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**BULLETIN  
D'INFORMATION  
SUR LES RESSOURCES  
GÉNÉTIQUES ANIMALES**

**BOLETÍN  
DE INFORMACIÓN  
SOBRE RECURSOS  
GENÉTICOS ANIMALES**



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## ANIMAL GENETIC RESOURCES INFORMATION

### BULLETIN D'INFORMATION SUR LES RESSOURCES GÉNÉTIQUES ANIMALES

### BOLETÍN DE INFORMACIÓN SOBRE RECURSOS GENÉTICOS ANIMALES

#### CONTENTS

#### Page

Basic demographic data – a prerequisite for effective management of animal genetic resources .....	1
<i>B. Scherf &amp; D. Pilling</i>	
Production environment recording .....	7
<i>B. Scherf &amp; M. Tixier-Boichard</i>	
Community-based management of farm animal genetic resources in practice: framework for focal goats in two rural communities in Southern Benin .....	11
<i>L.H. Dossa, C. Wollny, M. Gauly &amp; I. Gbégo</i>	
South African developed meat type goats: A forgotten animal genetic resource? .....	33
<i>A. Pieters, E. van Marle-Köster, C. Visser, &amp; A. Kotze</i>	
Genetic diversity and zebu genes introgression in cattle population along the coastal region of the Bight of Benin .....	45
<i>O.D. Koudandé, G. Dossou-Gbété, F. Mujibi, H. Kibogo, D. Mburu, G.A. Mensah, O. Hanotte &amp; J.A.M. van Arendonk</i>	
Evaluación de la variabilidad y potencial genético de poblaciones de bovinos criollos colombianos .....	57
<i>R. Martínez, J. Gallego, G. Onofre, J. Pérez &amp; R. Vasquez</i>	
Molecular characterization of two common Chadian cattle breeds .....	67
<i>C. Flury, B.N.R. Ngandolo, B. Müller, J. Zinsstag &amp; H.N. Kadarmideen</i>	
Characterization of Banni buffalo of Western India .....	77
<i>B. P. Mishra, K.P. Singh, D.B. Chavan, D.K. Sadana, R.S. Kataria, P. Kathiravan &amp; S.P.S. Ahlawat</i>	
Establishing a conservation flock for "Vorwerkhuhn" chicken breed – a case study of <i>in-situ</i> conservation of local chicken breeds in Germany .....	87
<i>S. Weigend, K. Stricker &amp; F.-G. Röhrßen</i>	
Recent Publications .....	89
Editorial policies and procedures .....	93



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## Editorial – The 5<sup>th</sup> session of the Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture. Recommendations and advices

The Fifth Session of the Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture took place in Rome in January 2009. This first meeting of the Working Group following the Interlaken Conference represented an important opportunity to foster momentum in the implementation of the *Global Plan of Action for Animal Genetic Resources*. The positive outcomes of the meeting, and the spirit of collaboration that characterized the discussions, were therefore very much to be welcomed. The Report of the Session<sup>1</sup> contains clear recommendations and advice to the Commission on Genetic Resources for Food and Agriculture, in particular on the design and elements of a Funding Strategy for the *Global Plan of Action* and on a process for evaluating progress in implementation.

A key objective for the immediate future is to translate the Strategic Priorities of the *Global Plan* into effective plans for action at country level. The Working Group recommended that the Commission welcome the *Draft guidelines to assist the preparation of national strategies and action plans for animal genetic resources for food and agriculture* presented to the meeting by the FAO Secretariat, and that it request FAO to finalize and publish these guidelines. Preparation of a National Strategy and Action Plan will help countries to decide on how to achieve more effective utilization of their animal genetic resources, taking national circumstances and priorities, including the availability of human and financial resources, fully into account. It will provide a means to better engage diverse interests within the livestock sector and to enhance understanding among policy-makers and the general public of the importance of animal genetic resources, the multiple roles and values of livestock, and the need to maintain the genetic diversity that will enable adaptation to changing conditions.

The Working Group also recommended that the Commission reaffirm the relevance of the establishment of country-based early warning and response systems for animal genetic resources as part of broader national strategies for the

management of these resources, taking into account national circumstances and the relevant Strategic Priorities and Actions of the *Global Plan of Action*. The Working Group stressed the importance of national back-up storage systems for animal genetic resources and recommended that the Commission encourage countries to establish such systems, if they have not done so already.

The Working Group recommended that the Commission acknowledge the important contributions of small-scale livestock keepers, particularly in developing countries, as custodians of much of the world's animal genetic resources. It stressed the importance of capacity-building to support the improvement of local and multi-functional breeds in low- and medium-input production systems, and institutional support to address the particular needs of such systems, while ensuring respect for the knowledge, innovations and practices of indigenous and local communities, and the application of relevant national legislation and international agreements. It also recommended that the Commission note the need for countries to take into account the contributions of small-scale livestock keepers and promote their full and effective participation in the implementation of the *Global Plan of Action*; in the preparation and implementation of National Strategies and Action Plans for Animal Genetic Resources; and as appropriate, food security, poverty alleviation and livelihood security policies and programmes.

A two-pronged approach to reporting on progress in the implementation of the *Global Plan of Action* was discussed a) Reporting by countries, regions, FAO and other organizations on the process of implementation of the *Global Plan of Action*; and b) Reporting by countries on the status and trends of animal genetic resources which will also help to assess the actual impact of the implementation of the *Global Plan of Action*. For the first type of report, the Working Group recommended that the Commission adopt a

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<sup>1</sup>All ITWG 5 documents are available at:  
<http://www.fao.org/ag/againfo/programmes/en/genetics/angrovent-5th-docs.html>

progress reporting interval of four years. With regard to status and trends reports on animal genetic resources, the Working Group recommended that the Commission request FAO to prepare synthesis reports based on data and information provided by countries through DAD-IS, and make these reports available to the Commission at each of its regular sessions. In this regard, the Working Group stressed the need for regular

updating of national data and information on animal genetic resources, and the importance of providing financial and technical support for developing countries to assist them in updating their data and information.

The Editors

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## Cinquième session du Groupe de travail technique intergouvernemental sur les ressources zoogénétiques pour l'alimentation et l'agriculture

La Cinquième session du Groupe de travail technique intergouvernemental sur les ressources zoogénétiques pour l'alimentation et l'agriculture a eu lieu à Rome en janvier 2009. Après la Conférence d'Interlaken, cette première réunion du Groupe de travail a représenté une importante occasion pour promouvoir la réalisation du *Plan d'action mondial sur les ressources zoogénétiques*. Les résultats positifs de la réunion, ainsi que l'esprit de collaboration qui a caractérisé les discussions, ont été hautement appréciés. Le rapport de la réunion<sup>1</sup> contient des recommandations et conseils précis pour la Commission sur les ressources génétiques pour l'alimentation et l'agriculture, et en particulier sur le concept et les éléments pour une Stratégie de financement de la mise en oeuvre du *Plan d'action mondial* et sur le processus d'évaluation des progrès obtenus dans la mise en oeuvre.

L'objectif principal pour le futur immédiat est la conversion des Priorités stratégiques du *Plan Mondial* en plans effectifs d'action au niveau national. Le Groupe de travail a recommandé que la Commission adopte l'ébauche des *Directives pour la préparation des stratégies nationales et des plans d'action sur les ressources zoogénétiques pour l'alimentation et l'agriculture* présentée lors de la réunion par le Secrétariat de la FAO, et que l'on sollicite de la FAO la finalisation et publication de ces directives. La préparation d'une Stratégie nationale et un Plan d'action aideront les pays à décider comment obtenir une utilisation plus effective de leurs ressources zoogénétiques tout en tenant compte pleinement des circonstances et des priorités au niveau national, y compris la disponibilité de ressources humaines et financières. De cette façon on mettra à disposition un outil pour faciliter un meilleur accord entre les différentes parties qui existent dans le domaine de l'élevage et une meilleure compréhension parmi les législateurs et le public sur l'importance des ressources zoogénétiques, les différents rôles et valeurs de l'élevage, ainsi que la nécessité de conserver la diversité génétique pour permettre son adaptation aux conditions changeantes.

Le Groupe de travail a aussi recommandé que la Commission reconfirme l'importance d'établir au niveau national des systèmes d'alerte et d'intervention rapide pour les ressources zoogénétiques à l'intérieur d'autres stratégies nationales plus larges pour la gestion de ces ressources, tout en considérant les circonstances nationales et l'importance des Priorités et des actions stratégiques du *Plan d'action mondial*. Le Groupe de travail a souligné l'importance des systèmes nationaux de sauvegarde pour les ressources zoogénétiques et a recommandé à la Commission d'encourager les pays pour qu'ils établissent ce type de systèmes s'ils ne l'ont pas encore fait.

Le Groupe de travail a recommandé que la Commission reconnaisse l'importance de la contribution des petits éleveurs, en particulier dans les pays en voie de développement, en tant que gardiens de la plus grande partie des ressources zoogénétiques existante dans le monde. On a souligné l'importance du renforcement des capacités de réalisation pour soutenir l'amélioration des races locales et multi fonctionnelles dans des systèmes de moyen et faible apport, ainsi que le soutien des institutions pour résoudre les besoins spécifiques de ces systèmes, tout en respectant les connaissances, les innovations et les pratiques des communautés indigènes et locales et l'application de la législation nationale appropriée et des accords internationaux. Il a également recommandé que la Commission note le besoin des pays à prendre en considération les contributions des petits propriétaires et à favoriser leur pleine et effective participation dans la réalisation du *Plan d'action mondial*; dans la préparation et réalisation des Plans nationaux de

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<sup>1</sup>Tous les documents ITWG 5 sont disponibles sur: <http://www.fao.org/ag/againfo/programmes/en/genetics/angrovent-5th-docs.html>

stratégie et d'action pour les ressources zoogénétiques; et, si nécessaire, dans les programmes et les politiques de sécurité alimentaire, atténuation de la pauvreté et sécurité des moyens d'existence.

On a discuté d'une double approche pour informer sur l'état de réalisation du *Plan d'action mondial*: a) rapports par pays, régions, de la FAO et des autres organisations sur l'état de la réalisation du *Plan d'action mondial*; et b) rapports par pays sur la situation et tendance des ressources zoogénétiques qui aideront à évaluer l'impact actuel de la réalisation du *Plan mondial d'action*. Pour le premier type de rapport le Groupe de travail a recommandé que la Commission adopte la présentation des rapports sur l'avancement du

travail avec un intervalle de quatre ans. En ce qui concerne les rapports sur la situation et tendance des ressources zoogénétiques, le Groupe de travail a recommandé que la Commission sollicite de la FAO la préparation de rapports synthétiques basés sur les données et l'information fournis par les pays à travers DAD-IS et que ces rapports soient accessibles à la Commission lors de chacune de ses réunions ordinaires. A ce sujet, le Groupe de travail a souligné le besoin d'une mise à jour régulière des données et des informations nationales sur les ressources zoogénétiques, ainsi que l'importance de fournir une aide financière et technique aux pays en voie de développement pour les aider dans la mise à jour de leurs données et informations.

Les Editeurs

## Quinta reunión del Grupo de Trabajo Técnico Intergubernamental sobre los Recursos Zoogenéticos para la Alimentación y la Agricultura

La Quinta reunión del Grupo de Trabajo Técnico Intergubernamental sobre los Recursos Zoogenéticos para la Alimentación y la Agricultura tuvo lugar en Roma en enero del 2009. Tras la Conferencia de Interlaken, esta primera reunión del Grupo de Trabajo ha representado una ocasión importante para fomentar la realización del *Plan de Acción Mundial sobre los Recursos Zoogenéticos*. Los resultados positivos de la reunión<sup>1</sup>, así como el espíritu de colaboración que caracterizaron las discusiones, fueron muy apreciados. El informe de la reunión contiene claras recomendaciones y consejos para la Comisión sobre Recursos Genéticos para la Alimentación y la Agricultura, en particular, sobre el diseño y los elementos para una Estrategia de financiación para el *Plan de Acción Mundial*, y sobre el proceso de evaluación de los progresos obtenidos en su realización.

El objetivo principal para el futuro inmediato es la conversión de las Prioridades Estratégicas del *Plan de Acción Mundial* en planes efectivos de acción a nivel nacional. El Grupo de Trabajo recomendó que la Comisión adoptara el borrador de las *Líneas guía para la preparación de estrategias nacionales y planes de acción sobre los recursos zoogenéticos para la alimentación y la agricultura* presentado a la reunión por la Secretaría de la FAO, y que se solicitara a la FAO que finalicen y publiquen estas líneas guía. La preparación de una Estrategia Nacional y un Plan de Acción ayudará a los países a decidir cómo conseguir una utilización más efectiva de sus recursos zoogenéticos, teniendo en cuenta plenamente las circunstancias y prioridades nacionales, incluida la disponibilidad de recursos humanos y financieros. De esta forma, se proporcionará un medio para alcanzar un mejor compromiso entre los distintos intereses dentro del sector ganadero y un mayor entendimiento entre los legisladores y el público sobre la importancia de los recursos zoogenéticos, las múltiples líneas de conducta y valores de la ganadería, así como la necesidad de mantener la diversidad genética que permitirá la adaptación a las condiciones cambiantes.

El Grupo de Trabajo también recomendó que la Comisión reafirmara la importancia del establecimiento a nivel nacional de sistemas de alerta y respuesta rápidas para los recursos zoogenéticos como parte de las más amplias estrategias nacionales para la gestión de estos recursos, teniendo en cuenta las circunstancias nacionales y la importancia de las Prioridades y Acciones Estratégicas del *Plan de Acción Mundial*. El Grupo de Trabajo subrayó la importancia de los sistemas nacionales de salvaguardia de los datos sobre recursos zoogenéticos y recomendó a la Comisión alentar a los países para que establezcan este tipo de sistemas en caso de que no lo hayan hecho todavía.

El Grupo de Trabajo recomendó que la Comisión reconociera la importante contribución de los pequeños agricultores, en particular de los países en vía de desarrollo, en cuanto guardianes de la mayor parte de los recursos zoogenéticos existentes en el mundo. Se subrayó la importancia de reforzar las capacidades para apoyar la mejora de las razas locales y multi funcionales en sistemas de baja y media producción, y el apoyo institucional para resolver las necesidades particulares de esos sistemas, manteniendo el respeto por los conocimientos, innovaciones y prácticas de las comunidades indígenas y locales, y el uso de la legislación nacional relevante y de los acuerdos internacionales. También recomendó que la Comisión tomara nota de la necesidad de los países de tener en cuenta las contribuciones de los pequeños propietarios ganaderos y promoviera su plena y efectiva participación en la realización del *Plan de Acción Mundial*; en la preparación y realización de los Planes Nacionales de Estrategia y Acción para los Recursos Zoogenéticos; y, cuando sea necesario, en los programas y políticas de

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<sup>1</sup>Todos los documentos de ITWG 5 están disponibles en: <http://www.fao.org/ag/againfo/programmes/en/genetics/angrovent-5th-docs.html>



seguridad alimentaria, alivio de la pobreza y seguridad de sustento.

Se discutió sobre un doble enfoque para informar acerca del estado de realización del *Plan de Acción Mundial*: a) Informes por países, regiones, de la FAO y otras organizaciones sobre el estado de realización del *Plan de Acción Mundial*, y b) Informes por países sobre la situación y tendencia de los recursos zoogenéticos que ayudará a evaluar el impacto actual de la realización del *Plan de Acción Mundial*. Para el primer tipo de informe, el Grupo de Trabajo recomendó que la Comisión adoptara la presentación de informes sobre el avance del trabajo a intervalos de cuatro años. En cuanto a los

informes sobre la situación y tendencia de los recursos zoogenéticos, el Grupo de Trabajo recomendó que la Comisión solicitara a la FAO la preparación de informes sintéticos basados en los datos y la información proporcionada por los países a través de DAD-IS y que estos informes fueran accesibles a la Comisión durante cada una de sus reuniones ordinarias. A este respecto, el Grupo de Trabajo subrayó la necesidad de una actualización continua de los datos e informaciones nacionales sobre recursos zoogenéticos, así como la importancia de proveer ayuda financiera y técnica a los países en vía de desarrollo para apoyarles en la actualización de sus datos e informaciones.

Los Editores

# Basic demographic data – a prerequisite for effective management of animal genetic resources

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## Summary

Demographic data describe the size, structure and distribution of livestock populations and how these change over time. They are fundamental to determining the risk status of breed populations both on a national and a global scale. Currently, no population data are available for 36 percent of the breeds recorded in the Domestic Animal Diversity Information System (DAD-IS), and for many other breeds data are updated so infrequently that monitoring trends in risk status is difficult or impossible. Data on the geographical distribution of breeds are also generally inadequate. A baseline survey of the breed population needs to be followed by periodic monitoring. The required frequency of the monitoring activities will depend on the generation interval of the species in question. Data may be collected via breed-level censuses or surveys, or estimated based on species level data. It is important that national decision-making takes account of the global demographics of the breed; a classification system distinguishing breeds present only in one country from those present in several countries has been developed. Much remains to be done to improve the availability of demographic data. Moreover, methods need to be developed that account for the risks of genetic erosion associated with indiscriminate cross-breeding. A further key requirement is the development of methods for representative sampling of national animal populations to allow estimates of their total population size and other demographic data to be obtained in a cost-effective manner.

## Résumé

Les données démographiques indiquent la taille, la structure et la distribution des populations domestiques et comment elles changent dans le temps. Ces données sont fondamentales pour déterminer la situation de risque des races au niveau national et mondial. Actuellement il n'existe

aucune donnée de population pour 36% des races enregistrées dans le Système d'Information sur la Diversité des Animaux Domestiques (DAD-IS), et dans la plupart des autres cas les données sont mise à jour avec si peu de fréquence qu'il est difficile et même impossible de suivre la situation de risque et la tendance. Très souvent aussi les données sur la distribution géographique des races ne sont pas appropriée. Une enquête de base sur les populations a besoin d'un suivi continu. La fréquence nécessaire pour faire le suivi des activités dépendra de l'intervalle entre générations des espèces à l'étude. Les données doivent être saisies à travers les recensements par races ou les enquêtes, ou aussi à travers les estimations basées sur les données au niveau des espèces. Il est important que les législateurs au niveau national tiennent compte de la démographie mondiale de la race. Un système de classement a été mis au point qui détermine les races présentes seulement dans un pays de celles qui se trouvent dans différents pays. Il reste encore beaucoup à faire pour améliorer la disponibilité des données démographiques. Cependant, il est nécessaire de développer des méthodes qui valorisent les risques de l'érosion génétique associés aux croisements sans contrôle. Il est aussi important de développer des méthodes représentatives d'échantillonnage des populations animales au niveau national afin de permettre l'évaluation de la taille totale des populations et des autres données démographiques qui peuvent s'obtenir en forme de coût effectif.

## Resumen

Los datos demográficos describen el tamaño, estructura y distribución de las poblaciones ganaderas y cómo éstas cambian en el tiempo. Estos datos son fundamentales para determinar la situación de riesgo de las razas tanto a nivel nacional como a escala mundial. Actualmente no existen datos sobre población para el 36% de las razas registradas en el Sistema de Información

sobre Diversidad de Animales Domésticos (DAD-IS), y para muchas otras razas los datos se actualizan con tan poca frecuencia que resulta difícil e incluso imposible monitorear la situación de riesgo y tendencia. También los datos sobre la distribución geográfica de las razas resultan a menudo inadecuados. Una encuesta de base sobre las poblaciones necesita un seguimiento y monitoreo periódico. La frecuencia requerida para monitorear las actividades dependerá del intervalo entre generaciones de las especies en cuestión. Los datos deben recogerse a través de los censos por razas o de las encuestas, o también por estimaciones basadas sobre datos a nivel de especies. Es importante que los legisladores nacionales tengan en cuenta la demografía mundial de la raza; se ha puesto a punto un sistema de clasificación que distingue las razas presentes solo en un país de las que se encuentran en diversos países. Todavía queda mucho por hacer para mejorar la disponibilidad de los datos demográficos. Sin embargo, es necesario desarrollar métodos que valoren los riesgos de la erosión genética asociada a los cruces indiscriminados. Otra necesidad importante es el desarrollo de métodos representativos de muestreo de las poblaciones animales a nivel nacional para permitir las estimaciones del tamaño total de las poblaciones y otros datos demográficos que puedan ser obtenidos en forma de costo efectivo.

**Key words:** *National strategies, Effective population size, Population trends, Geographical distribution, Risk status, Management.*

## Introduction

Demographic data describe the size, structure and distribution of livestock populations and how these change over time. They are fundamental to effective decision-making in animal genetic resources (AnGR) management, for example to address the question of whether a breed should be targeted for conservation or whether breeding strategies need to be adapted in order to avoid the loss of within-breed genetic diversity. The *Global Plan of Action for Animal Genetic Resources*, adopted by 109 countries at the first International Technical Conference on Animal Genetic Resources, held in Interlaken, Switzerland in 2007, and endorsed by the FAO Conference, highlights “characterization, inventory and monitoring of trends and associated risks” as one of its four Strategic Priority Areas (FAO 2007a).

The main focus of this paper is on the use of demographic data to inform strategic planning of the management of breed populations at national level, and in particular the basic decision as to whether a breed should be included in a conservation programme (Figure 1). However, they are also important for decision-making at supra-national level and for planning of breed conservation and development on a more local scale.

## Use of Demographic Data for Planning National Strategies for the Management of AnGR

In the context of national planning, one of the main factors to be considered is the risk status of the breeds under consideration – essentially an indication of the likelihood that the breeds will become extinct if no remedial action is taken. Clearly, risk status is linked to the size of the population – small populations are at greater risk of being wiped out by a disastrous event and will be more rapidly threatened by a downward trend. The preferred measure for the determination of risk status is the effective population size ( $N_e$ ) (FAO, 1992; Gandini *et al.*, 2004). This allows the rate of inbreeding, and hence the loss of genetic diversity within the population, to be inferred. Calculating  $N_e$  requires that data on the size of both the female and the male breeding populations are available.

In addition to the effective size of the population, risk status depends on population trends. Predicting future population trends and fluctuations, and hence the size of the population at a given point in the future, is difficult given the number of factors involved. Nonetheless, current trends in the size of the population need to be monitored. A downward trend, particularly a rapid downward trend, should serve as a warning, and (unless the potential loss of the breed is accepted) as a call to action.

A further important consideration for determining risk status is the geographical distribution of the population. Of particular importance is the extent to which a breed population is restricted to a limited geographical area. The more concentrated the population is in spatial terms, the greater the risk that all the animals, or a large proportion of them, will be affected by a localized disaster such as a disease epidemic. Data on breeds’ geographical distribution are important for a number of reasons in addition to

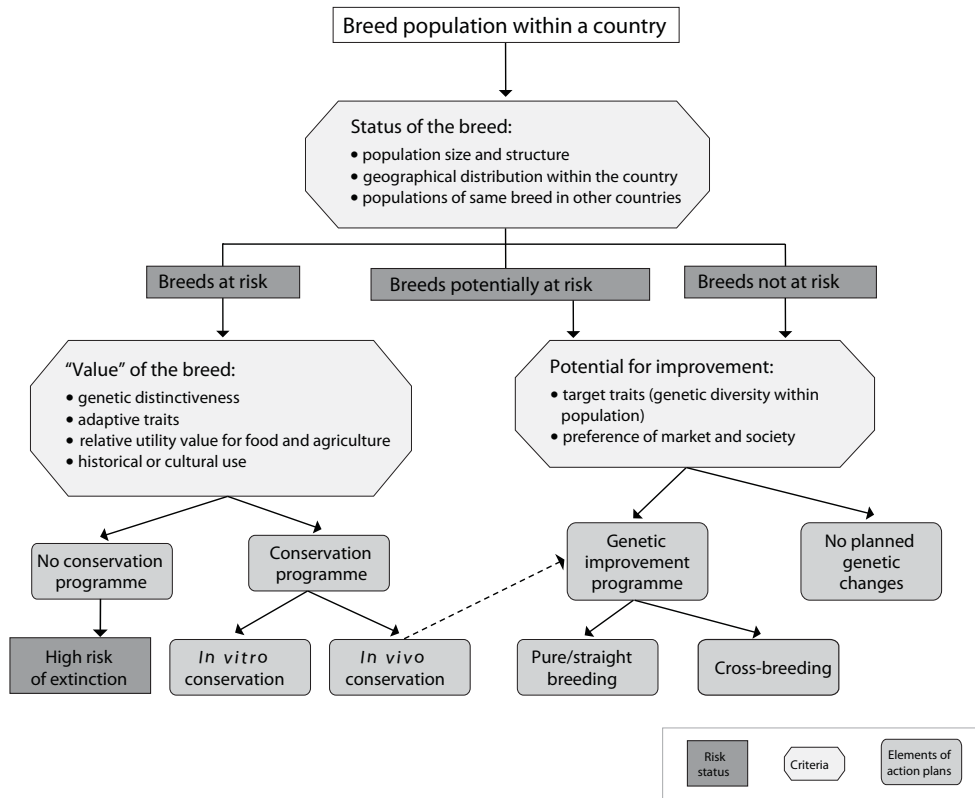


Figure 1. Information required to design management strategies. Source: (FAO, 2007b).

assessing risk. They facilitate further, more in depth, studies; they allow more effective planning for, and response to, emergencies that threaten genetic diversity; and, particularly if georeferenced, they allow breed data to be related to environmental and socio-economic datasets and hence more elaborate and comprehensive analysis (FAO/WAAP, 2008).

Finally, national-level assessment of risk status, and consequent decisions regarding conservation measures, need to be considered in the context of the demography of the breed on an international scale. A breed that has unthreatened populations in other countries is likely to be a lower priority for conservation efforts.

Determining risk status is, of course, only one aspect of the decision as to whether a conservation programme should be undertaken for a particular breed – genetic distinctiveness, adaptive traits, relative utility for food and agriculture, and historical or cultural factors need to be considered (Figure 1). Nonetheless, without basic demographic data, decision-makers will be at a loss.

to document changes and trends. This requires a baseline survey followed by periodic monitoring. Monitoring should be conducted at least once per generation of the species, particularly for breeds classified as at risk or potentially at risk. This requires (monitoring) surveys at intervals of about eight years for horses and donkeys, five years for cattle, buffalo, sheep and goats, three years for pigs, and two years for poultry species. Monitoring may be required more frequently depending on the reproductive technology employed for each species and breed. Thus the reproductive technology generally employed in the respective breed populations should be recorded. Monitoring should serve as the basis for national early warning.

Various methods may be employed to determine the total populations size, and these need to be documented (see Box 1). Analysis of data entered into the Domestic Animal Diversity Information System (DAD-IS)<sup>1</sup> by countries’ National Coordinators<sup>2</sup> revealed that 87 percent of entries are based on a census or survey at breed level, while

## Collecting Demographic Data

The above discussion has illustrated the importance of obtaining basic demographic data and the need

<sup>1</sup><http://www.fao.org/dad-is>

<sup>2</sup>National Coordinators for the Management of Animal Genetic Resources are officially appointed by the relevant authorities in each country.

**Box 1. Methods to determine total population size (FAO 1998).**

**Census at species level:** census was conducted by species and not by breed; knowledge (or an estimate) of the proportion of the total population of a species that is made up of a particular breed can be used to estimate the population size of that breed.

**Census at breed level:** population figures were obtained by breed in a regular census. Censuses usually cover the whole country or include representative samples of farms.

**Survey at breed level:** survey was carried out in a certain area only to estimate the population size of the breed in its distribution area.

**Survey at species level:** survey carried out at species level from which breed population sizes were obtained. In general surveys include more detail in the type of data collected but are usually not country-wide. Data extrapolation is needed.

**Estimate:** the population size is not really known but can be figured out on the basis of experience or last census.

11 percent are estimates based on a census at species level (e.g. a national agricultural census). However, for 36 percent of all breeds reported to DAD-IS, National Coordinators were unable to estimate the total population size. Moreover, population data for many of the breed population have been only reported for a single year or have not been updated regularly, making it difficult or impossible to monitor trends.

Agricultural censuses are conducted regularly by most countries (FAO, 2005). Some countries also carry out more specific national livestock censuses. At present, however, most national censuses do not contain breed-level data. Incorporating breed-level questions within such censuses is potentially an important means to improve the availability of breed demographic data. The 2006 National Livestock Census of Pakistan is an example of a census that collected breed-level data (for cattle, buffaloes, sheep and goats; data for horses, mules and asses were collected only at the species level) (Government of Pakistan, 2006). In the absence of breed-level data, a species-level census can nonetheless be the basis for a rough estimate of breed population size (see Box 1).

The smaller the breed population, the easier it will usually be to provide an accurate estimate of its total size. These are the populations for which higher accuracy is more important, as they may be at risk of extinction. For these populations more detailed surveys might be required.

Characterization at the molecular genetic level may be undertaken to explore genetic diversity

within and between populations, and to determine genetic relationships among them. In the absence of comprehensive breed characterization data and documentation of the origin of breeding populations, molecular marker information may provide the most easily obtainable estimates of genetic diversity within and between a given set of populations.

## The International Dimension

As noted above, conservation decisions need to be considered in the light of the status of the breed on an international scale rather than merely based on national level data. A basic requirement is to distinguish breeds that are present in more than one country from those present in only one country. A classification based on this distinction was developed during the preparation of *The State of the World's Animal Genetic Resources for Food and Agriculture* (see Box 2). Identifying transboundary breed populations enables coordination between countries planning conservation programmes. Regional transboundary breeds are found in substantial numbers in most regions of the world; conservation measures for these breeds should be planned at regional or subregional level.

## Box 2. Local versus transboundary breeds.

**Local breeds:** breeds that occur only in one country.

**Transboundary breeds:** breeds that occur in more than one country. These are further differentiated into:

- **Regional transboundary breeds:**  
transboundary breeds that occur only in one of the seven SoW-AnGR regions<sup>3</sup>.
- **International transboundary breeds:**  
transboundary breeds that occur in more than one region.

## Conclusions

Despite the importance of demographic data to decision-making in AnGR management, much remains to be done to fill the gaps and to address the priorities identified in the *Global Plan of Action*. For many breeds, no population data are available. For many others, trends in risk status cannot be adequately monitored because data are updated so infrequently. Within-country geographical distribution of breed populations – important for planning many aspects of AnGR management – is poorly recorded. Once collected, demographic data need to be made available to those who need them – hence the importance of information systems for AnGR. Improved demographic data need to be complemented by improved data on the phenotypic and molecular characteristics of the breeds' in question and on their uses and roles in the production systems where they are kept. These data also need to be made widely available to the relevant stakeholders.

At the international level, linking national breed populations with a common gene pool across countries has helped to provide a more realistic assessment of breeds' risk status. However, regional and global cooperation in the conservation and sustainable utilization of AnGR would benefit greatly if more comprehensive demographic data were available and used in the planning of management strategies.

In addition to addressing the problem of missing population data, other weaknesses of current systems for monitoring genetic erosion need to be overcome. A major problem is the lack of measures that capture genetic dilution caused by indiscriminate crossbreeding – a problem that is considered by many experts to be a major threat to AnGR diversity. At the same time, there are many

nondescript local populations for which it is unclear whether they form (relatively) homogenous groups that can be distinguished from neighbouring populations. Molecular characterization studies help to unravel such relationships, but need to be better coordinated and the results better combined.

A final point to emphasize is the need for the development of methods for representative sampling of national animal populations to estimate their total population size and other demographic data in a cost-effective manner.

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<sup>3</sup>Regions defined for the purpose of the SoW-AnGR report: Africa, Asia, Europe and the Caucasus, Latin America and the Caribbean, the Near and Middle East, North America and the Southwest Pacific.

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## Production environment recording

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### Summary

Improved understanding of the adaptation of livestock breeds to their production environments is important for many decisions in the field of AnGR management, ranging from genetic improvement to conservation. However, adaptation is complex and difficult to measure. One approach to this problem is to characterize adaptation indirectly by describing the production environments in which a breed has been kept over time, and to which it has probably become adapted. Comprehensive and comparable descriptions of the production environments in which animals are kept are also needed to make meaningful evaluations of performance data and to enable comparative analysis of the performance of different breeds. To address these requirements and in accordance with the *Global Plan of Action for Animal Genetic Resources*, it has been proposed that a recognized set of "production environment descriptors" should be established and used throughout the world as a common framework for describing breeds' production environments. An important aspect of the process will be the georeferencing of breed distributions, which will allow them to be linked to a range of existing georeferenced data sets (e.g. climatic data). The link between a breed and a specific production environment may offer a basis for the development of a niche market; examples include the Bresse chicken of France and the Abundance and Tarentaise cattle breeds of the northern Alps. Such niche markets represent important opportunities for keeping traditional breeds in use.

### Résumé

Améliorer nos connaissances sur l'adaptation des races domestiques à leur milieu de production est important pour de nombreuses raisons dans le domaine de la gestion des AnGR, qui va de

l'amélioration génétique à la conservation. Cependant, l'adaptation est complexe et difficile à mesurer. Une approche à ce problème est la caractérisation de l'adaptation indirectement, à travers la description des milieux de production dans lesquels une race se trouve et auxquels elle a dû probablement s'adapter. Il est aussi nécessaire d'avoir des descriptions compréhensibles et comparables des milieux de production dans lesquels les animaux se sont trouvés pour réaliser une évaluation des données de performance et permettre l'analyse de comparaison des performances des différentes races. Pour atteindre ces objectifs, et en accord avec le Plan Mondial d'Action pour les Ressources Zoogénétiques, il a été proposé qu'un ensemble reconnu de « *descripteurs des milieux de production* » soit établi et utilisé dans le monde comme cadre commun de travail pour la description des milieux de production des races. Un aspect important du processus sera la saisie des références géographiques de la distribution de la race, ce qui permettra de la mettre en relation avec un ensemble de données déjà existantes et référencées (p.e. données climatiques). La relation entre une race et un milieu spécifique de production peut offrir une base pour le développement d'un marché de niche, comme c'est le cas du poulet Bresse français et les races bovines Abundance et Tarentaise du Nord des Alpes. Ces marchés de niche représentent des occasions importantes qui permettent de conserver les races traditionnelles.

### Resumen

Mejorar los conocimientos sobre la adaptación de las razas domésticas a sus medios de producción es importante por muchas razones en el campo de la gestión de los AnGR, que va desde la mejora genética a la conservación. Sin embargo, la adaptación es compleja y difícil de medir. Un enfoque a este problema es la caracterización de la adaptación indirectamente a través de la



descripción de los medios de producción en los que una raza se ha encontrado y a los que probablemente se ha tenido que adaptar. También son necesarias las descripciones comprensibles y comparables de los medios de producción en los que los animales han estado para realizar evaluaciones de los datos de rendimiento y permitir los análisis de comparación de los rendimientos de las distintas razas. Para alcanzar estos requisitos y de acuerdo con el Plan Mundial de Acción para los Recursos Zoo genéticos, se ha propuesto que un conjunto reconocido de « *descriptores de medios de producción* » sea establecido e utilizado en todo el mundo como marco común de trabajo para la descripción de los medios de producción de las razas. Un aspecto importante del proceso será referenciar geográficamente la distribución de la raza, lo que permitirá relacionarla con un conjunto de datos ya existentes y georeferenciados (por ej. datos climáticos). La relación entre una raza y un medio específico de producción puede ofrecer una base para el desarrollo de un nicho de mercado, como los ejemplos que incluyen el pollo Bresse francés y las razas de vacuno Abondance y Tarentaise del norte de los Alpes. Estos nichos de mercado representan oportunidades muy importantes que permiten mantener a las razas tradicionales.

**Key words:** *Adaptation, Production Environment Descriptors (PEDs), Georeferencing, Surveys.*

## Introduction

Livestock animal genetic resources (AnGR) have been domesticated throughout the world to meet local or regional needs. Animals have been selected by farmers for their particular characteristics or cultural value whilst they were also adapting genetically to local conditions, diseases, available feeds, climate, predators and many other persistent variables imposed by the local environment. Improved understanding of the adaptation of livestock breeds to their production environments is important for many decisions in the field of AnGR management ranging from genetic improvement to conservation. However, adaptation is complex and difficult to measure. One approach to this problem is to characterize adaptation indirectly by describing the production environments in which a breed has been kept over time, and to which it has probably become adapted. Comprehensive and comparable descriptions of the production environments in which animals are kept are also

vital to make meaningful evaluations of performance data and to enable comparative analysis of the performance of different breeds.

## Data Requirements

To address these requirements and in accordance with the *Global Plan of Action for Animal Genetic Resources* (FAO, 2007a), it has been proposed that a recognized set of “*production environment descriptors*” (PEDs) should be established and used throughout the world as a common framework for describing breeds’ production environments. It is intended that such a framework be used as the basis for the inclusion of more detailed production environment data within FAO’s Domestic Animal Diversity Information System (DAD-IS at: <http://www.fao.org/dad-is/>). A meeting held in Armidale, Australia in 1998 made a first attempt to devise a PEDS framework, and developed a worksheet or questionnaire for the purposes of collecting PEDs data (FAO, 1998). At a follow-up meeting held in Caprarola, Italy in 2008 the previous work was reviewed and further developed (FAO, 2008). According to the framework devised at the latter meeting, a breed’s production environment is divided into two main domains, the management environment and the natural environment. These domains are further broken down into a hierarchy of criteria (see Figure 1). Measures were defined to describe each criterion.

Many developing countries have very little capacity to collect and analyse production environment variables. However, most of the measures required for the natural environment domain are now available on global high resolution maps with the exception of the distribution of diseases and parasites. If breed distributions were georeferenced it would be possible to overlay them with these mapped data sets, which could allow far more comprehensive description and analysis of the breeds’ production environments. Georeferencing of breed distributions should therefore be given high priority.

## Data Collection

Surveys will be organized differently depending on the institutional background. In developed countries, where commercial and conservation farms keep registers of individual animals and their pedigrees, structured surveys can be used to collect

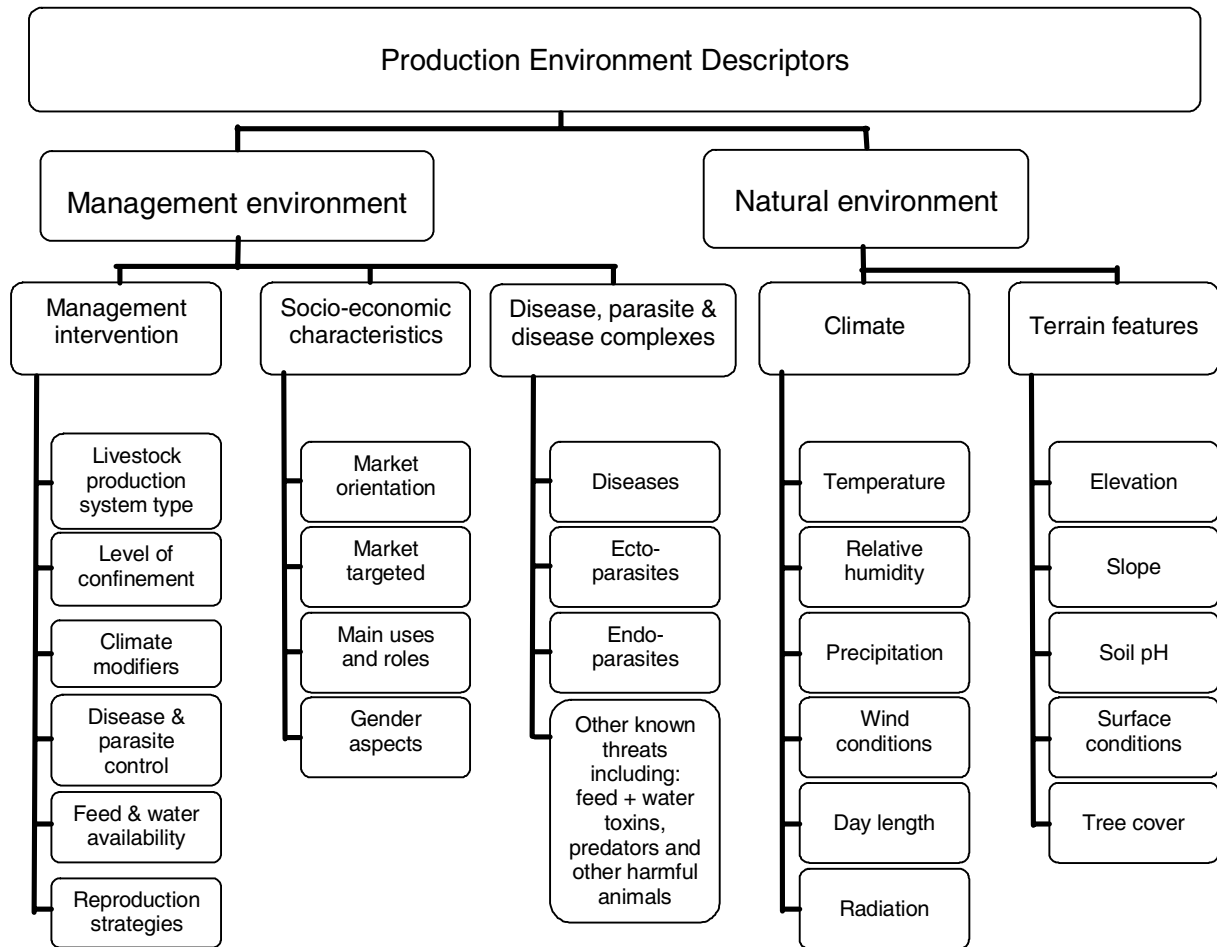


Figure 1. Production environment descriptors for characterization of animal genetic resources.

information on production systems and the environment. The procedure should take advantage of current data collection systems and additional costs should be quite limited.

In countries where such data are not regularly recorded, specific surveys need to be set up. For traditional communities in pastoral and farming production systems, participatory surveys and structured interviews can be used to generate data on breeding objectives, breed and trait preferences and production system constraints. In the context of traditional breeds, these descriptions give insights into the multitude of functions and services that breeds provide for their keepers. Statistical sampling procedures can be applied to study localities, farms and individual animals once the sampling framework is defined.

In situations where limited documented information on breed identification and characteristics is available, extensive exploratory surveys may be necessary. However, exploratory

surveys have limitations; the facts generated are highly subject to the biases of questionnaire respondents. Thus, steps need to be taken to ground-truth and cross-check findings using complementary procedures such as key-informant interviews, focus-group discussions and reporting-back sessions with respondent communities. Consequently, these surveys become demanding in terms of time, skilled personnel and financial resources. This has been observed, for example, in livestock breed surveys in Zimbabwe and Ethiopia. (FAO, 2007b).

### Use of Production Environment Descriptions for AnGR Management - an Example

Due to their adaptation to specific environments, local breeds may have considerable value for niche

production. Verrier *et al.* (2005) provide two examples where niche markets have been successfully established by connecting natural constraints with specific features of local breeds. The creation of niche markets is supported in France by a certificate, the Appellation d'Origine Contrôlée (AOC = controlled term of origin). The Bresse AOC chicken is raised only in the Bresse geographical area as defined by law to promote product quality throughout the production process. For the AOC, a geographical district has to be defined and characterized by specific features of the natural conditions and production system, which cannot be found in another geographical area. Another example provided is AOC cheese production from Abondance and Tarentaise cattle breeds on high-altitude pastures of the northern Alps. These two breeds show some adaptation and functional traits of interest for the mountain farming system and the use of high-altitude pastures.

The efficiency of these systems and their dynamics do not depend only on the traits of the breeds but also on the organization of farmers and producers. A clear genetic strategy is needed, including on-farm performance recording and an emphasis on adaptation and functional traits in the selection goal. In harsh environments, such as mountain regions, particular attention should be given to adaptation to the local environment. The ability of local breeds to produce in such conditions, due to their rusticity and their productivity in relation to the environment, should be fully evaluated.

Niche products are appealing because they may combine, at a local level, dynamic breed conservation and economic profitability. Niche products are generally more expensive than standard products, and their success will depend on the buying power of consumers. Thus, niche products appear to present a very good opportunity to preserve local breeds in a favourable economic context such as may be found in developed

countries. Niche products may not be so easy to develop in developing countries. Cultural practices are also key factors in the successful development of niche products.

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## Community-based management of farm animal genetic resources in practice: framework for focal goats in two rural communities in Southern Benin

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### Summary

This paper describes and analyses the process of implementing participatory community-based management (CBM) towards sustainable management of goat genetic resources in two rural communities in Southern Benin from November 2005 to February 2007. The process started with the selection of the communities. This was followed by a participatory situation analysis, identification of problems and of possible solutions, and the provision of relevant information and training to interested farmers. It was facilitated by a multidisciplinary research team composed of a specialist in livestock production systems, a socio-economist and an agronomist. The interaction between the research team and the farmers aimed to develop and implement community led strategies towards better management and conservation of the local resources of goat. The approach adopted to facilitate the creation of representative, accountable and legal local institutions and the efforts made in ensuring their empowerment are described. It has been shown that once local people recognise the benefits of such community-based activities and are offered the relevant information and technical support, they can organize themselves effectively and take appropriate actions to better manage and conserve their local resources. The interactive nature of this approach allows its rapid adjustment to different local conditions and thus its replication elsewhere.

### Résumé

Cette étude décrit et analyse le processus d'élaboration et de mise en œuvre de mécanismes

pour une gestion à base communautaire des ressources génétiques caprines dans deux communautés rurales au sud du Bénin. La première étape de cette recherche-action initiée en Novembre 2005 par une équipe pluridisciplinaire composée d'un spécialiste des systèmes de productions animales, d'un socio-économiste et d'un agronome est la sélection des communautés. Elle a été suivie par un diagnostic participatif des conditions actuelles d'utilisation des ressources caprines locales, par l'identification des contraintes et des solutions possibles, par des échanges d'informations pertinentes entre communautés rurales et chercheurs et par l'organisation de séances de sensibilisation et de formation à l'intention des éleveurs. Les résultats ont montré que lorsque les communautés locales sont informées du danger que représente la perte de la diversité génétique animale pour leur bien-être social, culturel et économique, et qu'elles bénéficient d'un appui technique adéquat, elles peuvent s'organiser de manière efficace et développer des stratégies appropriées pour mieux gérer et conserver leurs ressources zoogénétiques locales.

### Resumen

Este estudio describe y analiza el proceso de elaboración y puesta en marcha de mecanismos para una gestión con base comunitaria de los recursos zoogenéticos caprinos en dos comunidades rurales en el sur de Benín. La primera etapa de esta acción-investigación inició en noviembre 2005 con la selección de las comunidades por parte de un equipo pluridisciplinario compuesto por un especialista en sistemas de producción animal, un

socioeconómico y un agrónomo. A esta etapa siguió un diagnóstico participativo sobre las condiciones actuales de utilización de los recursos locales en caprinos, una identificación de las limitaciones y de las posibles soluciones utilizando los intercambios de informaciones pertinentes entre las comunidades rurales y los investigadores y la formación de ganaderos. Los resultados han mostrado que cuando las comunidades locales están informadas del peligro que representa la pérdida de diversidad genética animal para el bienestar social, cultural y económico, y si se les proporciona apoyo técnico adecuado, pueden organizarse de forma eficaz y desarrollar estrategias apropiadas para una mejor gestión y conservación de sus recursos zoogenéticos locales.

**Key words:** *Community-based management, Goat, Improvement program, Participatory research, Open-nucleus breeding scheme.*

## Introduction

The increasing recognition that conservation of natural resources is unlikely to be sustainable over the long term unless the local communities whose lives depend upon these resources are actively involved and their needs considered (Campbell and Vainio-Mattila, 2003; Mascia *et al.*, 2003; Chan *et al.*, 2007) has resulted in the development of a new conservation paradigm of 'community-based natural resource management' (CBNRM). CBNRM asserts the principle of management of natural resources by, for, and with local communities (Western and Wright, 1994) and recognizes that local people have sophisticated knowledge of local ecological and social conditions that can be effectively used to manage natural resources (Berkes *et al.*, 2000).

The concept of community-based management of farm animal genetic resources (CBMFAnGR) builds on principles of CBNRM. It refers to a system of FAnGR and ecosystem management in which the livestock keepers organize themselves and play a central role in identifying their FAnGR and in implementing all activities related its conservation and sustainable use (Rege, 2001). Effective participation of the communities and their empowerment are determinants for the success of a CBNRM program (Little, 1994; Ghimire and Pimbert, 1997; Berkes, 2004) and appropriate legal and self-reliant local institutions are necessary for its sustainability (Ostrom, 1990; Brett, 2003). The

same is true of any livestock genetic improvement program (Kahi *et al.*, 2005; Kosgey *et al.*, 2006). It is also argued that 'Open Nucleus Breeding Schemes' (ONBS) could be an appropriate strategy for genetic improvement and conservation of animal genetic resources under smallholder production systems (Kiwuwa, 1992; Mueller *et al.*, 2002; Olivier *et al.*, 2002). The thrusts of the action research described in this paper are to:

- Empower, organize and enhance the capacity of local communities to sustainably use and manage their small ruminants.
- Create a legal and financial framework that supports community-based initiatives.

## Materials and Methods

The methodology applied in this study is an iterative approach adapted from Sultana and Thompson (2003). It includes 4 major steps (Figure 1) and a lot of small steps within each major step.

### Selection of communities

For the purpose of this study, the definition of community has been restricted to that of a village. Two communes, Come and Toffo (Figure 2) were selected because of the relatively high proportion of poverty in their populations. According to WFP (1998), about 24% of the population in Come and 26% in Toffo live below the poverty threshold. Come is located in the fishery area about 60 kilometers west of Cotonou, the economic capital of Benin, whereas Toffo is located about 80 kilometers north west of Cotonou. An initial assessment was carried out in November 2005 to select in each commune, a representative village out of four pre-selected. Village leaders were first contacted by a representative of the local agricultural extension service in Come and by a research and development agent of the National Agricultural Research Institute in Toffo.

Following an initial expression of interest by the village leaders, a meeting with local resource persons was arranged in each village. These resource persons were identified and informed together by the research team and the local authorities. The following topics were discussed during the meeting: the species of livestock kept in the community, their importance, priority species

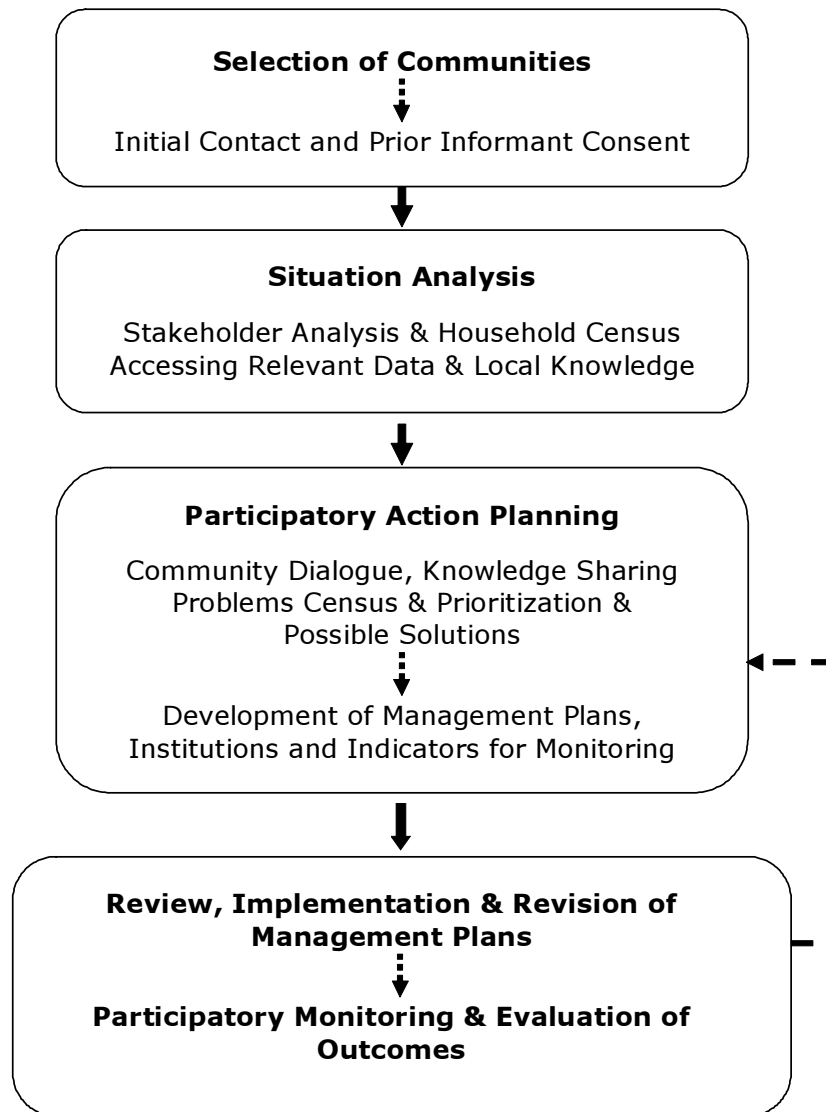


Figure 1. Methodological approach.

for eventual research action and the existence of any previous community based initiatives.

Subsequently, the village of Ouedeme-Pedah in Come and the village of Gbede in Toffo were selected based on following criteria:

- Relative importance of small ruminants.
- Accessibility in all seasons.
- Pristineness: locations where no previous long-term research projects had been conducted and that were not connected to national research institutions.
- Interest of village leaders in participation.

The field work team consisted of a specialist in livestock production systems, a socio-economist and an agronomist. This team was reinforced in each research location by a livestock technician and

a private veterinarian. In Gbede, the technician was a research assistant from the National Agricultural Research Institute, whereas the technician in Ouedeme-Pedah was a livestock extension officer. Together with the veterinarians, they provided the institutional support and acted as facilitators.

### Initial village meeting and socio-economic studies

In each village selected, local leaders were asked to arrange for a village meeting where the research team provided the participants with all information related to the project, its objectives and benefits. The

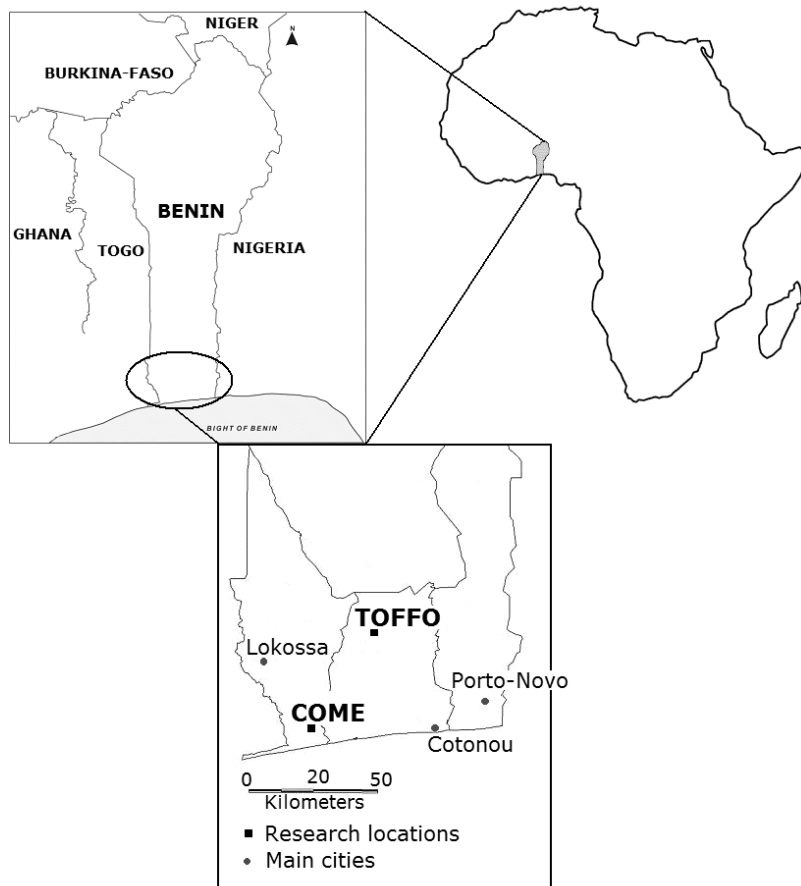


Figure 2. Research locations in southern Benin.

'Prior Informed Consent' (PIC) was obtained from the communities and was followed by the situation analysis which encompassed several socio-economic studies. It started with a participatory village social and resource mapping and seasonal calendar. Transect walks were done with community members to consider the geographical boundaries of the communities, their natural resources and related issues. One of the main concerns of the research project was to ensure that in each village, the socio-economic conditions and the concerns of the most vulnerable people keeping livestock were understood and taken into account during the development of the CBM framework. Therefore, three key informants were identified in each village based on their level of participation during the resource mapping and on their knowledge of the village for a participatory wealth rank exercise. A list of household heads living in the village was obtained from the chief of the village and was updated together with the key informants. Each key informant was interviewed separately. He was first asked about his own

perception of wealth and poverty. Then he was asked to sort cards containing the name of the head of households into pile representing the wealth status of each household according to the method described by Grandin (1988). More detailed surveys of a random sample households stratified by wealth classes was done to find out more about their sources of income and the contribution of different livestock species to their livelihoods. Focus group discussions and in depth interviews in randomly selected households were carried out to understand the ownership patterns of small ruminants, to record owners' local technical knowledge, their perceptions of constraints and their traits preferences.

### Participatory planning

Following the socio-economic studies, feedback meetings were held in each village in December 2005 to share information, to discuss and validate

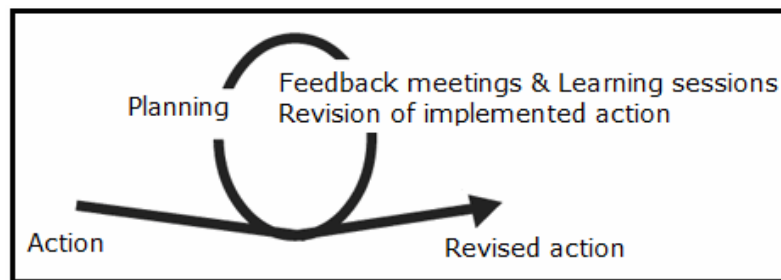


Figure 3. Management plan implementation loop.

the findings of the socio-economic studies and to mobilize communities towards CBM action planning. An interim planning team was elected and was responsible for the timing and organization of the next planning meetings. During subsequent village meetings and workshops, participants discussed, ranked and decided on key problems, determined causes and effects and proposed possible solutions. In each village, the interim planning team was assisted by a trained community development facilitator who was charged with the responsibilities of facilitating and supporting group development processes to reach the maturity and performance stages. This was achieved initially through supporting the facilitation of meetings and group dynamics, training and support in leadership skills, record keeping, and training in other areas of group development as well as providing specific technical support and linking groups with service providers. Various participatory tools such as brainstorming, ranking, problem and solution games, process diagrams, matrices and visualization techniques (for a review see Waters-Bayer and Bayer, 1994; Catley, 1999) were used.

### Review, implementation and revision of management plan

This phase was overlapping with the participatory planning phase and involved regular facilitated feedback meetings and interactive learning sessions. In an iterative way (Figure 3), implemented actions were discussed, revised and the overall management plan readjusted accordingly.

## Results and Discussion

### Community mobilization and exchange of knowledge

Initial investigations during baseline surveys indicated that the communities in Gbede and Ouedeme-Pedah were suspicious about outsiders, government and NGO led development initiatives. This implies that a few local leaders would prevail in most community decisions. Therefore, at the first village meeting, the research team was successful in avoiding the risk of raising financial expectations by discussing short-term and long term benefits of the research project. It has been observed that some community members, mainly local 'elites' lost interest in participating in the research activities when the communities were told they would not be getting any handout of money but only facilitation and training.

Through the different steps of the mobilization phase, the research team was successful in gradually convincing the participants that the research project was for their own benefit. The different participatory rural appraisal techniques used in this process were helpful in entering the communities, in getting to know the people and the natural resources (including farm animal resources), in establishing relationships with the communities, in collecting and sharing information, in building mutual trust and in improving the understanding of the different sources of livelihood. First and foremost the participatory village resource mapping exercises (Figures 4 and 5) revealed that people have a valuable knowledge of the natural resources, including domestic animal resources and forage plants available in their environment.



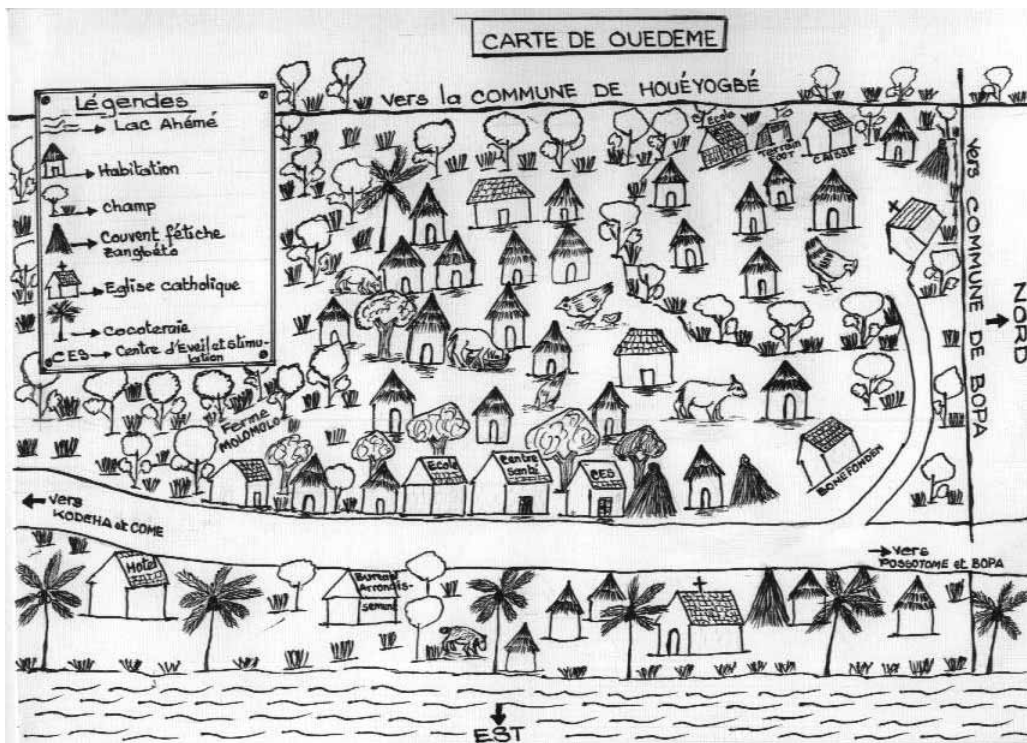


Figure 4. Sketch map village of Ouedeme-Pedah as drawn by community members.

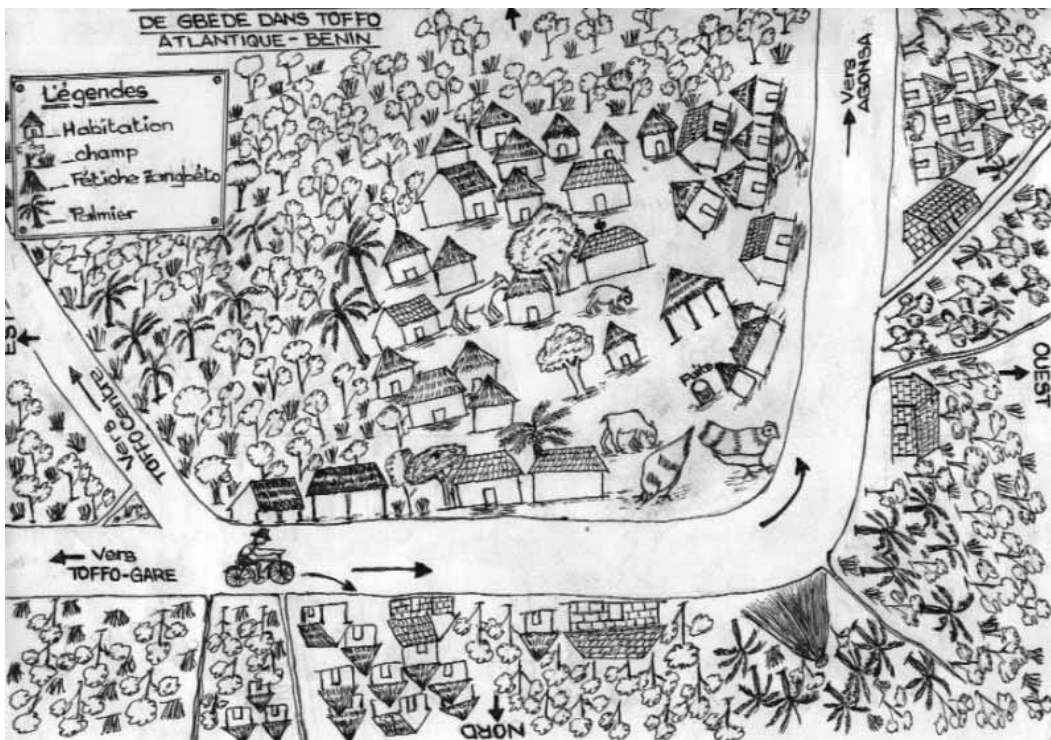


Figure 5. Sketch map village of Gbede as drawn by community members.

Table 1. Indicators of wealth in village Ouedeme-Pedah.

Criteria	Wealth classes		
	Rich	Medium	Poor
House and type of roof	Large houses with concrete walls; sheet-metal or tile-roofing; cemented floor	Houses in banco/clay walls; sheet-metal or tile-roofing; cemented or mud floor	Houses in banco/clay walls; straw roofing and mud floor
Number of fishing gears owned	4 and more	2-3	1
Transport means	4 and more dugout canoes; motorcycle and bicycle	2 dugout canoes, motorcycle or bicycle	1 dugout canoe
Agricultural land holdings	5 ha and more	1-3 ha	≤ 1ha; landless; sharecropping
Livestock owned	Large number of pig, goats, chicken, grass cutter	Pig, goats and chicken	Few goats and chicken
Labour employment	Employ labour	Employ labour but at lesser extent than the better-offs	Household members are casual workers and husband migrates during raining season to find non-fishing work
Education of children	Children attend school regularly	Children attend school irregularly	Interruption schooling of children
Financial status	Can borrow to other households	Can take a loan	Cannot take a loan
Other	Receive high social and political consideration	Use rarely basic medical services	Face food shortages; do not use basic medical services

Rare natural vegetation encountered in Ouedeme-Pedah are baobab trees (*Adansonia digitata*), iroko trees (*Chlorophora excelsa*) and bushes of mangroves (*Avicennia germinans* L.) in the most humid areas whereas planted vegetation included neem trees (*Azadirachta indica*), eucalyptus (*Eucalyptus camaldulensis*), acacia (*Cacia africana*) and coconut trees (*Cocos nucifera*). In Gbede, planted teak trees (*Oldfieldia africana*) and oil palms (*Elaeis guineensis*) predominate. The Pedah people are the dominant ethnic group in Ouedeme-Pedah and they live primarily on small-scale fishing and subsistence agriculture. The Aizo people dominate in Gbede. Agriculture is their major economic activity. The main food crops grown in both villages are maize, cassava and beans. Similar beliefs and religious practices were observed among both communities.

Key informants in both villages divided households in three wealth classes: rich, medium

and poor households. Out of a total of 47 households ranked in Ouedeme-Pedah, 45% were ranked poor, 34% medium and 21% rich. Similar figures (46%, 35% and 19% respectively) were obtained in Gbede for a total of 66 households. Table 1 shows the characteristics of each wealth group as described by informants in Ouedeme-Pedah. Irrespective of the village and irrespective of the wealth group, chickens followed by goats and sheep were the most kept important livestock species. In Ouedeme-Pedah, pigs were also kept by some households. However, despite the predominance of chickens over goats, the latter species was selected in the two communities as priority species for the purpose of the intended CBM research action.

The village goat surveys generated interesting information about breed perception, trait preferences and production constraints (Dossa *et al.*, 2007). Apart from the introduced goat types from

Table 2. Outcomes of the consolidated analysis of goat production problems in Gbede and Ouedeme-Pedah.

Constraint	Cause	Effect	Solution	Level of application
Lack of appropriate housing	<ul style="list-style-type: none"> <li>Lack of knowledge on improved housing</li> </ul>	<ul style="list-style-type: none"> <li>High losses and mortality rates due to:               <ul style="list-style-type: none"> <li>Lack of protection of animals against bad weather conditions and contagious diseases</li> <li>Missing to identify and to treat sick animals</li> <li>Consumption of poisonous plants and dirty water by wandering animals</li> <li>Road accident</li> <li>Theft</li> <li>Destruction of crops</li> <li>Tethering during cropping seasons leading to malnutrition</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Farmer training in improved goat housing</li> <li>Construction of improved goat houses</li> </ul>	Both individual and community
Disease outbreaks	<ul style="list-style-type: none"> <li>High costs of veterinary services on individual basis</li> <li>Difficulty to stock up on veterinary drugs for routine treatments</li> <li>Lack of regular vaccination against epidemic diseases</li> <li>Lack of regular control of internal and external parasites</li> <li>Lack of appropriate housing =&gt; close contact with infected free roaming goats</li> <li>Poor hygiene</li> <li>Poor nutrition</li> </ul>	<ul style="list-style-type: none"> <li>High mortality rates</li> <li>Small herd sizes with born-in herd bucks, very few village bucks</li> <li>High risk of inbreeding and delays in conception</li> <li>Kids grow slowly</li> <li>Very few goats to sell year-round</li> <li>Reduced profitability</li> </ul>	<ul style="list-style-type: none"> <li>Farmer's training in improved management practices</li> <li>Adoption of improved housing for animals</li> <li>Adoption of Improved health through               <ul style="list-style-type: none"> <li>Training on basic animal healthcare and hygiene</li> <li>Establishment of a Drug-box at village level</li> </ul> </li> <li>Organization by the village committee of regular and collective vaccination against PPR,</li> <li>Organization by the village committee of regular and collective control of internal parasites</li> <li>Strict regulation of the introduction of imported animals into the village</li> <li>Castration of unwanted and poor quality male goats</li> <li>Adoption of improved nutrition</li> <li>Purchase and rotation of a village buck among participating herds</li> <li>Purchase by the village committee and use of Burdizzo castrator to castrate unwanted or/and poor quality male goats</li> <li>Farmer training in               <ul style="list-style-type: none"> <li>Improved nutrition</li> <li>Improved cut and carried feeding system</li> <li>Rational use of crop residues and agro-by-products</li> </ul> </li> </ul>	Both individual and community
Feed shortage	<ul style="list-style-type: none"> <li>Seasonal fluctuation in feed availability</li> <li>Lack knowledge on rational uses of available feed resources</li> </ul>	<ul style="list-style-type: none"> <li>Poor or unbalanced nutrition</li> <li>Weak animals open to infections from bacteria or/and parasites</li> <li>Slow kid growth and bad body condition</li> </ul>	<ul style="list-style-type: none"> <li>Farmer training in               <ul style="list-style-type: none"> <li>Improved nutrition</li> <li>Rational use of crop residues and agro-by-products</li> </ul> </li> </ul>	Community

<sup>1</sup>Mentioned in Gbede only.

Table 3. Outcomes of the consolidated solution analysis in Gbede and Ouedeme-Pedah.

Village	Solution/Action	Purpose	Alternative	Political/ social impact	Technical/ economic aspect	
Both Gbede and Ouedeme- Pedah	Adoption of improved housing	<ul style="list-style-type: none"> <li>• Enable better management of individual herd</li> </ul>	None	Individual participant farmers as well as community will benefit	Need training and demonstration from resource persons	
		<ul style="list-style-type: none"> <li>• Reduce mortalities due to contagious agents and to non diseases related factors</li> </ul>				
	Strategic use of anthelmintics and wilting of cut and carried forage before feeding	<ul style="list-style-type: none"> <li>• Reduce morbidity rates due to sarcoptic mange</li> </ul>				
		<ul style="list-style-type: none"> <li>• Reduce conflicts between farmers inherent to the free-roaming system</li> </ul>				
		<ul style="list-style-type: none"> <li>• Elimination of the internal parasites burden</li> </ul>	None	Individual participant farmers as well as community will benefit	Need technical assistance from specialized staff	
		<ul style="list-style-type: none"> <li>• Increase feed conversion by the animals</li> </ul>				
	Organization of annual collective vaccination program against PPR	<ul style="list-style-type: none"> <li>• Reduce mortalities due to PPR</li> </ul>	Individual action against PPR	Individual participant as well as community will benefit: increase ability of participants to work together and enhance social cohesion	Need technical assistance from specialized staff	
			None	Individual participant will benefit	Need training and demonstration from resource persons	
	Adoption of improved feeding	<ul style="list-style-type: none"> <li>• Reduce malnutrition, abortion and pre-weaning mortalities rates</li> </ul>	None	Individual participant will benefit	Need training and demonstration from resource persons	
			None	Individual participant as well as community will benefit: increase ability of farmers to work together and enhance social cohesion	Need advices from resource persons	
Strict regulation of introduction of imported animals into the village	<ul style="list-style-type: none"> <li>• Conservation of local goat through avoidance of indiscriminate crossbreeding</li> </ul>	None	Individual participant as well as community will benefit: increase ability of farmers to work together and enhance social cohesion	Need advices from resource persons		
	<ul style="list-style-type: none"> <li>• Reduction of risks of introduction of imported diseases and infectious agents</li> </ul>					
Castration of unwanted/ poor quality male	<ul style="list-style-type: none"> <li>• Reduce risk of inbreeding and make better use of the best performing village bucks</li> </ul>	Individual control of mating	Individual participant as well as community will benefit	Need technical assistance and training from specialized staff		

(To be continued.....)

(... continued).

Village	Solution/ Action	Purpose	Alternative	Political/ social impact	Technical/ economic aspect
Gbede	<ul style="list-style-type: none"> <li>• Training of two (02) farmers appointed by the community as local castrator in the use of the Burdizzo castrator</li> <li>• Commitment of participants to share the expenditure for the purchase of a Burdizzo castrator and two (2) communal bucks of local breed for breeding purposes</li> <li>• Rotation of the communal bucks among participating herds. After a year of service, the communal bucks will be sold and renewed</li> <li>• Training of two (02) farmers appointed by the community as Village Animal Health Workers and establishment of a village based drug box</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce risk of inbreeding and make better use of the best performing village bucks</li> </ul>	<ul style="list-style-type: none"> <li>• Individual control of reproduction</li> <li>• Surgical removal of testicles (traditionally used castration method)</li> </ul>	<ul style="list-style-type: none"> <li>• Individual participant as well as community will benefit</li> </ul>	<ul style="list-style-type: none"> <li>• Need technical assistance and training from specialized staff</li> </ul>
Ouedeme-Pedah	<ul style="list-style-type: none"> <li>• Establishment of a village based drug and feedstuff store supplied by a private veterinarian but collectively managed by the community</li> </ul>	<ul style="list-style-type: none"> <li>• Trained farmers provide general advice on health and husbandry and basic animal health services to other farmers in the same village</li> <li>• Close and permanent contact with the veterinary services</li> <li>• Reduction of transport costs</li> </ul>	<ul style="list-style-type: none"> <li>• Individual contact with the Private veterinary services which are located at about 20 km far away from the village and not easily reachable</li> </ul>	<ul style="list-style-type: none"> <li>• Individual participant as well as community will benefit: increase ability of farmers to work together and enhance social cohesion</li> </ul>	<ul style="list-style-type: none"> <li>• Need technical assistance from specialized and resource persons/ Need financial support from micro-credit institutions or NGOs</li> <li>• Need continuous monitoring of the private veterinarian</li> </ul>

Table 4. Indicators and participatory monitoring arrangements agreed through CBM workshops in Gbede and Ouedeme-Pedah.

Village	Indicator/output	Type of monitoring	Responsibility
Both	<ul style="list-style-type: none"> <li>• Adoption by participants of improved management practices including regular vaccination against PPR and anthelmintic treatment</li> <li>• Decrease in disease incidence and mortality rate in participating herds</li> <li>• Increase growth rate of animals in participating herds</li> <li>• Decrease rate of abortion in participating herds</li> <li>• Increase in number of marketable animals in participating herds</li> <li>• Increase in overall herd productivity in participating herds</li> <li>• Adoption by participants in the Community-based management program of a participatory recording system</li> <li>• Adoption of the Burdizzo castrator</li> <li>• Castration of undesired/low performing males intervene 3-4 months of age</li> </ul>	<ul style="list-style-type: none"> <li>• Regular meeting and training sessions on different aspects of small ruminant husbandry practices and on recording system throughout a year: Application of the "Farmer Field School" approach</li> </ul>	<ul style="list-style-type: none"> <li>• Village committees with the assistance of the specialized staff and resource persons</li> </ul>
Gbede only	<ul style="list-style-type: none"> <li>• Effective rotation of the communal purchased bucks among participant herds</li> </ul>	<ul style="list-style-type: none"> <li>• Only farmers who confine their animals and adopt improved management practices can receive the buck. The buck can stay in a herd for a maximum of 30 days and should then pass to another herd. No specific performance recording was planned.</li> </ul>	<ul style="list-style-type: none"> <li>• The village committee should ensure the effectiveness of the rotation system. After a year of service, the communal bucks will be sold and new one bought</li> </ul>

northern Benin and from neighboring Sahelian countries, owners of goats in both villages clearly distinguished two varieties of goat native to southern Benin: the markedly dwarf and the short legged but non-dwarf. Although farmers perceived the markedly dwarf goat as more prolific and more resistant to disease than the short legged but non-dwarf, they considered that its growth is slower and it fetched relative lower prices on the market. Group discussions with elders in both villages revealed that the markedly dwarf goat was the most common goat variety encountered some decades ago. However, it has been progressively replaced by the non-dwarf goat and currently represented less than 2% of the breeding female goats counted in both villages. Communities also have a good knowledge of the seasonal occurrence of the major goat health problems and some valuable ethno-veterinary medicine practices. A number of locally available fodder resources are considered by farmers to have anthelmintic properties. The most promising plants include *Fagara zanthoxyloides*, *Morinda lucida*, *Moringa oleifera*, *Newbouldia leavis* and *Spondias mombin*.

### Planning with communities

During consecutive village meetings and workshops, the key problems, their causes and effects, the possible solutions and remedial actions and sets of criteria for assessing these actions were developed by each community. The results were very similar in the two villages (Tables 2, 3 and 4). In each village, the interim planning team worked out the timing, resources needed and the persons or institution(s) which would be responsible for ensuring implementation of each action. The interim planning team presented the first draft of the management plan to the wider community through village meetings. During this process the plan was discussed, additional issues were raised and the revisions took place. In the two villages, alongside CBM development activities, short term initiatives to improve productivity such as construction of improved goat housing, vaccination against Pests of Small Ruminants (PPR) and the adoption of other animal health control measures were taken up. These collective activities were done with the technical support of the research team and were aimed at motivating people to implement long-term and rational initiatives for better management of the goat resources.

### Creation of local institutions towards CBM

#### *Structure and legal framework*

The intensive and long-term facilitation process was extremely helpful in preventing some local or village elites to dominate the decision-making and in giving voices to marginalised members of the communities, especially women. In each village, a CBM committee was elected to replace the interim planning team. In most cases, members of the interim planning team were appointed to the CBM committee which were made up of seven democratically-elected members in Gbede and of twelve in Ouedeme-Pedah, including a Chair, Vice-Chair, Secretary, Treasurer and Vice Treasurer. They are responsible for the planning, the implementing, the co-ordination and monitoring of the collective activities which have been agreed by the community at general meetings. The elected committees must maintain bank accounts and financial records, report on performance to the community, organize and manage community meetings.

Once the management plan was formally agreed, the research project team maintained regular contacts with the elected CBM committees and provided the technical support agreed to under the plan. By then in each village, the CBM committee had started to draft self-imposed rules and regulations. The final self-imposed rules and codes of conduct were validated during a village workshop. As an important rule in both communities, the introduction of animals of any non-local genotype for breeding purposes is banned. In addition, the introduction of any breeding animal in the village must be subject to authorisation by the CBM executive committee. This authorization will be granted only when the animal is declared by the local veterinary officer to be clear of any infectious disease. Mechanisms were laid down for the enforcement of these rules. Membership was open to any villager who was committed to the objectives of the CBM group and its rules and regulations.

#### *Institutional formalization*

Institutionalization of a community-based organization (CBO) towards management and/or conservation of natural resources includes its creation, but also its legalization with reference both

to the local and national level (World Bank, 1999). In Benin, to be legally recognized, a CBO must go through a process to involve relevant agencies which are under legislation charged to administer the management of local communities. These are the Ministry of Agriculture Livestock and Fisheries (MAEP) and the Ministry of Decentralisation and Local Communities (MDCL). Upon reaching agreement with the community on the rules and regulations, the formalization process was begun by sending the CBM documents to the municipalities of Come and Toffo, which are decentralized institutions representative of the MDCL at local level. The two CBM groups soon received notification of their legalisation.

### *Financial framework*

During the participatory phase, the research team consistently emphasized local initiatives and self-reliance. In response, the communities mobilized their own funding through cost-sharing to implement the first developed community management improvement initiatives such as the installation of a small animal feed store in Ouedeme-Pedah, and the purchase of a Burdizzo castrator and of two bucks for breeding purposes in Gbede. In addition, in both villages the CBM groups have established initial registration fees and monthly subscriptions that all members can afford. Each CBM group has opened an account at a local credit and saving institution.

Experiences have shown that the dependence of CBOs on external donor funding has often led to lack of sustainability (Platteau and Abraham, 2002) while for its long term viability, a CBO needs to have a secure and sustainable funding base from the beginning. It has also been argued that in poor communities, local contributions are usually not sufficient (Swantz, 1997; Kleemeier, 2000). To complement the membership fees, the need to generate monetary resources within both communities through income generating activities that will add value to the communities' core activities has been acknowledged. It has been recognized that the process in which community-based organizations engage to stimulate or maintain business activity is generally a cost-effective and community-empowering process which can yield tangible benefits for participating communities (Binns and Nel, 1999). However, it has been argued that some communities, for instance the poor, often do not

have the financial resources to initiate these activities and that any newly developed local institution concerned with the conservation of natural resources requires some external financial inputs at least in the short term to gain internal legitimacy and acceptance at both village and regional levels (World Bank, 1999). In addition, it is widely agreed that time is required for newly developed institutions to be tested, reviewed and adapted by their members before internal legitimacy can be achieved. Therefore, although income accruing from better management of goat constitutes an undeniable incentive to maintain participation in the CBM groups, each CBM group also received from the research project a community-empowerment fund of 200 000 FCFA (1 euro = 655.957 FCFA).

### *Participation of women and poorer people*

The participatory approach used was also very successful in involving women in the whole process from the outset and in ensuring gender equity. Women have actively attended all the meetings and have participated in all planning and decision-making forums. The confidence and competence they have gained through their active participation in the planning and decision-making process have empowered these women to take a greater role within their community. They were well represented in both CBM groups as a whole, and in the CBM executive committees as shown in figure 6.

In Gbede, it is worth noting that in the elected CBM executive committee, the Treasurer, Vice Treasurer and auditors were women. In other words, they were responsible for the management of the community financial resources. The communities' decision to elect women to these positions was probably based upon their belief that the women would be more transparent, prudent, reliable and honest in handling the community money. Research has found that female representation and effective participation in a peasant committee enhances the committee's performance (Molians, 1998).

The participation of poorer people was also effective in both CBM groups as illustrated in figure 7, and has proved successful in impeding the better-off community members from dominating the decision-making process.



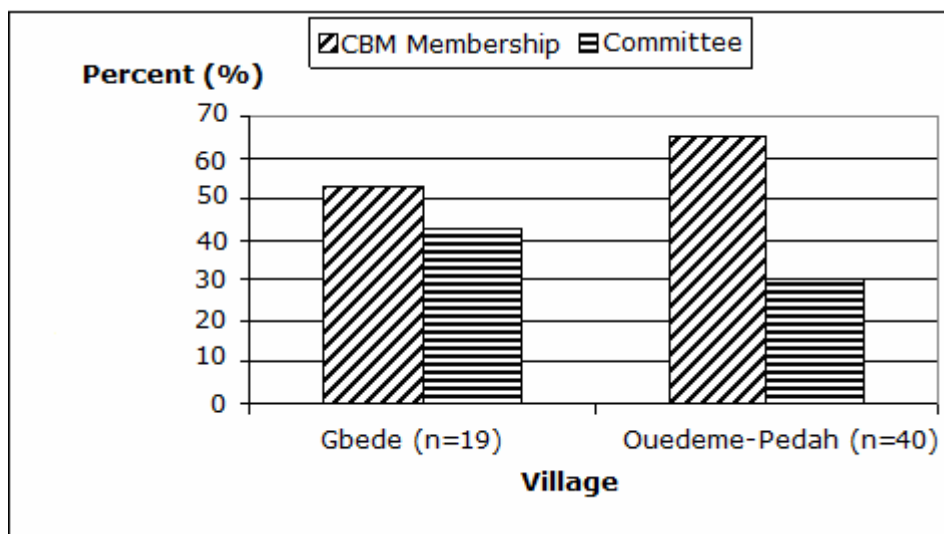


Figure 6. Representation of female people in CBM groups and in executive committees.

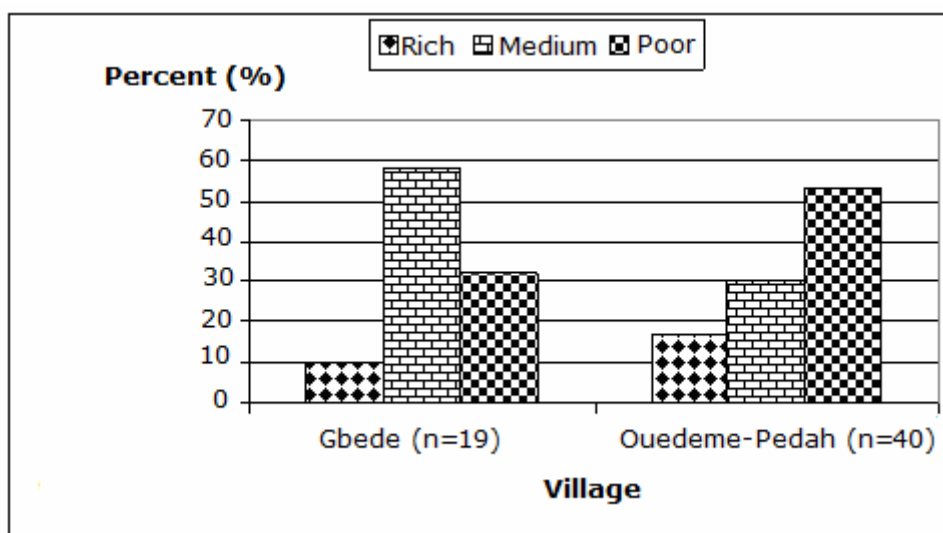


Figure 7. Participation of different wealth classes in CBM groups.

### Training and capacity building

Two general training and demonstration sessions were initiated and organized in each community close to the beginning of the CBM process. The objective was to improve goat farmers' management skills as identified by farmers themselves at the early stages of the participatory planning process.

Each training session lasted a full day. Although these sessions covered all general aspects of goat keeping, emphasis was put on improved housing, feeding and disease control. The training sessions were facilitated by the research team, but the lead trainer was a successful farmer identified by community members themselves. The number of

participants ranged from 17 to 25 in Gbede and from 23 to 37 in Ouedeme-Pedah. This 'farmer-expert' training approach was inspired by the well-known Livestock Farmer Field School (Minjauw, 2001). Although there has been yet no formal survey to measure the adoption by participants of the improved management techniques discussed during these sessions, a growing interest has been observed among community members. For example, actions were taken and 19 participant herds of goats in Gbede and 40 in Ouedeme-Pedah were successfully vaccinated against PPR and treated against internal and external parasites. For both disease preventive measures, a nil coverage rate was reported for the

Table 5. Chronology of events in planning and implementing CBM actions.

Date	Event
07 – 09 November 2005	First formal contact with selected communities and PIC
<i>Situation analysis</i>	
10 – 28 November 2005	<ul style="list-style-type: none"> <li>▪ Wealth ranking with key informant</li> <li>▪ Household census (socio-economic studies)</li> <li>▪ Participatory village resource and social mapping</li> <li>▪ Focus group discussions</li> </ul>
<i>Participatory planning for CBM actions</i>	
December 2005	<ul style="list-style-type: none"> <li>▪ Village meetings to validate PRA results and to agree on the major goat problems</li> <li>▪ Election of the interim planning committee</li> </ul>
January – September 2006	<ul style="list-style-type: none"> <li>▪ Elaboration of the by-laws rules and regulations by the interim planning committee</li> <li>▪ Meetings to validate village by-laws rules and regulations</li> <li>▪ Election of village CBM committee</li> </ul>
November 2006	<ul style="list-style-type: none"> <li>▪ CBM committee members received training in team-building, goal setting, program planning, community problem-solving, conflict resolution and finance</li> <li>▪ Finalization and validation by community members of CBM code of conduct document</li> </ul>
December 2006 – February 2007	<ul style="list-style-type: none"> <li>▪ Communities discussed with research team the feasibility, concepts, aims, benefits, legal and genetic aspects of a potential community-based genetic improvement program</li> </ul>
January 2007	<ul style="list-style-type: none"> <li>▪ Village CBM documents finalized and sent to the decentralized representation of Ministry of decentralization and local communities</li> </ul>
<i>Implementation of plans and monitoring</i>	
December 2005	<ul style="list-style-type: none"> <li>▪ Facilitated “Farmer’s expert” training workshops in improved goat housing and in improved goat nutrition</li> </ul>
March 2006	<ul style="list-style-type: none"> <li>▪ Vaccination against Pest of small ruminant and treatment against internal parasites and mange</li> </ul>
April 2006	<ul style="list-style-type: none"> <li>▪ Purchase of a Burdizzo castrator and castration training of two community members in Gbede</li> <li>▪ Purchase of two (02) communal bucks in Gbede</li> <li>▪ In commitment with a private veterinarian a small shop of veterinary products and animal feed was established in Ouedeme-Pedah</li> </ul>
From May 2006 – ongoing	<ul style="list-style-type: none"> <li>▪ Individual follow-up of CBM participant herds and recording of performance in each village</li> </ul>
January 2007	<ul style="list-style-type: none"> <li>▪ Two representatives of each community received training in community animal health services</li> <li>▪ Each CBM group received a development fund of 200.000 FCFA</li> </ul>
February 2007	<ul style="list-style-type: none"> <li>▪ Vaccination against Pest of small ruminant and treatment against internal parasites and mange</li> </ul>

previous year by the veterinarians in both communities. Likewise, increased adoption of improved housing and use of a Burdizzo castrator has been observed in both communities. The assumption is that continuous increased adoption could be achieved through further Livestock Farmer Field School sessions. In Gbede, two community members were designed by the community to assist the veterinarian during operations of castration in order to learn and to be able to perform the same operations later within the community. Furthermore, in response to the need to reinforce the community leadership skills and to promote interdependent leadership practices, supplemental advisory services and training in meeting-related activities such as team building, goal setting, program planning and community problem solving in conflict resolution and finance were provided to each CBM committee. The five day training program was designed by instructors from a local NGO who have expertise in leadership development, group dynamics, conflict management, problem solving, communication, managing change and community development. In addition, two people (a woman and a man) were appointed in each community by members to receive further training in animal health. The six day training in community animal health services was provided in both communities by a training team composed of a chief veterinarian and a technician, and will be repeated every three months.

#### *Monitoring of implementation of planned activities*

Table 5 shows the chronology of events in planning and implementing CBM actions. Implementation was facilitated through regular meetings of community members and planned interactive learning sessions. During the planning phase, community members identified some indicators for monitoring the outcomes of the CBM process. However, because of the lack of a well-established recording system in both communities, no formal monitoring of herd could take place. Therefore, at the outset of May 2006, a one-year participatory follow-up of individual herds of participants in the CBM program was implemented in both communities. Its main objective was to facilitate the establishment of a participatory recording system. For this purpose an enumerator was recruited and trained for each community. Animals in each herd were identified using a collar. Collars were previously used by farmers just to define

ownership. For recording purposes, each animal was given an identification number which was printed on a piece of wood with hot iron. The piece of wood was then added to the collar and attached to the neck of the animal. Wood is a locally available material and does not create any cost to the farmer.

Therefore, it is expected that this method of identification will be easily adopted by farmers and will facilitate the establishment of a suitable recording system. Each community was provided with two scales. The pursued objective was to familiarize individual farmers with some basic recording tasks such as weighing a new born kid and animals before sale. In addition, an enumerator was recruited in each community and trained in recording. He is based in the village and visits each herd every two-week. He records from each CBM participant, the events that have occurred in the herd since his last visit and weights the animals. He also provides farmers with advice on management issues.

#### *Towards a community-based genetic improvement program*

In both communities, various factors have been identified that constrain the development of effective genetic improvement programs. These factors include the small sizes of the herd and the lack of proper management practices (recording, feeding, housing and disease control). During the planning process, farmers in both communities have developed initiatives to overcome these constraints and to achieve increases in productivity in the short term while creating favorable conditions for genetic improvement. One of these conditions is the increased number of participating herds. As stressed by Olivier *et al.* (2002), when a farmer has one or two animals as occurs now in both communities, knowing the performance of an individual animal becomes relevant only when related to the performance of all other animals in the village. Similarly, Van der Werf (2000) argues that in larger populations, consisting of a larger group of farmers, there is more opportunity to exploit the existing variation among animals, thus creating more potential for genetic improvement.

Further participatory planning meetings were held with both communities. During these meetings, the concepts, aims and benefits and the legal and genetic aspects of each genetic improvement scheme as well as their feasibility were discussed with participants. In both communities, the principles of

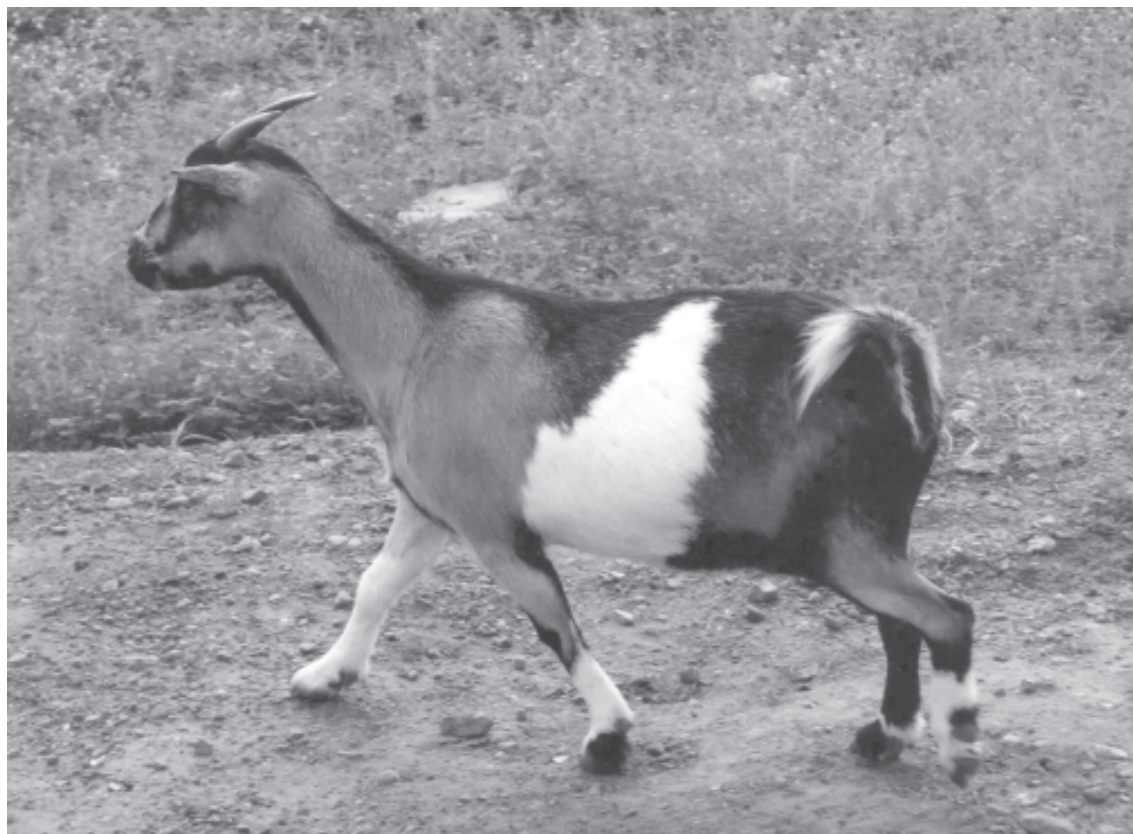


Figure 8. Short-legged but not dwarf goat, Southern Benin.



Figure 9. Dwarf goat, Southern Benin.

open nucleus breeding system (ONBS) has received wide acceptance. Each participant farmer has agreed to contribute the top performing females of his herd to the initial breeding herd.

The one-year screening of individual participants' herds has started in both communities aims to identify the best 50 females and 2-4 males. Height at withers, dam's litter size at birth, individual weight at birth and at six months of age were identified as initial selection criteria. However, these potential donors will not be housed in a central station but will be maintained in their respective herds of origin and a temporary contract will be signed between the CBM program and the individual farmer. The selected top 50 females will be mated with the top 2 males and the best performing offspring purchased by the CBM program to create the village nucleus. This nucleus will be located on land provided by the community and will be managed by the CBM executive committee with the support of a livestock technician acting as a nucleus manager. He will be responsible for performance recording and will be paid with the community funds. As agreed by participants in both communities, only male animals born in the village nucleus should be used in the participating herds whereas transfer of females will occur in both directions between the nucleus and the participating herds. This two-way gene transfer will allow genetic improvements made in the main population to be incorporated into the nucleus and vice-versa. Research by Mueller and James (1983) suggests that when 25 to 50% of the nucleus parents are selected in the base population (participating herds), the rate of increase of inbreeding in the nucleus is minimized and longer-term gains are maximized. In Gbede, farmers suggested replacing the bucks and the poorly performing females in the nucleus herd annually. Mating of relatives will be minimized by avoiding son-dam, daughter-sire and full-sib mating.

Generally, morphological traits including height at withers have higher heritability rate than fitness traits (Falconer and Mackay, 1996). Odubote (1996) obtained heritability estimates of 0.35 and 0.32 for litter size in West African Dwarf goats (Figure 8 and 9) from sire and sire-dam groups respectively. Since West African goats are already prolific (Wilson, 1991), selection for litter size would likely lead to higher incidence of multiple births. Likewise, Bosso *et al.* (2007) reported heritability estimates of 0.5, 0.32 for weight at birth and at weaning respectively. Starting from the results of these previous studies, a great response to selection based on these community-suggested traits can be

expected if farmers adopt appropriate management techniques (i.e. improved feeding, disease control, etc.).

Broek van den and Gbégo (1994) recorded a fertility rate of 1.3 and a prolificacy rate of 1.8 in village goats herds kept in balanced nutritional conditions in Southern Benin. However they reported a relatively high yearling kid mortality rate of 27% due to unidentified epidemic disease. With improved disease control, a yearling survival rate of 85% can be an achievable objective in the village nucleus herd and would allow each doe to produce 2 kids per year ( $1.3 \times 1.8 \times 0.85$ ). Annually, there will be a total of 100 yearling animals in the nucleus herd (50 males and 50 females). The top 2 males (4%) should be retained in the nucleus, the next 10 - 15 (20 to 30%) best males made available as breeding males in participant herds and the remaining 66-74% culled. The best 25% of the female animals could be retained annually in the nucleus for breeding purposes, and the 75% remaining culled.

The importance of the adoption of improved management practices by farmers for the success of the program can not be overemphasized. Further selection criteria could be identified and integrated later into the improvement program. The financial implications of such program have been discussed with farmers. The need for technical and financial assistance to create and operate the nucleus at least at the implementation phase of the program has been stressed by the farmers. However, the financial sustainability of the program will depend on the readiness of farmers to pay for the improved bucks they will receive from the breed improvement program.

Further relevant institutional, management and financial issues need to be discussed with the communities and a full proposal developed before the establishment of the outlined program.

## Conclusion

The process outlined in this paper was effective in mobilizing in a short duration of time, collective interest and resources towards better management of local goat resources in both research villages. Central to the success of the ongoing Community-based management process are:

- The communities have recognized that their goat resources which contribute to diversification of their sources of income and sustain their livelihoods are vulnerable to mismanagement.

- The communities have perceived the tangible and immediate benefits from the ongoing research activities.
- The participatory research methodology used in this study has proved successful in turning the process into local capacity building and empowerment exercises: by giving the community a forum for the 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 to discover and enhance their own potential in developing strategies and institutions towards better management of their goat resources.

In both communities, there have been preliminary discussions about possibilities for implementation of a community-based genetic improvement program. Farmers have shown strong interest in establishing an open nucleus breeding program with a central nucleus which would provide participant herds with local bucks of high genetic potential. However, to ensure the success of the implementation of such a genetic program, further discussions and institutional innovations are required. Also, with the adoption by farmers of improved general management practices being of paramount importance, further investigations are planned to scientifically validate the local knowledge of farmers on fodder resources and on ethno-veterinary practices through systematic on-farm experiments and to plan for participatory cost-effective technologies (improved feeding and control of diseases).

After more than twelve months of intensive interaction with the two communities, it can be argued that given some time for consolidation, and continued institutional and technical support, the two newly created CBM groups are highly likely to become self-reliant, socially and economically viable and to generate widely replicable results.

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## List of Acronyms

- CBM FAnGR: Community-Based Management of Farm Animal Genetic Resources.
- CBM: Community-Based Management.
- CBNRM: Community-Based of Natural Resources Management.
- CBO: Community-Based Organization.
- FAnGR: Farm Animal Genetic Resources.
- FCFA: Francs de la Communauté Financière Africaine.
- MAEP: Ministère de l'Agriculture, de l'Élevage et de la Pêche.
- MDLC: Ministère de la Décentralisation et des Communautés Locales.
- NGO: Non Governmental Organization.
- ONBS: Open Nucleus Breeding Scheme.
- PIC: Prior Informed Consent.
- PPR: Pest of Small Ruminants.

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