Living on the Edge

Women, Agrobiodiversity & livelihoods

Vañaja Ramprasad
LIVING ON THE EDGE

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Vanaja Ramprasad
This book is dedicated to the seed collectors, small and marginal farmers around the world

To be of the earth is to know
The restlessness of being a seed
The darkness of being planted
The struggle towards light
The pain of growth into light
The joy of bursting and bearing fruit
The love of being food for someone
The scattering of your seeds
The decay of the seasons
The mystery of death
The miracle of birth
Preface

“The greatest obstacle to discovery is not Ignorance - it is the illusion of knowledge”

- Daniel J. Boorstin

The United Nations has declared 2014 the International Year of Family Farming (IYFF) to highlight the importance of family and smallholder farmers. This is an initiative that could not have happened at a better or more opportune time. The global food crisis has invoked furious debates across the world, and despairing news about widespread hunger makes news almost every day. This begs a question. Have we stopped to think where lay the answers?

Ironically, they lie in the unbridled efforts to increase food production. The chemical and seed industries which are allied together in this effort are embedded in modern agriculture that is capital and technology intensive. It is this same capital and technology intensive agriculture which has created a plethora of economic, environmental and social problems. The dependence on fossil fuel for sustaining the need for energy intensive, subsidy oriented chemicals, which are severely polluting, portends an unsustainable future for food production.

The current food crisis has also been further exacerbated by the corporate monopoly over the supply chain in agriculture and corporate efforts to introduce newer technologies that are based on unsound scientific principles. While green fuel is sought as an answer to carbon pollution and climate change, the production of this fuel is directly in competition with food production.

It is also more than obvious that it is not the lack of food, but artificially driven high prices coupled with poverty and the entitlement gaps which are the real issues. It is reported that prices of food have risen 83 per cent since 2011 and today there 110 million more poor who are at risk. It is predicted that by 2025 there would be 1.2 billion who will go hungry (Runge and Senauer, 2007).
How could surplus production and malnutrition coexist? It was my quest to find an answer to this intriguing question which prompted my journey across India beginning from 1974. I was also inspired by the book ‘Where our food comes from’, written by Gary Paul Nebhan where he retraces Nikolay Vavilov’s Quest to End Famine. In the foreword by K.B. Wilson, he quotes Carlo Petrini the Founder of the Slow Food Movement who has said so eloquently that much of humanity no longer knows how to put their hands into the soil and instead specializes in curating with microwaves, long dead objects found in their refrigerators.

I undertook several trips across the country to interact with farmers. During my journeys across the different farm lands I saw the loss of diversity driven by economic interests. I quote further from K.B. Wilson’s preface where he says, “What drives this model of development is a cultural idea of ‘modernization’ in which the outside object is fertilized and local people are deemed ignorant or passively needing their share of the ‘benefits of science’.”

Gary Paul Nebhan pointedly brings out the fact that Vavilov’s legacy is more than just the seeds he collected from around the world, for what he most valued were the seeds that remained in a peasant’s field adapting and changing, along with traditional knowledge of where, when and how to plant them.
It was this inspiring reading which led to my understanding that agricultural biodiversity is the corner stone for building greater food security for human kind. Without it our food systems will collapse, crippled by pestilence, droughts, floods, global warming and climate change, and the politically driven economic and environmental effects of neo-liberalism and globalization.

I had the fortune of learning about seed saving from none other than the renowned geneticist Dr. Melaku Worde whose message was, “We should do more on-farm conservation through on-farm use of these crops. For this we have to identify the values that guided the selection of seeds by farmers. We have to understand farmer’s logic, their traditional means of community-based seed saving and exchange.”

The Seeds of Survival programme promoted a strategy of planting in one single field, a diverse admixture of several farmers’ varieties with different physiological tolerances and other adaptive responses among them. In almost all lots where such admixtures have been tracked across several years, yields through time have been found to be higher and more stable than those of any single so-called high-yielding variety.

With this backdrop, if we take a stand that another agricultural transition is possible what are our options? The answer to a more sustainable system lies in protecting the valuable biodiversity that is the heritage of humanity. My interaction with small farmers, largely women in the last 40 years of which the last twenty years have been spent on intensive work with them, has solved a conflict in my mind of why farmers are living on the edge. My involvement with farmers has also given me an understanding of the economic, ecological, cultural, political, and gender aspects of how agro-biodiversity and livelihoods are interlinked. I have often felt I was piecing a jigsaw together.

This book is an attempt to showcase the whole jigsaw. Beginning with the historical evolution of India’s agriculture and its roots, which go back to the Vedic times, we have traced agriculture practices and protocols as they existed at the time, for soil and manure management.

What happened subsequently, particularly during the colonization of India, and later, during and after Independence? India’s agricultural history even during colonization as documented by various British historians and scientists gives raving tributes. The ecological soundness of agriculture in India and its cultural linkages during colonization by the British have been lauded by eminent writers and scientists like Albert Howard, Augustus Volker and Indian historians like Dharam Pal.
And yet, this prosperity and ecological wisdom were to change. The advent of Independence saw us food insecure and hopeless. These were the events that laid the foundation, and gave birth to the Green Revolution, which have also been elaborated in a section of the book.

The subsequent sections outline the decades that followed, which have witnessed globalization and neo-liberalization. These are the decades when India, with its growing population became the market for agribusiness and trade. It is also the time that the World Trade Organization (WTO) and the TRIPS clauses had an impact on the genetic resources of the countries of the global south. The genetic resources of the south were the raw materials for biotech firms and corporations that opened the floodgates for the genetically modified crops with the message that these crops were imperative to feed the hungry millions. What is the truth?

The next section opens arguments that expose the myth that the world can be fed with genetically modified foods. Clear cases of golden rice and Bt. crops have been cited. Later chapters highlight farmer’s rights and the international response to initiate the sui generis system of laws and the national laws that are binding. They also unravel the challenges faced in introducing farmer based on-farm in situ conservation. In the process it is also seen how seeds that belonged to the farmers were sent into internal exile.

What is the transition we are looking for to ensure food sovereignty? Women have played a major role in sharing their knowledge of conserving the plant genetic resources. Despite the narrow margins of hope, what are the challenges that we face in on-farm, in situ conservation? A section of the book expands on the transition in agriculture to save livelihoods and the genetic resources.

The lessons learnt during the last decade and a half have raised some critical questions. How do we mainstream the role of diversity in feeding the world? What are the attempts at rehabilitating the ex-situ collections from the gene banks and how do we circumvent the poor germination encountered?

What is the impact of land use change in keeping the diversity alive? What is the impact of national level laws that deter the efforts to revive the diversity on farmer’s land? How can on-farm conservation be sustainable and economically viable for small farmers? How can we combine both technical and social aspects in the approach to
conservation? These and many other important questions surfaced in the attempt to conserve the diversity with farmer participation. The experience in swimming against the current are shared in one section. Women have played a major role in conserving the agricultural diversity and their special penchant for selecting and saving seeds and their role in ensuring agricultural biodiversity and providing the food for the households have been highlighted through on-field, real-life instances.

Where do we go from here? There have been attempts across the world to revive holistic ways of growing food. Agro-ecology is rooted in the synergy between ecosystem diversity and agriculture and rejects the limiting factor of production in a uni-modal system but establishes the fact that it is multifunctional.

Agro-ecology is the science to transition organic farming towards a truly sustainable and resilient form of agriculture. Presently organic farming is perceived as bound by cumbersome norms of third party certification, resulting in unaffordable products, available only in niche markets and more suited for export than local consumption. If the benefits of organic farming must accrue to the environment, enable food security, conservation and alleviate poverty and hunger, the road we take has to be a clearly thought out one. It should facilitate organic farmers to produce food in environmentally sound and socially equitable ways without adopting a specialized industrial model of production and distribution.
According to Miguel Alteiri (2012) a renowned ecologist, “the technological determinism that the organic movement emphasizes via development and dissemination of low input or environmentally appropriate technology is not only naïve but dangerous as it assumes these technologies in themselves have the capability of initiating beneficial social changes.”

If the movement has to be sustained, major policy changes in market opportunities and relevant research will be necessary. Governments and public organizations must encourage and support effective partnerships between universities, NGOs and farmer’s organizations to mainstream and empower organic farming.

The vision of organic farming can be totally relegated to the background when organic production is considered increasingly to be traded internationally for the consumption of the rich. The same will gradually be taken over in the name of economies of scale by the same forces that dominate the conventional agriculture. The answer is not in increasing organic farming and production for the privileged, and transport organic products to distant markets for generating profits for the few. Organic farming must be rooted in a complete change in vision to a new future for the next generation.

The democratization of our food system requires a change in the way we manage it. Of course the changes require a proper understanding of the issues and the degree of political will that emerges from social pressures and social movements for food sovereignty. Most often the reality becomes murky when feeding the population is posed as the critical need. Different movements converging together and creating the necessary pressure is imminent today to bring the right to sustainable food systems and a transition in agriculture.

People are passionate about their food. We have strong roots to our traditions and food plays an important role in this relationship with our culture. Where does food come from? Definitely not from the supermarkets. The diversity in agriculture is what gives us the luxury of
varied foods. We have inherited this diversity in food from agricultural and horticultural crops that have been maintained over the centuries. Unless we continue to safeguard this diversity and pass it on to our next generation we will be disconnected from our cultural heritage. The way agro-ecology is played out in promoting organic cultivation is also presented in the book.

We have to facilitate advocates of organic farming to promote an agricultural system that is local, small-scale, family operated, biologically and culturally diverse. This system has also to be humane, socially just and accessible to the poor.

In the last century, in the name of development, we have undervalued nature and subjugated ourselves to empty promises. The convergence of global capitalism has waged a war against small farmers. There is a growing middle class veering towards unbridled consumerism. In the last decade we have witnessed the tragedy of high subsidies to the tune of 400 billion dollars combined with forced removal of import restrictions as a ready made recipe for farmer’s suicides.

We should move towards a world that functions for the benefit of all life, and towards a unified whole and interconnected system. We have responsibilities as co-creators of the future in cooperation with the laws of the universe. Therefore we need to set aside narrow self-interest and co-operate with other cultures, races, nations and religions for the wellbeing of all life.

We have a choice as people to take to the unnecessary, unwanted and hazardous path offered by engineers of life or to follow our own deep traditions and values to choose abundant, safe and healthy food for our children, families, our communities and our nation.

We have to realize that local prosperity is based on the welfare of the small and marginal farmers. In this direction Green Foundation is a people’s movement to safeguard diversity in agriculture and food. We have in the last fifteen years focused on this aspect by working with the
Millets are a popular staple crop prevalent in the dryland tracts of South India and are highly nutritious, drought resistant and capable of cultivation in poor soils. In the recent past they were neglected in favour of other crops and became stigmatized as a poor man's crop. GREEN Foundation has been working to reintroduce and popularise the traditional grains to strengthen food security. There are seven botanically distinct millets, many different species and even more varieties with farmer given names.

Finger millet (Eleusine coracana) popularly known as Ragi, originated from Africa but introduced to India more than 3,000 years ago. The only millet in India which has been able to touch an average productivity level of more than 1 tonne per acre. Ragi is nutritious and staple food crop of many regions in India.

Sorghum (Sorghum bicolor) was domesticated in Ethiopia about 5000 years ago and brought to India around 1000 years BC. It is an important crop for various reasons: the ability of the crop to withstand drought, adjust to various soil conditions, comparative quick growth and good yields of not just grain but large quantities of fodder.

The recent past has seen the neglect of these in favour of other crops and became stigmatized as a poor man's crop. There are different distinct millets like little millet (Panicum sumatrense), pearl millet (Pennisetum typhoides), barnyard millet (Echinochloa colona), proso millet (Panicum miliaceum) kodo millet (Paspalum scrobiculatum).

Foxtail millet (Setaria italica) is popularly called as 'návane' in the vernacular. Foxtail millet is an ancient crop domesticated in Eastern Asia, mainly confined in India to the lower Deccan Plateau. Three to four decades ago, foxtail millet was consumed as the staple food. The straw yield may be 1000-2000 kg per hectare.
small and marginal farmers who eke out a living in the fragile ecosystems of the semi-arid tracts. It is also true that it is the subsistence farmers in the dry lands who are the custodians of the diversity. Small farms, farmers and their diversity however are disappearing fast, overwhelmed by the challenges that the above factors have thrown in their path.

It is also seen that this diversity which is at the heart of organic agriculture is being pushed into internal exile. If we have to resist the onslaught of mono cultures and the push for genetically modified seeds in the name of increasing production we will have to continue to work with the diversity of the dry land regions. The concept of productivity based on diversity has to be re-defined.

Living on the Edge will hopefully provide a way forward for this through examples, arguments, compelling evidence and commitment.

- Vanaja Ramprasad

This compilation of impressions on the two decades of work with women and their role in conserving agricultural diversity and sustainable agriculture and studying the impact on their livelihoods is the result of a long personal quest. At the outset it is not an academic exercise, but a simple narrative. I must also confess that every section that has been addressed could be elaborated as a stand alone document. On the other hand I have taken a bird’s eye view of all the issues that impact women’s livelihood based on agro biodiversity and not dealt with them in the detail manner that it deserves.
Food, along with air, and water constitutes the very foundation of life. Whether it be plant, animal or human, these ‘life support systems’ spell out the difference between existences or the absence of it. Food, as a source of sustenance is also not something that can be produced or accessed independent of the other elements, i.e., water, air, soil, seed etc.

It would be to state the obvious to say that only a canvas painted with all these elements, which are also vitally alive and protected, can sustain plant, animal and human life. Healthy interplay between these elements can ensure that life is sustained on the planet Earth. This however, is not easy to achieve as there are factors that constantly hamper this interplay – some natural and others man made.

Food as a source of sustenance was not always produced, as it is today. If one were to look around, food, and its sources always were, and continue to be omnipresent. The animal kingdom accesses food from its own environment; humans have the means to make themselves food sufficient just
by drawing on what the earth has to offer; even plants are food sufficient. Notwithstanding this, historically, food consumption has evolved a great deal. From a position of gathering or hunting food, cultivation and breeding of animals for the purpose of food became known when humans became more settled and less nomadic.

In Vedic texts (c. 3000 -2500 BP) there are repeated references to agricultural technology and practices, including iron implements; the cultivation of cereals, vegetables, and fruits; the use of meat and milk and animal husbandry. Farmers plowed the soil, broadcasted seeds, and used a certain sequence of cropping and fallowing. Cow dung provided fertilizer, and irrigation was practiced. The Greek diplomat Megasthenes (c. 300 BC)—in his book Indika (McCrindle, 1877) provides a secular eyewitness account of Indian agriculture:

“India has many huge mountains which abound in fruit-trees of every kind, and many vast plains of great fertility. . . . The greater part of the soil, moreover, was under irrigation, and consequently bears two crops in the course of the year. . . . In addition to cereals, there grows throughout India much millet . . . and much pulse of different sorts, and rice also, and what is called bosporum [Indian millet]. . . . Since there is a double rainfall [i.e., the two monsoons] in the course of each year . . . the inhabitants of India almost always gather in two harvests annually. ”

Land management was particularly strong during the regime of Akbar the Great (reign: 1556-1605), under whom scholar bureaucrat Todarmal formulated and implemented elaborated methods for agricultural management on a rational basis.[11] Indian crops—such as cotton, sugar, and citric fruits—spread visibly throughout North Africa, Islamic Spain, and the Middle East.

Kautalya mentioned use of cow dung, animal bones, fishes and milk as manure (Nene,Y.L., 2002). In the kural 1st century AD [Thiruvalluvar ]it is stated that manuring is more beneficial than plowing. Agnipurana (Shastri,J.L. and N.Gangadharan 1986) recommends application of excreta of sheep and goat and pulverized barley and sesame allowed to be soaked in meat and water for seven nights to increase flowering and fruiting of trees. In Varahamihira’s Brahat Samhita growing of sesame to flowering stage and then incorporating it as green manure is recommended. Surapala (1000 AD) describes the “ancient” practices of preparing liquid manure (kunapa) prepared by boiling a mixture of animal excreta, bone marrow, flesh and dead fish in an iron pot and then adding to it sesame oil cake, honey, soaked black gram and a little ghee(clarified butter). (P.M.Tamboli and Nene Y.L.)

Shastri J.L.(Ed) N.Gangadharan (TR) 1986 agnipurana Vol 30
Surapala 1000 A.D. quoted in  Surapala’s Virukshayurveda The science of plant life “in Agri History Bulletin No 1 Asian agri history Foundation secundarabad
History of Indian agriculture – a bird’s eye view

In India, there are records of cultivation of food i.e., agriculture, even as early as the Vedic times, and methods were prescribed for soil, seed, water, and practically every aspect associated with agriculture. This activity was associated with divinity; the elements were worshipped and food was celebrated and offered to the higher spirits before consumption. Food signified an intense universal energy and was worshipped as nature’s gift. It was also synonymous with diversity, culture, culinary skills and healthy, happy people.

Centuries passed, and by the time India, the nation as we know it today, attained Independence after 200 years of colonization by the British, food, and agriculture had undergone a sea change from what it was during the Vedic times.

Much has been written about the condition of, and change in the lives of Indian farmers during the colonial regime. Annexure one describes the life of communities as determined by the Chengalpattu Survey conducted by the British between 1767-74. The survey (Sundaram, 2006) clearly indicates that agriculture was alive and thriving, and comparable with the best anywhere in the world. It also establishes that no community in the region was threatened by lack of food security. While the data is restricted to one region, anecdotal evidence suggests that India was overall a prosperous region. The process of deterioration appears to have set in during colonization.
Through a succession of Acts and Laws that gave supremacy to land-owners over cultivators, and indeed created owners where there were none, the position of the Indian farmer was rendered more and more tenuous and he was pushed into a vicious cycle of debt and poverty and became demotivated towards farming. Additionally, the discouragement of all other trades and occupations drove greater numbers into farming, thus creating an imbalance between the land available for farming and those engaged in it. Development and growth dipped to abysmal levels when India was part of the British Empire and the region went from being prosperous to a poverty-stricken, hopeless one (Annexure two).

Amartya Sen has commented (O’Maller, 2013), “The rate of economic growth was close to zero percent a year for about 200 years when India was part of the British Empire. Adam Smith suggested in 1776 that India was one of the richest countries in the world. That quickly changed. Literacy rates in India when the British Empire ended in 1947 were abysmally low, something like 15 percent. In the British period famines occurred on a regular basis in India. The last famine in India was in 1943 – four years preceding independence.”

And yet, there are records to prove that this stagnation need not have occurred. In an enquiry conducted by Dr. John Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society of England, during 1889-91, he was asked to make recommendations (Voelcker, 1893) “for the improvement of agriculture and to promote the welfare and prosperity of the rural population”.

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He observed that, “... On one point there can be no question, viz., that the ideas generally entertained in England, and often given expression to even in India, that Indian agriculture is, as a whole, primitive and backward, and that little has been done to try and remedy it, are altogether erroneous... the conviction has forced itself upon me that, taking everything together, and more especially considering the conditions under which Indian crops are grown, they are wonderfully good. At his best the Indian raiyat or cultivator is quite as good as, and, in some respects, the superior of, the average British farmer, while at his worst it can only be said that this state is brought about largely by an absence of facilities for improvement which is probably unequalled in any other country, and that raiyat will struggle on patiently and uncomplainingly in the face of difficulties in a way that no one else would...”

His report also recommended that, “... it isn’t the introduction of Western practices that will help progress the state of Indian agriculture but the transference of the indigenous methods from one part of the country to another...” [see Annexure 3 for more excerpts]. This recommendation however, seems to have stayed within the confines of the report.

Independent India and the Green Revolution

Independent India began its existence with a multitude of problems of which food security was probably the most severe. Food stocks were perilously low, and two million people, including children, had died of hunger just prior to Independence in the Bengal famine. The country had seen a very bloody and gory partition; people were reeling from homelessness and hopelessness and things seemed irretrievable. According to Food and Agriculture Organization (FAO) (Nawani, 1994) of the UN, “...Partition of the country in 1947 left India with 82% of the total population of undivided India but only 75% of the cereal production. The surplus province of Punjab was partitioned and West Punjab, which had a well-established network of irrigation canals, went to Pakistan. Sind province, which too was a surplus province, also went to Pakistan. These two provinces together used to supply about one million tons of food grains to other provinces in undivided India. At the time of independence, thus, the new nation India started its tryst with destiny with lots of handicaps as far as food security was concerned...”.

Agriculture under the British regime had seen almost no growth, and had stagnated. The situation was grave enough for Pundit Jawaharlal Nehru, Independent India’s first Prime Minister to remark,
“Everything else can wait but not agricultural self-sufficiency.” In line with this priority, the 60s saw the advent of the Green Revolution. M.S. Swaminathan, popularly called the Father of the Green Revolution in India, says (Ragunathan and Viswanathan, 2013), “…there was once a ship-to-mouth food situation in India. Such was the intensity of the food shortage that large quantities of wheat had to be imported and sent immediately for consumption…”

The Green Revolution is credited with having made India food sufficient. According to an FAO (1996) report titled ‘Towards a New Green Revolution’, “…beginning in the 1960s, improved, high-yielding varieties of wheat spread quickly across Asia, soon followed by new strains of rice. Within 20 years, almost half the wheat and rice land in developing countries was being sown with the new varieties. In Asia, where the impact of the green revolution was greatest, almost 90 percent of wheat fields were planted with modern varieties and plantings of high-yielding rice had increased from 12 to 67 per cent.

In order to reap the potential of the new seeds, farmers also rapidly increased their use of mineral fertilizers, pesticides and irrigation. Between 1970 and 1990, fertilizer applications in developing countries shot up by 360 percent while pesticide use increased by 7 to 8 percent per year. The amount of land under irrigation increased by one-third. The gains in production were dramatic: world cereal yields jumped from 1.4 tones per hectare in the early 1960s to 2.7 tones per hectare in 1989-91. Over the past 30 years, the volume of world agricultural production has
doubled and world agricultural trade has increased threefold. These rapid gains helped avert a major food crisis in Asia and provided the springboard for rapid economic growth in China, Southeast Asia and South Asia...”

**A heavy price has been paid**

The benefits that the Green Revolution had towards mitigating hunger at a time when the country’s food security was threatened, is uncontested. India, and indeed the whole world, in the process however, can be said to have paid a price heavier than the gains it achieved.

The above quoted FAO report endorses this, “...The green revolution of the 1960s and 1970s depended on applications of fertilizers, pesticides and irrigation to create conditions in which high-yielding modern varieties could thrive. It taught scientists and policy-makers some important lessons for the future.

Reliance on seeds that have to be bought rather than saved from year to year and that require expensive inputs may exclude many poor farmers from the benefits of a green revolution. In many areas, water is being pumped out of the ground for irrigation faster than it can be replenished. Up to 60 percent of the water withdrawn for irrigation may never reach the crop. Poorly managed irrigation causes waterlogging and salt buildup that can turn fertile fields into a wasteland. Widespread use of just a few high-yielding varieties of wheat and rice may lead to the loss of traditional varieties and increase vulnerability to pests and diseases. By the end of this century, as few as 12 varieties of rice may cover 75 percent of the fields in India.

The environmental damage caused by misuse of fertilizers and pesticides sometimes outweighs their advantages. Experts estimate that only about half of the fertilizer used may actually benefit the crops; the remainder is lost from the soil by leaching, run-off and volatilization. Similarly, a large percentage of pesticides may not reach target pests. Instead, they contaminate people, land, water and air, and foster the emergence of resistant strains of pests...”

The following section deliberates on the aftermath of the Green Revolution and the advent of neoliberalism...
Green Revolution and After.
The Advent of Neoliberalism and Globalisation

The current context

As outlined in the last chapter, while the Green Revolution ushered in a situation of perceived food security, inequities continue to challenge the poor and the marginalized. In place of the plentitude of food and over-arching prosperity that was envisaged, the opposite has happened. Market economies have taken over agriculture and food availability, pushing farmers into exile, putting food out of the reach of multitudes of the world’s poor and created unimagined situations, of which hunger is probably the most challenging.

Technological developments also brought in other, more threatening dimensions into the production, distribution and consumption of food. This included global politics of control over food in all its domains, which has resulted in the undermining of indigenous knowledge. There is not one, but several threats that are facing food production itself. It is but inevitable that in such situations, the lives of food producers, i.e., farmers, particularly small and marginal farmers have become severely vulnerable. The more obvious threats to their livelihood and food security are reduced opportunities to work at their primary occupation - farming.

A combination of factors are responsible for this, chief among them being:

» Reduced fertility levels in soil which leads to input and resource intensive farming, which small farmers cannot afford

» Conversion to mono-cropping and cash crops over food crops, leading to indebtedness and lack of food security

» Loss of land for cultivation owing to rapid urbanization

» Reduced motivation levels in farmers to stay with farming owing to social welfare programmes that encourage trades and occupations other than farming.
Larger threats, greater implications

Threats which are not so obvious, and yet, are equally or more damaging to the lives of small farmers, are gaining foothold across the world. Neoliberalism is firmly entrenching itself in the arena of food and its production.

A paper titled ‘Hungry Corporations: Transnational Biotech Companies Colonise the Food Chain’ (Paul and Steinbrecher, 2003), says, “...Neoliberalism generally involves a belief in unfettered market forces, promoting freedom of movement for capital, goods and services, and the removal of government controls over private enterprise...”

The situation begs an answer to a question. If neoliberalism was touted to be the mantra for progress, why is there food insecurity in the world? Why do inequities exist?

The same paper provides answers, “...It breaks links to particular localities and seeks to remove regulation because this distorts markets. It dismantles community networks of care for the weakest members of society, believing they should be replaced by individual responsibility. The emergence of biotechnology and genetic engineering cannot be divorced from this context of neoliberal globalization. As has been pointed out by many researchers, food production and consumption were local until market economies emerged, which in turn drove the growth of global food trade. In order to pay back their debt, countries are still being encouraged to switch from agricultural production for their own local and national needs to the export of cash crops. This is leading to local and national food insecurity, with countries being urged to continue to export food, even when threatened by national shortages (Ireland and Ethiopia during famines, and Malawi in 2002–3)...

There are efforts to manipulate food from its very genetic makeup and treat it as a commodity to be traded across the borders. Food is increasingly being seen as another weapon to strengthen the arsenal of globalized controls. Neoliberalism has also resulted in insidious but increasing controls over natural resources like land, water and biological wealth by giant corporations.

Neoliberal policies, which were seen as a panacea to the world’s problems of hunger, poverty etc., have actually resulted in the opposite. While the bottom of the pyramid slides lower on all social indices, the upper half has continued to grow and prosper. The above quoted report points out the stark inequities that face the world today, “...100 million more people faced hunger in 2008, and 37 developing countries were in urgent need of food, whilst Monsanto’s net income doubled, the net
income of Cargill—the world’s biggest grain trader—soared by 86 per cent, and Archer Daniels Midland—one of the world’s largest processors of soy, corn and wheat—increased its earnings by 42 per cent…”

The impact of neoliberalism on agriculture and food security in India

The shifts in policies and global efforts to encourage free markets have hit farmers in myriad ways. The small farmer who engages in subsistence farming is inevitably the most threatened. The most primary is probably the impact on the seed security of small farmers and their rights to cultivate their lands in the ways most appropriate for them. It is here that the conflicts become most evident.

Farming across the world, (for the purpose of this document more specifically in India), can be clearly classified and split into two genres.

Technology and input intensive farming, which is heavily dependent on proprietary seeds, fertilizers and pesticides, and patented technologies, make up for one system. This system is heavily regulated and calls for large cash investments on seeds and other inputs, something that small farmers are not equipped for. Pursuing this system of farming has decimated a huge number of farmers in India and the farmer suicide figures are evidence for this.

The other system, more commonly known as traditional farming, is the one which thrives on local knowledge and holistic systems, and which has been the way of life for farmers for centuries. No less scientific, it adopts multiple cropping systems, uses cost-effective farm-saved seeds, and is less dependent on chemical inputs.

Seed saving is common in this form of agriculture and whole communities, particularly women come together to save and exchange seeds and farming technologies. The majority of the world’s poorest
farmers depend on this system to enable food security for themselves, and to stay seed secure.

Traditional agriculture however, does not find favor with governments. Large corporations have the ability to influence governments and policies, and these results in traditional systems getting sidelined and patronage being extended to branded seeds, chemical pesticides and fertilizers as governments scramble to bow to corporate interests. P Sainath, the renowned journalist endorses this view, “One of the dangers that neo-liberalism brought to our country is the shift in food crops to cash crops, which has resulted in greater domination of corporate houses on agriculture.”

The farming community, directly in conflict with what its traditional practices demand, is increasingly having to face complicated links that governments forge with agro-chemical companies, seed companies, veterinary drug manufacturers, banks, food processors, retailers, packers and other stake-holders in the food production and distribution chain. Each link in the chain is being increasingly controlled by giant corporations. The biggest tragedy probably is that while forging these links, and deciding on priorities, farmers have not been consulted and decisions, which divest them of all rights, have been made, completely leaving them out of the process.

In the last decade food and agriculture have been caught in the clutches of biotechnology and genetic engineering. And these are being offered as solutions to reduce hunger and malnutrition through higher yields and genetically modified seeds. There are serious concerns about the so-called pro-poor biotech that is emerging. Local companies are riding piggyback on the biotech revolution only to serve the interests of the US/European companies.

The concrete example of such a case is the Bt cotton. Bt is the generic designation for seeds to which a gene from soil, i.e., bacteria bacillus thuringensis (Bt) has been added. This gene enables the plant
to produce protein that is toxic to some types of insects especially the American bollworm. In India more than half the pesticides are used on cotton. As farmers in India have encountered the pesticide treadmill more poisons are required and hence the use of Bt cotton was justified. This argument does not hold water since the cotton crop is attacked by 17 other pests for which continuous use of pesticides was necessary. Therefore the large-scale introduction of the Bt cotton met with resistance because of implications like monopoly control and creating increasing dependence for seed and other inputs.

Similarly goes the story of the Golden Rice, which promised the alleviation of malnutrition and blindness in rice eating populations. The advent of Golden Rice has to be seen, not in a vacuum as claimed by the providers of the technology. It has to be viewed against a backdrop of market control rather than as a humanitarian exercise. To offer the poor and malnourished a high tech golden rice tied up in multiple patents that has cost more than 100 million US$ to invent and which may cost much more to develop, is much like what Leo Tolstoy said, “I sit on a man’s back, choking him and making him carry me and yet assure myself and others that I am very sorry for him and wish to ease his lot by all possible means - except getting off his back.”

India’s food production levels had peaked to around 209 million tons in the Year 2000. And yet about 42 percent of the rural population consumed less than 2430 Kcals per Consumer per day. Inadequate calorie consumption is seen among the cultivators cultivating less than one acre and the landless labor households. The Food Corporation of India (FCI) was established in the early 60s to support the Green Revolution. The Agricultural Price Commission (APC) and the public distribution system (PDS) were the two main support systems of the FCI. The PDS was the subsidized food system that allowed food to be produced at high costs during the Green Revolution to reach the consumers at low prices. Despite the country’s large network of PDS through which grains were made available at subsidized costs it does not seem to have had much of an impact on the consumption of calories which again reiterates the fact that it is not a single vitamin that is missing in the diets of people but food
as a whole. The truth is that hunger in the midst of plenty is the hallmark of today’s development.

According to Amartya Sen, in ‘Hunger, the old torments and new blunders’, the technological limits have been widely expanded. He goes on to say that what holds up Indian food consumption today is not any operational inability to produce more food, but a far reaching failure to bring entitlement to food within the reach of the more deprived sections of the population. In his essay on hunger Amartya Sen also points out the fact that we in India are determined to maintain at heavy cost India’s unenviable combination of having the worst of undernourishment and starvation deaths in the world and the largest unused food stocks on the globe.

It is obvious that the crisis of food is the result of the unsustainable global economic system based on over-consumption by a small percentage based on profit and greed born out of unequal power relations. There is a notion that food trade is vital to world food security. Localization of food production at the level of the community,
state, or region is rejected as a viable alternative. Food insecurity is not identified as a phenomenon of privatization and commercialization of food production and consequent destruction of ecological conditions of production and living environment.

Further adding insult to injury, sovereign nations has been left powerless and has been compelled to commit them to provide Intellectual Property protection to biodiversity. However through bilateral agreements as well as world intellectual property organizations the northern countries have pressurized the weak southern countries to accept the UPOV type "sui- generis" options thereby forcing them to accept intellectual property provisions beyond their obligation to WTO. The consequences of this for the food sovereignty and health care in developing countries are grave.

The patenting of plant varieties will limit access to genetic resources, could undermine traditional seed exchange at the local level and raise costs of inputs for agriculture. The patenting and copyrights system will severely undermine the importance of technology transfer and finally the IPR system recognizes the individual and not the community. This will eventually destroy the notion of collective knowledge and creativity that has hitherto contributed to the local knowledge systems.

Indian agriculture has never been threatened as it is today. A report published by the Times of India (Shrinivasan, 2013) says, “There are now nearly 9 million fewer farmers than there were in 2001, the first time in four decades that the absolute number of cultivators has fallen. Census data shows that while the proportion of cultivators to the total workforce has been falling steadily, this is the first time since 1971 that the number of cultivators has fallen in absolute terms. Cultivators remain the second-largest group at 119 million after ‘others’ but are now less than a quarter of the total workforce, a decline of over 7 percentage points over 2001. Over the last 50 years, the proportion of farmers to the total population has been in steady decline, but the fall has not been big enough for the absolute number to go down, given population increases. But in the last decade, the fall in farming has combined with the slowing rate of population growth to create a fall in the absolute numbers of farmers. As in previous decades, the proportion of agricultural labor has increased; there are now 144 million agricultural laborers, 30% of the total worker population against 26.5% in 2001. “The rise in agricultural labor could be explained by the falling size of land holdings over time,” census commissioner C Chandramouli suggested.”

To complicate matters further, the precious little land that is available for farming, has several competitors. Requirements for
IT Parks, SEZs and other forms of corporate activities have rendered thousands of farmers landless and pushed them into forced migration into already overburdened cities. Because they are not equipped for any occupation other than farming, they are forced to work as construction labor in cities and the meagre earnings they muster are inadequate for them to lead lives which provide for food, healthcare, education for their children and other needs. Additionally, they are also removed from proximity to their own communities and support systems – overall a vexing situation. Figures prove this. The box quotes a report of 2007 on land which has been lost to agriculture. The situation since, could reasonably be assumed to have become more aggravated and severe.

Threats to farmer’s aside, it is time to recognize that the general population too has been rendered vulnerable by the changes in the agriculture sector. We are now increasingly being faced by a situation where we are compelled to eat food that is laced with unacceptable limits of pesticides; we are compelled to eat food that has travelled thousands of food miles; we eat food that has been banned or restricted in the developed countries and is being dumped in developing countries. Additives are being added in increasing quantities and we can no longer be sure of getting farm fresh food, which is either fresh or safe. We are also beginning to eat more and more food ‘off the shelves’ of supermarkets. The following section explodes a few myths on safe food.
Urban and rural India is united by the common problem of unsafe food. It is a fact, however undesirable, that safe food in a country like India is a distant dream for the millions who live in unhygienic conditions and for those labelled as living below the poverty line. However, even the wealthier and middle-class urban consumers are exposed to various forms of unsafe food. One of the critical factors threatening the safety of food is pesticide residues. It started with the modernisation of agriculture, where pesticides played (and still play) a major role.

Research has established that over the last 20 years, vegetables, meat, grains, water, soil, and even blood have begun to contain pesticide residues. Chemicals (banned elsewhere) such as DDT, BHC, Dieldrin, Aldrin, Endrin and Malathion have been detected in the soil, water, vegetables, grain, pulses roots and tubers, spices, oil seeds, fish, eggs and milk in India.

Various studies and surveys conducted in India demonstrate ample evidence of pesticide residues in food. A survey conducted by Dr. Balwinder Singh, Department of Entomology, Punjab Agricultural University (PAU) (Dhaliwal, 2002) revealed DDT and BHC residues in wheat grains and flour, rice grains and maize flour. More than 80 percent of the samples were found to be contaminated. According to this study, most of the samples contained residues of DDT above the legal limit of 0.1 parts per million.

The daily ingestion of DDT through cereals alone was 69 percent of the prescribed safe level of 0.005 mg/kgb.w/day and was much higher than the total dietary intake of most developed countries (Karla and Chawla-1981).

Analysis of samples of infant formula (milk) revealed the presence of DDT and BHC residues (Dhaliwal, D.S 1990). The studies show that even the spray drying process in manufacturing of formula
does not reduce residues of DDT below the tolerance level. Mother’s milk is also unspared and 130 samples collected from Punjab were found to be contaminated with residues of DDT and BCH (Karla and Chawla, 1983). Whether it is breast milk, infant formula, vegetables or blood, the levels found in India are very high when compared to those in other countries.

In the case of Malathion, chronic manifestations have been observed which include significant reduction in plasma and RBC cholinesterase level.

Consumers are still far from becoming aware of contaminated food, let alone the laws on the compulsory labelling and banning of harmful additives in food. As more and more processed and canned foods, containing chemical preservatives pile up on supermarket shelves, it is important to be aware that chemicals like Butylate Hydroxy Toluene, sodium nitrates and nitrites, benzoic acids and brominated vegetable oils in soft drinks are harmful to health. Colour dyes that are added to intensify or restore the natural colour destroyed during processing are also found to be harmful.

India is also being assaulted by a chain of western food stores selling hamburgers, pizza and fried chicken. Aided by media advertising and attractive packaging, processed foods in the modern urban context convey the impression that the production of these processed foods has little or no relation to agriculture, farming communities and rural life.

The entry of MNCs such as McDonalds and KFC, who have dubious reputations in their own countries, has resulted in their intervention into primary areas like agriculture, food processing and pharmaceuticals. The grouse against these new fast food outlets was the exceptionally high use of chemicals to fatten poultry and livestock that has resulted in increased incidence of diseases in farm animals. For example, the use of DES (diethyl stilbesterol) is known to be used to fatten animals and can cause hormonal imbalances in the consumer.

Convenience foods, fast foods and processed foods, contradictory to popular belief are not making our lives easier. They are, if anything, bringing in a new spate of diseases such as hyperactivity in children fed
with coloured sweets and squashes, increase in carcinogenesis, heart
disease, asthma, skin allergies and obesity, to name only a few, in people
who consume high calorie, low residue food.

Seeds and chemicals - the nexus

Despite the various drawbacks seen in the chemical intensive
green revolution, there appear to be few lessons learned. If pesticide
consumption is one aspect of the growing chemical industry, organized
seed production is the other. The gene revolution has panned out in no
less an exploitative and unplanned manner as the Green Revolution.
As a result of liberalization, multinationals have entered the area of
seed production. The seed industry in India is primarily engaged in
the production and distribution of seeds that depend on high
doses of chemical fertilizers and pesticides, while there is proof
that several traditional seed varieties yield as much or more,
with the application of simple and cost-effective farmyard manure.
The market for hybrid seeds is growing and multinational
companies have taken full advantage of this by collaborating
with Indian companies.

The multilayered problems are not only with regard
to health hazards but also touch aspects like monopoly control through
Intellectual property rights. The stark differences between the green
revolution technology and the now much touted ever green technology is
well brought out by Suman Sahai (2006), “The Green Revolution (GR) was
a publicly-owned technology belonging to the people. The research was
conducted with public money to fulfil a public need -- inadequate food
production -- and it created public goods to which everyone had access.
There were no Intellectual Property Rights (IPRs), no patents vested with
multinational companies, no proprietary technologies or products. If
there was ownership of the GR, it was with the farmer. Once the seed
reached the farmer, it was his; he moved it where he wanted. Therefore,
despite its drawbacks, the Green Revolution addressed farmers’ needs
and India’s food production showed an upward curve.
The Evergreen Revolution (ER) is almost the exact opposite. It is a privately-owned technology. Six corporations (Monsanto, Syngenta, Bayer Crop Science, DuPont, Dow, and BASF Plant Science) control practically all research and output in the field of transgenic plants. Processes and products, including research methodologies, are shackled in patents and the farmer has no say, let alone any control. The technology creates only private goods that may be accessed only at significant cost (a bag of Mahyco-Monsanto’s Bt cotton seed in India costs Rs 1,600, as compared to between Rs 300 and Rs 400 for superior varieties produced locally).

She continues, “The seed belongs to the company, which strictly controls its movement. With the development of the popularly termed ‘terminator’ or sterile seed technology, the farmer is reduced to a helpless consumer, not a partner as in the case of the GR. The Evergreen Revolution has in its 20 years not yet produced a crop variety that has any direct connection to hunger and nutritional needs. The most prevalent crops remain corn, soya, cotton and canola, and the dominant traits are herbicide tolerance and insect resistance. Despite its other faults, the Green Revolution was able to put out a number of crop varieties in a short span of time that enabled direct yield increases, which brought immediate benefits to farmers. That, in short, is the contrast between the two revolutions, so assiduously camouflaged by the agbiotech spin masters.

India participated enthusiastically in the Green Revolution and is on its way to equally enthusiastically embrace the Gene Revolution or agbiotechnology. Yet there is little debate in the country on whether any lessons have been learnt from the Green Revolution. There is even less discussion by policymakers and other stakeholders about the path that agbiotechnology should take in India. There is no consultation with the public, as in many other countries (for example, in Europe), or any sharing of information as is done in almost all countries that are implementing GM technology.”

To counter the growing objections and opposition to pesticide usage, industry offered genetically engineered crops, which were purported to need lesser usage of
pesticides. It has been assumed by proponents of genetic engineering that since genes determine the characters of organisms, one can engineer organisms to fulfil all our needs. To quote from Jeffery Smith’s (2007) Genetic Roulette, “Documented health risks of genetically engineered foods in the US reveals that consumers do not know what they are eating since all foods including rice, corn, wheat, legumes like soybeans, vegetable oils, soft drinks salad dressings, vegetables and fruits, dairy products including meat, egg, chicken, pork and other animal products and even infant formula plus an array of additives and ingredients in processed foods are not labelled.” Lendman (2008) calls it an unregulated mass human experiment, the results of which are unknown and emphasizes the fact that agribusiness giants allow nothing to interfere with profits, safety is off the table, and all negative information is quashed. As a result, their studies are substandard, adverse findings are hidden, and they typically “fail to investigate the impacts of GM food on gut function, liver function, kidney function, the immune system, endocrine system, blood composition, allergic response, effects on the unborn, the potential to cause cancer, or impacts on gut bacteria.

As Dr. George Wald said, “Up to now, living organisms have evolved very slowly, and new forms have had plenty of time to settle in. Now whole proteins will be transposed overnight into wholly new associations, with consequences no one can foretell, either for the host organism, or their neighbours.... going ahead in this direction may be not only unwise, but dangerous. Potentially, it could breed new animal and plant diseases, new sources of cancer, novel epidemics.” (Jackson and Stich, 1976)

Arpad Pusztai was one of the first scientists to raise concerns about the safety of genetically modified foods. In the late 1990s, Pusztai, a respected molecular biologist, conducted research on GM potatoes for the Rowett Institute in Scotland. The potatoes were genetically altered to produce lectins, natural insecticides, to protect them against aphids. Pusztai conducted feeding studies on rats and found that the potatoes damaged the animals’ gut, other organs, and immune system. In 1998, Pusztai expressed his concerns about GM foods on a British television programme and was promptly suspended and forced to retire from his position. Dr. Pusztai’s research was later peer reviewed and published in The Lancet, a leading British medical journal...” (Roseboro, 2009)

Today, most existing diseases have no effective surveillance systems in place. If GM foods create new ones,
As Dr. George Wald said, “Up to now, living organisms have evolved very slowly, and new forms have had plenty of time to settle in. Now whole proteins will be transposed overnight into wholly new associations, with consequences no one can foretell, either for the host organism, or their neighbors.... going ahead in this direction may be not only unwise, but dangerous. Potentially, it could breed new animal and plant diseases, new sources of cancer, novel epidemics.” (Jackson and Stich, 1976) that potentially compounds the problem manifold. To quote Stephan Lendman, “The process of creating a GM plant requires scientists first to isolate and grow plant cells in the laboratory using a tissue culture process. The problem is when it’s done it can create hundreds or thousands of DNA mutations throughout the genome. Changing a single base pair may be harmful. However, widespread genome changes compound the potential problem manifold.

Promoters are used in GM crops as switches to turn on the foreign gene. When done, the process may accidently switch on other natural plant genes permanently. The result may be to overproduce an allergen, toxin, carcinogen, anti nutrient, enzymes that stimulate or inhibit hormone production, RNA that silences genes, or changes that affect fetal development. They may also produce regulators that block other genes and/or switch on a dormant virus that may cause great harm. In addition, evidence suggests the promoter may create genetic instability and mutations that can result in the breakup and recombination of the

Bt Brinjal in India – the controversy

Advocates of genetically modified crops say they can boost yields to feed the burgeoning population and also be advantageous to farmers to raise output and mitigate the use of pesticides. However, opponents point to the fact that introducing Bt genes into food crops can be hazardous to the environment and public health, and threaten biodiversity.

The controversy around introducing Bt Brinjal in India has been ongoing since 2010. It sparked a heated debate when farmers and consumers took to the streets across India. The Government of India put commercial cultivation of Bt Brinjal on hold following pressure from 13 state governments. India’s then Environment Minister Jairam Ramesh announced an open-ended moratorium on the introduction of Bt Brinjal until independent scientific studies established the fact that it was safe for human consumption. However, the moratorium was only on approving commercial trials
of Mahyco’s Bt.Brinjal variety using Cry1AcGene. The brinjal was genetically engineered by a consortium of scientists at Mahyco and state agricultural universities in Coimbatore and Dharwad to produce a bacterial toxin that kills worms.

The Bt brinjal is a suite of transgenic brinjals (also known as an eggplant or aubergine) created by inserting a crystal protein gene (Cry1Ac) from the soil bacterium Bacillus thuringiensis into the genome of various brinjal cultivars. The insertion of the gene, along with other genetic elements such as promoters, terminators and an antibiotic resistance marker gene into the brinjal plant is accomplished using Agrobacterium-mediated genetic transformation. The Bt brinjal has been developed to give resistance against lepidopteron insects, in particular the Brinjal Fruit and Shoot Borer (Leucinodes orbonalis)(FSB). The genetically modified brinjal event is termed Event EE 1. The Event EE 1 was introgressed by plant breeding into various local varieties by University of Agricultural Sciences, Dharwad and Tamil Nadu Agricultural University, Coimbatore. Some of the cultivars of brinjal include Malpur local, Manjari gota, Kudachi local, Udupi local, 112 GO, and Pabkavi local. Bt brinjal was approved for commercial release in Bangladesh in 2013.

Other institutions such as the Indian Institute of Horticulture Research, Bangalore are pursuing their research using Cry2A Bt gene which was reported in 2010 as being at an advanced stage. Similarly Institutions like Indian Institute of Vegetable Research Varanasi had also developed a variety of brinjal using a different gene. (Major singh) Along with this it is reported that dozens of research groups are trying to engineer cauliflower, mustard, rice, soya bean and tomato among other crops in an effort to import new traits to plants. The research includes a tomato variety that could survive without refrigeration for 45 days by a team in New Delhi.

The moratorium on Bt Brinjal had no implications on efforts to develop other GM crops. There were a number of scientists from
India, Australia, France and the UK and US who had sent messages to the minister raising serious reservations about the GM Brinjal and the way the tests have been done in India.

Though scientists have varied opinions, there is broad consensus that India is the center of diversity for Brinjal (major singh) John Samuels articulates a major concern on the potential for transgene flow from Bt. Brinjal to wild and weedy relatives and enable them to become aggressive weeds and that the potential for disruption of ecological balance and plant diversity is considerable. He also adds that the knowledge of the diversity and taxonomy of the wild relatives of Brinjal in south and South East Asia is incomplete. Moreover, more importantly the general concerns over transgene escape were incorporated into the Cartegena Protocol on Biosafety in the Convention on Biological Diversity (SCBD2000) to which the South Asian countries are signatories.

New crop hybrids for higher yields have been the dominating factor in modern agriculture for many years. While choosing quantity at the expense of quality it has become evident that high yielding varieties can be not only deficient in flavour but also in nutritional value. It is perhaps ironic that food producers are now relying on genetic engineering to put the “taste” back into food rather than returning to more traditional varieties.

We must also remember that unlike chemical pollutants and other problems in the food chain such as a BSE epidemic, once genetic pollution causing toxins/allergens and ecological disturbances are in our soil, crops, animals and their wild relatives, it cannot be cleaned up or simply allowed to decay and will be passed on to all future generations indefinitely. Given that we have viable and safer alternatives is it worth taking the risk? [Antonian, 1996]

gene sequence. Plants naturally produce thousands of chemicals to enhance health and protect against disease. However, changing plant protein may alter these chemicals, increase plant toxins and/or reduce
its phytonutrients. For example, GM soybeans produce less cancer-fighting isoflavones. Overall, studies show genetic modification produces unintended changes in nutrients, toxins, allergens and small molecule metabolism products.”

It is heartening to see a A Global Network Of Physicians and Scientists for Responsible Application of Science a Technology (1999) categorically committing themselves to the following statement:

“…Because we do not have enough knowledge to understand all of the hazards which GE foods present, or have fully reliable methods to test their safety or estimate the risks of introducing them into the food supply, it must be concluded that GE foods cannot be reliably certified as safe at this time.

There are several known ways in which the artificial insertion of a gene may cause unexpected complications of a kind that never occurs in conventional breeding. Some unexpected effects have been experimentally verified; see Examples of unexpected effects of genetic engineering. In addition, because the knowledge about DNA is very incomplete, there may be effects that cannot be even imagined presently, see ‘Incomplete knowledge about DNA’...”

This section would be incomplete without adequate attention being paid to the controversy surrounding Bt Brinjal.

In a world where consumers have no choices over the kind of food they eat; in a world where farmers have lost access to their own resources; in a world that is being governed by corporate priorities, which are limited to profit-making, what relief can farmers expect? Particularly because the majority of the world’s farmers lack voice and the ability to protect their own interests against the onslaught of corporate might?

It is obvious that political will has to be demonstrated towards protecting their basic rights. The situation calls for stronger Laws and Treaties that can protect farmers and their rights over what they grow. The following section makes a case for Farmer’s Rights.
Farmer’s Rights: A top down or bottom up approach?

Seeds and plants are not “genomes” to farmers, but they are life, livelihoods and the very basis of a sustainable life.

This section begins on the basic premise that farmer’s rights cannot be viewed as rights, benefits of which, accrue to the farming community alone, and exclude the rest of the world. Every living entity, human or animal, that consumes food is impacted by how food is produced. The section will examine the implications of taking away farmer’s rights and giving greater controls over food production to corporations. These controls are combined with the attendant freedom and protection to research, modify and put on the markets, seeds, and other agricultural inputs that might be improperly or inadequately researched, and/or might not keep long-term health considerations in view while ‘engineering’ food production with commercial interests being the prime concern.

To begin with, it is important to recognize that plant genetic diversity is crucial to the future of food security and that these diverse genetic resources provide protection against pests and diseases, in both human and plant, as well as changing climatic conditions. Diversity also plays a vital role in the survival of millions of small and marginal farmers who depend upon small-scale farming for their livelihoods, as well as general consumers, who might not be directly producing, but merely consuming what the farmers produce.

Killing diversity and substituting it with patented, proprietary, genetically engineered products will have disastrous consequences for humanity in general as the previous section amply demonstrated. It is vital to recognize that this situation occurs directly as a result of farmers being divested of their rights to conserve their diverse crop varieties and seeds.
The trend is not encouraging

The diversity of domesticated land races is disappearing at an alarming rate across the world. It has been estimated that there are up to 500,000 species of higher plants, i.e., flowering and cone-bearing plants of which about 250,000 have been identified or described. Approximately 30,000 of these are edible and 7,000 have historically been cultivated or collected by humans for food. Today, only 30 crops provide 95% of the world’s calorie and protein requirements and wheat, rice and maize alone provide more than half the global plant derived energy intake. A further seven crops, sorghum, millet, potatoes, sweet potatoes, soybeans and sugar (cane/beet) bring the total to 75% of the energy intake. While the number of plant species which supplies the world’s energy and protein is limited, the diversity within such species is high. There are, for example, more than 100,000 distinct varieties of rice (Oryza sativa) (FAO, 1996).

100 YEARS OF AGRICULTURAL CHANGE: SOME TRENDS AND FIGURES RELATED TO AGROBIODIVERSITY

- Since the 1900s, some 75 percent of plant genetic diversity has been lost as farmers worldwide have left their multiple local varieties and landraces for genetically uniform, high-yielding varieties.
- 30 percent of livestock breeds are at risk of extinction; six breeds are lost each month.
- Today, 75 percent of the world’s food is generated from only 12 plants and five animal species.
- Of the 4 percent of the 250,000 to 300,000 known edible plant species, only 150 to 200 are used by humans. Only three - rice, maize and wheat - contribute nearly 60 percent of calories and proteins obtained by humans from plants.
- Animals provide some 30 percent of human requirements for food and agriculture and 12 percent of the world’s population live almost entirely on products from ruminants.

Source: FAO. 1999b
The example of the Irish potato famine of 1845 to 1848 (Donnelly, 2008) brings out the consequences that can result from a lack of genetic diversity in the food supply chain. The potatoes consumed by the Irish peasants lacked inter and intra species diversity which caused the famine that killed 1.5 million people and many had to emigrate from Ireland.

Across the world, there is an increased interest in biotechnology and the commercial use of genetic resources. This is also bringing in a regime of IPRs (Intellectual property rights) and new seed regulations at national levels. Ever since contracting parties concurred with the negotiations of the WTO and trade related IPRs, an anti-commons (genetic resources are considered a common property of humanity) situation has arisen, with multiple actors excluding each other from the right of access to plant genetic resources. Article 27.3(b) states that members may exclude from patentability “Plants ....and essentially biological processes for the production of plants ...however, members must protect plant varieties with patents, a sui generis system or combination of the two.” (Helfer, 2004) While the approach protects plant varieties, those with IPRs will vary from country to country. TRIPS requires member countries to adopt some minimum level of plant variety protection. Unfortunately this is not seen as a threat to conservation and sustainable use of these

<table>
<thead>
<tr>
<th>Country</th>
<th>Resource</th>
<th>Varieties lost</th>
<th>Notes</th>
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<tr>
<td>China</td>
<td>Wheat varieties</td>
<td>90% loss</td>
<td>Of 10,000 varieties used in 1949 about 1000 (10%) remained in 1970s</td>
</tr>
<tr>
<td>Korea (S)</td>
<td>Garden landraces</td>
<td>74% loss of 14 crops in home gardens</td>
<td>26% of landraces present in 1985 remained in 1993</td>
</tr>
<tr>
<td>Mexico</td>
<td>Maize varieties</td>
<td>80% loss</td>
<td>Only 20% of maize varieties planted in 1930s remain; maize being replaced by more profitable crops</td>
</tr>
<tr>
<td>USA</td>
<td>Varieties of apple, cabbage, field maize, pea, tomato</td>
<td>80-95% loss</td>
<td>Percent loss comparing varieties grown 1804-1904 and present</td>
</tr>
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Loss of crop plant genetic resources: examples at country level (FAO, 1998)
resources. This is seriously impacting food security and the outlook for combating poverty in the world.

Farmers Rights

Let’s examine a paradox. Over time, a situation has developed where farmers are struggling to retain rights over what has belonged to them without question since the dawn of agriculture. And yet, biotechnology firms from developed countries have unbridled access to the same genetic diversity grown by local farmers. They are able to modify these into engineered varieties without any compensation to the farmers who have been the custodians of the resources for centuries. Conversely, the engineered crop varieties come to the developing world with huge price tags, which these same farmers are compelled to buy. Corporations argue that newly bred varieties deserve both IPRs and monetary compensation since they invest money and time in developing them. There is increasing international pressure for intellectual property protection for plant varieties and farmer’s rights are insidiously being usurped.

This trend was first recognized a few decades ago, and there have been some efforts to restore the rights of farmers to continue to have access to their practices and knowledge. The concept of farmer’s rights was first officially addressed in 1986 by the FAO in a working group but it was to become one of most contested issues. In the negotiations that followed, most developing countries as well as some industrialized countries like Norway advocated comprehensive and internationally binding recognition of farmer’s varieties whereas countries like the US and Australia did not support the stand. Finally, in 1999, the heated debates resulted in a compromise in the form of the Plant Treaty on Farmer’s Rights. Two articles of the Treaty that have an important bearing on Farmer’s rights are articles 6 and 9.

Article 6 emphasizes the fact that diverse farming systems need to enhance sustainable use of agricultural biodiversity and the

LEGISLATIONS IN INDIA

- The Design Act, 1911
- Communication bill, 2000
- The-Patents Act, 1970
- Information Technology Act, 2000
- Protection of Plant Variety and Farmers Right Act, 2001
- Biological Diversity Act, 2001
contracting party should expand the use of local and locally adapted crop varieties. Article 9.1 says the contracting parties recognize the enormous contribution that the local and indigenous communities and farmers of all the regions of the world, particularly those centres of origin and crop diversity have made, in accordance with their needs and priorities each contracting party should as appropriate and subject to its national legislation take measures for ensuring food security and sustainable agriculture.

There have been several efforts in the same direction since then. The International Treaty on Plant Genetic Resources (ITPGRFA) was framed in the year 2001. However, the origins of the non-binding ITPGRFA go back to an FAO conference in 1983. The realization of farmer’s rights is the cornerstone of the Plant Treaty. The Treaty was adopted by 120 contracting parties and entered into force in 2004. The objectives of the Treaty are:

- Conservation and sustainable use of crop genetic resources
- Fair and equitable sharing of the benefits arising from its use for sustainable agriculture and food security.

India has the distinction of having contributed to the debate on Farmer’s Rights. With the PPVFR Act that was passed in 2001, India in principle granted framer’s rights by protecting both breeders and farmers. However, the Act originally emerged as a response to the seed industry’s demands for breeder’s rights and the provisions on farmer’ rights were added due to pressure from NGOs. The PPVFR Act together with the breeder’s rights has successfully acknowledged the rights of the farmers. Despite the fact that many stakeholders are not even aware of the bill, the PPVFR Act of India is a far reaching one in terms of recognizing farmer’s rights in the world.
Plant Variety Protection (PVP) in the Indian law

Farmer’s varieties are usually developed as a collective and spread over large geographical regions and often the same variety is found in several villages and sometimes, even across national borders of neighboring countries with similar agro ecological regions. Farmers have also been traditionally exchanging, selling and saving seeds without let or interference. But traditional knowledge is dynamic and changes over time. Additionally, when it is associated with biological and agricultural diversity, this knowledge has to be treated with an understanding that they are two sides of the same coin.

The national biodiversity authority recognizes the rights of the communities over traditional knowledge. Articulation of farmer’s rights and protection of traditional knowledge in the Indian legislation is a case in point to illustrate that it is spread over a number of national laws i.e. the PPVFRA 2001, Biological Diversity Act 2002, the Patent Amendment and the pending Seed Bill of 2004. The intention of particularly the PPVFRA was to reflect the farmer’s rights as stated in the International treaty. Article 39 of the legislation states that farmers who have bred or developed a new crop variety shall be entitled to the same plant breeder rights to which breeders themselves are entitled. According to the Indian government it is a national response to the sui generis provision of the TRIPS to protect the plant varieties. However, there are several contradictions that emerge from this.

From a review of literature on the PVP Law it is evident that however good it appears, it only privatizes the planting material. For a group of farmers who toil to get a farmer’s variety PVP certificate, there is no clarity on how counter claims on the same variety from other farmers is going to be dealt with. Considering that Indian farmers are traditionally used to an environment free of controls, this raises the question on how appropriate the PVP system is in the Indian context. Greater numbers of PVP certificates being issued only means more breeders having control over plants and seedling material which hitherto was freely available to the farmers. In the light of more patent like rights and more patents themselves what is the role of PVP?

PROPOSED GOALS OF PPV & FR ACT, 2001

- To encourage the development of new varieties
- To protect Plant Breeders’ Rights (PBR).
- To stimulate the growth of seed industry.
- To recognize and Protect rights of farmers.
With respect to the impact of international legislations the Indian PVP law is greatly influenced by the UPOV 91 (Union for the Protection of new Varieties of Plants). UPOV 91 is designed to protect products of modern biotechnology and essentially derived crop varieties. The key criteria of UPOV followed by laws means that the plant variety must be novel, distinct, and unique and stable (DUS criteria). These criteria contradict the needs of farmers involved in farming especially organic farming as uniform is the opposite of diverse. Varieties that are able to adapt to different conditions are not stable. Novelty and distinctness apply to varieties that are stable and uniform.

The Indian PPVFRA has adopted the provisions of the CBD relating to benefit sharing, without a proper instrument to implement it. Given the vague system of registration and benefit sharing in the law and the inability of farmers to apply for registration, it seems farfetched that farmer’s rights are going to be protected.

The PPVFRA has also announced, ‘The Plant Genome Savior Community Recognition Award to Recognize the Contribution of Rural and Tribal Communities to Genetic Resource Conservation and Enhancement’. The Act makes it clear that the reward is for only those farmer varieties that has some ‘economic value’ for breeders and which have been used as base material or donor crop for further development by breeders. In other words the rewards to farmers are from money got from the privatization of farmer’s genetic material. It is essential to remember that farmers do not simply save genes when they select and develop a variety; on the other hand they sustain a way of life and a culture. The pressure for community control over genetic resources has pointed out that the law actually threatens to alienate farmers from their crops by granting IPR over plants to few individuals or corporations.

To even label them merely ‘genome saviors’ is to reduce the holistic nature of what farmers do, to a phrase they would neither
understand nor appreciate. Seeds and plants are not ‘genomes’ to farmers, but they are life, livelihoods and the very basis of a sustainable life. The campaign further stresses the fact that an Act like this which claims to be recognizing the contribution of farmers and tribal communities are actually stripping the poor of their collective rights over resources and paving the way for further marginalization.

The tightening of the PVP system will have a large impact on farmer’s seed practices, particularly farmer’s access to seeds. The Seed Bill of 2004, which has not received official sanction even 10 years after it was drafted, was formulated with the intent of regulating the seed quality. It focuses on private participation in seed production and distribution achieved through a system of compulsory licensing. The seed bill has been critiqued to have taken away the little benefits offered by the PVP law. In the light of legislations that are having a far reaching impact on farmer-saved seeds, a set of measures are called for to address the compatibility of seed laws and plant variety protection to take into account communities’ needs. Literature abounds on the topic to recommend reinforcing the traditional sharing system with a system of peer production and distribution of germ plasm as an alternative way to develop crop varieties and dynamically sustain genetic diversity.

The debate around the Act has highlighted the fact that it has been defined by national level decision makers without taking into account the regional and local level perspectives. It has been pointed out by those who have studied the history and evolution of the law that the focus has been on asserting and assigning ownership rights, than on utilizing traditional knowledge and genetic resources for the benefit of the farmers. There is a clear disconnect between what the Treaty aims to ensure as farmer’s rights through article 6 and 9.

Yet another observation is the lack of co-ordination between various laws and bodies that has posed a problem in realizing farmer’s rights. The different acts like the Biodiversity Act, Patent Act, the pending Seed Bill look at only one aspect and the overall agricultural development in the country is not taken into
account. The Act that has been passed even before the Treaty came into force, does not engage itself with the provisions of the different articles meant to ensure farmer’s rights. Also some studies of the PPVFR Act have concluded that the ownership based approach have not provided significant economic returns.

There are glaring examples of farmers like Farmer Dadaji Khobragade from Maharashtra who has been struggling for the last 30 odd years and who has developed varieties like the HMT has not been successful in registering his variety with the PPVFR authority. For a farmer who has toiled for several years and has developed unique varieties that have been grown on almost one lakh acres in five states and in several districts of Chattisgarh, still lives in poverty.

Farmer’s Rights is a concept that needs to be actualized; it is a need; and in the light of the increased stranglehold that corporations are exercising over seeds and other inputs required by the agricultural sector, it is also an urgency.

The story of Larry Proctor who brought a bag of mixed beans from Mexico is often quoted as one of the case of misappropriation of genetic resources. The mixed bag of beans from Senora in Mexico was later separated as black and yellow and planted over several seasons and the best plants were replanted and selected. A few years later proctor declared his selected beans as an invention and applied for US IPR on the plant. With the IPR on hand Proctor’s Agro Company started enforcement actions against importers warning them of infringement and the need to pay royalties. Ultimately thousands of farmers who cultivated the beans for generations were economically impacted. The patent had to be challenged and after a long battle the rights of the farmers were retrieved. The case of the enola bean which was named after the wife of Proctor is not an isolated one. There are other examples like the Turkish land race of wheat that supplied American varieties with genes for resistance to stripe rust, a contribution estimated to have been worth $50 million per year. The Indian selection that provided sorghum with resistance to green bug has resulted in $12 million in yearly benefits to

Mexican beans, south Asian basmathi rice, Bolivian Quinoa, Amazonian ayahuasca, Indian chickpea, Peruvian nuna beans, Andean moc a all have been subject to predatory Intellectual property claims.

(Ribeiro, silvia and katty Jo wetter sept 2009)
American agriculture. An Ethiopian gene protects the American barley crop from yellow dwarf disease to the amount of $150 million per annum. It is no exaggeration to say that the plant genetic resources received as free goods from the Third World have been worth untold billions of dollars to the advanced capitalist nations.

However, rights or no rights, communities have ways of resisting controls and asserting their independence. There are instances across the world where people have risen collectively to resist oppression and controls. The recent public agitations in Egypt (the Tahreer Square movement) and India (India against Corruption movement) are just two examples. Similarly too in the arena of agriculture. Resistance movements in the agriculture sector are coming alive across the world and the following section gives a glimpse into the significance and impact of these movements.
In response to the various threats to them, farmer’s resistance movements have come to life across the world. These movements have also adopted various bottom up approaches and vast efforts have sprung up across the world especially amongst the agrarian communities to spread the concept. The movements have stood out for their efforts to resist the various pressures and exploitative tactics being used against them.

Women farmers have played a major role in changing the mind set of the Green Revolution era which did not look at the regional variations. They have demonstrated that food supply is not a route to profit but a source of nutrition and sustenance. There have been efforts to empower women to remodel farming into integrated systems that encompass water, flora and fauna, and to perceive them as systems for survival.

The most important lessons emerging from the movements are that the circular loops of fertility, seeds and resilience of communities in the food web are not just economics. They are also about sustainable localized food production.

It begins with the seed itself. Multiplying and exchanging seed within the communities establishes the right to their livelihood. Saving the seed symbolizes the spirit of self-determination and the spirit of regeneration, and the effort to regain control over resources and rights to Food. Those who participate in these mega- efforts are the small and marginal farmers in rain-fed areas.

Public action includes not only what is done for the public by the state, but also what is done by the public for itself – Amartya Sen, Hunger: Old torments and new blunders
Politically conscious social movements are focusing on the concept of 'food sovereignty' in the place of food security. Food sovereignty is not a matter of semantics alone but is a social, cultural and ethical significance as well as political resistance against control over food systems in a globalized world.

The common purpose of the movements is to reclaim the value of food as a source of nourishment and not poison, as a source of peace and not conflict. Food must be a source of health and not disease; a source of prosperity and not poverty, and must nurture rather than destroy and decimate.

Resistance movements are voicing concerns and responding in different ways. There are the campaigns against bio-piracy and the patenting of biodiversity. Movements have resisted the co-option of national governments and insisted upon developing national level legislations to protect and promote the local knowledge systems. Movements have engaged themselves in seeking clarifications for the ambiguities, highlighting the traps and bottlenecks and challenges.

The links in the box alongside point to some of the agitations held in the recent past, protesting against GM seeds and the efforts of corporations to kill local biodiversity:

1. El Salvadoran farmers protest millions in US aid over GM seeds
2. Farmers, activists protest sale of genetically modified seeds
3. Kenyan farmers in protest over monsanto’s genetically modified corn
4. National Farmers and Social Strike gets seeds control law 970 suspended
5. Burma: Big farmers’ protest over govt failure to resolve land grab problems
6. Forcing Farmers to Plant Genetically Modified Seeds: Colombians Revolt Against Seed Control and Agricultural Tyranny

But these have more or less remained as pockets of action and what is required today is a collective upraising; a mass movement that can resist the onslaught of corporate houses attempting to usurp the rights of farmers through IPRs and the subscription of governments to WTO dictates. This movement has to be bottom-up and large enough to compel corporations to ‘push back’. It has to be large enough to break the links; dismantle the nexus and must have the power to wrest back lost strength and rights, and restore a happy future for generations to come.
The importance of local efforts at sustaining life in all its biodiversity

Small and marginal women farmers have a huge role in the route to preserve biodiversity and to save the source of food the soil, water and genetic resources despite the heavy odds. In the midst of an ecological and economic crisis, political control over food production and cultural collapse, women have proved that they are the back bone of food production for their families and their communities.

Having worked for more than two decades on this issue and very intensively in the last decade on biodiversity based sustainable agriculture, we, at GREEN Foundation understand that food is central to our lives. We have to stop thinking we can feed the world by ‘life’ eroding manipulations at the seed level. On the other hand we have learnt from women and small farms that we have to pause to restore the balance that is continuously being eroded.

The following chapters will delineate the importance of preserving biodiversity in agriculture at the farm level; it will build a strong case for encouraging small and marginal farmers to make greater use of low-cost, environment friendly methods of farming. It will bring alive the efforts that women farmers have made to keep to themselves, the rights over seed, what food, and how to produce it. Their experiences will demonstrate the power of local efforts at biodiversity conservation and the success stories that are associated with it.

It will also give a glimpse into the economics of small farms and the priorities that small farmers have, which are more important for them than what a corporate views as priorities. It will also give concrete examples of the work of GREEN Foundation, an organization that has worked with small and marginal farmers in conserving biodiversity at the farm level – in a bid to demonstrate that it is possible...
Before understanding the importance of on-farm conservation and its unambiguous role in preserving agricultural biodiversity, it is important to understand the significance of India’s traditions and culture, which farmers held sacred with regard to seeds and integrated farming systems. India has been acclaimed as one of the mega diversity centres of the world. The different agro climatic conditions of the country lend themselves to diverse crops that are acclimatized to local conditions. To give an example, India, at one time, was home to more than 100000 rice varieties. Similarly, India shares with Africa, the pride of being home to several millets like bajra, finger millet, foxtail millet, little millet, kodo millet and sorghum in the semi-arid tracts and desert zones. The temperate zones of the hilly regions and the irrigated areas nurture cereals like wheat, barley and oats.

Subsistence farming has traditionally been pursued in India, for almost eternity, with the dry deciduous forests providing a strong support base. They provided leaf-litter for manure and fodder for animals. In turn, the livestock manure enriched forests and farms. Good forests especially the broad-leaved forests, were essential for the preservation of water in springs, which was in turn necessary to irrigate the fields. Knowledge and practices in a traditional society, living in close proximity with nature, functioned like a well-oiled system. It was a highly interdependent network of actors. The very foundations of subsistence farming lay in the

In a world that lurches from crisis to crisis, it is always difficult to call attention to a catastrophe in the making. But, like many disasters engineered over long periods of time, corrective action must be taken before the momentum of impending disaster becomes too great to halt.

In the race to feed a world population that could grow to more than 10 billion in the year 2050, traditional crop varieties and local animal breeds are being wiped out at an alarming rate. New ones, better suited to industrialized farming, are becoming the world standard. Industrialized agriculture favors genetic uniformity. When vast areas are planted with a single high-yield crop variety, traditional crops are lost and whole harvests can be destroyed by one pest or disease. The loss of this biodiversity threatens world food production and could eventually put human beings at the top of the endangered species list.

Unfortunately, the importance of maintaining the world’s plant and animal biodiversity has not always been apparent. In 1970, the United States suffered the consequences of highly industrialized farming, when southern leaf blight destroyed almost $1 billion worth of corn and reduced yields by as much as half. More than 80% of the commercial U.S.-grown corn varieties were susceptible to the disease. Eventually, resistance to the blight was found in an African corn variety, Mayorbella. A major catastrophe was averted by incorporating this resistance into commercial varieties.

Since the beginning of this century, Europe has lost half of its domestic breeds of animals. One-third of the remaining 770 breeds are in danger of disappearing in the next two decades. Much of this loss is the result of market pressures and other incentives leading farmers to replace varied and locally adapted plant and animal varieties by a limited number of commercial ones.

Today, about 150 plant species are cultivated worldwide, while just three--rice, corn and wheat--supply almost 60% of the calories and protein derived from plants. If this trend continues, it will lead to the nutritional impoverishment of our food supply.
The biological diversity of aquatic species is threatened by habitat destruction, overexploitation and reliance on a few highly productive species. Fleets using sophisticated detection devices are too efficient at catching fish. Moreover, bottom trawl nets destroy vital habitat.

About 80% of aquatic food production comes from fishing wild species in oceans, seas, rivers and lakes, yet we are in danger of losing many of these populations before we know which additional species could be domesticated and used for fish farming. While fish farming will continue to increase, its long-term viability will depend on keeping reserves of wild populations.

Though Earth’s biological diversity once seemed inexhaustible, today, with our rapidly growing population, we know the planet’s biodiversity is a finite resource. If managed wisely, it is also renewable. While the 1992 U.N. Conference of Environment and Development in Rio de Janeiro focused world attention on preserving the environment and the world’s biodiversity, the international economic system has yet to establish a value for the preservation of biodiversity and the environment in general.

The urgency of resolving such outstanding issues can be easily understood. Just 7% of the Earth’s land surface, the tropics, is home to 75% of the world’s terrestrial biological diversity. If current trends continue, we could lose many valuable but unknown species before their worth can be evaluated.

If we are to preserve the biodiversity of plants and animals while producing enough food for the world, the cost of conservation must be incorporated in the cost of agricultural production. We must keep in mind that the price of preserving biodiversity is far less than the penalty for letting it erode. Once lost, this heritage cannot be recovered or restored.”

careful conservation of biodiversity. The heirloom seeds held carefully by farmers were the living links that kept their relationships with land unbroken. Farmers, centuries ago, saw the wisdom of preserving their heritage and began domesticating crops with the simple act of selecting seeds for re-sowing. Saving seeds became a part of the culture and tradition that made agriculture a way of life.

Home gardens maintained by women were a repository of their knowledge on the different uses of flora. Women had the knowledge and understanding of the different crops to be cultivated for the needs of the
family, and this knowledge kept their families food secure. Preservation of seeds was a very important function within the agriculture systems they followed. Women also had excellent knowledge about collection, storage and use of seeds. They selected the seeds according to predetermined characteristics and decided on the quantity and variety to be saved as well as the methods of preservation. Women decided what was to be sown and what was to be used as food.

Women’s knowledge has been the mainstay of crop production, animal husbandry, dairy and forestry. This helped them to maintain the characteristics of the local varieties. Women’s work and knowledge was thus central to biodiversity conservation and sustainable utilisation of resources in rain-fed agriculture.

The multi-cropping system practiced by farmers was also vital for food security and biodiversity conservation. Farmers combined species and structural diversity in time and space through both vertical and horizontal organization of crops. The higher biodiversity of plants, microbes and animals inherent in these systems supported production of crops and mediated a reasonable degree of biological recycling of nutrients. The bio-diverse crops exploited the full range of micro-environments which differed in soil, water, temperature, altitude, slope and fertility within a field. They engaged in effective recycling practices and relied on biological interdependence that provided vibrant predator–pest relationships.

Several combinations of crop mixtures are widely grown in India. Pulses and oil seeds are grown with maize, jowar and bajra. In the case of upland rice several mixtures are prevalent in eastern UP, Chotanagpur
division of Bihar and Chattisgarh region. The patterns that have been observed give evidence to the fact that there has been a wide range of mixtures that are observed, i.e., 30 rice based farming patterns, 12 maize based cropping patterns, 17 jowar based different patterns, 9 ground nut patterns and 16 cotton patterns.

During the kharif season especially in the unirrigated areas of the north, wheat and barley or gram or wheat, barley and gram are the mixtures observed. Brassica and safflower are grown mixed with gram or even with wheat. (College of Agricultural Banking, 2007)

When the crops began to flower, women observed them and harvested seeds based on size, grain formation, resistance to pest and diseases. They relied on local resources plus human and animal energy without dependence on modern technology. Traditional knowledge was the cornerstone of these communities and it provided locally manageable, sustainable and cost effective survival strategies for them, especially to the poor. The Green Revolution largely benefitted the farmers in the irrigated areas, the fertilizer and seed industry and urban consumers while leaving a negative effect on small farmers in the dry lands. Today industrialization of farming has undermined the role of the farmers in contributing to seed security. Subsistence farming still remains peoples’ main source of livelihood, but it cannot be seen in isolation. Forest, grasslands, farms, livestock and water are all organically linked with each other and in the past, everybody
respected these links. In the case of domesticated bio-diversity, in-situ conservation and sustainable use were more or less synonymous as far as crop and livestock use was concerned.

Overwhelming evidence is now available on the severe loss of diversity in the transition to modern agriculture where agricultural fields are immensely simplified with single crop productivity. The overall loss in genetic diversity cuts across both domesticated and wild flora and fauna. More than 90 percent of India’s rice diversity has been lost and the rest are under the threat of extinction. Intercropping and inter species diversity is severely reduced and genetic diversity even within a single crop is lost in modern agriculture.

In the last decade however, the revival of traditional agriculture has indirectly established a rescue process of species, varieties and breeds threatened by under-use or extinction. The future of reviving biodiversity conservation depends on involving the end users of diversity in conservation initiatives. The efforts in this direction must include involvement of local communities, and establishment of networks of farmers working in different parts of the country. It is a well-known fact that of the vast diversity in food crops, only rice, wheat and maize, is now used as staple crops. Taking this observation further brings us to the question of the varietal diversity within the above mentioned species that have been neglected due to the over emphasis on breeding new lines for increased productivity.
Role of indigenous varieties

Indigenous varieties/seeds that have potential for high yields and other characteristics like pest and drought resistance, in different soil and agro climatic conditions, have been under utilized and neglected. How do we define under utilized crops? As argued by the well-known geneticist Melaku Worde, a wide variety of plant and animal species provide material for nutrition, food, feed, fibre and medicinal uses. Such diversity is also crucial to sustain current production systems, improve human diets and support biological systems, essential for sustainability/livelihood of local communities. Unfortunately, these have been sent into internal exile.

The fact that diversity has special significance for the maintenance and enhancement of quality and productivity in agricultural crops has been well acknowledged. Historically, farmers have managed many varieties 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. Open pollinated varieties, which represent an important gene pool for resource-poor farmers living in marginalized and stress-prone areas, are rapidly vanishing. They are replaced by very few hybrid varieties which require inputs not affordable by poor farmers and which entail dependence on large seed companies and increased quantities of water. Therefore maintenance of species and varietal diversity in farmer’s fields is crucial to sustainable agriculture, especially for resource poor farmers, practicing agriculture under on-farm input management in marginal lands.

Diversity within species has narrowed over the last few decades. Taking the example of rice, the vast diversity comes from the different geographical regions and have special characteristics that have evolved in tune with the environment. Unfortunately these have been neglected with the advent of the Green
Revolution, where the focus has only been to increase productivity through a narrow genetic base backed by synthetic inputs and increased quantities of water.

Limitations and threats associated with crops have stimulated many farmers, especially in the horticulture sector, to produce their own seeds. In order to do this, they have often had to rescue local varieties and develop their own system of selection and distribution. In many cases, the systems include the exchange of seeds between farmers as a fundamental instrument (e.g. bio village seed banks). Farming systems which do not depend on chemical inputs encourage the preservation and expansion of older, locally bred and indigenous varieties and breeds. Farmers who save their own seeds can gradually increase crop resistance to pests and diseases by breeding for “horizontal resistance”. Horizontal resistance is the ability of a crop to resist many or all strains of a particular pest (which differs from breeding for “vertical resistance” to have a gene to resist one specific strain of a disease). By exposing a population of plants to a certain disease or pest (or to several pests at one time), then selecting a group of the most resistant plants and interbreeding them for several generations, a given population becomes more resistant than the original population. Horizontally resistant cultivars are well adapted to the environment in which they were bred, but may be less suitable for other growing conditions.

Notwithstanding the demonstrated benefits of seed-saving, there are several pressures on farmers who save seeds to switch to buying seeds. These pressures are mainly exerted by large seed corporations. The following section elaborates on this situation.
Technological developments have led to the transformation of agricultural systems in the developing and developed countries. The organized seed production sector has brought in market-oriented technologies for plant breeding. Seed production, processing and packaging have been developed exclusively to suit high external input agricultural systems.

It is predicted that India can become a hub of commercial seed production for the South East Asian region and will also be able to supply African countries. The seed sector is seen as a major driver of agricultural sector in the country and is expected to push faster rates of seed replacement with higher use of proprietary hybrids.

One important factor attracting international seed companies to India is the country’s varied agro climatic conditions and abundant skilled and unskilled labor, as seed production, particularly hybrid seed production, is highly labor intensive. Private seed production is largely centered around Bangalore for vegetable crops and Hyderabad for field crops, particularly cottonseeds.

The emergence of these two seed production centers is due to ideal climatic conditions, better infrastructure, the technology and research leadership and the expertise of the two regions’ seed farmers in manipulating crops for perfectly synchronized flowering. The initial focus of many of these companies has been cottonseed, for which genetically modified (Bt) hybrids have already been approved by the Indian
government for commercial cultivation, with other bio-engineered crops in the pipeline. Most of these companies have licensing agreement with Monsanto Corporation for the Bt gene; some are trying to develop their own Bt technology, legally or otherwise.

Large seed companies including national and multinationals are outsourcing the production of commercial seeds they sell. Contract seed production with farmers as producers is the network prevalent in north Karnataka. Seed companies enter into agreements with farmers either directly or indirectly through local production agents. Agreements are binding on procurement prices, terms of payment and quality standards. Farmers are paid for the produced seeds after testing for germination and purity. Some companies pay farmers in advance to help them meet the cost of production. Final payment is conditional subject to meeting quality standards mentioned in the agreement. The seed company takes no responsibility for crop failures due to extraneous factors such as drought, flood, wind, destruction by wild animals, endemic pests and diseases, etc. Crop protection is the sole responsibility of the farmer/producer. Farmer’s fields are supervised by the company’s staff throughout the production cycle. Technical staff guides them on planting, isolation, fertilization, parental line maintenance, pollination/hybridization, pest and disease control, harvesting, maintenance of purity, drying, processing and cleansing, etc.

Chemical fertilizers and pesticides are used widely to produce the seeds of prescribed quality under the guidance of the company’s staff. Training for hybridization is conducted to enable the farmer to produce the seeds. The management of seed production is the sole responsibility of the farmer himself. Pollination/hybridization is the most important step in seed production. Two pure line varieties selected by the breeder are maintained separately during production in species having bisexual flowers like chilli, tomato, etc.

Emasculcation of flowers is done to remove male parts in the bisexual flowers of the female parent a day before stigma receptivity. It is done on daily basis during flowering for hybridization. Simultaneously pollen is extracted from the male line by collecting the anther from unopened, mature bud and drying them under warm temperature or
electric bulb. Hybridization is carried out every day morning by supplying pollen to the stigma of female line. The seeds set in these female flowers are F1 hybrid seed for commercial cultivation. Similarly, in cross pollinated crops such as gourds and cucumbers, female flowers of the female parent are covered with butter paper covers to avoid cross pollination and pollinated with pollen of the male parent to hybridize.

The seed thus produced is procured, treated with chemicals, packed and sold under the company’s brand name in the market for commercial production by the farmers. Companies have a network of distributors, dealers and retailers to sell the seeds to the farmers. The hybrid seeds or improved varieties are used by the farmers for their commercial production with modern technologies of chemical agriculture.

Why do farmers grow more GM crops? The real reasons for GM crops becoming popular with farmers is tied directly to the farm income depression. Companies that promote GMO are capitalizing on the farm income crisis.

Public institutions such as universities and state seed corporations produce the seeds of notified varieties. They produce the seeds of crops such as sunflower, ground nut, bengal gram, cotton, maize, sorghum, safflower, etc in which seeds are required in bulk quantity unlike high value crops such as vegetables. The varieties released by public institutions are the ones whose seeds are produced by them.

The institutions breed high yielding varieties and hybrids in many crops. Breeders evolve hybrids and then they are released for cultivation after multi-location trials. University’s research stations extensively work on developing new varieties and hybrids for releasing for commercial cultivation. Institutions have large farms maintained by them for this purpose. They also outsource seed production through contract farming.

Seeds are multiplied under the supervision of institution’s staff which includes breeders, farm managers, seed technologists,
pathologists, etc. It involves huge investment on infrastructure like land, drying yard, storages, processing machinery, seed laboratories, packing machinery, etc.

Seeds multiplied in the farm are inspected in different stages for maintaining purity and other qualities. After harvesting, seeds are dried and divided into lots with prescribed quantity for different crops. Samples of seeds are drawn in each lot for testing in the labs. They are checked for physical purity, genetic purity, germination, pests and disease infection before clearing for the market for commercial cultivation. Seed inspectors are responsible for quality assurance during field production stages. The seeds, thus produced, are bagged in bulk quantity into the market. They are sold to the farmers through departmental networks under the subsidy schemes.

Under these circumstances indigenous interspecies and intra species diversity is being sent into internal exile. Over the years seed production has moved away from the hands of the farmers into the public sector and now to the private sector. As farmer’s dependency on seeds and all related inputs from external sources increased, the sustainability of farming has become a big question for the small and marginal farmers. With commercial seeds and commercial cultivation taking the center stage the future of farmers and the indigenous seeds are facing an uncertain future. The impact of course has had its toll on the culture of food and the perpetuation of fast foods and imported foods.

The diversity of food from the regions where crop diversity is more or less intact is a feast for the eyes and the taste buds. In the fast growing globalization of food and culture a movement to conserve the planet diversity and stall the crisis has to be done today. We cannot wait for tomorrow.

Removing the bottlenecks – GREEN Foundation’s efforts

Some of the main bottlenecks for successful promotion and conservation of varietal diversity within species has been the loss of indigenous knowledge related to seed/grain, poor co-ordination between occurrence of rainfall and seed
sowing, poor local processing facilities available even to be consumed as grains and lack of value addition, and poor market access. And yet, in view of the fact that millions of small farmers depend on subsistence agriculture and its often spells the difference for them between survival and/or the lack of it, is vitally important to keep these traditional systems alive, not only in India, but across the world.

The hands on experience of Green Foundation working with small and marginal farmers whose livelihood emanates from the use of diverse crops, flora and fauna for their sustenance yielded some valuable lessons in the quest for wholeness. The Foundation’s experience in conservation of diversity has gone beyond the debate of “Can indigenous varieties /organic farming feed the growing population, by broadening the concept of food security for the small and marginalized who are the custodians of diversity?”

It has provided answers by promoting varieties which suit fragile ecosystems like the dry lands, coastal areas and deep waters. These are being conserved by farmer’s networks being facilitated by GREEN Foundation. The following section will tell the story of GREEN Foundation’s efforts and the successes it has achieved, which can serve as a model for farmers ‘Living on the Edge’...
A tiny spark is often enough to ignite a fire; a few persons are often enough to bring change. The team at GREEN Foundation was but a small, very small group of people, who often felt powerless against the tide of negative changes that were sweeping across the agriculture sector. But over time, the organization has achieved change among a section of farmers who would otherwise have been forced to give up farming and migrate to cities, or continue to labor under the joint burdens of debt and hopelessness. In the process the Foundation has proved that sustainable agriculture, on-farm conservation, seed saving and traditional methods of farming are as relevant today as they were eons ago and that they can be the route to prosperity among small and marginal farmers.

The situation among farmers when GREEN Foundation set out to do something was crying for change. While the country was priding itself on the self-sufficiency it had achieved for itself through increased food production and the Green Revolution, evidence of that was missing on the ground. There were increasing numbers of the population, particularly farmers, who were displaying high levels of malnutrition. These were farmers who had been traditionally food-secure by growing their own food. It was this dilemma that prompted the team at GREEN Foundation to dig deeper into the reasons and thereafter face the somewhat painful discovery that the face of agriculture had completely changed. In place of the progress and prosperity it was supposed to bring, it had done the opposite for the farmers of India.

GREEN Foundation, established in 1992, began by working with just five women farmers of Dinnur village in Thalli Block of Dharmapuri district in Tamil Nadu. The village has around 15-20 households with a
population of around 120 people and is completely comprised of small and marginal farmers. When the journey began, GREEN Foundation had a vision of enabling small and marginal farmers to attain food security and lead a life of dignity by adopting traditional methods of agriculture. These methods were not new to them; it is just that they had moved away and lost their own traditional heritage. The attempt was to take them back to their roots.

GREEN Foundation was working from the conviction that farmers needed to be persuaded to go back to traditional farming, as even though they were growing food on their farms, they were not eating what they were producing and there was a lacuna in their cropping patterns. Farmers were growing food, but they were growing it for the market, rather than for consumption. The irony was that despite growing food grains for the purpose of marketing, they were at a loss, as they did not get the prices they expected and in fact needed, to sustain themselves. In the process of converting to mono-cropping and cash crops, they had also compromised their own food security. From a situation where their own farms had traditionally given them the food they required, they now had to purchase food with money they could ill afford, and very often did not have.

The other fallout of the conversion from traditional methods of agriculture was the disappearance of traditional seeds which could be stored at the end of each harvest and used for the next cropping season. Having to buy seeds and inputs every year further put a burden on the farmers, leading them into debt. The new cropping patterns had also resulted in a situation where the rich biodiversity that had contributed towards food, fuel and fodder in the past had dwindled alarmingly.

Thus, GREEN Foundation’s work with small and marginal farmers sought to impress on them that growing a single crop on a landholding of less than one hectare of land does not fulfill the basic requirements of a family. It neither fulfills their food requirements, nor does it give them enough income to purchase what they need. Considering 70 per cent of India’s farmers are small and marginal farmers, sustainable agriculture

“Perhaps the biggest single environmental catastrophe in human history is unfolding in the garden. The loss of genetic diversity in agriculture – silent, rapid, inexorable is leading us to a rendezvous with extinction to the doorstep of hunger on a scale we refuse to imagine.” (Fowler and Mooney, 1990)
is the only viable alternative for them, as it enables the availability of food for self-consumption as well as fodder for their cattle. Additionally, food security emanated for these farmers from seed security. Traditionally farmers had used local varieties of seeds to grow food, as these were known to respond well to local conditions, were drought and pest resistant and needed very little inputs.

GREEN Foundation began with modest assets i.e. the support of the five women farmers, a small patch of land, a handful of seeds and a strong determination to make a difference to the lives of small farmers. While seed was central to the work of the Foundation, the focus, from inception was on women, which emerged from the knowledge that women have a major role to play in the conservation of biodiversity at the farm level. It is women who take decisions regarding the amount of seed to be stored, the variety and ways to store them, selection of what crops to grow, as well as the important function of selecting healthy seeds for sowing.

It was not easy. Very early on, the team realized that traditional varieties of seeds had almost disappeared. Without seeds, the entire effort would be futile. Here began the quest for seeds – in remote villages, and
among the few traditional farmers who were still using them or were preserving them. Each time some variety of seeds was found, it was brought back to Thalli and multiplied by the participating farmers. On-farm conservation was slowly beginning to yield results, when, in a few years the team, along with the women farmers, was experimenting with almost 100 varieties of seeds, which included minor millets, oil seeds, dryland paddy etc. on small plots that were created for the purpose. The plots served as labs of sorts – the seeds, which were grown on dry land, were observed on various parameters – growth, the number of tillers they yielded etc. 50 gm of seed was observed to yield 1 kg of grain.

Slowly, steadily, GREEN Foundation began promoting awareness among the farmers in the Thalli area on the benefits of sustainable agriculture, including the importance of soil, water and other natural resources. But it was vital to involve greater numbers of farmers in the work.

GREEN Foundation met and interacted with women from the SHGs in the same areas and their meetings were used to spread awareness on the concept of sustainable agriculture and gradually more women farmers became interested in participating. The first community seed bank was established with the cooperation of the women farmers in 1994. The seed bank helped to create a space where seeds could be stored, exchanged and borrowed by interested farmers. The men put up resistance to the seed bank activities but were convinced about its usefulness after a drought which occurred in 1995, where the farmers noticed that despite the failure of rains, the local varieties survived, while the high yielding varieties failed. This demonstrated that local varieties were drought resistant. However, for real impact, it was important that the seed bank concept was expanded to larger geographies in partnership with the communities, and other NGOs who were working in those areas. These partnerships were strategically planned in order to leverage on the assets of goodwill and support the NGOs and communities enjoyed mutually.

Along with other NGOs in Karnataka, GREEN Foundation initiated the Community Seed Bank Network (CSBN) Project in 2001. The activity was carried out in two phases with the objective to address the need for seed conservation and
food security among small farmers through the process of conserving agro- biodiversity. To reach out to the maximum number of villages, and to achieve impact among a large number of farmers, GREEN Foundation identified organizations in different agro-climatic regions across Karnataka. The selection of each organization for the network was based on its agro-climatic location, nature of its ongoing work and its adaptability to the objectives of the project.

**The objectives of the network were to:**

- Conserve inter and intra species diversity suited to the ecological niche
- Integrate on-farm seed conservation through participation from the farming community with soil and water management
- Develop human institutions with skills by providing technical support to farmer-based conservation, and to enhance the use of local plant genetic diversity
- Initiate activities in seed conservation that are gender sensitive
- Establish sustainability by strengthening self-reliance of local farmers to improve their livelihoods and to improve seed security through community seed banks.

> "The community seed bank is not just a store where seed is kept for distribution or marketing, or a sophisticated storage facility which has temperature and humidity control; it is a system in the process of community agriculture which includes village level facilities, a garden or field where traditional varieties are safeguarded.

Through this system, farmers have played a key role in the creation, maintenance and promotion of crop genetic diversity. With the help of traditional skills which they have developed over centuries, they have been selecting crop varieties to meet their specific needs such as quality, resistance to pests, pathogens, adaptation to soils, water and climate etc., Under this system local farmers have established their own seed networks to facilitate seed supply to their families and local markets.

Community seed bank therefore is a system composed of all of the above. It is among the major strategies for maintaining genetic diversity in crop/plant species."

Dr. Regessa Feyissa Scientist. Ethiopia.
Over the duration of the project, the CSBN succeeded in reviving:

- 43 varieties of finger millets (Eleusine coracana)
- 18 varieties of dryland paddy (Oryza sativa)
- 66 varieties of wetland paddy
- 24 varieties of Sorghum (Sorghum bicolor)
- 4 varieties of wheat (Triticum aestivum)
- 7 varieties of chili (Capsicum frutescens)
- 18 varieties of amaranth (Amaranthus frumentaceous)
- 9 varieties of pumpkin (Cucurbit pepo)

The seed bank concept also received recognition in December 2003 from a team of external evaluators who concluded that the seed
bank initiatives had resulted in the increase of seed diversity in the project region. It also recognized the potential of networking with NGOs in different agro-climatic zones across Karnataka. The report Green Foundation seed quest 2004 says, “The idea of networking with different NGOs in different agro-climatic zones all over Karnataka is a very bold idea because it automatically means a fair amount of knowledge and technology transfer from GF to NGOs and capacity building of the NGOs on these issues. The experience of GF being the product of long years of hard work, such knowledge being openly shared and disseminated is wonderful.”

The work of women in strengthening the CSBN is noteworthy. After several rounds of interactions with farmers it was decided that farmers have to benefit economically from the management of the seed banks. Each seed bank is now managed by a group of enterprising women who take the responsibility to grow out the seeds, test for germination and keep a roster of seeds available in the seed bank.

The work of women in strengthening the CSBN is noteworthy. The following section carries a clutch of stories emerging from the field. They portray some of the most active and progressive women farmers who contributed to the work of the network from its operational areas.
This section pays tribute to some of the countless, strong women across India, who have either stayed rooted to tradition or recognized the value of tradition and revived it in the field. They are the seed mothers; the barefoot scientists who toil in the field, experimenting, conserving and reviving the age-old forms of traditional agriculture that they know will provide them and their families with safe, healthy, nutritious food. What’s more, these women have, by conserving and lending traditional seeds, have ensured that the base of traditional farming is strengthened.

Rajamma, Kulumedoddi, Kanakapura taluk, south Bangalore.

“One year we could not find any di-ammonium phosphate or DAP in the local market. We went in search of it everywhere, but we found nothing. It was a very poor harvest that year, even though there were good rains. We had become dependent on outside sources for our needs,” explains Rajamma, a trusted community member in Kulumedoddi, in Kanakapura taluk, south of Bangalore.

A heavy dependency on external sources for inputs of farming had left her and her family vulnerable to fluctuating markets, weakening their livelihood security. Chemical fertilizers are not the only farming inputs that Rajma acquired from external sources. Of particular concern was access to good quality seeds within her community. As she says, “Everything in agriculture begins and ends with the seed.”

For years, farmers in Rajamma’s community would buy hybrid varieties of vegetables. “We used to wait in long queues to buy ‘packet’ seeds every year during sowing season,” she recalls. “The problem with
‘packet’ (hybrid) seeds is that they cannot be saved from year to year.” Community members in Kulumedoddi report that changing cultivation practices over the years resulted in a loss of indigenous varieties in the area. As farmers converted to hybrid seeds, seed conservation practices slowly began to dwindle. This affected the food security of community members, most of whom are farmers cultivating crops for family consumption. “In the olden days, there used to be many different seed varieties. If a six-month crop failed, we had a fast-maturing, two-month crop that we could grow for our families,” explains Shivrudraiah, a noted community leader in the area.

Rajamma explains why indigenous seed varieties and good seed management are so important to her, “With indigenous varieties, excess seeds can be used for home consumption. This is not possible with ‘packet’ seeds brought from outside.”

The Community Seed Bank established in Kulumedoddi provided farmers like Rajamma access to good quality seeds within their own community. The seed banks gave access to seeds on the condition that they return twice the amount they borrowed. “I’ve been using the seed bank for seed exchange since it began,” says Rajamma. She points out that she no longer has to wait in long queues for seeds that may not be available; it also means she saves money because she does not have to buy seeds and very importantly, it means increased food security. “Indigenous varieties don’t need much water and are resilient to climate change,” she says. These varieties also strengthen the nutrition security of her family. “They have many nutritional benefits which are missing in crops grown from hybrid seeds.” Good seed management and conservation also addresses economic concerns for Rajamma. “Only when we have good seeds can we have good harvests and savings,” she says. Indigenous seed varieties also respond well to low-cost organic inputs, which cut down costs of cultivation.

Hombalamma, Kanakapura taluk, south Bangalore

Hombalamma is an active organic farmer who has been part of the movement to save seeds. The only earning member in her large family,
the six acres of land she owned were the only assets she possessed and she remembers how she had to struggle to make ends meet by cultivating the land. She recalls the time she had cultivated her fields with chemical inputs and seeds, "I used to wonder why my yields were reducing every year and why the soil on my fields was becoming hard and unproductive."

With some amount of skepticism, she decided to adopt the practices recommended by GREEN Foundation more than a decade ago. Several years down, she beams with pride as she looks far into the distance and sees that her fields are bursting with bountiful fields of grains, pulses, vegetables and castor seeds.

Hombalamma has been able to buy six additional acres of land out of the surplus income she has earned by adopting traditional practices, using traditional seeds and believing enough in the system to stay with it. As she says, "It took two years before the soil responded to the different system of agriculture I had adopted. The fertility which had completely disappeared had to be built into it all over again. But I persevered and I am happy I did. I have built up enough assets for my entire family to be comfortable."

Hombalamma is now much in demand as a resource person and visits different parts of the state to give farmers know-how on traditional seeds.

Manjulamma from Kulumedoddi in Kanakapura taluk

Manjulamma of Kulumedoddi knows the challenges of being a farmer. Lack of electricity cut off water supply to her fields for a month once, and most of her crops failed. "Everything was gone except for the indigenous varieties we had planted at GREEN Foundation’s suggestion. Those crops survived. That’s when we realized how important they were for us."

Capacity building initiatives by GREEN Foundation have succeeded in raising awareness of women farmers to understand the importance of indigenous seeds and biodiversity conservation. Traditionally responsible for managing the seed
requirements of their families, they are considered the custodians of biodiversity. In Kulumedoddi, the influence of women farmers has played a very important role in the promotion of indigenous seed varieties. The Devaralamma Community Seed Bank in Kulumedoddi is run almost entirely by women in the village. Manjulamma says that indigenous varieties have many advantages, “With indigenous seeds you can use organic inputs to get good yields. With hybrid seeds, good yields are possible only with the use of expensive chemicals.”

Gangamma leads in seed conservation.

Chinnikatte is small village situated in the semi-arid region of the Haveri district of Karnataka. Gangamma is middle-aged woman residing in the village and led the process of tracing the varieties. They collected local varieties of food crops. Gradually, members’ of the seed bank who doubted reviving local varieties were convinced and farmers participated in GF’s approach to the formation of CSB to re-introduce the local varieties. In fact they needed these varieties for the cultural, social, nutritional, and economic values attached to them. They utilize the CSB in Chinnikatte, which has become a safe haven for numerous varieties including; minor millet, bajra, sorghum, field bean, red gram, and castor seeds.

GF supported the CSB with a small grant for the purchase of seed storage devices and other seed treatment materials. Later, bilimaggin save (minor millet), karimaggian save (minor millet), two varieties of ragi (finger millet), redgram (pulse), chali (winter) redgram, male (rain) red gram were added to the stock of seeds at the bank.

And to address the nutritional needs of the village communities, GF facilitated the establishment of backyard bio-intensive Kitchen Gardens (In biointensive kitchen gardens fruits, vegetables, medicinal and flowering plants are grown. It also has a vermicompost pit, urea pit, Basket compost, live hedge fencing). Gangamma played a key role in promoting this among the women.
The communities felt concerned about the survival of the kitchen gardens during the summer season. Ms. Gangamma became handy in creating awareness among the village folks on how to use domestic wastewater, a success story that saw members initiate the kitchen gardens. The men of Chinnikate were also an integral part of the seed banks. They assumed several responsibilities including the distribution of seeds, formation of kitchen gardens, constructing vermicompost pits and seed collection.

After the formation of CSB in Chinnikatte, borrowing of seeds from moneylenders has been scaled down. With the result, farmers’ dependency on moneylenders for seeds is gradually reducing. The farmers are realizing self-sufficiency in fodder production as a result of growing local varieties. It has been proved that even during the last drought season, farmers were able to get considerable amount of grain and fodder.

The farmers are getting convinced of the values of growing the local varieties of crops and are reducing the growing of hybrid varieties. Consequently they have reduced use of chemical fertilizers and pesticides. They are using more vermicomposting now instead of chemical fertilizers and pesticides. The seed bank has brought several varieties, which were abandoned years ago due to modern agriculture. The government authorities consult members of CSB in implementing programs in the villages. Gangamma, a leader and role model in the seed conservation project, organizes meetings and has been chosen as a member of local Panchayat for her leadership qualities and selfless services to the communities.

Seed mother Puteeramma, Dharampuri district, Tamil Nadu At a time when indigenous seed diversity is fast diminishing, Puteeramma, a 70- year-old woman who resides in Chanmatta village, Dharampuri district of rural Tamil Nadu has set an example for in-situ conservation of seeds. Puteeramma is among farmers who can rightly be referred to as an institution in conserving seed diversity.
While the entire village has been enticed to grow high response crop varieties, Puteeramma can be seen growing three indigenous varieties of finger millet (ragi), of paddy (Kari Munduga and bilimunduga) and four varieties of sorghum, as major crops. In addition, castor, little millet (same), kodo millet (navane), huchellu (niger), thogari (green gram), field beans, horsegram, yellu (sesamum), cow pea, local safflower (a thorny variety unique to this region) and sajje (bajra) are cultivated on her 10 acre dry land farm, with the assistance of her husband Sri Gowda. The elderly woman is advancing the legacy of her mother-in-law who was known previously for indigenous seed conservation. “I continued to conserve indigenous seeds for purposes of food consumption and multiplication due to respect for my mother-in-law. She is no more. If I fail to continue this practice her soul will not rest in peace,” she is reported as saying. She does not believe in selling seeds. She says, “The seed is our mother which should be revered and not be sold as a commodity.” She donated 10kg of traditional munduga ragi (finger millet) seeds free of cost. Puteeramma uses traditional mud storage devices for storing grains and seeds. These devices include, gudana (a big mud pot), maddike (earthen pot), balage (a container made of bamboo), mooide (container made of ropes of paddy straw, kodo millet straw and some fibrous weeds) and vaade (pot with a cylindrical shape body and with a narrow lid).

Culture and rituals embedded in biodiversity. There are plenty of evidences to show that women have played a critical role in safeguarding the culture related activities in agriculture.

Culture and Rituals embedded in biodiversity

“Culture is enclosed in Nature and Nature is reworked in Culture” The close links between culture and biodiversity can be aptly described as the panorama of rural livelihoods being drawn on the canvas of culture with the hues of biodiversity.
Studies on the rural livelihood systems have indicated that the kinship and folk religion of rural India, the role and significance of culturally embedded practices of food production, the articulation of rituals in changing forms, the shifting significance of cultural prescriptions are portrayed in symbolic forms. The cultural ethos of rural India goes back thousands of years. Life in rural India as in any other part of the world is embedded in the symbolic worship of nature and rituals very specific to the region. The heterogeneity of the communities in the Indian subcontinent adds to the color and life.

Agriculture as a livelihood encompasses a multiplicity of tasks combined with the judicious use of resources in the form of water, soil and biodiversity. Various natural elements, processes, flora and fauna are closely observed, understood and integrated into the cultural agenda. As we understand from the past there is not a moment of monotony in the lives of the agrarian communities which are filled with the rituals either to celebrate or probe the intricacies of nature. The indeterminate nature of the symbols used in these rituals leaves room for creative interpretation. If one understands the symbols it becomes explicit that people have not probed into the material nature of the world but into its inner meaning. Hogger in his research on symbols and understanding livelihood systems as complex whole, states, “meaning and the purport of existence cannot be researched in the outer but only in the inner reality. While meaning and purport are as important foundations of livelihood systems as natural resources and food, they do not lend themselves to the same type of description, they can be visualized, felt and communicated only in symbolic terms.”. It is obvious that culture is the binding factor and what emerges is the celebration of life, the diversity of life forms and the symbolic need to explore and expand the psychic dimension.

Agriculture in rural India is based on the close association of culture and biodiversity. Unlike modern agriculture, it is not just a source of livelihood, but part of the depth and breadth of the lives of the peasants. Despite the fast eroding bond with the ways of farming farmers do maintain their links with the seasons and the
The rituals start with the new plough known as “honneru” that signifies the worship of the earth, up to celebrating the arrival of the rains called “malerayana habba” and worshipping the sun and the moon during the harvest festival called makara sankaranthi. When the constellations change their path. All these rituals have their roots in the worship of the five elements of which life is comprised.

The disappearing Agricultural rituals

The Negilu pooje is perhaps one of the oldest and most symbolic of agricultural rituals which was performed by the farming community on new year’s day according to the Hindu Calendar.

Two new wooden ploughs are placed in the north eastern corner of the land 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 are sown. The seeds represent the diverse crops like finger millet, niger, field beans, horse gram, red gram, mustard, paddy and castor. The seeds are left to germinate for a period of nine days. This is a symbolic way of testing the seeds for germination. After the nine days the worshipped bowl is transferred to a near by water source for immersion, thereby bringing together the natural resources like water, soil and the diversity.

Farmers integrate philanthropy and a sense of self provisioning in their farming system. Illustrative of this is the Koorige or the seed drill which has three compartments through which the seeds are dispersed. The philosophy behind this is articulated by one of the women when she says “ondu manisharige.ondu akeekalu thinnage, mathondu dharmake” which means one portion of what they grow is
for themselves, while the other two provide food for the birds and charity.

Next in the line of festivals is ‘karibanta’ performed during the month of September and early October to protect the crops from pests. The ubbe and uttare rains bring the ear heads to maturity. During this period crops are most vulnerable to pest attack. The branch of the tree locally known as Pachadi (Dalbargia peniculata) is fixed in the field and acts as protection against pests while it turns black overnight. This ritual is performed by the whole community. Farmers look forward to the harvest with joy and trepidation. A post harvest festival, the rashi pooja also referred to as ‘kalada devaru’ is performed between the months of January to March as tanks giving for a successful harvest. The threshing yard is cleaned and swabbed with cow dung, perhaps to ensure purity of the harvested grains. The heap of grains is decorated with agricultural implements, weeds and flowers. Subsequently the grain is taken home after distributing a share of it to the farmers who helped in cultivating it. Rain plays a very significant role in the lives of the farmers who cultivate in the rain fed areas. They depend on the local wisdom to predict the onset of the rains. Rainfall is linked to the stars. Farmers narrate the impact of rainfall on their survival as “Bharani male biddara dharaniyakka davana which means bharani rains will bring prosperity by way of plenty of food” The everyday life of farmers which is dependant on nature’s vagaries is full of such events and rituals. No explanations can be offered to validate this rational thought except that it stands the test of local wisdom.

These are just a few from among the hundreds, possibly thousands or millions of women farmers across the country and the world, who do their little bit to counter the ill-effects that chemical farming is wreaking. They are probably in the minority, but are the vital entities that will ultimately ensure that our links with tradition are preserved; and that our world still has access to priceless resources which otherwise would have been lost forever. Therefore it is imperative that their interests are protected. The following section outlines the way forward for farmers such as these.
Way forward and conclusions

The previous sections of this book have amply demonstrated the value of biodiversity, indigenous knowledge and traditional farming. It is also widely accepted that indigenous knowledge is a powerful resource and complementary to the knowledge available from Western scientific sources. Therefore in studying such systems and taking it forward it is not possible to separate agricultural biodiversity from the culture that nurtures it. The key to understanding how traditional farmers maintain, preserve, manage biodiversity is to recognize the complexity of their production systems. (Miguel A. Alteiri 2000,)

While outlining the way forward for a safer, more sustainable agriculture system that will ensure food security for the multitudes of farmers who farm on small landholdings, it is important to be aware of some vital facts. Simplistic views exist, which point to narrow and specific causes that affect productivity. Some of the causes attributed to reduced productivity are nutrient deficiencies and pest infestations. There is also a perception that these can be overcome merely through new technologies. This narrow approach diverts us from understanding the systemic problems inherent in agro ecosystems. An appreciation of the context and complexity of agriculture can help us to go to the roots of the problem.

According to Miguel Alteiri (Alteiri et al 1998) the science of agro-ecology (which is defined as the application of ecological concepts and principles to the design and management of agro ecosystems, provides a framework to assess the complexity of the agro ecosystems. According to him “agriculture is not only possible, it is already taking a multitude of expressions of alternative agriculture from various variations of organic agriculture to more peasant based subsistence oriented traditional agriculture” (Alteiri et al, 2000).
It is also known that the principles of agro-ecology are relevant in the practice of permaculture that integrates system design, agro-biodiversity and ecosystem services. Permaculture design emphasizes patterns of landscape, function and species assemblies. The focus of permaculture is not on separate elements but rather on the relationships created among the elements like soil, water and biomass all placed together when the whole becomes greater than the sum of its parts. Permaculture draws from several disciplines including organic farming, agroforestry, integrated farming and agro-ecology. Permaculture design seeks to minimize waste, human labor, energy and external inputs (Holmgren, 1977).

Biodiversity and healthy soil are central to ecological approaches to making farming more drought resistant and resilient to extreme changes in weather conditions. Some proven practices by farmers are increasing cover crops and crop residues that protect soils from wind and water erosion. The cultivation of legume inter crops, manure and composts build soil rich in organic matter. It is also known that soil rich in organic matter needs less water. “Organic matter improves the activity of organisms, earthworms and makes the soil less compacted” (Tirado and Cotter, 2010).

In a country like India, small farmers still form the majority and are categorized as subsistence farmers. They continue to practice mixed agriculture integrating crops and livestock with most of the production contributing to maintain the households need for food, with very little surplus for ensuring cash income. It is well known that subsistence farms usually consist of small land holdings between 2.5 to 5 acres with cultivation of a diverse mix of traditional land races with relatively low yield potential when cultivated as individual crops. “Livestock is often a key component of subsistence farming systems, providing the much needed milk, meat, fuel, fertilizer, draft power and transportation. Several factors such as climate, soil types, local economics, markets, and availability of labor, knowledge base and traditions influence the cropping systems and decisions on which crop varieties are cultivated” (Haque, 1995).
Traditional ways of cultivation have evolved over a time period. They have as their foundations, a deep understanding and knowledge of the local ecology, which integrate the need for food and other basic needs like fodder and fuel. The hallmark of traditional agriculture is precisely its dynamism. “Farmer’s selection of crops yields a constant stream of new varieties adapted to changing environmental conditions.” (Wilkes, 1995)

It is also true that agro-biodiversity is concentrated in regions of the world where small farms still predominate. The farmers who cultivate small farms display their knowledge and understanding of growth and cultivation of crops. It is common knowledge that modern, intensive agro ecosystems that rely on monocultures and genetic homogeneity make the crops more susceptible to diseases and pests and to climate variations.

In an exploratory study in all traditional farming areas it was observed that small farms are much more productive than large farms if total output is considered rather than yield from a single crop like Bt. cotton and HYVs of rice. In overall output diversified farms produce much more food than large monocultures. It has been lucidly discussed by Donald Q. Innis (Innis, 1997) in his essay on intercropping and the scientific basis of traditional agriculture that under this system, numerous farmers who care about their future can feed their families, keep their families employed, keep soil on the land, utilize more of the sun and water than mono-cropping and solve many cultural and agricultural problems in a methodical way.
Traditional farmers in India have long practiced continuous cropping without noticeable detrimental effect to the soil, probably because crop mixtures are used (Wilson and Wyss, 1977). The system of mixed crops, so common in India, is undoubtedly a successful and profitable method which has probably done more to uphold the fertility of Indian soils than any other practice.

Donald Q. Innis also shows that comparisons are made using land equivalent ratio which expresses intercropped yields as a ratio of mono-cropped yields. He argues that in an inter cropped field total yield gives a land equivalent ratio of 1:42. Whereas the ratio of intercropped yields to mono-cropped yields is 1:42:1. This means that all other factors being equal the crops when grown together produced 42 percent more yield than the same crop when grown as a mono- crop (Innis, 1997).

The range of issues that this volume attempts to address starts with the traditional knowledge systems inherent in India’s agriculture history and goes on to the challenges faced while conserving the agricultural biodiversity that is the basis of People’s food security and sustainable agriculture and the attempts to overcome the same.

The numerous initiatives in India and across the globe to conserve agricultural biodiversity are merely specks in the face of the mammoth onslaught posed by giant efforts to industrialize agriculture in it’s entirely. At the base of this struggle, are some basic questions that need to be answered. How do people take control of their lives? It is a divide between political struggle and economic empowerment. Most of the times technical solutions are backed by science and technology, and offered as solutions to strengthen what is basically an economic and political effort for dominance.

Agriculture is still a small-farm story since half a billion farms of less than two hectares produce a significant proportion of the world’s food says a report from IFPRI and 50 percent of that from India. The livelihoods of 2.2 billion people are still linked to small-scale agriculture across the world. (Singh 2012)
The critical factors that emerge in today’s globalized world are how we channel the agriculture sector to autonomy. Is it through fair-trading or remaining at the edges of formal and political institutions?

Important issues that shake the foundations of agriculture have been examined i.e., the process of globalization with multi trade and free trade agreements that dominate. The importance of conserving agricultural diversity and the threats that weaken the process and finally the economic stakes of the small farms have also been examined, as also the role of women in keeping traditional agriculture alive.

These issues have to be examined in the context of today’s fast changing economy. Farmers are not only facing the effect of globalization and multilateral trade from the global to the local. “They are also experiencing turbulence and change in many aspects of rural society including demographic transition, urbanization, re-structured food habits, land mafias, labor shortage because of migration and evolving patterns of off-farm work that restructures the ways rural people make their living” (Vorley et al, 2012).

Over the last few decades concerns have arisen about feminization of small-scale farming and gender dimensions of agriculture and employment. There are opportunities and challenges that the development of value chains presents for women’s income and empowerment as social and economic actors in their own right (FAO,2010). “It is a well-known fact that gender stereotypes keep poor and uneducated women in lower paid, less skilled and insecure work within the value chain. The challenge is to ensure gender equality throughout the chain and to prevent traditional patterns of gender discrimination from being repeated” (Bolzani, etal). The brief also emphasizes the fact
that women remain the main drivers of traditional value chains in local markets for fresh or processed foods such as vegetables, fruits, grains, tubers, dairy products and fish. As the returns are often low women are in particular need as they tend to have poorer access to inputs, extension and markets.

Rural areas are going through a demographic shift as quoted by Proctor and Lucchesi (2012) from the National Sample Survey. It is observed that nearly 40 percent of farming households and a higher proportion of small holders will quit farming if they were given a chance. This is supported by the surveys done by Satendar Arya and Sanjeev Asthana in two Indian states which confirms that 77 to 81 percent of farmers do not want their children to take up farming as an occupation.

Under these circumstances the face of small farms will change if there are fewer farmers in the next generation. Along with off-farm jobs and dynamic land markets, there will be questions. Who is farming and on what land?

It is also acceptable that small farm livelihoods can benefit from diversifying into off-farm and urban incomes. In situations of environmental threats like the impact of climate change, more investments are required on the farm and remittances from off-farm jobs become essential for those staying in farming. It is also seen as a practice that farmers often survive by moving seasonally to work as laborers in other’s farms or in the urban situations.

In the Green Revolution era in the 1960s and 1970s India addressed its growing reliance on food imports by promoting water and capital intensive technology to raise yields of rice and wheat. This benefitted only large farmers who had ample irrigation. The country’s National Agricultural Policy in 2000 talked about sustainability, efficiency and equity as its goals but never mentioned the special needs of small farmers. It reflected as a uniform view of the sector.
Taking into consideration the different sustainable ways of supporting small farms and small farmers in conserving agricultural diversity the way forward can be summed up as follows:

- Replace some of the simplistic assumptions on why productivity is affected with holistic approaches that have shown proven outcomes.
- Emphasize the role of agro ecology and permaculture in the place of reductionist approach to solving the problems faced by farmers.
- Support small farmers in their critical role in practicing mixed agriculture.
- Preserve traditional ways of cultivation and the role played by small farmers.
- Initiate community seed banks within the reach of farmers in every region.
- Ensure community ownership and protect farmer’s rights over the genetic diversity within the seed banks and explore alternatives to protect the diversity from IPRs than by IPRs.
- Empower women to reinforce their role in conserving the diversity and build their capacity in managerial roles.
- Ensure gender sensitive policies in conserving agricultural diversity.
- Recognize women’s rights to knowledge of PGR within the new systems that patent, privatize or compensate knowledge and genetic resources.
- Ensure access and control over productive resources like land, water and genetic resources for women.
- To ensure women’s role in conserving the agricultural diversity the following aspects must be considered in policy making:
  - Secure land rights of women.
  - Document knowledge of women on biodiversity which is being eroded and give it protection from IPRs.
  - Implement gender sensitive research on biodiversity.
  - Integrate women into local institutions that deal with biodiversity management.
  - Introduce changes in traditionally restricting conditions that erode women’s role in conserving the genetic resources.
  - Compensate farmers for the ecosystem services they provide in conserving the diversity that is the bedrock of food security.
Arya and Asthana emphasize that agriculture sector fails to recognize that small-holder agriculture requires special solutions in terms of farm inputs and social support systems. The greying of farmers is a reality and if one has to provide incentives for the youth to return to their villages with more skills and knowledge, it is vital to make village life more attractive.

If small scale farming and rural development has to be sustained, it has been emphasized that to bring markets and small farmers together, investments in small farmers is a necessity and not a luxury. Scholars, who have studied the impact of markets and economics in influencing policy, have observed that they do not benefit the poor. “Rights-based development aligns the interest of small scale farmers with social movements that resist corporate penetration into agriculture, resist globalization and advocate greater democracy and food sovereignty as part of human rights” (Vorley et al). The same document quotes the stand taken by Via Campesina, a peasant movement that claims to represent 200 million small-scale farmers around the world, advocating since 2001 at the UN Human Rights Council for an “international declaration on peasant rights, protecting their rights to land, seeds, freedom to determine prices and agricultural knowledge.”
The above discussions leave us with a few questions. How can policies address the special needs of small scale farmers? What knowledge do farmers need about relevant policies, laws and programs to make informed choices? Can farmers carve out a political and civic strategy independent of the state? How can farmers integrate the efforts required for conservation of agricultural biodiversity and their livelihoods? Are the laws conducive to protecting the farmers as custodians of the agro-biodiversity? Can markets respond to the efforts of small farmers to conserve the diversity? Above all can women’s co-operatives be strengthened in agricultural policy? Can the government provide the monetary support and training needed to strengthen the women producer groups? These and many other questions stir our thinking.

What can be done? It is by now well-recognized that small farmers farming in the dry land, rain-fed regions play a critical role in conserving agricultural diversity in the course of the multi cropping systems practiced by them. Their knowledge and agricultural biodiversity are like two sides of a coin. Economic benefits and political awareness of their role in conservation is the key to sustainable agriculture and food security. Keeping this in mind a wide range of answers that lead to policy changes can be envisioned.

Ever since the advent of Green Revolution there have been a plethora of anti-small farmer policy distortions which have favored capital-intensive agriculture. In the process, the self-esteem of small
farmers has been completely eroded. Therefore, undoubtedly, policies to boost the social recognition of the farmers should be mooted. For farmers living in remote rural areas tangible benefits of housing, transport, public health, education for their children and other civic amenities will deter them from out migration.

What genetic diversity in food crops has taught us is that traditional varieties of grains, vegetables and fruits not only have different genetic attributes but also unique value of taste. For this very reason there is scope for development of domestic and international market value that commands a premium price. Farmers have to be compensated for the ecosystem services provided through their effort to conserve the diversity as a trade off for the low yields. Local and national governments should provide the means to sustain this. Policies that generate off-farm employment opportunities in rural areas can help to economically sustain farmers.

In conclusion, the central argument of this publication is that attempts to conserve in-situ, on-farm diversity must go hand in hand with efforts to support the small farmer. Economists and environmentalists alike fail to appreciate the fact that diversity is the sin qua none of resilience and sustainability.

“In thrall to a romantic notion of wilderness many economists and environmentalists fail to appreciate that agricultural biodiversity is just as valuable or indeed arguably more valuable from the stand point of human wellbeing as the diversity found in tropical rain forests or spotted owls found in the ancient forests of north western U.S.”[Boyce, 2004].
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Preface


The Beginning


Green Revolution and After
The Advent of Neoliberalism and Globalisation


Safe food – myth or reality?


Farmer’s Rights: a top down or bottom up approach?


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THE CHENGALPATTU SURVEY: 1767-74

Undertaken by the British Government, the Chengalpattu Survey done between 1767 and 1774 provides detailed information about the organization and functioning of over 2,100 localities in the district, which stretches 180 km long and 80 km wide at places. The survey, led by British engineer, Thomas Bernard, focused on determining the value of the lands in the Chengalpattu district and also understand the appropriate ways to govern the Jaghire.

Significantly relevant in “understanding the essential preferences and seekings of The people of India and their ways of putting those preferences and seekings in practice in the public domain”, the survey has value in shaping the future to a great extent.

The following vital points emerge from this study:

1. Both levels of agricultural production and productivity were very high in the localities studied and compared favorably with the best levels reached at that time in other parts of the world.

2. All the artisans like weavers, carpenters, blacksmiths, goldsmiths, braziers, silversmiths were also adequately provided for in the locality budget. Households consisting of oil pressers, woodcutters, shoemakers, stone-masons, lime-burners, salt-makers, arrack distillers, basket makers, cotton refiners, engravers, perfume makers received their due share of the total agricultural produce.

3. The importance of households providing various administrative, cultural and other essential services to the community (such as Medical men; Pandaram households, Brahmana households
engaged in scholarship and religious, cultural and temple services) was duly recognized and provided for.

4. Barbers, washer men, kanakkapillais (registrars and accountants), Palayakkarar (militia men) were all part of the total number of beneficiaries included in the annual society’s budget.

5. In short grain allocations made included law and order, registry, education, health, culture and religion, apart from the artisan and industrial activities.

**Agricultural Production and Productivity**

Despite not-so-fertile lands, the peasants of Chengalpattu obtained fairly high average yields and successfully managed a level of productivity that “compares favorably with the best in the world today”.

From about 2 lakh kanis of land, an average annual production of around 20 lakh kalams of foodgrains was obtained, which means a kalam in this district fetches around 125 kg of paddy. Thus, the average working out to be 2.5 tons per hectare.

Source: cps.org

**Annexure 2**

**Chronological order of key famines in India between 1765 and 1947**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NAME OF FAMINE (IF ANY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1769-70</td>
<td>Great Bengal Famine</td>
</tr>
<tr>
<td></td>
<td>Occurred in Bihar, Northern and Central Bengal. An estimated 10 million or one third of Bengal population lost their lives</td>
</tr>
<tr>
<td>1784-84</td>
<td>Chalisa Famine</td>
</tr>
<tr>
<td></td>
<td>Occurred in Delhi, Western Oudh, Eastern Punjab, Rajputana and Kashmir. Up to 11 million died.</td>
</tr>
<tr>
<td>1791-92</td>
<td>Doji Bara Famine</td>
</tr>
<tr>
<td></td>
<td>Occurred in Hyderabad, Gujarat and Marwar. An estimated 11 million people died during 1788-94.</td>
</tr>
</tbody>
</table>
1837-38  Agra Famine
Occurred in Agra Province, Delhi and Hissar. Around 800,000 people lost their lives.

1860-61  Upper Doab Famine
Occurred in Eastern Rajputana wherein 2 million people lost their lives.

1865-67  Orissa Famine
1 million people lost their lives, mostly in Orissa and Bihar.

1868-70  Rajputana Famine
Occurred in Ajmer, Western Agra and Punjab. Around 1.5 million people lost their lives.

1876-78  Great Famine
Occurred in Mysore and Hyderabad and witnessed a very high mortality varying from 6.1-10.3 million.

1896-97  Indian Famine
Occurred in Madras, Bombay, Bengal, United and Central Provinces and claimed the lives of 5 million people.

1943-44  Bengal Famine
Occurred in Bengal and took the lives of 1.5 million from starvation and another 3.5 million from epidemics.

Annexure 3

IS INDIA’S AGRICULTURE CAPABLE OF IMPROVEMENT?

In an enquiry conducted by Dr. John Augustus Voelcker, Consulting Chemist to the Royal Agricultural Society of England, during 1889-91, he was asked to make recommendations “for the improvement of agriculture and to promote the welfare and prosperity of the rural population”.

Below is a summary of his findings -

Despite the fact that under the British rule, Indian agriculture was primitive and backward with little remedial measures undertaken,
the Indian crops were “wonderfully good”. Thus, the state of Indian agriculture is largely due to “an absence of facilities for improvement which is probably unequalled in any other country”. These are facilities such as access to water and manure.

Yet, nowhere can one find better examples of animal husbandry, cleaning the land from weeds, knowledge of soils and their capabilities, right time to sow and reap. Furthermore, Indian farmers knew much about crop rotation or the system of ‘mixed crops’ as well as fallowing.

“But, to return to the question of improvement; while some have erred by calling the agriculture primitive, and, forgetting that novelty is not necessarily improvement, have thought that all that was needed was a better plough, a reaper, a threshing machine, or else artificial manures, to make the land yield as English soil does, others have equally erred by going to the opposite extreme, and have condemned all attempts at improvement, asserting that the raiyat knows his own business best, and that there is nothing to teach him."

Finally, it isn’t the introduction of Western practices that will help progress the state of Indian agriculture but the “transference of the indigenous methods from one part of the country to another.”

Annexure 4

AGRICULTURAL SECTOR ON THE EVE OF INDEPENDENCE

From the book, ‘Indian Economic Development’

The Indian economy during British colonial rule was primarily an agricultural economy. Almost 85 per cent of the country’s population lived in villages during that period and derived its livelihood directly or indirectly from agriculture. Despite being the major source of livelihood, the agriculture sector continued to experience stagnation and deterioration during British rule.

State of Indian agriculture sector on the eve of Independence was as follows –

1. Weak Productive Accumulation – At the time of independence, the means of production were defective, there was insufficient use of fertilizers, machines were defective etc. All these lead to weak productive accumulation.

2. Unemployment and underemployment – Poor capital formation in agriculture led to rise in unemployment and underemployment.
3. Low levels of Production and Productivity – Farmers were poor, undernourished, had low stamina and no incentive to work. It led to low productivity of labor. Agricultural production in India was less than its demand. It produced only 508 lakh tonnes of food grains in 1947-48. At that time, just 13 crore hectares of land was under cultivation.

4. Sub division of landholdings – Landholding is defined as the area of land which a person or a family owns. It could be one piece of land or a number of small scattered pieces of land. At the time of independence, what prevailed was division, subdivision and fragmentation of landholdings.

Indian agriculture was stagnant. The main causes of stagnation were as follows

1. Land Tenure System

• Zamindari System – Zamindars or landlords were the owners of the land. The actual collection by Zamindars was much higher than what they had to pay to the Government. This system led to multiplication of middlemen between cultivators and Government, absentee landlordism, exploitation of peasants by unsympathetic agents, enmity between landlords and tenants. Under the system intermediaries benefited at the cost of both actual cultivators and the state.

2. Commercialization of Agriculture –

• This means production of crops for sale in the market rather than for self-consumption. Farmers were forced to cultivate commercial crops like Indigo. Indigo was required by the textile industry in Britain for dyeing of the textile. As a result, there was fall in production of food crops. The farmers had to suffer from frequent occurrence of famine. Indian agriculture was transformed in to a raw material exporting sector for England.
Acknowledgement

I wish to acknowledge all the support I have received in making this dream a reality. At the end of two decades it was a deep desire to share with a larger community all the learning that came out of the work with women in conserving the agricultural diversity with which is the foundation of nutritional and food security. While I started collecting my thoughts it went into coldstorage for a few years. It was at the behest of dear friend Bharathi assisted by Shwetta who came forward to edit the volume to give it shape and life. I owe it to her for the meticulous scrutiny of the text and made it presentable. She has been very patient to accommodate all aspects of the text and carried out several iterations of editing. But for the time she spared, this effort to share my thoughts with a larger group of friends would have not seen the light of the day. I would like to express my heart felt gratitude to Bharathi for the same. The designing skills of has made the volume come to life. I thank Cheluvaraj for sharing his skills of design that has made the presentation very attractive, colourful and lively.

I am very grateful to Dr. Vasavi an eminent anthropologist and academecian who gave her valuable inputs while writing this document. It would not be an exaggeration if I were to say that I drew a lot of inspiration from her writings “Harbinger of Rain” and “Shadow Spaces”.

I would like to thank the thousands of farmers who inspired me to undertake this journey. The warm hospitality with which they received me every time I was at their door is unforgettable. Many of them shared their joy of reaping a good harvest and often their problems which may be I failed to solve given the limitations of the circumstances in which I worked. I am grateful to them for all that they have taught me from simplicity to sustainable living.
I have had the opportunity to mentor the many youngsters who worked with me in this endeavor. Many of them have started their own initiatives to spread this concept in the state of Karnataka. I thank them for taking this forward.

I would like to thank all the colleagues who stood by me in times of trials. I would like to particularly thank Mr. Sundareshan, Sanjeev Raju, Rama, Veena Pai, Shivakumar Kiran, Sunil, Pradeep, Ramesh Hegde, chitrani, Sindhu, Srinivas, Gangadhar, and many others who worked with us in different capacities and different periods. Every time there were demands on their time and energy my colleagues unhesitatingly gave their best. But for their hard work we would have not been able to participate in this unending quest. To say the least we worked as a family.

I wish to thank Ubining, Mr. Paul of Polyp UK and ETC for permitting me to use the cartoons.

I want to place on record the effort put by my colleagues particularly Rama who provided the excellent collection of photographs that have been used in this text. I would also like to acknowledge the very hard work of Shivakumar who managed to bridge between the organization and the people literally and figuratively. Considering the fact that the area where our work was initiated was divided with a dry deciduous forest in between and reaching out to villages was an arduous task, I thank all the field managers who willingly came forward to live in the villages to carry out their work sometimes away from their families.

I would like to thank all the trustees Dr. Vasavi, Ashok Doraiswamy also called Dash, Ananda and Dr. Sudarshan who were present at times when needed and shared their wisdom in taking this movement forward.

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There are many others who I may not have acknowledged, but my gratitude goes out to the universe and everyone who I have interacted with in the course of my work.