

Assessing the Risk Status of Minor Millets in the Kolli Hills, Tamil Nadu, India



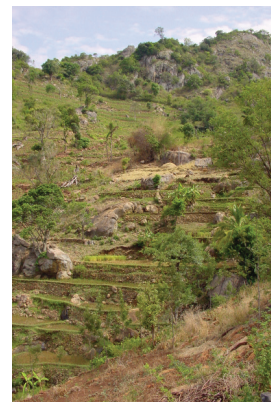
Executive Summary

While the objective of the overall PACS project is to explore the potential for applying payment for environmental services concepts to the conservation of agrobiodiversity, the specific objectives of the field work carried out in Tamil Nadu, India were to determine:

- the number of minor millet-growing households and their trend;
- the extent and trend of areas planted to specific minor millet species/varieties;
- reasons for the decline in some of these species/varieties; and
- the willingness of farmers to cultivate the most threatened species/varieties in the future (discussed in more detail in Research Findings 2).

Key Results

- It is estimated that over half (58-63%) of all households in the 5 panchayats are minor millet growers;
- There was a significant decline (20%) in the number of millet growing households between the 2008/09 and 2009/10 agricultural seasons, as well as – with the exception of finger millets – a decline in associated land areas;
- The species/varieties identified as being at risk (planted on less than 5 acres or by less than 20-30 farmers across the 5 panchayats) include:
 - all varieties of Italian, common and kodo millets
 - all but one of the varieties of little millet.
- The definition of an *in situ* conservation goal compatible with the maintenance of the public good environmental services associated with the continued cultivation of diverse millet species/varieties is required. Together with a wider monitoring/status assessment effort and application of a prioritisation tool (as it may not be possible to conserve everything), this will provide the basis for the establishment of an environmentally effective, cost-efficient, socially equitable and low risk agrobiodiversity conservation strategy.



Project Overview

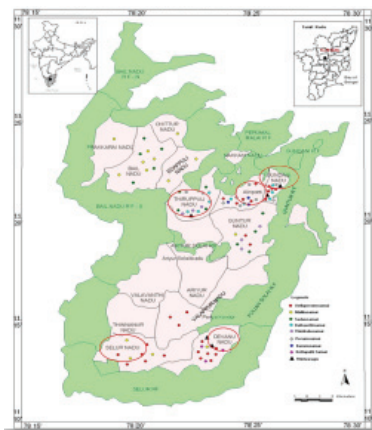
Bioversity International's program on Payment for Agrobiodiversity Conservation Services (PACS) seeks to explore the potential of PACS in sustaining the on-farm utilization of threatened but valuable crop varieties, so as to provide guidance for the design of effective, efficient and equitable *in situ* agrobiodiversity conservation strategies. In cooperation with the M.S. Swaminathan Research Foundation (MSSRF), a household survey was conducted with approximately 450 farmers from the Kolli Hills region in Namakkal district of Tamil Nadu, Southern India. This is a region where traditional minor millet landraces with high nutritional and cultural values are considered to be increasingly threatened.

Case study background

Under the locally varying agro-ecological conditions across the 14 panchayats and 297 settlements found in the Kolli Hills region, a number of landraces have evolved over hundreds of years of cultivation, so that millet cropping systems are associated with a relatively high level of intra-specific diversity.

Twenty-one different landraces (plus 2 improved varieties) from five millet crop species can be found in the Kolli Hills. These include: finger millet (*Eleusine coracana* or "kelvaragu"), Italian millet (*Setaria italica* or "thenai"), little millet (*Panicum sumatrense* or "samai"), common or proso millet (*Panicum miliaceum* or "panivaragu") and kodo millet (*Paspalum scrobiculatum* or "varagu"). The latter two are cultivated only to a very limited extent.

Research was carried out in 5 panchayats (Devanur, Alathur, Thiruppuli, Gundari and Selur – see map below) in the Kolli Hills region, as these 5 panchayats are considered to encompass a large range of the minor millet diversity found in this region.



Kolli Hills

Minor millet crops are considered to be becoming increasingly marginalized due to a growing emphasis on commercial crops and the resulting changes in cropping systems, consumption and production patterns of local farmers. Cash crops, such as cassava (tapioca), are increasingly competing with millet crops for land. Consequently, the field work carried out aimed to determine:

- the number of minor millet-growing households and their trend;
- the extent and trend of areas planted to specific minor millet species/varieties; and
- reasons for the decline in any of these species/varieties.

Should such declines indicate that particular species/varieties are tending towards or have moved below what might be considered to be a safe minimum population (see Factsheet 2, Section 2 – Defining a Conservation Goal and Technical Note 3), then the development of a conservation strategy would be warranted. In such a case, and acknowledging the role of farmers as key agents in the conservation process, a further objective of the fieldwork was to:

- assess the willingness of farmers to cultivate the most threatened species/varieties in the future.

Data Collection

With this purpose in mind, a farmer household survey instrument was developed which covered topics related to demography, household organization, wealth and production system characteristics. Stated preference approaches were also included in order to assess farmer willingness to participate in a minor millet conservation programme (initial results reported in Research Findings 2). Between January and May 2010, approximately 90 farming households per panchayat were interviewed within (depending on population sizes) 6-13 randomly selected settlements in each panchayat. Within each settlement, specific farming households were selected through a semi-random sampling approach, in order to ensure that at least 50% of the interviewed households per settlement would be minor millet growers. Field assistants began by randomly interviewing farming households regardless of whether they were minor millet growers or not. Subsequently, if it looked like the 50/50 ratio would not be achieved, they then purposefully selected millet-growing households.

Initial Findings

Land use and crop production

Average landholding size per farming household is approximately 2.6 acres of which just under 2.1 acres is used for agricultural purposes. With the exception of much higher levels in Devanur (which a wealth ranking exercise revealed to be the wealthiest of the 5 panchayats), there has been only a modest (7%) decrease in the total land area under cultivation over the last five years.

On average farmers manage between three and five crop species, out of which two to four are non-millet crops. Almost all minor millet farmers also cultivate non-millet crops. Crop diversity (number of different crops) is highest in Thiruppuli. Although the number of crops cultivated is lowest in Gundani (identified as the least wealthy of the 5 panchayats), Devanur ranks lowest when taking into account the relative distribution of land area among different crops. This is because large land areas in Devanur are allocated to jack fruit and cassava, while other crops only play a marginal role.

Jack fruit is the most prominent crop in all panchayats but Thiruppuli, where coffee and cassava dominate the production systems. Cassava is the second most important crop after jackfruit in all other panchayats. In general, minor millet crops are on average planted on rather small areas (0.22-0.45 acres), with finger millet being the most important millet crop (cultivated by approximately 60% of the sampled households) followed by little and Italian millets. Common millet was only grown in Thiruppuli, while kodo millet had completely disappeared from the Kolli Hills' production systems in the 2008/09 season.

Compared to the 60% adoption rate for finger millets, adoption is higher only for rice and cassava (72%). Jackfruit is cultivated by fewer farmers but on much larger land areas. Depending on the panchayat, farmers cultivate on average 2.4-6.7 acres of jack fruit, 1.2-1.6 acres of cassava, 0.3-1.0 acres of rice and 0.22-0.45 acres of finger, little or Italian millets. Despite lower adoption rates for little and Italian millets, land areas farmers plant with these millet species do not differ very much from the ones under finger millet.

Significant yield differences between the five panchayats suggest varying agro-ecological conditions within the Kolli Hills region. It is reported that Thiruppuli provides the highest yields for many crops, including cassava as well as finger and little millets. Both these minor millet species seem to outperform (500-560kgs/acre) when grown in the conditions of Thiruppuli, with yields that are almost twice as high as in the other four panchayats. While the yield differences between finger and little millets seem to be limited, Italian millet is generally associated with lower yields.



Fox-tail millet

An analysis of the millet cultivation practices revealed that millet plots are on average 0.37 acres large and almost half practice intercropping, particularly with beans, mustard and/or redgram (pigeonpea). Broadcast sowing is used by over 93% of farmers. Between 4-20% of farmers plant more than one millet landrace, although on average only 2.1% planted more than one millet landrace on an individual plot. Issues of intercropping and mixed millet planting can create challenges for area-based monitoring measures.

We also note that millets are mainly produced for subsistence needs, as is rice. All other crop output, including cassava, is largely sold.

Changes in millet cultivation

Number of minor millet growing households

Of the total number of farming households sampled, approximately 70% were minor millet growers. Given that 80% of the total interviewed households ended up being randomly selected, this suggests that approximately 58%-63% of all households in the 5 panchayats were in fact minor millet growers in 2008/09. However, we also observed a 20% overall decline in the number of millet growing households in the 2009/10 season, so that these figures may overstate the more recent status of millet growing households. This fall in the number of millet growing farmers can be directly contrasted to an average 25% increase in the number of cassava farmers across the five panchayats, supporting the hypothesis that millets are more and more being replaced by cassava.

However, the relationship with land area is somewhat less clear cut. A 19% decline in finger millet farmers is associated with a 10% increase in the finger millet land area. This indicates that although more and more farmers switch to cassava, fewer farmers cultivate millets but those who do grow it grow it on larger areas. By contrast, little millet farmers numbers have declined by 35% and area by 25%, while for Italian millets this decline is 44% and 31%, respectively. The last 0.9 acres of common millet in 2008/09 completely disappeared and kodo millet was absent in both seasons. Declines in millet land areas planted were most commonly attributed to the existence of more profitable crop options, low productivity and returns, and unfavourable weather conditions. For those farmers who did not reduce their millet areas, its importance as a staple food was the most important factor, followed by its role in maintaining soil fertility.

Risk Analysis

The definition of an *in situ* conservation goal capable of ensuring the maintenance of the public good values associated with the conservation of crop diversity (i.e. the maintenance of agroecosystem resilience, evolutionary processes and geneflow, traditional knowledge and future option values) might be based on a range of factors (see Factsheet 2 and Technical Note 3). To maintain the

forementioned services, more than just land area might be taken into account and consideration could be given to such factors as, *inter alia*, farmer numbers, the spatial distribution of communities involved in conservation activities, the functionality of the seed system, and the amount and age of seed stored. While the choice of such factors and their weighting remains to be scientifically determined, it would nonetheless appear that a number of the millet landraces studied might well be considered to be at risk.

As can be seen in Table 1, the total land area remaining under most landraces is rather small. Those planted on a total of less than 5 acres or by less than 20-30 farmers across the 5 panchayats include all the varieties of Italian, common and kodo millets, and all but one of the varieties of little millet. Kodo, common and some little (sadansamai) and Italian (palanthinai) millet varieties were not cultivated at all during the 2008/09 and 2009/10 seasons. Considering the area planted to little, common and Italian millets, we note that on average only 6.7% of household agricultural land area is dedicated to these species, with this proportion being as low as 3.5%-3.7% in Gudani and Selur. By some emerging risk measures (e.g. those applied in the province of Lazio, Italy), the above figures would suggest that these species/varieties are at medium to high levels of risk.

Table 1 Status of Minor Millet Varieties across 5 Kolli Hills Panchayats

	2008		Estimated 2009	
	Average Farmer Numbers	Area (Acres)	Average Farmer Numbers	Area (Acres)
Finger millet				
Sundangikelvaragu	279.70	89.00	227.70	98.20
Perungelvaragu	176.70	82.40	143.80	90.90
Karunguliyankelvaagu	102.40	40.20	83.40	44.40
Arisikelvaragu	107.20	31.70	87.20	35.00
Sattaikevaragu	70.50	23.30	57.40	25.80
Karakelvaragu	31.90	8.50	26.00	9.40
Total	768.40	275.20	625.60	303.70
Little millet				
Vellaperumsamai	184.90	127.10	120.40	96.00
Kattavettisamai	11.00	12.80	7.20	9.70
Karumsamai	20.30	3.80	13.20	2.90
Malliasamai	9.80	2.70	6.40	2.00
Thirigulasamai	13.80	1.20	9.00	0.90
Sadansamai	0	0	0	0
Total	239.80	147.60	156.10	111.50
Total excluding Vellaperumsama	54.90	20.50	35.70	15.50
Italian millet				
Perunthinai	13.50	7.00	7.60	4.80
Koranthinai	24.10	5.00	13.60	3.50
Senthinai	4.40	3.00	2.50	2.10
Mookanthinai	11.60	2.00	6.50	1.40
Palanthinai	0	0	0	0
Total	53.70	17.00	30.20	11.70
Common millet				
Panivaragu	10.30	0.90	0	0
Total	10.30	0.90	0	0
Kodo millet				
Thirivaragu	0	0	0	0
Total	0	0	0	0

= Varietal areas with < 5 acres in total;

= Farmer numbers < 30 in total

While the choice of an *in situ* risk threshold being established at 5 acres and 20-30 farmers is admittedly somewhat arbitrary, it is clear that even the choice of a threshold at half that level would still leave many of the varieties listed in Table 1 as still being considered at risk.

Future Research Considerations and Components of a Conservation Strategy

It should nonetheless be appreciated that should areas of highly similar varieties be found in the remaining 9 panchayats in Kolli Hills, then some of the varieties listed in Table 1 may eventually turn out to be less threatened overall. This suggests both the need for additional sampling in those panchayats (and indeed other locations in India) as part of a monitoring effort and risk assessment, as well as consideration of the degree of potential dissimilarity between

landraces in the different panchayats. The latter would permit an analysis of the extent to which such species/varieties found there may actually contribute in practice to increasing the totals of those already listed in Table 1.

It is important to consider the dissimilarity issue, as our results indicate that the different landraces studied played a role largely only in one or two panchayats. Thus it appears that millet landraces are adapted to the very specific production conditions in each agroecological zone and hence the degree of dissimilarity may be high. Further research is clearly needed to resolve this question, particularly in the context of the development of Weitzman-type prioritisation tools whose results can be strongly influenced by the spatial level of analysis (see Factsheet 2 and Technical Note 1).

The above is part of Bioversity International's Payment for Agrobiodiversity Conservation Services programme of work, which has support from the Syngenta Foundation for Sustainable Agriculture (SFSA) and the CGIAR's System-wide Program on Collective Action and Property Rights (CAPRI). Research was carried out in collaboration with the M S Swaminathan Research Foundation (MSSRF), India; the Fundación para la Promoción e Investigación de Productos Andinos (PROINPA), Bolivia; the Centro de Investigación de Recursos Naturales y Medio Ambiente (CIRNMA), Peru; and the Department of Land Economy, University of Cambridge, United Kingdom.