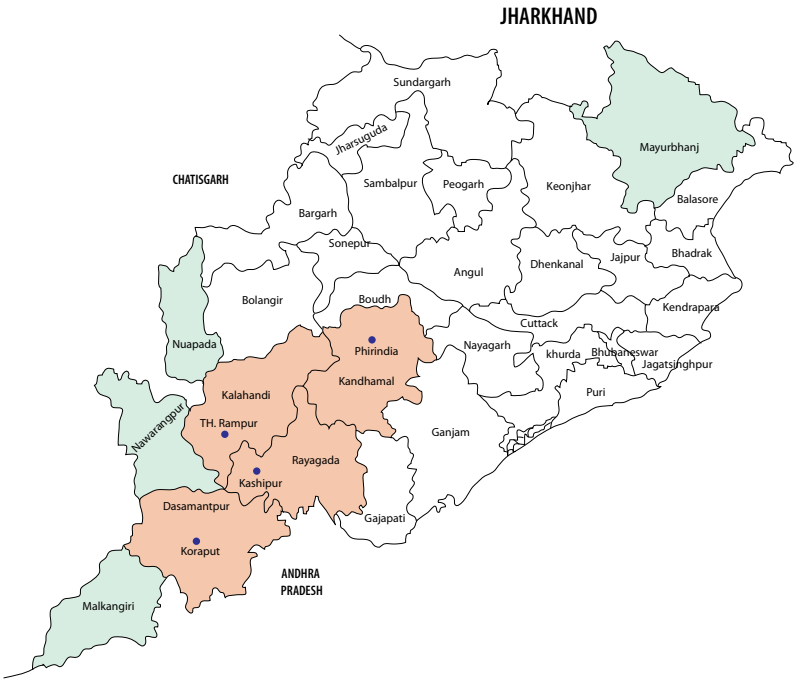




1. Agragamee and its work

Agragamee works with tribal farmers in 8 districts of Orissa – Kalahandi, Kandhmal, Koraput, Mayurbhanj, Nawarangpur and Rayagada since 1981. It is concerned with the human rights of tribals, dalits and other disadvantaged people. Its objective is to improve the tribal livelihood systems and initiate a process for the reconstruction and rebuilding of the degraded tribal ecosystems. Agragamee helps tribal communities, especially tribal women to preserve their crop biodiversity and to strengthen their traditional practices for conservation and agriculture. The geographical spread of its conservation agriculture is across the 4 districts of Kalahandi, Koraput, Phulbani and Rayagada, mainly in 8 Panchayats covering 120 villages.

Map of Orissa



Agragamee's focus areas are:

- Agriculture and cropping patterns;
- Natural resource use and management;
- Environmental regeneration;
- Implementation of pro-tribal and pro-poor acts and provisions;

- Improving educational opportunities of tribal communities;
- Entrepreneurship development.

Agragamee has undertaken a detailed mapping of paddy and millet varieties in its field area. Its interventions in community-based biodiversity management include experiments with the farmers to introduce improved techniques for soil fertility management in different kinds of land – upland, medium land and lowland with detailed process and output recording. It helps farmers to develop linkages with different research institutions and NGOs through training and exposure. Agragamee is promoting and refining various indigenous seed storage structures and disseminating these to the community through a variety of media. This has led to a renewed interest in the local varieties, mixed cropping, low external input sustainable agriculture (LEISA), and an interest in preserving the germplasm.

1.1. Natural resource management

Agragamee is working with tribal communities to improve their natural resource management (NRM) and agricultural systems. Its efforts include NRM interventions as also a strong advocacy component for people's rights, including the right to land for landless tribal families, the right to forest produce, and the right to decision-making regarding development. These advocacy efforts have resulted in several policy reformulations by the Government of Orissa, including land to landless tribal families, the right over forest produce to Panchayats in tribal regions, and the recognition of village committees to implement Government works instead of sub-contracts to private parties. In a landmark ruling, the Government of Orissa ruled that the new lands settled for tribal families would record the names of husband and wife in the title deeds. This never-before decision has been instrumental in increasing the social and economic security of tribal women.

On the ground, the work includes a range of interventions, namely, the construction of water harvesting bodies, community-based forestry/agro-forestry, soil fertility improvement through contour bunds, contour plantations, hedgerow management and drainage treatment. Agragamee's LEISA interventions include crop rotation and crop management efforts through zero tillage, agricultural waste management and recycling, organic compost making, home-made organic pesticides and fertilisers as viable alternatives to high chemical input agriculture. This work focuses on women's involvement as

a matter of policy, since women are most often excluded from participation in the development process, unless special attention is given to them. NRM interventions are underway in 7 districts of the state, including Kalahandi, Koraput, Malkangiri, Nawarangpur, Nuapada, Phulbani and Rayagada.

1.2. Tribal women's organisations

A strong federation of tribal women's organisations has been formed in 5 districts of Orissa – Kalahandi, Koraput, Nawarangpur, Phulbani and Rayagada with Agragamee's support. These community-based organisations (CBOs) process and market the tribal agricultural as well as minor forest produce. They generate employment and profits for the tribal community, while ensuring better floor prices for the raw products, which the government has been unable to do.

These organisational and state policy decisions have given a boost to tribal agriculture, as well as livelihoods, helping them to improve their traditional production systems with assured tenurial security. Their traditional production systems which include a range of millets like *ragi* (finger millet), *navane* (foxtail millet), *bajra* (pearl millet), *jowar* (sorghum), along with rice and maize, grown in mixed cropping swidden patches have also received a boost due to the land reclamation and soil conservation efforts. Agro-forestry efforts are instrumental in improving soil fertility, enabling farmers to make better use of their land by growing firewood and fruit trees along the contours. Agragamee is supporting efforts for community grain banks, which help to store surplus grains and provide buffer food, while doubling up as seeds banks. In several instances, the grain banks play multiple roles – they help communities to access food during the lean season, and avoid the clutches of the moneylenders.

1.3. Learning from NRM and CBOs

Agragamee has learned that targeting and empowering women from the concerned communities sustains the positive change from NRM-related capacity building and advocacy. Without excluding men from the process of social transformation, the focus on women underscores a ground reality – tribal women suffer on all accounts and remain deprived of the most basic entitlements – land ownership, minimum wages, decision-making, health, nutrition, education or control over natural resources. In the tribal regions, women are the ones who are most motivated and most able to unite through

CBOs and federations – to fight hunger and poverty, moneylenders and liquor-mafias, exploitation and deprivation. Agragamee's proposed project focus has to be understood in the light of this learning and the multiple contexts of tribal oppression in Orissa..

In Dasmantpur block of Koraput, Mahila Mandals (women's groups) have come together to protect their wastelands and uplands commons. Each village has formed its own rules for the protection and management of common resources with the involvement and participation of every household. The Mahila Mandal members raise and care for the nurseries with fruit bearing saplings, forest species and vegetable seedlings at a cluster-level of 5 villages in a centrally located village. The nurseries have distributed cashew seedlings to all the villages on an individual basis (an average of 150 seedlings per household) and also to all the Mahila Mandals on a group basis.

Tribal agriculture over the years has depended on a common understanding of land use and traditional laws of protection. Thus, even as the tribals produced a range of crops, they were also able to preserve the forests and their natural ecosystem. However, with the intrusion of modern land ownership and land use patterns, much of it has been destroyed. Agragamee's efforts seek to reclaim the traditions of the past through support to various people-centred programmes. The lessons learned show the way forward for Agragamee as well as the community which has been on the brink of poverty and starvation.

2. Tribal agriculture – *podu chaso* sustains biodiversity

2.1. Diversity of foodgrains in *podu chaso*

Podu chaso, or slash and burn cultivation in the tribal regions of Orissa, is significant for the diversity of crops it has helped to sustain as also the diversity of cultivation practices it has generated. All of the land under shifting cultivation is not mountain land; nor are all of the crops grown on the hill or mountain slopes, the typical shifting cultivation or swidden land. Crop rotation, intercropping, and other sustainable agricultural practices are a part of the inherited knowledge system of the *podu* farmer.

An amazing variety of rice germplasm has been preserved by the tribal farmers in the undivided Koraput region of Orissa. They have several varieties of short

duration and long duration upland paddy that grow on the middle region slopes. However, most of the scented varieties of paddy are lowland varieties. One of their most exquisite varieties of scented rice, Kala Jeera is thus named because the paddy is black in colour before being de-husked.

They also have short and long duration varieties of millets – *ragi* (finger millet), *kangu* (foxtail millet), pearl millet, sorghum, and others. Amongst pulses, they grow several varieties of broad bean, *arhar* (red gram), cow pea, rice bean, *urad* (black gram), and a local variety commonly called *baeil*.

The tribal communities' entire system of agriculture including shifting cultivation practised on mountain slopes and lowland helped to preserve this rich diversity of crops and cultivation on different types of land and soil. This knowledge system is of high value today, when the genetic wealth of plant resources is being usurped by multi-national corporations and their aggressive marketing strategies.

2.2. In tune with local agro-climatic conditions

The *podu chaso* system has developed in tune with the climatic conditions of the Southern Orissa districts where the monsoon is the main agricultural season. It is characterised by a thin continuous drizzle for 4 to 5 months of the year. It provides the continuous moisture necessary for hill slope cultivation, without washing away the soil to any significant extent. The shifting cultivation crops are completely tuned to the local agro-climatic conditions. Their shallow root zones thrive on the thin soil layers of shifting cultivation, while their moisture tolerance enables them to survive and produce a bountiful harvest. The burning enriches the potassium content of the soil, while also controlling pests and weeds.

The tribal knowledge systems also have a deep understanding of the crop rotation practices required to maintain the shifting cultivation cycles at the optimal level. In the lowland paddy areas, tribal communities have developed indigenous systems of water management and crop optimisation, combining long duration and short duration varieties that enables the crops to withstand the high water currents of the monsoons in the valley bottom land, while optimising land use.

2.3. Categories of land for *podu chaso*

The typical shifting cultivation of the tribal communities of Southern Orissa is practised primarily on two categories of land:

- Medium land: This land has a slope ranging from 3% to 10%. Rice and millets followed by a last crop of niger are cultivated annually under rainfed conditions on this land. The land is cultivated in three to four-year cycles, with equal fallow periods. This land is highly eroded, with rills and gullies eating into the cropped area. Most of the medium lands are under private ownership.
- Upland: These are hilly regions with slopes ranging upward of 10% to about 45%. With sufficiently fallow periods, this land has good regenerating capacity and productivity. But due to various reasons, the fallow period has been going down, leading to land slides during the monsoons, which inundate lowlands, and lead to huge amounts of crop loss. Most of the uplands are regarded as uncultivable wastes. These are government lands, on which nobody is allowed ownership, except under special consideration.

2.4. Land allocation to landless tribal persons

In 1993, the Government passed an order for the upland slopes to be recorded in the name of landless tribal persons as a special provision for the International Fund for Agriculture Development (IFAD) funded Orissa Tribal Development Project (OTDP) in Kashipur Block. This was a landmark

legislation, in which the title deeds were sanctioned to landless tribal families on slopes between 10% to 30% gradient. The title deeds were required to record the name of the husband and wife providing economic security to women as well in the bargain. Under the Land Acquisition Act, special provisions also facilitated acquisition of these lands by industrial and mining companies. .

3. Threats to biodiversity – loss of traditional knowledge and genetic resources

3.1. Commercial felling

Biodiversity has been part and parcel of the unique ecology of the tribal regions, and has helped to preserve it. The major threats to biodiversity are commercial felling which is destroying the forests that thrived alongside the *podu* patches, and climate change which is drastically altering the rainfall patterns. The traditional swidden patches of the tribal communities were clearings in the middle of the forests, which in fact were primarily taken up to supplement the roots, tubers, and other foods that they got from the forest. Tubers from the forest formed their staple for several months every year. What a rich and varied diet! A variety of tubers, a range of fruit (including the most delicately flavoured mangoes, kendu and wild figs), mushrooms, supplemented by a variety of cereals, a choice of pulses, and a huge range of edible greens, and vegetables, wild and semi-wild!

3.2. Dams

Alas, far from trying to learn about these lifestyles and knowledge systems, "modern" man, chose to commercialise these regions. Deforestation and its ill-effects have been further aggravated by the big dam projects, mines and industries, which not only acquired and destroyed forests that the tribal communities had preserved for centuries but also displaced the communities themselves, destroying their culture, society and livelihoods. Dams have taken up lakhs of hectares of forests and tribal lands in the four districts of Rayagada, Koraput, Malkangiri and Nawarangpur, that formed the undivided Koraput district till 1992. This land acquisition has forced the indigenous population to take up cultivation on steeper and steeper hill slopes and hill tops causing a huge amount of soil erosion, and further deforestation

3.3. Climate change

The changing rainfall patterns of the region due to climate change have affected cultivation practices, and the fragile geo-physiology of the region. In recent years, this pattern of gentle rain for long periods has been replaced by cloud bursts and cyclonic weather that result in a huge wash out of the soil, destroying upland crops, and inundating valley bottom fields as well.

All this has brought the tribal communities, to the brink of starvation. In fact, hunger stares them in the face for several months in a year, their rich forests have disappeared, their luxurious hill slopes on which they could grow upto 10 different crops in one place in one season have turned to barren patches of rock, and rubble, on which they keep trying their podu, in desperation trying to relive the memories of those bountiful days, in not such a distant past.

3.4. Plantation economy

Permanent tree crops as a substitute for *podu* is an option which underscores the failure of modern science, present day government and multi-lateral programmes in addressing the problem. It has been tried time and again, and led to little change. In fact, the failure of the government programmes, and the destruction of the tribal eco-system provides opportunities for commercial interests to entrench themselves. Eucalyptus plantations have begun to cover several hundreds of acres in these regions. These plantations are aggressively pushed by providing the tribals with ready cash loan. The money quickly disappears as most of the loan money is exhausted in the watch and ward of the plantations. At the end of four years, the paper mill owners buy up the plantation yield at the market rates, against the loan and the interest that would have accrued.

Calculations indicate that for one acre of plantation, a farmer earns barely Rs 800 at the end of four years. However, the ready cash provided to the farmer is a temptation many cannot resist. Once a eucalyptus plantation is established, it is very difficult to root it out, and the land remains locked under this monocrop for at least 16 years.

Thus, if the plantation economy is established in regions like Koraput, then we are in grave danger of losing the tribal communities, who will be replaced by rich business men, who can easily afford to wait out the period required for plantations to become productive. This business class can also respond to the other dynamics of a commercial plantation economy, unlike the local tribal farmers. Along with the tribal communities, we will also lose the rich plant genetic diversity so carefully preserved by these conscientious and responsible ecosystem people. The proliferation of eucalyptus groves already bears silent testimony to this in Koraput.

3.5. Displacement by business interests

The many orchards of spices and coffee that are coming up are almost all owned by people who are not even from the state of Orissa. The tribal land is leased out to businessmen from Andhra Pradesh, Kerala, etc. The land is taken up for ginger, or coffee and spice cultivation. The tribal people migrate for work, as their agriculture has been giving them very poor returns anyway. The agreement is almost like a permanent transfer, albeit without any written records (since it is illegal for the land of a tribal person to be sold). Yet, politically and financially, a tribal farmer would never be able to reclaim this land.

3.6. Inroads by multi-national corporations

Multi-national corporations (MNCs) are acquiring thousands of acres of land for mines and industries in the mineral and natural resource-rich belt of Orissa. They are wantonly destroying pristine forests and *podu* land in their quest for profits. This has resulted in the displacement of thousands of families. These corporations indulge in aggressive and violent intervention with the support of the local government. In this scenario, the priorities, values, needs, and basic human rights of the tribal communities are being ignored.

4. Government programmes for development and NRM

4.1. Orissa Tribal Development Project (OTDP)

In the 1990s, the International Fund for Agriculture Development (IFAD) implemented the Orissa Tribal Development Project (OTDP) in Kashipur Block of Orissa. Its objective was to improve the tribal livelihoods through agricultural and market development. A major thrust of the programme was agro-forestry, wherein the hill slopes under shifting cultivation were divided into three zones based on their gradient, 0-10 degrees, 10-30 degrees and 30 degrees and above. The 0-10 degree slope was earmarked for annual cropping with soil and water conservation measures being undertaken; the 10-30 degree slope was earmarked for agro-forestry and the slope above 30 degrees was earmarked for plantation. The entire hill slope was divided into strips of one hectare and distributed to the tribal families with priority given to the landless. The zone of the 0-10 degree slopes was surveyed and settled with ownership rights given to the tillers.

4.1.1. Agro-forestry

Soil conservation measures such as contour bunding (stone and vegetative) on the hill slopes, checking gully and ravine formation through appropriate drainage treatment, and other erosion control measures were introduced. Fruit-bearing trees like mango, litchi, guava and cashew were introduced as part of the agro-forestry programme. Miscellaneous plantation was taken up on the slopes above 30 degrees. Using sophisticated equipment, land survey and settlement processes were completed in 400 villages of Kashipur and *patta* (title deeds) were distributed in more than 150 villages. Local NGOs and

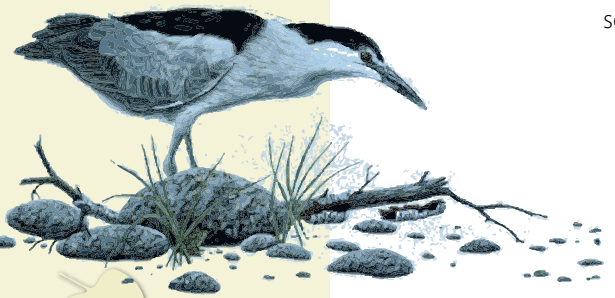
the tribal leadership were engaged in the decision-making process, thereby minimising the conflict.

4.1.2. Issuance of patta

Initially, the tribal community adopted the OTDP model with a great deal of enthusiasm. The land was settled and the *patta* were issued after the Government of Orissa passed an order that this kind of agriculture should be applicable to all tribal areas. However, the impact of these measures had poor sustainability, and now the agro-forestry slopes bear mute testimony to the inadequacy of present day know-how to reclaim wastelands in high-relief shifting cultivation areas.

According to the IFAD Evaluation report, the OTDP is a classic example of a development intervention in which the "hardware" side of development was given far more weight than the "software" side, both during design and implementation. This is reflected in the allocation of financial resources for human resource development for which a mere six percent of the total project resources were earmarked. Even the project management component was allocated more resources at eight percent.

Further, the report emphasises: "The OTDP implemented a component for land survey and settlement, which resulted in the allocation and distribution of *dongar* (hill) lands to the tribal population in Kashipur block. Until recently, the population in the block were making use of the *dongar* lands in an informal manner, as and where possible, for agricultural purposes (mainly shifting cultivation). However, access to these lands was not secure and consistent; and land productivity was low.



4.1.3. Benefits and drawbacks

The benefits and drawbacks of the legally secure land tenure are evident from the OTDP experience.

a. *Benefits*: From an agricultural point of view, the allocation of parcels of lands and the provision of land titles has reduced shifting cultivation practices, which has consequently promoted relatively sound environmental management practices and helped restore agro-ecological balance. It has also substantially increased the productivity of these lands. From a socio-economic point of view, the project illustrated that when land titles are registered in the names of both spouses, the social and economic status of women is enhanced, providing them with greater security, confidence and independence. It has also provided them with more opportunities for income-generation through activities such as vegetable gardening and small livestock rearing. Overall, then, the ownership of even a tiny piece of land has improved the economic conditions of those concerned. It may be noted that a somewhat better level of literacy was also observed among the beneficiaries.

b. *Drawbacks*: The Orissa evaluation mission witnessed another feature of prime concern in the land reform process under the project, which concerned the implication on community ownership and management of forest lands and water. Common property resources are particularly important for the tribal people, since they derive a large part of their income and nutrition through the processing, consumption and sale of minor forest produce. But, as mentioned above, much of the community owned land was individualised, and land titles were recorded jointly in the names of both spouses. While this step was welcome, the package of privatisation of property upset the existing social security for the tribals. Now, smallholders in distress could either lease their land to moneylenders and others, or be mobilised by the development process for eviction, settling for cash compensation for their piece of land.

Due to the development of alumina projects funded by multi-national corporations, affected tribal families received cash compensation in several areas of Orissa.

Unless land reform programmes are accompanied by opportunities for employment and marketing, access to rural financial services, and institutional support, they further disinherit the tribal communities. However, provision of support services and linkages will contribute to unleashing the potential and productivity of the target population.

The OTDP evaluation observed, "With regard to the protection of the tribals rights over community forests and other lands, following the central legislation introduced in 1996, the Gram Sabha (Village Assemblies) in the tribal areas has been entrusted to protect the community rights over community land and forest. The OTDP has preceded this Panchayati Raj enactment, and unfortunately this power is not being exercised by the Panchayat in many tribal areas (in Kashipur itself, the Government of Orissa has notified the transfer of tribal land to the alumina project companies without consulting the local Panchayat). Moreover, some community lands have also been encroached upon by the rich and powerful. Therefore, projects and programmes promoting land reform should simultaneously pay sufficient emphasis on the management and conservation of community resources such as forest lands. Furthermore, the communal rights of the tribal people over such areas should be safeguarded, as they form an integral part of the overall production system of the population."

The land settlement was carefully avoided in those Panchayats, where the Alumina Project of the Utkal Alumina International Limited was planned. Initially, the settled lands, and the soil conservation measures seemed to have much impact. Soon, the tribal practice of shifting cultivation negated much of the gains. Although, tribal ownership is recognised, the soil loss, and degradation of land resources continues apace. This also indicates that the technology selection for providing viable and eco-friendly alternatives to shifting cultivation practices was highly inappropriate.

4.2. Watershed development projects

4.2.1. Low impact

Several watershed projects have been taken up under different government programmes in the tribal regions. These projects with substantial investments for earthworks, water resource development, and manpower have had hardly any impact. They have also done very little to establish the viability of the soil conservation and erosion treatment model for the environmentally degraded upland tribal areas. A few watersheds have helped a fraction of the tribal community to improve their livelihoods, but, by and large, these fractions do not include the poorer sections. On the other hand the land development measures have done little or nothing to improve soil fertility, decrease top soil loss, or to help establish a healthy vegetative cover.

According to a Planning Commission Report, the 16.5 million hectares treated under the micro-watershed approach do not get reflected in the net sown area, which has stagnated at around 142 million hectares for the last 20 years. The Planning Commission Report states, "Although the Ministries of Agriculture and Rural Development have implemented watershed projects for more than a decade, evaluation reports have shown that most projects have failed to generate sustainability because of the failure of government agencies to involve the people.... Most government watershed development investments have yielded disappointing results given the vast resources allocated…"

4.2.2. Causes for multi-level failure

Several reports indicate the multi-level failure of the watershed programme due to poor community participation. However, there is little review of the techniques and technology used for the treatment of watersheds, and to link the

interventions to the livelihood needs of the poorer sections of the community. Thus, while NGOs do better with their increased sensitivity towards the needs of the more marginalised sections, the cost-benefit ratios for watersheds still raise many questions.

This is especially unfortunate in the upland tribal areas, where the pace of environmental degradation is accelerating, with the accompanying impoverishment of and distress of the local communities. The poor results of the watershed approach does little to build the faith of the tribal people who respond in a superficial manner, in anticipation of the wage payment as some succour to their poverty stricken lives. Watersheds also fail to recognise the traditional knowledge systems, and do little to promote indigenous varieties and crops. There is an imperative need to address all this, for any level of people's involvement and sustainability.

5. Organic conservation agriculture

One option for tribal communities could be conservation agriculture. In Brazil as also other Latin American countries, a concerted effort for conservation agriculture has helped shifting cultivation farmers to improve production, check soil erosion, and improve the overall ecology. A case study of the Food and Agriculture Organisation (FAO) states, "Where new conservation-effective technologies or practices have met farmer requirements for risk aversion, create no major conflicts and have an assured beneficial effect, adoption has been shown to be very rapid, e.g. zero tillage in the Brazilian *cerrado*, use of shade trees for coffee production in parts of Costa Rica, agro-forestry in Kenya and Nepal." Conservation agriculture is being actively promoted as it is now known that this technology mitigates, and in fact counters climate change by sequestering atmospheric carbon into the soil.

The European Parliament initiated a project under Member of Parliament M. Stephane Le Foll. It was run by the Joint Research Centre of the European Union under the leadership of the Directorate of Agriculture and Rural Development of the Commission. In its final wrap-up conference of the project, the Commission recognised conservation agriculture thus, "No-till in continuous soil coverage should be retained as the main way to maintain a productive agriculture, to meet the challenge of food security, but also to assume its place on the global agricultural markets by producing more, respecting the resources, and being competitive."

The Commission further recognised, "Conservation agriculture, because of its proven results, [as] has been confirmed by the studies, and during the feedback sessions by nearly all speakers, as the form of agriculture the more able to meet the missions of the future European agricultural policy."

5.1. Promoting organic conservation agriculture in Orissa

Agragamee has initiated organic conservation agriculture with tribal farmers in the two districts of Koraput and Rayagada covering 24 villages in 4 Gram Panchayats.

5.1.1. Seed mapping

The first step towards promoting organic conservation agriculture entailed surveying, collecting and recording different seed samples, their characteristics, and their cultivation techniques in the 24 villages. The upland, medium land and lowland rice varieties, as well as other cereal crop varieties were mapped on the parameters of variety, cultivation type, maturity, plant type, aroma, seed quality, colour of husk, dehusked colour, and awned as follows (refer Tables 1, 2 and 3):

Table 1: Upland rice variety

Upland rice variety	Cultivation	Maturity	Plant Type	Aroma	Seed Quality	Colour husk	Dehusked col.	Awned
Bodidhan	Dry seedling	80	Semi tall	Non Scented	Small	Straw	Red	Awnless
Matidhan	Dry seedling	80	Semi tall	Non Scented	Small	Red	Red	Awnless
Paradhan	Dry seedling	90	Semi tall	Non Scented	Medium	Black	Red	Awnless
Variety	Cultivation	Maturity	Plant Type	Aroma	Seed Quality	Colour husk	Dehusked col.	Awned
Jaliamami	Dry seedling	120	Semi Dwarf	Non scented	Medium	Straw	White	Awnless
Dudmara	Dry seedling	120	Semi Dwarf	Non Scented	Medium	Black	Red	Awnless

a. **Upland rice variety**

Source of collection: Store
Soil: Red lateritic
Growing season: Autumn *(biali)*
Fertiliser used: Nil
Total varieties: 5

Table 2: Medium land rice variety

Medium land rice variety	Type of Cultivation.	Maturity in days.	Plant type	Aroma	Seed quality	Husk colour	Dehusked colour	Awned
Parijata	Transplanting	80	Semi-tall	Non scented	Fine	Golden	White	awnless
Paikani	Tansplanting	110	Semi-tall	Non scented	Small round	Purple line	Red	awnless
Khandagiri	Tansplanting	100	Semi-tall	Non Scented	Fine	Golden	White	awnless
Kanchi	Dry seedling	120	Semi-tall	Non Scented	Fine	Brownish	White	awnless
I.R.-36	Dry seedling	120	Semi-tall	Non Scented	Fine	Golden	White	awnless
Tippadhan	Dry seedling	90	Semi-tall	Non Scented	Medium	Brownish	Red	awnless

b. **Medium land rice variety**

Source of collection: Store;
Soil type: Red lateritic
Growing season: Autumn;
Fertiliser used: Nil
Total varieties: 7

Table 3: Lowland rice variety

Lowland rice variety	Type of Cultivation	Maturity	Plant type	Aroma	Seed Quality	Seed husked	Seed Dehusked	Awned
Sunapaikani	Transplanting	140	Tall	Scented	Medium	Golden	White	Awned
Laiseri	Transplanting	145	Semi tall	Scented	Fine	Golden	White	Awned
Mirlo	Dry seedling	140	Semi tall	Scented	Small Round Golden	White	Awnless	
Tulsibas	Dry seedling	140	Semi tall	Scented	Small round	Black	White	Awnless
Raipuria	Dry seedling	130	Semi tall	Scented	Coarse	Purpleline	White	Awnless
Machhakanta	Dry seedling	170	Tall	Scented	Fine	Golden	White	Awnless
Deolbhog	Dry seedling	180	Tall	Scented	Fine	Golden	White	Awnless

c. **Lowland rice variety (scented)**
Source of collection: Store;
Soil: Red lateritic.
Growing season: Winter
Fertiliser used: Nil (only compost)
Total varieties: 7 +

d. Other lowland rice varieties]

- A total of 17 varieties of non-scented rice
- 8 varieties semi tall, and 9 varieties tall
- 2 of them are transplanted, the rest are direct seeding
- 2 red varieties.

e. Other cereal crop varieties

- *Ragi* (finger millet): 7 varieties, maturing between 140 to 160 days; grain colour ranging from light red to deep red-black;
- *Kangu* (foxtail millet): 3 varieties; colour ranging from light creamish yellow to black; harvested in 120 days; planted as a border crop with other millets;
- *Khedjana* (Juar): harvested in 180 days, usually mix cropped with other millets; popped like corn, or cooked as rice.
- *Suan:* small round, white grains, cooked as rice, harvested in 150 days.

5.1.2. Cropping patterns

Agragamee undertook a study of different cropping patterns in the region and found 3 combinations as follows:

a. Combination

- pland Paddy Monocrops – Matidhan, Paradhan, Bodidhan
- Medium Land Paddy Monocrops: Paikani, Kanchi, Tippadhan
- Low Land Paddy Monocrops: Tulsibas, Mirlo, Sunapaikani, Laiseri

b. Combination II

- Matidhan, Cajanua Cajan;
- Matidhan, black gram
- *Ragi, arhar*
- *Ragi* black gram
- *Jowar,* cowpea

c. Combination III

- Ladies finger, cowpea, radish, bottle gourd, pumpkin
- Brinjal, tomato, cluster bean
- Brinjal, dwarf beans, ladies finger, soya bean, runner bean in the border

5.1.3.Conserve and survive interventions with tribal farmers

Based on the seed mapping, characterisation and cropping patterns, Agragamee recorded the performance history of different crops. Agragamee also initiated experiments with farmers to introduce improved techniques for soil fertility management. 64 farmers were encouraged to take up 3 different combinations on 3 different kinds of land: upland, medium land, and lowland, with detailed process and output recording. These activities formed the basis for initiating organic conservation agriculture among farmers in tribal areas. As it allows farmers to cultivate the crops of their choice and preference, it has found a high level of acceptance. The readiness to give land for organic conservation agriculture experiments was beyond all expectations in the Kashipur Block, Rayagada District, and Dasmantpur Block, Koraput District.

Agragamee helped the tribal farmers to develop linkages with different research institutions and NGOs through exposure, training and networking. They promoted and refined various indigenous seed storage structures. Local practices, success stories, the importance of local seeds, and experiences with market-led agriculture were widely disseminated to the tribal farmers through posters, booklets and pamphlets.

Thus, in an effort to promote eco-villages and family farms, Agragamee introduced crop combinations to 800 tribal farmers for improving backyard and upland cultivation. The farmers were encouraged to take up a combination of indigenous practices along with the application of different organic manures and recycling as well as conservation measures to check erosion and soil loss. Since the crop combinations were readily accepted by the farmers, the manure applications are being upscaled.

5.2. Outcomes

The focus of organic conservation agriculture is on food, income and ecological security through conservation of indigenous seed material and practices. It draws on community and family initiatives for reclaiming degraded agricultural lands and commons.

Agragamee seeks to ensure equity by encouraging better land use and distribution by the community. It uses existing laws to enable local community

control over local resources. It provides farmers with opportunities for training and dialogue with other practitioners.

Thus, the promotion of organic conservation agriculture among tribal farmers in Orissa has led to:

- Increased interest in local varieties, and spread of concept to neighbouring villages;
- Mixed cropping system taken up to enhance crop production;
- Efforts for improved LEISA farming techniques;
- Better understanding of the importance and principles of mixed cropping;
- More villages keen to learn LEISA techniques and make efforts to preserve germplasm;

In India, many farmers have established organic conservation agriculture farms following in the footsteps of the great Japanese philosopher-farmer: Masanobu Fukuoka. Their natural farming efforts have visibly better results than the farms of their neighbours who insist on modern agricultural practices. One such farmer in Madhya Pradesh is Raju Titus. His example in his own farm, as also his efforts to upscale it in the farms of some of the retired bureaucrats of Madhya Pradesh have had their effect; the State Government is now planning to bring the whole state under conservation agriculture and natural farming.

In India, the state as well as the NGO sector must necessarily begin efforts in this direction; otherwise, we shall loose a wealth of genetic resources, along with the local knowledge systems of indigenous communities, whose value cannot be calculated in dollar or rupee terms!

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In Search of Alternatives

Loss of community knowledge and genetic resources among the Kurumba community of the Nilgiris

KEYSTONE FOUNDATION

Tamil Nadu

Snehlata Nath
Robert Leo

This case study focuses on the displacement and rehabilitation of the Kurumbas, an erstwhile food gatherer and hunter community. The consequent loss of their rich and biodiverse millet cropping system is owed to an ill-conceived resettlement policy. It examines the impact of small coffee and tea plantations on their livelihood and food security and highlights the community interventions that show the way ahead.

CONTENTS

1. Keystone and its work

Keystone Foundation aims to work on eco-development initiatives with indigenous communities in the Nilgiri Biosphere Reserve in the Western Ghats spread mostly across Tamil Nadu and partly in Karnataka and Kerala. It has built in strategies and practices that conserve biodiversity and address the livelihoods of forest dependent communities. Currently, it has programmes with bees and forest biodiversity, traditional and organic agriculture, water and wetland, environmental governance, organic market development, and culture and local governance. For more details see www.keystone-foundation.org

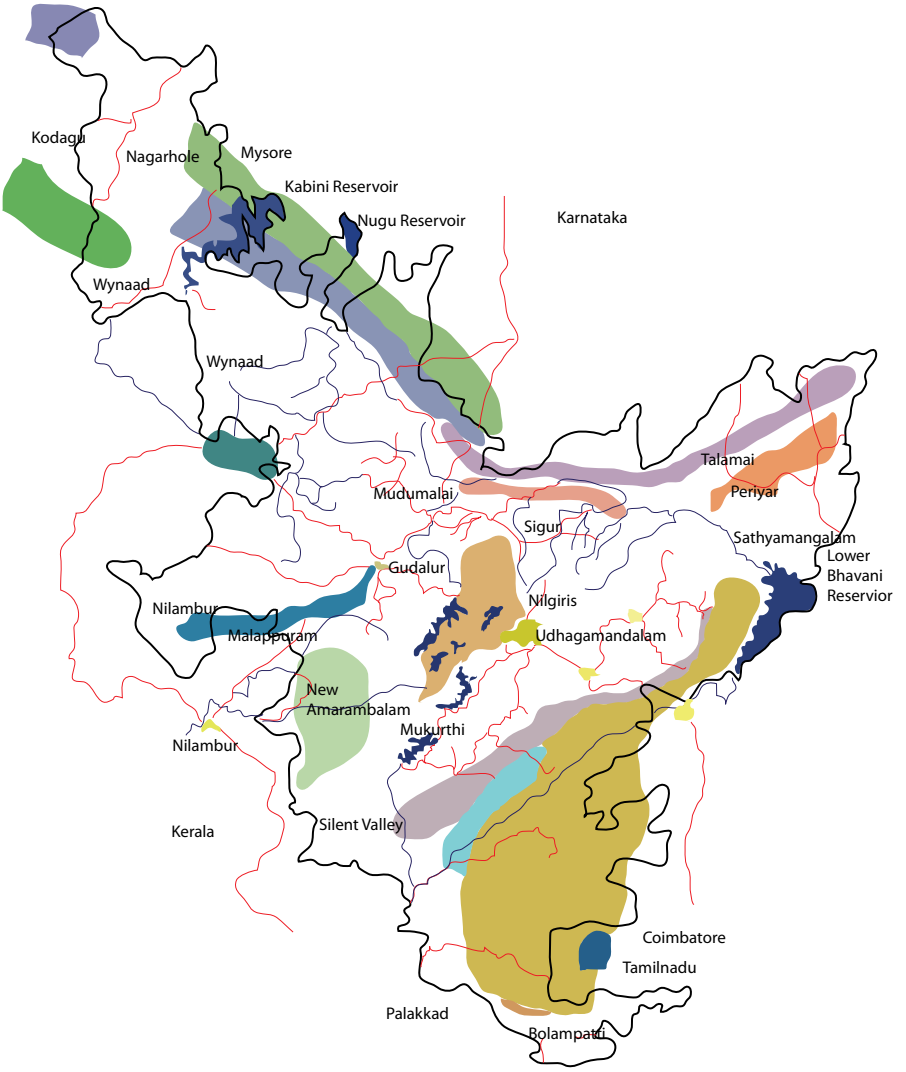
1.1. Location of the community

The Nilgiris Biosphere Reserve in the Western Ghats is home to the moist, dry, evergreen and montane (*shola*) tropical forests. The Nilgiris harbour a wealth of flora and fauna, much of which is restricted to the region, for example, the endagered lion-tailed macaque and the Nilgiri tahr. However, the Nilgiris forest ecosystem is under pressure from tea and coffee plantations, illegal, logging and commercial tree plantations with exotic species initiated by the Forest Department.

The Nilgiri Biosphere is home to a large number of indigenous adivasi communities, most of them forest dwellers and hunter gatherers dependent on natural resources for their livelihood. These distinct ethnic groups have small populations and live in geographical concentrations (refer Map 1: The Nilgiri Biosphere Reserve: Indigenous communities). The only surviving hunter gatherers of the Indian Sub-continent – the Cholanaikans live in the New Amarambalam area. Apart from the Todas – a well known pastoral group in the upper Nilgiris, other groups include the Adiyans, Alyars, Irulas, Kuruchiyans, Kurumbas, Mullukurumbas and Paniyas. The richness of this region in terms of the people with their unique cultural and social characteristics is incomparable.

This case study focuses on the Kurumba tribe, an erstwhile hunter-gatherer community that the government has classified as a primitive tribal group (PTG). It examines two different land uses promoted by the government for the Kurumbas – coffee and tea growing in the context of displacement and rehabilitation. Both land uses disconnected the Kurumbas from their traditional lifestyle and mixed cropping system that engendered rich biodiversity. The new tools, training and the size of the land holdings provided to them proved

Map 1: The Nilgiri Biosphere Reserve
Indigenous Communities



inadequate to enabling their livelihood security while resulting in tremendous cultural and ecological losses.

Today, the Kurumbas have had to carve out new lives and livelihoods in the context of displacement from their traditional habitats. In the case of the Pudukkadu settlement, increasing elephant attacks forced the Kurumbas to move there in the 1960s. In the case of the Banagudi hamlet, frequent landslides resulted in their resettlement there in the 1980s. While the Pudukkadu settlers are now struggling to grow coffee under the forest canopy, the families in the Banagudi hamlet are trying to eke out a living with tea growing.

In both cases, the loss of their traditional millet-based biodiverse cropping system has made them dependent on external inputs and resources for the new cash crops they have been growing. Their survival depends on supplementing their plantation income with wage labour. These scenarios highlight the immense loss of community knowledge and genetic resources due to displacement and ill-conceived rehabilitation and resettlement plans by the government. Thus, the Kurumbas have come to inhabit unfamiliar terrain where their community knowledge ceases to be applicable to their livelihood security. It is representative of the plight of the entire Kurumba community who live in similar circumstances of displacement and migration struggling to grow coffee or tea, or working as wage labour.

2. Context and background

2.1. Pudukkadu settlers

The families of Pudukkadu used to live inside the forest beyond the Coonoor River. This remote area lacked connectivity to the outside world. They had lands on which their parents were cultivating millets. Over the years, it became unsafe for them to live there as the elephant attacks, which were earlier occasional, became regular. The elephant attacks damaged the crops and also became life threatening. Due to the remoteness of the village, the people had to walk long distances for medical emergencies and the education of their children. Additional or supplementary income was hard to come by since they had to traverse long distances for wage work.

In the early 1960s, some families migrated on their own for wage work around the Barliyar and Coonoor region. The Kurumbas also worked as collectors of

non-timber forest produce (NTFP), bonded to traders in Mettupalayam and Coonoor. They collected honey *(Apis dorsata)*, shikakai *(Acacia concinna)*, *amla (Emblica officianalis)* and other forest produce.

About 26 families moved to the Pudukkadu area, on the Mettupalayam-Coimbatore state highway in the Nilgiri district of Tamil Nadu state in South India. The settlement is very close to the reserve forests of the Kallar/Barliyar slopes. 6 of these families again migrated. Presently, a total of 20 families from the Kurumba tribe live in Pudukkadu. They left behind their land, agriculture and their culture to escape the threat of elephant attacks. They began a new life with a big change in their food and lifestyle although they continue to maintain contact with the 3-4 families who continue to live in the forest beyond the Coonoor River.

2.1.1. Intervention by the authorities in Pudukkadu

During this period, the government allotted these families 15 acres of land taken from the forest department to cultivate coffee for their livelihood. Under the lab-to-land programme, they had to grow coffee under the natural canopy which provided excessive shade to the coffee plants although it did provide some fruit to the Kurumbas. However, the *kodali muruku* tree in the forest attracts the stem borer which also attacks the coffee plant.

2.2. Banagudi hamlet

Some of the Kurumbas have been resettled in Banagudi, a small hamlet in Kotagiri Taluk, Nilgiris district due to frequent landslides in their earlier habitat. The 39 Kurumba households live in `line houses' made by the Government housing programme near their sacred grove for which their hamlet is named. They live surrounded by other communities, mainly Badagas and Sri Lankan Tamil repatriates. The Kurumbas have migrated and settled in this region in the early 1980's.

Presently, the overall socio-economic condition of the Kurumba community in Banagudi, as elsewhere, is poor. Nobody holds a government job in this village. Only one person is a jeep driver with a private farm. They own television sets supplied by the government. There are 5 mobile phones and one motorcycle in the village. The government supplies rice at the rate of one rupee per kilogram under the public distribution system (PDS). There are 5 honey hunters and a few make brooms from Phoenix spp. They have done wage labour under the National Rural Employment Guarantee Act (NREGA) for 45 days but have no reserves for the near future. They cannot build their agriculture, expand plantations or secure jobs/educational resources on which their present and future generation can depend.

2.2.1. Intervention by the authorities in Banagudi

Earlier the Kurumba hamlet was located further down the valley in Manali yada. Since the area was prone to land slides, they were rehabilitated to the present location of Banagudi and resettled with the help of a local tribal organisation, Nilgiri Adivasi Welfare Association (NAWA). They were contacted by the United Planters Association of South India – Krishi Vigyan Kendra (UPASI-KVK) in 1982-83 and imparted training in tea cultivation. They worked on the land on a daily wage basis to raise the tea plantation with support from NAWA and UPASI-KVK. They were also linked to the State Bank of India for a loan of Rs 6,000 per family. About 24 farmers were linked to this programme under the lab to land scheme.

The aim of the programme was to provide regular income to the families under the scheme with new intervention and technology and rehabilitate these families from their earlier settlement. About 2 acres of land was allocated per family near the settlement for the purpose of growing tea. However, with fragmentation of the landholding over time, today, a family owns a mere few cents of land.

The case of the two families – Babu and Ponnan (refer Box 1) highlights the lack of viability of a small plantation model for the community, especially in terms of biodiversity, livelihood and food security.

Box 1 : Rootless alternatives

Babu is a farmer in his early 30's with a wife and three school-going children. He has no livestock. He has 10 cents of rainfed land on which he grows tea. He has about 250 tea plants from which he gets about Rs 2,400 per year, an amount just sufficient to meet his tea plantation expenses. Every twenty days, he gets some cash in hand by selling tea. If the rains are good, may be a little more is added to his income. In the tea plantation, he raised ten silver oak trees and planted some coffee which dried up. The tea provides cash which is immediately spent for payments other than food. Hence, Babu and his wife work as daily wage labourers to meet their food and survival expenses.

They came to Banagudi about 20-25 years ago leaving their native village on account of frequent landslides. After settling here, they were distanced from their cultivable land which lay fallow. Meanwhile, the local NGO – NAWA through UPASI – KVK assisted them both technically and financially. Through the lab to land programme they got a tea cultivation package and raised tea. The entire package including training was provided by UPASI-KVK. Food sovereignty is a major issue for them. Without access to food, they have to purchase all their food, except for a few wild foods that they gather.

Ponnan is the village headman who lives in the settlement with his wife. He has no livestock. He owns half an acre of tea plantation. They left their village and resettled in Banagudi about 25 years ago. They used to work under the Badagas as agricultural labourers. Through NAWA and UPASI-KVK they planted tea in half an acre of land about 20 years ago. He has 2500 plants. He gets water from a nearby spring from the forest, though it is a rainfed tea plantation. He started collecting tea leaf after one and a half years. There are three varieties of tea – VP, China and Vellichedi. The soil is top black soil and the underneath is red and a bit loamy in nature.

UPASI-KVK undertook the tea plantation as a lab to land programme and provided Ponnan the entire package from saplings to fertilisers. His current income is Rs 9,000 per year from the tea garden. He has sold 10 silver oak trees at the rate of Rs 200 per tree. He has about 20 coffee plants in his tea garden. There are a few birds that come to his tea garden which are beneficial since they feed on insects. He owns simple tools but hires the sprayer. He ploughs back the weeds into trenches to make manure. The gaur from the nearby forest visits their tea garden often and indicates an increase in the weeds.

He uses NPK complex – 50 kg twice a year. Yellowish spots on the leaf and leaf blisters are the main problems in tea. Shortage in rainfall and erratic rain has become a regular feature which affects the tea yield. If the crop fails, or the rate is low, he has to look for labour work. He earns Rs 5,000 per annum from the tea as net income. Ponnan now prefers tea cultivation since he cannot go for daily wage work at his age. Tea assures him of some income every 20 days. However, the market price for tea fluctuates. If it falls very low like in 2005-06, there is hardly any return and the cash income is very low.

2.2.2. Current situation of the intervention

The government intervention is long over after a link was made with the bank for a loan. All the families have repaid the loan. Since the returns from tea are not adequate for a family, people go for additional wage work in the nearby estates. There are some discussions about going back to their old land and reviving traditional agriculture with financial and seed support from Keystone. The opportunity to go back to their inherited lands for the cultivation of food crops is still an option in addition to enriching their tea plantation with other tree species. This would give them an opportunity to rear goats, which is also important for their rites and rituals.

3. Loss of community knowledge/practice

The Kurumbas are classified as a hunter-gatherer community, living off forest resources and practising cultivation of an "old" nature. Some of their practices continue into the present day. The land was cleared in the month of April and food crops like *ragi* (finger millet), pulses, greens and oil crops namely sesame were sown. This season was popularly known as kar pattam. The second cycle of sowing began in the second week of July, which was a major cropping season for all the farmers. During this cycle, a variety of crops were cultivated. Crops were harvested in a continuous sequence from August until the end of December. The traditional farming was practised locally with traditional governance, community participation, numerous rites and ceremonies, and seed and pest management controls. This system enabled food and nutrition security. However, displacement from the 1960s onwards due to various reasons led to a gradual loss of their knowledge and traditions.

When they lived in the forest, their community knowledge informed their practices, as was reflected in the cultural aspects of their cuisine, birth, marriage and death, sacred groves, rituals and ceremonies. The Kurumba community had five leaders, each one responsible for a particular stage of the life and/or livelihood cycle:

- *Modalai* – head
- *Mannukaran* – farming expert is important for the cultivation of millet
- *Jathi* – marriage functions
- *Bandari* – informer/conveyer of messages
- *Kurudalai* – rituals and rites

3.1. *Mannukaran* – the farming expert

All the five leaders would meet at the modalai's house to decide the land cleaning date. On the scheduled date, the *mannukaran* would perform the puja (worshipful offering) at home. He would go to the land to perform puja before sunrise. Thereafter, all the farmers would be involved in clearing the land. A puja would be performed for the farm tools. The cleared brush would be burnt in the field. The remaining stalks or stems would be collected and taken to the water source for which a separate puja would be performed. These were used for bunding on the hill slopes/farms. Water canals were dug to divert rain water. On the sowing date, the *mannukaran* would sow the seeds alone and

perform a puja by making pongal (foxtail millet and lablab food preparation). On the following day, all the farmers would sow the seed. Another puja was performed for the sowing tools.

The *mannukaran* would initiate the weeding operations with the invocation "kai arasi budadu" to prevent rat and animal attacks to the crops. On the first day of weeding, they would pluck keerai (Amarnthus spp.) and perform the puja followed by regular weeding. Similarly, the *mannukaran* played an important role during the harvest. He would visit all the fields, collect the grain – ear heads, cobs and panicles and divide them into two portions; he would keep one for seed at his home, the other he would take to the temple, perform puja and make pongal to offer to the soil, the environment and to God for providing the harvest. This harvest festival, thodu habba, entailed many celebrations, dances and foods.

3.2. Community beliefs and taboos pertaining to agricultural practices

The community maintained certain beliefs and taboos for their fields and millet crops:

- Women with menstrual periods were not allowed to work in the millet fields for 7 days;
- Women who had delivered were not allowed to work in the millet fields for 3 months;
- Footwear was not allowed in the fields;
- Eating non vegetarian foods was forbidden in the fields;
- Family members of any household with a death were not allowed;
- *Mannukaran* was responsible for implementing the rules strictly in order to prevent natural losses.

4. Impact of the practice/knowledge

4.1. Role of women and men in agriculture

The practice of millet cultivation amongst the Kurumbas was the backbone of their culture and agriculture, their relation to the land and the forests. In the millet cultivation of the Kurumbas, the crops were basically dealt with by the women who, after playing an important role in the sowing, weeding and harvesting, were fully responsible for post-harvest, storage and use throughout the year. Men and women played an important role in this system, involving other

members of the family. The exchange of grains took place between relatives and many visits were made during the harvest time for eating delicacies in the fields like roasted maize, popped amaranthus with honey, etc.

4.2. Crop diversity

The community also grew a diverse variety of main crops (*tenai kadu*), both cereals and vegetables. Due to their proximity to the forest areas, many wild varieties also found place in their millet fields (refer Table 1: Diversity of crops, fruit and vegetables). Such a high diversity of foods in a single field along with the knowledge of seed selection and storage, methods of storage, varied recipes of cooking and the awareness of the nutritional value of the foods was indeed rare.

4.2.1.Diversity of crops, fruit and vegetables

- Cereals: Amaranthus spp., finger millet *(ragi),* foxtail millet *(thenai),* little millet *(samai),* maize *(makka cholam)*
- Legumes: Dolichos lablab *(mochai),* horse gram *(kollu),* lablab *(dora avarai), ola avarai*, pigeon pea
- Vegetables: Amaranthus spp., arrowroot, beans, brinjal *(kathrikai),* chilli small *(jeeni malagai),* chillies wild, coriander *(kothamalli),* greens *(chukuti keerai), manathakkali*, mustard *(kadugu),* nannari *(sarasaparilla),* tomatoes *(thakalli),* tomatoes small, yam *(diascorea spp.)*
- Fruit: Banana, cape gooseberry, gooseberry, guava, jackfruit

Amongst the indigenous people, intensive systems of agriculture were not practised; instead, they scored high on biodiversity and traditional knowledge. This practice and knowledge was closely woven into the communities' knowledge of medicine, their practices concerning child rearing and everyday foods. Their traditional farming practices emphasised the role of the *mannukaran* with whom rested a great deal of knowledge about the soil, seasons and seeds. This also meant that the community could cope with climatic variations and aberrations, which now threaten the cash crops.

4.3. Ecological diversity

Millet fields had many wild species due to their proximity to the forest areas. This positively impacted on the health and nutrition of the Kurumba families who lived in tune with nature (refer Box 2: Nostalgia).

Zero level application of chemical inputs in the traditional farming practices of the Kurumbas played a critical role in maintaining the mountain ecosystems, water resources and a variety of life forms – soil organisms, insects, reptiles, and a variety of birds and mammals. Thus, the ecological diversity in mixed farming was enabled by pollinators, seed dispersers, soil fertility and crop raiding too. However, the birds were often considered a menace as they ate the crops off the panicles.

Box 2 : Nostalgia

"In our old village we had common agricultural lands where our parents were doing millet cropping which was natural farming. Our main crops were finger millet, foxtail millet, little millet, pigeon pea, etc. (refer Table 1) It was very simple and sustainable agriculture. We had a variety of foods which provided us a lot of stamina. Our parents were well built and very strong; as children we were also strong. We could walk long distances, do hard work, (today's generation hardly works) and efficiency was our trademark. We had plenty of greens, fruit and other vegetables along with millets and pulses which nourished our body, mind and soul. Our traditional food dishes were very delicious – the following are a few delicacies that we still remember

- Ragi rotti, kali, udur putti
- Samai: sapadu, upma, payasam
- Thenai: sapadu, kanji
- Makka cholam: kali, pori, sutti, pullungi vegavacchi chinna cholam: kali, kanji

Compared to our children we were very healthy and good in stature, with lots of activities bubbling around our day to day life. We used to collect different fruits, tubers and greens from our fields and forest. Our families were very close. We were always with our parents and there was a lot of observation and communication which created deep connections with our culture." (Janaki Amma, Village Pudukkadu, 24 July 2009)

4.4. Food sovereignty

The traditional biodiverse cropping system of the Kurumbas provided them with food and livelihood security. The millet yield from their land sufficed the Kurumbas for 3 to 5 months of the year. Millet was not sold in the open market in this region. Finger millet and foxtail millet preparations were the staple food of the Kurumbas, which they consumed for about 17 meals in a month (tribal families have two meals a day, that is, morning and evening).

Uncultivated food such as natural tubers, green, leafy vegetables, wild fruit and mushrooms collected from the millet fields and forests served as an important food resource for the Kurumbas.

4.5. Fodder security for livestock

The stalk and hay from the finger millet, little millet and foxtail millet was stored as fodder for livestock in the winter.

4.6. Livelihood security

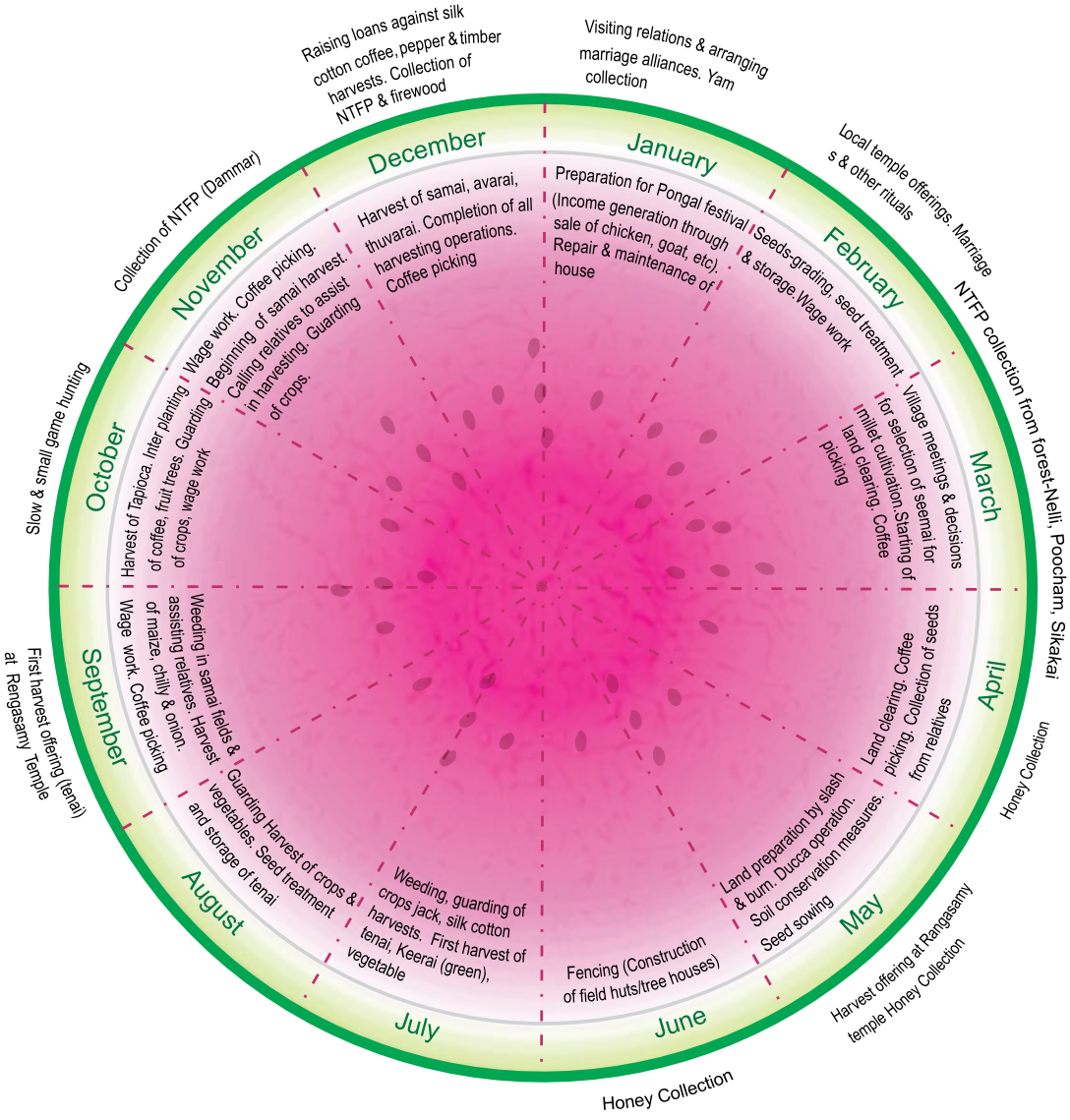
The Kurumbas valued the traditional land as an asset that was retrieved from the forest. They protected it from erosion and maintained the health of the soil. They undertook millet cultivation that required no irrigation in vast tracts of rainfed land on the hill slopes. The land preparation and package of cultivation was less expensive than that for vegetable cultivation. (Refer calendar of livelihood activities). Relatives and community members contributed their labour to the agricultural operations such as weeding and harvesting. They were paid in grain rather than cash.

4.7. Cultural aspect

The Kurumbas offered grain as a community to the deities during the annual rituals. They offered a bunch of earheads/panicles of all types of millets and cereals from the first harvest to the deity. These were placed them in the temple premises during the annual ritual or festivities. These grains were then shared among all the community members.

The men, women and children from the Kurumba community participated in the communal harvesting, threshing and separation of the millet/grain during *samai okkal*. Threshing began in the late evening and went on throughout the night till all the harvested grain was threshed. This enabled the community

Calendar of livelihood activities



to avoid the hot sun, and to ensure communal participation due to the availability of labour in the evening. *Samai okkal* served as an opportunity for a celebration in which songs, actions, traditional music and drumming as well as stories and interesting incidents from the time of guarding the field were shared.

5. Impact of tea and coffee growing on the Kurumba community

5.1. Ecological impact of tea and coffee

Tea and coffee have different ecological livelihood impacts on the community. Tea is a mono crop that has been cloned and propagated through various government schemes and the Tea Board. The land is totally cleared of trees, bushes, herbs and shrubs for growing tea. Tea is promoted on all kinds of slopes, with no consideration related to rainfall, soil or aspect. Tea, a hardy crop, has adapted even in elevations as low as 1200 metres, though it has poor productivity and returns. Tea growing comes with a set of practices related to the use of pesticides, fungicides and fertilisers. The subsidies on these serve as a kind of trap. The tea agents provide loans to the tea growers for the purchase of these subsidised inputs. They serve to indebt the farmer and determine the price at which the tea grower sells the tea.

Coffee on the other hand is an older plantation crop in the Nilgiris and the entire region. It needs greater diversity – shade trees, fruit trees, mulch and shaded valleys to grow. This is well-adapted to the tradition of mixed cropping practices of the Kurumba tribal community who grow it with a combination of trees and cash crops like silk cotton, pepper and other spices. Coffee plantations support many birds and insect species and have better soil profiles. They also provide the coffee growers with diverse income from different crops which are harvested at different times of the year. These in turn enhance the livelihood security of the tribal family. Through a plantation, there is enough scope with coffee to grow vegetables and other household crops. A similarly diverse scenario is not possible in a tea plantation that first takes out every other species to make room for tea.

Thus, the largely different tea and coffee plantations have caused different impacts on the community though both have led to the loss of the traditional millet/mixed cropping agricultural practices.

5.2. Soil nutrition

In the traditional cropping system, the management of soil nutrition is incorporated into the cropping system itself. There are crops which nourish the soil through nitrogen fixation, leaf fall, plough back, soil covering and mulch.

During the growing season, the millet field provides opportunity to grow millets, pulses, oil seeds, beans, greens, etc. In comparison, the coffee and tea plantation provide limited opportunities for mixed cropping, which results in low diversity of flora and fauna, and poor soil conditions.

5.3. Food diversity

The coffee and tea plantations have deprived the Kurumbas of growing/consuming nutrition-rich food crops. As Ponnan says, "There is money, but there is no food. We used to grow maize, *keerai*, amaranth, jackfruit, *ragi, samai, thenai*, banana, tubers like tapioca, sweet potato, yam and arrow root as well as collect honey. Now we buy food from the shops nearby and eat rice 3 times a day…"

5.4. Labour use

Picking coffee berries and tea plucking are labour intensive jobs. Tea leaves needs to be plucked every 20 days. As long as family labour is available for picking/plucking, there is some income; but if the labour has to be hired, as with the onset of old age, or in the case of sickness, it eats into the meagre profits of the planter.

In traditional agriculture, the community provides space for all types of agricultural work suitable for various age and gender groups, such as sowing, weeding, harvesting and threshing by women; ploughing by men; and lighter jobs such as to sit and watch the fields against birds during the day which the children or elderly can do; or against theft during the nights which the elderly can do. Such sensitivity to different age groups does not find a place in the coffee and tea growing practices.

5.5. Increased dependence on markets

Small coffee and tea plantations are not viable models with only the coffee berry or tea leaf as harvest. The planter is at the mercy of the open market which decides the price/rate of coffee and tea. Coffee and tea are crops are external input intensive. Currently, the Kurumbas have no practices for the regeneration of bio-resources on their land.

5.6. Loss of culture

With the switch to growing coffee and tea, the Kurumba community experiences a huge cultural loss. They have lost the knowledge and practices pertaining to their agriculture and their cuisine since they have been unable to transfer their knowledge to coffee and tea growing context. The plantation model is not yet integrated into their lives and livelihoods. With this have disappeared their associated rituals, traditional leaders and community institutions.

6. Factors that threaten the knowledge system/genetic resources

6.1. Migration

Migration has led to great losses for the Kurumba community. The food producers have become food purchasers. Their independence and dignity of life have been lost. Discussions with the community in Pudukkadu revealed that the elephant menace was not a natural occurrence but directly attributable to the increase in urbanisation at the foothills, and the plantations that disturbed or obstructed the elephant corridors. Many plantations that have come up in recent years are protected with electrical fences, which have led the elephants to encroach on human habitation.

6.2. Inadequate rehabilitation policy

To protect them from elephant attacks, the Kurumbas were resettled in Pudukkadu on forest land without adequate title to the land. Lack of attention to the needs and lifestyle of the Kurumba community while selecting a site for their rehabilitation has led to the virtual decimation of their heritage. If the government had provided them cultivable land they could have continued in their rich tradition of biodiverse millet cropping which met their food needs. They lost touch with their traditional food crops and cooking skills which in turn impacted on their nutrition and health.

6.3. *Mannukaran* expertise not transferred

The change of habitat and livelihood has stifled any growth in the expertise of the *mannukaran*. Although the traditional knowledge exists, the community is no longer in a position to enable the transfer of the invaluable community knowledge to the younger generation as would have been possible in their traditional environment. Thus, *thodu habba* is no longer celebrated in the coffee plantations, nor are the beliefs and taboos followed as they were in the context of millet cultivation.

6.4. Restrictive laws

The present settlement of the Kurumbas of Pudukkadu is restricted under forest laws. They cannot expand cultivation beyond the 15 acres where coffee is raised. The forest laws do not permit them to cut the shade trees although the shade is causing a variety of problems for the coffee plants such as pest infestation and disease, mainly, stem borers and berry borers resulting in low yields. The cultivation of coffee is still new to them for which they are unable to build on their traditional knowledge which is closely linked to agricultural biodiversity.

Says Malli of Pudukkadu, "We are neither in a position to go back to mixed crops nor acquire the new skills required for coffee growing. Our ignorance of current issues is also a big problem for us. We have become absolutely dependent, where is our freedom?"

6.5. Public distribution system

Discussion with the women focused on nutrition, specifically related to their children who are now being raised on the food available through the PDS. According to the women, the lack of traditional foods has negatively impacted on their health as they only eat rice and pulses grown with toxic chemical inputs. They discussed the possibility of the PDS supplying millets which would greatly enrich their diet.

In sum, there are several factors that threaten the traditional knowledge system, practices and genetic resources in the Nilgiris, specifically for the Kurumba community:

- Kurumbas are few in number;
- Kurumbas have become a migrant community in search of livelihoods, especially wage labour, due to which they are losing access to their lands, or their lands are becoming fallow;
- The shift from agriculture to wage labour has impacted the community culturally in the absence of community agricultural practices such as the importance of the *mannukaran* in communal agricultural practices and the associated knowledge;
- Irregular rains and growing disturbance from wild animals are important factors threatening their knowledge system. The current generation of

Kurumba farmers prefer wage work to planting their fields with the risk of no returns;

- Millet cultivation is becoming rare in the Nilgiris, endangering seed stock, and resulting in the loss of several hill varieties of millet, especially little millet, beans and amaranthus varieties;
- The PDS system that provides rice rather than their traditional diet of millets is slowly changing their food habits, leading to a nutritional and cultural loss.

7. Community interventions

The possibilities for the future entail a mammoth effort for the revival of community agricultural practices and community rights to land in which Keystone Foundation is engaged. The Forest Rights Act, 2006 enables claims to establish rights back to traditional lands. Coupled with appropriate technology interventions like micro-irrigation and solar power fencing, this can bring back the diverse agricultural system and revive the existing knowledge amongst the older generation. Hence, Keystone Foundation is emphasising the importance of the nutritional qualities and environmental benefits of these foods and crops by starting food festivals and recipe competitions amongst the community, supporting community seed banks to restore the genetic diversity and agri-biodiversity. It hopes that these efforts will enable the knowledge and practices to pass on to the younger generation.

7.1. Keystone's efforts

- Revive millet cropping: 7 to 80 acres, (3 to 375 families)
- Encourage mixed cropping with coffee in 875 acres
- Revive and recognise traditional governance
- Revive social spaces through multi-cropping
- Promote bee-keeping to enhance crop productivity, income and personal consumption
- Value addition for farm and forest harvests
- Incorporate indigenous ecological knowledge through CBOs (farmers' group, women producers' group and NTFP collectors' group)
- Train and engage youth groups in resource and ecological monitoring
- Facilitate participant farmers to convert their lands to different land uses as a strategy to cope with changing weather conditions!

7.2. Way ahead

Under conditions of poor soil fertility, highly erratic rains, and high pest incidence under the forest canopy, there is hardly any return from coffee for the Kurumba families. No food sovereignty, low income and low nutrition confront the Kurumbas. In such a scenario, the revival of biodiversity on their meagre lands is important to the community. They would like to enrich the coffee plantations with a variety of trees which will provide food and income. However, the government schemes of tea and coffee cultivation, horticultural loans and subsidies are not designed for the hilly lands of the Kurumbas which became neglected and fallow.

Keystone's interventions with the community seek to regenerate these fallow lands by reviving the biodiverse millet cropping system. The efforts to enhance agri-biodiversity in the context of livelihood security require several interventions at the community and organisational levels, namely:

- Document the biodiversity and sustain agriculture in the context of livelihood security;
- Research on-farm productivity and forest harvests, namely, yields and responses in the context of changing weather conditions;
- Increase diversity of tree and crop species suited to the local climatic conditions in their coffee plantations on the forest land so as to provide a natural yield insurance against pest, disease and the vagaries of nature;
- Exchange learning between farmers, CBOs and network partners;
- Promote biodiversity with sustainable farming practices on small landholdings;
- Enable farmers to conserve their own seeds/genetic resources;
- Document and identify local breeds for viable livestock;
- Enable the rights of farmers and NTFP collectors in policy making at the different levels of formulation and implementation.

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Threatened Indigenous Rice Biodiversity in Thane District, Maharashtra and Community-based Efforts in its Conservation

BAIF-MITTRA

Maharashtra

Sanjay Patil

This case study presents the action research on the indigenous paddy landraces in Thane district, Maharashtra. It examines the traditional practices associated with paddy cultivation and the characteristics of paddy landraces. It explores the reasons for the disappearance of the paddy landraces and describes its institutional and community interventions to save the endangered paddy landraces. BAIF-MITTRA's work on rice focuses on the promotion of on-farm conservation and seed multiplication involving farmers in participatory varietal selection from diverse paddy landraces.

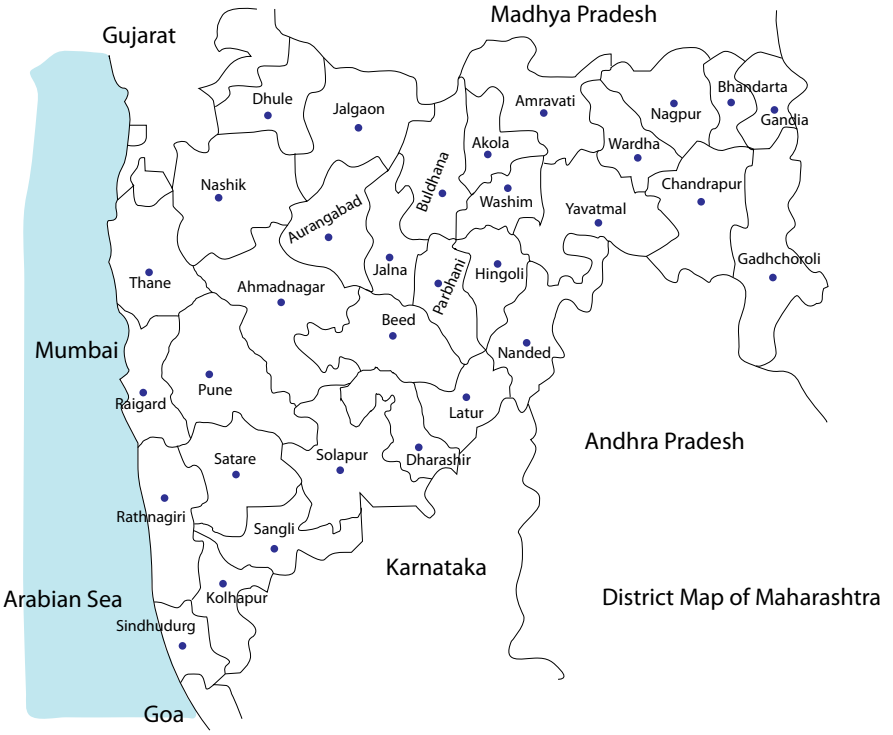
CONTENTS

1. BAIF-MITTRA and its work

BAIF Development Research Foundation was established in 1967 by the Late Dr. Manibhai Desai, a disciple of Mahatma Gandhi, to replicate his unique experiments in rural development. BAIF is well known both as a scientific and applied research organisation in the country, and has successfully implemented several livelihood enhancement projects, primarily based on the transfer of proven technology and the mobilisation of people at the local level.

BAIF, along with its associate organisation, MITTRA (Maharashtra Institute for Transfer of Technologies in Rural Areas), is actively involved in the conservation of local crops and animal breeds in the state of Maharashtra.

BAIF-MITTRA has started the Green and Applied Technologies Resources Centre (GATRC) in Jawhar taluk (block) of Thane district in Maharashtra. GATRC is being



developed as a dedicated centre for the experimentation, demonstration, field action research, and large scale replication of low cost sustainable agricultural practices.

BAIF-MITTRA recognises the urgent need to plan and undertake a programme to promote and popularise conservation, cultivation and management of neglected and under-used crop resources. Its objective is to diversify both income and crop options for marginal farmers while also improving the coping capacity of the rural marginalised communities.

The BAIF-MITTRA project on conservation of indigenous rice varieties is developed based on the learning from the pioneering efforts of GREEN Foundation, Bangalore; Centre for Indian Knowledge System (CIKS), Chennai; and Deccan Development Society, Hyderabad. The major thrust of the work with the tribal communities in the area has been to identify the local landraces in paddy, tubers and other millets. This project focuses on sustainable agriculture with low cost techniques to reap the yields.

1.1. Location

Rice is the second most widely consumed cereal in the world next to wheat. It is the staple food for two-thirds of the world's population. It is also an integral part of social rites, rituals and festivals in almost all Asian countries. India is

traditionally famous for its indigenous rice biodiversity. It has been home to a phenomenal diversity of both wild and cultivated crops. However, the recent years have witnessed a marked decline in the variety and diversity of cultivated crops such as rice and other cereals.

Thane is one of the northern districts of the Konkan region in the state of Maharashtra. It includes part of the Western Ghats region which is considered to be a biodiversity "hot spot". The area is host to an amazing diversity of rice and other food plants. The typical lateritic soils are poor, and agriculture is largely rainfed (only 5% to 7% of the Konkan region is irrigated).

The modern "high yielding varieties" did not make significant incursions into these regions during the first 2-3 decades of the Green Revolution (1960s-1980s). Hence, genetic diversity remained surprisingly high in some tribal areas. However, since the last 2 decades, there has been a gradual erosion of the indigenous biodiversity. Most indigenous rice varieties have been replaced by high-yielding varieties such as Ratna and Jaya, considered as the most responsive varieties in this area. The promise of the high yielding varieties has not been borne out in this region. The majority of farmers, especially the resource-poor tribal farmers could not afford to buy the fertilisers that are normally recommended along with these varieties

Thane district has a fairly large tribal population. The tribal people have traditionally cultivated over 300 diverse rice varieties with specific attributes such as hunger satiation, instant energy provision during peak workloads and for medicinal use. This wonderful diversity of rice has formed the basis of a nutritious and secure diet for the tribal population.

However, the erosion of rice diversity, as in many other regions, has taken place at an accelerated pace over of the past 15 to 20 years. During this study, 61 varieties out of the 300 rice varieties of the region were available with the farmers. However, only 4 of them are regularly sown, namely, Kolpi (Early), Dangi White, Dangi Red, Rajghudya. All others are rare or extinct. Although some of these 300 varieties are stored as a part of the breeding programme of the agricultural university, their outreach to the farmers is minimal. Hence, most farmers are ignorant about the existence of such gene banks, thereby hampering their access to these precious seeds and genetic resources.

In some of the remote areas, a few farmers have continued to cultivate the traditional varieties on a small portion of their land, mainly for their consumption. Thus, many of these crops still have their presence despite the negligence of the last 2 decades. This is indicative of their potential role in the cropping systems of India, especially in small land holdings.

2. BAIF study on indigenous paddy landraces

BAIF started its work on indigenous rice varieties in the tribal parts of Thane district on a pilot scale. It initiated a survey under the CBM-South Asia, India programme from January 2009 to September 2009. The scope of its work was to understand the occurrence of indigenous rice genetic resources, characterise them on the basis of food security, yield, pest and disease resistance, fragrance and try to understand peoples' perceptions for the continued cultivation of such varieties. Efforts were also made to know the traditional cultivation practices associated with such varieties.

2.1. Specific objectives

The specific objectives of the BAIF study on indigenous paddy landraces are to study the following :

- The traditional practices associated with paddy cultivation and pilot test a few of them;
- The status of indigenous rice genetic diversity in 5 tribal blocks and 25 villages in all;
- The agronomical and morphological characteristics and other useful traits and performance of paddy landraces;
- The farmers' perceptions about existing genetic resources, their use and continued cultivation;
- The reasons for the disappearance of the paddy genetic resources.

2.2. Study design

- District: Thane, Maharashtra.
- Taluk: 5 taluks – Jawhar, Palghar, Mokhada, Shahapur, Murbad
- Number of villages under baseline survey: 25 villages – 5 per taluk
- Number of farmers under baseline survey: 625 farmers – 25 per village
- Number of indigenous seed savers under study: 61 farmers out of the 625 contacted for the specific survey were identified as indigenous seed savers cultivating the indigenous paddy landraces.
- Number of landraces under baseline survey: 61 landraces
- Number of landraces under experimentation: 46 landraces
- Field experimentation centre: Jawhar taluk, Thane district
- Time period: January to September 2009

- Type of interactions: Personal interviews, group discussions, field visits to farmers fields, interactions with the Agriculture Department, Agriculture University, literature survey, seed exhibitions/mela (fair), etc.

2.3. Baseline survey

BAIF-MITTRA selected interior villages for the baseline survey as preliminary visits revealed the presence of paddy landraces in these villages. They conducted primary meetings with knowledgeable persons in the villages to document the farmers' knowledge about seed storage, traditional cultivation practices, local pest and disease management techniques, their perceptions of the need and importance of the indigenous landraces vis-à-vis the modern varieties, etc. They engaged in general and group discussions with the farmers. They involved 365 ashram school students to collect data on the village-wise existence of indigenous paddy landraces. This study enabled interaction with 1,856 farmers – men and women through seed exhibitions/seed mela (refer Box 1: Survey form).

2.3.1. Secondary data collection

45 representatives from NGOs, agricultural universities and research institutions, and government departments were involved in the data collection on rice varieties from secondary sources. BAIF-MITTRA also visited the Rice Research Station in Karjat, Maharashtra, B.S.K.K.V (Agriculture University) Dapoli, and M.S. Swaminathan Foundation, Chennai.

2.3.2. Awareness programmes

BAIF conducted seed mela (fair)/exhibitions in 5 blocks of Thane district to document people's knowledge about indigenous paddy landraces – their yield, specific traits and characteristics. It was an attempt to document the present status as well as the farmers' perceptions of rice biodiversity. They informed the farmers about the need and importance of crop genetic resource conservation through video CD and posters.

2.3.3. Dissemination

BAIF shared the data and its analysis with the Agriculture Department, school teachers, NGOs, and scientists through a one-day workshop. They analysed the data collected on the basis of water requirement, cultural aspects, crop period, yield, lodging and non-lodging characteristics, medicinal importance and special traits, if any.

2.4 Specific survey

BAIF-MITTRA identified 61 farmers who are cultivating indigenous paddy landraces for a specific survey (refer Box 1: Survey form). They undertook on-farm seed sample selection and collection of 46 landraces from the farmers' seed stock and from other organisations. They documented the traditional practices associated with paddy cultivation through personal interviews, group discussions and field visits.

Box 1 : Survey form	
Crop	Fragrance, threshability.
Common name, local name	Grain yield (q/ha), straw yield (q/ha)
Scientific name	Cooking quality, pest resistance
Variety (local name)	Disease resistance, end use
Climate of area/region	Special characteristics
Growing habitat, soil type	Present status of spread (villages/ taluks)
Land type	Trend in cultivation during last 10 years
Method of seedling preparation	Reasons for disappearance
Maturity period (sowing to harvesting), plant height (cm)	Name of farmer/community seed savers
Culm strength, panicle length (cm)	Information collected by
Panicle shattering, grain type	
Grain colour, seed coat (bran colour)	

2.4.1. Experimentation

On farm and laboratory experiments were planned to evaluate 46 of the selected paddy landraces on the basis of morphological and agronomic characteristics as per the guidelines of the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA). The characteristics, namely, the grain length and the grain width were measured with a micrometer in the laboratory.

Primary data collected from the baseline survey and the specific survey provided in-depth information about the indigenous paddy landraces and the seed samples gathered from seed savers who have been cultivating these landraces.

The experimentation entailed seed treatment with cow urine, wood ash and neem leaves prior to storage, and storage of seed samples in mud pots, cloth bags and envelopes.

Seedling preparation entailed raising seedlings of 46 paddy landraces at Chowk village in Jawhar taluk. For seed treatment, the seeds were mixed with 100 gm

of Azospirilum and shade dried. The seedling preparation beds were 25 ft x 3 ft. The material used for the raised bed preparation was 10 kg vermicompost, 10 kg neem cake and 500 g Azospirilum. The distance maintained between the two landraces was 25 cm.

a. On-farm experimentation

Pot experiments: were planned at Chowk village in Jawhar taluk to study the morphological and agronomic characterisation. The pot mixture was prepared by mixing 250 kg of farmyard manure, 250 kg of red soil, 100 kg of neem cake, 2 kg of blue green algae, 2 kg of Azospirilum. Earthen pots were filled with the pot mixture and watered. 13-day old paddy seedlings (3 plants/pot) were transplanted. On the same day, 3 paddy seedlings of each variety were planted in each earthen pot. 3 days after transplantation, the pots were drenched with *jeevamrut* (50 ml/pot) made with the excretions and secretions of the cow. Soil fertility, pest/disease management practices were carried out according to the organic cultivation methods.

Block design experimentation:

- Location: Jawhar
- Number of paddy landraces under experimentation: 46
- Plot size/landrace: 2×2 sq m
- Spacing between two seedlings: 25 cm
- Spacing between two lines: 25 cm
- Cultivation: Cultivated as per maturity period (Early, Mid Late, Late)
- Fertiliser application: Organic fertiliser (5:10:5), Neem cake, Azospirilum
- Transplantation of seedlings: After 16-22 days
- Method of cultivation: organic (seed to harvest)
- Parameters under study: Agronomic and morphological characterisation.

b. Laboratory experimentation:

In the laboratory, the paddy characteristics, namely, grain length and width were measured with a micrometer

2.5. Traditional practices associated with indigenous paddy cultivation

The survey yielded some important findings on seedling preparation and transplantation as important steps in rice cultivation. There are 4 traditional methods of seedling preparation – *rabb, utta,* sprouted seeds and raised bed. The seedlings then undergo single or double transplantation.

2.5.1. Seedling preparation

a. Rabb method

In February, farming household members collect biomass, namely, dried grasses, leaf litter, shrubs, tree branches. These are spread over the fields, covered with dried cowdung and a layer of soil and burnt. From the farmers' point of view, this method burns the seeds of the weeds thereby facilitating weed control. It also enables easy picking of seedlings for transplanting. From a scientific point of view, the ash provides important nutrients such as nitrogen and phosphorus for the seedlings.

b. Utta method

Dry and wet *utta* methods are adopted not as a regular practice, but in case of a shortage of seedlings during transplantation. The resultant plants are not healthy and more prone to pest and disease attacks. But it is better than keeping the land uncultivated.

- *Dry utta method*: The land is ploughed and the seed is broadcast without puddling.
- *Wet utta method*: The land is ploughed, puddling is done, the water is drained and the seed is broadcasted.

c. Sprouted seeds

The seeds are moistened and sprouted in a gunny sack for 2-3 days. The sprouted seeds are broadcast on puddled land. This method is important for the emergency preparation of seedlings. But the seedlings prepared are not thick.

d. Raised bed method

In the raised bed method, a bed of 12 ft x 3.5 ft x 0.5 ft is prepared by mixing compost, neem cake,vermicompost, azospirilum, etc and the seed is sown on it.

2.5.2. Double transplantation

Seedlings prepared through the *rabb* or *utta* methods are transplanted. The double transplantation of seedlings in the field itself offers several advantages despite a higher labour requirement:

- Increased shoot thickness;
- Reduction in seed rate;
- Increment in productivity;
- Healthy and hardy plant vigour;
- Absence of non-effective tillers;
- Long panicle;
- More filled grain percentage;
- Less pest and disease problem;
- Varieties: Kasbai, Rajghudya

2.5.3. Seed conservation

Institutional level trials were conducted on seed treatment and seed storage practices based on the samples collected from the seed savers:

- Seed treatment with cow urine, wood ash, neem leaves before storage;
- Storage of seed samples in clay pots, cloth bags and envelopes.

Experiments were conducted to assess the best method to store seed samples without decreasing seed germination capacity. Clay pots and cloth bags or gunny sacks were useful to keep and store seeds for the next sowing season, which is about 6 months after the harvest, but not for much longer than that.

3. Status of indigenous rice genetic biodiversity

Specific participatory surveys in the field enabled an understanding of the maturity period, tillering ability, yield, any specific traits, and facilitated the collection of good quality seed samples. A total of 61 farmers who continue to cultivate indigenous paddy landraces for a variety of reasons were identified and contacted. Yield is not the prime determinant to gauge the worth of a variety for these seed saver farmers (refer Box 2: Varietal selection criteria of farmers).

3.1. Diminishing number of landraces

The majority of the indigenous varieties are either rare or extinct. Of the 61 varieties available with the farmers, they sow 4 varieties regularly. These are:

1. Kolpi (Early) is valued for its fine grain, market value, resistance to stem borer and blast, good fodder value, excellent cooking rice;

2. Dangi (Red) and Dangi (White) are dry upland varieties that are valued for their ability to withstand harsh weather conditions where other varieties wither away. They require no external inputs, hence are important from the point of view of food security rather than yield. They have a bold grain that is suitable for gruel, roti preparation, as well as medicinal use;
3. Rajghudya is valued for its non-lodging character, medicinal properties, good fodder value. Its slender and long grain is ideal for cooked rice.

Box 2 : Varietal selection criteria of farmers

Yield (grain and straw)	Suitability of land
Fodder value	Drought resistance
Roofing material	Pest and disease resistance
Food security	Strong stems
Nutritional aspects	Good tillering ability
Cultural aspects (ritual use)	Grain size
Market value	Non-shattering

3.2. Perceptions of farmers and seed keepers

3.2.1. Local varieties

Local varieties give stable yields and require lower external inputs than the high-yielding varieties. They are more suitable to local farming conditions such as dryland rainfed cultivation and cope better with the vagaries of nature, disease and pests. Yet, but these local varieties are presently endangered.

Local genetic resources are in urgent need of conservation for some of the additional gains that they provide such as varieties that are short duration, pest resistant and suitable for dryland rainfed cultivation. Indigenous varieties provide a higher straw yield which is valuable to farmers as cattle feed and roofing material. They provide food security in times of distress (when other

crops have failed). They also taste better in comparison to the hybrid varieties. Many indigenous varieties fulfil specific nutritional and dietary needs, as well as have medicinal and ritual importance that the farmers perceive as valuable (refer Table 1: Character-wise varietal analysis).

3.2.2. High-yielding varieties

High-yielding varieties (HYVs) give a bumper yield for the first year but the seeds cannot be used for cultivation in the second year. HYVs have a better appearance, especially since the application of urea gives quick results in terms of vegetative growth. They do not give the promised yield without the use of chemical fertilisers, resulting in increased expenditure to the farmers. HYVs are not suitable for all farming conditions. They have compromised on the nutritional value of food.

3.2.3. Impact of modern farming practices

The continuous use of chemical fertilisers has reduced soil fertility. The water holding capacity and porosity of soil has decreased. It is difficult to replenish

the loss of soil nutrients with farmyard manure since reduction in livestock has led to poor dung availability. Pest and disease attacks have increased tremendously.

3.3. Characteristics of paddy landraces

Large numbers of paddy landraces are grown by the farmers of Jawhar taluk and Mokhada taluk of Thane district for various reasons as is evident from the character-wise and maturity-wise varietal analysis presented in Tables 1 and 2. In recent decades, these have received stiff competition from the HYVs introduced in Thane district, namely, Ratna,Jaya Sahyadri, MT-1010, Gujrat-2, Karjat-2, 3, 11, and Rupali due to their non-logding, pest resistance, high-yielding character (refer Table 4).

Table 1: Character-wise varietal analysis

S. No.	Character	List of varieties
1	Food security	Dangi (Red), Dangi (White), Dhaval, Dhundune, Dula, Hari, Kali Khadsi, Kali Kudai, Masala
2	Market value	Banglya, Dhaval Bhat, Kasbai, Kavla, Kolam, Kolpi (Early), Rajghudya, Surti Kolam, Zini(Wada)
3	Fodder value	Banglya, Dangi, Dula, Kasbai, Kolam, Kolpi (Early), Kolpi (L), Malghudya, Rajghudya, Vakvel, Zini
4	Medicinal values	Weakness: Dangi (Red), Dangi (White), Kali Khadsi Kali Kudai Increased lactation for nursing mothers: Dangi (Red) Weakness, wound recovery, fracture: Mahadi Weakness from delivery: Dangi (Red), Dangi (White), Malghudya
5	Disease resistant	Blast resistant: Banglya, Dev Bhat, Dhaval, Hari, Juna Kolam, Kalbhat, Kali Khadsi, Kali Kudai, Kasbai, Kolpi, Lalya, Malghudya, Masala, Kolpi (Mid late), Najar Bhat, Varangal Black
5a		Moderately blast resistant: Dangi White and Red, Dhundune, Dodgi, Karjat, Kasvel, Kolpi (Early), Masuri, Rajghudya, Varangal (Late), Zini

5b		Brown spot resistant: Banglya, Juna Kolam, Kasbai, Kavla, Lalya, Masala, Rajghudya
6a	Pest resistant	Case worm resistant: Banglya, Dev Bhat, Dhaval, Dhundune, Dula, Hari, Juna Kolam, Kasbai, Kasvel, Kolpi (E), Kolpi (Late), Kali Kudai, Lalya, Mahadi, Rajghudya, Sagg, Tamkudai
6b		Stem borer resistant: Dangi Red, Dangi White, Dhaval, Dula-1 Dula-2, Hari, Kali Kudai, Kasbai, Kolpi (Early), Masala, Sagg (Jawhar), Mahadi (Mid late), Varangal (Late), Rajghudya
6c		Brown plant hopper resistant: Banglya, Dangi Red, Dangi White, Kalbhat, Kasbai, Kolpi (Early), Lalya, Rajghudya
7	Non-lodging	Dodgi, Juna Kolam, Kasbai, Kolpi (Mid Late), Lalya, Sagg
8	Deep water	Kasvel,Dev Bhat
9	Roof thatching	Banglya, Dangi, Kasbai, Pacheki, Rajghudya, Sagg Bhat
10	Red rice	Dangi, Mahadi (Late), Devbhat, Kali Khadsi, Kali Kudai, Mahadi (Mid Late), Ratt Bhat, Varangal Black
11	Scented rices	Banglya, Devbhat, Dhaval Bhat, Dhundune, Dula-1, Dula-2, Kasbai, Kasvel, Masala, Sagg-JWR, Sagg-Wada, Sal Bhat, Tulshya, Vakvel, Varangal-Black.
12	Fragrant landraces	Banglya, Dula-1, Dula-2, Kalbhat, Kasbai, Masala, Sagg, Vakvel, Varangal (awned)
13	End use	Biryani, pulav, special dishes - Banglya, Kasbai, Kolpi, Masuri, Rajghudya, Surti Kolam Cooked rice for daily use – Kolpi, Rajghudya Gruel (kanji) – Dangi (Red) and Dangi (White), Mahadi, Rajghudya,Malghudya. Papad - Dhundune Beaten rice (poha), puffed rice (kurmura) - Dula-1, Sagg, Roti – Dangi (Red), Mahadi

Most of the tall landraces cause lodging at a later stage of growth and maturity but there are some tall, non-lodging landraces listed in S. No. 7 above.

Since grain yield is the sole criteria in the development of HYVs, a majority of them are dwarf causing fodder shortage for the farmers' livestock. However, the paddy landraces listed in S. No. 3 above provide long and durable straw.

Table 2: Maturity-wise varietal analysis

S. No.	Type	Period Days	List of landraces	List of HYVs [1]
1	Very early	<101	Dhaval, Dhundune, Dula-1, Dula-2, Hari Bhat, Javarya, Kali Khadsi, Kali Kudai, Masala Bhat, Sagg Bhat,	
2	Early	101-120	Dangi (Red), Dangi (White), Dodgi, Kalbhat, Malkolambya, Tamkudai, Maljavarya, Kavala, Kolpi (Early), Lalya, Malghudya, Malkolambya, Vakvel, Zini (Early), Varangal (Black)	Karjat 3 – Bold grains, good for roti; MT-1010 - Dwarf, fine grain, non-lodging; Ratna - Good yield, eary, short fine grain, smooth rice, resistant to blast;

[1] Ratna – 110-120 days, other HYVs 120-130 days

3	Mid late	121-140	Devbhat, Dhavul, Karjat Zini, Kasvel, Kolpi (ML), Mahadi (ML), Pacheki, Rajghudya, Varangal (awned), Zini (ML)	Gujarat 4 – Small plant, long and fine grain, market value; Gujrat 11 - Bold grains, daily use; Rupali - Single seedling transplantation, short, fine, dwarf variety; Sahyadri – 50-60 q/ha, tillers. Jaya- Bold & Dwarf (3 -3.5 Ft)
4	Late	141-160	Banglya, Juna Kolam, Kasbai, Kasvel, Kolpi (L), Masuri, Najar Bhat, Varangal (L)	

3.3.1. Grain and straw yield data of landraces

The grain and straw yield data of the paddy landraces under experimentation as well as their characteristics such as the number of tillers, grains/panicle have been recorded in the course of the specific survey (refer Table 3).[2]

Table 3: Grain and straw yield data of landraces

S. No.	Landrace	No of tiller/ plant	No of effective tillers/plant	No of grains/ panicle	Grain yield q/ha	Straw yield q/ha
1	Malghudya	27.5	24.5	172	24.0	31.0
2	Kolpi (Early)	15	14	267	43.4	83.5
3	Dangi(w)	12	12	253	43.0	89.0
4	Kavala	28	26	212	62.0	89.0
5	Lalya	43	38	210	63.0	87.0
6	Juna Kolam	22	20	215	45.0	65.0
7	Rajghudya	22	20	260	65.0	95.0
8	Kasbai	14	13	257	57.5	87.5
9	Banglya	16	15	258	65.0	95.0
11	Gujrat zini	14	13	152	63.5	95.0
12	Sagg (J)	16.7	15	189	34.0	53.0

[2] Grain and straw yield data are taken from the block design experiment carried out in Jawhar taluk and yield data of 1 sq. m. area

13	Sagg (Wada)	16.3	15	206	36.0	55.0
14	Dodgi	17	16	178	51.0	85.0
15	Kasvel	13	11	109	38.0	62.5
16	Varangal (awned)	23	20	135	41.0	84.0
17	Tamkudai	44.1	40	210	34.0	80.0
18	Zini (E)	18.6	17	210	34.2	73.5
19	Dula-1	15	14	130	35.8	84.0
20	Kali Kudai	29.4	25	138	37.0	40.0
21	Varangal (Black)	27.2	25	130	32.8	83.0
22	Pacheki	17.5	15	208	53.8	86.0
23	Najar Bhat	12	12	158	32.8	52.5
24	Dhaval	19.1	18	130	43.0	90.0
25	Dangi (Red)	11.1	10	138	45.0	98.0
26	Kal bhat	29.3	25	250	47.0	97.0
27	Dhaval	29	25	189	45.0	94.0
28	Vakvel	20	18	108	41.0	80.0
29	Dula-2	17	15	212	43.0	89.0
30	Kolpi (ML)	30.3	28	223	53.0	77.0
31	Kolpi(L)	20	18	260	63.4	85.0

In the case of landraces like Dhaval, Kal Bhat, Kali Kudai, Kavla, Kolpi (Mid Late), Lalya, Malghudya, Tamkudai, Varangal (Black) the number of tillers/seedlings are more than 25, which shows that the local paddy landraces have an ability to produce more than 25 tillers also. Similarly, the number of effective tillers is linked directly to the final yield.

Table 3 illustrates that paddy landraces like Banglya, Dodgi, Gujrat Zini, Kolam, Kolpi (ML), Kolpi (L), Lalya are good yielding landraces in particular situations and have the potential to give better yields of grain and straw.

Table 4: Average grain yield of paddy varieties

Sl. No.	Varieties	Average yield[3]
1	Jaya, Ratna and improved varieties	35-45 q/ha
2	Sahyadri (hybrid)	65-70 q/ha

[3] Source: Kharif crop general information, Commissioner of Agriculture, Government of Maharashtra.

3.4. Factors threatening indigenous paddy biodiversity

3.4.1. Government policy

Since the late 1960s, the government's policy has been to promote high yielding varieties under the Green Revolution so as to increase food production at any cost. Market oriented cultivation has taken precedence over food security for increasing numbers of farmers who have bought into the government's promotion of yield as the sole criteria for crop cultivation as per the modern agricultural system. Thus, early maturing and dwarf varieties have been promoted, which perforce require the use of HYV seeds and higher inputs.

The seed admixture that occurs in the process of threshing, harvesting and seed storage has resulted in the loss of seed purity in the indigenous rice varieties. The indigenous knowledge and practice to remove off-types from standing crops is no longer operational. This is one of the major reasons why seed purity is no longer maintained.

3.4.2. Pest and disease attacks

Some of the landraces are susceptible to pest and disease or they have lodging problems due to their greater height. For example, cultivation of the Surti Kolam landrace has reduced because of stem borer as well as lodging. The challenge is to identify and perpetuate those landraces that are disease resistant and can provide some yield even in adverse conditions which is not the case with hybrids.

3.4.3. Farmers' habit of changing varieties every 2-3 years

If the farmer has sown a particular variety in his/her land, he/she will continue to grow it on that land for 2-3 years and then change it. If this variety is not conserved on any other land, it becomes extinct. The farmers' perception is that the continued cultivation of the same variety on the same land for a few years lowers the yield of that variety on that land.

3.4.4. Increasing fragmentation of land holdings

Farmers find it difficult to maintain the vast variety of paddy landraces on their limited land holdings.

3.4.5. Long duration of indigenous varieties

While only 9 landraces have maturity days of 130-140+ days, 15 landraces are of the very early, and early varieties. Yet farmers preferred the medium and early hybrid, dwarf varieties which have good yield, are developed by universities and promoted by the agricultural extension system. However, with changing climate conditions, the need to conserve long duration landraces such as Banglya, Dangi Red, Dangi White and Juna Kolam is more urgent for their pest and disease resistant characteristics.

4. Interventions to save endangered landraces

Farmers are willing to maintain the genetic diversity of paddy if they have access to pure seeds of indigenous varieties. There are some indigenous varieties such as Banglya, Kasbai, Kolpi (Early) which have yields comparable to the high-yielding varieties.

4.1. In situ conservation

On-farm in-situ conservation is based on the proper documentation of indigenous varieties, morphological and agronomic characterisation of the promising landraces, participatory varietal selection and that organic paddy cultivation method (seed to harvest).

BAIF has raised the community awareness through farmers' exposure to field experimentation centres. BAIF and the farmers are now engaged in continuous on- farm study of 115 paddy varieties at different locations.

Seeds of hope – seeds of future

Mr. Shankar Pawar, a tribal farmer in Valvenda village in Jawhar taluk has taken active part in the demonstration and experimentation of paddy landraces.

"In the month of February, 2009, BAIF officers had given information about the importance and the need for conservation of the local paddy landraces, as well as the effect of chemical pesticides on the soil and humans. They had exhibited about 125 samples of paddy landraces which are very rare or extinct now. At that time, I decided to take part in the paddy germplasm conservation programme. But a lot of questions arose in my mind:

- What is the reason behind experimenting on paddy landraces at one place?
- Why single seedling transplantation?
- Why focus on local landraces when a lot of hybrid varieties are available?
- Will the local varieties give yield like the hybrids through the organic cultivation method?

Theoretically, BAIF officers responded to my queries. Although I was not fully satisfied by their responses, I agreed to give half an acre of my land for this work.

During the transplantation process, I was very unhappy because we had transplanted single seedlings that were 15 days old. My fields were looking empty. The people with me during the transplantation said, "You are mad, whatever we are doing is in vain and of no use."

But now my field is fully grown having 47 different landraces. I am happy that I came to know which varieties are suitable for my land, which are pest and disease resistant, which have good fodder value. About 350 farmers from the different paddy growing areas in Maharashtra visited my farm.

The BAIF scientists gave us training about participatory varietal selection, purity maintenance, organic paddy cultivation so that we can prepare our own seeds. We need not waste money for seeds and fertilisers. I am planning paddy cultivation from the market point of view also.

Farmers in Chowk, Jangalpada, Tople pada, which are near my village, have now selected 15 landraces for large scale multiplication. This programme is self- replicating."

4.2. Marketing strategies

The marketing strategies are developed to raise the demand for select indigenous varieties, for example, the promotion of aromatic and speciality rice, medicinal rice and nutritional varieties as holistic food items. Farmers are being trained in the organic cultivation of these varieties to fetch better market prices. They are being engaged in value addition to rice through processing it for a variety of end uses.

4.3. Seed conservation

BAIF initiated programmes for seed selection and seed production through the dissemination of germplasm at the farmers' level, and later through community seed banks.

During the phase of study and experimentation of indigenous paddy landraces, a participatory community-based programme was launched for the dissemination of germplasm for which 275 farmers were selected. They experimented upon 14 of the 46 landraces. The selected farmers were supplied with 1110 kg seed for seed multiplication.

During the Kharif 2009, 375 farmers have been involved in the seed multiplication programme. They have selected 20 varieties for large-scale multiplication out of 115 varieties which are available with BAIF-MITTRA. The varietal selection criteria of farmers in choosing landraces for cultivation are land type, crop period, yield (grain and fodder), market value, lodging and non-lodging properties, number of tillers per seedling, end use and pest disease resistance (refer Table 1). The landraces selected by farmers are Banglya, Dangi (White), Kasbai, Kolpi (Early), Kal Bhat, Lalya, Masala, Mulleri, Rajghudya, Sagg Bhat, Sharbati, Surti Kolam, Wada Kolam, Zini (Early).

The organisation has undertaken agronomical and morphological characterisation of the paddy landraces at 9 field centres in 7 villages.

4.4. Seed bank

BAIF-MITTRA has initiated community-based conservation of the crop genetic resource since December 2007. Two types of seed banks have been established at the institutional and community levels.

A central seed bank has been established at the Jawhar campus with crop varieties collected from the tribal blocks of Thane district. The institutional level seed banks are for experimentation and cataloguing.

4.4.1. Purpose of the central seed bank

- Study of agronomic and morphological characteristics;
- Easy access of seeds to farmers, researchers and students;
- Development of demonstration plots;

- Maintaining purity of the variety;
- Study of germination percentage.

The central seed bank has been established for storage, cataloguing and maintaining a database at the institutional level. A permanent accession code will be given to each landrace collected.

The samples collected in the central seed bank have gone through a series of experiments to check morphological, agronomical characteristics for scientific validation and preparing an in-depth database of individual paddy landraces.

The seed purification and seed production programme has been initiated to maintain seed purity and large scale multiplication of promising landraces.

4.4.2. Purpose of the community seed bank

The community level seed banks facilitate germplasm conservation and maintenance, seed exchange, participatory varietal selection, on-farm seed conservation and multiplication. The terms of borrowing for the community seed banks are as follows: if a farmer takes 1 kilogram of seed from the community seed bank, she has to return 2 kilograms after harvest while maintaining the line of purity of the seed. The local seed saver committee is empowered to assess, exchange and accept the seed.

The community seed bank is rooted in the view that the community can select, produce and exchange seeds among themselves and establish an independent seed security system at the village level. A seed savers' committee has been formed to keep checks on seed purity, manage seed exchange and establish market linkages.

The next steps planned are nutritional analysis of some of the promising landraces which have nutritional and medicinal potential. Registration of farmers' varieties is another major area of concern.

4.5. Important steps for the conservation and revival of local landraces

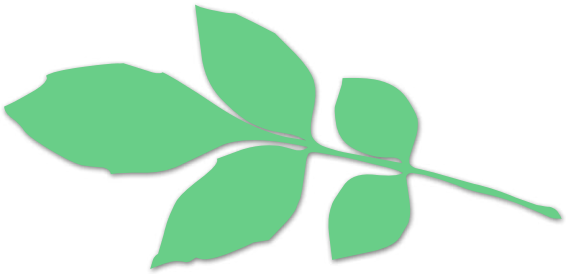
- Awareness programmes such as seed exhibition and *melawa* (gathering) for the collection and display of seed samples and data on paddy landraces

- PRA for specific data collection with selection from seed savers
- Establishment of central seed bank
- Morphological and agronomic characterisation of landraces
- Seed distribution at the community level for conservation, multiplication and production
- Seed selection and seed collection
- Establishment of community seed bank and seed savers committee
- Marketing and value addition
- Nutritional analysis of food crop/grain
- Registration of farmers' varieties

Rice is an integral part of the culture, tradition and staple diet of millions. Medicinal rice and speciality rice varieties are a unique genetic resource. These cultivars are mainly conserved by local farmers because of their use in the preparation of speciality foods. However, indigenous paddy varieties are now available with very few farmers and are reducing at a rapid rate. Climate

change, ecosystem disturbances and population increase also pose threats to biodiversity conservation.

There is an urgent need to take immediate action for the conservation of rice biodiversity. Characterisation of these paddy cultivars and the documentation of the associated knowledge will enhance claims to the intellectual property rights on these unique rice genetic resources. With knowledge comes the scope for registering these indigenous cultivars under the aegis of the new legislation intended for the protection of farmers' varieties and new plant varieties.



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2. Discussion with organisational members from Rice Research Station, Karjat; Agriculture University, Dapoli; Lokpanchayat, Sangamner.

3. Web-search:
   a. www.greenconserve.com
   b. www.navdanya.org
   c. www.ciks.com

Impact of the Green Revolution on Indigenous Seeds and Traditional Agricultural Practices in Karnataka

GREEN Foundation

Karnataka

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This case study examines the impact of the Green Revolution on the indigenous seeds and traditional agricultural practices in Karnataka. It explores the factors that have influenced the shift in agricultural practices and their impact on farmers. It examines policies pertaining to plant genetic resources, seeds and their implications for farmers' rights. It concludes with the need to create a favourable environment for reclaiming indigenous agricultural practices.

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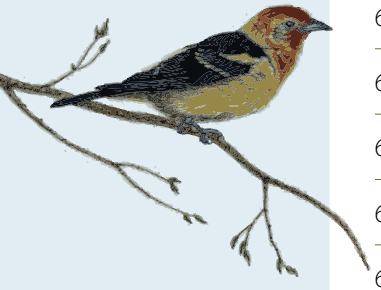


Boxes

1. GREEN Foundation and its work [1]

GREEN Foundation is a community-based organisation working with disadvantaged groups of small and marginal farmers, backward castes, tribals and dalits, especially women, in the semi-arid regions of South India, towards the conservation of agro-biodiversity and the promotion of sustainable agriculture.

GREEN Foundation's intervention commenced as a modest effort with five women farmers and a handful of seeds in Dharmapuri District of Tamil Nadu in 1996. With its passion, commitment and dedication to the conservation of biodiversity and an improvement in the livelihoods of marginal and subsistence farmers, its activities are currently spread across different districts and agro-climatic zones of Karnataka.

Over the past decade, GREEN Foundation's interventions have touched upon different dimensions of sustainable agriculture that have helped farmers secure seed, food, and better livelihoods. Working closely with the farming

[1] http://greenconserve.com

community, GREEN Foundation has succeeded in reviving the genetic resource base essential for the survival of small and marginal farmers by bringing together the socio-economic, ecological, cultural, and gender-specific aspects of biodiversity conservation.

The on-farm conservation and sustainable agriculture initiatives of GREEN Foundation have led to multi-stakeholder partnerships among farmers, scientists, and consumers in deploying traditional forms of biodiversity conservation, sustainable agricultural practices, and consumption patterns that are constantly validated and improved through scientific research.

2. Background of the study

The seed or beej in Sanskrit means basic, without which nothing can grow. The seed is the basis of agriculture; a local genetic resource that is symbolic of the continuity of the life form. Crop domestication began with the simple act of selecting and saving seeds for re-sowing. Hence, many rituals in agrarian families revolve around the seed – its conservation and propagation. Traditional sustainable agriculture and allied activities such as livestock rearing were the only source of food security and livelihood for many poor Indians; agriculture also accounts for half of the country's national produce. However, all that began to change in the last half century.

With the onset of the Green Revolution in the 1960s, improved and high yielding varieties (HYVs) of seeds were introduced along with chemical fertilisers and pesticides, and the promise of higher yields with a shorter crop duration. These were promoted as the new package of agricultural practices.

The objective of the Green Revolution was to increase food grain production to meet the needs of the growing population. The Green Revolution is credited with having staved off famine through increased production of rice and wheat. Paradoxically, the introduction of improved varieties has done little to improve food security. NSS data reveals that per capita calorie consumption in India has fallen since the 1970s.[2]

Moreover, the Green Revolution eroded the diversity of seeds which forms the basis and life line of agriculture. With few enterprising companies wanting to gain monopoly over nature's very own renewable resource, the seed has been translated into a non-renewable resource. These 'miracle seeds' have distanced farmers from their own time tested indigenous agricultural practices. The Green Revolution has largely benefited farmers with irrigated lands, the seed and fertiliser industries, and the urban consumers.

Purchasing seeds and chemicals from the market has rendered agriculture unviable for the small and marginal farmers. Instead of addressing the issue of hunger and food security, non-traditional farming has pushed the small and marginal farmer into debt and distress, and in some cases, suicide too. The past few years have witnessed high numbers of farmer suicides – many of them steeped in debt. This scenario demands a reassessment of current farming practices and agricultural policy.

Farmers, who had earlier preserved, exchanged and improved their own seeds with neighbours and relatives, were forced to depend on the market for seeds. The farmers' indigenous knowledge of agricultural practices ceased to be relevant in the context of the Green Revolution practices.

2.1. Objectives of the study

GREEN Foundation commissioned this study in 2009 to capture traditional agricultural practices with a focus on seed conservation, as well as the dramatic shifts in agriculture from inter-cropping to monocultures due to the Green Revolution.

[2] Reported in The Frontline, February 27 – March 12, 1999

The specific objectives of the study are:

- To illustrate the interplay and role of traditional agricultural and cultural practices in biodiversity conservation:
  - To understand agriculture as a celebration of community life;
  - To understand seed systems and the role of farmers, particularly women farmers, in maintaining the indigenous varieties in different communities in Karnataka.
- To understand the erosion of Biodiversity in the context of the Green Revolution:
  - To review and reflect on the cataclysmic shifts changes in agricultural practices/ systems;
  - To understand the changes in seed and crop varieties;
  - To understand the impact of these shifts, especially on the lives and livelihoods of small and marginal farmers.
- To understand seed/plant-related policies and their implications for farmers' rights in the context of:
  - Protection of plant varieties and farmers' rights;
  - Seed Bill.

2.2. Methodology

The study team visited villages in three out of the ten agro-climatic zones of Karnataka to understand the shifts in traditional agricultural practices due to the adoption of the Green Revolution technologies. The areas visited included Ramanagaram (earlier part of Bangalore rural district) and Kolar districts in the Eastern Dry Zone; Dharwad district in the Northern Dry Zone and Haveri district in the Northern Transition Zone (refer Annexure 1: Characteristics of the agro-climatic zones visited).

The study team held discussions with the staff of GREEN Foundation at Bangalore. The team participated in a two-day national-level consultation on Farmers' Rights to Genetic Resources organised by GREEN Foundation. The consultation provided a perspective on policy level issues in agriculture and their implications on the farmer.

The study team also held discussions in the field locations visited and with the staff of Gram Vikas, a rural development organisation in Mulbagal taluk, Kolar district. Gram Vikas, one of the community seed bank network (CSBN) partners in Kolar district, is a rural development organisation. It implements child sponsorship programmes. It is engaged in the revival of water harvesting structures such as tanks and ancient farm ponds, promotion of low cost sustainable agricultural practices such as organic farming, vermiculture, building and strengthening women's self-help groups, and public education and advocacy with civil society in favour of the rural poor.

The study team reviewed literature provided by GREEN Foundation to understand its work. The team undertook internet research on the global and national legislations pertaining to agricultural policy and practice so as to understand the extent to which these legislations are supportive of farmers' rights.

3. Traditional agricultural practices

Culture and agriculture were inter-woven into the traditional agricultural rituals and practices. They relied on observation, experimentation and conservation in agriculture; for example, in the selection of seed and improving landraces. Agricultural practices were labour-intensive with gendered and age-based division of labour. While the women were primarily involved in seed conservation, each family member had a role to play in the agricultural processes. The majority of the populace was engaged in subsistence agriculture in which the seed was the primary reproductive,

renewable resource. However, those engaged in agriculture had to develop coping mechanisms to deal with the vagaries of nature whether flood or drought.

3.1. Celebrating community life

Agricultural rituals coincide with significant operations in the agricultural cycle, namely, land preparation, sowing seeds for crop diversity, harvesting and testing for germination (refer Box 1: The centrality of seeds in agricultural rituals). In the Hindu context, the rituals have their roots in the worship of the five elements of life – air, water, earth, fire and space. They celebrate life in its glorious diversity and the spirit of community.

Box 1: The centrality of seeds in agricultural rituals [3]

'Negilu pooje' is the oldest agricultural ritual performed by the Hindu farming communities in Karnataka on the new year's day in March-April. Two new wooden ploughs are placed in the north-eastern corner which is considered sacred. An areca palm leaf folded into a deep bowl is tied to the plough. The palm leaf is filled with manure in which seeds of diverse crops are grown. This is left to germinate for a period of nine days. It is a symbolic way of testing

[3] GF 2004; discussions with Hombalamma, individual seed saver, Mandebaildoddi village, Krishnagiri District, TamilNadu.

for germination of seeds. After nine days, the worshipped bowl is transferred to a nearby water source for immersion, thereby bringing together the natural resources of seed, soil and water.

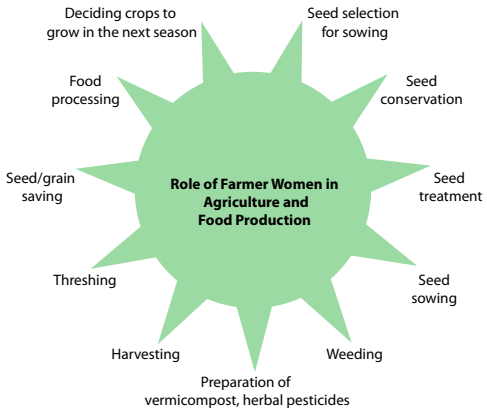
Ploughing and sowing operations take place immediately after the first rain, the *Doddabasavannana* rain in the month of April-May that usually comes a month after *Ugadi*. Prior to ploughing, farmers perform the *ulume pooje* (plough worship) and prior to sowing the *koorige pooje* (seed drill worship). The start of ploughing entails the worship of the plough and the land in a colourful ritual using a lot of vermillion and turmeric. Sacred offerings of sesame seeds, jaggery and rice are made to Mother Earth and then to women who signify the Earth. Nine varieties of seed or *Navadhanya*, representing diversity, are tied to the seed drill and the horns of the cattle.

The *koorige* has three compartments through which the seeds are dispersed in the fields, The three rows of sowing signify the philanthropic temperament of the farmers – *"ondu manasarige, ondu hakkigala thinnakke, matondu dharmakke"* – one row is for self, one for birds and the last one is for charity.

3.2. Role of women in agriculture and food production

Women farmers in Veeraiahannadoddi, Ramanagaram distrct, systematically analyse the role of women in agriculture and finally in food production through the following diagram[4]:

Women play a major role in biodiversity conservation – conserving seeds of the crop varieties to be grown in the field for consumption purpose, growing vegetable and fruit trees in the space around the house – it is the woman's hand that safeguards the biodiversity in an area (refer Box 2: Women as custodians of seeds and grains).



[4] Adapted from GF, 2004

Box 2 : Women as custodians of seeds and grains

A classic example of the importance of women's knowledge in conserving grains and seeds:

Muniamma of Mahadevgondanahalli had kept three bags of paddy at home, out of which one bag was of *salem sanna* which she planned to preserve as seed for the next sowing season and the remaining two bags were of and hybrid mix, which she planned to use for consumption purpose. But before she could take the two bags meant for consumption to the mill for de-husking, she had to leave the village for a few days on some emergency. She showed the two bags to her son and asked him to take it to the mill and get it de-husked. When she returned she found that the paddy she had kept aside for sowing had been de-husked. Her son had been unable to distinguish between the paddy varieties and had taken all the three bags to the mill.

As long as communities practise subsistence agriculture, growing crops mainly for consumption, decision making regarding the types and varieties of crops to be grown rests with both men and women in the family. The difficulty arises when decisions have to be taken on whether to grow for the market or for consumption. Whereas the men prefer to grow for the market, women prioritise food crops for consumption.

3.3. Role of women in traditional practices of seed conservation, storage and treatment

Traditionally, farmers, particularly women farmers, have employed several methods to control pests and diseases both during farming as well as storage. These are practices that have been perfected over several centuries of experimentation and observation and hence match up to standards of scientific rigour (refer Box 3: Farmers are scientists). Farmer women in many villages of Karnataka continue to observe the age-old practices of seed treatment, conservation and storage of grains, some of which the study team has documented below: [5]

3.3.1. Seed storage

- In Kanakapura taluk, a *moode*, basket made of paddy straw and weeds, stores seeds for up to two years.
- Gunny bags placed over the threshold store seeds. As people constantly step over the sacks, it disturbs pests and prevents infestation.
- A sack of rice strewn with red chillies prevents pest attacks.
- Earthen pots sealed with straw and cow dung protect the seeds of pulses, which are sandwiched between layers of sand or millet.

3.3.2. Seed treatment

Prior to sowing, farmers follow several practices to achieve an optimum healthy plant population.

- In Mahadevagondanahalli, field beans are treated with an application of castor powder and chilli powder.

[5] GREEN Foundation, 2003; GREEN Foundation 2005; farmers practices in Veeriahanadoddi, Reddihalli, Kurubarahalli, Chinnikatte, Lokur)

- Red gram is soaked overnight in a paste of red soil and dried in the shade to reduce insect damage.
- Paddy seeds are treated with a salt solution, washed twice and thoroughly dried till they are totally free of moisture. This helps to separate the healthy seeds from the chaffy ones. It also prevents fungus during storage, enhances germination, and prevents seed borne diseases at the seeding stage.
- In Chinnikatte, pulses and cereals are treated with the application of red mud paste. The seeds are dried and stored in gunny bags with neem leaves to protect them from insect infestation.
- Different crops are stored at different temperatures – sorghum seeds are dried in the sun and stored while still hot. Lab-lab seeds are dried in the shade and stored in gunny bags while cool. Alternately, they are exposed to the sun and mist prior to storing, usually during the *Ugadi* festival.
- Seeds are treated with castor oil, neem powder and custard apple leaf to prevent pest infestation during the storage period.
- Sorghum grains are treated with sulphur and stored in airtight gunny bags sealed with cow dung.
- Food grains are treated with salt water and dried thoroughly to preserve them.

Box 3 : Farmers are scientists.

"Once when I wanted to sow *Dodda jowar*, a local variety, I treated the seeds with a mixture of *gandaka* and *tutte* soaked in water. After the seeds were completely dried, I took them for sowing. After sowing more than three fourths of the land, I ran short of the treated seeds. Hence, I sowed the remaining land with the untreated seeds that I had brought along. When the crop was 3 feet high it was attacked by smut disease and I realised that the portion with treated seeds was free from this disease. That is when I realised the importance of seed treatment", Shri G.K. Chouti of Chinnikatte village.

3.4. Coping with drought and famine

Traditional agrarian communities mitigated the impact of natural calamities like drought and flood through agricultural practices such as crop diversification. Thus, farmers have ensured the availability of food grains during bad years. Environmental conditions that are less favourable for some crops may be more favourable for some others. This compensates for the loss of yield in some types of crops with adequate yield in some others.

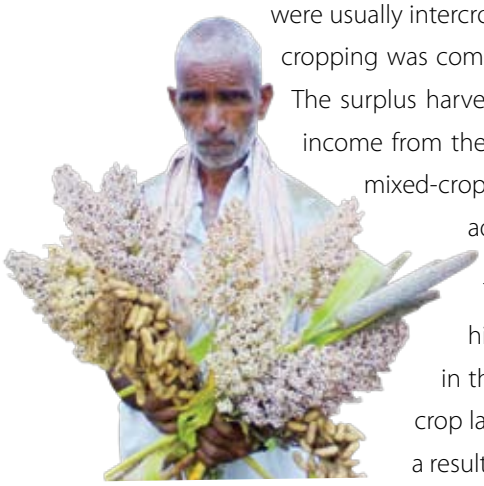
When there is a total crop failure due to a natural calamity, farmers resort to different methods of coping with the situation. Farmers in Mahadevagondanahalli reported surviving on leaves, fruits and seeds of various trees like tamarind, drumstick, etc., during the severe drought of 1965. Their food preparation also varied according to the intensity of the drought. Muniamma of Mahadevagondanahalli remembers surviving on *ganji*, a gruel of cereals. Farmers in Veeraiahannadoddi spoke about surviving on forest produce like edible roots, leaves and fruits of some plants during drought. Older people, who were more knowledgeable in the selection of such plants, collected the edible forest produce.

4. Impact of the Green Revolution technologies on traditional agricultural practices

Dryland rainfed farming is practised in 75% of the total agricultural area in Karnataka.[6] Large parts of Karnataka are in the Deccan Plateau, the rain shadow region of the Western Ghats, which was largely bypassed by the Green Revolution until about a decade ago. The new technologies have helped better endowed pockets offset by declining productivity in vast marginal areas. [7]

4.1. From food producers to food purchasers

Until the onset of the Green Revolution, farmers were practicing subsistence farming in these dryland tracts – their food requirements were met with produce from their own land. Pulses were usually intercropped with the main crops, namely, millets or paddy. Mixed cropping was combined with allied activities such as dairy and poultry units. The surplus harvest was taken to the market. If one of the crops failed, the income from the other crops and activities compensated the farmer. Thus, mixed-cropping served as a risk cover for the farmers that effectively addressed the issue of food security.



The Green Revolution introduced new varieties that promised high yields. Its vision was to solve the problem of food security in the entire world with a single formula. Large tracts of mixed crop land were converted into mono-crops of wheat or paddy. As a result, the landraces existing in a region for centuries were wiped out. According to Shivarudraiyya of Veeraiahannadoddi, "As yields in the initial years were very high compared to our local varieties, farmers readily converted to mono-cropping. They started growing crops only for the market and purchased food grains required for consumption."

The shift from indigenous agricultural practices in the early 1980's to the hybrid culture in the 1990's is clearly reflected in the timeline exercise conducted in Reddihalli, Kolar district (Eastern dry zone), (illustrated in Table 1: Timeline of crop practices, Reddihalli, Kolar district, Eastern Dry Zone). In the early 2000's, due to the intervention by NGOs as part of the CSBN project, a mixed culture could be seen in the areas under study as some farmers began to revert to their traditional practices. However, of the many traditional varieties that existed twenty years ago, only one or two are presently grown. Thus, "the technologies of the Green Revolution have played a major role in shrinking the local pool of genetic resources".

[6] *The Financial Express, 2002.*

[7] Naidu, Y.D. and Edith van Walsum, 2002.

Table 1: Timeline of crop practices, Reddihalli, Kolar district, Eastern Dry Zone

Crop practices	1980's	1990's	2000 to 2008
Ragi (Finger millet)	*Ragi* varieties grown – *pedda ragi* (150-day), *kaddi ragi*, *hasiru kaddi ragi* (150-day crop), *bili ragi* (120-day crop), *kari tene ragi* (90-day crop), *sanna kaddi*[8] *and dodda kaddi*.	Improved *ragi* variety introduced through agriculture department – MR1 (120-day crop), GPU28 (120-day crop) Around 75% of area still under local variety (hasiru kaddi) and 25% under improved variety	Area under improved variety expanded to about 50%. Production of *ragi* increased due to improved varieties. Hasiru Kaddi variety is the local variety grown.
Minor millets	Millets grown – little millet *(saame)*, pearl millet *(sajje)*, *burugu same*, and *arasame*. Arasame was used to make sweets during *Shivarathri* *Arkalu* grown during the dry season both as fodder and food	*Arasame* replaced with *avalaki* (beaten rice) sweet for *Shivarathri*.	Millets grown only where there is dry and waste land Millet consumption reduced.

[8] Sanna kaddi is a ragi variety that is disease resistant and has many earheads. As a result even if one earhead falls many others sprout assuring a good harvest. It results in minimal losses to farmers

Paddy	Paddy varieties grown – *Bhairu bhatta, kappu bhatta, Thoke bhatta, Mittu Bhairu bhatta, Kari bhatta, Kempu sanna, Samba, Krishna neela*, (which is a fragrant pulao variety), *Budda bhatta*.	Hybrid paddy varieties introduced – *Hamsa, Jaya, Sona masuri, Rashi, Warangal Samba,* KRH2 A wealthy upper caste farmer with irrigation facilities was the first to buy hybrid seeds from the society. Others followed.	Decline in paddy cultivation as the village tank does not fill up any more. Only those with access to bore wells, grow paddy
Maize	Maize grown for use both as fodder and food (90-day crop, 150-day crop)	Hybrid maize introduced	Maize grown only as fodder
Pulses	Horse gram, red gram, black gram, lab-lab, sorghum grown for food and fodder	Pulses still grown as intercrop	Pulses continue to be grown as intercrop
Commercial crops	Sugarcane grown, jaggery extracted *Dodda Gutkada* variety of groundnut grown. Unique feature – 120 seeds per plant.[9]	Sugarcane growing stopped as yields reduced	Vegetables grown as major commercial crop. *ragi* grown commercially by few farmers. No groundnut grown
Vegetables	Local varieties of tomatoes grown – no support required *Ajwain*, beans, bottle gourd, brinjal, chillies, fenugreek, onion, pumpkin, radish, ridge gourd, and tubers	Hybrid tomatoes introduced – plants needed support	Tomato cultivation increased – mostly hybrids New varieties of beans introduced Started growing cabbage and potatoes

[9] As each plant produced around 120 seeds, harvesting the crop was a labour intensive job. Hence, the farmers used to harvest only as much they required; the rest, they used to give to pig rearers for grazing. They earned good money from this as the groundnut was believed to be an excellent feed for the pigs and helped in increasing the pork value.

Use of seeds, fertilisers and pesticides	• Farmers used local seeds that were conserved at home, or they borrowed or exchanged with other farmers. • Low incidence of pests. Low use of pesticides. • Few incidents of pest attack managed with locally available resources. Example, when paddy was attacked with *bhatta chitte* it was treated with neem leaves and *naru* leaves. For infestation of worms in lab-lab, ash was applied, and a paste of lime was used for worm infestation in field beans	• Rich farmers with irrigation purchased seeds fertilisers and pesticides from the agriculture department • Dryland farmers continued to grow local varieties and used farm yard manure and organic pesticides	• Mostly rich farmers and a few small farmers bought seeds and other inputs from the Agriculture Department • Small and marginal farmers started preparing and using vermicompost, organic fertilisers, sand urea, etc.- promoted by Gram Vikas • Few rich farmers started purchasing vermicompost from the small farmers
Water resource	Village tank	Village tank gets filled three times in a year	Village tank filled only once in 2005 after 12 years; even then the water lasted only for three days
Cattle	• Only local breeds of cattle	• Farmers start buying cross-bred cows due to easy availability of loans	• Cross bred cows more popular

4.2. Changes in seed and crop varieties

Farmers enjoyed food sovereignty in terms of decision-making regarding the crops that can be grown in their fields. The decision to choose a particular crop type or a variety depended on the soil – its depth, water holding capacity, slope and drainage. Close observation and discussion with other farmers helped them in decision-making. However, the introduction of high-yielding varieties of seeds/crops irrespective of agro-climatic zones, eroded the indigenous knowledge of the farmers and consequently the local genetic resources.

Shivanappa a farmer in Therubeedi village in Kanakapura taluk of Ramanagaram district remembers growing only indigenous varieties of ragi such as *gutkindala ragi*, *pichakaddi ragi*, *karikaddi ragi* and paddy such as *mundaga bhatta* in his land from 1952 to the late 1980's, inter-cropped with horse gram, green gram, sorghum and red gram. Considering the natural properties of the soil and the land, he grew paddy in the low lying areas where there is greater moisture retention of his land and *ragi* in the upper reaches with lower moisture retention. *Tagginalli* (valley) *bhatta, dinneyalli* (ridge) *ragi* – this was the ancient wisdom.

However, in 1988 when the hybrid seeds promoted by the agriculture department (or government seeds as most farmers call them) were first introduced to his village, he started buying these. Shivanappa recounts, "By this time, the rains too had started declining. With fewer rainy days in a year, it was becoming difficult to grow the longer duration local varieties. Hybrid seeds promised harvest in 90 days as against local seeds that took 120 to 130 days. Hence many farmers shifted to growing hybrids." The 'government seeds' that were aggressively marketed and promoted held out the promise of high yields and high incomes (refer Table 2: Comparison between GP ragi (hybrid seed) and *Pichakaddi ragi* (indigenous variety).

Honnamma of Therubeedi village, Ramanagaram district (Eastern Dry Zone) recounts the superiority of the local varieties of ragi, "Where 1 kg of *Pichakaddi ragi* fed 5 members of a family, we now require 4 kg of Indaf *ragi* to feed the same number. The local varieties are hard (*gatti*), and smaller quantities are enough to fill your stomach." They were favoured for

Table 2: Comparison between GP *ragi* (hybrid seed) and *Pichakaddi ragi* (indigenous variety) [10]

GP *ragi* (hybrid variety)	**Pichakaddi *ragi* (indigenous variety)**
Crop duration 4 months	Crop duration 4.5 months
3-4 tillers per plant	8 tillers per plant
Tall plant	Short plant
Yield: 12 quintals/acre	Yield: 9 quintals/acre
5-6 kg seed used per acre for sowing and 4 ser fertiliser (DAP) used	16 kg seed used per acre, 1 ser fertiliser (DAP) used only once; later applies farmyard manure
Hollow stalk	Thick stalk
Cannot resist drought; crop dries up without rain since more DAP used	Can withstand drought; rain once in 15 days is enough
Rain at harvest time causes greater damage; grain germinates as it has absorbed more water	Does not absorb more water, hence grain keeps for longer without germinating
Grain weighs less and more hollow (compared to *pichakaddi*). More flour is required to make *mudde*. 4 kg flour is needed to feed five persons.	Grain weighs more (can identify if grain is hollow or heavy by listening to sound of the grain as it is being poured out in measures). 1 kg *ragi* flour can feed five persons.

their qualities such as their nutritional value, taste of the cooked grain, colour, texture, and ease of storing. They also provided superior fodder for the cattle.

Shri Uluwappa Akki of Annigere, Haveri district, gives a good example for this: "*Navane*, foxtail millet grown in North Karnataka was consumed by both humans and cattle. The stem waste of the plant was used for covering the fodder stock. But now this millet has almost become extinct as people find it difficult to digest. *Unde ragi* is another similar example".

Farmers share the differences between the local seed and the hybrid at the weighing yard- "Where one bag of the local variety of *ragi* weighs one quintal, the hybrid variety weighs only 90 kilograms". According to Narsinghnavar of Lokur, "Hybrid seeds can be stored for 4 to 6 months, but local seeds can be conserved and used for 3 years."

[10] Comparison by Sri Shivanappa, farmer from Therubeedi village, Ramanagaram District (his total land holding is 8 acres)

4.3 Shift from farm yard manure to chemical fertilisers

The changes in farming practices have also had far reaching impacts on people's lives and livelihoods and. Farmers and villagers report several changes not only in the food they eat, but also in the customs they practice, the festivals they celebrate and the kind of rituals that are observed.

The shift to hybrid seeds meant a compulsory shift to chemical fertilisers as the hybrids responded only to chemicals. Thus, along with the seeds, the government also started promoting chemical fertilisers. Earlier, all the inputs required for agriculture came from the farmers' backyard. But with hybrid seeds, this cheap and easily available input became redundant. For the farmers, purchasing chemical fertilisers seemed an easier option. The application of farm yard manure was a labour intensive process which demanded involvement of all the family members. With reducing family size, increasing migration, and increasing numbers of rural children in schools it became difficult to get family labour.

According to Shri Benchamaradi, a farmer from Hebballi village of Dharwad district, there was also a problem of indiscriminate use of chemicals by the farmers. He says, "If the government asked us to use 1 bag of DAP for 2 acres, farmers' greed for an even better yield led them to use 1 bag per acre. Nobody cautioned us about problems of over usage". Another fact that was evident from discussions with farmers was that usage of chemicals was proportionate to the economic status of the farmers and also to the availability of irrigation. The richer the farmers,

the more they spend on irrigation facilities and on chemical fertilisers. Medium farmers chose an in-between path – using both chemical and organic fertilisers in varied proportions. Among those who had still remained devoted to farm yard manure and compost were some of the small and marginal farmers, who could not afford the 'luxuries' of chemical fertilisers. Some still borrowed and entered the web of hybrids, monoculture and chemicals.

5. Factors that have influenced the shift in agricultural practices

Given the advantages of the traditional agricultural practices and the local seed varieties, discussions with the farmers clarified some of their reasons for shifting to the Green Revolution technologies.

5.1. Increasing urbanisation and changing lifestyles

Traditional agriculture is labour-intensive requiring more people for the preparation of organic fertilisers and pesticides; seed preservation, conservation and treatment; cattle rearing, etc. Decreasing farm incomes and the uncertainties of agriculture have pushed more people out of the villages and into cities in search of alternate livelihoods. For example, a small village of Therubeedi with 300 households has 100 young men working in the neighbouring city of Bangalore. In addition, smaller family size and the difficulty in procuring farm labour have added to the problems in practising traditional agriculture. Thus, with fewer hands to work on the farms, farmers began to turn to the relatively easier (albeit more expensive) option of purchasing seeds and fertilisers.

Ironically, even increasing education levels in the rural areas are seen by a few old-timers as a factor responsible for the decline in natural faming practices. According to one senior farmer in Mahadevagondanahalli, "As now-a-days all the children are sent to school, we have fewer hands to work in the fields. In the case of educated youth who work on the farms, their sophisticated life style prevents them from soiling their hands with cow dung and other organic wastes to prepare farm yard manure. Physically too, they are not strong enough to engage in hard work required for our traditional practices". According to Shri. Benchamardi, from Hebballi, Dharwad, "Wherever there are joint families they still use local varieties."

5.2. Declining cattle population

In the rural economy, cattle are the wealth of the farmers. Traditional agricultural practices depend a lot on cattle, its secretions and excretions – ploughing, organic manure, pest repellents, all make use of this local wealth. With a decline in the cattle population over the years, traditional agricultural practices have also suffered. This is one of the major reasons for farmers to opt for chemical fertilisers. According to Shivarudraiyya of Veeraiahannadoddi, "Earlier each family owned 20 to 30 heads of cattle. Now, this has reduced to 1 or 2 per household". Rural communities attribute the declining cattle population to the rapidly reducing grazing lands, reducing family size and increased awareness about education. Traditionally, women and children tended to cattle – children were often engaged in cattle herding. With more and more children enrolling into schools, maintaining cattle at home has become difficult for families.

5.3. Government policies undermine traditional agricultural practices

Coupled with the socio-economic factors are the political reasons for the shift in farming practices. In an attempt to supposedly increase food grain production and productivity, government policies from the time of the Green Revolution have actively been in favour of hybrid seeds and chemical fertilisers and pesticides. Fertiliser companies ride on heavy subsidies provided by the government. The policy thrust in favour of chemical fertilisers is evident from the fact that there is a separate Ministry for Chemicals and Fertilisers (instead of the ministry of agriculture dealing with fertilisers) with exclusive budgetary allocation for chemical agricultural inputs. Besides, there has been a decline in the budgetary allocation to development schemes in the agricultural sector. [11]

The promotion of exotic and non-local varieties was not limited to agriculture. Balamma of Yerjenahalli village explains how government loans and subsidies that are made available only for the purchase of cross-bred cows has effected the second most important economic activity in rural areas - livestock rearing.

[11] http://raitamitra.kar.nic.in/Agri%20Policy%20Eng.pdf accessed on 21 May 2009

6. How the shift in agricultural practices impacts farmers

6.1. Self-reliance to dependency

With the introduction of hybrid seeds and chemical inputs, farmers came to depend on markets to procure inputs. Due to a lack of proper financial institutions that work in favour of farmers, they often had to resort to loans from local money lenders who charged exorbitant interest. Shivanappa of Therubeedi village explains the vicious cycle of debt, "Since we have taken loans to buy seeds, fertilisers, etc. we need to grow HYVs to get a better price so that we can repay our loans; since we have decided to grow HYVs, we have to borrow to purchase seeds, fertilisers and pesticides." Gouramma of Chinnikatte explains the situation of a farmer after the harvest, "Nowadays, crops are directly taken to the market from the threshing yard as money lenders would be breathing down the necks of the farmers for recovery. Earlier, the crop was brought home and after rashi puje was stored at home till the farmer got a good price in the market." This also shows the vulnerability of the farmer to the market forces.

The early users of hybrid varieties and chemical inputs were the rich farmers who could afford to purchase them. Papamma, a farmer from Kurubarahalli in Kolar district, and SHG members in Reddihalli village mentioned how initially a few wealthy farmers with access to irrigation facilities such as bore wells were the first to use the 'government seeds'. Poor and marginal farmers followed the example of the wealthy farmers and started using hybrid seeds and fertilisers, even borrowing to do so. Farmers in the remote village of Kalagondanahalli in Ramanagaram district mentioned how chemical fertilisers made an appearance in their village as late as 2007. Remote villages with poor transport facilities still use indigenous seeds and farmyard manure as the government schemes and messages are yet to reach them.

6.2. Soil health deteriorates

Regarding the importance of the soil, Shri Mookappa Poojar of Chinnikatte recites this folk song:

"Manusha sattare mannige
Manne sattare matta yellige"

"When human beings die, they become one with the soil,
But if the soil dies, then where will everything else go."

Shivarudraiyya of Veeraihannadoddi explains the soil nutrient loss in his village, "Traditionally our area was famous for groundnut cultivation. 15 years ago we used to get 25 to 30 bags of groundnut per acre. When farmers realised the productive potential of our soils for growing groundnut, everyone shifted to this crop and started growing it as a monocrop at the cost of other pulses, cereals and millets. As a result, the soil has become so depleted that not a single groundnut plant grows on our soil now. We are even losing the seeds we are sowing".

Despite increased production, nutrition levels have declined. When some old timers compare the hard work of their youth with the life style of today's youth, they feel that the younger generation is not fit to do any hard labour in the fields. Pointing to the 92-year old Tammanna of Lokur village cleaning onion seeds in his back yard and preparing them for sowing, his grandchildren explain that the old man has his sight, hearing and all his teeth intact. They attribute his good health to his hard work as a farmer and the superior quality of food grains that were grown during his time.

6.3. Food habits change

Mookappa Poojar sings a folk song that praises *ragi* for its strength:

"Beku andare valle nidde,
Nungbeku endu ragi mudde,
Anta shakti mudde valage,
Nungathi yake nidde gulige,

Tutti alla adare pushti,
Tindor mayi bahala gatti,
Nungata iddare murkondu muddi,
Mududkondu mokka anta niddi"

"If one desires good sleep
Swallow *ragi mudde* (balls)
Such power resides in the *mudde*
Why swallow sleeping pills

Not costly but nutritious
If swallowed gives strength
Gulping *mudde* bit by bit
Curl up in deep sleep."

When farmers practised mixed cropping to grow a variety of cereals, pulses, millets and vegetables, their diet included foods that were suited to their geographic area and climate. However, with the changing agricultural patterns, eating habits too changed. When traditional food crops such as *ragi* and sorghum were replaced by commercial crops like cotton, mulberry, groundnut, etc. their inclusion in the daily diet also reduced significantly.

Some of the minor millets traditionally grown and eaten by small, marginal and dryland farmers such as *navane*, *sajje, bajra*, etc., especially in the Northern Dry Zone of Karnataka vanished with the advent of HYVs. These millets were recognised for their high nutritional value. Mathapati, a farmer from Hebballi explains the characteristics of *navane*, "If you have a meal of cooked *navane* in the morning, you will not feel hungry for the rest of the day. Nowadays, a few

farmers grow this in small quantities. The younger generation finds this millet, having high fibre content and low glycemic index, difficult to digest as they are no longer engaged in hard physical labour. As the seed coat is hard, women also find it difficult to de-husk and clean. Because of these reasons consumption of such millets has come down." Significantly, the poorer farmers, who have no access to machinery and use manual labour, reported consuming such grains. It is the food security of such small and marginal farmers that is threatened if the cultivation of such grains is given up.

Moreover, the Public Distribution System (PDS) has played a major role in changing the food habits of people, especially those who rely on the PDS. With the introduction of rice at a cheap price through the PDS, the interest in growing food crops has dwindled. Farmers prefer to grow commercial crops to earn money and purchase their food through the PDS. The local varieties with higher nutritional value are not available through the PDS. Thus, meals of *jowar rotis* in North Karnataka and *ragi rotis* in South Karnataka have been replaced by grains available in the PDS. *Idlis* and *dosas* made out of rice and wheat *chapatis* have become popular.

6.4. New kinds of pests emerge

Farmers have been using indigenous agricultural knowledge for seed selection as well as for managing pests and diseases in their crops. In their own way, through centuries of observation and trials, farmers had developed seed

varieties through a process of natural selection that were area/location/climate specific, thereby enabling the crops to withstand drought, pests and diseases. Moreover, the practice of mixed cropping served to repel a variety of pests since the farmer scientists had learned the value of companion planting (referBox 4: Trap plants as pest repellents).

Box 4: Trap plants as pest repellents

The traditional practice of mixed cropping has always promoted the use of trap plants as natural pest repellents. Growing mustard around the wheat crop; ladyfinger, cabbage and marigold in and around the tomato crop has been practised by farmer scientists as some of the natural ways of avoiding pests.

However with the sudden introduction of new varieties, farmers' knowledge and wisdom have become redundant. The new varieties are developed to respond to high external inputs and not through years of trial to withstand pests and disease. As a result, farmers are forced to use chemical pesticides to control the pests and diseases that accompany the use of newly introduced varieties. The Green Revolution based on the chemicalisation of agriculture, required herbicides to combat the weeds that the chemical fertilisers nurtured. The killing of predators led to changes in the micro-environment of the fields. Consequently, the emergence of new pests required the extensive use of pesticides to control them.

Farmers in Therubeedi reported pest in *ragi* for the very first time only in 2008. However, in spite of knowing the advantages of organic inputs over chemical and unsustainable inputs, farmers continue to depend on market driven seeds and fertilisers based on the myth of high yields as well as the need for low labour inputs. Farmers mention that the effects of farmyard manure lasts for 2 to 4 crop cycles whereas 'government manure' has to be used for every crop. They liken chemical fertilisers to an addiction from which farmers have to be gradually weaned away. "We have become spoilt; our lands have also become spoilt. We were spoiled like children who are given a hundred rupee note. Earlier chemical fertilisers were given to us almost free" says Mathapathi, about the government's efforts to woo farmers with subsidies for chemical fertilisers.

7. Policies and their implications for farmers' rights

If the Green Revolution took away farmers' control over their own resources by making them dependent on markets, the current policy regime on seeds, plants and farmers' rights seems to further undermine the farmers' right to food sovereignty and to consolidate the hold of the multinational seed companies. The president of the Minchu Akshaya Seed Bank in Chinnikkatte village, Haveri district likens the spread of the multinational s*eed companies to a second wave of colonisation*.

The response of small and marginal farmers to the current government policies on agriculture is succinctly captured in the words of a senior farmer from Chinnikatte village, "They say that the farmer is the backbone of the nation, but they are breaking the farmer's backbone. Today, farmers in India are toiling to feed three categories of people – "seed companies, fertiliser companies and money lenders".

Traditionally, knowledge in Indian communities has not been a marketable commodity – seeds and varieties developed over generations through trial and error have been exchanged, shared and multiplied by farmers either freely, or on terms that are not dictated by the market. The efforts to retain the seed as a renewable genetic resource are being undermined by the influence of modern

economic thought that has sought to control this local genetic resource by bringing it under the ambit of patent and ownership rights. This thinking has in turn impacted on the current policy regime that seeks to privatise the 'common heritage of humankind' through instruments such as the Protection of Plant Variety and Farmers' Rights Act (PPVFRA), 2001; the Seed Bill, 2002 and the Patent Act, 2002.

The important question in this context is: **Will the community seed banks be able to function as independent community-based institutions promoting seed conservation and biodiversity in the new legal environment?**

7.1. Protection of Plant Variety and Farmers' Rights Act

The Protection of Plant Variety and Farmers' Rights Act (PPVFRA) of 2001 is a result of India's obligation under the Trade Related Intellectual Property Rights (TRIPs) agreement which makes it mandatory for all parties to the agreement to have some form of intellectual property protection for their plant varieties. Though the PPVFRA is seen by many as more progressive in that it recognises farmers as breeders and has scope for rewarding the farmers' innovation, there are nevertheless several drawbacks.

The need for the protection of breeders' rights has not come from the farmers but from a system that seeks to privatise and monopolise intellectual property.[12] The Act is clearly loaded in favour of corporate plant breeders as it grants the right to sell branded seeds only to breeders and not farmers.

7.1.1. Farmers as breeders

The Act recognises farmers as breeders with provisions for farmers to register their existing varieties. Qualifying requirements for registration are *distinctiveness, uniformity and stability*. How are farmers' varieties going to be assessed for these qualities? Recognising farmers as breeders under the law, creates a situation where farmers at best compete against each other in cases where different farmers claim ownership over a particular variety, or at worst are pitted against each other, for instance, where the Act

[12] The Hindu Business Line, 12 March 2004.

provides for compensation in the case of non-performance of a registered variety. If a farmer's variety is found to perform below standards, who is to pay the compensation and how much? Several such questions need to be answered.

7.1.2. Benefit-sharing

Under the Act, farmers have the right to sell, exchange, sow and resow their varieties but cannot sell their seed under brand names. The Act stipulates disclosure of parental seed lines and farmers are eligible for benefits if their varieties are used. However the modalities of this are yet to be worked out. Though the Act specifies that registration will endow benefits such as a right to share in the benefits when the farmers' variety is used, it is unclear how this will be monitored and implemented.

- What happens when the seed companies sell the farmers' varieties under different brands?
- How much benefit will the seed companies offer farmers given their low levels of awareness and influence that do not empower them to assert their rights and claim benefits?

Similar to the PPVFRA, the National Biological Diversity Act (NBDA) of 2002 also provides for compensation and benefits to farmers and communities in cases where their varieties have been exploited commercially.

7.1.3. Registering varieties

Yet, if farmers do not register their varieties there is the danger of companies, corporate plant breeders or even research agencies registering such varieties and completely alienating farmers' rights (refer Box 5: Farmers' Rights: "Whom should we approach?"). In order to protect their own varieties from appropriation by seed companies, it becomes necessary that farmers register their varieties. Thus, it seems that the farmers are caught in a "damned if you do and damned if you don't" kind of situation. With low levels of awareness among the farming communities about the registration processes and the lengthy bureaucratic tangles that can be expected, the likelihood of farmers taking the initiative to register traditional varieties seems rather remote at present. This will indirectly help the bigger players such as the corporate breeders to get into the act first.

Box 5: Farmers' rights: "Whom should we approach?"

"Since the past two generations, our family has been growing Kari *Gundi Nandiyal* variety of sorghum. This variety grows 18 feet tall. It is renowned for its good taste and fodder value. A few years ago, people from the Agricultural University took some seeds of this variety from us for research. After changing one or two traits, they are now marketing the same in the name of *Kala Gonda* sorghum, and making profits. We feel cheated. Whom should we approach?" asks Dharnedhar of Narsighanavar family from Lokur, Dharwad district.

7.2. The National Seeds Policy of 2002 and the Seeds Bill of 2004

The National Seeds Policy of 2002 and the Seeds Bill of 2004 both seek to encourage private sector investment in seed production. The National Seeds Policy highlights the need to achieve food production targets with its thrust on technology. The policy document states, "Genetic engineering/modification techniques hold enormous promise in developing crop varieties…" The policy makers are clearly in favour of technology and high cost solutions.

7.2.1.Disinheriting the farmers

The few concessions made to farmers in the PPVFRA are sought to be undone by the Seeds Bill. While the PPVFRA acknowledges farmers' rights over their

traditional seed varieties and makes it mandatory for all those who register to disclose parental seed lines, the Seeds Bill has no such provision. This will make it possible for seed companies to register the farmers' varieties as their own.

The Second Amendment to the Patent Act 2002 specifies what can and cannot be patented in the food and agricultural sector. Under this Act, the processes used in developing new varieties of crops and their seeds are subject to patents. This Act seems to be supportive of breeding transgenic crops.

7.3. The government approach to agriculture –inimical to indigenous farming practices

It is not only in the area of seed, but in the entire domain of agriculture that the power of market forces, which influence policy, is evident. The strategy for enhancing production and productivity has always been through promoting so called HYVs of seeds and the accompanying expensive inputs such as chemical fertilisers and pesticides. Heavy subsidies are provided to the fertiliser industry in order to encourage the use of such products.

Similarly, the agriculture department's extension staff are trained to promote mainly high external input agriculture with hybrid seeds and chemicals; rather than low external input sustainable agriculture with traditional seeds and organic inputs. As a farmer in Reddihalli mentioned, "The government is actively promoting non-traditional methods. If

we want to buy traditional breeds of cows we will not get loans, we will get loans only for cross-bred; if the government says something, the people will follow. The government should promote traditional varieties and practices."

Both the National Horticulture Mission and the National Food Security Mission have a thrust on technology as a means of enhancing production. While the former talks of a holistic approach covering production, post production and post harvest management, processing and marketing, it nevertheless has the promotion of research and development (R&D) technologies as a major strategy.

The National Food Security Mission's objective is to increase production of rice, wheat and pulses in selected districts in the country. Even in an ambitious scheme such as this, there is no mention of coarse grains or minor millets which were the preferred diet for many sections of the rural populace, especially small dryland farmers for whom food security and nutrition is the biggest issue. Activists have long advocated for the inclusion of traditionally eaten food crops such as *ragi*, *sajje* and *navane* in the Public Distribution System. However, the Government continues to procure only rice and wheat for the PDS. Hence, small dryland farmers, who grow minor millets and coarse grains that require low inputs and hence are ecologically sound, derive no benefits from the public distribution system.

Much of the research on seeds and plant productivity is based on improved and hybrid varieties. It seeks to perpetuate the myth that all hybrid varieties are high yielding and traditional varieties are not. Examples abound of farmers growing traditional varieties and getting good yields. Lingamadiah of Channapatna in Ramanagaram district has been growing Mysooru Mallige variety of paddy for the past 12 years. He gets a good yield of 36 quintals/acre and also reports that his crop has exhibited no variation in germination. It is rich in taste and milling recovery, that is, he gets about 80 kilograms of rice for every quintal of paddy, whereas other varieties only yield 60 kilograms of rice for one quintal as the loss in husking is considerable. However, there has been no attempt at systematically collecting such data or conducting research on traditional varieties in the mainstream. There is very little documentation and formal

knowledge by western scientific standards on existing varieties and practices. There is also a lack of the kind of support that is required for acquiring and disseminating such knowledge.

8. Creating a favourable environment

Now, the onus is on the various stakeholders concerned with the issue of sustainable agriculture, most importantly, the policy makers, agricultural scientists and farmers to create a favourable environment for the revival of the agricultural tradition that has been eroded in the past few decades.

GREEN Foundation's years of effort at reclaiming and promoting traditional agriculture as a way of life have resulted in some measure of success with farming communities in several pockets of Karnataka. They are now beginning to unlearn the lessons learnt from the Green Revolution and to revert to their heritage with renewed passion. This will take time and may even require incentives to wean them from external inputs.

After the initial years of high yields, farmers are realising the futility of using hybrid seeds and fertilisers as the land is not able to sustain such practices over the years. The yields are beginning to dwindle as a result, for example, the groundnut crop in Veeraiahannadoddi. Mathapati also talks of reducing yields of groundnut in his area (Dharwad), "Earlier we used to get 10 to 15 bags of groundnut per acre, but by 2000 this had reduced to 4 bags per acre."

In Yerjeenehalli too, some farmers who had switched from indigenous to hybrid varieties have reverted to indigenous seed varieties after facing losses. During the continuous drought that occurred during the late 1990s', farmers of Kolar district realised that the hybrid varieties of groundnut were difficult to pull out when the soil hardened (as happens when there is less rainfall) resulting in extra costs for labour. After this, the farmers in this region shifted from the hybrid HL/GR varieties of groundnut that they purchased from the agriculture department to *sannaguttakai*, a local variety that they used to grow previously.

Farmers of Vigneswara VDC in Veeraiahannadoddi that is actively promoting organic agriculture explain the efforts that they are making to draw the farmers back to traditional agriculture, "We cannot ask farmers to shift to traditional

agriculture promising increased yield, as this is not possible in the first few years of the shift. Hence we motivate them to change in the interests of their own health. Again, we promote a gradual shift – by converting one portion of their land to traditional agriculture while retaining their current practice in the rest, we ask them to compare and list out advantages and disadvantages of both kinds of agricultural practices."

The high costs of external inputs as well as their shortage are other reasons that are prompting some of the farmers to return to sustainable and cost-effective inputs including the practice of saving seed (refer case study: GREEN Foundation, Seeding an Initiative: Community seed banks).Given the rising price of chemicals fertilisers and pesticides, and also their timely unavailability, the time seems right for farmers to reclaim the traditional agricultural practices that are more sustainable and have the capacity to fulfill the needs of every family that depends on it for their livelihood. The reversion will not be easy for the farmers given that reclaiming their traditional agricultural practices would require them to reorient their entire lifestyles. It would also entail bearing losses in yields in the initial years, until the soil regains its lost vigour. It is during this transition phase that the farmers need support from the government.

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Details of the agro-climatic zones in which the study was undertaken

Eastern Dry Zone – Kanakapura taluk, Ramanagaram district; Mulbagal taluk, Kolar district

Characteristics of this zone:

- Rainfall: low – 680 mm to 890 mm;
- Soil type: red loamy, non-gravelly soil with a narrow belt of lateritic soil;
- Crop season: Kharif;
- Main crops: ragi, rice, pulses, maize, oil seeds and mulberry. Recent land use trends show increasing portions under vegetable and flower crops;
- Maximum temperature: 34° in April;
- Irrigation: Well irrigation (open wells and bore wells) constitutes 80.3% of the irrigation.

Northern Dry Zone – Dharwad district

Characteristics of this zone:

- Rainfall: Low – 465 mm to 785 mm;
- Zone: Semi-arid;
- Soil type: Shallow to deep black soil;
- Crop season: Kharif in the shallow soil; a second crop is raised in the medium and deep black deep soils;
- Main crops: *Jowar*, maize, bajra, groundnut, pulses, sunflower, cotton and sugarcane; *jowar* is grown mostly under rainfed condition, while maize and rice are grown in irrigated conditions;

ANNEXURE 1

- Maximum temperature: 38° in April and May.
- Irrigation: Canal irrigation is an important source followed by well (open wells and bore wells) irrigation; around 27% of the sown area is irrigated;

Northern Transition Zone – Haveri district

Characteristics of this zone:

- Rainfall: 620 mm to 1300 mm, 780 mm is mean annual rainfall;
- Soil type: Black soil (shallow to medium) and red loamy soil in equal proportion;
- Main crops: *Jowar*, rice, groundnut, chillies, pulses, sugarcane, tobacco and cotton; jowar, rice, maize, wheat and other many other minor millets like *navane, sajje* are all grown under rainfed conditions;
- Maximum temperature: 38° in April and May;
- Irrigation: Well irrigation (open wells and bore wells); this zone is the second largest contributor at the state level of irrigated sugarcane.

Loss of Community Knowledge of Healing, Local Genetic Resources and its Links to Development Policy

The Experience of Shepherds from Gummadivelli Village in Warangal District, Andhra Pradesh

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This case study looks at the community knowledge of healing their flock of sheep and its links to the local floral diversity. It also examines the factors that threaten the local healing practices.

CONTENTS

1. Anthra and its work

Anthra was started by a diverse group of women in 1995 as a resource, training, research and advocacy collective. Anthra works with historically marginalised communities to strengthen their agriculture/livestock-based livelihoods in ways that are equitous and biologically diverse. It seeks to promote food sovereignty and livelihood security for these communities.

Community-led participatory research has been a fundamental component of Anthra's work, since its inception. A path-breaking contribution to farming communities was Anthra's pioneering participatory action-research on indigenous knowledge with respect to livestock production systems carried out between 1995 and 2003. Anthra co-ordinated the study in partnership with 6 different organisations in Andhra Pradesh and Maharashtra

The main objectives of the project were to explore, and revalidate the indigenous ethno-veterinary health care and animal management practices (including indigenous breeds, shelters, fodders, medicines and treatments, management practices, and local markets). The aim was to develop an approach to promote, reintegrate and synthesise useful indigenous practices into existing farming systems for sustainable, culturally acceptable and viable farming. Enquiring into the gender issues in indigenous knowledge and livestock production was an

underlying theme of the research. A technical advisory committee comprising of traditional elders and healers of the communities and scientists from the "mainstream research institutions" guided the research.

The research resulted in a wealth of traditional practices and a systematic database on genetic resources that were consolidated into visual and written documents/ community registers in local languages and made available at the community level, so as to prevent the erosion and loss of this knowledge system. The information is also accessible to the communities through a user-friendly computerised database. Many treatments and traditional fodders, were socially validated as per an assessment protocol collectively evolved by the communities and scientists, and subsequently recommended to farmers for practical use. Finally, information was disseminated through low-cost publications, training programmes, *jatras,* campaigns and school textbooks. Pilot efforts were made to conserve and promote valuable fodder and medicinal plants through community and kitchen herbal/fodder gardens.

1.1. Location of the community

Warangal district is in the Northern Telangana region of Andhra Pradesh. It is bound on the north by Karimnagar, on the west by Medak, on the South by Nalgonda and on the east and southeast by Khammam districts. This semi-arid area forms a part of the Southern Plateau and Hill Region. It has a forest cover of 3.70 lakh hectares (tropical dry deciduous and tropical thorny type forest). The major soil types in the district are red chalkas (55%), black soil (22%), loamy soil (14%) and sandy loam (9%). The River Godavari runs beside the boundaries of Eturunagaram and Mangapet mandals on the eastern side. 3 lakh hectares of the total of 5.27 lakh hectares of cultivated land are irrigated. The district is known for its ancient network of irrigation tanks, namely, Ramappa, Chanpur, Pakhal and Lakhnavaram tanks.

The total geographical area of the district is 12846 sq kms. The district has 5 revenue divisions, 14 blocks, 51 mandals and 1098 villages. The total population of the district as per the census (2001) is 32,31,000. The district is generally dry with temperatures ranging between 13° and 50° Centigrade. The average rainfall has come down to 994 mm from 1048 mm in the past 50 years.

The Golla community are the traditional shepherds in Andhra Pradesh, rearers primarily of the Deccani sheep breed which originated in the Deccan plateau region, and a few goats. In Gummadivelli village, Lingala Ghanpur Mandal, Warangal district of Andhra Pradesh, the majority of the shepherding households (40 out of 60) continue to be highly dependent on sheep and goat-rearing as a major source of their livelihood. The one-third who discontinued rearing small ruminants did so primarily due to the decline in the availability of grazing lands, fodder resources and diseases. Since about 15 years, most of the flocks have been converted to the Red Nellore breed thanks to the government scheme that introduced the Red Nellore rams into the flocks.

The farmers are small and marginal landowners with an average land holding of 2-3 acres of dryland. Till about 15 years ago, the farmers cultivated a variety of dryland food crops such as paddy, maize, pulses and vegetables. Since then, farmers have shifted to cotton cultivation under both rainfed and irrigated conditions. Sixty percent of the farmers use private borewells for irrigation.

The shepherds have been grazing their sheep on the common lands, temple lands and private fallow lands surrounding the village. Recently, the private lands which were earlier used for grazing were sold by the villages to real estate agents and the shepherds have to lease out those lands for a high price. Currently, 4-5 shepherds jointly lease the land *(kancha)* from June to December. They pay Rs 18,000-20,000 for the exclusive rights to graze their animals on the land. Some shepherds also lease the temple lands. From January they graze for 3-4 hrs a day on harvested crop fields. In the summer months from April

to June, many shepherds migrate to villages located in Devarapally Mandal, Warangal district, 40 km away, in search of fodder and water.

2. Context and background

Traditionally, shepherding communities have been taking care of the health of their sheep and goat flocks using their indigenous knowledge of herbal remedies practised since many generations. In the past, there was no access to veterinary hospitals or medical shops and shepherds depended exclusively on their own traditions of healing. The practices were extremely effective to treat a range of disease conditions. This knowledge is on the brink of extinction today.

According to the shepherds, the knowledge eroded rapidly during the last ten to fifteen years. The younger generation of shepherds do not have any knowledge of their traditional healing practices and are completely dependent on "modern" health care practices. They visit the local medical shops to purchase drugs, obtain services from the government veterinary department.

The phenomenon of the loss of their knowledge is closely entwined with the larger forces of 'development' that have impacted on the agriculture-livestock livelihood systems. This 'development' has transformed diverse food-farming systems into industrial systems of agricultural production characterised by mono-cropping cultivated with intensive chemicals and pesticides, devoid of diversity and food sovereignty, with the consequent loss of biodiversity and knowledge.

3. Community knowledge of healing

3.1. Objective

The older generation of the shepherds had immense knowledge about the herbal remedies to treat their animals. They knew several herbal remedies to treat a variety of disease conditions in their flocks. They had the knowledge of several medicinal plants locally available in their surroundings and on the grazing lands. They used to collect fresh herbs, leaves, young twigs, stem bark, fruits and root bark for immediate use as well as dry and store them for emergency use. Most shepherds were able to treat common conditions, but

approached experienced shepherds, who were specialists in specific disease conditions, when the need arose. There were traditional healers in the village and in the neighbouring villages who were treating all animal species and also human beings. The healers were paid in kind due to the belief that the treatment would not work if they took money for it.

Some of the traditional healing practices prevalent amongst the shepherding communities in this village are summarised below.

3.2. Knowledge of healing and its relationship to the local genetic resources

3.2.1. Diarrhoea

Dandiga Rajayya, a senior shepherd, said that he used to treat his goats for common diseases like diarrhoea, wounds, foot rot and fractures with herbs available in and around the village. For curing diarrhoea, he used to prepare a medicine from the leaves of *Phyllanthus reticulates*, mixed with salt, fresh turmeric and a porridge made out of *ragi* (finger millet – *Eleusine coranacana*). The herb *Phyllanthus* reticulates used to be abundantly available on the farm bunds, road sides, grazing lands surrounding the villages and on the hillocks. People of all ages in the shepherding households could identify the plant and were aware of the procedure to prepare the medicine to treat diarrhoea. Today, however, he lamented, no one remembers the treatment and the herb has become scarce. He believes it died because of the excessive use of pesticides.

3.2.2. Respiratory problems

Another elderly shepherd, Yadayya said that for respiratory problems like cough, cold and pneumonic symptoms (*domma* in the local language), the creeper *nalleda (Cissus quandrangularis)* provided effective treatment. He would grind the stem and leaves with garlic, pepper and salt and administer it orally.

He would also tie a portion of the creeper around the neck of the sick sheep to aid its recovery.

3.2.3. Worms, wounds and foot rot

The shepherds commonly used a seasonal herb called *resika (Enicostemma axillare)*, found only in the rainy season on the banks of tanks and ponds for treating wounds, foot rot and intestinal worms. Today this herb has virtually disappeared and they only deworm their animals with *perugu mandu* – the term used by shepherds to refer to the de-worming pills purchased at the local medical shops, or which are supplied to them through the government department.

3.2.4. Fractures

For the fracture of the legs, they would apply the latex of *medi chettu (Ficus racemosa)*, gum from Acacia nilotica along with egg white, and plaster with the stem bark of *moduga (Butea monosperma)*.

They also used to brand the animal in case of certain diseases.

3.3. Timeline and spatial spread

The vibrant knowledge system and practices, some of which are described above were completely intertwined with the local flora. Several farmers and some specialised healers had a good knowledge of the medicinal plants and protected these plants in their natural habitats – whether on grazing lands, field bunds, or forests. Many actually grew herbs near their houses or fields. They were aware and knowledgeable about the seasonal availability of the plant, its location, and the parts to be used. They knew the method of collecting the parts without destroying or damaging the plants, and ways of storing the medicines, so that they could be used in seasons when the plants were not available. This knowledge contributed immensely towards the conservation of the local genetic resources (flora). The elders mentored subsequent generations who built on the knowledge base through practice and innovation.

Thus, the indigenous knowledge for the treatment and care of animals has been built through observation, experimentation and use over hundreds of years. The traditional healing practices were widely prevalent till about

20 years ago in Gummadivelli village and the surrounding villages where small and marginal farming communities have been rearing different types of livestock. There were a few experienced healers who specialised in a particular treatment in the neighbouring villages. When the shepherds were unable to affect a cure with their own treatments, they would approach the specialised healers. The knowledge was passed on from fathers to sons and occasionally to daughters and wives.

3.4. Impact of knowledge/practice of healing

The indigenous knowledge of healing had helped the shepherds to treat their animals on their own with minimal dependence on fellow specialists. The treatment was safe and cost-effective. Shepherds were self-reliant, especially during emergencies and at nights. Several common health problems such as diarrhoea and bloat, injuries and wounds, respiratory conditions, skin and eye diseases were treated and cured with herbal remedies. A handful of contagious diseases could not be treated with these medicines.

The abundance of grazing lands which were well populated with diverse fodder grasses and legumes, coupled with the widespread availability of medicinal plants, were important reasons why in earlier decades, shepherds had flock sizes that ranged between 100 and 200 animals, whereas today the flock sizes average 75.

4. Current status of knowledge/ practice of healing

At present, it is the elderly shepherds who continue to retain this knowledge, but they no longer apply their knowledge of healing. There is no recognition for the traditional healers, who once were the centre of healing practices in the village. The reason they stated was that they are no longer the decision-makers regarding their sheep flocks, which are now managed by their children/sons, who have little time and patience for these practices. The younger generation is completely alienated from their indigenous knowledge and practices. The elders have stopped transferring their knowledge to the younger shepherds, as the former say that the youth are no longer interested in learning from them.

The youth say that they need ready-made quick fix remedies and solutions, and do not have the patience to walk long distances to collect herbs, prepare them and process them. The also say that there are many new diseases; for which the traditional knowledge does not work.

Today there is a huge scarcity of medicinal plants in the village and the surrounding commons. Several plants which were abundantly available and found everywhere are no longer available and have become rare. The newer system of mono-cropping that the Green Revolution introduced, coupled with the excessive use of chemical fertilisers and pesticides have killed the diversity of flora that once existed. The shepherds, therefore, have to walk longer distances to find the plants. Many plants have disappeared from the area.

4.1. Factors that threaten knowledge/practice of healing

There has been an emergence of new diseases that did not exist twenty to thirty years ago. Diseases such as Blue Tongue and Peste des petits ruminants are endemic today, but were first recorded in India as late as the mid-eighties, and are extremely virulent contagious diseases that fail to respond to local herbal remedies.

The thick, coarse wool of the traditional Deccani sheep protected them from the extremes of the weather (rain, sun, cold), The change of breed from the traditional Deccani to the current Red Nellore which is a short hairy breed, devoid of the protective wool coat has made the Red Nellore extremely susceptible to respiratory problems. The Red Nellore breed has enhanced fodder requirements compared to the Deccani breed. These are difficult to meet in the context of the declining grazing lands and fodder diversity, which compromises the health of the animals.

This complex mesh of factors has undoubtedly contributed to the dangerous decline in the indigenous knowledge of healing within the community. Today, the shepherds visit the local medical shops to avail of expensive antibiotics and other allopathic medicines. The irony is that the shepherds actually purchase "herbal remedies" packed in fancy bottles!

The absence of a responsive and well staffed government veterinary public health system which is available at all times to advise shepherds, has pushed shepherds to approach the private medical shops owners, who are everything rolled into one – extension agent, veterinary doctor, and drug supplier.

Today, each shepherd carries his own kit of antibiotics and other medicines along with syringes, and administers the antibiotics to his animals. Frequently, the medicines are wrongly administered without following the recommended dosage. Thus, irrational drug use has resulted in side effects and growing drug resistance among the small ruminants.

Government policies and programmes on land-use, agriculture and livestock rearing, health care delivery both pre-1990 in the Green Revolution era, as also post-1990 in the era of neo-liberal economic reforms, have played a key role in pushing through such changes and transformations at the local village level. These transformations have not occurred in a vacuum. They are a response to the economic and developmental policies of the government, and the liberalisation of markets, which have valued a certain kind of development trajectory in opposition to sustaining indigenous traditions.

CBM-SAP collaborators

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SATVIK

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