Small Ruminant Rearing

Breed Conservation and Genetic Improvement

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This report has been written for SA PPLPP by Dr. Chanda Nimbkar and Dr. Pradip Ghalsasi of the Animal Husbandry Division, Nimbkar Agricultural Research Institute, Phaltan, Maharashtra, India. It documents interventions on small ruminant breed conservation and improvement, their impact on small-holder livestock rearers, lessons learnt and issues requiring policy intervention for facilitating sustainable livelihoods and market participation of small-holders. It is based on extensive field visits and discussions with practitioners, staff of various programmes and livestock rearing communities, a secondary literature review and the authors' experience of over 20 years working in the area of goat and sheep improvement in India.

Photo credits: Dr. Chanda Nimbkar and Dr. Pradip Ghalsasi, Animal Husbandry Division, Nimbkar Agricultural Research Institute, Phaltan, Maharashtra, India

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Shriram with his Totapuri Bucks, Village Moredi, District Alwar, Rajasthan

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We apologise if there are any interventions we have been unaware of and have therefore not included in this report.

We hope that this report will be of use to policy makers, researchers, donors and field workers, in planning and implementing small ruminant conservation and improvement programmes, together with and for the benefit of the rearers and their animals.

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Executive Summary

Objectives

This report is the result of an assignment from SA PPLPP to document approaches, interventions and good practices related to small ruminant breed conservation and improvement in India, and their impact on the livelihoods of smallholders. The approaches included different ways of promotion of small ruminant rearing, with an emphasis on indigenous breeds, traditional systems for sharing small ruminant assets, assessment of production performance of indigenous breeds and their improvement through selection and, lastly, cross-breeding programmes. The documentation is based on visits to selected sites, where such conservation and genetic improvement programmes have been or are being carried out, and a review of secondary literature. An additional objective of the assignment was to identify and describe issues requiring policy intervention related to small ruminant breed conservation and improvement for the purpose of securing sustainable livelihoods for small ruminant rearers and facilitating their participation in the expanding market for small ruminants and their products.

Methodology

From 10 October to 15 December 2011, the researchers visited field sites in the states of Bihar, Karnataka, Kerala, Maharashtra, Rajasthan and Tamil Nadu, where interventions on small ruminant breed conservation and improvement have been undertaken. Information on these practices was received by SA PPLPP, following a public call for information on small ruminant rearing interventions issued in 2010. During the visits, goat and sheep rearers, and representatives of the implementing organizations were interviewed extensively. Information was also obtained from reports, books, published scientific papers and other literature. The current report is based on this information as well as the authors' experience of working in the area of goat and sheep improvement in India for more than 20 years.

Findings

- In the absence of effective project monitoring and evaluation in most cases, it is difficult to state whether the support provided by the documented interventions (which were visited) contributed to the improvement in numbers and/or productivity/quality of animals or to the improvement of rearers' incomes. Most of the interventions were, however, perceived by the beneficiaries to have improved the quality and productivity of their animals and their incomes.

- Barring a few exceptions, smallholder goat and sheep rearers in India have largely not benefited from organized goat and sheep genetic improvement programmes.

- Interventions that involve the genetic improvement of animals that is passed on from generation to generation are more likely to sustain beyond the life of the intervention. Interventions such as enhancing awareness, establishing and strengthening community organizations, and linking them with existing structures such as SHGs are also likely, with some monitoring, to sustain themselves after the project is over.

- Systematic genetic improvement programmes such as the All India Coordinated Research Projects, implemented by the government and other institutions, usually lacked adequate links with sheep and goat rearers and their participation, and have not established community organisations.

- Small ruminant conservation projects funded by the Government of India have suffered from lack of clarity in objectives and inadequate planning, monitoring and evaluation. Further, no documentation of their impact was available.

- Programmes implemented by NGOs that were visited were found to have established community organisations and institutional frameworks for community involvement, at least for the project duration, but did not have a systematic goat/sheep genetic improvement component.

- A strong community organizational structure and improved level of awareness and empowerment of participants can provide a sound basis to start a community-based genetic improvement programme for the local breed, should this be warranted.

- There are smallholders, who are very particular about the breed and phenotypic features of the goats/sheep they rear, especially breeding males; on the other hand, there are others, who wish to cross-breed their animals with breeds other than the prevalent local breeds if they perceive that the crossbreds have higher productivity and market acceptance, which will improve their income.

- Often, cross-breeding among indigenous breeds is carried on by smallholders on their own initiative and goes on for years without any government or other institutional support or intervention. This has led to a number of community evolved goats and sheep with distinct characteristics.

- One of the major constraints faced by smallholders in goat production is the non-availability of good quality breeding bucks, especially in states such as Maharashtra where the majority of goats are reared by smallholders, with only one or two goats per family. This is not so much a constraint in sheep breeding because sheep are kept in larger flocks so flock owners can afford to have their own rams and there is a tradition of maintaining good breeding rams.

- The main constraint faced by smallholders in expanding the size of their enterprises is the paucity of resources such as space, surplus funds for investment and scarcity of grazing lands, as well as the lack of human resources to look after additional animals. The shortage of readily available guaranteed good quality animals is also a major constraint.

- Previous cross-breeding programmes, using highly productive exotic temperate breeds, have had an impact in some cases and have increased the production of commodities such as milk, meat and wool but this has mostly involved increased inputs. The crosses have also had problems with adaptation to stressful circumstances. Additionally, cross-breeding programmes have not been sustainable due to the absence of scientific selection and breeding strategies to restrict inbreeding and the difficulties of continued imports of germ-plasm. Owing to these reasons, small ruminant cross-breeding interventions have not made a widespread impact on the livelihoods or economy of smallholder livestock rearers.

- Cross-breeding is more likely to be beneficial to smallholders if more appropriate, hardy and productive breeds are used and networks of flocks for multiplying exotic breeds are established.

- The majority of sheep and goats in India belong to hitherto ‘un-described’ (usually referred to as non-descript) breeds or they are ‘local’ animals not necessarily belonging to a distinct group or breed. The constant emphasis on ‘breeds’ in the context of conservation or improvement programmes, therefore needs to be reconsidered. Instead of emphasizing ‘breed purity’, it is important to improve the existing adapted populations of various breed types in different parts of the country.

Policy issues and recommendations

- Good quality, reliable data on livestock and breed populations and trends over time is necessary for formulating appropriate livestock improvement policies. Currently, there is an absence of accurate data on small ruminant breed populations.

- Animal identification and simple field performance recording of indigenous animals needs to be started at least in selected priority systems because it will help identify genetically superior animals for use for further breeding. Goat, sheep and other livestock recording in such systems and areas should be made an integral part of the duties of community organizers (under various development programmes), self help group (SHG) leaders and Panchayat Raj Institutions (PRIs).

- Livestock conservation and improvement programmes should be seen as important parts of national and state policies, aimed at alleviating poverty and improving the food and nutrition security of a country, region or locality as also contributing to incomes of livestock rearers, particularly smallholders for whom livestock rearing is often the main livelihood activity.

- Livestock genetic improvement programmes should be treated as development programmes and their success measured in terms of indicators much broader than just genetic progress in the selection criteria used.

- Livestock keepers' community organizations are of vital importance for any genetic improvement programme for small ruminants in India and other developing countries. Ideally, these organizations should be established and nurtured for an adequate period of time (at least 2 years) prior to the commencement of a breeding programme. A participatory, bottom-up approach should be used to make these organizations viable in the medium and long term.

- The critical element in a genetic improvement programme is to have a holistic, integrated and participatory approach, and carry it out systematically, following all logical steps involved. Genetic improvement programmes also need to be integrated into a broader improvement approach that addresses disease risks and ways to increase the efficiency and profitability of feeding practices.

- The duration of a genetic improvement programme has to be at least 10 years and such programmes require strong institutional support.

- Genetic improvement, to be successful, usually needs to be accompanied by improvements in nutrition, health and management of livestock. However, whereas improvements in these other components of livestock production give short-term benefits and incur ongoing expenses, genetic improvement is permanent and is passed on from one generation to the next automatically so long as the improved animals are used for breeding and their progeny retained for further breeding. Genetic and environmental improvements thus have a synergistic relationship.

- Changes in the objectives, structure and direction of currently established ICAR programmes for small ruminant rearing will help to increase their effectiveness tremendously.

- Semen freezing and artificial insemination (AI) technology can be used effectively in goat breeding, to overcome the constraint of lack of good quality breeding bucks and the difficulty and economic non-viability of maintaining a buck for smallholders. This technology is not so practical for sheep breeding because of the way sheep are reared; also, the peculiar anatomy of the ewe's cervix makes laparoscopic insemination involving surgery necessary for a satisfactory

conception rate using frozen semen. It is not practical to carry out such a procedure under field conditions. This technology is, however, essential for *ex situ* conservation of both goats and sheep.

- Intensification of livestock production using more productive livestock genotypes together with other interventions can be an effective means of improving the livelihoods of some of the poorest farmers. Well-designed, cross-breeding schemes using more productive breeds that are also adapted to stressful conditions and feed shortages can yield improvement much faster than within-breed selection schemes.

- The best way to conserve a breed is to have it maintained by livestock owners and to have a long-term breeding programme for it, suitable to the livelihood and cultural needs of smallholders. Facilities for *ex situ in vitro* conservation should also be strengthened because it may not be possible to maintain all breeds/populations live in perpetuity.

1. Pro-poor Small Ruminant Breeding, Conservation and Improvement

The term 'livestock improvement' is used here to denote improvement of productivity or economic performance of individual animals, which is judged from a socio-economic viewpoint, taking into account both inputs and outputs. Livestock improvement encompasses genetic improvement through breeding, production and delivery of appropriate improved livestock genotypes and ensuring their sustainability. Rege *et al*. (2011) state that "animal breeding is pro-poor if it supports poor livestock keepers to get out of poverty and prevents progressive livestock keepers from falling back into poverty, considers the constraints specifically faced by poor livestock keepers and helps them to best use the existing asset base (land, livestock, intellectual and social capital and infrastructure) accessible to them." They also point out that pro-poor animal breeding is not necessarily only about genetic improvement; non-genetic interventions and concurrent development of effective technology, institutions and policies are required. Pro-poor genetic improvement also means that the breeding objectives of such a programme correspond with those of poor livestock keepers and that animals included in the improvement programme are reared under management conditions similar to those available with poor livestock keepers. This is to increase the chances of acceptance of improved animals by livestock keepers and the adaptation of improved animals to the harsh conditions, disease risk and deprivation they are likely to be exposed to with poor livestock keepers. Similarly, pro-poor livestock conservation strategies enable and empower smallholders to continue to use livestock for their livelihood, production, commercial and cultural needs. In this sense, *in situ* conservation can be termed as a pro-poor conservation strategy. However, when changing circumstances render it uneconomic, difficult or impossible for smallholders to continue to rear their livestock, *ex situ* conservation of well-adapted and productive local germ-plasm for the future is also a pro-poor conservation strategy.

Although there are success stories, breeding programmes in developing countries have too often failed and important lessons are to be learnt from both the successes and the failures. The reasons for failure range from the simple, for example, improved animals ending up being slaughtered for cultural or economic reasons, rather than used for breeding, lack of demand for genetically improved animals and shortage of financial and logistic resources, to the complex, for example, un-sustainability of breeding programmes, their scale being too small for impact, incompatibility of improvement programmes with the breeding objectives of livestock keepers, insufficient involvement of livestock keepers in programme development and inadequate consideration of prevailing constraints in the production system. There are too few accounts available that provide sufficient detail on an adequate number of generations to permit judgement about success or failure from a genetic improvement viewpoint. Cross-breeding programmes have also failed in many cases. Both the successes and the failures of past programmes strongly indicate the **need for systematic participatory approaches**.

Methods of Livestock Genetic Improvement

Within-breed improvement through selection and the use of between-breed diversity through cross-breeding or breed substitution are the two main methods of livestock genetic improvement. Selection within breeds or strains is intended to increase the average level of genetic merit of the population for the economic production of the final marketed product/s, for example, live lambs or goat meat. Objective within-breed selection usually involves measuring and selecting on the basis of productivity (for example, litter size, milk yield, growth of the young and size at maturity). Within-breed improvement through selection is necessarily fairly long term (at least 10 to 15 years to see appreciable results) because the achievable rate of genetic gain is low. Even with high accuracies of selection, resulting from new methods for managing field data and suitable models of analysis, the annual rate of genetic gain achieved in output per animal in dairy cattle in western free market countries was 1% (Cunningham, 2010).

In developing countries, with small flock sizes, large fluctuations in rearing conditions and management between flocks, and over time within a flock, lack of systematic livestock identification, inadequate recording of livestock performances and pedigrees, and constraints related to the subsistence nature of livestock rearing (where monetary profit is not the most important consideration), the accuracy of selection will be much lower, resulting in even lower rates of genetic gain. However, locally adapted breeds are likely to be highly variable and the highest performing animals of such breeds can have great productive potential. Therefore, the screening of livestock populations previously not subjected to systematic selection is likely to give quicker results to provide high genetic merit foundation stock for nucleus flocks.[1] This is because identifying animals of high production performance from a large (>5,000) population and bringing them together in one flock lifts the flock straightaway to a higher genetic level compared to the general population. This presumes accurate identification of superior animals in the field, based on their production performance, which may not always be possible. But the lower accuracy of selection can be compensated for by a higher selection intensity, through selecting only a small proportion of a large population for further breeding. Population screening for traits such as milk yield in goats or weight-for-age in goats and sheep (in the absence of birth date records, only after the age of 15–18 months, which can be estimated from the number of permanent teeth) can be done effectively by holding competitions and offering attractive prizes. The prize-winning, high-performance animals then have to be identified with ear tags and they or their progeny purchased for use for further breeding. Systematic recording and selection have to be continued in the nucleus, to achieve continuous genetic gain. Genetic improvement so achieved in the nucleus is disseminated to the flocks of livestock keepers by way of distribution of breeding males or semen. Improvement in production due to such genetic improvement can contribute to improved income and the livelihood of livestock keepers, who depend on low-input systems.

Cross-breeding with a more productive breed can yield faster improvement. However, an appropriate improver breed has to be available, which will adapt to the conditions where it is to be introduced. If it is a completely new introduction, it is better to conduct a trial and monitor the performance of crosses for a few years before undertaking large-scale cross-breeding. There are many other considerations such as ensuring supply of good quality animals of the improver breed, livestock keepers' acceptance of the improver breed, a distribution strategy of breeding males or semen, and a strategy for maintenance of the local breed so that it is not displaced completely by the crosses. Financial consideration is also important because it could be expensive to import the improver breed.

Genetic improvement, to be successful, usually needs to be accompanied by improvements in nutrition, health and management. However, while improvements in these other components of livestock production give short-term benefits and incur ongoing expenses, **genetic improvement is permanent** and is passed on from one generation to the next automatically so long as the improved animals are used for breeding and their selected progeny retained for further breeding. It is also true that improvements in components of livestock production other than genetics are **more effective and successful** in improving incomes and livelihoods **if** they are **accompanied by genetic improvement**. **Genetic and environmental improvements** thus have a **synergistic relationship**.

[1]Nucleus flock: It is not cost effective to include all animals in a breeding programme, on account of measurement and recording costs, and the difficulties of proper control. The solution is to concentrate effort on a relatively few elite breeding animals, referred to as a nucleus flock, and disseminate their superiority to the general population (base flock). Nucleus flocks are 'closed' if only animals from the nucleus flock can contribute to genetic improvement of the nucleus population, and are 'open' if sufficiently competitive animals from the general population are introduced into the nucleus on a regular basis. Open nucleus flocks have less inbreeding, and can benefit from the superior genetic potential of animals from the larger population, thereby yielding faster genetic progress.

Criteria for Prioritizing Production Systems for Genetic Improvement Interventions

Production systems where genetic improvement interventions are more likely to succeed are those:

- that have a high level of market orientation.
- that have a reasonably good resource base so that livestock are not ordinarily in danger of starvation.
- in which livestock keepers care about the quality of their livestock or about their distinctive features and make special effort to procure such livestock and maintain them reasonably well.
- in which livestock keepers have reasonably large flocks or are relatively well-off so that they are not likely to sell good breeding animals and are willing to incur a small amount of expenditure for inputs for the livestock.
- in which livestock keepers are literate and have a high level of awareness.

2. Major Small Ruminant Breed Improvement Interventions in India in the Past 30 Years

i. The Indo-Swiss Goat Development and Fodder Production Project (ISGP) was started in 1981 in Rajasthan, with the objective of improving goat production through genetic improvement and increasing fodder production. The project was formalized through an agreement between the governments of India and Switzerland and was implemented through the Rajasthan State Department of Animal Husbandry, with technical support from Intercooperation, Switzerland. Its main objective was to develop strategies for sustainable improvement of goat production in the semi-arid farming systems of Rajasthan in order to improve the income-generating capacity and nutrition of families belonging to the weaker sections of the rural community.

Phase I from 1981 to 1984 focused on building infrastructure at the Ramsar Farm, Ajmer (Rajasthan), to establish several exotic X local crossbred goat strains and distribute genetically superior bucks (Kropf, 1990). The 180-day milk yield of 178 Alpine[2] X Sirohi and 92 Toggenburg[3] X Sirohi goats at the Ramsar farm (160.3±4.0 kg and 160.9±4.8 kg, respectively) was only about 23% higher than the Sirohi at the Ramsar farm, and the kidding rate of the Sirohi (69%) was higher than the crosses (48%) (Kropf *et al*.1992). Based on these results, the **project decided that the 23% increase in milk yield of crosses was not enough to justify the investment and running cost of a large-scale, cross-breeding programme** and started to concentrate on selective breeding within the Sirohi breed. Following this, the project carried out the **first ever large-scale performance study of Sirohi goats at the field level**. Sirohi goats belonging to farmers were identified individually with ear tags. From 1988–91, milk records were measured monthly in 461 flocks. The average of 3,406 records of 60-day milk yield was 90±29.7 kg and the average of 2,860 records of 180-day lactation was 245.3±74.2 kg (de Groot *et al*., 1992). This milk production **performance** of the Sirohi **measured in the field** was **88.5% higher than** the least squares mean of 180-day lactation yield (130.1±3.1 kg) of 362 Sirohi goats kept **at the Ramsar farm** and was considerably **higher than previous published reports on the Sirohi** breed from small research station trials carried out by agricultural universities and research institutes. This is also a common observation in other programmes, in which the performance of animals kept at research stations is compared with those in livestock keepers' flocks. The reasons for better performance of animals in smallholder flocks may be genetic differences but are equally likely to be differences in management between owner-managed flocks compared to flocks managed by paid employees at organizational farms because owners often graze the animals for longer hours and take efforts to graze them on better pastures. Sirohi goat owners are particularly known for taking good care of their animals and providing the goats with ample concentrate feed. In another ISGP publication (ISGP, 1990B), an analysis of 433 lactations of 180-days each of Sirohi goats concluded that 35% of the lactations produced more than 300 kg and 9% produced more than 400 kg whereas the average was 269 kg. Goats with such high levels of milk production can be **considered 'elite' animals**. These findings confirmed the importance of the Sirohi as a well-adapted and well-performing, dual-purpose breed for semi-arid conditions.

[2] Alpine is a breed of domestic goat, known for its good milking ability. The breed originated in the French Alps. Alpine goats range in colour from white to grey to brown and black. Mature does weigh around 57 kg, and are about 0.8 m or 30 inches tall at the shoulder. *(Wikipedia)*

[3] The Toggenburg goat breed, named after the Toggenburg valley in Switzerland where the breed originated, is the oldest registered goat breed. Toggenburgs are medium in size, moderate in milk production and have relatively low fat content in their milk. *(Wikipedia)*

The ISGP, thus, proved for the first time in India that individual identification of goats and milk recording in the field was feasible, thus fulfilling an important condition for the establishment of a breeding programme.

A **'milk recording and buck rearing scheme' was introduced in 1989**. Buck kids from does with 180-day lactation yields of $\geq$ 300 kg were identified at 2–3 months age as potential breeding bucks and were purchased by ISGP straightaway or when they were one year old. In 1989–90, 139 such bucks were distributed for breeding. The project operated in **146 villages, with 677 goat keepers and 564 'poorest of the poor' goat keepers owning about 18,000 breedable does** (ISGP, 1990A). However, "the whole sector of small ruminants played only a marginal role in the state government livestock policy. This resulted in an almost total lack of ownership of ISGP by the Rajasthan Animal Husbandry Department. Finally, when concrete results and recommendations for the extension of the project were becoming available, the department had lost interest in the project and did not fulfil its obligations. By mutual consent, the project was prematurely terminated in 1992. Fortunately, the essential part of the know-how gained could be transferred to interested partners in the newly started NGO Programme Rajasthan" (Wieser *et al*., 2000).

ii. The All India Coordinated Research Project on Goats was started by ICAR in 1971 in the 4th Five Year Plan, with the objective of improving the efficiency of milk, meat and fibre production by cross-breeding indigenous breeds with other better-producing indigenous breeds or high yielding exotic breeds. Crossbreds were mostly reared under intensive conditions.

The following results were reported by Misra (1988):

- **Milk component**
  Malabari goats of Kerala were crossbred with the European dairy goat breeds Saanen[4] and Alpine in Thrissur, Kerala, with the objective of developing a milch goat suitable for the agro-climatic conditions of Kerala. The optimum level of exotic breed proportion was found to be 50%. Saanen X Malabari and Alpine X Malabari crosses were found to be superior to pure-bred Malabari in growth, survival, milk yield, fecundity and feed conversion efficiency. The Saanen X Malabari had an average lactation yield of 211.5 kg in 200 days, which was 147% higher than contemporary pure-bred Malabari goats. The Saanen X Malabari required 2.47 kg dry matter per kg milk produced, as compared to 2.71 kg for Alpine X Malabari and 3.54 kg for pure-bred Malabari goats. Thirty-nine cross-bred bucks were distributed to local farmers and development agencies. Artificial insemination with cross-bred buck semen was also made available and about 500 does were inseminated. However, there does not appear to have been any monitoring of the cross-bred animals with farmers. Nor was a suitable synthetic goat breed developed.

  The unit had problems with inbreeding because live animals or frozen semen of the exotic breeds could not be imported and presumably inbreeding was not controlled by maintaining an appropriate population structure. The difficulty with importing germ-plasm was on account of a ban imposed by the government on the import of live animals or semen of exotic dairy goat breeds since these were suspected to be carriers of the disease Caprine Arthritis Encephalitis (CAE). In 1988, it was recommended that the unit

[4] Saanen goats are a white breed of goat, named after the Saanen valley in Switzerland. Saanens are the largest of the dairy goat breeds in Europe. Does typically weigh 68 kg or more, and bucks weigh over 90 kg. The Saanen breed also produces the most milk on average, about 3.8 litres per day; the milk tends to have a lower fat content, about 2.5–3% (*Wikipedia*).

be phased out because it had run for a sufficiently long period and had generated enough basic data.

- **Meat component**
  The meat production performance of three north-western Indian goat breeds, Sirohi, Marwari and Kutchi, was evaluated at the Central Sheep and Wool Research Institute (CSWRI) in Avikanagar, Rajasthan. One of the major objectives was to compare the pure-bred performance of the three breeds under semi-intensive and intensive management systems, although intensive feeding is not the norm in the field. Perhaps this was to encourage intensive commercial goat rearing enterprises. The three breeds are, however, from different geographical areas with varying climate and other conditions and each breed is adapted to its distinctive environment.

  Under intensive feeding, the six-month body weight of Sirohi, Marwari and Kutchi male kids was 26.4, 24.7 and 25.4 kg, respectively. The feed conversion ratio of the Marwari was 7.24 kg dry matter per kg gain in body weight, which was lower than the other two breeds.

  Black Bengal goats were crossbred with the Beetal breed in Ranchi (now in the state of Jharkhand), with the objective of developing a composite meat breed suitable to the local agro-climatic conditions. Beetal X Black Bengal male kids achieved an average body weight of 14.7 kg at six months as against the target of 15 kg and this was 61% higher than pure-bred Black Bengal. The crosses also produced about 60% more milk than the Black Bengal and had 45.6% greater feed conversion efficiency than pure-breds. In farmers' flocks, the crosses were significantly heavier till three months of age. However, the difference between pure-breds and crosses was **not significant at six months** of age. The hot carcass weight of crosses was 28.7% higher than pure-breds but the dressing percentage and percentage of bone in the carcass were the same. The age at first kidding of the crosses was about 100 days higher than that of pure-breds. The conclusion was that the Beetal could be used as an improver breed in the Chhotanagpur plateau region and that a farmer could earn 70% more by rearing a cross-bred kid rather than a local pure-bred kid (Singh *et al*., 1989). No details of the economics are, however, given in the report.

  Two programmes were carried out for 'Genetic improvement of goats for meat production in farmers' flocks'—one among Marwari goats in Bikaner district in Rajasthan and one among Malwa goats in Mhow in the Indore district of Madhya Pradesh. These programmes were started in 1987, and were termed 'On-farm Client-oriented Research'. The average body weight of male Malwa kids under conventional range management conditions was reported to be 21.1 kg at 9 months in the Gavali Palasia village, District Indore. This was significantly higher than the 9-month weight of Malwa male kids (15 kg) in Simrol village, District Indore. This indicated the genetic variability available for selection.

  Marwari is a widely distributed breed, covering nearly the whole of Western Rajasthan. According to the programme document, superior germ-plasm was to be identified in farmers' flocks and improver flocks were to be formed. Male kids were to be selected from improver flocks on the basis of body weight at six months and milk yield of the doe, based on at least three consecutive milkings in the first month of lactation, and on **carcass traits 'if possible'**, giving preference to multiple-born kids over singles. Selected males were to be used for breeding in farmers' flocks. The meat production performance of the progeny of improved sires was to be evaluated. A report of this

project in 1997–98 (Progress Report, 1998), that is, 10 years later, listed its major achievements as:

a) Body weight and measurements of 1,522 goats were recorded for breed description.
b) Performance recording of 263 kids of 15 sires distributed the year before revealed that their weights were higher than their contemporaries but not significantly. (It is not clear whether the comparisons accounted for the probable environment and management differences between flocks).
c) Twenty-six bucks were purchased at the age of 6 months; their body weight was 7.1 kg above the population average. In 1996, the 6-month weight of selected bucks was 1.4 standard deviations above the population mean.
d) More than 6,000 goats were de-wormed and protected against ecto-parasites, and free treatment was given to about 4,000 goats.

It appears that the programme was well planned and had ambitious targets for the selection of male kids. It however seems that improver flocks were not formed and the selection of male kids was done only on the basis of 6-month body weight. It is also not clear how the males were to be evaluated for carcass traits if they were to be used for breeding. It also seems that proper genetic analyses of the data were not done. Therefore the extent of genetic progress was unclear even after 10 years. The programme also suffered from other constraints such as inadequate funds to purchase superior bucks and inability to recruit adequate and suitable staff.

- **Fibre component**
  Cross-breeding of goats of the Angora[5] breed was carried out at the Mahatma Phule Krishi Vidyapeeth in Rahuri, Maharashtra, to develop a composite Angora suitable for mohair production under local agro-climatic conditions. The **7/8 Angora** had **superior mohair yield and quality** compared to other genotypes although its **reproductive efficiency was poor**. Reciprocal cross-breeding of ¾ Angora and 7/8 Angora was, therefore, done. The technology of rearing Angora goats for mohair production was not accepted by farmers in the vicinity of the university. Commercialization of mohair production was not found to be a practical proposition because the quantity of mohair produced was too little.

"With the experience gained and information generated, it was decided to **abandon cross-breeding in the 8th Five Year Plan (1992–97)** and improve meat and milk production of indigenous breeds through **within-breed selection**" (Swarup and Singh, 2011). Institutional flocks (farm units) of Jamunapari, Barbari and Sirohi breeds were established in 1993—Jamunapari and Barbari flocks at the Central Institute for Research on Goats (CIRG), Makhdoom (Mathura), Uttar Pradesh, and the Sirohi flock at the CSWRI, Avikanagar (Tonk), Rajasthan. A field unit for Jamunapari goats was also established in 1993 in the Chakarnagar block of Etawah district of Uttar Pradesh, which is considered to be the home tract of this breed. The main objective of the farm-based units was to conduct selective breeding, and to improve the production and reproduction performance of the breed. The sub-objectives were:

a) To estimate genetic variance of economically important traits in goats (for example, body weight at birth, 3, 6, 9 and 12 months of age, milk yield, lactation duration)
b) To estimate the **breeding value** of male and female animals
c) To facilitate *in situ*/*ex situ* conservation of elite germ-plasm and its effective utilization

[5] The Angora goat is named after Ankara in Turkey, historically known as Angora. The original rearers of the Angora goats are the Kurds of Central Asia. Angora goats produce the lustrous fibre known as *mohair*. These goats are shorn twice a year, producing between four to five kilograms of hair each year. *(Wikipedia)*

d) To estimate production economics of goats under **farm conditions**
e) To validate farm-based goat production technologies under field conditions

The farm-based flock of Barbari goats at the CIRG had 342 adult females and 91 adult males on 31 March 2011 whereas the Jamunapari flock had 305 breeding females. The Sirohi unit at the CSWRI had 361 adult females and 52 adult males. These animals generally had good production performance. The Sirohi unit reported that the 6-month weight achieved was 20.8 kg against a target of 17.5 kg and 150-days milk yield was 112.2 kg against a target of 87.5 kg (CSWRI, 2011). The kidding percentage of the flock was 89.9% and the survivability was 97%. It is, however, not mentioned over what period the targets were achieved; nor was there an economic analysis. None of these units reported the breeding values of selected animals vis-à-vis the average breeding value, standardized selection differentials[6], selection intensities or generation intervals. It appears that proper genetic analyses of the data were not done and, therefore, genetic progress was not estimated. This is inexplicable because each unit has qualified scientists (quantitative geneticists) with PhDs in animal breeding. A proper assessment of the success of these genetic improvement programmes cannot, therefore, be made.

Bucks are sold from the farm units "to various agencies for breed improvement. Preference is given to various State government agencies" (Swarup and Singh, 2011). Only the Sirohi unit report has given a list of the places where bucks were supplied during 2010–11 (CSWRI, 2011). Twenty-two of the 63 bucks supplied were given to Uttarakhand, where the terrain, climate and other conditions are vastly different from Rajasthan, the home-state of the Sirohi breed. When providing bucks from such government-funded flocks established for genetic improvement, priority should be given to goat rearers in the areas where each breed is traditionally reared. There also needs to be some kind of a multiplier flock structure for distribution of bucks and a follow-up mechanism in place, to evaluate the performance of the bucks and their progeny. There are apparently **no guidelines on where the breeding animals should be distributed**. Efforts are not made to restrict distribution only to the traditional tracts of the breed and other suitable areas and production systems. Since 2006, 175 to 280 Barbari breeding bucks and 55 to 165 Jamunapari breeding bucks were supplied for breed improvement every year. Moreover, farm flocks are not open to the introduction of good quality animals from village flocks. Therefore, there is no opportunity of accessing genetically superior animals with smallholders to raise the genetic merit of the organized flock and reduce inbreeding.

Six field units for goats were established in 2001, based on flocks owned by smallholders and maintained under a village management system in the specific home tract of each breed. The objectives of the field-based units were:

a) To assess the production performance of goat breeds in farmers' flocks and improve the germ-plasm through selection
b) To evaluate the socio-economic status of goat breeders and the economics of goat production in farmers' flocks
c) To disseminate pro-poor, goat-based technologies under field conditions and assess their impact on goat production.

The field-based units were of the Black Bengal goat at Kolkata; the Ganjam in Bhubaneshwar (Odisha); the Jamunapari in Chakarnagar, Etawah district (Uttar Pradesh); the Marwari at Bikaner and Sirohi in Udaipur (Rajasthan); the Sangamneri in Rahuri (Maharashtra); the Surti in Navsari (Gujarat); and the Malabari at Thrissur in Kerala (Swarup and Singh, 2011). '*The*

[6] Superiority of the selected animals over all animals available for selection, expressed in standard deviation units.

*results of this project indicated that there was **substantial improvement** in meat and milk production of **goats in farmers' flocks** of different breeds'* (Swarup and Singh, 2011). However, there did not appear to be enough evidence for this statement. It was found that genetic and environmental influences on animal performance such as body weight or milk yield were not separated in the data analysis. Perhaps, this could not be done as full pedigree records were not available; in fact, individual animal identification was not done in some units. Trends of estimated genetic progress in important traits over time were not reported. The annual reports of individual field units were found to have reported phenotypic superiority of bucks selected for breeding, in body weight at a certain age compared to all available bucks (for example, 3 to 4 kg in 3-month body weight and 4 to 9 kg in doe's 90-day milk yield in the Sirohi breed unit). These should have been reported in standard deviation units for proper comparison.

Field units for the Assam Hill Goat in Guwahati, Black Bengal goat in Ranchi (Jharkhand), Gaddi goat in Palampur (Himachal Pradesh) and Osmanabadi goat in Phaltan (Maharashtra) were added in the 11th Five Year Plan in 2009–10 whereas the Jamunapari field unit was closed down as "most of the objectives (as stated above) were achieved" (Swarup and Singh, 2011).

The farm- and field-based units of various goat breeds have, thus, been in operation for 10–20 years (except the new field units that were established three years ago). Most field-based units have been operating in the same villages and with the same selected households over this period; although with fairly large numbers of goats. For example, the Sirohi field unit is recording the data of 787 goats belonging to 66 households in 15 villages in Udaipur; the Marwari field unit is recording the data of 3,427 goats in 119 households in four villages in Bikaner; and the 3-year-old Osmanabadi unit is recording the data of 814 goats belonging to 280 households in six villages in Maharashtra. However, because of the limitations of the technical programme, they are **not able to identify genetically superior genotypes from a wider area**. This is because a lot of detailed recording such as body measurements of kids at birth, and at 3, 6, 9 and 12 months is required. However, these records are not used for genetic evaluation. The Osmanabadi unit has established goat keepers' groups in the villages and has started giving them training in one- to two-hour sessions in the village once a week although the project does not include a training component (NARI, 2011).

Overall, these projects need to be made more community oriented and participatory approaches need to be introduced urgently. It must also be emphasized that genetic improvement of goats is the objective; and not data generation. The reporting formats need to be changed accordingly. Thorough periodic assessment and monitoring of the projects should be undertaken by independent, recognized assessors, who have knowledge and experience of both animal breeding and rural development.

***iii. The All India Coordinated Research Project (AICRP) on Sheep Breeding for fine wool and mutton*:**

The objective of this project was "cross-breeding of genetically low yielding indigenous sheep breeds with high yielding exotic sheep breeds such as Rambouillet[7] (wool and meat), Dorset[8] and Suffolk[9] (meat)" (Singh, 1986). This project was started during the **Fourth Plan (1969–74) and continued up to the Seventh Plan (1985–90)**. The exotic fine wool

[7] The Rambouillet breed was originally developed in France from Merino crosses with English long-wool breeds. It is a dual purpose breed, with superior wool and mutton characteristics. *(Wikipedia)*

[8] The Dorset or Dorset horned breed of sheep is known for its prolific lambing. Both horned and polled Dorsets are found, and are generally white, medium in size with good body length and muscle conformation to produce a desirable carcass. *(Wikipedia)*

[9] Suffolks were originally developed in England as a result of crossing Southdown rams with Norfolk horned ewes. The product of this cross was an improvement over both parent breeds. Suffolk sheep are primarily raised for meat. *(Wikipedia)*

breeds used for crossing were Rambouillet and the Soviet Merino. The objective was to develop new fine wool breeds suitable for different agro-climatic regions of the country, capable of producing 2.5 kg annual greasy fleece yield and weighing 35 kg at 2 years of age. Some of the new breeds/strains that were developed were Hissardale, Avikalin, Avivastra, Sandyno and Bharat Merino (CSWRI, 1998). **Wool quality improved appreciably** (that is, fibre diameter and medullation percentage reduced substantially) but wool yield increased only by 2–3% in Chokla and Nali crosses. F1 crosses of Nali and Chokla breeds had 22 to 51% lower average fibre diameter but about 18% lower staple length. The crosses also had lower reproductive performance than the indigenous breeds (Singh, 1986). There is no economic analysis available of the extent to which the improvement in wool quality could translate into higher prices for the wool, raising the total income from sheep rearing. The effect of these developments on smallholder sheep rearers was **probably negligible**. Wool prices in India have fallen considerably in recent years, due to the large-scale import of better quality wool whereas meat prices are increasing fast. Therefore, the importance of wool from the point of view of breeding for smallholders has declined sharply. In fact, in coarse wool breeds such as the Deccani, it costs more to shear the sheep than the income earned from the sale of wool.

The exotic mutton breeds selected for cross-breeding to increase mutton production were Suffolk and Dorset. These were crossed with the indigenous breeds, Malpura and Sonadi, in Avikanagar, Rajasthan, and with the Deccani in Rahuri, Maharashtra. A composite mutton breed called 'Mutton synthetic' was developed by pooling together crossbreds of Suffolk and Dorset with Malpura and Sonadi and stabilizing the exotic inheritance at 50%. Cross-breeding was found to be advantageous for improving mutton production under intensive feeding and management, as indicated by a 10–20% increase in 3- to 12- month weights, except for the Muzaffarnagari breed (Singh, 1986). Intensive fattening is, however, not the norm in field conditions. Kandasamy (2009) states that the success of cross-breeding with exotics for mutton was, at best, modest.

The Indian Society of Animal Genetics and Breeding recommended in its National Seminar in October 1992 that, "In view of the fact that cross-bred sheep have not shown desired improvement in the farmers' flocks, there is a need to assess their performance under farm and field conditions vis-à-vis indigenous breeds." Such a study does not appear to have been undertaken.

iv. The Network Project on Sheep Improvement (NWPSI) (Arora and Prince, 2011):

- This project was started by the ICAR in 1990 by changing the objectives of the AICRP on sheep breeding. According to Kandasamy (2009), this project appears to be a **tacit admission of the failure of cross-breeding for fine wool and mutton** in the arid and semi-arid and hot and humid agro-climatic regions of India. The duration of the project was until 31 March 2012, which was the end of the 11th Five Year Plan but the project has probably been continued into the 12th Plan. Its objectives were to carry out surveys to find out the status and performance of indigenous sheep breeds, genetic evaluation and genetic improvement of indigenous sheep breeds in the local environment. There are **six farm-based units**:
  - Chokla sheep for carpet wool at the CSWRI in Avikanagar, Rajasthan
  - Marwari sheep for carpet wool at the CSWRI Arid Region Campus in Bikaner, Rajasthan
  - Muzaffarnagari sheep for mutton and wool at the CIRG in Makhdoom (Mathura), Uttar Pradesh
  - Deccani sheep for mutton and wool at the Mahatma Phule Krishi Vidyapeeth in Rahuri, Maharashtra

- Nellore sheep for mutton at the Livestock Research Station of Sri Venkateswara Veterinary University, Tirupati, in Chittoor district, Andhra Pradesh
- Patanwadi sheep for mutton and carpet wool at the Sardarkrushinagar Dantiwada Agricultural University, District Banaskantha, Gujarat

Each of the farm-based units has an **open nucleus flock of 250 ewes**. It is not clear how the ewes are selected. For the carpet wool breeds Chokla and Marwari, ram lambs from the nucleus flock are selected at 6 months of age on an index of both body weight and wool weight; and for hair breeds used for meat such as the Nellore, ram lambs are selected only on body weight. It is not, however, clear whether these selection criteria were acceptable to sheep owners or whether they were arrived at after discussion with sheep rearers. Phenotypic selection differentials are mentioned but they are not adjusted for environmental factors such as whether the lamb was born as a single or twin and the age of the lamb's dam, making the comparisons invalid. Selection differentials need to be expressed in terms of estimated breeding values or standard deviation units. The preliminary selected ram lambs are mated to tester ewes (1 ram to 20 ewes) at 1.5 years of age. They are then selected further, based on the performance of their progeny (at which time the rams are 2.5 years old). The best 4–6 rams, selected again after progeny testing, are used for breeding in the **250-ewe improver flock**. The progeny of these progeny-tested rams are to be used as sires for shepherds' flocks, and female progeny are to be used as replacements in shepherds' flocks. However, the reports of the Chokla, Marwari, Muzaffarnagari, Deccani and Nellore sheep farm units in the project annual report (ibid., 2011) have no mention of progeny testing. They just say, "Each year, top 10–14 rams were selected for breeding **based on their own index score**." The Patanwadi unit report does not say how rams were selected. There was no planning of where the selected rams should be disseminated for maximum impact or monitoring of whether the disseminated rams indeed contributed to the improvement of productivity in base flocks or at least the shepherds' opinion of them. Selected rams were mostly sold to other 'projects' such as those funded by the Central Wool Development Board.

There are also four field-based units in operation:
- Magra sheep for carpet wool at the Rajasthan University for Veterinary and Animal Sciences in Bikaner, Rajasthan
- Madras Red sheep for mutton at the Tamil Nadu Veterinary and Animal Sciences University in Kattupakkam, Tamil Nadu
- Ganjam sheep for mutton at the Orissa Veterinary College of the Orissa University of Agriculture and Technology at Bhubaneswar, Odisha
- Deccani sheep for mutton at the Mahatma Phule Krishi Vidyapeeth at Rahuri, Maharashtra

Each field unit was to have four centres, one of which would be a ram rearing centre and the other three centres would work with at least 1,500 ewes per centre. These ewes would be placed in shepherds' flocks with at least 30–40 ewes per flock. Ram lambs were selected from these shepherds' flocks on the basis of body weight and wool weight at 6 months. The Ganjam sheep unit reported that the selected rams were 4.75 kg heavier at 6 months than their contemporaries. The Madras Red Sheep Unit reported 30%, 19% and 16% improvement in the 3-month, 6-month and 12-month weight of the experimental population over the base population over 16 years from 1993–94. The Magra unit reported a 3 kg higher weight of selected rams at 12 months of age and a 0.3 kg higher annual wool yield over the average of their contemporaries. The selected ram lambs were reared at the ram rearing centre and then distributed to shepherds' flocks during the breeding season. The progeny of these rams were recorded and the breeding value of the rams evaluated on the

basis of progeny performance. It is not clear whether each ram was to be tested only in one shepherd's flock or more than one and, if rams were moved from one flock to another, how the differences among flocks in the timing of the birth of lambs were accounted for. Progeny tested rams were then to be used extensively for genetic improvement programmes. Every year, at least 20% of all rams **were to be** replaced by superior rams selected from the field. The best rams were always to be allotted to certain identified flocks. About 20 to 84 rams were selected, purchased and distributed by the different units during 2010–11. The total amount spent on the programme during the 11th Plan was Rs.112 million.

v. ***The Mega Sheep Seed Project*** (Arora and Misra, 2011):
This project was started by ICAR in **2009 as a programme in the 11th Five Year Plan (2007–12)** and will probably be continued in the 12th Five Year Plan. It has the "objective of **producing around 80 breeding rams per breed of four sheep breeds (Mandya, Sonadi, Mecheri and Chhotanagpuri) every year** so that 8,000 breeding ewes of each of these breeds could be mated to these rams by the end of the 11th Plan in 2012," thus bringing about the improvement of these indigenous sheep breeds.

The project centres are located at State Veterinary Universities—Bidar, Karnataka for Mandya sheep; Bikaner, Rajasthan for Sonadi sheep; Chennai, Tamil Nadu for Mecheri sheep and Ranchi, Jharkhand for Chhotanagpuri sheep, with the co-ordinating unit based at the CSWRI, Avikanagar, Rajasthan. The project **envisaged the building up of a flock of about 500 ewes and 30 rams of each breed at the end of four years** to produce 'elite rams'. An amount of Rs.1.15 million was provided to each centre, to purchase sheep for the nucleus flock. It is not clear whether there were any criteria established for purchase of animals. The Sonadi, Mecheri and Chhotanagpuri units distributed 22, 42 and 60 rams, respectively, to registered farmers during 2010–11 whereas the **Mandya unit** reported that they **did not have an adequate number of ram lambs available on the farm and nor could breeding rams be procured in the field; therefore, no rams were distributed**. They also reported that the price of Mandya ewes, rams and hoggets[10] was very high; they could not, therefore, procure the requisite number of sheep from the field within the given amount.

The NWPSI and the mega sheep seed projects are steps in the right direction for improvement of indigenous breeds. However, they need to explore farmers' preferences and breeding objectives, ensure better participation of farmers in both planning and implementation, and establish community organisations or use existing community structures to support project work.

vi. ***A programme for the conservation of the Beetal goat breed in Punjab*** was jointly implemented from 2005 to 2008 by the National Bureau of Animal Genetic Resources (NBAGR) with the Krishi Vigyan Kendra (KVK) operated by the Society for Creation of Heaven on Earth, an NGO working in Tepla, Ambala (Pundir, 2010).

The objective of this programme was to **reverse the declining trend in the population of Beetal goats** since a survey conducted by NBAGR in 1997 showed the estimated Beetal population to be 20,800. The programme was carried out in 92 farmers' flocks in 41 villages. The different phases of the programme were:

- Recording of the growth and production of 176 selected does
- Identifying the best 100 does, from among these, based on growth, milk production and prolificacy

[10] Hogget: A young sheep of either sex from about 9 to 18 months of age (until it cuts two teeth).

- Selecting the best 50 male kids of these superior does (if they weighed >12.5 kg at weaning and the doe's average daily milk yield was >2.25 kg) and encouraging farmers to rear these to maturity.
- Sending the mature bucks to villages other than their original village, to use for breeding. This was done in order to control inbreeding. Each buck mated about 25 does.
- Repeating the above procedure in the second phase, 100 Beetal does, which showed good production performance, and belonged to 50 more farmers were identified. Forty-two male kids of these 100 does were raised to maturity and disseminated for breeding.
- Training was given to goat keepers in goat rearing, and booklets were published in Hindi and Punjabi, to describe a package of rearing and management practices for goat keepers.
- Regular vaccinations were administered to goats in selected villages
- Linking goat keepers to individuals, government and non-government organizations (NGOs) that wanted to purchase Beetal goats.

Five goat keepers, registered under the project, won state-level awards for good animals.

The booklet by Pundir (2010) claims that the project managed to demonstrate that Beetal goat rearing is profitable and, as a result, many new farmers started rearing Beetal goats. This has, however, not been substantiated by subsequent independent assessments.

3. Interventions in India for Conservation without a Breed Improvement Component

The Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, GoI, had a programme for the conservation of threatened breeds of small ruminants (and rabbits, pigs, pack animals and equines), for which an outlay of Rs.150 million was provided during the Tenth Plan (2002–07). Its objective was "to preserve the breeds of small ruminants, etc., which are on the verge of extinction by providing proper infrastructure and germ-plasm in association with State Governments and their undertakings, NGOs, professional bodies and institutes, private limited companies, etc." The Department intended to establish 18 units of small ruminants during the 10th Plan. However, funds were provided for the conservation of six goat breeds and four sheep breeds[11]. The goat breeds were: Terresa goat in the Andaman and Nicobar Islands, Malabari goat in Kerala, Sangamneri goat in Maharashtra, Black Bengal goat in Tripura and West Bengal, Jamunapari goat in Uttar Pradesh and the Long Haired goat in Nagaland. Of these, the Terresa and the Long Haired goat breeds are not registered. The sheep breeds were: Bandur in Karnataka, Madgyal in Maharashtra (not a registered breed) and Bonpala and Garole in West Bengal.

In the 11th Five Year Plan, Rs. 450 million was allotted for this programme. It was intended to support breeds with a declining population and an existing population of around 10,000 animals or less. Nucleus breeding units were to be supported along with 'strengthening of policy and institutional framework and linkages with research agencies'. In the annual report of the Department for 2010–11, funding to the Government of Gujarat for a nucleus breeding unit of the Surti goat is also mentioned. **No documented results are available on the impact** of this project.

There were no guidelines given to establish nucleus flocks, the recording and selection to be done in them and the distribution of animals from these flocks. There was no monitoring or evaluation of these units either.

[11] http://www.dadf.gov.in/dahd/upload/Annual%20Report(eng).pdf

4. Small Ruminant Breed Improvement Projects Implemented in Tropical Developing Countries Other than India

The following are some examples of acceptable results (by world standards of achievable genetic progress[12]) in well-targeted, within-breed selection and cross-breeding programmes in small ruminants in developing countries in the tropics.

i. The national sheep selection programme (Programme National de Selection Ovine—PNSO) in the Ivory Coast (Côte d'Ivoire) (Yapi-Gnaoré *et al*., 1997):

The drought in 1972–73 led the Government of *Côte d'Ivoire*, to declare animal agriculture as a high priority sector for development with an emphasis on short or medium reproductive cycle species. As a result, the PNSO programme was started in 1983**,** with the objectives of improving the growth and the live weight of the local Djallonké[13] sheep breed, which is a thin-tailed hair sheep breed of the tropical dwarf type, adapted to humid and sub-humid climates and believed to be trypanotolerant.[14] Up to 1998, the governments of Ivory Coast and France, and the EEC, through the European Development Fund, provided funding for the selection programme, which was an open nucleus breeding scheme. Since 1999**,** the programme is funded by the Government of Ivory Coast.

Extension activities among participating farmers were being carried out since 1977—six years before the programme was established—to improve its chances of success (Yapi-Gnaoré, 2000). The farmers, who were recognised as capable of keeping records of their flocks, correctly identifying their animals, following the prophylactic programme of the Ministry of Animal Production and providing supplementary feed to their animals during critical periods, were selected to participate in PNSO. **Selection was based on male individual weights at 80, 180 and 365 days of age** (without a correction for non-genetic factors). The farmers (low- to medium-input production system) participating in the PNSO were **required** to sell their best ram lambs to the central testing station and to castrate the others and only use rams provided by PNSO as breeding sires. Top ranking rams were distributed to farmers participating in PNSO whereas second category rams were provided to farmers outside PNSO. Annual genetic progress from 1984 to 1992 was 0.28% (28 gm/year) for the 80-day weight, 0.05% (11 gm/year) for 180-day weight and 0.04% (14 gm/year) for 365-day weight. Although this estimate of genetic progress is fairly low for these traits, **it is positive**. The low estimate of genetic response could be attributed to:

- Poor data recording in the PNSO (records from only 29 out of the 71 farms being available for analysis)
- Data representing only three to four generations of selection
- Selection of sires only, and not dams
- A high proportion of lambs with unknown sires because more than one sire was used in a group of ewes

[12] A breeding scheme aims at genetic improvement in the breeding goal through the selection of the best parents to produce the next generation. The **breeding goal** reflects the combination of traits that the breeder aims at improving through selection. The amount of genetic improvement in the breeding goal (and the underlying trait) depends on the **accuracy** of selection, the **intensity** of selection and the **generation interval**.

[13] The Djallonke sheep are known for their adaptation to the tropical hot and humid environment of West Asia where they originated. They are generally white although sometimes spotted with black or red colours. They have a wither height of 40-60 cm and a body weight of 20-30 kg. They are primarily reared for meat. *(Source: Animal Genetics Training Resource, ILRI and Swedish University of Agricultural Sciences)*

[14] Trypanotolerance: Ability of a few livestock breeds to survive, produce and reproduce in tsetse-trypanosome infected areas where other breeds cannot, without recourse to the use of chemical drugs. *(Source: International Trypanotolerance Centre, The Gambia, West Africa)*

- The stressful tropical environment leading to a reduction in the selection response due to natural selection
- Poor nutrition and inconsistent management in farmers' flocks, making it difficult for genetic potential to be expressed
- Declining selection pressure over the years due to the use of inferior or untested rams because of **the high demand for rams compared to the availability**

In 1999, 143 breeding farms were involved in the programme, with a total of 17,000 ewes. **The breeding nucleus had about 200 rams and no ewes**. The demand for breeding rams outstripped the supply. However, apparently the programme ended abruptly in the early 2000s due to the civil war (based on informal communication with persons working on other livestock improvement projects in Africa).

ii. The FARM Africa goat improvement project, using cross-breeding with the Toggenburg dairy goat breed in the eastern highlands of Kenya (Peacock *et al*., 2011)**:**
The exotic dairy goat breed, the Toggenburg, was introduced for cross-breeding with indigenous goats in order to increase their milk production and growth. The programme was designed to breed a dairy goat that was productive and fitted the needs of smallholder farmers, who had 1–2 acres of land and deficient feed resources. The programme enabled beneficiaries to sustainably produce more productive goats and, as a result, contributed to improved food security through the consumption of goat milk and an increased income from the sale of milk, breeding bucks and castrates. The **components of the programme that contributed to its success were affordable community-based animal health services, development of appropriate housing and adequate feed and in-built, farmer-managed breed improvement and multiplication of improved stock**.

The Toggenburg and its F1 and ¾ crosses with indigenous goats proved highly adaptable and had lactation yields of 480 to 500 kg in 190- to 225-day lactations. This means about 2.1 to 2.6 kg milk per day. In comparison, the daily milk yield of indigenous goats is reported to range between 300 gm to 1.5 kg for the Small East African goat and the Galla (Somali) goat, respectively. This project, later called the 'Goat model of FARM Africa', was started in 1996 in Kenya and later in Tanzania, Uganda and Ethiopia (Peacock, 2008). It is claimed that the sustainability of the 'goat model' was ensured by establishing farmer-managed organizations to provide support services and inputs, including veterinary care, breed improvement and training. The increase in the annual income of goat keepers is claimed to have been from less than $100 to over $1,000 (ibid., 2008).

iii. Development of the Dorper sheep and the improved Boer goat in South Africa (Ramsay *et al*., 2000): "The development of the Dorper sheep and the Improved Boer Goat are two of the most successful **long-term** livestock programmes in South Africa. The Dorper is a composite mutton sheep breed, developed through crossing an indigenous breed with a British mutton breed; the improved Boer goat was developed using a breeding strategy based largely on selection for fertility and meat production. Both breeds were developed for low-input production environments and both have subsequently been influenced by market preferences and trends as well as *'fancy points'* such as strict adherence to specific colour patterns, finer points of appearance and the type of 'cover' or fleece that often have no bearing on adaptive or production traits. Both breeds were also part of government-assisted programmes and both benefited from the establishment of a breed society and a national recording and evaluation scheme.

The main objective of the Dorper programme was to develop a hardy meat-producing sheep for the extensive production areas of the country. The breed was developed by crossing Dorset

Horn sheep with the fat-rumped black-headed Persian sheep, a local Somali sheep variety. The Grootfontein Research Institute of the Department of Agriculture played a major role in the further development of the breed. The overriding trait in the breeding programme was adaptability (improved ability to survive in unfavourable conditions, ability to reproduce regularly in these conditions and ability of lambs to grow rapidly to a marketable weight).

Although the numbers of the composite breed increased, progress was not as expected until a breed society was formed in 1950. As the popularity of the Dorper increased, its distribution widened from the more traditional arid and semi-arid areas to higher rainfall areas and semi-intensive production systems. Selection in these conditions as well as buyer preferences had an influence on breeding objectives and breed standards, which led to a change in the Dorper breed to an animal that was shorter-legged and more compact with an even distribution of fat and a short and smooth hair coat. Performance data showed that growth had also improved. Performance testing started to be used sensibly to facilitate a balance between reproduction and growth. Participation of breeders and breed societies in the new scheme increased rapidly. This was most encouraging and showed the breed society's commitment to on-going evaluation and improvement. These were, however, all large-scale producers/ranchers. "Modern breed evaluation techniques can enable those involved to predict trends for the major traits. This information should be used to avoid a skewed approach to production traits where adaptability might be compromised."

An exceptional local breed systematically selected for meat production is the Boer goat from South Africa. In the late 1920s and early 1930s, a few breeders focused breeding objectives on improved conformation for meat production, quality meat and the ability to browse. Colour selection followed and the typical white goat with a red head began to establish itself as the only meat goat in Africa. A Boer Goat Breeders' Association was formed in 1959. In 1970, a National Goat Performance Testing Scheme was started, as part of the mutton sheep performance testing scheme, and provided a framework to record and evaluate the performance of goats. The number of participants has fluctuated over the years. In 1975, there were **eight breeders with 500 does in the scheme whereas, in 2000, there were 12 breeders with 3,866 registered animals**. Although selection has largely concentrated on the ability to produce a saleable carcass off the *bushveld*,[15] there has been a tendency among some breeders to select for *'fancy points'*, some of which may be negatively correlated with more important adaptive traits. The improved Boer goat was developed with focused breeding objectives to fit into a specific environment. The development was very successful and the animals produce more meat per unit area than any other goat breed in a similar environment. The breed is also being used very successfully in semi-intensive smallholder systems in many countries (ibid., 2000).

[15] Bushveld *(pronounced as bushfelt)* originates from the Afrikaans word 'bosveld', which is composed of the words 'bos' meaning 'bush', and 'veld' meaning 'field'. It has become a generic term to refer to the wild, open and unpopulated spaces of Sub-Saharan Africa, though nowadays it is more specifically used to refer to game reserves. (*Source*: The Safari Guide)

5. Lessons to be Drawn from These Interventions

- Good quality reliable data on livestock and breed populations and trends over time as well as the drivers of these trends is necessary for formulating appropriate livestock improvement policies and their successful implementation.

- Field performance recording of indigenous animals can reveal their genetic production potential, which is largely unknown, and help to identify genetically superior individuals that should be used for further breeding. The larger the number of animals that can be recorded and screened, the higher the chances of successfully detecting superior individuals. Such recording, however, has to be kept as simple as possible.

- Most small ruminant improvement and conservation programmes of the government and the ICAR have not led to desired results, and have had limited focus on regular monitoring and evaluation. Also, small ruminant rearers were largely not involved in either the design or the subsequent implementation of these programmes.

- Cross-breeding with more productive breeds can lead to substantially higher incomes for smallholders if the programmes are planned and implemented properly, by choosing the most appropriate breeds for the production system, resource base and climate, and carrying out selection within the crossbred population. Further, livestock keepers should be trained to manage the cross-breds, and market linkages should be established to ensure sustainability of the programme.

- Livestock keepers' community organizations are of vital importance for any small ruminant genetic improvement programme, in which individual flocks are small. Ideally, these organizations should be established and nurtured for an adequate period of time (at least 2 years) prior to the commencement of a breeding programme. Livestock keepers should be integral to programme development from the discussion of the concept, through its planning, design and implementation. This will ensure their ownership of the programme, increase the likelihood of its success in the short term and pave the way for livestock keepers managing and taking forward the programme independently in the long run. It is critical to the success of such programmes that community organizations identify what traits small ruminant rearers perceive as valuable within their breed population and its production environment, and incorporate such traits in the breeding programmes, to fulfil community perceptions and requirements.

- Genetic improvement programmes for small ruminant production require strong institutional support and consistent policies over a minimum 10-year time horizon. Empowerment of livestock keepers should be central to all such programmes, involving rigorous training and capacity building, in technical and business practices. Since women play an important role in the rearing and management of small ruminants, their participation in all stages of programme development and institution building is essential for success.

- Breeding programmes for particular breeds should be carried out in an appropriate environment for that breed. Additionally, livestock keepers, who keep a particular breed in the specific native tract of the breed, should be the priority recipients of superior animals produced in a breeding programme for that breed. There should be clear guidelines on how the superior germ-plasm is to be disseminated.

- Artificial insemination technology can effectively achieve wider dissemination of improved goat genotypes. This technology may not be so appropriate in field conditions for sheep, considering the nature of sheep-rearing with large, frequently migratory flocks and breeding

rams always kept in the flock. Also, laparoscopic insemination is necessary to obtain high conception rates using frozen semen in sheep because of the anatomy of the cervix in the ewe. Laparoscopic insemination is a surgical procedure and it is not practical to carry this out in shepherds' flocks.

- Monitoring the performance of improved animals from a nucleus breeding flock after introduction into farmers' flocks needs to be an integral part of a breeding programme because such feedback can then guide the breeder as to the changes required in the breeding objective.

- Livestock improvement programmes should be treated as development programmes and their success measured in terms of indicators much broader than just genetic progress in the selection criteria used. For example, indicators could be increased household income or identification of animals giving higher yields under farmers' conditions and their wider use for breeding, creation of awareness among livestock keepers about animal identification, record keeping and better livestock management, creation of organizations of livestock rearers and their empowerment to run the organizations efficiently and implement performance recording programmes, and improved self-respect among small ruminant rearers.

Registered Breeds of Goat in India

Attapady Black

Barbari

Beetal

Berari

Black Bengal

Changthangi

Chegu

Gaddi

Ganjam

Gohilwadi

Jakhrana

Jamunapari

Kanni-adu

Konkan-Kanyal

Kutchi

Malabari

Marwari

Mehsana

Osmanabadi

Sangamneri

Sirohi

Surti

Zalawadi

6. Comparison of Populations of Various Small Ruminant Breeds in India

Reliable breed-wise small ruminant population data is still not available. A breed-level livestock census was carried out in 2007. The census report with state-wise estimated numbers of different livestock species is available on the website of the Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India (GOI, 2010). The population estimates for different breeds given below are from this census report. It is uncertain whether to consider these estimates as reliable because the official website http://dahd.nic.in/Default1.aspx that makes available a 'quick report search', displays a disclaimer at the top, which states:

> *"These Tables are generated based on the data provided by respective State Animal Husbandry Departments. However, NIC (National Informatics Centre) has made all efforts to ensure the accuracy of reports. Any discrepancy found in the data, is the responsibility of State Animal Husbandry Departments. The results are for internal vetting purpose and should not be used for any other purpose."*

Additionally, the relative breed population estimates should be considered in the context of human populations to which they provide a livelihood component. The changing environmental and land-use context for each breed is also important to put the breed population estimates in perspective.

According to the 2007 census, sheep population in the country increased by 16% from 2003 to 2007 and the goat population increased by 13%. Fifty per cent of the total goats were in five states—Rajasthan (15%), West Bengal (11%), Uttar Pradesh (10%), Maharashtra (7%) and Bihar (7%) whereas the three states of Andhra Pradesh (36%), Rajasthan (16%) and Karnataka (13%) accounted for 65% of the total sheep. The census figures also indicate that 51% of the total 68 million sheep in India and 63% of the total 140 million goats are 'non-descript' or 'unrecognized'.

There are 25 indigenous goat breeds (of which 23 are registered[16]), the population numbers of which are listed in the census and this list inexplicably includes the southern African Boer breed. It appears that the Black Bengal goat breed found in West Bengal, Jharkhand, Odisha, Bihar and Tripura is the most numerous breed in India, with a population of 20.9 million, followed by the Marwari goat breed of Western Rajasthan and Northern Gujarat, with a population of 7.6 million. These are followed by the Barbari of Uttar Pradesh with 3.2 million, Sirohi of Rajasthan with 2.9 million, Kannaiadu of Tamil Nadu with 2 million, Jakhrana of Rajasthan with 1.95 million, Osmanabadi of Maharashtra with 1.5 million and Jamunapari of Uttar Pradesh with 1.1 million. There are eight goat breeds with a population of 500 to 800 thousand each (Gaddi of Himachal Pradesh and Uttarakhand, Kodiadu of Tamil Nadu, Malabari of Kerala, Nandidurga of Karnataka and Kutchi, Mehsana, Surti and Zalawadi of Gujarat). There are another six goat breeds with populations of 150 – 400 thousand each (Beetal of Punjab, Changthangi and Khagani of Jammu and Kashmir, Ganjam of Odisha, Gohilwadi of Gujarat and Sangamneri of Maharashtra). The two breeds with the smallest populations close to endangerment are the Chegu of Himachal Pradesh (population 10,000) and the Attapadi Black of Kerala (population 7,700).

These figures, however, differ quite widely from those submitted by India to the FAO's Domestic Animal Diversity Information System (DAD-IS) online database[17] and other published reports. The Jakhrana, a breed found only in the Alwar region of eastern Rajasthan, was considered to be endangered (population 8,000 in 2004 as on the DAD-IS website). However, the livestock census 2007 reports its population to be 1.95 million! The Jamunapari breed was also considered endangered with a population of 5,000 in 2004, as per the DAD-IS database, but the livestock

[16] Registered as distinct breeds by the National Bureau of Animal Genetic Resources (NBAGR). <http://www.nbagr.res.in/reggoat.html>

[17] dad.fao.org

census 2007 reports its population to be 1.1 million. The extremely small number of pure-bred Jamunapari animals remaining was also confirmed by the Animal Husbandry Department of Uttar Pradesh (Ahlawat *et al*., 2009). The Barbari breed population in 1987 according to DAD-IS was about 80,000 and, according to the 2007 Census, it is 3.2 million. According to a survey done by NBAGR, the Beetal goat breed population in Punjab in 1997 was 20,800 (Pundir, 2010) whereas the 18th Livestock Census puts it as 66,446 in Punjab and 120 thousand in Haryana. The Sangamneri breed population, according to DAD-IS, was 40–60,000 in 1995, and the 2007 census reports it to be 210 thousand. Dr. Mandakmale from the Mahatma Phule Krishi Vidyapeeth (personal communication on 29th February 2012), the principal investigator of the Sangamneri field unit of the ICAR goat project, reported that there are now only about 10,000 pure Sangamneri goats left. He said the reasons for such a drastic reduction are a change in the priorities of goat keepers, leading to a change in the breed of goat maintained from Sangamneri, which is a milk breed, to meat breeds, relatively lower profitability of the Sangamneri because of less prolificacy and invasion of other breeds such as Sirohi.

With such huge discrepancies of population figures, it is more than likely that the breeds that need urgent efforts to boost their populations will be neglected.

There are 39 registered breeds of sheep[18] in India whereas there are population figures available for 42 indigenous sheep breeds in the 18th Livestock Census Report (GOI, 2010). However, of these 42, the Kashmir Merino and the Hissardale are crosses or synthetic breeds created using exotic breeds. The Nellore of Andhra Pradesh is the most numerous breed with a population of 6.2 million, followed by the Marwari with a population of 5.2 million. The Deccani is the third most numerous sheep breed, with an estimated population of 4.3 million of which 2.6 million are in Andhra Pradesh, 1.5 million in Karnataka and 250 thousand in Maharashtra. The 'Animal Genetic Resources of India' database released by the NBAGR stated the Deccani population only in Andhra Pradesh to be 4.34 million in 1982.

The most numerous breeds after the Deccani are Bellari in Karnataka, Jaisalmeri in Rajasthan and Mecheri and Ramnad White in Tamil Nadu with populations of 1.5 to 1.9 million each. The Madras Red from Tamil Nadu and the Nali from Rajasthan are next with a population of about 1.15 million each. There are five sheep breeds with populations of 500 to 650 thousand each: the Bonpala (West Bengal), Chokla (Rajasthan), Hassan (Karnataka), Kilakarsal (Tamil Nadu) and Patanwadi (Gujarat). Eight other sheep breeds have populations of 200 to 440 thousand each. These are: the Chhotanagpuri (Jharkhand), Gaddi (Himachal Pradesh and Uttarakhand), Garole (West Bengal), Kenguri and Mandya (Karnataka), Magra and Malpura (Rajasthan) and Vembur (Tamil Nadu). The Bolangir (Odisha), Doomba (Gujarat), Pugal and Sonadi (Rajasthan) are sheep breeds with populations of about 100 to 170 thousand each. There are three breeds with populations between 60,000 and 80,000. These are the Changthangi (Jammu and Kashmir), Coimbatore (Tamil Nadu) and Rampur Bushair (Himachal Pradesh). The Jalauni and Muzaffarnagari (Uttar Pradesh), the Poonchi (Jammu and Kashmir) and Shahabadi (Bihar) have populations between 20 and 50,000 each.

The Gurez (Jammu and Kashmir) and Nilgiri (Tamil Nadu) sheep breeds have populations between 11 and 17,000 each. The Karna breed from Jammu and Kashmir (J and K), with a population of 1,836, is at a high risk of extinction and the Bhakarwal breed also from J and K is nearly extinct with 78 animals. Another sheep breed, the Shapo from J and K has a population of only 450 according to DAD-IS. It is a matter of grave concern that at least three of the indigenous sheep breeds from Jammu and Kashmir (the Bhakarwal, Karna and Shapo) appear to be close to

[18] Registered as distinct breeds by the National Bureau of Animal Genetic Resources (NBAGR). <http://www.nbagr.res.in/regsheep.html>

extinction and others such as Gurez, Poonchi and Changthangi have relatively small populations. On the other hand, the number of exotic and cross-bred sheep in Jammu and Kashmir is 2.45 million. It is, therefore, clear that cross-breeding has been followed in this state without regard to conservation of the indigenous breeds. As these indigenous breeds are adapted to the high altitude, cold regions of the state, their extinction is a great loss to the state and the nation. Urgent efforts need to be made to at least freeze the semen and if possible, embryos of these breeds while some animals of these breeds are still alive. Efforts also need to be made to multiply numbers using the few remaining live animals.

Similar to the population figures for goat breeds, the sheep breed population figures also have some anomalies. Some examples of these are:

- The DAD-IS database gives the 'reliable' population estimate of Bonpala sheep as 1,349 in 2005, reduced from 30,000 in 1977 whereas the 18th Livestock Census gives an estimate of 600,000!
- According to DAD-IS, the population estimate of the Chokla breed was 20,000 in 2005 whereas the 18th Livestock Census reported this population estimate to be 580,000 in 2007.
- The Mandya sheep breed of Karnataka is known to be an endangered breed and yet the 18th Livestock Census reports its estimated population to be 300,000.
- The 18th Livestock Census reports the population of the Ganjam sheep breed from Odisha to be only 55, while the DAD-IS database gave the figure of 227 thousand for its population in 1977. There is a field unit of Ganjam sheep under the Network Project on Sheep Improvement and there is no mention in its report of the breed being close to extinction.

Such widely differing figures from different sources perhaps indicate that census enumerators are unable to differentiate between breeds. Under the circumstances, it might be wise to start improving the existing mixed populations, whether of a particular breed or not, through selective breeding for production performance.

The Origin of the 'Breed' Concept in Livestock and Its Use in India

There are many opinions on what constitutes a 'breed'. The dictionary definition of a breed is 'a stock of animals or plants within a species, having a distinctive appearance and typically having been developed by deliberate selection.'

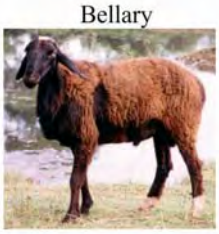
A broader definition at the other end of the spectrum, which brings out the cultural perspective of the term, is, 'a breed is a breed if enough people say it is' (Woolliams and Toro, 2007). In a study of literature, Woolliams and Toro concluded that the question, "What is a breed?" is a simple question but difficult to answer.

In India, with its vast diversity of livestock genetic resources, most of which have not yet been characterized, described and grouped into 'breeds', the concept of ***'breeds' should be used flexibly*** *and mainly for ease of organizing sustainable use and conservation programmes. For example, the 'Deccani' breed of sheep is a conglomeration of at least four strains that look different but which are all adapted to the stressful monsoon dependent environment of the Deccan plateau. It is, thus, a good example of the* ***'inclusive' use of the 'breed' concept****. On the other hand, restrictive use of the 'breed' concept with* ***excessive emphasis on finer points*** *of phenotypic features such as colour, type of hair and shape of horns is likely to leave large numbers of animals outside the purview of development projects, leading to a* ***loss of genetic diversity****. The FAO (2007) definition, which brings out the cultural aspect of the term 'breed' and is, therefore, more acceptable for India, is: 'a breed is either a sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species, or a group for which geographical and/or* ***cultural separation from phenotypically similar groups has led to acceptance of its separate identity****'.*

Registered Breeds of Sheep in India

Balangir

Bellary



Bhakarwal

Bonpala

Changthangi

Chokla

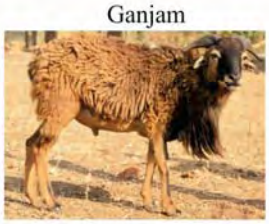
Chhotanagpuri

Coimbatore

Deccani

Gaddi

Ganjam



Garole

Gurez

Hassan

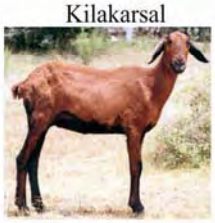
Jaisalmari

Jalauni

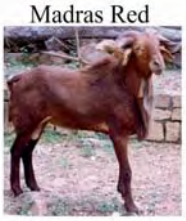
Karnah

Kenguri

Kilakarsal



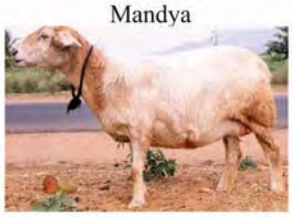
Madras Red



Magra

Malpura

Mandya



Marwari

Mecheri

Muzaffarnagri

Nali

Nellore

Nilgiri

Patanwadi

Poonchi

Pugal

Ramnad White

Rampur Bushair

Shahabadi

Sonadi

Tibetan

Tiruchi Black

Vembur

7. Other Interventions for Small Ruminant Breed Improvement and Conservation in India

In 2010, SA PPLPP issued a call to obtain information on small ruminant breed conservation and improvement interventions implemented by organizations in India. In response, information was received from **six organizations (Refer Annexure 1)**. As a part of this study, field sites of **four** of these interventions[19] were visited, and information was obtained about the remaining two from reports and other literature. Information was also obtained about five other interventions[20] through field visits either as a part of the current assignment or from previous visits.

It is **difficult to assess** the results and impact of the projects visited because **no baseline surveys** were done in any of the projects, and only a small sample of beneficiaries were visited in the given time-frame. Observations from the field visits are compiled below.

The interventions reported in Sections A and B attempted **breed improvement and conservation directly:**

A. Breed improvement through within-breed selection

i. ***The Malabari goat breed improvement programme (MGBIP) implemented by 11 NGOs in Kerala****:*

Malabari breeding bucks selected on the basis of phenotypic superiority for size and appearance were provided to clusters of goat-keeper families in villages (one buck per 25 families). These families mostly had local goats but some also had Malabari goats. Further, other breeding-related interventions such as buck selection, buck purchase, rotating bucks after one year to avoid inbreeding, record keeping, and selection and training of buck and doe keepers in management practices, including growing high protein fodder such as Azolla, were carried out.

The total number of households that benefited under the programme was 4,400 in 44 villages. Target villages were provided with 176 bucks purchased from the native tract of the Malabari goat in North Kerala. The bucks were purchased from farmers by knowledgeable officers from participating NGOs, with the help of government veterinary doctors, who assisted in their health certification.

Workshops, experience sharing and training were carried out to improve the knowledge of goat rearing of farmers involved in the programme.

Results and impact:

a) *Impact on the number and the quality of animals*: Information was not available to assess whether the MGBIP led to an increase in the number of goats reared. Both Malabari and local goats seen during the field visits in November 2011 were largely

[19]The Malabari Goat Breed Improvement Programme in Kerala; the Rotational Goat rearing scheme implemented by TANUVAS in Coimbatore; Heifer International supported goat rearing interventions in Rajasthan and Bihar; and Anthra's work on the conservation of the Deccani sheep breed in Maharashtra.

[20] The Saanen Goat Cross-breeding Programme implemented by the Rural Agricultural Institute, Narayangaon, Pune district, Maharashtra; Introduction of Rambouillet Merino sheep from the Central Sheep Breeding Farm, Hisar, Haryana into Karnataka; The Boer Goat Cross-breeding Programme implemented by the Maharashtra Goat and Sheep Research and Development Institute (MGSRDI), Phaltan, Maharashtra; Artificial insemination (AI) in goats implemented by Nimbkar Agricultural Research Institute (NARI) and MGSRDI, Phaltan, Maharashtra and by BAIF Development Research Foundation, Pune, Maharashtra.

very good. In many cases, it could not be ascertained whether these animals were the progeny or further generation descendants of the MGBIP bucks.

Malabari Goat,
District Wayanad

Local Goat,
District Wayanad

Local Goat,
District Kannur

Malabari Buck,
District Wayanad

The good impact of the project on the quality of animals was, however, evident in animals belonging to a few beneficiaries in Wayanad and Kannur districts. Representatives of the Kerala Gram Nirman Samiti, which carried out MGBIP in the Nilambur block, Malappuram district, said that the progeny and descendants of the Malabari bucks had greater height, weight and milk yield.

Malabari Goats, District Malappuram

b) *Impact on goat keepers' knowledge of goat management technology*: Most of the goat keepers visited had good knowledge of the fodder, supplementary feed, mineral and vitamin requirements of goats, as a result of the programme; they appeared to be giving adequate supplementary feed to their goats. There was a wide range of concentrate feed in use. Goat keepers used whatever was readily available and what they could afford. These included commercially available feed pellets for cattle/buffaloes (Rs 18 per kg), coconut oil cake (Rs 14 per kg), fish oil, groundnut cake (Rs 27–33 per kg), sesame oil cake, wheat flour and *rawa*[21] waste (Rs 14 per kg), maize grain powder (Rs 16 per kg), rice, rice gruel/porridge, tamarind (*puli*) seed powder. Some goat rearers were aware of herbal medicines. Although vaccination was found to be carried out only in one or two places, usually goat keepers reported that there was little disease or infection among the goats. This may be attributed to good management practices and the provision of good shelters.

Concentrate Feeding

c) *Impact on livelihoods of goat rearers and incomes earned by them*: The project provided good quality Malabari breeding bucks. The provision of a breeding buck, in itself, will ensure that the doe/s will conceive when in oestrus and become productive, provided the buck has satisfactory libido and fertility. This is important especially if a breeding buck was not available earlier. In order to assess the impact of the project, it needs to be

[21] Semolina or coarse, purified wheat middlings used in making Indian snacks such as *upma*. *(Wikipedia)*

decided how much of the production of the goat (milk or kid/s) is to be attributed to the availability of the buck for breeding.

The impact of such a project where genetic improvement is sought to be disseminated through breeding bucks will be apparent only when the progeny start producing themselves. This involves a delay of 2–2.5 years from the introduction of the breeding buck and mating of the existing does by the buck. Moreover, in the absence of animal identification and regular record keeping, it is not possible to assess the performance of the selected buck's progeny against that of other local bucks.

Any additional impact of such a project depends on the genetic superiority of the buck allotted by the project compared to the does owned by goat keepers. Half of the buck's genetic superiority will be passed on to its first generation progeny. In the absence of any information on the buck's pedigree and its own or its mother's or other relatives' performance, or the performance of the does already with goat keepers, it is not possible to predict whether breeding with the buck/s would improve the productivity of the progeny and to what extent.

Malabari Does with their Kids
Village Karavoor, District Kollam

Malabari Breeding Buck
Village Kozhichal, District Kannur

Of about 50 goat keepers visited, five had 4–10 does each and one had more than 30. All the rest had only one or two does. Any improvement in goat productivity will not have a large impact on the livelihood/income of those owners, who had only one or two goats. However, if the increase in productivity means that they get half to one litre of milk from their doe(s) daily it has a sizeable impact on the family's nutrition and well-being because they may not afford to buy that much milk at the price of Rs 25–30 per litre. Traditionally, goat milk is consumed within the household.

Sustainability of the intervention after project conclusion: Field visits under the current assignment were undertaken almost six years after the end of the project. Project activities at the cluster/group level had mostly ceased; they were going on at the individual level in some families. Some goat keepers were still rearing the progeny of the project bucks. Some, who had reared project bucks during the project, are still rearing breeding bucks and making them available for breeding, for a fee, with does in the area. Some say that the buck service fee covers the cost of buck feeding whereas others say they have to spend extra money. Usually, **buck service fee** is Rs 100 per doe but some goat keepers

Improved goat housing using locally available material

mentioned that the charge was Rs 150–200 and one goat-keeper (Ms. Gracie from Kodangara in the Parassala area of Thiruvananthapuram district) said the service charge for a good buck known to transmit good milking ability was Rs 300. When the project was in operation, cluster members were charged only Rs 25 to Rs 50 per buck service in some clusters whereas in the others, buck services were free for cluster members. Almost every goat-keeper visited had a raised and slatted floor goat house. One of the project activities, was the provision of **cheap and convenient goat houses** to accommodate 3 to 5 goats. These were found to be in use and obviously protect the goats effectively from heavy rain. The houses were kept clean, and all the goats seen were well-cared-for, with only one or two exceptions. One goat-keeper in Cheengeri village in Wayanad had built a spacious new wooden goat house with wooden feeders.


Wooden goat house with feeders, Village Cheengeri, District Wayanad

The goat and buck keepers appeared not to be aware of the importance of maintaining records. Nor did the NGOs have any records of the production performance of the goats belonging to project beneficiaries. They seemed unaware of what records should be maintained for breed improvement, and how they could be used. **The inadequate emphasis on recording hampered the assessment of the sustainability of the project**.


Daisy John
Village Cherikkathu,
District Kasaragod

Rema
Village Kenichira,
District Wayanad

A major achievement of the project has been the **empowerment of women** and the improvement in their status. During the visit, most women beneficiaries and community organisers that we met appeared knowledgeable, confident and enthusiastic about their work related to goat rearing.

<u>Did the intervention lead to the promotion and up-scaling of the Malabari goat breed?</u>

The MGBIP appeared to have certainly contributed to the promotion of the Malabari goat breed. Goat keepers had a favourable opinion about the Malabari breed in all the areas visited.[22] More goat keepers have started purchasing breeding bucks from the Malabari goat's native breeding tract in Kannur and Kasaragod districts. The purchase of breeding bucks by the project in itself led to an increase in the demand for good quality bucks, encouraging Malabari goat keepers in the native tract.

[22] Villages visited in Kerala: Anchal, Yeroor, Karavoor and Kottarakkara in Kollam district; Kodangara (Parassala) in Naiyyatingara *taluka*, Thiruvananthapuram district; Njettikulam, Kunnipala and Bhoodan Colony across the Chaliyar river in Nilambur block, Malappuram district; Cheeral, Cheengeri and Kenichira villages in Sultan Bathery *taluka*, Wayanad district; Thirumeni and Kozhichal in Kannoor district; and Cherikkathu, Kolichal *taluka*, Manimoola and Sankaranpady, Chengala *taluka* in Kasaragod district.

Community Perceptions regarding the Malabari Goat Breed

a. Are larger in size and more handsome.
b. Are more disease-resistant.
c. Can be sold for a higher price.
d. Give more milk of better quality.
e. Eat a larger variety of grasses and leaves
f. Medicinal value of their milk is, therefore, higher
g. Immunity of children raised on Malabari goat milk is higher
h. Have a lower fodder requirement
i. Give more kids, that is, triplets compared to twins
j. Have a higher kidding frequency (exact time period was not mentioned)
k. Have higher kid growth so kids can be sold quicker
l. Don't have horns
m. Have a docile temperament

However, many goat keepers rear local goats and are satisfied with their performance as well. ***All the above claims are anecdotal, since no records have been maintained.***

Malabari Goats

Local Goats

Key lessons learnt

A project such as the MGBIP has many of the ingredients for the successful promotion of a breed and improving its contribution to livelihoods. These are:

a) The project established **community organizations**, strengthened existing ones and empowered women livestock keepers.
b) The project chose an indigenous adapted goat breed for promotion.

The promotion of animal identification and record keeping by goat owners would have contributed additionally to breed improvement and selection of better animals for dissemination for breeding. Records of the progeny of bucks would help to assess the genetic merit of bucks, for traits considered to be economically important. If records are available, the breeding value of the bucks can be calculated easily. It is twice the mean deviation of the progeny from the population mean (Falconer, 1986). The breeding value can give a valuable estimate of the genetic merit of a buck and it is essential to calculate it for a project like this. It is, therefore, essential that goat and other livestock recording are made an integral part of the duties of community organizers, SHG leaders and PRIs.

In Kerala, it rains 3,000–4,000 mm every year. Yet, there is a **fodder/feed shortage in summer**. The under-nourishment of goats leads to higher susceptibility to disease. Therefore, alternatives need to be promoted such as planting of fodder trees for use in summer, developing and supplying dryers to dry forage and tree leaves appropriately in the monsoon so that they retain their nutritive content and can be stored for summer. Therefore, an integrated programme **for improvement in health, nutrition and breeding** is needed.

The high rainfall and long rainy season make it necessary for goats to have adequate shelter. MGBIP promoted appropriate goat houses, built with locally available material, and these were found to have contributed substantially to the health and well-being of animals.

MGBIP was started in 2001; SDC-IC announced in 2003 that it was going to phase out the project and it ended in 2005. Genetic improvement by selection is a slow process and, therefore, breed improvement programmes should ideally run for a period of 7 to 10 years. **Ending such programmes abruptly, severely erodes potential gains and adversely affects sustainability of interventions.**

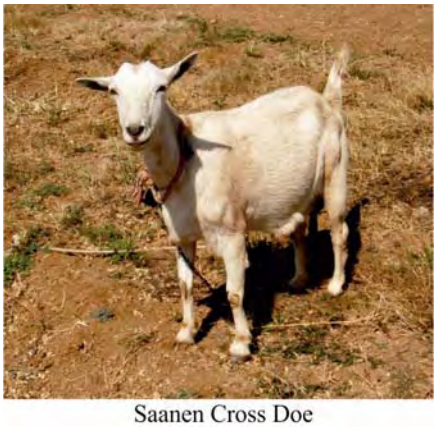
B. Breed improvement through cross-breeding

B1. Cross-breeding with indigenous breeds

***Sirohi goat cross-breeding programme implemented by NIRDESH, Bihar*:** The details of this programme are given in section D1(i). This programme was not a success on account of almost 90% mortality of Sirohi goats purchased from Uttar Pradesh and introduced in the programme areas in Bihar (in the districts of Madhubani, Raxaul and East Champaran).

B2. Cross-breeding with exotic breeds/introduction of high-yielding breeds

i. *Development of the twinning Deccani (NARI Suwarna) sheep with the introduction of the FecB (Booroola) mutation for higher prolificacy from the Garole breed of West Bengal through cross-breeding and selection by the Nimbkar Agricultural Research Institute (NARI) Phaltan, District Satara, Maharashtra:*
This intervention has been documented separately by SA PPLPP. It made opportunistic use of the sophisticated technology of *FecB* gene detection by using a blood sample of sheep and has developed a more productive Deccani sheep with an average litter size of 1.6 (compared to 1.0 for the Deccani) and the ability to rear twin lambs, adapted to the climate of the Deccan plateau. The project has also developed a package of management practices to be followed to maximize the income from the twinning Deccani. A number of smallholder shepherds in the vicinity of Phaltan and some smallholders in Andhra Pradesh and Tamil Nadu have adopted the technology. The continuance of the mutation in the sheep population is ensured, provided ewes and rams carrying the mutation are retained and used for further breeding.


Saanen Cross Doe at Narayangaon

ii. *The Saanen goat cross-breeding programme implemented by the Rural Agricultural Institute, Narayangaon (RAIN), Pune District, Maharashtra*.
Saanen goats were imported by RAIN from England, Israel and Australia between 1977 and 1988. A stall-fed flock of Saanen and cross-bred goats was established, and cross-breeding of local farmers' goats with Saanen bucks (through natural service) was carried out. In about 20 years, 7,000 local does were cross-bred with Saanen bucks and 1,200 breeding bucks, either pure-bred Saanen or crosses with >75% Saanen proportion, were supplied throughout India. About 20% of the goat owners within a 20 km radius of the Institute adopted Saanen-cross-breeding of their does. Saanen cross does were found to yield 2–3 litres milk per day or 300 litres per lactation compared to about 60 litres yielded by local does. All farmers visited (in 2011, over 30 years since the programme started) were of the opinion that Saanen cross goats have a good milk yield. A few farmers sell goat milk

at Rs 35 per litre whereas some mix it with cow milk and get Rs 18 per litre. It is difficult to assess comparative rearing costs for Saanen cross compared to local goats because no records were available. Most Saanen cross goats are tethered by the road side and on field bunds. Sometimes weeds removed from crops are fed to them. Most goat keepers give about 500 gm *lucerne* per day per goat to local as well as Saanen cross goats. They also said that Saanen cross goats are easier to manage unlike other goats and they perform well under stall-fed conditions. Most goat keepers thought that the response to extra feeding is better in Saanen cross goats compared to local goats. One farmer, however, mentioned that Saanen cross goats cannot withstand the hot sun.


Saanen Cross Goat

Cross-breeding with Saanen still continues but RAIN has been unable to import new Saanen does or bucks since 1988. They imported 8 Saanen goats from Israel in 1999 with a proper import licence from the Directorate General of Foreign Trade, GoI (dated 13 November 1997, revalidated on 13 November 1998 up to 12 May 1999) but these goats were destroyed (killed) by the quarantine officer at Mumbai airport, citing a GoI notification of 21 September 1998, banning import of livestock from countries such as Israel and the U.S.A. which have reported Transmissible Spongiform Encephalopathy (TSE) group of diseases. The programme is now encountering problems of inbreeding on account of the failed import and because appropriate selection and breeding strategies were not used in the nucleus flock from the beginning to control inbreeding.

The main findings from the visit to RAIN were:

- Some local goat keepers still have excellent Saanen cross does, yielding 2 to 3 litres milk per day, with some lactating continuously up to one year without conceiving.
- Most of the owners of Saanen cross goats are relatively well-to-do farmers although they do not possess large landholdings. It, therefore, appears that the better management and feeding required by Saanen cross-bred does to yield reasonably high quantities of milk cannot be provided by poor or marginal farmers. Thus, it is mainly the relatively better-off farmers, who are taking advantage of the improved cross-bred germ-plasm.
- A distinct characteristic of Saanen cross-bred goats, mentioned by their owners, is the 'companionship' benefits of Saanen cross goats as compared to local goats, referring to the greater tameness and affectionate nature of the Saanen cross goats as compared to local goats.

A major learning from this intervention is that when a breed is imported from another country, further imports have to be made at regular intervals to control inbreeding or a programme and population structure devised to minimize inbreeding. Importing requires considerable investment of financial and other resources. Further, the import of live animals is increasingly subject to more stringent restrictions.

iii. *Introduction of Rambouillet Merino sheep in Karnataka from the Central Sheep Breeding Farm, Hisar, Haryana*:
American Rambouillet Merino sheep are reared at the Central Sheep Breeding Farm at Hisar in Haryana and Rambouillet X Nali rams are supplied mainly to state governments. Traders in the Bangalore region in Karnataka purchase these cross-bred rams and supply them to progressive farmers, who have set up stall-fed sheep farms. It is estimated that about 50 farmers in 20 villages would


Stall-fed Rambouillet Cross Sheep

have tried this exotic cross-breed and about 25 farmers continue rearing it. They find it profitable to sell 4–5 month-old sheep, weighing 20–25 kg for Rs 5,000 each. However, no poor or marginal farmers were found to rear cross-bred sheep. The high initial investment needed, stall-feeding costs and the higher risk are factors that prohibit small farmers from taking up cross-breeding with the Rambouillet Merino.

iv. *The Boer goat cross-breeding programme implemented by the Maharashtra Goat and Sheep Research and Development Institute (MGSRDI), Phaltan, Maharashtra*:

Boer cross local goat
Zadak baichi wadi, District Satara

MGSRDI has been providing the germ-plasm of the Boer goat breed in India since 1994. The Boer goat breed was developed in South Africa and is considered to be the world's best meat goat breed, combining high productivity and hardiness. Boer goats are able to thrive in a wide range of climatic conditions and are well-suited to stall-feeding, and can also be kept under smallholder management conditions. This has been amply demonstrated by the experience of many smallholder farmers and landless labourers, who get their does cross-bred with Boer bucks from MGSRDI. Cross-bred Boer kids born to local does grow fast and vigorously and are sold for lucrative prices, either for breeding or for slaughter. Boer X Local kids with smallholder goat keepers have been observed to weigh about 25 kg at 6 months and with better feeding, they weigh more than 30 kg at 6 months. When the Boer was first introduced in the Phaltan area of Maharashtra in 1994, local butchers would not buy Boer cross-bred kids. However, now the sign-boards of many mutton shops in Pune and Hyderabad have pictures of Boer bucks on them. The change is probably because Boer goats are fairly widespread now and butchers have found their meat to be of acceptable or even desirable quality. Mr. and Mrs. Sambhaji Nivrutti Donde of Rajale village in the Phaltan *taluka* of Satara district get their local does inseminated with the Boer cross buck kept in Rajale by MGSRDI. One of their does gave birth to three male kids in March 2011; at the age of 4 months, the kids weighed 32, 31 and 28 kg respectively and were sold for Rs 4,000 each. They were reared on cow's milk since the doe did not have enough milk for three kids. Boer has thus proved to be a hardy, suitable improver breed for goat keepers, who wish to earn a higher income through the greater weight and better meat conformation achieved by cross-breeding their goats with the Boer.

Mr and Mrs Sambhaji Donde with their doe and its Boer-cross kids

Mr and Mrs Tanaji Dinkar Dhembare of Wadjal village with their local doe and its Boer crossbred kids

v. *AI in goats implemented by NARI and MGSRDI, Phaltan, Maharashtra:*


Boer Buck

NARI and MGSRDI jointly started offering AI in goats at NARI's Wadjal farm in 1994, with fresh, diluted Boer buck semen, using a simple cervical insemination method appropriate to field conditions. Now local goat keepers bring their does in oestrus to any of the three NARI farms. The does are inseminated with either Boer or Osmanabadi buck semen, according to the goat owner's choice. The cost of AI is Rs 75 per insemination (the price is the same for Boer and Osmanabadi buck semen); a repeat insemination is given without any additional charge if the doe does not conceive and is brought back for AI in the next cycle. Good quality bucks of these two breeds are currently available. Selected Osmanabadi bucks were purchased under the Osmanabadi field unit of the All India Coordinated Research Project on Goat Improvement of ICAR and were, therefore, available. They were selected from four districts of Maharashtra on the basis of their own growth rates, their dams' milk yield and conformity to phenotypic features preferred by discerning Osmanabadi goat keepers. More than **4,200 local does** have been inseminated up to September 2011 with an **overall conception rate of 44%**. The conception rate **increased to 65%** during 2010–11 due to correct protocols being followed by technicians and their improved skill, resulting from several years of experience.


AI in Goats


Osmanabadi Buck

NARI and MGSRDI also freeze Boer and Osmanabadi buck semen in pellet form and carry out inseminations with frozen semen. About 450 local does have been inseminated with Boer goat frozen semen pellets so far. A well-equipped laboratory to freeze buck semen in straws is being established at NARI with a grant from GoI (Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries) and will be fully functional by the end of 2012. It has however, already started freezing buck semen in straws on a small scale. AI will be easier with the use of frozen semen straws and AI guns, thereby reducing the chances of contamination. Further, the frozen semen straw technology will permit one person to do the AI as compared to two people now needed for AI using a semen pellet (one to do the AI and one to hand over the glass pipette with the semen to the inseminator). A **40–50% conception rate can be expected with frozen semen**. The Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST) in Srinagar took 500 pellets of Boer goat frozen semen from MGSRDI in March 2008. MGSRDI also imparted training in AI technology to three technical staff members of SKUAST. SKUAST wrote a letter (No. AU/SRS/Boer Semen/273) on 8 July 2009 to MGSRDI to report a 76% conception rate of the Boer buck


A farmer taking his goat for AI to the NARI Farm, Phaltan, Maharashtra

frozen semen. Other agencies such as various state government animal husbandry departments (for example, Odisha, Madhya Pradesh), the Tamil Nadu Veterinary and Animal Science University, many local AI technicians, who offer a mobile goat and cow AI service, and many goat-keeper farmers have also taken Boer goat frozen semen pellets from MGSRDI over the years.

vi. *Goat AI implemented by BAIF Development Research Foundation, Pune, Maharashtra*:

BAIF started AI in goats in 2003 but this programme has now been discontinued and buck semen is not available with BAIF now. The technicians who do AI of cattle and buffaloes, used to do the AI of goats also. The charges were Rs 50 per insemination. Eight villages in the Kopargaon area in Ahmednagar district in Maharashtra, where BAIF's goat AI programme was implemented, were visited in November 2011. Goat keepers had 1–3 local does per household. These does were tethered and stall-fed. There is **a severe shortage of breeding bucks** in this area. Sometimes, goat keepers have to take their does in oestrus over a distance of 5 km for mating. Does belonging to a few of the goat owners were found to be empty for almost a year due to the unavailability of breeding bucks. On the day of the visit, two women goat owners asked for buck semen as their does were in oestrus that day. The charges for a natural buck service are Rs 80–100 or approximately 5 kg grain. AI technicians said that the conception rate achieved was 30% but this could not be confirmed because proper follow-up of inseminated does was not done and no records were available. Findings from the visit indicated the **high demand for breeding bucks and for AI services**.


Kids born through AI,
Kopargaon, District Ahmednagar

During the visit to Kerala, it was found that the Kerala Livestock Development Board had made available Malabari buck frozen semen at state government veterinary clinics from about 2010 and there was good demand for AI. The charge was Rs 20 per AI. A government veterinarian in the Nilambur block of Malappuram district mentioned during the visit in November 2011 that she had finished the stock of buck semen with her, and had not received any supply for over a month.

C. Breed conservation through awareness creation and knowledge dissemination to Deccani sheep rearers, implemented by Anthra in Maharashtra and Andhra Pradesh.


Madgyal Ram

The Deccani is a wool sheep breed traditionally reared on the Deccan plateau in Maharashtra, Karnataka and Andhra Pradesh. This is a **hardy breed adapted to long migration and seasonal feed shortage**. Over the last 15–20 years, Deccani sheep rearers have started crossing their Deccani sheep in Maharashtra with rams of the taller and


A flock of the Lonand strain of Deccani Sheep

heavier Madgyal (Wijapuri) breed from Southern Maharashtra and adjacent parts of Karnataka, with Nellore rams in Andhra Pradesh and with the Yelugu (Kenguri) breed in Karnataka. This is due to the **perceived higher meat yield** from the larger sized Madgyal, Nellore and Yelugu breeds and the **sharp increase in the price of meat** leading to an increase in the price received by sheep rearers for lambs and adults and a **decline in the price of wool**. According to Anthra (2008), the Andhra Pradesh State Animal Husbandry Department encouraged shepherds to replace their Deccani breed with heavier non-wool sheep breeds. The conversion rates from pure-bred Deccani to cross-bred Deccani X Nellore vary from 40% to 100% in different districts and villages of Andhra Pradesh (Aebi, 2009). The larger breeds need more feed and are perceived to be more susceptible to disease and infection and less capable of coping with long migration. As they are hair sheep and do not have any wool, cross-breeding has adversely affected the wool-based weaving enterprises in these areas. Anthra has, therefore, undertaken a programme to convince the shepherds to keep only Deccani rather than other breeds (rams and ewes) in their flocks. Anthra's interventions promote the **formation of shepherd groups,** and encourage them to take up collective action to address their problems. Anthra ensures that information and technical support reach shepherds and shepherds discuss strategies to improve the health of their sheep and goats, preserve local animal genetic resources, **address issues related to access to water and pastures, and access services from the government veterinary department** and private veterinarians/para-vets (ibid, 2008). These interventions are being carried out since 2004. A visit was made to participating shepherd flocks in the Satara and Solapur districts in Maharashtra. Visits could not be organized to the Medak district of Andhra Pradesh where Anthra is similarly working on the conservation of the Deccani sheep.

Results and impact

i. *Impact on the quality of animals and conservation of the Deccani breed :*

Lonand Deccani Sheep in Bhadali, Phaltan, Maharashtra

According to Anthra, black is the dominant colour of the Deccani (ibid., 2008). Observations during the field visits, however, revealed that the sheep in the Bhadali area in Phaltan taluka in Satara district were Lonand Deccani and were predominantly white, with a small proportion of brown and black animals. There were multi-coloured sheep also, with spots and patches of brown and black on a white background. Some of the shepherds interviewed were found to be definitely convinced about the wisdom of maintaining only Deccani ewes and rams (Lonand Deccani in the Bhadali and Wai areas of Satara district and black Deccani in Alankapuri area of Solapur district), whereas others have pure Madgyal or Madgyal cross rams. Shepherds owning both types seem equally happy with their animals. It was evident that the general trend in all the visited areas among shepherds is still towards the use of Madgyal or Madgyal cross rams. Barring a few exceptions, shepherds associated with Anthra and also those not associated with

Black Deccani in District Solapur

Madgyal Cross Ram

Anthra were found to be strongly attracted to the Madgyal breed because Madgyal cross lambs grow faster and earn a higher sale price than Deccani lambs. Aebi (2009) also found varying opinions about the Deccani and Nellore breeds among shepherds in Andhra Pradesh. Some of the shepherds she questioned were convinced that the Nellore sheep would disappear due to their greater susceptibility to diseases whereas others felt that cross-breeding would continue, favouring the Nellore breed. She found that sometimes shepherds from villages where Anthra was working favoured cross-breeding their ewes with Nellore rams whereas shepherds from other villages where Anthra had not spread their message, opted for the Deccani breed. The Deccani breed competitions held by Anthra have promoted enthusiasm among the shepherds to rear Deccani sheep, and having an animal from their flock/s win a prize has become a source of pride for them. Anthra's efforts have also generated local and national interest in the Deccani (ibid, 2008).

Aebi (2009) has reported her study of 10 shepherds' flocks in Andhra Pradesh—three Deccani, four Nellore X Deccani and two Nellore flocks. She found that Nellore and Nellore X Deccani ewes lambed just as frequently as Deccani ewes. Nellore flocks usually seemed to have higher lamb and ewe morbidity and mortality, whereas Deccani flocks had lower ewe mortality; Nellore X Deccani flocks had lower lamb mortality. There were considerable variations in the gross income, expenditure and net income from the flocks of different breeds. The Nellore flocks had a slightly greater gross and net income whereas the Deccani flocks appeared to have a low expenditure. Aebi (2009) further stated that because the Deccani breed has lower feed and management requirements, it would be wiser for the economically weak and insecure households, typically small and marginal land holders, women and landless labourers to rear the Deccani breed. According to her, shortage of fodder is the major constraint to sheep rearing in these areas, and changing the breed by cross-breeding has sharpened rather than mitigated this crisis.

In Maharashtra, shepherds give extra feed in the form of a concentrate to their animals whereas this is not the practice in Andhra Pradesh, according to an Anthra worker. The concentrate is usually grain such as sorghum, maize or wheat or a high protein concentrate such as groundnut cake.


Concentrate Feeding

ii. <u>*Impact on livelihoods of sheep rearers*</u>: As per information provided by Anthra "The intervention has reduced the mortality and morbidity of sheep and goats considerably through **regular preventive and curative health interventions and better management and feeding practices** thus resulting in reduced losses and increase in incomes". It also states that "the community is able to take **collective action** for accessing timely vaccinations and de-worming medicines from government veterinary hospitals." Shepherds in Satara and Solapur districts appeared to be well aware of which vaccines to use and how to access them both through government veterinarians and privately. They also had **stocks of antibiotic and ayurvedic medicines** and could use them as required. They **contact**ed Anthra staff **by telephone** to enquire about the treatment of specific problems and administered these either themselves or took the help of private veterinarians.

During the visits, it was evident that the shepherd families are more prosperous because of the **increased sale prices of lambs** in the last few years, whether they keep pure Deccani sheep or cross-bred Madgyal X Deccani sheep. Some of them have built *pucca* brick houses in place of the thatched roof huts that they used to live in. Anthra's interventions have no doubt made a contribution to their increased prosperity. Some of the shepherds, however, said that crossing with the larger Madgyal is profitable since Madgyal cross lambs sell for

Rs 500 more than Deccani lambs whereas others stated that Madgyal rams and crosses have a higher fodder requirement and fall sick more often and so they cannot afford to rear them. Aebi (2009) stated that shepherds have resorted to cross-breeding as a livelihood strategy, considering the changed circumstances and the increase in the price of meat.

During the visit, undertaken towards the end of the monsoon (November, 2011), Maharashtra was in the grip of a severe drought. In **2011**, it rained **less than half of the average annual rainfall**. The severity of the drought will increase over time and it is likely that there may not be any rain for another seven or more months. The shepherds, however, were determined not to sell any breeding ewes because that would affect their future income and livelihood. Some were contemplating **purchasing dry fodder** for sheep in the summer and all lamented that there were now **very few acacia trees left** whose leaves and pods provided nutritious fodder for the sheep in late winter and early summer.

Information provided by Anthra also states, "**Wool craft has been a vibrant activity in the past**, both men and women were involved in wool cleaning, carding, spinning and weaving. Over the past 10 years, the occupation is slowly declining as the wool markets have collapsed and the breed has changed, now with collective action efforts are being made to revive the wool craft through the sanghams." We did not visit any households involved in wool spinning and weaving. The shepherds said that they used to be able to sell black wool for Rs 19 per kg but now get only Rs 12 per kg (a 37% reduction in price) and the price of white wool is even lower at Rs 7–8 per kg.

iii. *Access to better markets*: The intervention does not have a component of facilitating or **improving market access**. Some shepherds in Solapur district said that earlier they used to sell lambs at the weekly markets in nearby towns whereas now butchers come to their flocks to buy lambs. The shepherds in the Bhadali area in Satara district said they preferred to take their lambs to the market because they got higher prices in the market compared to selling to visiting butchers.

Key lessons from the intervention

- The **support** provided by Anthra to the shepherds is **invaluable** because it has helped to improve their **self-esteem**, has made them aware that they are playing a useful role by maintaining the Deccani breed and has encouraged them in their sheep rearing occupation. Such support is usually not found to be forthcoming from the state government animal husbandry department. The intervention has also improved **shepherds' knowledge** of sheep management and veterinary treatment, and has made them **more independent**.

- This intervention could be **extended into a genetic improvement programme** by keeping a minimum number of records and selecting more productive (faster growing) rams.

- **Marketing linkages** must be established through the state government so that rams and ewes purchased for dissemination under government schemes will be procured from registered Deccani sheep breeders. This will be mutually beneficial. Linkages should also be established with private breeders, hotels in the area, slaughterhouses and butchers, who buy animals in large numbers in or near the main consumption centres of meat.

D. Interventions that have enabled smallholders to build their flocks and increase their small ruminant assets

D1. Value-based holistic community development model promoted by Heifer Project International (HPI) and implemented by NIRDESH and GPSVS in Bihar and by Ibtada in Rajasthan

Women SHG's promoted by GPSVS and NIRDESH in Bihar

The major components of this model are the distribution of two or three goats (does) each to women beneficiaries to augment their income, with the condition that they **'pass on'** this **gift** when the does give birth, working with self-help groups (SHGs) of the beneficiaries and regular training of members to ensure they become agents of change in their communities. The overall objective is the socio-economic empowerment of women and their enhanced confidence and status. The programme included training in SHG management and leadership, improved livestock rearing, establishing kitchen gardens and improvements in household nutrition. A policy of including everyone in the community (not just the marginalized), building harmony among community members, inculcating values and ensuring sustainability are the crucial aspects of this programme. In addition, there is a component of providing **livestock health care** facilities through a **network of trained para-professionals**. Heifer International's project partner in Rajasthan (Ibtada) has implemented this, and *pashu sakhis*, as these trained para-professionals are referred to, provide a much-needed health service for livestock in the project villages. The *pashu sakhi* model implemented by Ibtada has been documented separately by SA PPLPP.

GPSVS and NIRDESH, Bihar

Ghogardiha Prakhand Swarajya Vikas Sangh (GPSVS), an NGO working in the Madhubani and Raxaul districts of Bihar, distributed about 100 goats purchased from Nepal to 53 beneficiaries in three villages of Madhubani District in December 2010. Two does were given to each beneficiary. Similarly, another NGO, National Institute for Rural Development, Education, Social Upliftment and Health (NIRDESH) distributed 200 Sirohi does purchased from Uttar Pradesh to 200 beneficiaries in four villages in the East Champaran District in Bihar in March 2010.

Sirohi Goats distributed by NIRDESH

Local Goats distributed by GPSVS

Each beneficiary was given three to four days' training in goat management before receiving the goats. This training was given in the villages by the two NGOs with the help of staff from the Bihar state animal husbandry department and Sudha Cooperative Dairy, which is a Government of Bihar undertaking.

Results and impact


Local Goats re-distributed by GPSVS

i. *Impact on the number and the quality of animals*:

All does that were distributed were brought from outside and were **not native to the region**. Consequently, there was **heavy mortality** among these does. Mortality in does purchased from Nepal by GPSVS was about 50% as compared to 90% mortality among Sirohi goats purchased from Uttar Pradesh by NIRDESH. GPSVS subsequently purchased about 40 local (Bengal) does and distributed these to beneficiaries, whose does had died. There was about 10% mortality in these local goats. NIRDESH also purchased local (Bengal) goats and distributed them to beneficiaries, whose original goats had died. It was difficult to ascertain improvement in productivity of goats because **records were not available**. By and large, goats introduced from other places did not perform well because they were not adapted to the new climate, feed and management, and were predisposed to various diseases such as enteritis and pneumonia because of the stress of transport over a long distance.


Local Goats re-distributed by NIRDESH

ii. *Impact on goat keepers' knowledge of goat management technology*


Local Buck

Beneficiaries interviewed during the field visits **preferred goats to cows**. They said income from goats commences faster after purchase as compared to cows. A few goat keepers were found to be very good in the management of goats and kids and, in spite of adaptability and disease problems, had reared their goats well. A few women said that their caste did not permit them to rear goats. Muslim households appeared to be more interested in goat keeping. Most goat owners had adequate knowledge of goat rearing and feeding, even before the intervention. All goats were taken for grazing on bunds in paddy fields. Supplementary feed was given to most does and was in the form of ground wheat or maize, *dal chuni*[23] and *roti*. Almost all goat owners covered their goats with sewn cotton or jute cloth in the East Champaran district to protect them from the cold. All goat keepers could recognize signs of oestrus in goats and took the goats in oestrus for breeding to larger flocks, which had breeding bucks. **Vaccination against Peste**


Using gunny bags to protect the goats from the cold


Improved Buck given by NIRDESH for breeding

[23] Chuni is the outer covering of any lentil (*dal*) and is a milling by-product.

des petits ruminants (PPR) was not done at the beginning due to non-availability of vaccine. Most of the 200 goats distributed under the HPI intervention in East Champaran district died due to PPR. NIRDESH, however, finally managed to procure the vaccine from the government and now regular vaccination against PPR, enterotoxaemia (ET) and haemorrhagic septicaemia (HS) is done despite the severe shortage of vaccine.

iii. *Impact on livelihoods of goat rearers and incomes earned:*


Dried goat dung used as cooking fuel

On account of the high mortality, most goat keepers, who received goats, did not get any income. The goats that died were replaced to some extent - beneficiaries who lost all three goats, were given two goats in replacement and those who lost two, got one goat. In spite of these problems, they were still willing to keep goats. Discussions with goat keepers revealed that they **could earn Rs 1,200–1,500 per goat per year** but some had not earned any income at all. Goat droppings are made into dried cakes for fuel and these are sold at Rs 300 per quintal.

Sustainability of the intervention after project conclusion

There was an initial setback to this project due to the heavy mortality of goats. Mortality is lower among local goats that have now been supplied but there continue to be problems such as abortion. This may be due to hormonal imbalance or a disease such as Brucellosis. Appropriate investigations need to be done to ascertain the cause. The intervention will be further strengthened with beneficiaries' experience in goat keeping and the improved knowledge and experience of local para-vets in the treatment of goats (these para-vets are diploma holders, who usually treat cows and buffaloes in the area). There is a veterinarian from Nepal, who also treats goats. Unlike the interventions by Ibtada (detailed below), the projects in Bihar do not include a component of creating a network of para-professionals by training local men or women.

Key lessons from the intervention

- To increase chances of success under such a programme, animals for distribution should be selected locally since animals brought from outside are more likely to have difficulty in adapting to a new environment.
- Essential vaccines such as ET, HS and PPR should be available easily in required quantities to prevent the spread of at least those diseases against which vaccines are available.
- The para-vets, who monitor the health of animals, need to be given proper training in feeding, management and veterinary treatment. The beneficiaries also need to be given training in feeding and management.

Ibtada, District Alwar, Rajasthan


Village Goat Rearing Group

As per progress reports shared by Ibtada in October 2011, Ibtada **distributed 630 does and 169 kids in 2010** to members of 16 goat-keeper groups of 10 or more women each in 12 villages. These does were mostly of the Sirohi (locally also referred to as the Ajmeri) breed, and some were crosses between Sirohi and local goats. In many cases, the beneficiaries went to other villages with Ibtada staff members to select goats for purchase. They selected goats that 'looked good' instead of purchasing only 'pure' Sirohi. Therefore, the goats distributed may be said to be 'Sirohi type' goats. Of these, 79 does and 74 kids died, the **mortality** thus being 12.5% among does and **43.8% in kids**. These women 'passed on' 42 does to

other beneficiaries. They sold 124 male kids for Rs 197,900 (Rs 1,596 per kid), which works out to Rs 314 per doe disseminated. The women have 624 does and 436 kids on the date of the report.

The report also mentions that 234 does and 107 kids were received as a **'pass on' gift by members of seven groups of women goat keepers in six villages**. Among these does, the **mortality was 10.7% and among kids it was 7%**. These women have so far sold 64 kids for Rs 95,950 (averaging Rs 1,499 per kid), which works out to Rs 410 per doe disseminated. There are 233 does and 118 kids present with the women on the date of the report.

The villages Bagad Rajput and Navli in the Alwar *tehsil* and Amka, Moredi and Dumoli in the Pratapgarh *tehsil* were visited and discussions were held with women beneficiaries. In addition, six *pashu sakhis*, or women para-vets, trained by Ibtada were interviewed.

Results and impact

i. *Impact on number and quality of animals*

The project has had a positive impact on the number of goats in the villages. The **mortality in adult does was low** (for example, in Bagad Rajput, of the 45 does disseminated, only three died over three years) and most of these does have had kids, leading to an increase in numbers. This can also be seen from the 'closing stock' figures in the Ibtada report mentioned above.

Imran with the Totapuri buck given by Ibtada

Batisi Does

Obtaining the 'gift' of goats also encouraged some of the women beneficiaries to purchase more does and increase the number of does they maintain.

Totapuri Doe with Kids

The project does not have a component of taking steps to genetically improve the quality of goats. However, Ibtada supplied Totapuri breeding bucks in many villages. Totapuri is a large-sized goat with a white body and brown, spotted head and neck. Legs are white or brown or white with brown patches. Many colour variations are also seen, with varying proportions of white and brown on different parts of the body. It has extremely long ears and a very pronounced nose hump. It is about twice the size of the local Batisi goat. Smallholder goat keepers prefer the Totapuri, since Totapuri or Totapuri-cross kids sell for a higher price than kids of other local breeds probably because of the high demand for them. Male kids are reared for sale for the Bakr Id festival and fetch a very high price (averaging Rs 10,000–15,000 for a one-year-old buck).

Meherunnisa with her flock
Village Amka, District Alwar

ii. *Impact on goat keepers' knowledge of goat management:*

All the beneficiaries visited had good knowledge of what to feed their goats and were using a variety of feed and concentrates to keep their goats healthy and productive. Some of the feeds they use for goats are cooked pearl millet (*bajra*),

cracked wheat (*dalia*), fenugreek (*methi*), cluster beans (*guar*), buttermilk and jaggery.


A Pashu Sakhi administering medicines to a goat

Ibtada has also trained about 80 *pashu sakhis*. Some of them are illiterate but **they know very well how to treat common ailments of goats** and other livestock. The results of this **training programme** are **impressive**. The illiterate and semi-literate traditional village women, who have received this training, use modern allopathic medicines to treat goats and other livestock successfully. They also carry out vaccinations and de-worming. Most of them have the full support of their families. They also earn a modest income from this profession.

iii. *Impact on livelihoods of goat rearers and income earned:*

The project has had a substantial impact on the livelihoods and incomes of most participating goat rearers. Apart from some exceptions of beneficiaries whose goats were 'lost' or eaten by predators or turned out to be unproductive, others were able to rear and sell kids for reasonably high prices (Rs 1,500 to Rs 3,000 per male or female kid and Rs 6,000 to Rs 7,000 per one-year-old goat). Some beneficiaries sold some or all of the does received by them due to various reasons and purchased others, and they now have more does than they originally received.


Kesanta with one of her bucks reared for sale
Village Navli, District Alwar


Sheela with her goats
Village Navli, District Alwar

iv. *Strong community organizations*

Ibtada's success in the **goat development and livelihood improvement** project can be attributed in large measure to the **strong community organizations** built up and operated efficiently by it, that is, women goat keepers groups, SHGs, **clusters of SHGs and apex federations** of SHG groups. The 'cornerstone' training of SHGs, established by HPI to give moral underpinnings to the SHG movement, was found to have had a profound impact in the villages where it was imparted two or three years before the present visit. The other components of HPI's '**value-based community development model**' such as technical training for livestock health management, kitchen gardening and family nutrition are also very useful components. Indeed, as stated in the information submitted by HPI to SA PPLPP, "The strength of the program is that it has empowered the women not only in socio-economic terms but also by giving them the opportunity to **believe** that they can **positively contribute to society.**"

v. *Indigenous breeding interventions*

During the visit to Ibtada, goats such as the Batisi, Totapuri and Nagphani were heard about and seen for the first time. These are not among the recognized breeds of Indian goats. The Batisi is apparently the local goat of the Alwar region of Rajasthan, known locally as a **good dairy goat**, which gives up to 2.5–3 litres milk per day. 'Totapuri' is another goat, which is reared in this area. Totapuri goat breeders in the Thosada and Chausal areas near Alwar and Pratapgarh, respectively, were visited. Nagphani is said to be a cross between the Sirohi and Totapuri. Some believe the Totapuri itself to be a cross between the Jamunapari and Sirohi. The breeders, however, say that 'Totapuri' is a distinct breed and some have been rearing it

for many generations. It has the Sirohi colours (brown and white spots) on the head and neck, a more extreme nose hump than the Jamunapari and a white body like the Jamunapari. It appears that goat keepers are maintaining genes of the Jamunapari breed desired by them in the form of the Totapuri, which may very well have originated as a cross between the Jamunapari and Sirohi. Totapuri is larger and taller than the Batisi. There is **high demand for Totapuri kids for fattening for the Id market** and they command very high prices. Two- to three-month-old kids are sold for Rs 3,000–3,500. Additional details regarding kid rearing and fattening in this region can be accessed from the SA PPLPP report on Small Ruminant Product Markets, Opportunities and Constraints. Such 'indigenous' breeding interventions should be supported because they are **introduced by knowledgeable and experienced local breeders,** who have developed these breeds, taking into consideration the local environment and management conditions and market opportunities. The 'recognized' breeds we see now are probably the result of such development interventions by livestock breeders in the past. The Totapuri breeding intervention is very successful because it is being followed by a large number of goat keepers, who earn a good income from rearing this breed. There are lessons to be learned from this intervention for established institutional breeding programmes.

If a local or institutional breeding intervention introduces cross-breeding, a precaution needs to be taken to ensure that it does not lead to a reduction in numbers of the local breed and its eventual extinction. *Ex-situ* conservation of a local breed should be undertaken if warranted by the situation. The breeds that become popular should be studied and people who want to rear them should be made aware of their specific attributes.

D2. <u>Rotational goat rearing promoted by the Tamil Nadu Veterinary and Animal Sciences University (TANUVAS) in the Tirupur region of Tamil Nadu with financial assistance from local Lions and Rotary Clubs</u>:


Goat distributed by TANUVAS in Tirupur

The scheme was started in 2002 in 25 villages, 10 of which are in the tribal area. Villages were selected by TANUVAS as per the **recommendations of Rotary or Lions Club officials** or following **requests by village *panchayat* leaders**. Under this scheme, beneficiaries were selected for goat distribution by giving preference to the **most marginalized members of society** (such as widows, elderly and physically handicapped women), most of whom were from backward or scheduled castes. Most of the selected beneficiaries resided in the *dalit* section of the villages and worked as agricultural labourers. Selection of beneficiaries was done with the help of village leaders. These leaders also took the responsibility to ensure that the **beneficiary returned a goat** as per the project norms. Working with SHGs was not a part of this project. A one-day training on goat management was given to selected beneficiaries before the distribution of goats, and included sessions on goat housing, selection, feeding, vaccination, profitability of cross-breeding and the economics of goat rearing.

The women beneficiaries were given one local goat each for free (worth about Rs 2,000), aged 5 to 6 months and purchased in local markets (in Muttur and Kundadam), and they were required to return a male or female goat of the same age or Rs 2,000 in cash. No time period was specified for this return and it often turned out to be quite a long period. The amount of Rs 2,000 included the cost of the goat and its insurance premium for one year. The limited amount

available constrained the quality of animals purchased. The returned goat was to be given to the next beneficiary.

The scheme is continuing in the same 25 villages, and from 2010, Tellicherry (Malabari) goats purchased from markets in the adjoining Kerala state (Thrissur area) are being distributed. From 2010, the programme is funded by TANUVAS. The amount per goat has been increased to Rs 2,300. The university has allotted funds to prepare a training manual, which will include topics on management, disease control and breeds of goats.

Results and impact

i. *Impact on the number and the quality of animals:*
In the absence of data, it is difficult to say whether the intervention brought about an increase in the number of animals in the project villages. Breeding bucks were not supplied along with does. Bucks maintained by other larger flocks in the villages were used for breeding the does given under the scheme (buck service charges varied from zero to Rs 100). Tellicherry goats given in the Devanampalayam village in 2010 appeared to be larger than the local goats and the goat keepers reported that they had a higher twinning percentage.

ii. *Impact on goat keepers' knowledge of goat management*:
Most goat keepers visited knew about goat rearing and feeding. All beneficiaries took their goats out for grazing during the day and gave them supplementary feed in the evening. The concentrates fed were:
a. Groundnut cake soaked in water given to young kids
b. Rice soaked or boiled in water given to adult does
c. Maize flour or cotton seed cake given when grazing was inadequate


Goats being fed with banana flowers in Tirupur


Supply of goat medicines by TANUVAS in Tirupur

All goat keepers visited knew signs of oestrus in goats and took goats in oestrus to breeding bucks. Vaccination against PPR and foot and mouth disease (FMD), regular de-worming, dipping or bathing against ecto-parasites and treatment of sick animals were carried out by the university extension officer with the help of local government veterinarians. If the university were to withdraw from the project, government veterinarians and private practitioners are the only ones who could take over the work. Beneficiaries said they would source fodder from different places in case of a shortage and if there is a bad drought, they would sell goats and repurchase them when conditions are favourable again. They would, however, lose money because they would sell when the prices are low and would have to repurchase when the prices are higher.

All the beneficiaries visited said they would prefer a big breeding buck but if such a buck was not available, any buck would do since it was important that the doe conceived. They

had not heard of AI in goats but said they would avail of such a service if it was available because some **had to take their does over a distance of 5 km for breeding**. None of the beneficiaries appeared to be aware of the concept of inbreeding.

iii. *Impact on livelihoods of goat rearers and incomes earned*: Receiving a goat under the scheme meant that elderly women and men, who could not do hard work as wage labourers any more, could earn an average of at least Rs 85 per day from the goat.[24] This was an important addition to their family income from other sources. Women working as farm labourers take their goat with them and feed it with the weeds from the fields. This reduces their expenditure on the feeding of the goat. Some beneficiary families have managed to raise margin money for house construction, for expenditure on a family member's medical treatment or to purchase a cow. They also get **goat milk for home consumption** and have animals available for **ritual slaughter** at religious ceremonies or for family functions.

Twenty-five goats were distributed in Rakkiapalayam village in September 2008. Eight of the beneficiaries were visited. Five of them had passed on either a female or a male goat whereas two had returned the goat they had received since they got other jobs. One goat died so there was no pass-on. The two other villages visited were Devanampalayam where 25 goats were given and Varkuttapalayam where 60 goats were given in three instalments of 20 each in 2005, 2007 and 2009.

Sustainability of the intervention after project conclusion:
Over 500 goats have been distributed from 2002 to 2011 (approximately 45 annually). The mortality in these goats has been only about 10%. Even if TANUVAS support is withdrawn, it seems likely that rotation of goats will continue. The pass-on may take longer than envisaged but at least 60–70% beneficiaries will pass on the goats, mainly to their relatives. The village leaders will ensure that the passing on will take place. The circumstances where the pass-on has not been made are mainly sudden death of the goat, death of the beneficiary, the goat being unproductive and mortality in kids. Supply of improved goats will give better benefits in terms of production and income earned.

Did the intervention lead to the promotion and up-scaling of the local breed?
This project did not have a breed conservation or improvement component. The objective was mainly to improve the livelihoods of goat keepers and the very poor and help them to increase their livestock assets.

Key lessons learnt
- The 'pass-on-the-gift' model appears to work.
- The quality of goats distributed is as important as the number.
- All distributed goats should be ear tagged for individual identification and their records maintained for informative documentation and selection of outstanding goats. Efforts also need to be made for training and capacity building in goat management.
- Improved breeding bucks should be made available to ensure improved productivity of the progeny of distributed goats.
- If distributed goats are insured, the beneficiaries will get a replacement should the goat die.
- Unproductive goats among the distributed ones should be culled immediately on detection and replaced.

[24] The average daily income has been calculated on the basis of the sale price of kids reared.

Nachal from Village Varkuttapalayam, District Tirupur

Nachal received one doe under the programme in 2005. Since then, this doe has kidded 7–8 times. To increase the number of does owned by her, she purchased two more does from the market. She now has 10 adult does, 9 kids and a buck retained for breeding, which will be sacrificed after a temple is constructed in the village. The small flock of goats is taken out for grazing by either her husband or herself. She passed on one doe to her daughter but this died and no further rotations were done. Each year, Nachal sells about 20 kids, worth Rs 40,000. Annually she spends Rs 2,500 on medication and approximately Rs 3,500 for maize grain for the goats. She earns a net income of approximately Rs 3,400 per goat per year or about Rs 93 per day. Nachal and her husband are dependent on their son who works in a textile company earning Rs. 6,000 a month, and during lay-offs, he works as an agricultural labourer for Rs 250 a day. Goat rearing is an important supplementary source of income for the family. They are now set to receive an improved breeding buck from VUTRC.

Jodhimani from Village Varkuttapalayam, District Tirupur

Jodhimani had some experience of goat rearing, and had two does before she received a third doe under the programme in 2005. All three does have kidded many times. She has retained all the females born in her flock and now has 14 does and 14 kids. The flock is taken out for grazing by both her husband and herself. In 2011, she did not increase the size of her flock on account of the drought. Jodhimani annually incurs an expenditure of approximately Rs 3,500 for extra feed in the form of maize and rice grain. Her annual income is about Rs 26,000 through the sale of young kids to the local butcher for Rs 2,000 each. In addition, she also earns a small income through the sale of goat droppings used as manure in agricultural fields. She sells about 10 bags of manure each month at Rs 40 per bag. The total net income from her goat rearing enterprise is about Rs 1,900 per goat per year or about Rs 75 per day.

D3. Promotion of goat rearing among tribal communities through the use of the traditional '*vaata*' system,[25] and training in goat health care and monitoring through community organizations (implemented by Girijana Deepika and Tholakari Adivasi Mahila Vedika, Andhra Pradesh, with support from Anthra):

The description below is based on the submission by Anthra in response to the SA PPLPP call for information on small ruminant rearing interventions (May 2010) and the case study by Rajamma (2008). A visit to the East Godavari district in Andhra Pradesh where this work is being carried out could not be organised. This programme was **started in 2003 and ended in 2008** but the passing on of goats under the *vaata* system has continued. Thirty-two households benefited directly and many more through the gift of goats received through the *vaata* system.

Girijana Deepika has been working in the forested Eastern Ghats region of the East Godavari district among the Konda Reddy, Koya Dora and Konda Kammara Adivasi communities since 1988. It revived the "village level *gottis*, a traditional forum of *adivasi* communities where community members meet as equals to discuss, analyze, debate and collectively work on reclaiming their resources for rebuilding their livelihoods."[26] 'Tholakari', a membership-based organization of *adivasi* women was then started in 2005. The women members of the village *gottis* became members of Tholakari at the district level, paying an annual membership fee of Rs 5. The *vaata* system was started in 2000 as a means to rebuild poultry assets of women, who did not own any livestock assets. After a survey of land and livestock ownership in 2003, the *gottis* decided that assisting women to **rebuild their goat wealth** would help to further strengthen their livelihoods. The women suggested a modification to the traditional *vaata* system so that the women would return just one kid to the village *sangham* after the second kidding of the goat received by them instead of returning half the offspring to the original owner throughout the life of the goat. The women also decided that the Kanchu Mekha, or the dwarf, prolific goat, of this region would be distributed. The beneficiary *gotti* members were also trained to manage their goats, treat their animals with herbal remedies and de-worm animals using herbal medicines. The *gotti* leaders were encouraged to approach the local veterinary hospitals to access vaccinations. Fifty-two adult does and five bucks were purchased and distributed in 2003 but **37 of them (65%) died within two weeks** because of a PPR outbreak. No insurance claims were entertained because the animals died within two weeks of getting insured. The remaining 20 animals were saved by treating them with a combination of homoeopathic and herbal remedies. Each beneficiary, whose doe survived, passed on a kid within a year to a beneficiary whose doe had died. In Chaparatipalam village in Rajavommangi mandal, only four goats survived and kidded, producing twins. Four of the kids were given to four other women. **Eight women in this village now have a flock of about 18 goats each** and have earned substantial income from selling surplus kids. The village *gottis* monitor the repayments and goat health care. **Non-availability of PPR vaccine**, however, **continues to be a challenge** at least until the time when the information was submitted (May 2010). Another major challenge mentioned is the lack of any credit schemes to facilitate goat rearing focused on indigenous and traditional breeds that are more suited to the area - most credit schemes focus on dairy animals and cross-breds.

Key lessons learnt

- The 'passing on the gift' model of increasing goat assets appears to work well if community organizations are strengthened for monitoring the process.

[25] A traditional asset building system to help women rebuild cattle, goat and poultry resources in the tribal region of Andhra Pradesh

[26] Girijana Deepika: Challenges for a people's organization in Andhra Pradesh, by Madhusudan (Participatory Learning and Action, June 2008) http://pubs.iied.org/pdfs/G02867.pdf

- The stress on goats in purchase-sale transactions and transfer to a new owner, appears to make them more vulnerable to infections such as PPR. If possible, goats should be vaccinated a week prior to being transferred to a new setting.
- Timely and adequate supply of vaccines is extremely important to save smallholders' animals.

D4. Construction of lambing/kidding sheds and delaying breeding to reduce mortality of new-born lambs/ kids in the harsh winter of Ladakh, Jammu and Kashmir

Goat and sheep rearing is a key livelihood activity for the largely nomadic and semi-nomadic communities that inhabit the high altitude plateaus of Changthang, bordering Tibet in the Ladakh region of Jammu and Kashmir. The region witnesses extreme cold, with temperatures in the winter months (December to March) often falling to minus 20 degrees celsius. Livestock raised by the traditional Changpa community are well adapted to the hostile environment and marginal pastures of the region and provide a range of products and services. The domestic goats of the Changthang region (primarily the Chegu and the Changra) reportedly produce the finest Cashmere (Pashmina) in the world[27].

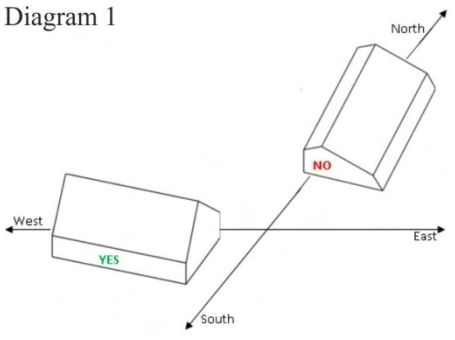
Fodder collected in the summer from reserve pastures is used in the severe winter months. It is observed that livestock lose up to 40% of their body weight from autumn to early spring, on account of the severe weather conditions and limited fodder availability. Traditionally, lambing/kidding takes place in February when the winter cold is at its peak; because livestock are maintained in the open, the mortality of the young lambs and kids is often as high as 50%.

At government livestock rearing farms in the vicinity (Upshi and Khuril), it was observed that mortality of the young could be significantly reduced by providing lambing sheds to protect the new-born sheep and goats, and delaying the mating season by 40–60 days. This resulted in the young being born when the weather improved and there was grass available in the pastures for the milking ewes/ does.

Based on the results obtained at government farms, the Department of Animal Husbandry, Jammu and Kashmir, in collaboration with local NGOs[28] promoted the construction of lambing/ kidding sheds in the area. The sheds were designed to benefit from solar radiation, and were constructed using local material and masonry skills.

Design and Cost of a Lambing Shed:

Diagram 1



Since the sun is higher in the sky during the summer, the roof of a building picks up most of the solar radiation whereas, in winter, south facing walls pick up most of the solar radiation. The lambing shed is, therefore, aligned along an east-west axis to maximize the surface area facing south (reference diagram 1). Further, the shed should be constructed at a place where there is no obstruction to direct light, and the duration of the winter sun is more than six hours. The lambing shed should be constructed close to where flocks are stationed during the lambing period and if possible close to the family settlement. Positioning the lambing shed close to the homestead will allow utilization of the shed for other purposes after the lambing period is over.

[27] Misra et al., 1998; Ahmed, 2002, quoted in Pastoral Nomads of the Indian Changthang: Production System, Land-use and Socio-economic Changes by Tsewang Namgail, Yash Veer Bhatnagar, Charudutt Mishra and Sumanta Bagchi.

[28] The Ladakh Ecological Development Group (LEDeG), Leh Nutrition Project and Ladakh Environment and Health Organisation (LEHO).

The size of the shed depends on the number and type of animals in the herd, and the family's needs and resources, particularly the availability of land for the construction of the shed. On an average, four square feet should be allowed for each goat/sheep. A 12 x 24 sq-ft shed can accommodate 60 to 80 sheep and/or goats.

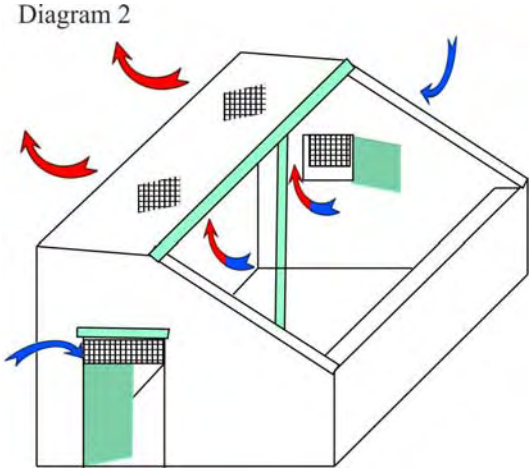
The material required and costs associated with the construction of a 12 x 24 sq-ft shed are detailed below:

Material	Quantity	Estimated Cost (Rs)
Stones	300	600
Bricks	1,000	2,000
Door	1	1,800
Window	1	1,400
13 feet wooden poles (*ballies*)	4	1,600
Wooden pole for the roof (5 ft)	1	100
Tree branches/Twigs (12 to 15 ft)	60	1,020
UV resistant polythene sheet (150 gm)	1	1,500

Other costs include mason charges for six days, 20 person days of unskilled labour, and transportation costs for material, which vary from case to case. Average costs for a 12 x 24 sq-ft lambing shed are in the range of Rs 16,000 to Rs 18,000 per shed.

During sunny days, even in the winter, the UV polythene sheet that serves as a roof warms up the shed and temperatures can rise; this is detrimental to the young lambs and kids. Overheating and humidity in the shed can lead to dehydration of the young stock and, therefore, proper ventilation is required to be maintained in the shed. This is done by placing windows covered with a wire mesh on the sides and on the roof of the shed (see diagram 2). As the warm air rises, it is replaced by cool air from outside through these ventilators maintaining the temperature in the shed during the day. During the night, when the temperature falls, these ventilators can be closed to keep the shed warm.

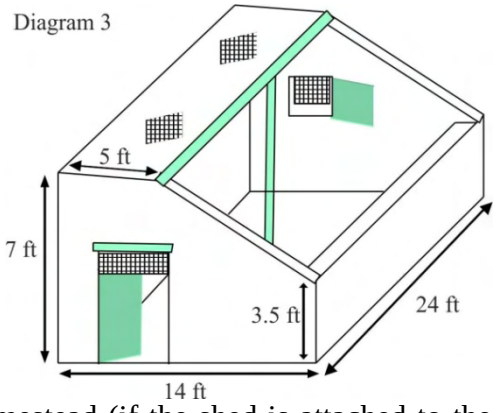
Diagram 2



<u>Construction Methodology</u>

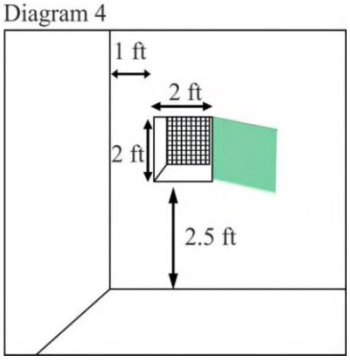
If the surface of the proposed site is not even, some amount of levelling may need to be done. A foundation of at least 1-ft depth and 1.5-ft width is recommended; if the soil is soft, the foundation depth should be a minimum of 1.5 ft. The foundation is made of stone, with a mix of mud and cement mortar. The walls can be made of mud bricks or rammed earth, or stone, in case mud is not available. The south facing wall measures 3.5 ft and the north facing wall should be 7 ft in height. The finishing of the walls should be done with mud plaster, including the inner walls; this will improve insulation. A half-foot slope is recommended for a 5-ft wide roof. The slope should be away from the homestead (if the shed is attached to the home), to avoid accumulation of snow and rain. The main beam of the roof will be supported either by a central pole with an extra 6-ft beam or by a partition wall, but that would take up more space. In addition to the roof openings, as demonstrated in diagram 2, windows should be provided to facilitate air circulation (see diagram 3). All openings should be covered with wire mesh. To

Diagram 3



support the polythene sheet, joists are placed laterally every 5 ft, and wire is tied horizontally every 1.5 ft. This is necessary to support the polythene sheet and prevent it from being damaged by the wind. The polythene sheet should be fixed on a sunny day, so that it contracts as it gets cold and fits securely. The poly-sheet is secured with bags filled with mud both on the roof and on the side walls.

Diagram 4



Poly-sheet secured with bags filled with mud, placed on the roof and on the side walls

By the end of 2008, with support from NGOs in the area, 80 lambing/ kidding sheds were constructed across 11 villages in the Changthang area. Nineteen local masons were trained in the construction of these sheds. Based on information provided by NGOs in the area, the lambing sheds contributed to a reduction in the mortality rates of new-born lambs and kids. The sheds are often used for other purposes by the family during the spring and summer months, such as growing vegetables, spinning wool, weaving carpets or knitting.

(Adapted from the Lamb Shed Construction Guide by J. Bel, V. Stauffer, I. Paljor, Lobzang and Rigzin, Groupe Energies Renouvelables, Environment et Solidarites (GERES) and with additional information provided by Dr. Deen Mohammed, LEHO, Ladakh)

8. Summary of the Impact of Breed Conservation and Improvement Interventions in India

- **Genetic improvement component:** Of the six responses received to the invitation from SA PPLPP to contribute information on small-ruminant breed conservation and improvement interventions, **none was about a systematic genetic improvement programme**—either of within-breed selection or cross-breeding. The response received from SDC-IC about the Malabari Goat Breed Improvement Programme (MGBIP) had a component of providing **Malabari bucks selected on phenotype by visual observation**. The remaining five responses were about livelihood promotion through goat rearing, building up assets in the form of goats by 'passing on' the gift of the goat received, and breed conservation through knowledge dissemination and awareness creation. In the absence of production or income records before and after the intervention, it is not possible to say whether the support provided by these documented interventions contributed to an improvement in the productivity/quality of animals. The interventions were, however, perceived by the beneficiaries to have positively contributed to both the quality and productivity of their animals, for example in the MGBIP in Kerala and the distribution of Tellicherry (Malabari) goats under the rotational goat breeding programme in Tirupur, Tamil Nadu. The intervention by Ibtada (Alwar) under the HPI programme has established a **strong community organizational structure**, largely operated by participating rural women with some guidance and support from Ibtada staff members. Such a structure and the resultant improved level of awareness and empowerment of participants can provide a sound basis to start a community based genetic improvement programme of the local breed. If such a structure is already established, it will be easier to introduce animal identification, simple recording, selection and training to improve awareness of the principles of genetic improvement. In addition, the structure can support other interventions such as facilitating access to inputs and linkages to markets.

- **Smallholders' preferences for specific breeds:** There are some smallholder livestock keepers, who prefer animals of only certain breeds, and they are very particular about the phenotypic features and other characteristics of the animals they rear—especially of the breeding males. There are, however, others, who are attracted to animals of breeds other than the prevalent breeds if they perceive that these are of higher productivity, have better market acceptance and will improve their income. Such livestock keepers are even willing to incur extra expenditure on supplementary feed for crosses which have higher performance because they expect that the market price received will be high enough to cover the additional expenditure and bring them a higher income. The **cross-breeding of Deccani sheep with the Madgyal** in western and southern Maharashtra and **cross-breeding of local goats with the Totapuri goat** in the Alwar region of Rajasthan are examples of this preference. Sometimes, however, smallholders resort to cross-breeding on account of peer pressure or because others are doing it, without adequate knowledge of the increased inputs required to maintain cross-breds or exotic breeds.

  It is note-worthy that such cross-breeding among indigenous breeds started by livestock keepers themselves and the results of which are obviously desirable to them, goes on smoothly over many years (>10 years) without any government or other institutional support or intervention. Many of the breeds that we have today have probably evolved from such cross-breeding by communities themselves. **These initiatives should be studied and lessons learnt compiled, to improve the chances of success in more systematic genetic improvement programmes**.

- **Changes in the rearing of small ruminant breeds due to reduction in grazing lands and access to grazing:** In the Nagaur, Jodhpur and Tonk districts of Rajasthan, a sheep called Kheri, capable of meat and carpet wool production, has been reportedly developed by migratory sheep breeders (Bhatia and Arora, 2008). It is considered to be a **cross-bred with unknown levels of inheritance from the Marwari, Malpura and Jaisalmeri sheep of Rajasthan**. It is

reported to have **evolved due to a drastic reduction in rainfall in the last ten years,** leading to sheep being taken to far away places, and cross-breeding of the Malpura with the Marwari breed taking place during migration (Gowane and Arora, 2010). The Kheri is reported to be replacing the Malpura sheep, traditionally reared in this area. Kheri sheep owners are of the opinion that these animals can travel long distances, can better sustain the stress in lean periods and regain lost condition faster when conditions become favourable as compared to the Malpura (Sharma *et al*., 2003). Kheri sheep are slightly smaller than the Malpura and have a marginally higher wool yield, which is reported to be due to its Marwari genes (Gowane and Arora, 2010). This appears to have been a fortuitous, gradual change in the breed rather than a change due to a conscious decision by livestock rearers. This probably also illustrates the process by which a lot of the breeds that we see today evolved and indicates that such evolution of new breeds will continue. **It also possibly indicates the impracticability of insisting on 'breed purity' and 'pure' breeding at all times.**

In a separate documentation undertaken by SA PPLPP of the impact on livestock rearing as a result of watershed development interventions by the Watershed Organisation Trust (WoTR) in the Ahmednagar district of Maharashtra[29], there is indication of a shift away from sheep rearing by the traditional community of sheep rearers (the *Dhangars* in Maharashtra) as a result of the closure of forest lands for grazing and the ban on grazing in treated areas in the upper reaches of the watersheds.

- **Constraints faced by smallholders in breeding:**
  i. A major constraint is the non-availability of good quality breeding bucks, especially in areas such as Maharashtra where the majority of goats are kept by smallholder families with only one or two goats per family. Such owners cannot afford to maintain breeding bucks. If there are no large flocks with breeding bucks near them, often their does remain empty for long periods of time, severely reducing their income from the does.
  ii. Some smallholders with larger flocks have to sell their fast-growing male kids to butchers, to meet their urgent need for cash, instead of retaining them for breeding. Therefore, often the slow-growing stunted kids that get left behind end up breeding with the does.
  iii. Frequently, because breeding bucks and male kids are with the does in the same flock, does that are too young and small for breeding conceive and give birth, with disastrous consequences. If such young pregnant does do not get adequate nutrition, they abort or their kids are stillborn or die soon after birth, and the stress on the doe so debilitates it that it can never grow into a successful breeding animal. This phenomenon is not noticed in sheep flocks although rams and ewes are always together in these flocks also. This is probably because ewes attain sexual maturity and exhibit oestrus at a slightly older age than does.

- **Constraints faced by smallholders in expanding their flocks:** The main constraint is the lack of resources such as space, surplus funds for investment and scarcity of grazing, as well as the lack of labour to look after additional animals. Inadequate access to health care, particularly vaccination, is another major constraint a small ruminant rearer faces. The perception that goats and sheep are detrimental to the environment has also had a negative impact on small ruminant rearing and there are limited credit opportunities and loan schemes for small ruminant rearers. The lack of easy availability of guaranteed good quality animals is also a major constraint.

  Some smallholders are, of course, not interested in increasing their flock size. They focus on rearing just one or two animals to obtain milk for home consumption or to earn some cash from the sale of kids. They are, however, still interested in having their does bred by good quality bucks and in services such as vaccinations and veterinary treatment for their animals when necessary.

[29] http://sapplpp.org/goodpractices/CPR-Livestock/watershed-development-and-livestock-rearing

9. Emerging Lessons and Issues for Policy Advocacy Related to Small Ruminant Breed Conservation and Improvement

Apart from a few exceptions, smallholder goat and sheep rearers in India have largely not benefited from organized genetic improvement programmes. Currently, there are different kinds of genetic improvement projects in progress in 12 goat and 13 sheep breeds funded by the ICAR. These projects have not carried out systematic genetic analyses and estimates of genetic progress are not available. Most of these systematic breeding programmes are probably achieving some genetic progress but they have inadequate links with livestock keepers. Additionally, there is one goat cross-breeding project being carried out by the Maharashtra Goat and Sheep Research and Development Institute and one gene introduction project in sheep, being carried out by the NGO Nimbkar Agricultural Research Institute, Phaltan, Maharashtra. The interventions by six NGOs, information on which was received in response to the call by SA PPLPP and summarized above, have strong links with livestock keepers but lack a systematic genetic improvement component. One of the probable reasons for this could be the NGOs' lack of technical capacity in animal breeding. Genetically improved animals are usually not available to sheep and goat rearers. Substantial genetic variation still exists and encourages the belief of future success if a programme can be systematically and scientifically carried out.

The **important lessons and policy issues** that emerge from the review of literature, visits and several years' field experience are:

I. **Small ruminant genetic improvement programmes are not being given adequate importance and support:**
Well-implemented, small ruminant genetic improvement programmes delivering improved genotypes, together with other interventions such as improvements in health, nutrition and other aspects of livestock management, and establishing market linkages, have the potential to improve the income of the poorest of the poor rural households while contributing to the nation's food security. Improvements in health, nutrition and management will bring short-term benefits that will provide incentives for a community to engage in the projects whereas genetic improvement will bring benefits that take longer to achieve but are permanent and cumulative.

Livestock genetic improvement programmes should be seen as investments because the effects of selection accumulate over time. An example given by Flint and Woolliams (2008) from European animal agriculture illustrates the significant value added by livestock genetic improvement if it is done systematically and scientifically (that is, it is managed by effective institutions driven by markets). "A conservative estimate of the annual value of livestock production in Europe is €123 billion. Annual genetic gain in the livestock industry at the producer level is 1.5% or €1800 million. The annual research and development cost of breeding organizations, including collecting data for estimating breeding values and carrying out breeding programmes but not product marketing, is approximately €150 million, thus yielding a benefit to cost ratio of about 10." Genetic gains are permanent and cumulative so that the gain made in one year will give benefits over all subsequent years without further intervention. Considering the constraints of lack of infrastructure, shortage of trained and experienced personnel, low level of literacy and awareness among livestock keepers in developing countries, even a benefit to cost ratio of 5 will make such improvement worthwhile. There are strong market incentives in India for such projects from the growing and more prosperous urban population. Infrastructural and training support has to be provided to small ruminant rearing communities so that they can take advantage of these market incentives.

Small ruminant conservation and improvement programmes should, therefore, be seen as important parts of national and state policies, aimed at alleviating poverty and improving the food production of a country, region or locality and the income of livestock keepers. Funding agencies that support projects for 'community development and livelihood promotion through small ruminant rearing' should ensure that such projects have a livestock genetic improvement component, where appropriate.

II. **Good quality reliable data on livestock and breed populations,** trends over time and the drivers of these trends are necessary for formulating appropriate livestock improvement policies. State and central governments should make efforts to collect such data periodically, and also analyze reasons for the increase or decrease in the number of specific breeds. It is important to work with livestock keeper communities, especially for the collection of breed-wise population estimates. Efforts need to be made to understand both the livestock population through better characterization, and the human population that depends on these livestock for their livelihoods.

III. **Design and implementation approach for a genetic improvement programme:**
The examples of the Indo-Swiss Goat Project in Rajasthan and the PNSO sheep improvement project in the Ivory Coast indicate that simple projects based on animal identification and objective measurement of animal performance have higher chances of success. There needs to be a holistic analysis of a small ruminant production system before a genetic improvement programme is undertaken. Such an analysis should consider the livelihood context of small ruminant rearing and therefore the genetic improvement programme should be undertaken in a participatory manner through all its stages. Genetic improvement programmes also need to be integrated into a broader improvement approach that addresses disease risks and ways to increase the efficiency and profitability of feeding practices.

Genetic improvement programmes should follow all the logical steps involved which are characterisation of the production system and constraints to production, defining the breeding objective or goal of improvement, choosing a breeding system (s) and breed (s), deciding on population size and structure, identifying the selection criteria, obtaining or estimating genetic parameters, designing the animal recording system, estimating breeding values for the selection criteria, designing a mating scheme for selected animals, designing a multiplication scheme to disseminate genetically superior animals or semen and assessing genetic change, and reviewing the breeding programme regularly (Baker and Gray, 2004).

IV. **Time horizon for a genetic improvement programme**: The duration of a genetic improvement programme—especially a selection programme—should be at least 10 years. At the end of 12–15 years, every effort should be made to make the programme self-sustainable. Funding and implementing agencies need to be aware that if they withdraw support half-way, the whole exercise would be meaningless. The extra investment due to the longer time period would be worthwhile because the gains due to genetic improvement are permanent and cumulative.

V. **Necessity of livestock keepers' participation in the planning and operation of the genetic improvement or conservation programme:** From the beginning, every genetic improvement or conservation programme should have a component to assess community priorities, identify traits and characteristics that are important for them, train and empower livestock owners so that, in the course of time, they will be able to take over and run the programme themselves. Existing networks of SHGs and PRIs can be used and built upon for this purpose. Participation of women is one of the prerequisites for the success of any

such programme because small ruminants, particularly goats, are primarily reared by women.

To ensure livestock owners' participation, any genetic improvement programme needs to be preceded by the establishment and nurturing of livestock keepers' community organizations for at least two years. It will then be easier to include livestock keepers in the programme from planning through to implementation. This period is essential to understand how livestock keepers practice genetic improvement and then integrate their practices with the science of genetic improvement. This period should be used to establish groups and systems in villages, to carry out tasks such as animal identification and recording. This will ensure their cooperation, contribute to the success of such programmes and pave the way for livestock keepers, to manage and take forward the programme on their own in the long run. Such community organizations will also help identify what traits small ruminant rearers perceive as valuable in a breed, and allow for breeding programmes to incorporate community perceptions and requirements.

VI. Changes in the objectives, structure and direction of currently established ICAR programmes will help to increase their effectiveness tremendously.

- Screening of large numbers of animals, based on a simple selection criterion should be part of every genetic improvement programme in order to detect animals with outstanding performance.
- Each project should be given adequate funding over an 8–10-year period. Before funding, it is necessary to ensure that the organization implementing the project has the capacity and commitment to carry out the project rigorously over such a long time frame.
- User-friendly databases should be developed to simplify data entry, storage and retrieval instead of the current system of each centre having its own method. A database will help to maintain data integrity. There should be provision in the database to check the validity of the data during data entry.
- Participation of livestock keepers is a crucial element of every programme. In fact, these programmes should be embedded in the livestock keeper communities. Training of livestock keepers in health management and genetic improvement aspects should also be a component in every programme.
- Genetic improvement programmes and their coordinating units should have adequately trained staff for regular monitoring of the programme. Currently, some of the units do not follow the technical programme correctly and scrupulously because of the lack of monitoring. Regional monitoring units could be set up instead of only one central monitoring unit. Reporting formats also need to be changed and made more meaningful and should be developed with a view to eliminate fraudulent reporting.
- If monitoring shows a unit to be ineffectual or inefficiently operated, funding to that unit should be withdrawn. Specific monitoring criteria need to be laid down for this. In fact, ICAR should look for competent partner organizations, which may not necessarily be state veterinary and animal science universities.
- All such projects should be periodically reviewed by independent, recognized assessors.
- Superior animals of any breed produced by the programmes should be given preferentially to livestock keepers in the traditional areas where those breeds are reared. The dissemination of improved animals should ideally be made through a breed society in a nucleus-multiplier-flock structure. For this purpose, researchers running the programmes should establish contact with livestock keepers in such areas, make them familiar with the breeding programme, take suggestions from them on the kind of animal desired by them and make changes to the programme accordingly.

- The field performance of the improved animals produced by genetic improvement programmes and disseminated to livestock keepers, and of their progeny with livestock keepers should be monitored to gauge the success of such programmes. Specific and standardised indicators should be developed for this purpose.
- Training of animal breeding in universities needs to be improved and strengthened.
- Agricultural and Veterinary University students should be encouraged to take up research topics allied with ICAR's genetic improvement programmes such as:
    - Establishing minimum recording protocols necessary for genetic improvement programmes
    - Data analysis methods to account for small flock size and large environmental variation
    - Participatory research methods for community based livestock genetic improvement
    - Accurate identification of genetically superior animals under field conditions
- International collaboration should be actively sought and attempts should be made to involve organizations working on community based goat and sheep improvement projects. ICAR should draw upon the considerable body of material available on community based projects and strive to make improvements based on the knowledge and experience of scientists both from within and outside India.

VII. Conservation of indigenous breeds: There is no better way to conserve a breed for future generations than to consistently keep the breed or population viable by using an efficient, demand-driven, long-term breeding programme suitable to commercial and cultural needs of livestock owners (Phillipson *et al*., 2011). *In situ* conservation is, therefore, the most effective method of conservation, provided it is economically viable for livestock keepers. Smallholder livestock keepers should be supported to continue to maintain the breed. Such support could be in the form of:

a. Training of community animal health workers (preferably women) from the villages where livestock are maintained, in livestock management (health, feed, shelter) so as to improve the sustainability of the livestock keeping enterprise
b. Ensuring the availability and delivery of vaccines and essential livestock medicines
c. Strengthening livestock feed resources and feeding practices in the villages where the livestock are maintained by providing fodder tree seedlings and pasture development on community and private land.
d. Promoting improved but inexpensive housing for small ruminants, using locally available material.
e. Strengthening organizations of livestock keepers and encouraging them to establish identification and basic recording of their livestock
f. Strengthening credit facilities to livestock keepers to expand their flocks
g. Ensuring that the livestock keepers obtain remunerative prices for the sale of their animals and are not exploited by middlemen. Support for the creation of collectives of smallholders could facilitate better bargaining and economies of scale for small ruminant rearers as compared to accessing markets (often located at a distance from their rearing base) as individual rearers selling one or two heads of livestock.
h. Subsidies or cash payments to livestock keepers for rendering a service to society by conserving livestock with special attributes for the future could also be considered, provided an efficient system of making such payments and monitoring livestock rearing is worked out. It would, however, be better to develop sustainable local institutions to inculcate the principles and practices of genetic improvement and the related synergistic husbandry interventions into the daily management of flocks to contribute to the livelihoods of livestock keepers.

Ex-situ conservation: Frozen semen and/or embryos of endangered or 'at-risk' breeds should be stored. Since reliable information on the actual numbers of small ruminant breeds is not available, it is extremely difficult to identify breeds that are at the greatest risk of extinction. Mapping of small ruminant breeds and present numbers must be undertaken urgently to identify the breeds that face the greatest risk of extinction.

VIII. **Well-designed cross-breeding with more productive breeds from other regions with stressful environments should be a part of the breeding policy of state and central governments:** Earlier cross-breeding programmes, using highly productive exotic temperate breeds, have not made a substantial impact on the livelihoods or economy of small ruminant rearers. However, intensification of livestock production, using more productive livestock genotypes can be an effective means of improving the livelihoods of some of the poorest farmers. Well-designed cross-breeding schemes, using breeds that are more productive and have the capacity to adapt to stressful conditions can yield improvement much faster than within-breed selection schemes, especially in response to market signals and if well-linked to markets. Adequate consideration has to be given, however, to maintain a population of pure-breds for sustainability.

IX. **Supporting farmer interventions:** The breeds we see today are probably the result of many experiments, including cross-breeding carried out by livestock rearers over generations. Such experiments give rise to new variations from which a selection of animals profitable for the changing agro-climatic and market conditions can be made. Such interventions should, therefore, be supported as far as possible. If it happens that the advent of a new cross-bred threatens the viability of an existing breed, either that breed should be conserved *ex situ in vitro* or people who continue to rear that breed should be given adequate incentives.

X. **Animals belonging to 'recognized breeds' as against local, *desi* or nondescript animals:** The local or *desi* animals in any region are usually just as productive and locally adapted as animals belonging to the recognized breeds in that region. They should, therefore, be included in conservation or genetic improvement programmes. Animals should then be evaluated objectively on the basis of their production performance for the traits considered important by their owners. This is a matter of selecting the desired genes rather than the genotype.

XI. **AI in goats:** Provision of bucks is sometimes untenable due to various reasons such as buck maintenance not being economically viable in small flocks, disease and other health problems, reproductive problems such as poor semen quality, poor libido and behavioural problems due to bucks being aggressive and injuring other goats, and women or old people not being able to handle them. The goal should, therefore, be to develop semen freezing and AI technology for field use. This is especially relevant for areas such as Maharashtra, where most goats are kept in flocks of 1 to 2 goats each. Goat AI can be combined with cattle AI services provided by state governments and NGOs. Private sector delivery of AI would also be feasible. Cattle AI technicians will require some additional training to do goat AI successfully.

Ram and buck semen freezing technology is also essential for *ex situ* cryo-conservation (conservation in liquid nitrogen).

XII. **Avoid excessive regulation:** Too many constricting regulations could stifle a livestock industry, operating more or less vibrantly in the existing system and market forces. For example, if the population of a goat breed decreases alarmingly, the state government may

ban the export of animals of that breed to other states or countries. Such a ban on export of animals of that breed may be counter-productive. Goat keepers will not rear goats, which they cannot sell to earn an income. They are likely to earn a higher income from people outside the state, who might like to buy these animals as highly prized breeding animals. Such situations of alarming reduction in the numbers of a breed need to be tackled with a mix of policy solutions such as raising the awareness of livestock keepers about 'not selling the goose that lays golden eggs', cryo-conservation of frozen semen and embryos of the concerned breed, and appropriate support to encourage current rearers to increase their flock size and bring in new rearers.

Many state governments in India have detailed breeding policies about the breeding of livestock and some of them prohibit cross-breeding of small ruminants. Livestock keepers have the right to decide what to breed their animals with. The government should raise the awareness of livestock keepers about the different breeds available, and which breed is the most appropriate for their area and conditions, instead of prescribing a restrictive 'breeding policy'.

In conclusion, small ruminant rearers in India have not really experienced the benefits of systematic and organized genetic improvement on a large scale so far. India's small ruminants are reared by knowledgeable smallholders. Genetic progress can be achieved by combining the rearers' traditional knowledge with science, using proper but simple tools and targeted investment through community organizations. Genetic improvement has the potential to revolutionize livestock keeping in India, and improve the standards of living of the rearers along with the nutritional security of the country.

References

Aebi, R. (2009). Sheep husbandry on the Deccan plateau in India: Recent developments and new challenges from keeping the native Deccani breed and the introduced Nellore breed. BSc thesis at Swiss College of Agriculture SHL, Bern University of Applied Sciences.

Ahlawat, S.P.S., S.C. Gupta and D. Kumar. (2009). *Atlas of Animal Genetic Resources of India*. New Delhi: Today and Tomorrow's Printers and Publishers.

Anthra. (2008). Pastoralists of the Deccan: Keepers of the Black sheep Deccani. In *Bridging the Knowledge Divide: Livestock Livelihood Resources in the Emerging Context*. Hyderabad and Pune: Anthra. p. 50-59.

Arora, A.L. and S.S. Misra (eds.). (2011). *Mega Sheep Seed Project.* Project coordinator's Annual Report 2010-11. Central Sheep and Wool Research Institute, Avikanagar, Rajasthan. p.29.

Arora, A.L. and L.L.L. Prince. (eds.). (2011). *Network Project on Sheep Improvement.* Project coordinator's Annual Report 2010-11. Central Sheep and Wool Research Institute. Avikanagar, Rajasthan. p.33.

Baker, R.L. and G.D.Gray (2004). Appropriate breeds and breeding schemes for sheep and goats in the tropics. In *Worm Control for small ruminants in tropical Asia*, Canberra, Australia: Australian Centre for International Agricultural Research. Edited by Sani, R.A., G.D.Gray and R.L. Baker, ACIAR Monograph 113. p.63-95

Bhatia, S. and R. Arora. (2008). Genetic diversity in Kheri – A pastoralists developed Indian sheep using microsatellite markers. *Indian Journal of Biotechnology*. Vol. 7:108-112.

Central Sheep and Wool Research Institute (CSWRI) (1998). *35 Years of Research.* Report. p. 128

Central Sheep and Wool Research Institute (CSWRI) (2011). Genetic improvement of Sirohi Goats for meat and milk production. All India Coordinated Research Project on Goat Improvement. *Annual Report*, Rajasthan: Avikanagar. p 15.

Cunningham, E.P. (2010). A time of change. *Journal of Animal Breeding and Genetics*. 127:419-420.

de Groot, B., R.A. Narayan Prasad, R.L. Soni, P. Nett, and W. Kropf (1992). Performance of Sirohi goats under village conditions in Rajasthan, India. In *Pre-conference Proceedings – Abstracts of Contributory Papers* – V International Conference on Goats, New Delhi. Vol. 1: 53.

Falconer, D.S. (1986). *Introduction to Quantitative Genetics*. Second Edition. Essex, England: English Language Book Society/Longman.

FAO. **(**2007). *The State of the World's Animal Genetic Resources for Food and Agriculture*, edited by Barbara Rischkowsky and Dafydd Pilling. Rome: Food and Agriculture Organization of the United Nations.

Flint A.P.F. and J.A. Woolliams (2008). Precision animal breeding. *Philosophical Transactions of the Royal Society B.* 363:573-590.

Government of India (GOI) (2010). 18th Livestock Census 2007. All India Report based on Quick Tabulation Plan – Village level Totals (Provisional). New Delhi: Government of India, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries. http://dahd.nic.in/LS_hindi.pdf.

Gowane, G.R. and A.L. Arora (2010). Performance evaluation of sheep in farmers' flock of Eastern semi-arid region of Rajasthan. *Indian Journal of Small Ruminants*. Vol.16 (1): 87-91.

Indo-Swiss Goat Development and Fodder Production Project (ISGP). (1990A). Annual Administrative Report 1989-90. Ramsar, Ajmer: Department of Animal Husbandry, Government of Rajasthan. p. 50.

Indo-Swiss Goat Development and Fodder Production Project (ISGP). (1990B). Results of performance recording in village goat herds 1988/89. Technical Report 0190. Ramsar, Ajmer: Department of Animal Husbandry, Government of Rajasthan. p. 43.

Kandasamy, N. (2009). Breeding for improved wool and mutton production in Indian sheep: A retrospective. In *Proceedings of the X Annual Conference of the Indian Society of Animal Breeding and Genetics,* Chennai: Madras Veterinary College, Chennai. pp. 22-30.

Kropf, W. (1990). *Mission Report on Animal Breeding.* Ajmer: Indo-Swiss Goat Development and Fodder Production Project. p. 22.

Kropf, W., R.A. Narayan Prasad, O.P. Sharma, B. de Groot, and G. Nieuwhof (1992). A comparison of milk yield and reproductive performance of Sirohi goats with Alpine X Sirohi and Toggenburg X Sirohi crosses. In *Pre-conference Proceedings – Abstracts of Contributory Papers* – V International Conference on Goats, New Delhi. 1:59.

Misra, R.K. (1988). Project Coordinator's Report. *All India Coordinated Research Project on Goats.* Central Institute for Research on Goats, Makhdoom, Mathura. p. 90.

NARI 2010-11. (2011). *Annual Report of the Osmanabadi Goat Field Unit under the AICRP-Goat Improvement of ICAR.* Phaltan, Maharashtra, India: Nimbkar Agricultural Research Institute. p. 25.

Peacock, C. (2008). Dairy goat development in East Africa: A replicable model for smallholders? *Small Ruminant Research*. 77:225-238.

Peacock, C., C.O. Ahuya, J.M.K. Ojango and A.M. Okeyo (2011). Practical cross-breeding for improved livelihoods in developing countries: The FARM Africa goat project. *Livestock Science*. 136(1):38-44.

Phillipsson, J., J.E.O. Rege, E. Zonabend and A.M. Okeyo (2011). Sustainable breeding programmes for tropical farming systems. *Animal Genetics Training Resource*, version 3. Edited by Ojango, J.M., B. Malmfors and A.M. Okeyo. International Livestock Research Institute, Nairobi, Kenya and Swedish University of Agricultural Sciences, Uppsala, Sweden.

Progress Report. (1998). *Genetic Improvement of Marwari Goats for Meat Production in Farmers' Flocks.* Bikaner: Rajasthan Agricultural University. p.37.

Pundir, R.K. (2010). *Goat Farmer's Participation: A Success Story on Conservation of Beetal Goat*. Karnal: National Bureau of Animal Genetic Resources, ICAR.

Rajamma (2008). Democratizing livestock ownership for building food sovereignty. In *Bridging the Knowledge Divide: Livestock Livelihood Resources in the Emerging Context*. Hyderabad and Pune: Anthra. p. 18-23.

Ramsay, K., D. Swart, B. Olivier, and G. Hallowell. (2000). An evaluation of the breeding strategies used in the development of the Dorper sheep and the improved Boer goat of South Africa. In *Proceedings of the Workshop on Developing Breeding Strategies for Lower Input Animal Production Environments.* Edited by Galal, S., J. Boyazoglu and K. Hammond. ICAR Technical Series No. 3. p. 339-346.

Rege, J.E.O., K. Marshall, A. Notenbaert, J.M.K. Ojango and A.M. Okeyo. (2011). Pro-poor animal improvement and breeding – What can science do? *Livestock Science*. 136(1):15-28.

Singh, V.K. (1986). *Revised Terminal Report.* All India Coordinated Research Project on Sheep Breeding. Bikaner: CSWRI. p.356.

Singh, D.K., L.B. Singh and A.R. Deb. (1989). *Annual Progress Report*. All India Co-ordinated Research Project on Goat for Meat Production. Birsa Agricultural University, Ranchi, Bihar. p. 93.

Sharma, R.C., A.L. Arora, A. Kumar and R. Kumar. (2003). Evaluation of mutton type sheep in farmers' flocks of Rajasthan. http://agris.fao.org/aos/records/IN2005000358

Swarup, D. and S.K. Singh (eds) (2011). All India Coordinated Research Project on Goat Improvement. *Project Coordinator's Report. 2009-10 and 2010-11*. Central Institute for Research on Goats, Makhdoom, Mathura (U.P.). p. 60.

Wieser, M., F. Schneider and S.Wälty. (2000). *Capitalisation of Experiences in Livestock Production and Dairying (LPD) in India (CAPEX)*. Bern: Intercooperation.

Woolliams, J. and M. Toro. (2007). What is genetic diversity? In *Utilisation and Conservation of Farm Animal Genetic Resources*, edited by K. Oldenbroek. The Netherlands: Wageningen Academic Publishers.

Yapi-Gnaoré, C.V., J.E.O. Rege, A. Oya and N. Alemayehu. (1997). Analysis of an open nucleus breeding programme for Djallonke sheep in the Ivory Coast. Response to selection on body weights. *Animal Science*. 64:301-307.

Yapi-Gnaoré, C.V. (2000). The open nucleus breeding programme of the Djallonke sheep in Cote d.Ivôire. In *Proceedings of the Workshop on Developing Breeding Strategies for Lower Input Animal Production Environments.* Edited by Galal, S., Boyazoglu, J. and Hammond, K. ICAR Technical Series No. 3. p. 283-292.

Annexure 1

South Asia Pro Poor Livestock Policy Programme (SA PPLPP)

Call for Good Practices on Small Ruminant Rearing

Formats received relevant for the Report on Small Ruminant Breed Conservation and Improvement

Sr. No	Title	State/ Region
SR 1	Malabari goat breed improvement programme	7 districts in Kerala
SR 10	Rotational Goat Rearing Scheme designed by TANUVAS	Tamil Nadu (Districts Tirupur and Coimbatore)
SR 21	Building Livestock Assets: Acquiring goats through the traditional *Vaata* system	Andhra Pradesh (District East Godavari)
SR 22	Conservation of Deccani Sheep and Osmanabadi Goat for strengthening livelihoods of pastoral communities	Maharashtra (Districts Satara, Kolhapur and Sholapur) and Andhra Pradesh (District Medak)
SR 24	Heifer Project International - Community Development through livestock rearing	Rajasthan (District Alwar) and Bihar (District Muzzafarpur)
SR 30	Construction of Lambing Sheds	Jammu and Kashmir (Leh, Ladakh)

Abbreviations

AHD	Animal Husbandry Department
AI	Artificial Insemination
AICRP	All India Coordinated Research Project
BSS	Bharat Sevak Samaj
CAE	Caprine Arthritis Encephalitis
CIRG	Central Institute for Research on Goats
CSWRI	Central Sheep and Wool Research Institute
DAD-IS	Domestic Animal Diversity Information System
EEC	European Economic Community
ET	Enterotoxemia
FAO	Food and Agriculture Organisation of the United Nations
FMD	Foot and Mouth Disease
GoI	Government of India
GP	Good Practice
GPSVS	Ghogardiha Prakhand Swarajya Vikas Sangh
HPI	Heifer Project International
HS	Hemorrhagic Septicemia
ICAR	Indian Council of Agricultural Research
ILRI	International Livestock Research Institute
ISGP	Indo-Swiss Goat Development and Fodder Production Project
KVK	Krishi Vigyan Kendra
LEDeG	Ladakh Ecological Development Group
LEHO	Ladakh Environment and Health Organisation
MGBIP	Malabari Goat Breed Improvement Programme
MGSRDI	Maharashtra Goat and Sheep Research and Development Institute
MSSS	Malankara Social Service Society
NARI	Nimbkar Agricultural Research Institute
NBAGR	National Bureau of Animal Genetic Resources
NGO	Non-Government Organisation
NIC	National Informatics Centre
NIRDESH	National Institute for Rural Development, Education, Social Upliftment and Health
NWPSI	Network Project on Sheep Improvement
PNSO	Programme National de Selection Ovine
PPR	Peste des Petits Ruminants
PRIs	Panchayati Raj Institutions
RAIN	Rural Agricultural Institute, Narayangaon
SA PPLPP	South Asia Pro Poor Livestock Policy Programme
SDC-IC	Swiss Development Cooperation–Intercooperation
SHG	Self Help Group
SKUAST	Sher-e-Kashmir University of Agricultural Sciences and Technology
TANUVAS	Tamil Nadu Veterinary and Animal Sciences University
TSE	Transmissible Spongiform Encephalopathy
VUTRC	Veterinary University Training And Research Centre
WoTR	Watershed Organisation Trust

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