PRINT: ISSN 0970-9274 ONLINE: 2456-6608
DOI: 10.31901/24566608.1996/07.01.01

J. Hum. Ecol., 7 (1) : 1-8 (1996)

Biodiversity, Sustainable Agriculture and Tribal Farmers

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KEY WORDS Biodiversity. Sustainable Agriculture. Nilgiris. Irula. Food-security. Subsistence-farming.

ABSTRACT The importance of Biodiversity is being increasingly realised in recent times. This is done more so in the context of sustainable development. Sustainable Development, from a resource use point of view, has two facets - the biological and the socio-cultural. What is argued in this paper is that Sustainable Development is possible only when objective conditions are created for optimum conservation of biological resources and socio-cultural practices in such a process of conservation. To understand this interactive process the case of the Irula, a Scheduled Tribe farming community, of the Nilgiris in Tamilnadu is presented. It is shown through this case study that with the increasing market-pressure the Irula have changed their traditional patterns of cultivating the local cultivars to the commercial crops. The traditional cropping pattern involved a variety of local cultivars which contributed to the gene pool of agricultural crops and now which are almost extinct. This process has also effected the food security of the Irula since most of the extinct local cultivars were basically the staple food-crops.

Biodiversity includes the whole range of life's varieties from wild eco-system to the genetic diversity of the domesticated agricultural crops. Biodiversity is the result of millions of years of evolutionary history. Apart from biological diversity human cultural diversity has also co-evolved in the recent geological past.

Biodiversity is being lost at present more rapidly than at any time during the past. Based on this secientists predict that enormous number of both plant and animal species could be extinct in the near future. It is important to conserve species richness and genetic diversity within species for ecological rejuvenation. Discussing the value and importance of bio-diversity, the World Charter For Nature adopted the policy (1982). "that every form of life is unique and warrants respect regardless of its worth to human beings."

The highest level of biodiversity and the richest pools of genes are located almost exclusively in the tropical and sub-tropical areas of the Third World. The alarming rate of deforestation of the tropical rain forests leads to the destruction of habitat which harbours wild progenitors and weedy forms of other basic food plants. The other factors which are threatening the bilological diversity of the planet are the irrational exploitation of plant and animal species and the biological invasions like notorious weeds. It is increasingly realized that loss of species and erosion of genetic material is a serious threat to sustain the development of humanity at large and to meet the changing human needs in particular.

The human race derives all of its food other needs as well, from both the wild and domesticated biological resources and this is largely possible because of biodiversity. Thus, the concept of sustainable agriculture becomes more important in the contex of biodiversity which is essential to meet the current and future food demands. Since the expansion of land to suit the agricultural needs reached the staturation point, the future increase in the production of agricultural crops to meet the food demand could be achieved only through the application of improved varieties with the required bio-technological advance. This, in itself, is antagonistic to the concept of conservation of local cultivars, which Swaminathan (1992) calls the folk-cultivars.

In the context of sustainable crop production Chopra (1994) feels that "diverstiy is encomposed of elite cultivars, breeding materials or less known plants and the wild rel-

atives of crop plants". In a global context " As many of the world's diverse life forms from microbes to higher animals and plants have a direct or indirect influence on agriculture, conservation of these organisms is essential for sustainable agriculture" (Swami-nathan, 1992). Thus, it has been realized that conservation of genetic resources is of utmost importance for not only the current agricultural production but also for future food security.

Genetically diverse species and wild relatives of major and minor crops provide sources of parental raw materials for plant breeding, these genetic resources are also encomposed with genes for imparting tolerance/resistance to biotic and abiotic stresses and for development of cytoplasmic male sterile (CMS) systems.

Ironically many of the high yielding varieties are prone to attack by a number of pests and diseases which hamper the overall production markedly. More than 20,000 species of pests destroy a third of the total world food production annually. To avoid or minimize this loss, control strategy can be evolved using plants with genetic resistance to pests and diseases which are relatively cheap and also environmentally sound. The extreme homogeneity brought about by the universal adoption on vast area of cultivation of few crop varieties and the green revolution have accelerated the loss of species which were being cultivated as a part of the traditional agricultural systems. Garrison (1986) points out that "the technological bind of improved varieties is that they eliminate the resource on which they are based. Winston (1986) continues that, "the gene pools most likely to prove immediately useful in bio-technological applications are threatened more by the spread of modern crop-varieties to existing fields than by the clearing of new land. So, plants which could withstand biotic and abiotic pressures better and forming the key for sustainability in agriculture are being lost with greater homogenization".

Developments in the field of biotechnology have enhanced the scope of locating and transferring useful genes from wild species to cultivated crops and creating a novel gene combination. So, conserving and enhancing germplasm is an essential factor for sustainable agriculture.

After 1980's the world has started witnessing serious activities to avoid the constant deterioration of the life-supporting systems. To improve the conditions several views and ideas are provided by various agencies regarding biodiversity, eco-system and sustainable development :

1. Definition proposed by WCED (known as *Bruntland Commission* 1987) is that "Sustainable Developement is development that meets the need of the present is development without compromising the ability of *future generations"* (emphasis added).
2. IUCN, UNEP, WWP (1991) define sustainability as "improving the quality of human life, while living within the carrying capacity of supporting eco-systems".
3. UN conference on Environment and Development held at Rio (Earth Summit-92') explains in its Article 2 regarding the 'sustainable use' as follows :
   ".....the use of components of biological diversity in a way and at a rate that doesn't lead to the long term decline of biological diversity, thereby maintaining its potential to *meet the need and aspirations of present and future generations*" (emphasis added).
4. The citizens convention on biodiversity organized by NGOs and held during the same time as 'Earth Summit-92' views 'sustainable use' as "that (which) doesn't interfere with the ecological integrity of living things or their ecosystems and which is socially equitable to people. Thus implies :
   that all members of *present and future generations receive a socially equitable*

share of an access to benefits of natural resources :

that the basic structure of genetic resources and their ecosystem is not depleted by the use of its components; and that all life forms are treated in a way that respects their intrinsic, social, aesthetic, cultural, traditional, spiritual and other values and that our activities don't cause suffering on any living thing (emphasis added).

5. A sustainable society is described by Swaminathan (1992) as :

- respect and care for community life;
- improve the quality of human life;
- conserve the earth's vitality and diversity;
- minimize the depletion of non-renewable resources;
- keep within the earth's carrying capacity;
- change personal attitude and practices;
- *enable communities to care for their own environment;*
- provide a national framework for integrating development and conservation; and
- forge a global alliance" (emphasis added).

It is possible to draw some common points from the above views and definitions, in understanding what is sustainability in the contex of bio-diversity :

1. Sustainable use of biological resources requires an equitable use of the resources contemporarily and also an intergenerational equity;
2. Sustainability is possible by improving the quality of life in consonance with the conservation of the local eco-systems;
3. Sustainability can be achieved by leaving the care of the eco-systems to the local communities and respecting the latter's cognitive knowledge about the biological conservation.

Keeping the above understanding as the back-drop, let us consider the case of Irula agricultural practices.

NILGIRIS BIOSPHERE RESERVE AND THE IRULA AGRICULTURE : A CASE STUDY

The Nilgiris or Blue mountains is located at the junction of the eastern and western ghats of the Indian peninsula. Ecologically, biologically, geologically and culturally it is a most fascinating region. Vertically the Nilgiris area is located from 295 to 2590 meters above the mean sea Level. The high elevation of the district naturally results in low temperature. The rainfall is not uniformly distributed and varies considerably from one place to another due to difference in elevation, undulation and unevenly wooded terrain. The western parts of the district rely mainly on the south-west monsoon in July and August and the eastern parts recieve much of the rain from the north-eastren monsoon in October and December, and the average rainfall is 965.84 mm. The district has an enormous forests area, which forms 56.2 per cent of the total area of the district. The net area use for agriculture consists of as much as 25 per cent of the total areas of the district.

The Nilgiris is one of the Biosphere Reserves, which had been proposed first among the other thirteen biosphere reserves identified all over India, with an *in situ* conservation approach or an open conservation system. Within its boundaries it consists of a wide variety of flora and fauna. Defining a *Biosphere reserve*, Ansari (1986) says that "conservation of natural areas and the genetic material they contain is the basic philosophy behind the concept of Biosphere Reserve". Now there is a general agreement that sustainable developement is the only strategy by which the resources of a Biosphere Reserve can be both used and conserved for future.

Apart from the biological richness of the Nilgiris biosphere, another most important and interesting character of the Nilgiris area is its cultural polyvalance. Different groups of tribals are inhabiting different regions of the district and involved in different occupations. These groups include mainly; 1. Toda, 2. Kota, 3. Irula, 4. Kurumba and 5. Paniya. These ethinic groups '....form an inseparable component of the ecosystem. Most of them lose their dignity and even the will to live if they are taken out of their original inhabitats" (Chitrapu, 1987). They possess a very rich cultural heritage and maintin a harmonious relationship with the surrounding environment and are also known for their classic inter-tribal dependency during the past.

The Irula of the Nilgiris don't live on the mountain plateau, but occupy the lower slopes, jungles and clearings at an approximate altitude of 800 to 1600 meters on all sides of the Nilgiris hills.

The village selected for the case study is located in the northern slope of the Nilgiris, 1200 meters above mean sea level, surrounded by forests on all four sides. The Irula of this settlement were traditionally hunting-gathering people. The elder generation of the Irula vividly remember their forager past-collecting of wild yams, honey and other minor forest produce and taking shelter in the caverns of the area. Later the Irula were employed by the Badaga to look after the latter's cattle and farms located in the surroundings of this place.

Before 1950' these Irula were serving in various *Hutty* and lived in small huts which were constructed near the cattle pens. Normally a *Hutty* comprises two or there cattle owning Badaga families six to eight Irula families and three to six Badaga cattle pens. Every year the Badaga families stayed for a few months and moved later to the massif for the rest of the year. The Badaga also had dry land agricultural *farming adjacent to their cattle* pens. The Irula who had acquired the skill in practice of agriculture were engaged in the fields. The other Irula were assigned the task of taking care of the cattle. Apart from involving in agricultural activities the Irula woman worked in the Badaga houses. The Irula children starting at six or seven years took care of the cattle in the pen. Later they accompained their parents for grazing the cattle or to the agricultural fields. For all the labour provided by one entire Irula family for the full week, the reward was three *Kolagan* Regi (Italians millet) and four annas (quarter rupee). But by the end of the week and some times even earlier, the Irula families faced grain shortage. To meet the deficit of grains the Irula continued the traditional practice of collecting yams, greens, fruits and small game hunting.

When the Badaga owners sold all the land to the outside migrants and left the place, roughly 40 to 50 years back, the patron-client relationship between these two groups ended. This was the time when the Irula started clearing the forest in the surrounding areas of the habitat and began their own independent agriculture, with the knowledge they gained from the Badaga.

Changes in the Irula Subsistence Agriculture

Generally the Irula practise dry land agriculture crops, in close association with monsoon rains. The crops are cultivated during the main (*Karbogam*) and second (*Avinbogam*) season annually. The main season is spread between March and October. The second season starts in the middle of August and continues till December.

When the Irula began their own independent agriculture they took, from the previous Badaga owners, the seed which includes only two main crops: 1 Finger millet (two varieties) and 2. Sorghum, and one inter crop Lablab beans. For the second season also they cultivate the same finger millet.

In course of their own agricultural development; the Irula added some more subsistence crops and enriched the genetic diversity of their crop system through brrowing from the neighbouring village Irula and the relatives from Karnataka. The crops added are one main crop kidney beans (two varieties) and five inter crops. They are: 1. Amaranth, 2. Gingelly, 3. Mustard, 4. Italian millet and 5. Bajara. Apart from the same finger millet they cultivate for the second season, four more new crops have been introduced, 1. Horse gram, 2. Coriander, 3. Chick pea, 4. Cluster beans.

In the late 1970's and onwards due to their greater contacts with negihboring farms, where they practise more intensive commercial crops, few more new cash crops have diffused into the Irula earlier subsistence agriculture. They are: 1. Groundnut, 2. Maize and 3. Sunflower. All these crops are being cultivated and sold to the middlemen who are visiting the village during the harvest period from outside. The contact with the middle men has added some more strength to the practice of the cash crops. The middle men provide seed as well as small loans to cultivate cash crops. The number of families adopting the new crops and the area under cultivation are gradually increasing.

Apart from this, change is taking place in the Irula traditional kitchen gardens. They buy seedlings or create their own nurseries and cultivate chilly and tomato in their plots as the main season crops. Plantain gardens by two families are also getting introduced in the agriculture. They sell the vegetable in the nearby village market. Few years back, the Tamil Nadu Government Sericulture Department introduced mulberry and now four Irula families have poorly maintained mulberry gardens.

The Irula also remember when they were working in the Badaga farms, they used to cultivate a variety of dry land paddy called *varanell*. They continued the practice for a few years after they had started their own agriculture. But due to the failure in the rainfall, there was a gap for a few years, and later they couldn't *find the seed* to continue the cultivation of the variety. Now they say that this particular variety is not found any where in the surrounding area.

Details of Irula Land Holding Pattern

In this village, the land holding pattern varies between less than 0.5 acre to four acres (Table 1). Though the land holding per household is very low (1.7 acres), the variation in induvidual holding is considerable. Out of the total 105 families, 78 have land. Of those, two households practising agriculture possess less then 0.5 acre, while six have between 0.51 and 1.0 acre of land. Twelve households have between 1.01 and 1.5 acres, fifteen have between 1.51 to 2.0 acres. Majority of 32 families involved in agricultural operations possess between 2.01 to 2.5 acres of land while only two families have 2.51 to 3 acres and the remaining nine families posses above 3.01 acres of land. A total of 133 acres are cultivated by 78 huoseholds of the entire village.

Table 1 : Land holding pattern among Irula

S. No.	*Land holding (in acres)*	*Frequency (Households)*
1.	<< 0.5	2
2.	0.51 to 1.0	6
3.	1.01 to 1.5	12
4.	1.51 to 2.0	15
5.	2.01 to2.5	32
6.	2.51 to 3.0	2
7.	3.01 >>	9
Total :	133 acres	78

Average Land Holding : 1.7 acres per household

The changing atmosphere of the village and new opportunities for income generation have indirectly affected the sincere involvement of the Irula in their agricultural activities. Table 2 shows, the amount of land cultivated by the number of families during the

year 1991-92. Only one fifth of the households (19.2%) covered all the land they owned. A little higher than (51.3%) one half of the land owing families cultivated roughly 50% of the area owned. The households which cultivated less then a quarter part of the land were also not negligible (21.8%), and some of the households possessing little amount of land property (7.7%) left all their land fallow for the whole main and second seasons. The table also shows, that very little interest was paid by the Irula towards their second season crops. 86.4% of the household didn't cultivate either fully or at least one half of the land, only 15. 4% of the families cultivated at least less than a quarter part of the land they owned during the second season.

During the initial stages, the Irula followed the traditional Badaga agricultural practices they had inherited from them. The incerase of the influx of outsiders provided the Irula an opportunity to get exposed to new, modern and improved agricultural practices. Most of the cash crops found in the present crop list are borrowed from them and recently the Government Sericulture Department introduced mulberry in the Irula farming. Due to these new additions the traditional farming of local varieties of corps by the Irula of this are got disturbed. Apart from the new crops added they also started cultivating the hybird varieties of *Ragi* (Italian millet) and *Jolam* (Sorgham), the traditional crops, which they had inherited from the Badaga land owners. This process of almost a total substitution of traditional local cultivars for commercial crops and hybird staple food-corps is largely due to the borrowing from the neighbouring frams and initiative by the Government Department, through extension activity and monetary support in the from of subsidy. This process, in essence, encouraged the phenomenon of homogenisation of crop-patterns rather than encouraging diversity of crop varieties. Thus the Irula are left with very little choice in the matter of preserving the local cultivars. This also had a compounding effect on their basic food security. When the Irula were still cultivating the local varieties of staple food, were assured of meeting their basic food needs for some part of the year, but with the increasing monetization, the Irula are forced to cultivate nonstaple food and commercial crops.

The new context certainly provided new wage-labour opprtunities to the Irula small and marginal farmers which directly affected their farming activities. This also made the younger generation of the Irula fail to acquire the traditional knowledge of their agriculture system. Adoption of new crop varieties and increasing homogenization lead to genetic erosion and finally the influence of market in bringing commercial crops affected their own food security. Borrowing of few capital intensive practices required additional knowledge beyond the Irula traditional wisdom. The cumulative consequence of these factors is forcing the Irula to move away from cultivating the genetically diverse varieties, to which they were traditionally accustomed. Thus on the one hand the market influence poses a threat to conserve the gremplasm of traditional varieties of cultivation which provided these small farmers with the food se-

Table 2 : Number of Irula household (HHs) cultivated land during the year 1991-92

Season	*Area fully cultivated*		*Roughly 50% of the areacultivated*		*Small part of land cultivated*		*Left as follows land*	
	HHs	%	*HHs*	%	*HHs*	%	*HHs*	%
Main season (Karbogam)	15	19.2	40	51.3	7	21.8	6	7.7
Second season (Ayinbogam)	-	-	-	-	12	15.4	66	84.6

Table 3 : Average output subsistance and commercial crops

S. No	*Season*	*Name of the crop*	*Total area cultivated (in acres)*		*Out put in quantity (bags)*		*In Rs.*	
			Subsis-tance	*Cash*	*Subsis tance*	*Cash*	*Subsis-tance*	*Cash*
1.	Main Season	Finger Millet	38	-	180	-	45,000	-
	(Karbogam)	Sorghum	5	-	30	-	7,500	-
	Ragular :	Gound nut	-	15	-	38		10,000
		Mize	-	4	-	6		1,800
		Beans	-	10	-	12		4,800
		Sunflower	-	1	-	1	-	160
		Total	43	30			52,500	17,568
	Intercrops:	Lab Lab beans	25		10		3,000	
		Amaranth	5	-	2	-	500	
		Gingely	-	4	1		-	400
		Bajra	1	-	No harvest	-	-	
		Italian Millet	1/2	-	No harvest	-	-	
		Mustard	-	5	-	1/2	-	400
		Mzie	-	25	-	10	-	3,000
		Total	31 1/2	34			3,500	3,800
II	Second season	Horse gram	2	-	1/2		100	
	(Aiynbogam)	Black gram	1/2	-	No harvest	-		
	Regular :	Corriander	-	2	-	2	-	400
		Bengal gram	-	1	-	1/2	-	150
		Cluster beans	1/2	-	No harvest	-		
		Total	3	3			100	550
III	Horticultural	Chilly	-	5	-	-		1,000
	Crops	Tomato	-	5	-	-		1,500
		Water Melon	-	2	-	-		200
		Plantain	-	6	-	-		5,000
		Mulberry	-	6	-	-		4,000
		Total	-	24	-	-		11,700

Main Season : Regular Crop:
Subsistence crop average out put in Rs/acre: 1220.98
Commercial crop average output in Rs/acre : 541.85
(Regular main season crops+Horticultural crops)

Inter Crops:
Subsistance crop average out put in Rs/acre: 111.11
Commercial crop average out put in Rs/acre : 117.76

Second Season:
1. Subsistence crop average output in Rs/acre : 33.33
2. Commercial crop average out in Rs/acre : 183.33

curity, and on the other, they are forced to look for wage labour to augment their day to day means of survival.

Table 3 shows the drastic difference in the avarage output in terms of cash received per acre in respect of the Irula regular subsistence crops (Rs. 1220.93) and the commercial crops (Rs. 541.85). In the case of main season inter crops, even though there is not much of monetary difference between the

types of corps (subsistence Rs. 111.11 and commercial Rs. 117.76) it should be noted that though a few types of the mini millets have been sown but they didn't harvest. Regarding the second season, the out put reflects the poor attention paid by the Irula. If the same situation continues in future many of the intercrops and second season crops will vanish from the agricultural system of the Irula. The point sought to be made through this analysis is that there is an increasing influence of the commercial crops on the still developing Irula agriculture. Under these circumstances, what will be the future of the local cultivars? How to sustain the biological diversity *vis-a-vis* the agricultural species? These are questions closely intertwined to the broader question of sustainable agriculture. Sustainable Agriculture can only be understood from the view point of bio-ecological sustainability but also to be seen from the point of socio-economic sustanability.

Finally the bottom line is how does one plan sustainable agriculture in the context of small and marginal farming communities like the Irula? A community which was traditionally cultivating local cultivars is drawn into the commercial-market system, and in the name of developemt homogenized varieties are introduced by Government and private agencies. Under such a situation the community could not withstand these pressures. The result is that today many of these local cultivars are almost extinct. The Irula farmers are thus drawn into a *market-vortex* and are unable to conserve the local varieties and cosequently are deprived of the basic food security which they enjoyed bio-ecological earlier. Thus, not only the bio-ecological diversity and sustainability but the socio-economic sustainability is drastically effected. In fact what is being suggested here, in the context of sustainable agriculture is to integrate both biological and social factors. They are intricately inter-related. No biological conservation is possible without socio-economic sustainability of the agricultural practices.

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