

CHANGES IN LIVESTOCK EMPHASIS TO HELP FARMERS ADAPT TO CLIMATE CHANGE

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ABSTRACT

INTRODUCTION:

Climate change will require various sorts of adaptability from farmers for them to achieve sustainable production. Africa's long past of climate variability has already taught its farmers that mixed farming, including mixed cropping combined with animal production, is the sustainable approach. New emphasis on organic techniques and the reduction of expensive inputs from multinationals only reinforces similar lessons for the future.

REASONING FROM LITERATURE:

- To much of Africa, cattle came relatively recently, and are already being identified as a threat to environments vulnerable to climate change. A return to small meat animals is argued, and also a move from factory farming.
- In addition, reliance on fossil fuels has become unsustainable. Transport and cultivation alternatives already in use have become newly important and can be more actively developed. In particular, one species of working animal – the donkey – is already environmentally adapted, being African in origin, with proven low impact on marginal environments.

CONCLUSIONS AND EXTENSION IMPLICATIONS:

- South African farmers are well positioned to make the necessary adaptations.
- The disadvantages and lack of future for cattle keeping need to be emphasized.
- Promotion of small livestock should be an essential strategy for farmers in all, but especially the marginal, areas of South Africa.
- Extension of knowledge concerning donkey use and management will help farmers not only in conservation agriculture, but in marketing of products and income generation through transport.

1. INTRODUCTION

1.1 Past Patterns

Climate change is nothing new for Africa. Since the extra-warm period known as the 'Holocene' which followed the Ice Ages – during all of which humans existed in Africa if few places else – there have still been fairly dramatic changes from time to time, for which there are both archaeological and historical records. The sequence of the Plagues of Egypt as recorded in the Old Testament (Exodus 7-11) is a classical description of the effects of a suddenly changing climate, and we know that, at about the same time (around 2000 BC) the Sahara was becoming the desert that it is today. By that time, in most of Africa, some kind of farming was already practised, although the records often make it difficult to separate climate change from environmental changes brought about by human activity (Whyte 1963). Some of the relevant evidence is described in Jones (1984b), which gives a summary of evidence available 25 years ago; more has accumulated since.

At the end of the first millennium after Jesus, there seems to have been another fairly dramatic change. Pastoralism – shorthand for 'mobile and extensive livestock-keeping' – was already

practised in marginal areas, and mixed farming of various sorts was the African norm, but suddenly there seems to have been a dramatic increase particularly in cattle-keeping, especially south of the equator. As none of the indigenous cattle breeds of eastern and southern Africa today – unlike some in West Africa – seem to be trypano tolerant, the cause of this increase gives rise to speculation. Perhaps it was due to the retreat of the tsetse fly from previously endemic areas, perhaps itself due to an increase in cultivation which thinned out the bush, but it seems fairly certain that some change in climate was behind it, possibly another drying one. The result was certainly a lasting change in African social systems, with ‘cattle-keeping’ becoming a defining feature for many of them (Herskovits 1926). Recent times have seen the import of exotic breeds, very far from trypano tolerant.

All this was apparently the result of major climate changes, although there is little agreement as to what caused them. At any rate, the effects on the environment and societies have been long-lasting, which suggests the major nature of the changes.

Lesser changes in climate, but still profound ones, are also a feature of African environments, and there seems to be a rhythm to them – although here again no convincing cause has yet been proposed. Written and geological records of the flooding of the Nile going back to Holocene times (Nicholson 1976) suggest a periodicity of about 100-300 years of alternating wet and dry periods. Historical records from southern Africa echo this: after an apparently cold and dry period stimulating population movement around 1700 AD (Bonner 2003:15), David Livingstone, travelling through Botswana in the 1850s (Livingstone 1857), saw more water in rivers and pans than was seen again until the 1970s – and not seen since. It has been argued (Whyte 1963) that variations on this timescale would have had most effect in marginal environments, which describes much of the area where South African farming is practised. This wet/dry cycle seems to be overlain by a shorter one of about 20-30 years. Every African of sufficient years remembers very well the years of drought and the years of flood that come and go. These, however, are not only shorter-lived than other changes, but seem to be much more local in their extent. This seems to be in the nature of Africa, which is a unique continent spanning both tropics as well as the Equator, but global is not ruled out.

1.2 Responses

Not only did farming adapt, but the very character of African farming seems to have been formed by these patterns (Jones 1984a & b). Wherever it starts in the world, farming seems initially to be mobile. In Africa, it stayed that way. We can assume a mixture of crops and livestock, and in the marginal areas where cultivation was not possible, nomadic pastoralism and seasonal transhumance reaching out from cultivated areas. But the climate variability pushed cultivation, too, and it was seldom that more than one generation of people could continuously work the same land. Almost every African society has some legend of ‘migration’, in reality reflecting not one large migration but many small ones (Jones 1984a). Techniques of conservation and intensification such as mixed cropping, the ‘chitemene’ (as known from Zambia) use of ash, stock enclosures rotating with gardens – all these were utilized, but they were also easy to move to a new place when change of climate dictated. This was visible in Botswana in the mid-1970s, a very wet period when suddenly cattle-posts in the Kalahari were being vigorously cultivated, leaving Okavango riverside villages deserted and their fields in fallow (Jones 1984b). The character of traditional African farming is clearly mobile and opportunistic and, for its people, productive.

It goes without saying that the system ruled out any fixed land tenure.

There are, however, three other interesting aspects to this adaptive approach to farming in Africa:

1. The only tillage tool was the hand hoe; ploughs were not used except in the north-east.
2. Cattle seem to have arrived on the scene relatively late. Before the marked increase in cattle-keeping at the end of the first millennium AD, cattle were present, but seemingly not in great numbers. The earliest pastoralists in southern Africa may not have had them at all; sheep seem to have been more important (Walker 1983; Webley 1995).

3. Donkeys don't seem to have been known south of the Equator until Portuguese and other colonists brought them (Joubert 1995). Primarily they are a transport animal, which suggests that, until recent times, no long distance transport of bulk goods was necessary, and also that consumption was close to production, i.e. homes close to fields.

The late arrival of cattle, such an important meat source today, and the absence of donkeys are both also suggestive of a very early start to African farming and its spread to the south, much earlier than supposed until now. It may have taken place before cattle and donkeys were domesticated, even though both were probably domesticated in Africa. Donkeys, certainly, were carrying backloads in Egypt 6000 years ago (Rossel *et al.* 2008), so that farming may have spread to southern Africa a millennium or two before that.

1.3 Aiming for Sustainability

There may be disagreements about the present changes which seem to be affecting climate, but the United Nations (UN 2008) has at least been taking them seriously. So what is different now? Three things:

1. Although we cannot be sure that the previous major climate changes (i.e. around 2000 BC and AD 1000) were global ones, we know that the current one is. Along with South Africa, the rest of the world is facing change, and at the same time Africa is subject to global economic forces to an extent not known before.
2. Although the cause/s of previous changes may not be identifiable, the cause of this one is. Human activity, especially industrialization (including industrial farming) has dramatically increased the production of 'greenhouse gases' (GHGs), most notably carbon dioxide and methane. Because of GHGs, less of the earth's heat is able to escape its atmosphere, and so the temperature of the whole earth's surface rises. Africa's contribution to this might not be large, but there is international pressure on Africa not to increase it, even to diminish it.
3. The number of people occupying the planet is vastly greater than it was even 100 years ago, even in Africa – where population increase has been less. Not only does this mean ever-increasing gas emissions, but it also means fewer options in escaping the effects. In the past, when one environment became uninhabitable, it was usually possible for people to move to a more favourable one without too much upheaval. Now most of the desirable environments are already full to capacity, and their occupants are vigorously defending them.

So, although we may not know exactly what we are facing in any given part of the planet, we have known for some time (e.g. Whyte 1963) that various things will be more likely:

- a. There will be an increase in human conflict over available resources, such as water (Anderson & Chandani 2008; Ruane 2007; Steinfeld *et al.* 2006: xxii), and this will first be felt in the drier areas.
- b. Weather patterns will become more extreme: winds will be more violent, rainfall will be more torrential, and drought will be more burning (Spore 2008a).
- c. Various plants and animals will occupy areas different to the areas occupied in the past, always assuming that they do not simply disappear. Human activity is already causing species extinction through destruction of habitat, as we all know.

At the same time, much emphasis is being placed on the concept of 'sustainability' as a way of ensuring social and political stability for humans. No enterprise should be embarked on, it is argued, unless its future can be guaranteed (Gold 1999; Munday 1998).

In the face of unavoidable change, how can this be done? Only, it could be argued, by the adoption of *adaptable* strategies. Every enterprise should incorporate the potential for changing it, just as was learned in the past. It is no coincidence that the most powerful recent recommendations for African farming should have focused on two main solutions:

1. **ORGANIC TECHNIQUES.** No less a body than the United Nations, along with others, has concluded that organic farming "offers Africa the best chance of breaking the cycle of poverty and malnutrition" and that "traditional practices increase yields by 128 per cent in East Africa" (Independent 2008; see also UN 2008; IAASTD 2009; Markwei *et al.* 2009). Most organic techniques also maintain biodiversity, important to adaptation.

2. **INCREASED LIVESTOCK-KEEPING.** There is currently hot debate about the advisability of humans eating meat and/or dairy products at all (e.g. Goodland & Anhang 2009; FAO 2006; Heap 2008; Steinfeld *et al.* 2006; van't Hooft 2009). At the same time, it is recognized that many more African environments will become unsuited to cultivation, and that stock-keeping must be seen as the viable alternative (ELIDEV 2009; World Bank 2009). In particular:

Livestock are an integral part of nearly all rural livelihood farming systems⁸. Large numbers of poor and marginalized farmers depend on livestock as their primary or secondary source of income. Livestock are an important resource and act as a 'bank' for poorer households. For many landless people, livestock are the only productive asset they have next to their labour. Livestock provide a livelihood for 50% of the 700 million poorest households in the world. Compared to land, the ownership of livestock is generally more equitable. In mixed farming or crop/livestock systems in semi-arid regions, keeping animals is directly linked to crop production, as the animals provide draught power and soil fertility depends on manure. In the arid areas of the world, livestock are often the only source of livelihood⁹, and people's diet is predominantly based on animal products. In these areas, ruminants contribute to livelihood through their capacity to convert low quality roughage into high quality products such as milk and meat. (LivestockNet 2006:5)

Also:

...in some areas, particularly parts of sub-Saharan Africa, *use of animal traction is increasing, substituting for fossil fuel use*. Cattle manure is a good fertilizer; it presents a low risk of over-fertilization and improves soil structure. Livestock also use crop residues and agro-industrial by-products, such as molasses cake and brewers grains, some of which would otherwise be burned. However, cattle in extensive production systems in developing countries often have limited productivity. As a result, a large share of feed is spent on the animal's maintenance rather than on producing products or services useful to people. The result is inefficient use of resources and often high levels of environmental damage per unit of output, particularly in overgrazed areas. (FAO 2009:60 – italics ours)

...for those that are relatively close to large human settlements, for example, there may be options for both integration of livestock systems into the market economy and for off-farm employment opportunities; for those that are more remote, both market and off-farm employment opportunities may be much more limited. (Jones & Thornton 2008:9).

Note the importance of markets. But it is also acknowledged (Thornton *et al.* 2009) that pastoralists are making their own adaptations to climate change, and that these are so far little known. In South Africa, we are in a good position to find out more.

2. WHERE THIS REASONING LEADS

Combining these two solutions – the organic approach and a change of emphasis away from crops and towards livestock keeping – may be interesting, because at first glance they look contradictory. 'Organic' tends to be seen as pertaining to crops, forgetting that the integration of livestock is one of the four core principles of conservation agriculture (ATNESA in press), and a keystone of sustainability (IAASTD 2009:29; Maarse 2009; Rota & Sperandini 2009:3).

Other approaches (FAO 2006; Steinfeld *et al.* 2006) see livestock as a distinct threat to environments, and the debate continues (e.g. Abend 2010; Black 2010; Guardian 2010). It is a question of scale and type, however. A great deal has been discussed and published on this subject, volume increasing daily, and two organizations in particular have much to say on the subject: the International Institute for Environment and Development (website www.iied.org) and ILEIA, which advocates low external-input agriculture (website www.leisa.info). Both of these organizations emphasize the importance of biodiversity, and also see sustainable futures in terms of *small-scale* traditional 'mixed' farming techniques as practiced at a *local* or 'community-based' level, where indigenous knowledge is important.

Organic farming techniques certainly favour the use of animals as part of the system; even when we turn to more general techniques of conservation agriculture (CA), this is still true (IAASTD 2009). CA requires, among other things, minimal disturbance of the soil so as to preserve structure and micro-organisms, and although one might conclude that this precludes

the use of animals, this is to think only of animals used for ploughing, whereas they can contribute much to the saving of labour, not only in cultivation but also in transport, where they may also contribute to environmental protection rather than destruction, and of course their wastes can be rich in microorganisms as well as degradable fibres, all good soil food (FAO 2009:60; IAASTD 2009).

It is in this context that it becomes necessary to think not just of 'livestock' but of *species* of domestic animal, because each offers differential effects and benefits. This is where local innovations may prove very significant. It is not just a question of returning to past technologies because they are suddenly proving very sustainable and adaptive, but of finding what, in the traditional approaches, would most suit the needs of the future. And it is worth noting that, despite the association of the 'cattle complex' culture with Africa (Herskovits 1926), even in the late 1960s it was stated that small stock outnumbered cattle in Africa (Abrahams 1967).

2.1 The Future For Cattle

The fact that cattle arrived relatively late in African societies, as described above, suggests much about their environmental limitations, whatever the social advantages may be. The introduction of breeds exotic to Africa has further exacerbated the problem presented by cattle, and it seems the time has come to reverse the trend.

Cattle (*Bos spp*) is the genus that is seen as the least desirable in environmental terms, but mostly because of the huge increase in an appetite for meat in large emerging economies such as China. The sudden recognition that "Cows consume 8kg of grain for 1kg of meat" (Heap 2008), and that irreplaceable areas of rainforest are being destroyed to provide this is leading to very strong arguments for the adoption of vegetarianism. The same source, however, points out that: "There is a further hiccup with the vegetarian option: most of those who avoid meat source their protein from dairy foods. And dairy animals pump out gases and gobble up supplementary feed just like the rest." This does not, however, take into account that dairy products are probably not consumed in the same quantities as meat. What is really at issue is the matter of 'factory farming'.

The basic rule is that the lower the quality of feed, the greater is the percentage of energy that ends up as methane, and the bigger an animal the greater is the percentage of feed ingested that is transformed into methane. On the other hand, grassland can be a carbon sink, and the lower the stocking rate and the lower the fertilizer application, the greater is the sink capacity. Furthermore, cattle are not the only source of methane. Wildlife of similar size (e.g. elk/moose or eland) produces comparable amounts of methane. Termites, as other important 'decomposers', also produce methane.

If cattle are not fed on grass, the carbon prints of producing concentrates, transport costs etc also have to be taken into account. And *beef and milk produced in an intensive way is more harmful to health than grass-based beef and milk...* tannins, which are in leaves of trees and shrubs, can reduce the methane output. ... (Bayer 2009, a little edited, italics ours; see also correspondence on the topic from the same source, and t'Mannetje 2007).

2.2 Changing Emphasis

In summary, browsing animals produce less methane than ones that only graze, and intensity of production, arising from intensity of consumption, increases the carbon footprint of meat. It is also follows that there are meat-producing animals that are less damaging to the environment than cattle. That the rich may need to change their diets is certainly arguable, but there are societies in the world that do not have the option, and only occupy the environments that they do because pastoralism allows them to (De Haan *et al.* 2002; Neely *et al.* 2009; Seré 2009a & b). Their animals are not consuming food which would otherwise be available to humans in greater quantities, but it is still a worry that these animals are suffering the effects of the change to which they contribute.

Even for such people, however, alternative species may exist (Spore 2008b). Add to this the argument that organic and conservation techniques may enable cultivation of hitherto unusable areas, and their options anyway do not seem so limited.

2.3 Further Environmental Options

2.3.1 Agricultural Work

With fossil fuels being not only major carbon emitters, but a major cost for many of the world's economies, their use has been problematic for decades. Yet the industrialization of agriculture has meant an increase in the use of fossil fuels as part of the conduct of agriculture itself. Using agriculture as a source of fuels, i.e. biofuels, has already proven to be a non-starter (Organic Consumers 2007), so what is needed is to reconsider agricultural work in terms of fuel reduction generally.

Agricultural work divides into two main activities: cultivation (including land preparation, planting and weeding) and transport. Techniques of conservation agriculture are minimizing the role of cultivation, at least where it is heavily mechanized, and there have long been solutions to on-farm and off-farm transport that are not dependent on fossil fuels.

2.3.2 Transport

Being useful as a transport animal these many millennia past rather led to the neglect of the donkey once the internal combustion engine began to power transport as well as agricultural equipment. A realistic look at transport, on the other hand, reveals that a century of using the internal combustion engine has not at all dispensed with donkey use, only relegated it to lesser roads and poorer people. In fact, one advantage of the donkey is that it does not need roads at all, since the pulling of wheeled vehicles is only one of the transport functions of a donkey; it can do more efficient work when back loaded (Ayo-Odongo *et al.* 2000). Other advantages of donkeys, simply as GHG-emitting livestock, are that they are *not* ruminants and they *are* browsers. And nobody has been able to produce them on an industrial scale, in a factory! Yet producing them is not difficult. Being African in origin (Beja-Pereira *et al.* 2004) the donkey is already environmentally adapted, with proven low impact on marginal environments (Jones 1998).

However, it is not necessarily these attributes that account for the new popularity of donkeys (Fielding & Starkey 2004; Jones 2004b), but outright economy. As fuel prices rise, donkeys as transport animals become more appealing and even the South African Department of Transport is now developing regulations and putting up road signs to allow their improved use (50/50 2003).

Significant in this scenario is the emphasis, mentioned above, on the sustainable attributes of small-scale, local mixed farming, and the simultaneous need to access markets. Transport has become important just at a time when it is also expensive, and fossil fuels are seen as environmental threats. Fossil fuels may soon go, but the production of machinery has its environmental hazards and is never likely to be cheap.

2.3.3 Other Work

Cultivation and transport might be the major areas of work, but they are not the only ones. So, especially in the context of the possible growing importance of goat and sheep husbandry, it is interesting to note that donkeys are becoming popular in South Africa, as already elsewhere, as guards and managers for sheep and goats (Miles 2005), living longer and being more reliable than dogs.

3. THE EXTENSION MESSAGE

From all this, there are certain things that those working in agricultural extension need to recognize as important:

- South African farmers are well positioned to make the necessary adaptations, as the majority of them still have limited access to machinery, fuel and expensive chemical inputs. These they will be able to dispense with in the interests of sustainability.
- The disadvantages and lack of future for cattle-keeping need to be emphasized, especially in those areas where overstocking is already a problem.

- Promotion of small livestock should be an essential strategy for farmers in all, but especially the marginal, areas of South Africa. It should be noted, though, that it is important to concentrate on 'indigenous' breeds such as Damara and Pedi, which are better adapted to the conditions and vegetation.
- Extension of knowledge concerning donkey use and management will help farmers not only in conservation agriculture, but in the marketing of products and income generation through transport, as well as in their management of other stock.

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