

Summary

The main objective was to develop a framework for community-based management (CBM) actions aiming to better utilize and to conserve the local small ruminants genetic resources in southern Benin. Hence, the study was designed in such a way as to:

1. Understand the livelihood contribution of each species of small ruminant to smallholders and identify a priority species (sheep or goats) for CBM activities,
2. Collect and collate existing information on phenotypes and conduct surveys to map the phenotype structure of local populations of the targeted species
3. Record and understand farmers' traditional breeding strategies and practices and
4. Analyse the opportunities and constraints for CBM.

Chapter 2 presents the results of a survey carried out to understand the factors affecting the decision of rural people to keep sheep or/and goats in southern Benin and to identify priority species for CBM activities. A total of 228 households were interviewed using structured questionnaires. The questionnaires included general household as well as individual household members' socio-economic information. Predictive models were developed using logistic regression. The results showed that it was more likely that younger household members ($p < 0.05$), especially women (60%) were owners of small ruminants. Owners of small ruminants were less likely involved in off-farm activities and had often no access to credit facilities. Gender, ethnicity and perception of risk associated with species were the major factors affecting people's choice of species. Goats (91.4%) were more popular than sheep (34.7%) because they were not affected by any ethnic or cultural restriction like sheep. They were also perceived to be a lower risk investment than sheep. Women represented 71% of the keepers of goat. Money from the sale of goats were primarily used to purchase staple food and clothes (36% of respondents), to finance income generating activities (22% of the respondents) and to pay school fees for children (12% of respondents). These findings spotlighted the financing and insurance functions of small ruminants, particularly of goats. It was concluded that keeping goats

could be an effective and feasible way to increase food security and to enhance livelihoods of the resource-poor people in rural southern Benin.

In Chapter 3, a countrywide survey was conducted to map the phenotype structure of the local populations of goats. Thirteen morphological traits were measured on a total of randomly selected 1672 female mature goats from four vegetation zones ranging from South towards North Benin. Four populations were characterized as distinct and may be referred to as ecotypes. The cluster analysis showed that the two southerly populations were closest to each other. Populations from northernmost vegetation zones always had larger features and less additional teats than those from southernmost zones. They also tended to have wattles and dropping ears. In the canonical discriminant analysis, the first two canonical variates were significant and accounted for 92% of the variability among vegetation zones. Measurements that were best able to separate the populations, as judged from the canonical variate analysis, were: height at withers, neck length, rump height, tail length and the ratio ear length/thoracic depth. Discriminant function models correctly allocated more than 70% of the individual goats to their a priori vegetation zones. These results provided supporting evidence for spatial variation in population of goats in Benin. The significant morphological variability recorded infers a considerable genetic variability that needs to be maintained for further genetic improvement and to respond to changes in climate, disease and market conditions. Further on-farm performance experiments were suggested to characterize these local goat populations on a sound ecological basis and to allow formulation of sustainable breeding and management strategies.

Because market is widely considered as an important driving force for loss of genetic diversity, a market study was undertaken in **Chapter 4** to examine the effects of selected qualitative and quantitative traits of goats on their market price and to identify market potential for increased smallholder's goat production. Data on breed type, sex, coat color, age, health and live bodyweight were recorded from 288 goats traded in two rural markets in southern Benin. Buyers were questioned about the purpose for which each animal was bought. A double logarithmic hedonic model was applied to link prices to the animal's physical attributes. Goats were sold alive and the animals were not weighed. Two distinct groups of sellers were present: the traders/retailers (54%) and the small-scale producers (46%). The majority (54%) of all traders were women. About 72% of the

producers declared that they come occasionally to the market to sell their animals to generate urgent needed cash while the remainder 28% mentioned that they come to the market only to sell their sick animals. All the sellers lived close to the markets. Of a total supply of small ruminants (1510 animals) recorded in the two markets, 56% were goats and 44% sheep. The majority of the goats (81%) were perceived as of local Djallonké breed type, 6% were perceived as of Sahelian breed type and the remaining 13% were perceived as crossbred between Djallonké and Sahelian breeds. Of a total of 288 traded goats recorded in the two markets, 38% were purchased by traders for resale purposes, 38% by consumers for ceremonies or festive purposes, 7% for sacrificial purposes, 8% for rearing purposes and the remaining 9% by caterers. Caterers include people who owned a small restaurant and sell food and cooked pieces of meat but also those who have a small butchery. Live weight and sex were significant ($p < 0.001$) characteristics affecting prices. The estimated elasticity of demand for goats with respect to live weight was 0.99. Given the significant premium associated with these characteristics, goat keepers could significantly improve their profitability through the adoption of appropriate management and marketing practices. These results provided an empirical evidence of the existence of market potential for the local type of goat in rural southern Benin.

Chapter 5 presents and analyses the process of implementing CBM framework towards sustainable utilization of goat genetic resources in two rural communities (Gbede and Ouedeme-Pedah) in southern Benin from November 2005 to February 2007. The process started with the approach and selection of the communities. The process started with the selection of two rural communities followed by a situation analysis, a participatory planning, implementation and monitoring of CBM actions. In the early stage of the situation analysis, the perspectives of smallholder goat keepers were investigated in both villages using structured questionnaires, focus group discussions, ranking exercises and participant observation. A total of 38 goat farmers (16 in Gbede and 22 in Ouedeme-Pedah) were interviewed, the details of their management practices and local knowledge analyzed and the characteristics of their animals recorded. The results are presented in **Chapter 6**. Goats are mainly kept for sale whenever cash is needed. Traits related to reproduction, to behavior, to health and to meat production were considered equally important and were ranked very high by goat keepers. Increased net income per flock through increased number of marketable animals was the derived breeding objective

from the trait analysis. Poor management practices (poor disease control, poor housing and nutrition, uncontrolled mating) were identified as key obstacles to improved smallholder's goat production. Farmers were found more focused on immediate short-term benefits. Therefore, it was concluded that the overriding priority towards improvement was to develop initiatives to address the management constraints, and that the most effective way to achieve this is to bring farmers together in a participatory action planning process. Additional information on the communities and on their sources of livelihoods were collected through participatory village resource mapping and wealth ranking exercises, transect walks and focus group discussions and used together with the results presented in **Chapters 2, 3, 4 and 6** to plan with the communities for community-led strategies towards better management and conservation of the local goat genetic resources. The participatory action planning process was facilitated by a multidisciplinary research team built of a specialist in livestock production system, a socio-economist and an agronomist. This team was reinforced in each village by a livestock technician and a veterinarian. The CBM approach outlined in **Chapter 5** was effective in mobilizing in a short duration of time, collective interest and resources towards better management of local goat resources in the selected rural communities. Central to the success of the CBM process was that:

- the communities have recognized that their goats resources which contribute to diversification of their source of income and sustain their livelihoods are vulnerable to mismanagement
- the communities have perceived the tangible and immediate benefits from the CBM actions
- the participatory research methodology used in this study has proved successful in turning the process into local capacity building and empowerment exercise: by giving them a forum for exchange of knowledge and experiences, and for analyzing their problems and finding solutions, by providing them with relevant information and training and by helping them in framing rules and regulations, the research program has enabled local people in discovering and enhancing their own potential at developing strategies and institutions towards better management of their goat resources.

In both communities, there have been preliminary discussions about possibilities for the implementation of a community-based genetic improvement program. Farmers have shown strong interest in establishing an open nucleus breeding scheme which would

provide participant flocks with local bucks of high genetic potential. However, further discussions with the communities as well as technical and institutional innovations are required to ensure the success of the implementation of such genetic improvement program. Also, the adoption by farmers of improved general management practices being of paramount importance, further investigation are needed to scientifically validate the local knowledge of farmers on fodder resources and on ethnoveterinary through systematic on-farm experiments and to plan for participatory cost-effective technologies (improved feeding and control of diseases).

In general, the results of the CBM process have shown that because of the important role that play goats in their welfare and because they were offered the relevant information and technical support, people in the targeted communities organized themselves effectively and took appropriate actions to better manage and conserve the local goat resources. Given some time for consolidation and continual institutional and technical support, these newly created CBM groups are most likely to become self-reliant, socially and economically viable. The interactive nature of the CBM approach developed in this study allows its rapid adjustment to different local conditions and thus its replication elsewhere.

Chapter 1

General introduction

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1.1 Foreword

The growing evidence of the potential to improve the livelihoods of rural families in Benin through increases in productivity of their small ruminants has resulted in a national consensus on the need to focus attention on the long-term sustainability of village small ruminants' production (Arodokoun et al., 2001).

It is widely agreed (ILCA/FAO/UNEP, 1979a and 1979b; Wilson, 1991; Mason, 1996) that the populations of sheep and goats kept by almost smallholders in southern Benin are primarily of local origin and belong to the West African Dwarf (WAD) breeds, which are spread across West African countries. However, very little information is available on the performance of these local populations of small ruminants, on their adaptation and ability to thrive under the prevailing harsh environmental conditions as well as their resistance to diseases. According to Rege (1998), the lack of adequate knowledge about the economic, scientific, socio-cultural and genetic potentials of these dwarf breeds is the main reason of the observed very low production in the sub-sector of small ruminants' in most West African countries. Also, efforts to develop this sub-sector have been biased in favour of meat as the only one output of economic value and have tended to ignore other substantial benefits from keeping these local breeds. As a consequence, most improvement livestock programs hitherto have resorted to crossbreeding or directly replacing the dwarf breeds by imported breeds, which are thought to be more productive and more market oriented (Gbangboche et al., 2002). The influence of such improvement programs in combination with the lack of adequate livestock development policies and the existing distorted market incentives for other breeds imported from neighboring Sahelian countries (Niger and Burkina Faso for instance), have been increasing the threat of genetic dilution and reducing the gene pool of the most appropriate local genetic resources. Anderson (2003) argues that the importance of local breeds is not only their ability to fulfil livelihood functions, but also their genetic contribution to adaptive and other traits to crossbred animals.

Variations between breeds are estimated to account for about one half of the genetic variation within a livestock species, while the other half is accounted for by the variation

between individuals within a breed (Hammond and Leitch, 1995). It is crucial to maintain this genetic diversity in order to continue to improve the performance of the animals and to respond to change in climate, disease and/or consumer preference (Notter, 1999), while improving the livelihoods of livestock keepers (Anderson, 2003).

Methods to maintain genetic diversity in domestic animals involve either the cryogenic storage of genetic material (*ex-situ* methods) or the maintenance of living animals in reproducing herds/flocks (*in-situ* methods). Independent of the approach, programs to conserve farm animal genetic resources (FAnGR) are costly to implement (Brem et al., 1984; Smith, 1984; Loemker and Simon, 1994; Ollivier and Renard, 1995). Therefore priorities have to be set up. Since different species play different livelihoods functions (Anderson, 2003), it clearly appears that the decision about what to conserve depends on the knowledge and perception of what is most useful to local communities. Therefore, as advocated by Ruane (2000), the overall first criterion for setting conservation priorities is the choice of species. This author further suggested several criteria to identify priority breeds or populations. They include the degree of endangerment of the breed or population, its traits of current economic value, its special landscape value, its traits of current scientific value, its cultural and historical value and genetic uniqueness. In other words, breed characterization is an essential first step in the urgent task of genetic resource conservation (Baker, 1992; Hodges, 1992; Rege and Gibson, 2003) that must follow the definition of priority species.

Both *ex situ* and *in situ* conservation approaches have strengths and weaknesses. However, *in situ* conservation approach has gained wider support. It is considered as more effective (Gandini and Oldenbroek 1999; Anderson and Centonze, 2005) because in addition to conservation of FAnGR in their natural agro ecosystem, it also ensures the conservation of farmers' traditional knowledge. Fowler and Mooney (1990) go further to argue that agricultural diversity (including domestic animal diversity) cannot be saved without saving the farm community. CBD (1992) makes also this point and advocates for a community-based management (CBM) approach.

The CBM of FAnGR intends to create, through the bottom-up, participatory approach, conditions whereby local communities stand to benefit from a sustainable use and management of FAnGR for improving their social and economic well-being, while