

Gender equality, resilience to climate change, and the design of livestock projects for rural livelihoods

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Currently, there is growing interest in how livestock projects can contribute to resilience to the effects of climate change. In this article we recommend a shift away from gross productivity to sustainability, via the use of thrifty local breeds, with an additional emphasis on improving survival of young animals. These animals, due to their local adaptations, are more likely to be resilient to climate change. There is a gender dimension to these proposals, since smaller animals and local breeds are more likely to be perceived by communities as suitable for husbandry by women. We recommend a re-orientation towards an explicit gender equality focus for these projects.

Key words: gender equality, resilience, livestock breeds, sustainability, poverty, pro-poor policy

Introduction

The contribution of livestock projects to resilience to the effects of climate change is a subject of growing interest. Whether such a contribution would have implications for women and gender relations clearly merits study. It is estimated that of the world's 900 million poor livestock keepers, two-thirds are rural women (BRIDGE 2014, 17). Gender equality has been a development priority, alongside poverty alleviation through a focus on rural livelihoods, for development agencies and governments for many years.

Livestock projects are being seen as a key part of development programming around the goal of enhancing resilience to climate change. Development agencies have for many years recognised the importance of livestock systems for rural livelihoods. However, over the last 60 years livestock projects have had a mixed and often disappointing history. Their effects on food supply and security, and on poverty alleviation, have often not been as positive as had been hoped. They have often failed in part because of institutional and administrative shortcomings. Another reason for failure has been when innovations have been unsuitable for the context. In addition, livestock projects have failed to integrate a gender perspective, which has in turn affected their efficiency.

The tendency has been to address gender issues by integrating gender analysis into research, and follow this through in project design which attempts to promote enhanced productivity in livelihoods by focusing on extending, and enhancing, women's role in production. As a result, projects have tended to be informed, rather than led, by an awareness of gender roles and relations in a community and a goal of enhancing the efficiency of household livelihoods systems; opportunities to enhance the status of women, and to create more sustainable projects, are lost. This general approach has long been criticised by advocates for gender equality (Razavi 1997, Warren 2007), who have argued for a shift from a focus on efficiency to an empowerment agenda. We develop this argument in this article, in the specific context of livestock projects.

There is now a trend towards focusing more on gender issues in livestock project design, and gender issues are now stated as being 'mainstreamed' in much livestock research and development (FAO 2005; ILRI 2012; FAO 2013). An emergent USAID doctrine is that 'women must be included [in

livestock-climate change research], gender analyses are required to ensure that design and implementation includes women ... and all activities will report on gender impacts' (Russo 2012, 7).

We suggest in this article that a four-way complementarity between the goals of agricultural development, poverty alleviation, climate resilience, and gender equality, could be achieved in farming systems by promoting the adoption of small animals, which are often traditionally cared for by women. Cattle are expensive animals and their place in poverty alleviation initiatives seems to us to be uncertain; if their husbandry is to be promoted, local breeds should be preferred, rather than imported breeds or crossbreds, which require extra management and husbandry inputs. Critics of current African smallholder resilience strategies argue there has been in the past a 'problematic' emphasis on 'technical and infrastructural adaptive strategies' (Tschakert 2007, 382) to climate change. A focus on promoting currently available local livestock resources avoids this pitfall. As we argue, this also provides a culturally- and locally-appropriate entry point for development work which supports gender equality in farming communities. This would be grounded in an explicit commitment to supporting women and girls to challenge gender inequality through ensuring project activities enable them to gain better access to, and more control over, economic resources, plus other elements designed to challenge gender inequality appropriate to the particular cultural, social and economic context (1).

Special attention will need to be given to pastoralism, which may be the livestock system most often considered as posing challenges to gender equality. A substantial component of the developing world's livestock is kept by pastoralists; these systems are likely to be threatened by climate change, but they are of huge economic significance in many developing countries and may also provide some of the means of adapting to newly arid environments (Krätli *et al.* 2013). Worldwide, 26 per cent of the world's land area is taken up by permanent pasture (de Haan *et al.* 2010, page 37), and there are probably (Rass 2006) 120 million pastoralists and agro-pastoralists worldwide. Particular political, social and environmental challenges exist in patriarchal pastoralist systems in fragile ecosystems. Most are highly patriarchal, with 'gender roles [being] strongly marked, and ... extremely similar across the world' (Blench2001b, 42).

Indicators on the position and condition of women in pastoralist communities consistently highlight the gaps which remain in terms of health, educational attainment, and other development goals, and the links between these gaps, and gender inequality (IFAD 2012). For example, the out-marriage of girls to other villages has implications for the intergenerational transfer of animal husbandry skills and knowledge to girls vis-à-vis boys. However, distance from global debates, tensions and challenges for pastoralists as a marginalised category within states, and the specificity of the gender roles within pastoral communities, create complex challenges for advocates of gender equality. Gender inequality is linked to the disadvantages which arise from the position of pastoralist women in the gender division of labour in animal husbandry and other livelihood activities.

Resilience of livestock systems to climate change: the gender dimension

The relationships between gender roles and relations, and farming systems, began to be studied in the 1970s; the work of Ester Boserup (1970) was particularly influential. Practical studies, initially in crop systems and subsequently in pastoral and mixed farming systems, mainly conducted from the early 1980s, have included work where the roles of women have been specifically evaluated. Enormous diversity in the gender-division of crop production practices has been documented,

including economic transactions between men and women as part of 'internal markets' within the household (Palmer 1991).

Three areas of study in the gender and development literature are, in our view, particularly relevant to understanding the role of livestock development programmes in supporting enhanced resilience, improved livelihoods, and gender equality in pastoralist communities. These are gender roles, gender analysis of livelihoods, and gender-specific effects of climate change.

Gender roles

Context-specific, up-to-date knowledge of gender roles and power relations in daily life is critical to design of livestock-focused development projects. Understanding about the livestock husbandry process by learning it task-by-task has implications for development policies and practices, potentially affecting the ways gender issues are understood and addressed in projects. A livestock system can be compartmentalised spatially and temporally, enabling individual farmers to choose their entry points into a given system. For example, poultry production can involve the rearing of purchased day-old chicks, or the natural or mechanised incubation of eggs; egg production can be by the rearing of home-bred birds, or by the purchase of point-of-lay birds. Such decisions have implications for the project in relation to who it will involve and in what ways, and what the outcomes may be, in terms of poverty alleviation, enhanced resilience, and potential changes to gender relations.

Within the field of livestock systems research, projects and programmes, a roles-based understanding of gender relations has often lingered. This approach poses little direct challenge to entrenched gender-based inequalities. It is somewhat understandable that a roles-based approach to gender analyses appears to have remained attractive, since the care, management and marketing of livestock and their products involve the integration of defined 'productive' and 'reproductive' tasks. These tasks differ considerably in their scheduling, the time they take to perform, and the skills and physical effort required to complete them, but these characteristics do not divide neatly down gendered lines.

Generalisations about men and women's roles in mixed-sex households practising livestock husbandry include the notion that men (typically, older men), are more involved in the political aspects of livestock husbandry, such as the allocation of land, whereas women may be more commonly responsible for tasks which 'reproduce' the income-generating workforce, such as collecting water and fuel for household activities. There are sets of tasks in animal husbandry that can be classified as either reproductive or productive (and hence are seen as either female or male in nature). For example, tasks related to the care of the lactating cow and her calf are distinctively concerned with reproduction, while growing-on the weaned animal to the point of sale may be seen as production.

The producer/reproducer duality is most usefully seen as a spectrum, the contribution of men and women to each set of roles varying between, and within, cultures. In reality, women are both producers and reproducers. For example, milking for sale, which has traditionally been seen as a 'productive' task, is the responsibility of women in many communities (Blench 2001b; Köhler-Rollefson 2012). That roles of women can change over time is being demonstrated; for example, among the Borana (Marie-Luise Hertkorn *et al.* in press).

Gender analysis of livelihoods

Many studies have shown the significance of livestock in the livelihoods of poor women, men, and their dependents in sub-Saharan Africa and south Asia (Kristjanson *et al.* 2010). At household level, women's incomes, and livestock rearing and dairy production in particular, have been shown to reduce female labour and improve family nutrition as a whole (Koopman 1997). A recent development has been the placing of such geographically-limited projects in a global context, and there is now an extensive body of literature on how promoting women's involvement in agriculture will increase global food supply and enhance food security and rural livelihoods (FAO 2011; Wiggins and Keats 2013). Project reports affirm that there have, indeed, been positive benefits to women (Kristjanson *et al.* 2010), but one study found that although technical development in smallholder dairying in Morocco increased milk production, it also imposed additional labour burdens on women (Nassif 2008).

Women farmers are numbered disproportionately among the poorest livestock keepers. They generally have less access to capital, technical innovation and advice, and other inputs, and are excluded from many aspects of decision making in economic activities generally. Key concerns for women in farming (2) are the physical, financial, political and social barriers that prevent them from accessing markets, highlighting the fact that livestock systems do not exist in isolation. Changes in the market and regulatory environment for milk have been very much to the disadvantage of pastoralist women in Nigeria (Blench 2004). Studies like those of Marie-Luise Hertkorn *et al.* (in press), in which pastoralist women were interviewed in detail about their roles and their perceptions of these roles, are potentially of great value in designing sustainable interventions in these systems.

A focus on gender in livelihoods means a focus on the value of women and men, girls and boys, as 'human capital' or 'social capital' in livelihoods, and the importance of investments of different kinds in the social capital relationships and networks present in rural communities. These concerns have implications for gender equality. Traditional owners of livestock often include among the reasons given for keeping animals, payment of school fees, bride-price, and discharge of other social obligations (3). Using livestock as bride-price, or to bring in money to pay for school fees, are ways of building for the future by investing in human capital and/or social capital. Obviously, decisions about spending livestock-generated wealth in different ways are important from a gender perspective. The number of years of primary schooling a girl receives has a strong influence on her age at marriage (USAID 2007, Jensen and Thornton 2003), and therefore the potential of livestock ownership to facilitate girls' education is significant.

Gender-specific effects of climate change

Studies on female-specific roles in mitigation or adaptation of livestock systems are in their infancy (ILRI 2012), but clear gender differences have already been demonstrated in strategies for coping with food shortages attributable to climate change (for example Lambrou and Nelson 2010). Women are fundamental to the resilience of the household. Although they are the key producers of food in rural areas, their knowledge and labour remain unacknowledged in many assessments of food security, and particularly in relation to livestock production and agroforestry (BRIDGE 2014).

Harmful effects of climate change are expected to bear particularly heavily on women in rural areas, though it is acknowledged that they can contribute to both mitigation and adaptation; the specific issue of supplying water to livestock has been signalled (UN WomenWatch 2009). Shortage of space here precludes a thorough discussion, but it seems clear that gender roles and power relations are highly context-specific. Even gender issues in relation to water supply are difficult to generalise. In the Borana system in southern Ethiopia, while men are responsible for watering the main, mobile herd, women collect the water needed by the calves kept at the homestead (Hertkorn *et al.* in

press), and provide water for domestic and caring purposes. Both sexes find their work more challenging when water resources are inadequate, need to be paid for, poorly located, or sporadic in supply, but the impact of each of these factors differs according to gender and other characteristics. Men tend to be assumed to represent the whole family to planners, but involving women in the planning, operation and maintenance of water supply and effluent use or disposal facilities, is clearly necessary.

It is pastoralist societies that are the livestock systems most visibly being affected by climate change. As these societies come under increasing pressure, it is becoming increasingly clear to researchers that they are in fact much more adaptive than previously appreciated – perhaps highlighting the tendency of Western researchers to describe these ‘traditional cultures’ as more monolithic and unchanging than they really are. This perception was, in the past, identified in the gender and development literature as a block to progress on gender equality (Macdonald 1994). An example is that many systems previously thought to be exclusively pastoral also involve crop-raising (Blench 2004). The flexibility in land-use patterns and livelihood strategies shown by such systems may give hope that their apparently gender-regressive, patriarchal structures may indeed be capable of liberalisation.

Further illustrating this adaptability, some traditional livestock keepers have been capitalising on the availability of a diversity of species and breeds, in order to adapt to climate change, disease risks and market requirements. Bekele Megersa *et al.* (2014) observed a shift from cattle to camels, and an appreciation of the relative merits of different cattle breeds among the Borana of southern Ethiopia; Roger Blench (1999) describes how pastoralists of arid and semi-arid Nigeria were adapting their herds to changing ecological conditions by using bulls of specific breeds. In Ethiopia and Kenya, attitudes of farmers towards crossbreeding with exotic breeds differ in ways reflecting the stronger market orientation in Kenya (Zander and Drucker 2008).

Gender analyses of climate change must also consider how gender roles, relations, and concepts of masculinity shape the way in which male farmers experience the results of climate changes. For example, men are widely seen as main or only breadwinners, and often experience considerable pressures due to perceived failure to live up to this norm during times of food insecurity. Rural-to-urban migration plays a key role in household and individual coping strategies, and this is an important factor to consider within the livestock project planning process. The out-migration of men in some local contexts may present new opportunities, as well as commitments, for women in relation to animal husbandry.

Resilience of livestock systems to climate change: the animal dimension

Studies on current and predicted future effects of global climate change on specific livestock systems, and of livestock as a driver and mitigating agent (Gerber *et al.* 2013) of climate change, are abundant. A particular focus has been on resilience and adaptation of the livestock systems of the developed world, to the effects of global climate change.

Experience in the developed world has been that about half of the improvement in animal production thus far has been due to improved husbandry, and about half to selective breeding (FAO 2010). Thus, livestock development programmes have usually adopted a dual approach, management innovations being accompanied by a degree of genetic improvement. Particularly in the case of dairy cattle, high-performing western breeds have been imported and either bred pure or, more usually, admixed into local breeds. The appeal of crossbreeding is that an immediate “genetic lift” is obtained, while to achieve the same result by selective breeding within the local

breed would take many generations. Unfortunately, crossbreeding results in animals which are less adapted to harsh environments.

High, and increasing, proportions of local breeds are currently endangered to some extent, and international support has been obtained for FAO's Global Plan of Action for conservation (FAO 2007). The world's livestock systems are based on a few domesticated mammalian and bird species; about 38 in total. These are differentiated into breeds, of which a small number have been greatly favoured by farmers, and are today truly global, for example Holstein-Friesian and Jersey cattle. Use of high-input, high-output breeds developed in the western world, and their crossbreds, continues to be advocated but much expert opinion now considers these practices should end, 'unless there is clear evidence for the benefit of using an exotic breed' (FAO 2010, 51) (4).

In a recent FAO study Irene Hoffmann (2013) responds to the challenge of climate change, by focusing on local adaptation of breeds, which is a multifaceted characteristic, encompassing anatomical, physiological and behavioural adaptations. There are many descriptive studies, formal and informal, of the performance of locally-adapted breeds in their traditional livestock systems. In many livestock programmes in the tropics, local sheep and goat breeds, with their lower dependence on inputs, have been found preferable (Kosgey *et al.* 2006). An influential study (Ayalew *et al.* 2003) on dairy goats in highland Ethiopia, found household welfare to be improved by better management of local goats, and adoption of crossbreds was unnecessary. There is a good case to be made for crossbreeding if dairy cattle are to be promoted (Roschinsky *et al.* 2014), but, as we discuss below, such activities are not appropriate for interventions aimed at gender equity and poverty alleviation.

Designing gender-transformative livestock projects

Bearing in mind all the complexities outlined thus far, what might a gender-transformative livestock project look like? Projects on livestock have generally aimed to alleviate the constraints that are known or believed to prevail in the system by providing livestock keepers with at least one of the following (Ashley *et al.* 1999): better disease control, new production resources, higher productivity, improved storage and processing, access to markets, information on production and marketing techniques.

As discussed above, most agricultural livestock projects have been based on gender-neutral approaches which leave existing gender inequalities untouched, and may in fact harm gender relations and disempower women further; or approaches which analyse gender roles and power relations sufficiently to gain an understanding of work and intra-household and community relations, enabling women or men to be targeted to meet a specific need. Political and social resistance, as well as the wider context of changing environmental challenges, means that gender-transformative livestock policies could be ambitious, but have the potential for significant impact. There is some evidence that animal production projects can improve human nutrition, possibly because they have included either an education component or supported women in their gendered roles (Leroy and Frongillo 2007).

First, we think that it is important to maintain a focus on power and ownership in the process of creating gender-transformative livestock policies. Numerous studies have shown that in the introduction of new crop varieties and technologies, technical innovations are usually taken over by men (for example Doss and Morris 2000). This may be due to strong associations between women and 'traditional' (rather than innovative or technologically progressive) farming practices within the rural development sector. We also suggest that greater consideration be made of the role of girls in

animal husbandry, as they often play key roles in food production and shoulder heavy work burdens (BRIDGE 2014); this would also be an interesting aspect of research into gender-transformative livestock programmes.

In general, systems involving large-bodied, relatively expensive animals like cattle may be unsuitable for projects where poverty alleviation is a priority. Projects focusing on cattle have been challenged (in the specific context of heifer-in-trust projects) as the intrinsic risks of keeping these expensive animals may be difficult to cover (Sumberg and Lankoande 2014). Livestock systems which depend on increased inputs may actually harm women in terms of workload and control over assets, since their perspectives on innovations are not sought and they may not benefit fully from projects, while their labour and support may be assumed. The fact that cattle – and in particular exotic and imported breeds – are much more likely to be assets controlled by men also means projects focusing on them are less likely to enhance women's status in marriage, households and communities than projects focusing on other classes of livestock.

Women are more likely to farm locally-adapted breeds, and small animals (sheep, goats or poultry) rather than cattle (Kohler-Rollefson 2012). Complex and context-specific power relations in local communities place limitations on which species of livestock it is permissible for women and girls to keep. In patrilineal inheritance systems, also, the present reality is that women have fewer rights to, access to, and control over land, and local breeds are less demanding of high-grade forage. Heavy workloads mean that women have limited time to attend to livestock, and local breeds are relatively easy to manage and have fewer disease problems. Extension services and credit are less accessible to women, and these breeds require less of these inputs. Local breeds can yield materials for niche and speciality products, which can provide women with opportunities for income generation.

The changing preferences of traditional livestock keepers, highlighted earlier, offers a potential way in to gender-transformative programming. The association of female farmers with local cattle is clear in Kenya, where exotic cattle were owned by 63 per cent of male-headed households and by 49 per cent of female-headed households. In Rwanda, the corresponding proportions were 45 per cent and 32 per cent (Kristjanson *et al.* 2010).

Sheep, goats, pigs and poultry (5) are more appropriate for the kinds of projects we envisage (Valdivia 2001; Halimani *et al.* 2013; Madzimore *et al.* 2013). If marketing chains can be established other species such as rabbits and guinea pigs have been found suitable. Signalling that such diversification is likely to be acceptable and sustainable is the observation by Roger Blench (2004) of these activities in communities that are not the subject of development interventions. The participation of women in the selection of animals and breeds is paramount to the success of any such initiatives vis-a-vis poverty and sustainable livelihoods goals. In the context of climate change, women should also be involved in disaster risk management elements of livestock project planning, from which they have historically been excluded.

A major advantage of sheep and goats is that they can survive and thrive on crop residues. They can also support artisanal activities such as leather- and fibre-based handicrafts. The potential for livestock to provide additional income for women is especially relevant, because, generally speaking, male farmers are more likely to also gain non-agricultural income, for example from casual and wage labour (Koopman 1997). Traditionally women's supplementary earning activities are closely linked to the food sector (and therefore are vulnerable to food insecurity), and are ultimately influenced by a 'male economy' (*ibid*). Gendered access to and control over cash is likewise an important consideration in project design, which has been explored in other sectors, for example in the context of microfinance and innovative banking systems (FAO 2005). Projects could also consider the

promotion of donkey breeding; this versatile species has been widely regarded as of low status (Blench *et al.* 2014) but is acknowledged as making “a great contribution ... to the daily life of rural people, especially women” (Swai and Bwanga 2008, 11).

Consideration should be given to locating the animals close to the household. Although, for sheep and goats, flock productivity is higher under shepherding or free-range systems, the labour requirement is high (Mahanjana and Cronje 2000). When animals are kept in household-based (stall-fed) systems, which use cut-and-carry forage, performance and survival are poorer. However, the breeding season can be controlled, which is not possible in free-range systems, and survival will be favoured if young are born and females lactate at benign times of year. A key part of projects would be training and advising women in basic animal husbandry, while adopting a focus which recognises their existing considerable skills and knowledge. The focus could be on increasing survival of young animals (6). Locating the animals close to the household obviously has an additional very important advantage in terms of women’s time-use spent in caring for animals, and addresses any issues of security involved in travelling distances away from home.

Such programmes would have collateral benefits. National livestock and animal health departments would be able to identify animals of probable genetic merit, for institutional breeding programmes. Herds and flocks, under close daily scrutiny and with a reporting mechanism, could act as sentinels, detecting climate change-related changes in disease prevalence. They could also be entry points for other initiatives, such as biogas generators and indeed for conservation of floral and faunal biodiversity.

Projects aimed at benefiting women should be aware that many technical or infrastructural innovations carry risk. The first is of increasing women’s workloads past a point which women themselves see as sustainable or acceptable. Monitoring and evaluation would need to ensure that women were able to report on this issue and evaluate the extent to which the goals they desire are being met on acceptable terms. This is related to the risk that the benefits of projects risk being pre-empted by men. Projects that persist in directing resources towards the household head, denying men and women separate enterprises where appropriate, risk limiting women’s access to assets. Collective family ownership of livestock can hide inequalities within the household. Projects with empowerment objectives will recognise that introduction of assets such as livestock can increase incidences of intra-household competition and gender-based discord, and, even, violence. It is also recognised that the establishment of formal environmental management programmes can reinforce existing power structures and create new interest groups as a result of newly available resources (Hoben 2003). A sound assessment of local context is important, so that concepts of ‘ownership’ of assets, including livestock, within farming households are understood.

Gender-transformative livestock projects will have to be supported by animal health services and husbandry advice, presented accessibly and in a gender-sensitive manner. The community animal health worker (CAHW) model may be applicable. CAHW systems have been operating, mostly but not always funded by NGOs, in many countries since the 1980s (for example OXFAM GB 2007). Men are in a very substantial majority in these schemes, though there are some innovations aimed at gender equity (for example Brigitte Bagnol (2012) reports the training of women as poultry vaccinators in southern Africa). Training has emphasised disease control; this is the aspect of husbandry animal keepers are most willing to pay for, and CAHWs derive their income from selling the vaccines and drugs they administer. Many diseases are in cash terms not worth treating, though having a depressing effect on performance. Whether CAHWs could be trained and incentivised to provide husbandry advice and support may be problematic; clearly, pathways for dissemination of husbandry advice would vary between and within countries. Husbandry advice must be realistic and

take full account of local knowledge and elements of ethnoveterinary medicine, following the principle of capitalising on 'the capabilities and strength of the poor' (Heffernan 2004, 238).

Conclusions

Livestock projects with a pro-poor focus have aimed to improve livelihoods and food security. Noting that climate change is likely to bear more heavily on women, we have conceptualised livestock projects whose explicit aim is the advancement of gender equity coupled with resilience to climate change. We noted the considerable potential of initiatives to reduce mortality rates of young livestock. Local livestock breeds should be favoured in development projects because of their relatively low requirements for maintenance and growth which not only adapt them to the adverse conditions that exist, especially for female farmers, today, but also pre-adapt them to the challenges that climate change will impose. The emphasis on traditional, local breeds betokens an appreciation of the value of local resources. We have concentrated on rural livelihoods because these have been the focus of concern over direct effects of climate change. Our model is also applicable to urban and peri-urban livestock keeping.

With gender equality as the priority, project design would be pervaded by awareness of the specific challenges women face, leading to genuine gender mainstreaming. We argue that this prioritisation also confers resilience to climate change. This approach to development projects would elevate the treatment of gender issues from the periphery to the centre of project design.

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Endnotes

- (1) While we focus here on gender and resilience in livestock projects, the issues we raise here have relevance to rural livelihoods in the developing world in general. Our study is foreshadowed by that of Catherine Hill (2005), who presents a checklist and advice on livestock project design in relation to gender and HIV/AIDS. However, climate change and the choice of livestock breeds are not treated in that work.
- (2) In developing countries women make up a high proportion of the agricultural labour force (20% in Latin America, 40% in sub-Saharan Africa) and perhaps two-thirds (about 400 million) of low-income livestock keepers (FAO 2011).
- (3) For example, in northeast Zimbabwe in 1997, 'the approximate equation [was] that two or three cattle will pay for secondary education for one child, i.e. corresponding to education to O level standard', while the then-current bride price was 4-12 heifers (Hall and Blench 1998, 8; also see Otte and Chilonda 2002).

- (4) Unplanned crossbreeding is a serious threat to the conservation and sustainable development of local, adapted livestock breeds (FAO, 2007). The disadvantage is that genes for local adaptation cease to be expressed predictably and the result in a few generations can be a population with a high proportion of poorly adapted, modestly performing animals. If there is veterinary care and improved management, these genes for local adaptation will have lost their immediate relevance but this cannot be considered a sustainable, or 'climate-change-proof' outcome.
- (5) In some countries, backyard poultry production has been officially discouraged because of disease concerns (Otte et al.2006). This is unfortunate because field study has shown poultry are particularly important in female-headed households (for example in Ethiopia: Aklilu *et al.* 2007). At the same time, local poultry meat production industries are under pressure from imports. The policy environment for projects based on poultry may therefore be difficult. Regarding pigs, whose diet is effectively similar to those of people, a reliable, cheap local feed source is particularly important.
- (6) Mortality rates of young animals in traditional systems in sub-Saharan Africa, for example, are very high; 22 per cent for cattle, 27-28 per cent for young sheep and goats (Otte and Chilonda 2002, 52-56).

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