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REPORT ON AN EXPERT MEETING ON SUSTAINABLE UTILIZATION

Table of Contents

	<i>Para</i>
I. INTRODUCTION	1-2
II. BACKGROUND AND CONCEPTS OF SUSTAINABLE UTILIZATION	3-10
III. PERSPECTIVES ON SUSTAINABLE UTILIZATION	11-14
IV. GUIDING PRINCIPLES FOR SUSTAINABLE UTILIZATION	15-32
V. KEY STRATEGIES FOR ACHIEVING SUSTAINABLE UTILIZATION	33-63
VI. CONCLUDING REMARKS	64-72

REPORT ON AN EXPERT MEETING ON SUSTAINABLE UTILIZATION

I. INTRODUCTION

1. Conceptual understanding of conservation strategies for animal genetic resources for food and agriculture (AnGR) was strengthened during various consultations, the results of which are reflected in the information document *A strategic approach for conservation and continued use of animal genetic resources*¹ and the conference on “Options and Strategies for the Conservation of Farm Animal Genetic Resources” in Montpellier, France. However, less attention had been paid to the subject of sustainable utilization. To address this deficit, FAO and WAAP convened an expert meeting on “Sustainable Utilization as a support to the further development of the Global Strategy for Animal Genetic Resources Management” in Ferentillo, Italy, from 2 to 4 July 2006. The main objectives of the meeting were to define sustainable utilization of AnGR; identify guiding principles; and identify the gaps which cannot be handled by this group of experts. The fields of expertise of the participants included: animal breeding (ruminants and monogastrics); livestock production systems; economics (with an emphasis on the valuation of AnGR and the economics of breeding programmes); animal health; animal physiology; animal welfare; and social science.

2. Section II of the paper briefly describes the background to the meeting: the challenges facing the livestock sector; the concept of sustainable utilization as developed in the context of the management of biological diversity; and the need to adapt and develop the concept for the specific requirements of agriculture and in particular the management of AnGR. Section III outlines some of the perspectives on sustainable utilization that emerged during the meeting and framed the discussion. Section IV discusses guiding principles that need be considered if sustainable utilization of AnGR is to be achieved. Section V presents some more specific recommendations addressing the following areas: information requirements for sustainable utilization; the development of AnGR and the production systems in which they are kept; market development; and the establishment of a favourable policy environment for sustainable utilization. Finally, some conclusions are offered, focusing particularly on what further work is required to clarify and develop the concept of sustainable utilization of AnGR.

II. BACKGROUND AND CONCEPTS OF SUSTAINABLE UTILIZATION

3. Livestock sector development presents many challenges. Food security is a key objective. In many parts of the developing world, rapidly increasing demand for livestock products is being driven by urbanization and rising incomes. At the same time, hunger and nutritional deficiencies remain widespread in many parts of the world. Food security is, however, not simply a matter of increasing production. Ensuring that food is available in all geographical areas, and to all sections of society including the poor is essential. To achieve this objective, issues of distribution and livelihood development have to be taken into consideration. The Millennium Development Goals adopted by the United Nations in 2000 have further emphasized the obligation on the international community to address poverty reduction and a range of social issues at the global scale. The relevance of the livestock sector in this context is highlighted by the very large numbers of poor livestock keepers on a global scale (Thornton et al., 2002).

4. The Convention on Biological Diversity (CBD), signed in 1992, is the main international legal framework for the management of biodiversity. Parties to the Convention are committed to conserve their biodiversity, to ensure its sustainable use, and to provide for equitable sharing of the benefits arising from this use. Biological diversity under the Convention is broadly defined – ranging from the

¹ CGRFA/WG-AnGR-4/06/Inf. 6

diversity of genes to the diversity of landscapes, and includes diversity created by human activity such as livestock breeds and crop varieties. The CBD thus obliges countries to conserve and sustainably use their AnGR. Moreover, meeting the requirements of the Convention also means that livestock production systems have to be managed in such a way as to minimize negative impacts on the wider environment and wild biodiversity. The significance of the latter issue is emphasized by the large proportion of the world's land area that are used for livestock production – almost 70 percent of the world's agricultural land is permanent pasture (FAOSTAT). Thirty-three percent of arable land is used for the production of animal feed (FAO, 1996), and pollution from industrial livestock production units is often a threat to the biodiversity of neighbouring ecosystems. Moreover, the livestock sector is a major contributor to global emissions of greenhouse gases such as methane and carbon dioxide (Steinfeld *et al.*, 2006). These effects have been, at least, accompanied by an increase in the production of animal-derived food. The Millennium Ecosystem Assessment (2005) concluded that out of 24 ecosystem services examined livestock production was one of only four services that have been enhanced in recent years (the others being crop production, aquaculture and carbon sequestration). Overall, it is clear that the development of the livestock sector is of great social and environmental as well as economic significance.

5. The importance that the term “sustainability” has gained in the international debate can be attributed to its use in the “Brundtland” Commission's report (WCED, 1987). “Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 24). This general principle has given rise to many other definitions of sustainable development, sustainable production or sustainable use of resources. A common feature of many such definitions is that they include three elements: the biophysical (biological/physical), the economic and the social.

6. Article 2 of the Convention on Biological Diversity (CBD) defines sustainable use as “the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.” The concept was further refined and elaborated through the development of the Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity². However, these guidelines focus on biodiversity in general, and on general principles and policies. The principles need to be interpreted and specified for use in the context of agricultural biodiversity.

7. Unlike some other forms of biological diversity, there is nothing novel about the idea of utilizing the biodiversity inherent in crop and livestock species. Many have been directly utilized by humankind for millennia. Indeed, utilization by humans and the controlled breeding they have imposed is the reason for the existence of the biodiversity of these species in its present form. The challenge is to develop a clearer understanding of what sustainability means in the context of the management of genetic resources for food and agriculture, and to develop guidelines and concrete management strategies to achieve sustainability.

8. Sustainable utilization of AnGR is recommended by FAO and other stakeholders as the preferred avenue for safeguarding genetic diversity. In the context of AnGR management, the term “utilization” is used to refer to strategies that are applied to breeds³ that are currently not at risk of extinction. As such, it is distinct from “conservation”, the term used to describe strategies that have to be put in place to protect breeds that are at risk.

9. “Utilization” of AnGR has been defined by FAO as: “the use and development of animal genetic resources for the production of food and agriculture. The use in production systems of AnGRs that already possess high levels of adaptive fitness to the environment concerned, and the deployment

² <http://www.biodiv.org/programmes/socio-eco/use/addis-principles.asp>

³ The term “breeds” captures only part of the genetic diversity within farm animal species, in part because of considerable within-breed diversity, but also because the breed concept is only culturally relevant in some production systems and regions of the world. However, livestock genetic diversity and options for its utilization are usually discussed in terms of breeds, and this use is retained in the current report.

of sound genetic principles, will facilitate sustainable development of the AnGRs and the sustainable intensification of the production systems themselves. The wise use of AnGRs is possible without depleting domestic animal diversity. Development of AnGRs includes a broad mix of ongoing activities that must be well planned and executed for success, and compounded over time, hence with high value. It requires careful definition of breeding objectives, and the planning, establishment and maintenance of effective and efficient animal recording and breeding strategies.” (FAO, 1999). The concept thus encompasses the development of adapted genetic resources, ensuring that they remain a functional part of production systems, and the sustainable intensification of these production systems.

10. The distinction between sustainable utilization and conservation outlined above is not unproblematic. If conservation is understood in a broader sense – that of ensuring the maintenance of all relevant AnGR, then sustainable utilization can be considered one option (among others) for achieving this goal. Alternatively, given that the role of conservation is to ensure that genetic resources are available to farmers and breeders in the future, it could be considered as part of an overall strategy for the use of AnGR in a sustainable manner to meet current and future human needs. For operational purposes (planning and reviewing the state of current capacity), the distinction is useful as it allows a clearer delineation of AnGR conservation programmes (particularly *in vivo* programmes)⁴. However, it should not be concluded that management approaches identified as being applicable in the context of sustainable utilization are necessarily inappropriate for breeds that are at risk.

III. PERSPECTIVES ON SUSTAINABLE UTILIZATION

11. Sustainable utilization of AnGR involves several inter-related concepts. The major objective is to ensure that AnGR are managed in such a way that the needs of both current and future generations can be met. Another key concept is that ongoing use is the best means to ensure that these resources remain available for future use. This ongoing use must in itself be sustainable – it must meet current objectives (economic and social) without compromising the natural environment and resource availability.

12. Livestock breeds in existence today are those that have provided sufficient value (economic, social or cultural) to ensure that livestock producers have continued to keep them. Continued use of the breed within the environment in which it was developed provides a number of advantages, including maintenance of local knowledge about how best to manage the animal, further opportunities to acquire knowledge of the breed, maintenance of the production environment, and continued opportunities for the livestock to adapt to local production conditions. In situations where local usage is not achievable, an alternative is to seek opportunities to use the animals in other environments. If it is impossible to identify viable strategies for sustainable utilization, conservation measures including cryoconservation and a variety of *in vivo* methods (*in situ* or *ex situ*) have to be considered if the loss of the breed is to be prevented.

13. Use of AnGR occurs within agricultural production systems. These systems should be sustainable not just economically (e.g. in terms of production level or efficiency of production), but also environmentally (e.g. avoiding pasture degradation) and socially (e.g. respect for local traditions and culture). Moreover, society is increasingly considering the broader environmental and social consequences of agricultural production. Concerns include wider environmental impacts, poverty reduction, gender equity, impacts on human health, and the development of rural communities. There may also be a desire to preserve the cultural and historical aspects of traditional forms of livestock production, including the breeds kept. These concerns and values may be reflected both in policy measures, and in the choices made by the consumers of animal products.

⁴ CGRFA/WG-AnGR-4/06/Inf. 6

14. Developing policy responses to such concerns is a great challenge. Conflicting interests may have to be accommodated, and the relevant information on which to base decisions may be difficult to obtain. Inappropriate livestock development policies are often an important constraint to achieving sustainable utilization. Lack of relevant knowledge and market failures of various kinds may limit the power of the consumer to exert influence through purchasing decisions.

IV. GUIDING PRINCIPLES FOR SUSTAINABLE UTILIZATION

15. The context and perspectives outlined above indicate that livestock development in general, and AnGR management in particular, has to address a variety of production environments. Measures for enhancing the sustainable utilization of AnGR have to be appropriate to the specific context and will thus vary from one situation to another. The meeting, therefore, developed a rough framework categorizing production environments.

16. Livestock production varies in terms of many characteristics and there are several potential ways of classifying production systems. The method of classification chosen for the purposes of the meeting discussion was based on the variation of livestock production with respect to two axes: the extent to which the production environment is controlled, and the extent to which production is oriented towards the market. The axis relating to the extent of control of the production environment was chosen because enhancing sustainable utilization requires an optimal match between genetic resources and the production conditions. Where the production environment can be controlled, the strategies available to achieve this match tend to differ from those available under less controlled conditions. The degree of control of the environment is closely related to the extent to which external inputs are used. The axis relating to the degree of market orientation was chosen because the current and potential market for animal products has a large influence on the use of AnGR and, depending on the circumstances, provides opportunities for intervention aimed at enhancing sustainable utilization. While this classification framed the discussion, it was also recognized that other factors including the scale of the operation influence the utilization of AnGR.

17. Within the framework, four categories of livestock production were identified:

- subsistence-oriented production (low control of the environment and low market orientation);
- industrialized commercial production (high control of the environment and high market orientation);
- “extensive” commercial production, e.g. ranching (relatively low control of the environment and high market orientation);
- niche market production (control of the production environment could be high or low, orientation on the market is high, but the nature of the market is different from that found in the previous two categories: niche markets relate to specific production conditions, recognizable speciality products, or often a combination of the two).

18. The degree of control of the environment has important implications for the choice of AnGR, as adaptive traits become increasingly important with decreasing control. Production for large retailers and export markets favour the use of high output and genetically more uniform breeds because of economies of scale and the need to meet requirements for uniform products. Niche markets and production for subsistence and local markets allow a greater variety of breeds to be kept and greater variety of products besides food and fibre.

19. With respect to the development of sustainable livestock systems the following discussion focuses on three widely recognized dimensions of sustainability: economic, environmental and social. The guiding principles aim to describe the attributes that allow systems to achieve efficiency, taking each of these dimensions in turn.

Economic dimension

20. Economic viability will depend on different attributes depending on the characteristics of the production system. For industrialized and extensive commercial production systems, raising livestock productivity is the main attribute contributing to economic efficiency. For subsistence-oriented production, however, food security and meeting other household needs is the primary objective. This may not require maximizing biological productivity, but rather aim at efficiency in the use of the available resources. An important objective for these households is to manage risk. As such, the role of animals as a form of insurance is a major consideration.

21. For all systems with a commercial market orientation, including niche markets, the increasing market demand for food safety is an important factor affecting market access and hence economic sustainability. The demand for food safety can lead to conflicting market pressures. There may be a demand from large retailers for uniform products from standardized production environments which are thought to minimize the prominent risks associated with food-borne diseases such as salmonellosis or brucellosis. There are also market pressures related to other aspects of the production process such as those that lead to the accumulation of undesirable residues, for example, antibiotics and heavy metals in food. Concerns of this type have been a contributing factor to the rise of niche markets.

22. Animal health and food safety standards can have a major influence on access to export markets and hence to the economic viability of some commercial systems. The effectiveness of regulatory instruments at country level is an important factor in this respect.

23. Direct and indirect governmental subsidies often form an important contribution to farm income. There are examples for all systems, but it is the industrialized commercial production that has benefited most from subsidies. While subsidies may be a valid means of sustaining livestock production and achieving policy objectives that are difficult to achieve through market mechanisms, sustainability may be at risk if the financial resources and political will to continue the subsidies cannot be maintained.

Environmental dimension

24. To be sustainable, production systems have to minimize environmental impacts that undermine their future capacity to produce. It is also necessary to avoid affecting the wider environment in such a way that social or environmental objectives beyond the livestock sector are constrained. Even if steps are taken to address these threats, environmental changes that present new challenges to livestock production are likely to occur. Thus, another aspect of sustainability is to ensure that the livestock population retains sufficient diversity to be able to respond to a changing environment. As well as having negative impacts, livestock can play some positive environmental roles. These functions often require animals with particular adaptations. It is, therefore, important that genetic resources are managed in such a way as to retain breeds or types of livestock with these capacities, and to ensure that they remain integral components of productive landscapes.

25. Industrialized commercial livestock production is the focus of many environmental concerns. The geographical separation of livestock production from the production of animal feed creates problems with respect to the cycling of nutrients. For example, the discharge of excessive nutrients into water courses can have an adverse effect on aquatic ecosystems. Other impacts on local ecosystems arise from gaseous emissions from inappropriately managed livestock wastes, and the pollution of land with heavy metals. Consideration also has to be given to the environmental impact of producing the animal feed required by industrial production systems: for example, the inappropriate use of fertilizers and pesticides, use of irrigation in dry areas, or the destruction of ecosystems such as rainforests to make way for feed crop production. Conversely, a possible positive outcome of increasing industrialization is that the higher land productivity associated with industrialized systems may reduce the demand for land and hence reduce the pressure on wildlife habitats.

26. The emission of greenhouse gases from livestock production is a major environmental concern at the global level, and is a problem associated with all production systems. Methane is an inevitable

product of ruminant metabolism. However, industrialized commercial production systems utilizing high output breeds are characterized by higher efficiency in feed conversion and hence lower methane emissions. Conversely, nitrous oxide emissions from livestock wastes, and carbon dioxide production through the use of fossil fuels in mechanized farming and in the transport of inputs are more associated with industrialized production than with other systems.

27. In grassland systems, whether subsistence oriented or “extensive” commercial, the degradation of rangelands may occur as a result of inappropriately managed grazing. The encroachment of crop production into the more fertile rangelands, which leads to more intensive use of less favourable areas of the rangelands, is a contributing factor. Higher livestock density in more marginal areas may also lead to adverse effects on wildlife biodiversity. In some parts of the world, notably in South and Central America, the destruction of rainforest ecosystems to make way for livestock or feed production is a great concern both from the perspective of biodiversity and of atmospheric carbon dioxide emissions (Steinfeld *et al.*, 2006).

28. Grazing livestock can, however, contribute to environmental objectives. One way of promoting the sustainable use of arid rangelands is through mobile production strategies of the type traditionally adopted by pastoral peoples. If this is to be achieved, livestock breeds adapted to the harsh conditions and to the particular objectives of the pastoralists are required.⁵ Managed grazing may be a means of promoting the conservation of particular plant species or communities, which in turn may provide habitats for a range of animal species. This function has become increasingly significant in the management of nature reserves, particularly in Europe. Other specific environmental services provided by grazing animals include the removal of biomass to reduce the risk of fires. Payments for environmental services of this type may provide a basis for the continued economic sustainability of some breeds. There are also positive interactions between livestock, wild vegetation and the soil, that can result in higher biodiversity. One example is that livestock manure can contribute to the diversity of soil microflora and microfauna.

29. In all systems, livestock diseases may have important environmental consequences. Diseases may transfer between livestock and wild animals and have serious consequences for wild biodiversity. Conversely, many diseases are transmitted from wild animals to livestock, which may negatively affect their biodiversity. Animal health measures such as the use of insecticides can also have adverse environmental impacts if not carefully managed.

Social dimension

30. Production systems are socially sustainable if and when they are in accordance with the social and cultural values of society. Human health, for example, is a major social concern. Sustainable livestock production systems must allow the nutritional requirements of the population to be met, while at the same time minimizing the risks from zoonotic diseases. Generally in poorer societies, and especially where there is degradation of the environment, the relationship between animals and people are close, increasing the risk of zoonotic diseases. All production systems are affected by concerns related to human health, but the perceived importance of the problem and the control mechanisms available vary. Other significant social concerns, particularly relating to subsistence oriented production systems, include alleviation of poverty, avoiding the marginalization of particular ethnic groups, and ensuring that local or indigenous knowledge is respected and valued.

31. In the case of market oriented production systems, the market (interactions between consumers, retailers, and producers) has a strong influence. Especially where human populations have become more urbanized and agriculture has become less economically important, the values of the general public have to some degree fallen out of step with those of agricultural producers. This gap presents a challenge to commercial producers, as the public may be unwilling to purchase products

⁵ CGRFA/WG-AnGR-4/06/Inf. 9

from systems that do not correspond to their values, or to tolerate policies and regulatory frameworks that do not address their concerns. Some basic cultural values are not easily influenced by short term events, but public attitudes and consumers' behaviour with regard to particular animal products may be influenced by the media, by persuasive marketing strategies, or by campaigning pressure groups. In recent years, public concerns have included animal welfare, preserving traditional rural landscapes and communities, traditions and cultures (e.g. support for "family" farms). While for industrialized producers it is difficult to address some concerns, these developments open new opportunities for niche market producers and extensive commercial production. Another element often associated with niche-market development is the use of breeds that are linked to a particular landscape or region that has some cultural appeal to the consumer.

32. Social concerns vary from culture to culture, presenting an additional challenge to commercial producers targeting export markets. In a more globalized economy, communities that have a high purchasing power will tend to exert a larger influence on products and how these are produced. This greater purchasing power is found in developed countries and emerging economies.

V. KEY STRATEGIES FOR ACHIEVING SUSTAINABLE UTILIZATION

33. Based on the guiding principles, key strategies for achieving sustainable utilization are outlined below.

Acquiring relevant information

Characterization of breeds

34. An integral component in any plan for sustainable utilization is to characterize the AnGR in question. This includes developing an understanding of production, functional and adaptive traits. The requirement for improved characterization is particularly great in subsistence-oriented systems. However, an improved knowledge of breed characteristics may also serve as a means to identify potential new niche products. Characterization needs to take into account the effects of spatial and temporal variability within the production system (e.g. year to year variation in the performance of different sheep breeds). Characterization aimed at enhancing sustainable utilization needs to describe a broad set of breed attributes beyond simple production traits, including aspects such as the efficiency of resource utilization, ability to utilize marginal areas, predictability of production, and resistance to disease. Where decisions have to be taken in situations where such information is not fully available, common sense will often help.

35. The results of characterization efforts will need to be communicated to livestock users and others involved in setting policy on AnGR use. Improved awareness of breed characteristics (e.g. specific local adaptations) allows for better understanding by local producers and by policy-makers of the value of the breed – aiding efforts to maintain the breed. Characterization may promote the formation of breed organizations which in turn promote the utilization of the breed. This research, communication and organizational development all requires funding, but it is not clear how this investment will be achieved within current funding structures.

Targeting animal genetic resources for interventions

36. Although from some perspectives all diversity is of value, it is impossible to ensure the sustainable utilization of every breed. It is therefore necessary to consider how efforts should best be focused. Efforts are most needed in situations where inappropriate policies and external interventions have led to inappropriate decisions regarding breed choice and management. However, if the objective is active further development of a breed, success is likely to require a local community or breeding association that highly values the breed in question, and has a long history of (local) knowledge and experience of working with the animals.

37. Another factor to be considered in the targeting of interventions is the specific characteristics of breeds under consideration that make them unique; for example, adaptive traits such as disease and

heat resistance or specific feeding behaviour. Replaceability of the breed is a further consideration. Other criteria might include a focus on breeds that are specific to restricted regions or are unique in terms of their morphological, functional or cultural characteristics or the products that they produce. Criteria of this type have been used in the choice of breeds for inclusion in existing conservation programmes. To date, however, well-considered targeting of breeds has been hampered by the lack of information.

Optimize the use of animal genetic resources in the context of their production environments

Sustain production systems

38. As described above, livestock production takes place in the context of production systems and within agricultural landscapes. If particular production systems disappear, the associated breeds may no longer have a sustainable use. It is, however, neither possible nor desirable to maintain production systems in a static state. Policy efforts to maintain and promote AnGR should not come at the cost of limiting opportunities for farmers to improve their livelihoods through other forms of agricultural or off-farm economic activity. This is a particularly important consideration in subsistence-oriented production systems.

39. In some cases, technical improvements to nutrition, management or animal health may be essential. Sometimes simple improvements to animal health care will improve the economic viability of the system. Where management practices have already been substantially improved, corresponding genetic changes may be required. This could involve genetic improvement of the breed in current use, breed replacement, or cross-breeding. In reality, management and genetic improvements function together, as changes in management create new opportunities for selection and vice versa. In other circumstances, sustainability may depend more upon policy issues such as the access of local livestock keepers to resources, in particular access to land.

40. The provision of livestock services and extension should be in line with the objectives of the livestock keepers, and accept and build on their local knowledge. It should be recognized that livestock keepers are diverse with respect to knowledge of livestock production. Traditional livestock keepers such as pastoralists have particularly rich knowledge of their animals. Others who have more recently taken up livestock keeping may be more susceptible to inappropriate advice regarding breed choice. Another factor to be considered is that some cultural practices, such as the exchange of animals for dowry or bride price, can have important implications in terms of breeding management. Thus, in some circumstances the sustainability of the genetic resources depends upon the sustainability of the culture and practices and vice versa.

Working with local livestock keepers

41. A key aspect to developing sustainable utilization in subsistence-oriented production systems is creating or strengthening structures that bring the users of the animals together and help motivate and organize communal efforts. In the longer term, building these structures may serve a capacity-building role – allowing the farmers better access to information, strengthening their position in relation to extension services, facilitating the organization of training, and improving bargaining power when marketing products. Particularly important in this process is to listen closely to the requirements of the producers. Development must be based on local values associated with livestock and avoid simply imposing perspectives on genetic “improvement” of local breeds. Care should be taken to avoid an over-emphasis on productivity-related objectives at the expense of other considerations such as reducing the level of risk faced by the livestock-keeping households. A respect for, and willingness to build upon, local knowledge of the production system is required. The integration of local knowledge with scientific knowledge requires an understanding of the context in which the local knowledge has been developed, and an understanding of the limitations on the extent to which it can be transferred to other situations.

42. Breeding programmes also need to ensure that outcomes can be evaluated not just using the tools accessible by scientists but also by the producers themselves. This may involve using traits that are readily assessed and recorded by the producer (e.g. a visual assessment of wool quality), or providing the tools and training to producers that will allow them to make more accurate quantitative assessments.

Full utilization of the current genetic resources

43. The world's current AnGR are not used in an optimum way. In all production systems there are potential means to make better use of the available genetic resources. A means of utilizing more fully the potential of current animal genetic diversity is by improving the fit between the animal and the environment (including the management system) in which it is kept. This requires an assessment of environmental constraints, such as those associated with harsh climate, poor feed resources, and disease. Understanding genotype \times environment interactions will allow judgements to be made regarding the appropriateness of the current breeds in use. Genotypic adaptations which may be of interest include efficient feed conversion in high output breeds, efficient use of low quality feed resources in locally-adapted breeds, and grazing behaviour related to specific types of vegetation. Ecosystem services such as conservation grazing and fire-control will require livestock with particular adaptations, to enable them to thrive in specific local environments and with relatively low levels of management input. Moreover, these functions may in some circumstances require very specific grazing and browsing behaviours, which are only displayed by a narrow range of breeds. In some cases, the extent to which livestock contributes to soil erosion or soil compaction because of weight, hoof characteristics, and grazing behaviour, may be an important factor for the choice of species or breeds.

44. Appropriate utilization of AnGR is an important tool for improving animal health, whether through the choice of a breed that is resistant to local diseases or parasites, cross-breeding to introduce resistance genes into a new population, or within-breed selection for disease or parasite resistance. The greater the diversity of the available AnGR, the more options are available for a close fit between the environment and the animals, at national and global levels.

Development of breeding programmes

45. One way of improving the use of AnGR is through the continued improvement of existing breeds. Structured breeding programmes have so far focused on a few, mainly commercial breeds of five major species. In some situations, carefully conceived cross-breeding programmes may also have merit as a rapid method of introducing desirable traits into local well-adapted breeds. Sometimes using other breeds or even species may be the method of choice. Different breeding strategies are associated with different degrees of risk for the loss of genetic diversity. Replacement of local breeds with international transboundary breeds obviously poses a high risk as does cross-breeding in an indiscriminate manner. Conversely, well-planned cross-breeding might provide a method to maintain local breeds, while developing composites may at least conserve some of the genes. Straight-breeding to adjust the local breeds to the changing needs of producers is the most viable option to keep local breeds in production, even though it will inevitably result in some reduction in genetic diversity within the breed. The decision not to implement an organized breeding scheme can be considered as having the least impact. If no organized breeding is in place, natural selection will play a larger role in the genetic changes occurring within the population. However, inbreeding and genetic drift may endanger small populations if reproduction is not controlled.

46. Selective breeding efforts can vary in scope from highly organized breeding programmes through to simple culling decisions under less controlled environments. The choice of methods will depend on the objectives of the breeding programme, access to genetic resources, and the technology and infrastructure available. Strong natural selection under production systems with low degrees of environmental control will lead to selection for adaptive traits. Opportunities for selecting for production traits may, however, be limited because of high levels of mortality. Under these conditions, the use of breeding animals from multiple farms may be required to enlarge the basis of selection.

Another approach is to work towards improving management conditions to reduce mortality, and give the producers greater opportunity to exercise selection.

47. Generally, breeding objectives have focused on increasing productivity, often measured at the individual animal level. However, breed development that takes into account the full range of attributes that make production systems sustainable, will require selection for criteria that have not conventionally been considered in most structured breeding programmes. In addition to the more typical production and productivity traits, breeders will need to consider traits important for consumer and animal health, resource-use efficiency, and other environmental and social impacts. Breeds that have been successful under current production systems will not necessarily be those that succeed in alternative production systems that are more ecologically or socially sustainable.

48. Animal breeders need to remain aware of the broader effects and social acceptability of the modifications towards which they are working. For example, the development of double-muscled breeds of cattle has achieved some production benefits, but at costs to animal health and welfare that are unlikely to be sustainable in the medium to long term. Although new technologies offer potential means to address some social concerns, these will need to be implemented cautiously. For example, research on genetically modified pigs may allow pig production with lower environmental emissions of phosphorus. However, for some people at least, this end will not justify the means.

49. Operationalizing some of these social and environmental objectives will be difficult as it requires defining selection traits related to these objectives. Furthermore, the development of breeding programmes that use a wide combination of traits will pose a significant challenge. Negative correlations among desirable traits may occur. For example, the selection for increased resistance to one parasite may lead to reduced resistance to another, and increased production leads to reduced fertility. A further prerequisite for the sustainability of any breeding programme is that it increases the economic success of the producers involved.

50. In general, selection will lead to reduction in variation in the targeted trait. Moreover, some selective breeding programmes can lead to increases in the rate of inbreeding. Inbreeding is of particular risk when working with small populations and where there is limited flow of genetic resources between farms. Even in large well-established breeds, inbreeding can be a risk when many producers select from a very limited pool of males which are considered to be top performers. Breeders need to work towards maintaining the necessary level of within-breed diversity.

51. A functioning regulatory framework can help organize and foster breeding programmes. Specifically, these regulations can provide consistency in animal identification, herd books, and performance assessment that provide certainty/accountability in the exchange of genetic resources. In many developed countries, a body of legislation addressing these issues is in place. However, the conditions of subsistence-oriented production present great obstacles to the implementation of any regulatory framework for these matters.

52. While necessarily there has to be flexibility in the planning and implementation of breeding programmes, some general principles can be identified. At national level, a baseline analysis, is needed. The analysis should include and assessment of the country's production conditions, and of the characteristics, roles and values of the available AnGR. Existing institutions and regulatory structures should be assessed. All relevant stakeholders should be involved in the process. Potential strategies for breed development appropriate to the local conditions and in keeping with the country's overall livestock development objectives should then be identified, assessed and prioritized.

53. At the livestock keeper level (i.e. where the actual breeding programme is implemented), the first step should be an analysis of the production situation, to understand the constraints and to identify the potential for active involvement in breeding activities. It is important to define the minimum set of structural elements for implementing the programme. Sometimes this can be less sophisticated than is conventionally assumed by scientists.

Develop and exploit marketing opportunities

54. The value of animal production can be increased by marketing products more effectively. The discussion in this section focuses on niche markets, as this sector of the market is important from the perspective of promoting sustainable utilization (mostly in developed countries). Development of niche markets relies on creating perceived value regarding the conditions of production or about product quality. Clearly, in many circumstances these factors will work in combination. If niche markets on an international scale are to be accessed, this may require improved knowledge and capacity building among farmers to allow their products to meet international food safety standards.

55. Changes in consumer preferences, such as the emergence of the Slow Food movement are leading to demand for a greater range of consumer products. In some cases, this can lead to demands for products from specific breeds e.g. Reggiana cattle used to produce Parmigiano Reggiano; similarly, chickens from local breeds command higher prices than broilers in many countries. In other cases, the demand may be for products from specific landscapes (e.g. Swiss alpine pastures) which themselves may be best used by locally adapted breeds. Cultures may vary in their propensity to adopt these niche market products. Those consumers that particularly value food quality or specific production methods are the most likely to be ready markets. Intermediaries between the producer and the consumer may reduce the opportunity for this type of specialty marketing. For example milk is often shipped from many producers to a single processor making it difficult for consumers to choose milk from a specific farm. Products that can be produced on-farm, such as artisanal cheeses, are likely to be most suitable for niche marketing.

56. Breeds that thrive in alternative production systems will often be different from those that are most productive under more controlled production conditions. Thus, changes in consumer demand and development of new production methods will need to be accompanied by efforts to select and improve the breeds that are most suitable for these production systems. Breeders and producers need to be careful to avoid creating new concerns. For example, from an animal welfare perspective, any move towards more extensive production should be accompanied by measures to select breeds that do not suffer under the range of environmental conditions that the animals will experience.

Policy options: creating an enabling framework for sustainable utilization

57. There are a number of ways in which policy can either facilitate or hamper sustainable utilization of AnGR. Policy should consider the role of market versus regulatory forces. Much commercial trade in AnGR is driven by a relatively small number of animal breeding companies that focus on the high output breeds used in controlled production systems. These companies have a commercial interest in spreading the use of these breeds, potentially threatening the sustainable utilization of locally adapted breeds used under less controlled production systems. These commercial interests cannot be expected to promote public good values associated with the preservation of these genetic resources. For this reason, governments should use the available policy instruments to meet their responsibilities to maintain animal genetic diversity within productive landscapes. This may require the use of public funds to support breeds and maintain animal genetic diversity. Governments also need to ensure that information on breed performance is effectively used to identify means of sustaining the economic utilization of the breeds. The objective of promoting AnGR diversity has to be balanced with other objectives in livestock development such as national food security, or quick restocking of livestock after disasters, but any imposition of exotic breeds should only occur after careful review of the merits of locally adapted breeds.

58. If policies are to have a positive impact on sustainable utilization of AnGR and the sustainable development of livestock production systems, structures need to be in place that encourage representation of relevant stakeholders in policy decisions. For example, pastoralists are users of locally adapted breeds that may represent important genetic resources, but these individuals are often minorities that may find it difficult to make their voices heard in policy deliberations. The relative influence of different stakeholders and the mechanisms through which they are consulted will vary considerably from country to country. At the national level there may be problems associated with the

division of responsibility among the various organizations responsible for maintaining AnGR. For example, the Ministry of Environment is normally responsible for a country's obligations under the CBD, but policy with regard to livestock will largely lie in the hands of the Ministry of Agriculture.

59. The characteristics of the regulatory frameworks affecting the livestock sector can also impact the sustainable utilization of AnGR. Some laws directly relate to the management of AnGR. At the global scale, the main legal framework for the management of biodiversity including farm animal biodiversity is the CBD. Given the broad remit of the CBD, it is important to ensure that the specific problems of agrobiodiversity and in particular AnGR diversity are addressed. In particular, it is important that frameworks for international exchange of animal genetic material respect countries' sovereignty over their genetic resources, but do not restrict exchange of material essential for sustainable management. At national or regional (e.g. European Union) level, relevant laws include those regulating performance recording, animal identification and the keeping of herd books, all of which facilitate the implementation of breeding programmes⁶.

60. AnGR management is also affected by many other aspects of legislation. For example, animal health-related regulations will in some circumstances act to facilitate international exchange of AnGR by providing a measure of assurance regarding disease risk. Preventing the spread of diseases which could have a devastating effect on livestock populations is also of great importance. However, these measures can also act as trade barriers, in that they restrict the importation of material from countries that cannot meet international standards. The relationship between health-related trade restrictions and the development of livestock production systems in affected countries and how this in turn relates to the utilization of genetic resources and to broader social and environmental impacts is a complex matter deserving further study. However, some general points can be made here. For example, many international transboundary breeds are traded from a wide range of countries including those that are free of the important transboundary livestock diseases. Obtaining genetic material from these breeds is, therefore, unlikely to be a problem for those wishing to import. However, there may be problems relating to less widely distributed breeds or species that originate from areas where diseases are endemic. Another area of concern is that trade constraints could also hamper conservation approaches based on international genebanks, by restricting the movement of semen and embryos from disease-affected countries.

61. Policies put in place for disease eradication and emergency slaughter in the case of epidemics should also consider potential effects on rare local breeds.⁷ For example, during the outbreak of foot-and-mouth disease in the United Kingdom in 2001, several local breeds were placed in jeopardy by the slaughter programme. With regard to aid and development policy, donor nations and their breeding organizations should be aware of their responsibility concerning the impacts of development and rehabilitation projects on AnGR diversity. *Ex ante* impact assessment of the aid should include a consideration of effects on local breeds. Recipient countries also need to be critical, as in some cases donor nations have an economic interest in the establishment of the exotic breeds. A basic requirement to achieve this is sufficient and easily accessible information about the AnGR present in the recipient country.

62. Conventional policy tools use legal mechanisms or provide financial incentives to promote sustainability. However, the behaviour of livestock keepers or breeders is not simply motivated by financial motives or the need to abide by the law. Culture, in the sense of what is felt to be valued by peers and the wider society, can have an influence. Possible policy measures that might have some influence in this respect and facilitate a cultural shift in production values could include award programmes valorizing more sustainable production goals, including the social and environmental dimensions.

⁶ see Part 3 E of *The State of the World's Animal Genetic Resources*

⁷ see Background Study Paper No. 32

63. Although a detailed discussion of policy instruments was beyond the scope of the meeting, codes of conduct for the exchange of AnGR, and diversity impact assessment of development interventions were proposed as potential instruments.

VI. CONCLUDING REMARKS

64. Utilization is the reason for the existence of AnGR diversity in its current state. Breeds that are in existence today are those that have, over time, been developed and used by humans to meet their objectives. Current utilization has to consider current objectives. However, this should not be the only factor influencing decisions in AnGR management. The concept of “sustainability” requires that consideration is given to the future availability of the resources in question. While this does not necessarily mean that all currently existing breeds should be maintained, the aim should be to ensure that future options and capacity to meet human needs are not compromised. The concept of sustainability also implies that the wider social and environmental consequences of the current utilization of AnGR have to be considered. Trade offs between the different facets (economic, social and environmental) and levels (national, international) of sustainability, and conflicts between different stakeholder groups will need to be balanced.

65. Ongoing utilization is regarded as an effective means of ensuring the availability of resources for the future. Utilization is likely to continue if the breeds are perceived to provide genuine benefits in the short term (whether these are private benefits for the livestock keeper, or public benefits for which society is willing to pay). However, there may be circumstances in which no current benefits sufficient to justify ongoing use of a particular genetic resource are identifiable. In these circumstances, future availability is threatened. If it is considered that maintaining the threatened resource for the future is an important objective, then conservation measures are likely to be required. In some cases, (e.g. *in vitro* conservation) the distinction between conservation and sustainable utilization is quite clear. However, in the case of *in situ* conservation the animals will normally be used, even though this use would not be sustainable without external support. Where possible, conservation measures should be seen as a means of “bridging the gap” – enabling the resources to remain available until a sustainable pattern of utilization emerges.

66. Current utilization of AnGR is for various reasons sub-optimal. One widely recognized reason for sub-optimal use of AnGR is a lack of knowledge. The meeting thus stressed the need for improved characterization. Improved knowledge would support another broad objective identified by the meeting – that of matching AnGR to the production conditions.

67. The two main areas of direct intervention to promote sustainable utilization identified by the meeting were in the fields of breed development and marketing. Breed development presents a particular challenge in subsistence-oriented systems where the relevant organization, infrastructure and knowledge are likely to be lacking. Any interventions in this field have to be based on adequate knowledge of the breeds in question and of the production system. Success is unlikely unless the local livestock keepers (and other relevant stakeholders) are involved in the planning and implementation of the scheme. This is a situation in which the concept of social sustainability becomes concrete. In the context of breed development, it should be acknowledged that optimizing current utilization and implementing improvement programmes for the short or medium term, may in some cases not be compatible with the maintenance of a higher level of genetic diversity, or take account of other longer-term public goods issues.

68. In the case of niche market development, the main objective is to enable the livestock owners to make a living from keeping breeds that would otherwise be unprofitable. However, the niche markets may also be linked to social or environmental concerns (i.e. when consumers pay a premium for products raised in socially or environmentally-sound systems). This linkage is dependent on the existence of consumers who are willing and able to pay, and on the possibility of providing marketable products that can be identified with the desired outcomes. In other cases, the public sector may be prepared to pay for “niche” functions of a public goods nature such as conservation grazing or fire control. There is no conceptual reason why activities supported by the public sector should not be

considered sustainable. However, from a practical perspective there may be concerns regarding the availability of funding in the long term.

69. Another factor that has the potential to distort the utilization of AnGR is inappropriate policies. At the level of interventions in the specific field of AnGR management, the meeting recognized that such distortions could be the result of ignorance (highlighting again the need for adequate characterization) or result from the tendency of some stakeholders to promote their own interests. Legal frameworks related to both genetic improvement and niche marketing may play a role in facilitating the emergence of sustainable utilization. Many other aspects of policy and legislation can affect the management of AnGR. In most cases, it is unlikely that promoting sustainable utilization of AnGR alone will be a decisive factor shaping policy. Wider concerns about social and environmental sustainability may, however, affect policy development. In some cases, policies put in place to address such concerns may favour the sustainable utilization of AnGR by promoting production methods or systems associated with the keeping of a broad range of AnGR.

70. This meeting was limited to technical issues, such as livestock–environment interactions, breeding, animal welfare and animal health, and policies closely related to these issues. The social dimension of sustainable utilization of AnGR was considered in parallel to these technical aspects. Thus, the perceptions of local communities regarding the value of animals and how this affects utilization were discussed. It was agreed that production systems are socially sustainable when they are in accordance with social and cultural values of societies. Differences and dynamics in these values were briefly reviewed, in particular with regard to the importance of animal welfare. Clearly, the social dimension of sustainable utilization needs to be broadened to fully consider the principle of equity. A broadened concept would be a logical output when legal and policy aspects for sustainable utilization of AnGR are discussed at a follow up workshop. Such a workshop may use the principles, and the associated operational guidelines, of the Addis Ababa Principles and Guidelines for Sustainable Use of Biodiversity to orient its discussions.

71. A key concern is to operationalize capacity building in all technical aspects of AnGR management (in the areas of: effective characterization, exchange, breeding and conservation strategies supplementing use). In this context, guidelines for capacity building will entail the provision of financial support, incentives, secure access to resources and services, and assistance with technical breeding support and with market-entry knowledge.

72. The key strategies recommended by this meeting involve a variety of policy and legal elements. For example, sustaining production systems is related to access rights to natural resources, and the rights of indigenous people. The prospects for developing and maintaining local and niche markets need to be examined in the light of relevant aspects of the WTO's portfolio, such as zoosanitary measures and trade regulations for globalized markets. Similarly, the harmonization of intellectual property rights pursuant to the Trade-Related Intellectual Property Rights (TRIPS) agreement could pose a threat to AnGR by, *inter alia*, prioritizing the protection of rights in the genetic development of exotic breeds rather than local rights in indigenous breeds. Thus, guidelines for sustainable utilization need to prescribe required international practices and approaches, particularly in the areas of intellectual property rights, zoosanitary measures and the general harmonization of technical standards. Moreover it is must balance these practices within the context of the mandates of other institutions such as the WTO and the CBD.

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