TRENDS IN THIRD-WORLD AGRICULTURE WITH RELEVANCE TO TRACTION ANIMALS

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Introduction

At the 1996 World Food Summit in Rome, 186 countries adopted a 'Plan of Action' which committed them to reducing the number of chronically undernourished people in the world by half by the year 2015. This would be achieved by assuring supplies of 'sufficient, nutritionally adequate and safe food'. Food security is defined as having access at all times to enough food for an active, healthy life. The basic causes of food insecurity are insufficient national food availability, and insufficient access to food by households and individuals. How these factors interact is shown in Figure 1, reproduced from Smith *et al*. (2000).

Food security is more than just food production or the achievement of subsistence. It cannot be considered in isolation from other social issues. For example, in many societies especially in Africa, women do much of the farm work and they apparently have greater influence over household decisions there, than they do in societies where they are only responsible for purely domestic matters. The conclusion, enunciated by Ester Boserup (Eriksen, 1995) is that the political position of women in agricultural societies is usually weakened when new technology is introduced as this technology tends to be controlled by men.

Issues of social equity are intimately bound up with decisions relating to development. An innovation may benefit one sector of society and penalise others. In this paper I try to consider how the activities of TAWS and other organisations interested in traction animals can be placed within the frameworks of food security and social equity.

Food Security: The Global View

Nutrition security is obtained when food security leads to an active, healthy life. Care (all the positive inputs given to an individual, of whatever age, by the household and the community) and health are the determinants of this process. Smith *et al*. (2000) consider that there are three indicators which make it possible to determine where insecurity exists, and what are its causes. These are:

1. Daily dietary energy balance per head. This is a measure of national food availability, from all sources including food aid. The dietary energy requirement (calculated from demographic data with allowances for physical activity) of the population is subtracted from the country's total dietary energy supply. There is a dietary energy surplus if the supply is greater than the requirement, and a deficit if the supply is smaller than the requirement;
2. Absolute poverty rate, namely the proportion of the population whose income is less than one US$ per day;
3. Child malnutrition, which is taken as a measure of nutrition security because it is determined by care and health as well as by food security. It is the proportion of children less than 5 years old who are underweight.

Countries can be classified as high or low poverty, and as being in dietary energy surplus, or deficit (see Table 1, from Smith *et al*., 2000).

Table 1: Classification of highly food-insecure countries. The percentages of children that are malnourished are given in brackets.

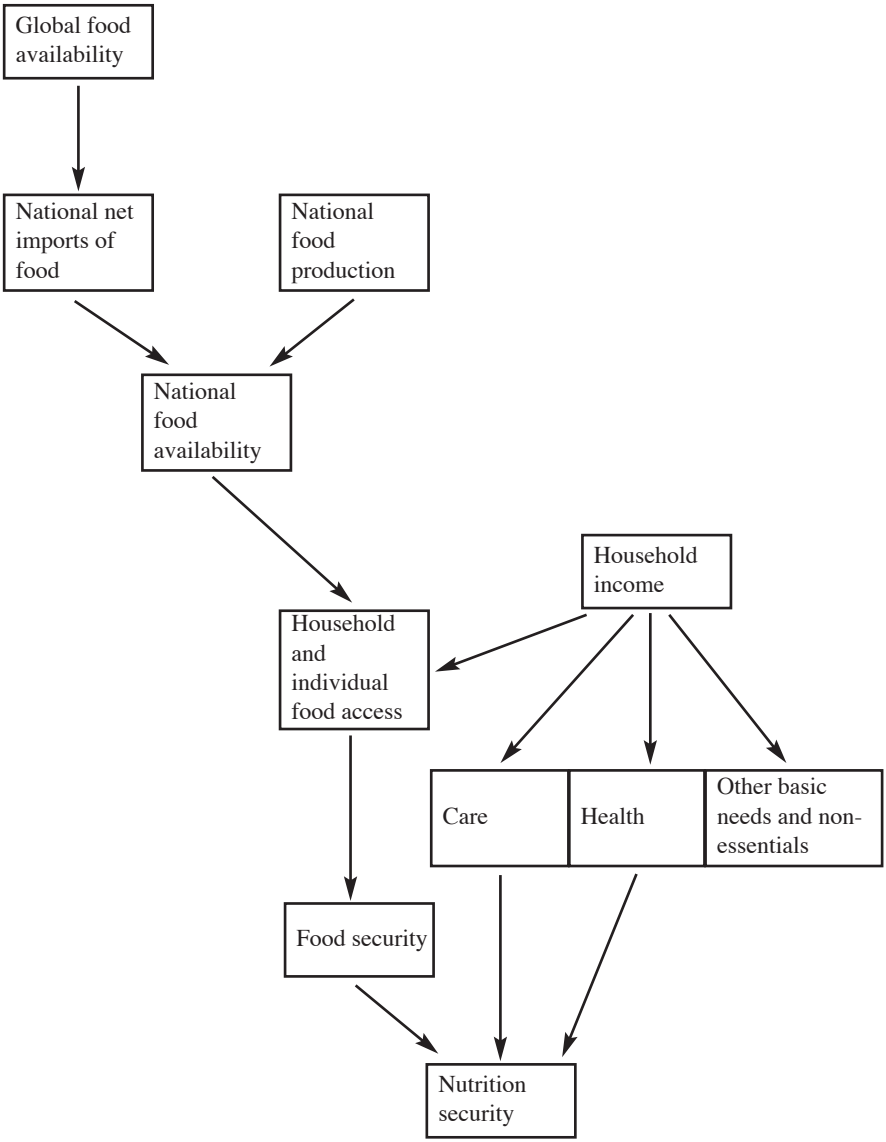
	National food availability			
	Dietary energy deficit		Dietary energy surplus	
High poverty	Bangladesh (56) Ethiopia (48) Afghanistan (40) Laos (40) Madagascar (40) Somalia (39) Chad (39) Cambodia (38) Congo, D.R. (34) Mali (34)	Malawi (30) Burundi (29) Sierra Leone (29) Haiti (28) Guatemala (27) Mozambique (26) Zambia (24) Kenya (23) Zimbabwe (13) Mongolia (12) (25 million children)	India (53) Vietnam (45) Myanmar (43) Niger (43) Sudan (34) Burkina Faso (33) Rwanda (29) Uganda (26)	Gambia (26) Senegal (22) Liberia (20) Honduras (18) Lesotho (16) Cameroon (15) (75 millionchildren)
Low poverty	Angola (35) Tanzania (31) Yemen (29)	Guinea (24) Central African R. (23) Bolivia (8) (4 million children)	Nigeria (39) Pakistan (38) Sri Lanka (38) Indonesia (34) Philippines (30) Congo (28) Botswana (27) Namibia (26)	Benin (25) Mauritania (23) Ghana (23) Malaysia (20) Togo (19) Guyana (18) China (17) Gabon (15) (46 million children)

These comparisons support the view that poverty is the most widespread cause of food insecurity. Development programmes need to address both food availability and poverty reduction, and the balance between these two objectives depends on the particular country.

Efficiency of the linkages

The efficiency of the links in the framework in Figure 1 must be maximised if food security is to be achieved. Draught animal power has a part to play in most of the links and to the factors determining nutrition security. I will concentrate on the links between national food production and national food availability, and between household income and household and individual food access.

Figure 1: Factors determining food and nutrition security.
Reproduced from Smith *et al*. (2000)



National food production – national food availability

Constraints on the effectiveness of this link arise from difficulties of food distribution and of paying for inputs, mainly fuel and fertiliser. Economies of scale at farm level may be disadvantageous for some rural people.

❏ The overall picture

Typically, in developing countries about 75 percent of the population is employed in agricultural before the drive towards urbanisation and development gathers speed. Urbanisation effectively stabilises at a point when each remaining farm family has to feed not 1.3 families as in the pre-urbanisation phase, but 2.5 to 4 families. This can only be done by agricultural modernisation.

In much of the developing world, increase in food production has not greatly increased national food supply; still less has it contributed to improved food security. For example in West Africa (Wiggins, 1999) during the period 1961 to 1991 increased agricultural production matched national population growth in only 4 out of 14 countries. However, it matched rural population growth in 9 out of 14. This indicates a failure to supply the cities. The result has been that the increased population has been supplied by food imports.

Fuel and motor vehicles have to be bought at world prices. As urbanisation proceeds, energy use increases (Jones, 1991) and the transport sector uses a higher proportion of the nation's energy consumption, much of this for personal transport. Fuel is easily taxed and prices will be expected to rise. The agricultural sector may find it hard to compete for the purchase of fuel. Thus, the contribution of draught animal power may be as much the protecting of agriculture against difficulties in producing food due to lack of fuel, as the direct provision of transport of food to market.

Fertiliser requirements rise too. In West Africa, reduced fallowing periods are leading to decline in soil fertility and artificial fertiliser will become more important. At present, the average annual application of artificial fertiliser to the 55 million hectares of arable land in West Africa is 9.6 kg/ha. Obviously the desirable amount of fertiliser depends on the crop and the location but about 55 kg per hectare would make a valuable difference to maize, to take one example. For continuous cultivation to be maintained in the humid tropics, one tonne of lime and 500 kg of artificial fertilisers are needed annually (Carr, 1989).

Moving manure to fields is labour-intensive and farmers have different strategies for manuring their land. Keeping draught animals has obvious benefits. However, reliance only on animal manure is not a viable technology for field-scale crop production using only hand power in the humid tropics (Carr, 1989).

❏ Utilisation of crop residues

For every kg of grain produced, at least one kg of straw is produced as well. Smil (1999) calculated that worldwide the annual harvest of crops is 2750 million tons dry matter, and of crop residues 3750 million tons. These figures are replicated in the kinds of farming systems in the developing world with which we are concerned today. In principle much of

this could be fed to ruminants or equids which could then be used to till the land and cart the crops. We should not forget that crop residues have many uses apart from feeding to animals. Farmers are interested in the feeding value of crop residues (Schiere *et al*., 2000) suggesting this may influence their choice of which variety to sow . For example, millet stover (crop residues) can be mulched, burned, or fed to animals and Lamers and Bruentrup (1996) found the advantages of each course depended on the amount of land and labour available and the number of livestock.

❑ Farm sizes and yields and consequences for the rural poor

Even though draught animal power has been enthusiastically advocated in the course of many projects, its adoption has in some areas been slower than anticipated (Jolly and Gadbois, 1996) and this advises further consideration of how its appropriateness can be ensured. It is more likely to be adopted where there is a tradition of cattle keeping and a lack of tsetse flies. Carr (1989) describes how in such an area in Uganda the number of ox ploughs increased from 282 in 1923 to 16,000 in 1938 and 70,000 in 1969. For the first 20 years there was no government intervention, it was just the farmers responding to a technology which allowed them to add cotton to the food crops they could grow. Farmers differ in the commitment they make to the technology. For example, in north-east Zimbabwe the incidences of use of draught animal power were as given in Table 2 (Hall and Blench, 1998).

Table 2: Use of different tillage and draught animal options in Rwenya, Zimbabwe (survey of 610 households in 1997)

	No. of farmers	%
Hire tractor	19	3.1
Hire oxen and plough	199	32.6
Use own oxen and plough	45	7.4
Have own scotch cart	62	10.2
Have own donkey cart	4	0.7
Manual labour only	281	46
Total	610	100

Whether draught animal power increases labour productivity depends on various factors, but an increase in farm size may be practicable (Pearson, 1998). Yields per hectare may remain unchanged (Pearson *et al*., 1999) or may change in ways that may or may not be advantageous. In Mali, yields/ha of food crops decreased but yields of cash crops increased (Jolly and Gadbois, 1996). Increase in farm size and an increase in profitability of cash cropping are both developments that could improve the overall economic performance of agriculture. They might not automatically lead to alleviation of rural poverty as they both imply a shift of the poorer people from smallholding to paid employment, or to unemployment and destitution. All these observations raise the question of what effect development of draught animal power will have on the rural poor who do not possess such assets. There are environmental aspects too. For cultivation with draught animals to be effective, trees need to be cleared and this can degrade the environment and deprive the community of tree products.

It is clear that at the practical level a strong scientific and technical understanding of draught animal power is very important. But this is not enough to ensure the success of a project. At the policy and planning levels there will be social, environmental and other issues that need to be considered before draught animal power is promoted in development projects.

Household income – household and individual food access

Households have survival strategies which involve balancing expenditure on food, care, health and other basic needs and non-essentials (Figure 1). When food aid becomes part of the survival strategy, food security is not sustainable. An attractive scenario is of the rural poor being given access to a range of money-earning opportunities, or for small farmers being able to add value to their crops. Can draught animal power be expected to provide such opportunities?

❏ The overall picture

Food access is only possible if households have a cash income. Self-sufficiency, by which is meant a cashless economy, is probably only a practicable strategy for a small minority of households, if any at all. Off-farm employment is a key element for very many, probably most, rural households in the developing world. The option exists for them to migrate to towns to work and to remit funds to support the household, or at the least to avoid being a burden during periods of food shortage. In some areas, such as north-east Ghana, the result is a lack of farm labour at critical times of the year. In the longer term, remittances can become so much a part of household survival strategies that long-term investment in the landholding is discouraged (Blench, 1999). Draught animal power could be very helpful here in reducing labour commitments provided it is affordable. Systems based on hiring out or contracting, rather than on personal ownership, could be appropriate.

❏ Integration of producers and markets

Farmers depend for their income on the marketing of their produce. Crops reach their markets through the activities of market traders. They do not always have a good public image and are often described as 'exploitative, profiteering and cheating' (Lyon, 1999). The institutions of which they are part are highly structured and the prospects of a farmer being able to short-circuit them, except in very local markets, are not good. Consequently, one possible advantage of draught animal power, in enabling farmers to take their produce to market and cutting out the traders, is probably illusory.

❏ Trades linked with draught animal power

Part of the appeal of draught animal power is that it requires supporting specialists, people to make and repair harnesses, panniers, vehicles and implements, and veterinary and other experts. It would be useful to know if it is particularly effective at creating new jobs.

Maintaining the linkages

I would like to consider two contributions that TAWS can make to maintaining and improving the linkages in the food security chain.

The first contributes to strengthening the links between national food production and national food availability, and takes a long-term view. It relates to the characterisation and conservation of local breeds of work animals, especially the equids.

The second contributes to understanding of the link between household income and household and individual food access, and relates to informed discussion of the development interventions that are appropriate.

❑ Genetic resources

If the linkages within the food-security system are to be maintained, the genetic resources enabling them to respond to new conditions must also be protected. Most notable examples of this are the different crop varieties that are available. However there are also genetic resources of draught animals. What is known of these?

The global database on animal genetic resources is the Domesticated Animal Diversity Information System (www.fao.org/dad-is) in which census, production, performance and other data are stored, with assessments of the numerical status of each breed. Data are entered for each member country by a government-appointed National Coordinator. Coverage is not even and some of the data are clearly erroneous. For this purpose, FAO defines a breed as 'a population of domestic farm animals which a country claims to be unique' (Scherf, 1995). The data on horse and donkey breeds of Africa and Central and South America and the Caribbean are summarised in Table 3.

Table 3: Breeds of equids in Africa, and in Central and South America and the Caribbean

	Africa horses	Africa asses	C/S America horses	C/S America asses
Number of countries claiming distinct breeds	20	15	11	1
Total number of breeds	74	24	31	5
Status				
Extinct	4			
Critical	0			
Endangered	6		3	
Decreasing	1			
Not at risk	13	4	16	1
Range of total (census) population sizes	500 to 65,000	158,000 to 250,000	100 to 1,000,000	1,250,000
Breeds with no numerical data	50	20	12	4

Note: 21 of the African horse breeds are South African breeds of distinct European or North American origin. No population data are available for these breeds which are in any case probably irrelevant to agricultural development.

The countries featuring in this table are: Algeria, Benin, Botswana, Burkina Faso, Central African Republic, Chad, Egypt, Eritrea, Ethiopia, Kenya, Lesotho, Libya, Mali, Mauritania, Morocco, Niger, Nigeria, Senegal, Somalia, South Africa, Sudan, Tanzania, Togo, Tunisia, Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Mexico, Peru, Uruguay, Venezuela.

Countries of particular interest to TAWS members which do not claim any distinctive horse or donkey breeds, include much of sub-equatorial Africa and all Latin American countries apart from Cuba, Mexico and Paraguay.

However, there is often much knowledge available within the countries about local breeds and National Coordinators should be encouraged to add these data to the databank. In the absence of accessible data, it is understandable that policy makers and development agencies would often regard most horses and donkeys in the developing world as nondescript, their genetic identity not needing special recognition or protection.

Local breeds should, on the contrary, be regarded as an asset because of the local adaptation they may exhibit, such as disease resistance and ability to cope with nutritional stressors. To use local breeds in a development programme is to convey the message that local resources are of value. A development programme that is using imported breeds could be giving the impression that local resources count for little, and that all good things come from abroad. Although there can be instances when a fresh start is required (for example where it is desired to benefit a disadvantaged group in society), dependence of this kind is not generally a model for sustainable development.

Bringing in new breeding stock to 'restore vigour' can engender heterosis (hybrid vigour, the performance of the offspring being greater than the mean of the parental values) in the crossbred progeny. Inputs will be greater. An improvement in genetically determined aspects of performance and viability without large increases in input, can also be expected by crossbreeding with any distinct breed, such as another local breed from the same country.

Under the Convention on Biodiversity, countries commit themselves to protect their natural and agricultural genetic resources. I think we can expect to see the day when, in addition to an environmental impact statement, proposals for development projects are expected to include a 'genetic impact statement'. Projects should only be approved if they make provision for the genetic conservation of local breeds.

Appropriate development initiatives

Thanks to excellent scientific work involving inputs from animal scientists, nutritionists, veterinarians, engineers and many others, the biology of the draught animal and the constraints on its operation are becoming well understood. With input from people from other disciplines, including social scientists and policy and administration experts, the effectiveness of development projects involving these animals will be enhanced. However, it might now be time for reflection on how appropriateness of specific projects can be assessed. Perhaps some projects, which might favour economic interests of particular sectors of society, are best supported on the basis of an investment yielding a return to the investor. Perhaps draught animal projects which will improve food availability but will not have the same effect on food access are in this category.

These thoughts are stimulated by the following observations. Production per hectare is not automatically increased by the use of draught animals, and only a few developing-world farmers are rich enough to own them. Technological innovation can disfavour women, and it might be claimed that if draught animal power were so advantageous, more farmers would be using it. However there are counter arguments; labour shortage can be a problem in many areas so improved labour productivity per hectare can be an advantage, while many farmers who cannot afford to keep it can hire draught animal power when they need it. The benefit of draught animal power for cultivation is not confined to its owners; it can be disseminated to those who hire or borrow it.

I wonder whether there is a difference in basic nature between the economic and social benefits of developments in animal cultivation, and those of developments in animal haulage. Even though the same animals are often used for both purposes I think it is informative to consider the two separately.

Regarding development of draught animals for haulage, growth of demand for transport means there is no doubt of its need. It represents development of new service trades. Social groups which may be unable to participate in the benefits of agricultural innovation may not be disqualified from such new opportunities.

I think there is a strong case for more work on the haulage technologies, which might also imply more work being done on the equids. In many countries donkeys have a very different position in the public mind from that of cattle, buffaloes and horses, and they are probably well suited to projects involving the provision of credit to would-be donkey owners.

However, I am glad to say there is one development intervention which does not need to be the subject of soul-searching about its appropriateness, and this relates to animal welfare. In fact, just as food security and social equity can be seen as states that are good in absolute terms, at least in the context of the western neo-liberal tradition by which the richest countries in the world operate, so too is animal welfare. Development interventions are driven by 'provider push' as well as by 'customer pull' and people want to help. This is why TAWS exists. Projects that aim to improve the welfare of work animals are justified, but in my view they must be designed sensitively. For example, local sensibilities may be offended if therapeutic or nutritional treatments are available for draught animals which are not as freely available for sick or malnourished children. Accordingly, it may be best to concentrate on veterinary problems which do not have an obvious human analogue, such as farriery and the correction of defective harnessing.

These final considerations add some force to the plea for local breeds to be properly valued and used. They will tend to be adapted to local diseases and parasites and will also be of appropriate body size and conformation.

Summary

The problems of achieving world food security are reviewed. The roles of draught animals in assuring national food availability and household access to food are considered. Genetic resources of equids in Africa and Central and South America are found to be inadequately documented, and development projects should seek to use local breeds for reasons of local

adaptation, and because they provide an appropriate model for sustainable local development. If aid is to be oriented towards alleviating poverty, the appropriateness of fostering development of draught animal power for tillage requires further consideration, mainly for reasons of social equity, while the value of its development for haulage might be seen as being less equivocal. Promoting the welfare of working animals is thoroughly worthwhile but projects must be designed sensitively.

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