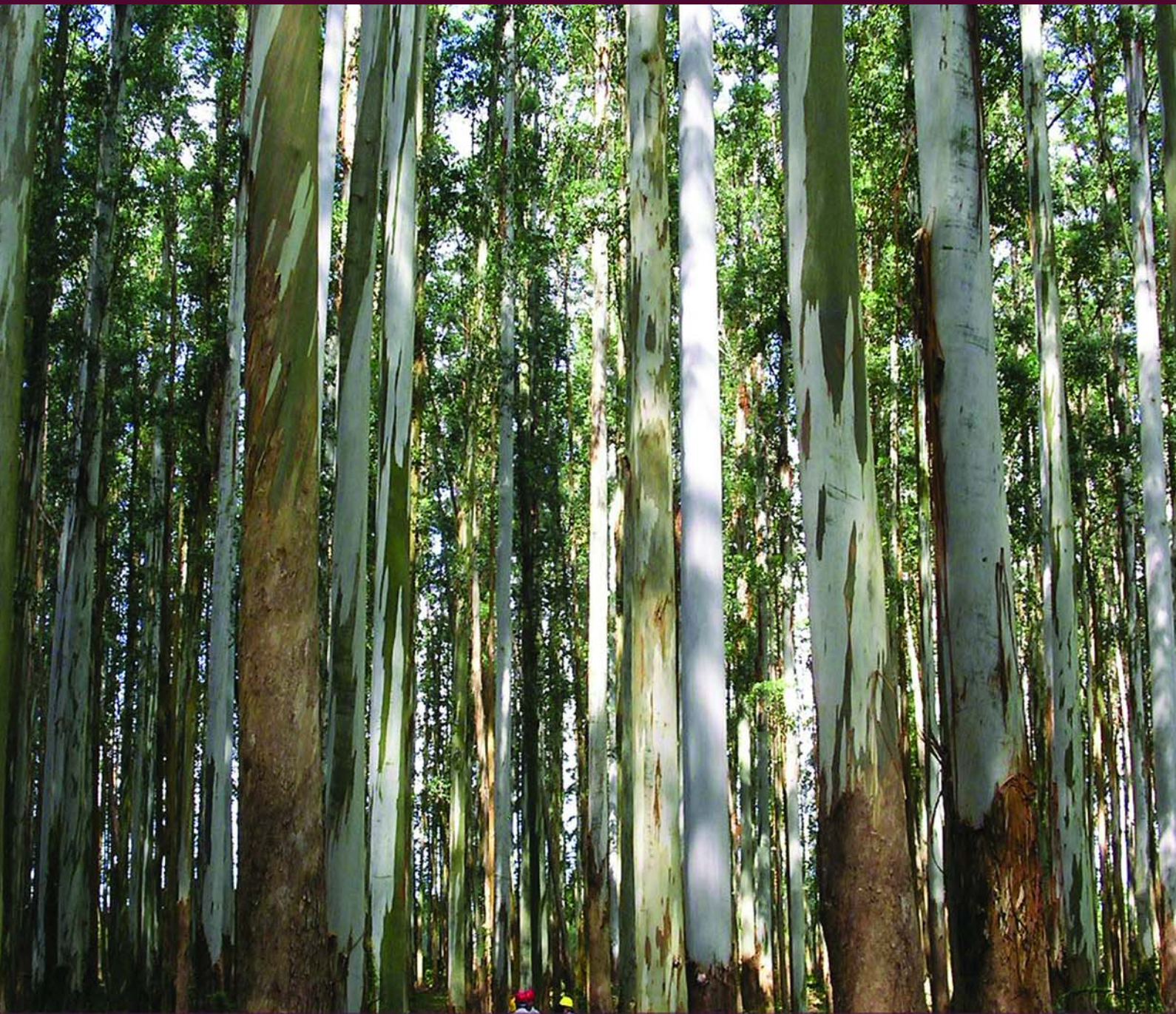


# Agriculture *for* Development



**Tropical  
Agriculture  
Association**

**Climate change: Tropical Forests**

**Climate change: Bangladesh**

**Organic matter**

**Caribbean food crops**

**No. 10 Summer 2010**





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The TAA is a professional association of individuals and corporate bodies concerned with the role of agriculture for development throughout the world. TAA brings together individuals and organisations from both developed and less-developed countries to enable them to contribute to international policies and actions aimed at reducing poverty and improving livelihoods. Its mission is to encourage the efficient and sustainable use of local resources and technologies, to arrest and reverse the degradation of the natural resources base on which agriculture depends and, by raising the productivity of both agriculture and related enterprises, to increase family incomes and commercial investment in the rural sector. Particular emphasis is given to rural areas in the tropics and subtropics and to countries with less-developed economies in temperate areas. TAA recognizes the interrelated roles of farmers and other stakeholders living in rural areas, scientists (agriculturists, economists, sociologists, etc.), government and the private sector in achieving a convergent approach to rural development. This includes recognition of the importance of the role of women, the effect of AIDS and other social and cultural issues on the rural economy and livelihoods.

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Cover Photograph: *Eucalyptus grandis* plantation in South Africa (Courtesy Paul Jacovelli, Sawlog Production Grant Scheme, Uganda)

# Editorial

## Fossil or Bio Fuel?

In recent weeks oil has covered the waters of the Gulf of Mexico, reached the shores and soaked the front pages of the world's daily newspapers and almost drowned the television news. BP has had a rough time. It is one of the major producers of oil that drives the world's engines and economies. But let's look at the other side of the coin, metaphorically speaking, and we find that there are a lot of financially poor farmers in Africa, Asia and elsewhere that are suffering now and will continue to suffer as a result of the quest by the industrial countries to substitute petrol with biofuel in cars and lorries. It is these countries way of saying, "Look, we are going to help in slowing down the rise in global temperature by putting the brakes on climate change".

Before the deadline of June 30 for EU member states to submit their renewable energy plans to the EU, charities ActionAid and Friends of the Earth Europe called on leaders to halt the expansion of biofuels. Land grabbing in developing countries, mainly in Africa, is taking place at an ever-increasing rate to feed the EU's quest to meet its energy needs. The EU's renewable Energy Directive requires 10% of transport fuel to come from renewables by 2020 – most of it likely to come from biofuels. EU companies have already got or requested 5 million hectares of land for biofuels; but it is estimated that 17.5 million hectares will be needed to meet the 10% target. Where is this quantity of land going to be found? Land that is desperately needed to grow food for the mouths of the hungry. Under the Treaty of Lisbon all EU policies must have the eradication of poverty as the

primary focus, but this is obviously not the case with the EU renewable energy policy.

Europe already imports 25% of its biofuels and this figure is bound to increase as demand for biofuels increases under political pressure to meet unrealistic targets. The European Commission calculates that most of its renewable energy target of just under 10% will come from biofuels. Are biofuels going to be environmentally sustainable? This is the main question that we should be asking, not just in relation to Europe's projected needs but on a worldwide basis. Have the politicians done their homework correctly? Is it going to be possible to produce sufficient biofuels to satisfy the political aspirations without damaging the food production in countries in Africa, Asia and elsewhere? Personally, I doubt it.

We all want to do our bit to help reduce carbon dioxide emissions so as to mitigate climate change, but the margin between fossil fuel and biofuel is not that great. Read Paul Jacovelli's article to see how tropical forests will be affected and Hugh Brammer's experienced views on the problems facing the people in Bangladesh.

# The effects of climate change on tropical forests

## Introduction

The debate on climate change rages on. Much-heralded international conferences come and go and accusing fingers are pointed in various directions with doubts over the authenticity of some of the data that was used to justify some of the more alarmist claims such as melting glaciers and rising sea levels. Amidst all the politicking and scepticism, however, are two undeniable facts – namely, that the continuing loss of tropical forests is contributing significantly to climate change and in addition, climate change is now having a major effect on tropical forests. Confusing it might be, but for the sake of the many millions of people and the countless biodiversity that depend on tropical forests, we urgently need to make many more people aware of the situation so that catastrophes can be avoided (or their impact minimized).

## The importance of tropical forests

Only after 1980 did it become clear that conversions of land use, primarily deforestation in the tropics, induces substantial carbon losses to the atmosphere. These losses have to be compensated by other terrestrial sink processes in order to close the global carbon budget (Heimann, 2007). Tropical forests act as huge carbon ‘sinks’, which store carbon until the forests are cleared and burnt. It is now much more widely understood too that tropical forest ecosystems play an important role not just in the carbon cycle but also in regulating local and regional climate (Fig. 1). This fact has been known for many years by local communities, whose lives are closely

linked to the forests but it is only relatively recently with the sheer scale of forest clearance, that the impact is being felt much more widely. A good example is the outcry in 2009 when the Mao watershed in western Kenya started to dry up and the livelihood of millions of people is being threatened: this was after many years of deforestation fuelled by population pressures and poor governance by officials.

## Deforestation in the tropics

Deforestation in the Tropics is continuing at a completely unsustainable level (Fig. 2). Even though a recent report claims that the level of deforestation has slowed (FAO, 2010) more efforts will have to be made to stop the vast majority of the world’s tropical forests from disappearing up in smoke. Easier said than done, of course, especially in poor tropical countries where population growth rates are extremely high and there are weak

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**Paul Jacovelli is the Chief Technical Advisor to Uganda’s Sawlog Production Grant Scheme (SPGS). With over 13,000 hectares established since 2004, SPGS is proving a robust model for attracting private sector investment in timber plantations – see [www.sawlog.ug](http://www.sawlog.ug) – and at least contributing something positive to the region’s otherwise negative carbon balance, caused primarily by deforestation for fuelwood and clearance for agriculture.**

Fig. 1. Tropical forest ecosystems are essential for the livelihood of many people and countless biodiversity. This tropical high forest is under severe pressure in Uganda.





institutions 'mandated' to conserve the remaining natural forests.

Why is deforestation such a major issue in terms of climate change? Simply because greenhouse gas emissions (of which CO<sub>2</sub> is the best known) from deforestation contribute almost one-fifth (18%) of all emissions released into the atmosphere (Stern, 2006). This is why so many are now stressing that two of the most effective approaches to coping with climate change are by reducing deforestation and planting of new forests.

Deforestation is driven largely by social and political factors whereby the land (for both subsistence and commercial agriculture) is valued more highly than the forest. Recent efforts to raise the stakes by attracting payments for the various ecosystem services provided by the forests – known as REDD (Reduced Emissions from Deforestation and Degradation) – have not yet met with universal acceptance and is proving to be neither fast nor easy to implement (Hansen *et al.*, 2009). In particular, there are disagreements over monitoring and who the beneficiaries should be. It is becoming increasingly likely, however, that without REDD, efforts to limit temperature increases will fail (Meridian Institute, 2009). The most recent approach is known as REDD+, which in addition, promotes the enhancement of forest carbon stocks through wise management of forests,

was touted at the 2009 Copenhagen conference and is rapidly gaining support (Andersen *et al.*, 2009).

## The impact of climate change on tropical forests

Although scientists (and many others too) may not agree on the details of climate change, there is a general consensus that there are already increased CO<sub>2</sub> levels and temperatures worldwide, including the already hot tropics. The concentration of CO<sub>2</sub> in the atmosphere has risen by approximately 35% since the pre-industrial era to around 380 ppm now and is steadily rising by 1-2 ppm per year (Karnosky *et al.*, 2007). Most research shows that this combination of rising CO<sub>2</sub> and higher temperatures is likely to have a positive effect on tree growth in general, though it should be stressed that most of the research has been carried out on small trees in laboratories or growth chamber conditions (Luo *et al.*, 2005). Trees generally increase photosynthesis in elevated CO<sub>2</sub> levels. Leaf area index (an important factor for forest productivity) has also been shown to be enhanced by increased CO<sub>2</sub> (Karnosky *et al.*, 2007). The relationship between increased CO<sub>2</sub> and temperature on growth, however, is complex since changes in photosynthetic rates and water-use efficiency may affect the forests' response to rising temperatures.

Having trawled a sample of published literature on climate change and tropical forests, the consensus seems to be that its impact cannot be predicted with any certainty but that the general environment for forestry appears likely to become more difficult. Any gains from increased growth (from warmer and longer growing seasons and the CO<sub>2</sub> fertilization effect) may be offset by climate-induced dieback of tropical forests and woodlands (Allen, 2009). Some models worryingly predict catastrophic dieback of parts of the Amazon forest ecosystem (Bernier and Schoene, 2009). Table 1 summarizes the main likely impacts of climate change on tropical forests.

Fig. 2. Deforestation is responsible for around 18% of greenhouse gas emissions and will continue unless such forests are valued more.



Table 1. The Likely Impact of Climate Change on Tropical Forests

Climate Change Issue	Direct Impact on Tropical Forests
Rise in CO <sub>2</sub> levels	<ul style="list-style-type: none"> <li>• Increase in plant growth</li> <li>• Improved water use efficiency</li> <li>• Increased forest productivity</li> </ul>
Increase in drought incidence	<ul style="list-style-type: none"> <li>• Increased stress on trees (leading to tree deaths)</li> <li>• Increased pest and disease outbreaks</li> </ul>
Increase in temperatures	<ul style="list-style-type: none"> <li>• Longer growing seasons</li> <li>• Increased stress in times of water deficit (leading to tree deaths)</li> <li>• Increase in forest fires</li> </ul>
General climate change	<ul style="list-style-type: none"> <li>• Changes in species distribution</li> <li>• Geographical range of pests and diseases may also be extended</li> </ul>

## Tropical tree plantations

Whilst tree plantations have their critics (sometimes well justified), it is a fact that such plantations are increasingly meeting many countries' industrial and domestic wood needs. Indeed, it is now estimated that planted forests are now providing over half of the current consumption of industrial wood (Evans, 2009). Forestry plantation development is certainly now being recognised as a powerful development tool for developing nations, providing much-needed rural employment and attracting private sector investment. Once in their production stage, forest plantations can also significantly reduce the impact on natural tropical forests. However, this largely depends on the country's ability to protect their remaining natural forests in the face of great pressures from increasing populations, corrupt officials and government policies that do not recognise the true value of forested land.

Tree plantations can have a highly beneficial impact on climate change on a local and regional scale. Provided the plantations are not established through clearing natural forests (which has occurred in some tropical countries), the carbon balance of the plantations can be very positive across multiple rotations. Fast growing tree crops store significant amounts of carbon whilst they grow, which is why tree planting schemes may attract carbon funding (Fig. 3). Depending on the end use of the plantations,

a large proportion of the carbon can then stay locked for many years in the wooden products made from the trees.

## The impact of climate change on tropical tree plantations

Climate change poses a major threat to tropical tree plantations. Indeed, the impact of climate change may be clearer for tropical tree plantations than the highly complex, natural tropical forest ecosystems. For important economic and management reasons, plantations generally consist of a very limited number of species (or clones) planted over a wide area. Thus changes caused directly by climate (e.g. temperatures

Fig. 3. Fast growing timber plantations in the tropics can store substantial CO<sub>2</sub> as well as taking the pressure off the remaining natural forests. This is a 22-year-old *Pinus caribaea* plantation in western Uganda.





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and rainfall) or indirectly (e.g. increased incidence of pest populations) can impact severely over a wide area very quickly. This risk of monocultures can be offset somewhat by careful planning and management strategies – such as ensuring that a large-scale planting programme incorporates a range of species (or clones). However, in practice investors tend to plant the most productive tropical species from a very small species range – notably, *Pinus caribaea*, hybrid *Eucalyptus* clones, *Acacia* spp. and teak (*Tectona grandis*).

Whilst tree improvement (breeding) programmes should always ensure that the genotypes being tested are screened against known pest and disease threats, the long timescale of tree breeding (even in the tropics), means that the serious impact of climate change (directly or indirectly) could quickly overtake any tree breeding efforts to find resistant genotypes suitable for a particular site or region. A tree breeding strategy with multiple populations and genotype testing over a wide range of sites offers the best long-term solution for tropical plantations. For the short-term, however, the impact of climate change on plantations can be minimised by adopting sound silvicultural techniques in order to reduce the stress on the planted trees: this includes the following:

- more scientific site-species /clone matching;
- improved planning (timing) of operations – especially land preparation and planting;
- better weed control to reduce competition;
- raised awareness of pest and diseases (and actions where appropriate).

## Conclusion

Tropical forests impact greatly on climate change, principally

through the greenhouse gases (notably CO<sub>2</sub>) released from deforestation. Climate change (which is the direct result of increased GHGs in the atmosphere) in turn is having an impact on the remaining tropical forests. The effects are complex but generally appear to be causing a decline of tropical forest ecosystems.

Protection of remaining tropical forests could come through a combination of better conservation and wise management. Payment for the services provided by such forests (e.g. through REDD) could be part of the solution by putting a more realistic value on such forests. Where possible, the natural forests can be supplemented by fast-growing plantations to provide timber, fuelwood and other useful products. This combination of efforts could greatly reduce global carbon emissions but it requires more widespread political support than we have seen to date.

Fig. 4. A mature *Eucalyptus grandis* plantation in South Africa.





*This is a revised version of a paper presented at the Humanitarian Centre seminar on Community-based Adaptation to Climate Change held in Hughes Hall, Cambridge, 21st November 2009*

# Climate change and development in Bangladesh

## Context

Adaptation to climate change in Bangladesh needs to be seen in the context of the country's overall development needs. Bangladesh's population is now *ca.* 150 million. It is increasing at more than 2 million a year. The urban population is expanding rapidly; from 15 per cent of the country's population in 1981 to 27 per cent in 2008. Foodgrain production in the past 30 years has increased roughly in parallel with the growing population due largely to the expansion of irrigation in the dry season, and dry-season rice production now exceeds production in the wet season. None-the-less, because of greatly increased investments in industry, services and communications, the agriculture sector now provides only 19 per cent of GDP versus 37 per cent in 1989-90; (the agriculture sector includes forestry, fisheries and livestock as well as crop production).

The rapid changes taking place in Bangladesh present major challenges, regardless of climate change. There is still scope to increase agricultural production via more efficient use of irrigation water and fertilisers, and breeding crop varieties adapted to a wider range of environmental stresses. Average rice yields (all varieties) are only 2.6 t/ha compared with potential yields of 5.5–7.5 t/ha with new HYVs and 7.0–8.5 t/ha with modern hybrids (Hossain *et al.*, 2009). However:

- about 30 per cent of the country is too deeply flooded to grow HYVs of rice in the

monsoon season, and another 10 per cent is occupied by steep hills in high-rainfall areas (2000–>5000mm) that are unsuitable for intensive food-crop production;

- it is estimated that 1 per cent of agricultural land is being lost annually to urban and industrial development;
- the average farm size in 2005 was 0.59 ha, and 87 per cent of farm holdings were 1 ha or less (Asaduzzaman, 2009);
- the easily-available surface-water and groundwater resources are nearing full exploitation, and salinity and arsenic contamination affect supplies in some areas;
- monsoon-season crop production remains exposed to flood, cyclone and drought hazards, and the rapid growth of Bangladesh's population and economy means that many more people and much greater economic assets are exposed to such hazards than in the past.

The government of Bangladesh elected in late 2008 committed itself to achieving national self-sufficiency in foodgrain production by 2013, and to providing full flood protection, dredging of the rivers and surface-water irrigation. However, the feasibility of providing these measures remains both technically and financially uncertain: for the past twenty years, donor governments and agencies have been reluctant to fund major water development projects because of environmental concerns and problems of governance (i.e., constipated institutions and corruption).

## Hugh Brammer

**Hugh Brammer worked in East Pakistan/Bangladesh for over 30 years and has authored several books on soils, agriculture and floods in Bangladesh. He was FAO Agricultural Development Adviser in Bangladesh 1974–1987.**

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## Climate change

Most (but not all) of the Global Circulation Models (GCM) considered in the IPCC 2007 report predicted a slight (<10 per cent) increase in rainy season rainfall by 2040 over most of the Ganges-Brahmaputra-Meghna (GBM) catchment area affecting Bangladesh (Cruz *et al.*, 2007). More recent estimates suggest <5 per cent increase in monsoon rainfall by 2050 (Hu *et al.*, 2010). Predicted temperature increases seem more likely to have significant effects on agriculture, and it is generally assumed that the frequency of floods, cyclones and drought will increase. Estimates (mainly conjectural) of the area affected by a 1m rise in sea-level range between one-tenth and one-third of the country, with 10–30 million people displaced. The recent World Bank-funded study (Hu *et al.*, 2010) estimated that the combined effects of changes in temperature, rainfall, flood and cyclone frequency, and sea-level rise by 2050 could reduce monsoon-season rice production in Bangladesh by 1.5–3.5 per cent annually and dry-season rice production by 5.5 per cent.

## Uncertainty

These predicted outcomes of climate change are highly uncertain. The IPCC 2007 report acknowledged that the GCMs on which regional predictions were made are still crude. Existing models cannot yet predict the Indian monsoon satisfactorily. A recent DFID-supported report on the impacts of climate change on Bangladesh illustrates the scale of this uncertainty (Farquharson *et al.*, 2007). Monsoon rainfall simulated by the four GCM models used ranged between *ca.* 150 and 350 mm lower than the observed mean July rainfall averages for 1979–99, and rainfall was higher by 5–50 mm per month in the dry season. Simulated temperatures in the models differed from actuals by between –8° and +13°C in the dry season and between –10° and +4°C in the monsoon season.

If the models are so far out in trying to model the existing climate and there are such big differences between model outputs, what reliance can be placed on predictions of future climate? The present uncertainties regarding the direction and magnitude of possible changes do not provide a reliable basis for planning. How realistic is it to plan for 2050 and beyond? How realistic would plans based on the Club of Rome predictions in 1970 have been?

## Status quo v. dynamics

Those considering the potential impacts of climate change on Bangladesh apparently assume a static environment and a passive people. But the GBM delta in Bangladesh, is dynamic, and so are the government and people of Bangladesh. Bangladesh is not helpless against climate change and sea-level rise, although it might need technical and financial help to withstand the projected climate and sea-level changes. But help can (or should!) only be given where it is actually needed. It should not be based on uncertain model outputs and armchair assumptions.

The combined GBM rivers are estimated to bring down *ca.* 1 billion tons of sediment to the Meghna estuary each year. Analysis of satellite images shows that sediment deposition in that estuary created 451 km<sup>2</sup> of new land (net gain of accretion over erosion) in the 24 years between 1984 and 2007 (data awaiting publication). Elsewhere, there was a net loss of 53 km<sup>2</sup> of coastal land west of the estuary during the same period (mainly at the western, Indian end of the delta front), and negligible change on the Bangladesh coast east of the estuary. The changes in land area and distribution in the Meghna estuary since about 1950 are well seen on Google Earth images; (the date of the map outline of Bangladesh on those images is uncertain, but the land boundaries in the estuary approximately represent the situation shown on 1949 airphotos seen by the author). Given the large amounts of sediment delivered annually to the Meghna estuary, net land

accretion is likely to continue with sea-level rise. None-the-less, the distress caused by erosion along estuary channels and the coast must not be discounted: families displaced by land erosion do not necessarily benefit from new land formation; new 'raw' alluvium is not of the same quality for crop production as older, developed soils that are eroded; the land is still exposed to seasonal floods before it is embanked and to storm surges even afterwards; and groundwater is saline, so is unsuitable for drinking.

Much of Bangladesh's coastal area is protected by embankments, built in the 1950s and 1960s to keep out salt water at high tide, that created polders between tidal rivers. If properly managed, these embankments should keep out rising sea-levels for at least the next 50 years. Proper management would include measures to raise embankment heights, to repair breaches speedily after damage by storm surges, and to enable sedimentation from tidal rivers to build up land levels inside polders (a technique known as warping) in parallel with rising sea and river levels. Where warping might be insufficient, pump drainage could be installed. Parts of the Netherlands are >6m below sea-level. Bangladesh must emulate the Dutch in fighting the sea. There is much that the government and people can do themselves. But since Bangladesh does not have the economic and financial resources of the Netherlands, they will also need external support in order to protect their land.

Bangladesh's agricultural scientists and farmers will not remain passive as environmental conditions change. The dynamism of agriculture in Bangladesh is shown by the threefold increase in rice production since 1971 as the population tripled. Plant breeders produced many new higher-yielding crop varieties during that period, including salt-tolerant rice varieties that are widely grown in coastal areas. They are currently working on rice varieties to tolerate a wider range of environmental stresses such as flood submergence, drought

and soil arsenic contamination. Additionally, Bangladeshi farmers are highly resilient, opportunistic and entrepreneurial. They have generations of experience of coping with environmental and market stresses.

## Climate variability

Table 1 shows how minimum and maximum temperatures varied between 1964 and 2008 at Rajshahi in the drier west of Bangladesh. With global warming, one would expect that the last date of low winter temperatures would become earlier with time and that there would be an increasing number of days with extremely high temperatures in the hot season. The data in Table 1 provide no conclusive evidence that such changes have occurred over the 45 years of record. The end-date of the cool winter season has fluctuated over time, and was similar at the end of the period to what it was 40–45 years ago. Counterintuitively, the average number of days per year with extremely high temperatures actually decreased over the 45-year period. Similar changes also occurred at other places in the NW region of Bangladesh.

The author conjectures that the reduced number of extremely hot days per year – significant because they interfere with pollination of rice – reflects the change from the former dry-season fallow land to widespread irrigated boro rice cultivation in the dry season in the past two to three decades. That change in land use could also have advanced the end-date of the cool winter period; so also could the 'heat island' effect of urban warming (the majority of meteorological

*Table 1. Changes in minimum and maximum temperatures at Rajshahi 1964–2008 by pentad*

Pentad	Mean last date of minimum <15°C	Mean No of days per year with maximum >40°C
1964–68	9/3	11.4
1969–73	13/3	20.0
1974–78	17/3	3.0
1979–83	15/3	10.0
1984–88	14/3	9.0
1989–93	15/3	6.6
1994–98	16/3	6.8
1999–03	14/3	1.6
2004–08	8/3	2.4



stations in Bangladesh are in cities/towns that have expanded immensely in the past two decades). These findings and observations provide a salutary warning that global warming is not the only factor that can change local climates.

Table 2 shows the variations of annual rainfall at Rajshahi between 1964 and 2008, while Table 3 shows how rainfall in June (the first month of the monsoon season) varied. The great variability from year to year means that

farmers have to be prepared for drought or excessive rainfall every year. The drought that occurred in 2009 was widely interpreted as evidence of climate change. However, Table 3 shows that low rainfall in June is a recurring phenomenon. The average rainfall at Rajshahi in the dry winter season (December–February) is 31.5 mm, so a 10 per cent decrease with climate change would have no practical impact. There have been many years with zero rainfall in one or more of these months in the past 45 years.

Table 2. Annual rainfall at Rajshahi by pentad 1964-2008

Period	No of years with records	Mean mm	Lowest mm	Highest mm
1964–68	5	1419	1139	1958
1969–73	3	1467	944	2060
1974–78	5	1604	1062	2006
1979–83	3	1890	1758	2071
1984–88	5	1467	1252	1575
1989–93	5	1408	839	1765
1994–98	5	1489	1142	2062
1999–03	5	1550	1363	1862
2003–08	5	1533	1145	2018
Mean 1964–2008		1522		

Table 3. June rainfall at Rajshahi by pentad 1964-2008

Period	No of years with records	Mean mm	Lowest mm	Highest mm
1964–68	5	248	26	447
1969–73	5	340	209	614
1974–78	5	327	77	557
1979–83	4	224	65	289
1984–88	5	273	175	407
1989–93	5	241	85	455
1994–98	5	229	92	291
1999–03	5	279	222	348
2003–08	5	269	92	507
Mean 1964–2008		271		

Table 4. Rajshahi maximum temperature analysis by pentad 1964-2008

Pentad	No of years with records	No of days per year with >40°C		Annual absolute maximum °C	
		Mean	Range	Mean	Range
1964–1968	5	11.4	3–25	42.7	41.7–43.3
1969–1973	2	20.0	12–28	43.5	41.9–45.1
1974–1978	5	3.0	0–7	40.0	37.1–42.2
1979–1983	4	10.0	0–20	41.0	36.8–44.4
1984–1988	5	9.0	0–14	42.2	41.5–42.5
1989–1993	5	6.6	0–18	41.1	39.4–43.7
1994–1998	5	6.8	2–16	42.2	40.2–43.3
1999–2003	5	1.6	0–5	40.4	39.2–41.8
2004–2008	5	2.4	0–8	41.0	39.8–42.8

The great year-to-year variability makes it difficult to identify any change in annual rainfall or in rainfall patterns that might be linked with global warming. A recent analysis of daily temperature data for eight stations also showed great inter-annual variation and the lack of a consistent pattern of temperature changes with time. Table 4 illustrates the variability at Rajshahi during the 45-year period of temperature records and the lack of evidence for increasing maximum temperatures with time. Together, Tables 1 to 4 provide no evidence that temperatures or rainfall at Rajshahi have become more variable over the past 45 years. It may be added that there is no evidence that the frequency of floods or cyclones in Bangladesh has increased during that period; there were, in fact, many more cyclones between 1960 and 1970 than in any subsequent period of similar length. That does not mean that changes may not occur in future. What it means is that there is no conclusive evidence at present for the climate trends predicted by existing GCM outputs.

## Conclusions

What does the above mean for adaptation to climate change in Bangladesh? It means that the government of Bangladesh and the Bangladeshi people have much more urgent matters to worry about at present than climate change.

If global mean annual temperatures increase by 2°C during the 21st century, that is at an average rate of 1/50th of a degree a year. Global sea-level is currently estimated to be rising at 3.4mm a year (Allison *et al.*, 2009). But even if the rate were gradually to double in the next 20 years, that would increase sea-level by only about 10 cm (4 inches) over the next two decades. Those rates of temperature change and sea-level rise are unlikely to affect farmers' lives and livelihoods significantly during the next 20 years.

But Bangladesh is already badly exposed to recurrent natural disasters. The government and the people have to be prepared for the

risks of flood, cyclone and drought every year. And the increasing pressure of population on the land, the growing scarcity of water for irrigation and other uses, increasing salinisation of rivers and soils in the south-west due to abstraction of water upstream, arsenic contamination of soils and rice in some areas, and the increasing costs of fertilisers and fuel are affecting farmers' lives and livelihoods now. The growing number of people unable to make a living from the land because of population increase means there are increasing numbers of economic migrants from rural areas that need to find employment or relief in urban areas or abroad. Those are problems of more immediate importance than climate change.

The present focus of international agencies, NGOs and the Government of Bangladesh on climate change is distracting attention from development issues that ought to be addressed now. The neglect of current problems threatens the lives of many millions of people. That is apparently true also for other developing countries and other TAA members may care to provide factual information for countries they are familiar with.

This does not mean that climate change can be ignored, in Bangladesh or elsewhere. What it does mean is that climate change needs to be seen and addressed in the perspective of overall development needs. Fortunately, most of the measures needed by the government and people of Bangladesh to adapt to projected levels of climate change and sea-level rise are required anyway to deal with the country's existing problems:

- measures to increase security of lives and livelihoods against floods, cyclones, drought, salinity in coastal areas and a variable climate;
- agricultural research to increase the range of crops tolerant of existing environmental stresses and to increase efficiency of irrigation and fertiliser use;
- assessment of the extent and severity of arsenic contamination of soils, and research on practical mitigation methods;

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- strengthening of agricultural extension and support services to farmers;
- continued provision of support prices and/or input subsidies to assure farmers of profitable returns from the risky production investments they must make;
- education and skills development together with employment generation to enable the growing urban population to contribute productively to the national economy;
- measures to reform governance and institutions, so as to provide an enabling environment for international donor funding.

These are matters that deserve the attention and support of donor governments, international agencies and NGOs as much as by the government of Bangladesh. A similar balanced review of needs and opportunities in other developing countries is recommended.



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Based on a paper 'Land Husbandry Guidelines for Sustaining Kenya's Agricultural Productivity' given at a TAA South-West Group seminar on Developments in Kenyan Agriculture, at Bicton College, 13th May 2010

# Organic matter – key to agricultures' sustainability

T.F. Shaxson

**“Without regular and dependable supplies of food, other agricultural products, and water, our whole economic structure will collapse, and no amount of accounting, book-keeping, reckoning, buying or selling will sustain it”.**

Cormack & Whitelaw, in: 'Conservation – A Handbook for Teachers', 1957.

## Evidence of unsustainable agricultures

Many factors affect sustainability of agricultural systems, but none so basically as the condition of the soil, which is determined by the dynamic nature and consequences of interactions between the four components of its productivity: physical × chemical × hydrological × biological.

### Governments aware

In the tropics, governments have long been concerned about falling productivity of soils – often ascribed to soil erosion and the factors apparently causing it. They enacted laws to limit overgrazing, deforestation, inappropriate tillage, but these were widely ignored

and/or ineffective because some underlying causes of the problems were not appropriately analysed or addressed (e.g., soil erosion considered a primary cause of damage, rather than a consequence of changes in the soil). In temperate regions, e.g., UK, concern has been expressed about damage to soils, in the forms of compaction, erosion and long-term decline of soil organic matter (DEFRA, 2009).

### Farmers aware

Farmers express perceptions of declining soil quality, falling yields over time at constant inputs and/or of rising costs per unit of production. The severity of degradation is sometimes masked until a shock uncovers it, as in the following quotes from Malawian smallholder farmers (Evans *et al.*, 1999):

*“We saw erosion increasing but always knew that we could increase our yields with fertilizer.... We were still getting enough food because of the fertilizer we received on credit.*

*“Now we are in a dilemma. We used to rely on fertilizer to improve our yields; now fertilizer is too expensive and interest rates are making credit prohibitive.*

*“Not only did we not understand what was happening to our soils, but the process of degradation was obscured for those using fertilizer.... It was only when we stopped using fertilizer that we realised something bad was happening to our soils” (author's emphasis).*



Figure 1. The growth of plants depends on what remains in place rather than what has eroded away (near Brasilia, Brazil).



Figure 2a. Poor soil porosity in the upper catchment results in excessive runoff and erosion of soil during the rains (Nthondwe, Malawi).



Figure 2b. Same site. Unabsorbed rainfall lost during the rains is not available for river-flow in the dry season.



(The author has been advised of similar comments from China and Nepal).

### Disruptions

Under the influences of solar radiation, rock weathering, water, other organisms and gravity, plants and soils have co-evolved over 300 million years or more. Their living and non-living components have developed many and complex inter-relations and inter-dependencies of mutual benefit (Uphoff et al., 2006). In undisturbed conditions at any place, dynamic self-adjusting equilibria are reached among the living and non-living components of the local ecosystem, under the influences of climate and gravity (Downes, 1982). Agriculture disrupts these by attempting to alter – and then maintain – the modified systems to suit our own demands for preferred outputs from the land. The statements above, of both governments and farmers, reflect consequences of such disruption of fundamental soil processes. Such disruptions can disfavour optimum plant growth.

They can also diminish the quality and regularity of water-supplies from the landscape.

They also have other repercussions on the wider environment and the services which we expect it to provide, for example, restriction of volumes of plant-available water within the rooting depth of soil limits crop yield. The severity of the effects of disturbance is thus related to the adequacy of human management on the occurrence, nature, direction and effects of the agro-ecological changes that are consequences of agricultural land use.

### Significance of spaces in structures

The useful characteristics of buildings are primarily the spaces – rooms, corridors, entrances – within and between which actions take place. So it is with productive soils. Good soil structure in agriculture connotes the presence of a mix of



appropriately sized and suitably located voids within the soil mass which are beneficial to the functioning of the soil's inhabitants.

### Soil aggregates and pore-spaces

In undisturbed soil, porosity is a result of the combined effects of (a) burrowing animals, e.g., moles, worms and insects; (b) channels left after decomposition of dead plant roots; and (c) aggregation of individual soil particles into rough-sided clumps, by micro-organisms producing gummy polysaccharides and other exudates, by attachments of plant roots, by mycorrhizae and other fungal hyphae, as well as by the static attraction of 'active' clay particles one to another.

Because they are not of uniform size and are somewhat angular, such aggregates do not necessarily all fit snugly together, leaving spaces between the points and planes where they touch each other. The relative abundance, at a given time, of spaces of different pore sizes, from sub-mm.-scale to that of cms, determines volumes and rates of movement of both water and of gases (notably oxygen and carbon dioxide) through the soil matrix. The varied strengths of the aggregates' internal and external adhesions also determine the ease with which roots are able physically to penetrate and grow within the soil mass, and the ease/difficulty with which the pores may suffer collapse.

Good soil structure and its porosity serves five particular functions in the root-zone: the expansion of root systems; the movement of water; a habitat for soil micro-organisms; the diffusive ingress of oxygen; and diffusive egress of carbon dioxide.

### Loss of useful pore spaces from the soil

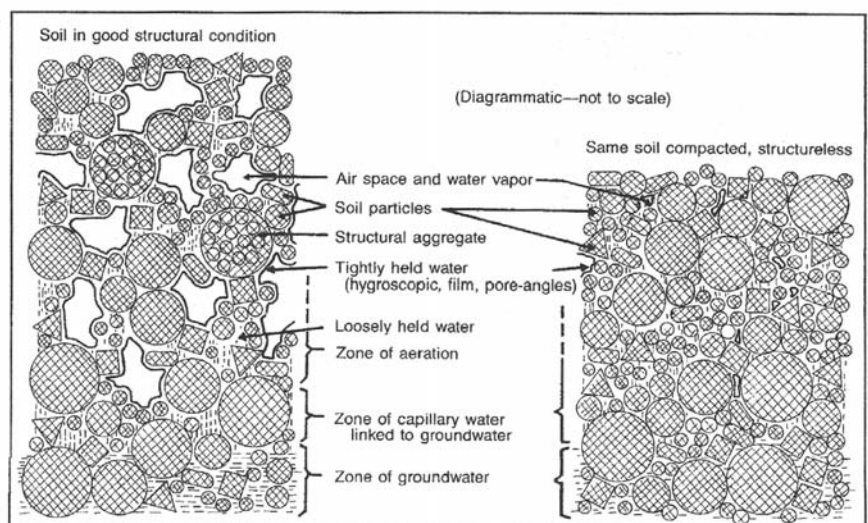
A productive soil will have a mixture of different classes of pore size, from those of sub-millimetre scale upwards, through which water, gases and roots each are able to move at differing rates. Loss of pore spaces follows from whatever natural and/or imposed factor

leads to pulverisation, compaction, or collapse of soil aggregates. Such damages to soil structure diminishes not only the total pore space per unit volume of soil but also increases the proportion of very small pores through which water gasses and roots can pass only very slowly or not at all. Such hindrances are reflected in the poorer performance of plants, whether crops, grasses or trees. Such damage to a soil's condition cannot be remedied, either adequately and/or to long lasting effect, purely by mechanical means or the application of synthetic fertilizers alone, being of themselves passive rather than active in their effects.

### Repair and maintenance of soil structure

Build-up, repair and maintaining the stability of porous structure in an agricultural soil (as also in an undisturbed one) is a biological attribute. It derives from the actions and effects of the soil-inhabiting organisms, viz. plants and associated macro-, meso- and micro-organisms, as indicated above. For organisms to function and reproduce, they require water, nutriment, a source of energy, and transformation or disposal of the by-products of their metabolism. The workings of the soil ecosystem are such as to tend towards its inhabitants optimising their own surroundings for their activities.

Figure 3. While the number of individual particles remains the same, the characteristics of the soil as a porous medium are changed by the loss of pore-spaces between them (Shaxton *et al.*, 1989).





Maintaining suitable conditions for the soil biota to reproduce enables, across time, unbroken continuity of their life processes and derived effects, whether the organisms are plants, animals, fungi, microbes, etc., and even though individual cells' life cycles may be no more than a matter of days. Thus the process of maintaining and reforming porous soil structure should become an ongoing feature of a well managed system. The situation illustrated in Fig. 3 can be reversed by the actions of the soil biota.

### Organic matter:

Useful organic matter in the soil is a combination of both a living component (the soil-inhabiting organisms) and a non-living component (the plant and animal remains on which they depend for their activity).

### Substrate

Carbon-rich materials such as plant remains are the substrate/'food' of the soil organisms, from which are derived the benefits to soil functioning that are favourable to agriculture. Using solar radiation, above-ground plant cells build complex molecules, with solar energy in their molecular bonds, by photosynthesis from carbon dioxide, water, and nutrient ions, and, as a by-product of these processes, liberating oxygen back into the air.

Translocation downwards of photosynthesised carbohydrates (in particular) to the subterranean plant organs (roots, tubers, etc.) also carries down the chemical bond-energy incorporated in these sugars, etc. Dead cells sloughed off as the root tip grows become a zone of intense microbial activity, because young cells from the root-tip region are higher in readily decomposed materials than older, more lignified cells. The microbes produce enzymes that enable carbon-rich molecules in these dead plant cells to be oxidised and broken down into their less-

complex constituent parts. The soil biota then utilise the bond-energy released during this process of simplification to drive their own metabolism and reassemble these simpler materials into different more complex combinations which they require for their own structures and functioning. Comparable biotic activities take place also throughout the soil mass where there is sufficient organic matter substrate, though its intensity may be slowed, even where there may be adequate porosity and aeration, by relative insufficiency of one or more nutrients, notably nitrogen, in the soil.

In this circular sequence of processes, respiration by organisms releases gaseous carbon dioxide into soil's atmosphere in interconnecting soil pore-system, whence it diffuses back to the above-ground atmosphere. Inversely, the same porosity must be sufficiently well developed to permit diffusion of oxygen in the opposite direction down into the soil atmosphere for respiration to continue.

### Cation exchange capacity (CEC)

Montmorillonitic clays provide some of a soil's CEC, which is a measure of capacity to capture and retain plant nutrients out of the soil solution. CEC is also an indicator of the soil's capacity to release such nutrients gradually back into the soil solution in response to declining concentrations following their uptake by plant roots. The complex organic ('carbon-rich') molecules of soil organic matter have very many molecular 'hooks' to which such nutrient ions can attach (Flaig *et al.*, 1977). This makes soil organic matter a particularly valuable source of additional CEC which buffers soils' nutrient content against the potential leaching effects of free draining water descending through the root zone, while slowly releasing nutrient ions back into the soil solution in response to falling concentrations due to plants' uptake through the roots.



## Decline of soil organic matter

The pejorative term ‘soil mining’, applied to poor agricultural landscapes and systems, is indicative of one or more of the facts that:

- (a) poor structural condition may have resulted in soil erosion having stripped away some or all of the formerly organic matter-rich topsoil;
- (b) harvesting and carry-off of plant materials (in addition to any leaching in drainage water) have depleted the nutrient content of the soil, in the absence of adequate replenishment;
- (c) the soil organisms have been decomposing the more resistant forms of soil organic matter (complex humic materials) when readily available nutrients have become insufficient to satisfy their metabolic requirements. It appears that once this resource is almost depleted, the soil may no longer respond economically to the application of manufactured fertilizer materials alone (Marenya and Barrett, 2007). This may be cause of the Malawian and other farmers’ concern reported above.
- (d) tillage, by breaking up and loosening of the soil, has facilitated excessively rapid respiratory oxidation of the soil organic matter – in proportion to the depth, severity and frequency of disturbance (Reicosky, 2001) – faster than it has been replenished.

## Maintaining soil organic matter

Biotic activity in the soil requires organic matter as a substrate for the recycling of nutrients from plants to soil and back again, and for developing and maintaining appropriately porous soil structure. Therefore a regularly repeated supply of sufficient carbon-rich materials is essential to maintaining a soil’s organic-matter level. In some parts of the world this was formerly achieved with ‘bush-fallow rotations’, in which short periods of a few seasons under crops were alternated with decades-long periods in which the native vegetation regrew relatively undisturbed. The soil organisms benefited from increasingly abundant leaf-fall and expansive root-growth

to both depth and width, and the soil’s structure, porosity and nutrient availability was regenerated by action of the soil organisms. In more recent years past it was elsewhere common to have dense rooted and productive grass breaks managed in rotations with crops. The grasses’ rooting assisted regeneration of structure damaged by the earlier tillage for crops.

But the effects of the shortening or complete lack of time sufficient for biotic recuperation of soil structure by any means has left many soils in a compacted, pulverised and/or biologically weakened and less healthy state for sustainable agricultural production in the future.

Figure 4a. 1960 before no-till farming. One pass of a disc-plough after three years cropping in flue-cured tobacco: ‘mechanical’ structure. Much more tractor-work required to break it up into a semblance of a seed-bed.



Figure 4b. On the same day. An adjacent section of field, on the same pedological soil type: after one pass of a disc plough after three years under a soil-restorative break of dense-rooted Weeping Lovegrass (*Eragrostis curvula*): ‘biological’ structure. Much less work to produce a good seedbed (Mlombozi, Malawi).





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Under well-managed mulch-based zero-tillage farming, soil structure of this type would be created and maintained at and below the surface on a continuous basis, by the soil biota under a permanent supply of organic-matter substrate – the mulch of crop residues.

## Mulch-based zero-tillage farming – a second paradigm of agriculture

Mulch-based zero-tillage farming involving crop diversification, also known as Conservation Agriculture, can satisfy most, if not all, the requirements for improving a soil to healthy<sup>1</sup>, productive and sustainable condition. The presence of many earthworms in the soil is a significant positive indicator of it being in good condition. The other benefits – economic, environmental, social – which follow from the installation and development of mulch-based no-till systems are described in a range of other articles from across the world (e.g., [www.fao.org/ag/ca](http://www.fao.org/ag/ca)).

It is ideally characterised by three specific features operating simultaneously:

- Maintenance of a permanent and complete cover over the soil surface, of crop residues and cover crops complemented, as feasible, by other organic matter (such as manures and composts), as both a protection against extremes of weather conditions and simultaneously as a substrate for the soil biota;
- Once the soil has been recovered to a permeable condition, minimal mechanical disturbance thereafter during necessary operations, such as of seeding crops and/or grasses, harvesting, and weed/pest control, so as to minimise/avoid excessively rapid respiratory oxidation of organic matter to carbon dioxide;
- Use of rotations and/or sequences of plants, including N-fixing legumes, for both maintaining biodiversity, adding

nitrogen, increasing the bulk of organic matter of varied composition, and interrupting build-up of pests, diseases and weeds.

In many places, it may be considered necessary on sloping land at the outset to maintain or install physical measures, such as contoured earthworks, for detaining surface runoff water and eroded soil. As soil porosity improves, surface runoff progressively reduces while the proportion of incident water – as rainfall or irrigation – increases, to the benefit of both plants, the groundwater, and streamflow. The need for, and the required size of, specific physical conservation works thereby lessens over time.

## Conclusion

The spectre of ecological unsustainability of the common paradigm of tillage-based agriculture mandates the development and spread of more-sustainable alternatives, of which mulch-based zero-tillage systems seem most closely to match the requirements of an optimum scenario. The example of rapid spread of such systems in Brazil, for instance, and increasing areas in other countries across the world, (currently totalling about 116 million hectares under various production systems, and growing at the rate of 6 million hectares per annum), provides evidence of its acceptability by adopting farmers as a more secure form of agriculture, even given the significant changes in both thinking and practice that are entailed for its satisfactory adoption. From this viewpoint, mulch-based zero-tillage farming deserves immediate attention, encouragement and support to make the changeover, before it becomes too late.

I would like to acknowledge Amir Kassam's valuable comments during the finalisation of this paper.

<sup>1</sup> SOIL HEALTH: a definition: "... 'Soil health' emphasizes a unique property of biological systems, since inert systems cannot be sick or healthy. Management of soil health thus becomes synonymous with management of the living portion of the soil to maintain the essential functions of the soil, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health". (Trutman, 2000. TropSCORE website)



# The politically diverse Caribbean: how the Caribbean Food Crops Society serves all

## Historical Perspective

**The end of European colonization left the Caribbean in a strange condition. Unfortunately almost all the original (native) peoples were wiped out, except in perhaps three or four of the 20 plus countries in the region. In the other countries there may be a few people who can trace their ancestry back to one or two native (many times great) grandparents. The vast majority, however, are 100% descended from European colonizers, African slaves, East Indian or Chinese indentured labourers, Middle Eastern merchants, etc. Of this vast majority, many (perhaps most) are racial mixes of two or more of these colonial arrivals.**

The Caribbean nations are usually considered to be island countries, but this is not quite true from the political standpoint. The north-eastern shoulder of South America is a vast area known as the Guianas. This was colonized by Portugal, France, the Netherlands, Britain and Spain. The Portuguese and Spanish Guianas have for centuries formed part of the countries of Brazil and Venezuela. The French, Dutch and British Guianas are now the territories of Guyane, Suriname and Guyana and are politically and socially considered to be Caribbean territories.

There were four major Caribbean colonizers, British, Dutch, French and Spanish. Most of the islands and Guianas changed hands many times from one colonizer to another before settling down after the Industrial Revolution in Europe when the Caribbean countries were no longer of great economic significance. Thus when we speak of former “British” or “Dutch” Caribbean islands, we are usually referring to the status after the finish of the many upheavals of the 18th and early 19th centuries.

## Political status

Today most of the former British colonies are independent states, but there are a handful of tiny British colonies that are fairly happy to

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remain dependent. UK interest in these places can no longer be described as very intense, but the British Government does help considerably when natural disasters (which are depressingly frequent in the Caribbean) strike their remaining colonies. The UK also occasionally intervenes when it is perceived that government mismanagement steps over the line; this causes tension within the region as the UK actions are regarded as “unwanted interference”.

Suriname (formerly Dutch Guiana) has been independent for 35 years. The Dutch speaking islands in the Caribbean form the countries of Netherlands Antilles and Aruba; these countries are partners with the Netherlands in the Kingdom of the Netherlands.

It is well known that Haiti was the first Caribbean country to gain independence from colonial rule in the wake of the French Revolution. The other French speaking islands and Guyane are considered as overseas departments of France; as such their citizens vote in French elections and their footballers grace the French national team (e.g. Thierry Henry and Florent Malouda).

Spain “lost” its American colonies in the first half of the 19th century; it also lost the Caribbean territory of Dominican Republic during this period; it hung onto the islands of Cuba and Puerto Rico until 1898, when the United States forced them to be sold. Today Dominican Republic and Cuba are fully independent, but Puerto Rico has self-governing status within US jurisdiction and sovereignty. Near to Puerto Rico, the US Virgin Islands (former Danish colonies) are an unincorporated US territory.

All this has left a very fragmented region. When the English speakers talk of the Caribbean, they usually are talking only of the countries whose final colonial power was the UK. Similarly the French “Antilles” only refers to the small territories which are overseas departments.

An earlier article in *Agriculture for Development* (Lauckner, 2009) described the

history of agricultural research in the Caribbean. The TAA can be considered a product of this history as many of the TAA founders worked at the Imperial College of Tropical Agriculture (ICTA) in Trinidad. ICTA and its successors today (Caribbean Agricultural Research and Development Institute and University of the West Indies) are considered Caribbean regional and not just national institutes. But their “Caribbean region” is only the “former British” region. The French national organizations, INRA and CIRAD are very active in the Antilles and Guyane. The very dry Dutch islands have not paid much attention to agriculture in the last 50 years, but Suriname has a strong agricultural sector without many linkages even to the neighbouring Guyana and Guyane. Puerto Rico and the US Virgin Islands both have universities involved in agricultural science teaching and research, with more links to the US mainland than to neighbouring islands. Cuba and Dominican Republic both have very strong agricultural teaching and research institutes with close links to other Spanish speaking countries, but only loose links with non-Spanish speaking Caribbean countries.

It can be deduced that agriculturalists in the Caribbean belong to several different political groupings and contact between the groupings could be better. However, once a year, this problem is marvelously addressed at the annual meeting of the Caribbean Food Crops Society (CFCS).

## Caribbean Food Crops Society

The CFCS is an independent professional organization of interdisciplinary orientation and membership, and is not affiliated with any public or private institution. CFCS brings together scholars, researchers, extensionists, growers and other professionals, and its objectives are to advance and foster all aspects of Caribbean food production, processing and distribution. It seeks to involve members from all four major language groups of the region.



Currently there are over 300 members representing 23 separate territories.

The CFCS was founded in 1963 when the first annual meeting was held in St Croix, US Virgin Islands. The 46th Annual Meeting is scheduled for the Dominican Republic in July 2010; since its inception, on only two occasions in 1976 and 1980 have annual meetings not been held. This is quite a remarkable achievement for the Caribbean where traditions and continuity are difficult to establish. At the opening meeting in 1963, 18 scientific presentations were made; by the 1970s the typical meeting usually had more than 40 presentations, but after the missing year of 1980 the society was not able to attract more than 40 presentations until the 1984 meeting saw a record 79 papers delivered. That 1984 meeting really confirmed that the CFCS was here to stay. The record number of presentations to date was recorded at 169 in 2006 and it is almost certain that it is only a matter of time before the record is indeed broken again.

In 1963, on founding, CFCS was focused only on food crops. However, the focus has long since become much broader and, for example, animal production is frequently featured. The name (Caribbean Food Crops Society) has remained the same, as that branding is well known in the region, but this should not be

taken to indicate a lack of interest in other forms of agriculture.

The most remarkable thing about the CFCS is its ability to attract from the whole of the Caribbean, not just from one political group. At the annual meetings, delegates overcome the language barriers by having simultaneous translations of English, Spanish and French. The Dutch Caribbean people (like their counterparts in Europe) are able to understand everybody, and they usually give their presentations in English; when listening to other presentations the Dutch speakers never seem to need translation whatever the language. Another hurdle everybody overcomes to attend the meetings is the problem of travel within the Caribbean; it is not always easy to get from countries which speak one language to those which speak another.

Table 1 indicates the territories where the CFCS has held its annual meetings. This shows the geographic spread among the different political groupings; although the larger territories tend to have hosted more meetings, some of the smaller territories have managed to host at least one meeting. It will also be noticed that on four occasions, meetings have been held outside the political Caribbean, in countries which nevertheless have Caribbean coastlines (Costa Rica, Honduras, USA and Venezuela). Two

Table 1. Territories where the Caribbean Food Crops Society has held annual meetings, 1963-2010

<i>Territory</i>	<i>No. annual meetings</i>	<i>Territory</i>	<i>No. annual meetings</i>
Antigua and Barbuda	1	Martinique	*4
Barbados	4	Puerto Rico	6
Costa Rica	1	St Kitts Nevis	1
Dominica	1	St Lucia	2
Dominican Republic	5	Suriname	2
Grenada	1	Trinidad and Tobago	4
Guadeloupe	*4	USA (Florida)	1
Guyana	1	US Virgin Islands+	4
Honduras	1	Venezuela	1
Jamaica	4		

\* The meetings in 1969 and 1977 were held jointly in Guadeloupe and Martinique. Hence, although 46 meetings have been held (up to 2010), the total meetings in this table add to 48.

+ These were held in St Croix (2), St John (1) and St Thomas (1)



relatively large countries which have failed to host CFCS meetings are Haiti and Cuba. Haiti and Suriname became the first non-English speaking members of CARICOM in 2002. CARICOM is the community of nations, founded in 1973, comprising former British colonies, with dependent colonies as associate members. Since Haiti joined CARICOM, there have been more linkages with the rest of the Caribbean and only their dire economic status has prevented a more active role of that country in the CFCS. Cuba poses a similar problem of economic difficulties; also it is (even by Caribbean standards) difficult to get flights to Cuba.

The composition of the Board of the CFCS ensures that the diversity of the region is represented. Senior management includes the President, Chairman, Secretary and Treasurer. Ordinary members are elected to represent their language groups; three members each for the English, French and Spanish speakers and one member representing the Dutch speakers. These members are elected for two years, but these are not concurrent, so in any year at least one (and often two) English, French and Spanish speaking representatives is elected. Again this may seem to discriminate against the Dutch, but the reality is that from the Dutch Caribbean (including Suriname) population of just over half a million, perhaps 2-3 delegates go to the CFCS meeting. The populations of English, French and Spanish speakers are probably around 20 times those of the Dutch and these generally manage at least 20 (and usually many more) delegates at the CFCS.

The annual meetings allow scientists to interact with other scientists with whom they normally have little contact due to a language barrier, and give them the opportunity to set up linkages for future development work. The value of the interactions can always be seen in the lively discussions which follow many of the presentations. Apart from the presentation of scientific papers at CFCS meetings, there is a half-day devoted to a Farmer's

Forum, when local farmers present their problems and experiences. This forum and the day reserved for a field trip bring delegates face to face with farming in the host nation.

Another annual session is reserved for the heads of research stations. This facilitates interaction amongst the administrators and research decision-makers represented by deans of university faculties, directors of research stations and senior officials of ministries of agriculture.

## Reference

Lauckner, B. (2009) Agricultural Research in the Caribbean: an outline from Victorian times until today. *Agriculture for Development* 8, 8-12.

**Delegates  
from outside the region  
are welcome  
at CFCS meetings,  
particularly if they have an  
interest in tropical  
agriculture.**

**TAA members interested in  
attending the 2011 meeting  
– likely venue Mexico –  
should check  
announcements on the  
CFCS website at  
<http://cfcs.eea.uprm.edu/>**





## Joint Meeting of the Tropical Agriculture Association (Scotland & North of England Group) and the Institute of Aquaculture, University of Stirling, 29th April 2010

# Challenges associated with increased consumption of animal products: local aspirations – global opportunities

**Report compiled by David Jakinda Otieno (d.j.otieno@ncl.ac.uk)**

**and Helio Lima Neto (helio.lima-neto@ncl.ac.uk), PhD students at Newcastle University**

**(from Kenya and Brazil, respectively).**

There has been an increasing pressure on the livestock sector to meet the global demand for high-value animal protein. The world's livestock sector is growing at an unprecedented rate and the driving force behind this enormous surge is a combination of population growth, rising incomes and urbanization. Annual meat production is projected to increase from 218 million tonnes in 1997-1999 to 376 million tonnes by 2030. There is a strong positive relationship between the level of income and the consumption of animal protein, with the consumption of meat, milk and eggs increasing at the expense of staple foods.

Urbanization is a major driving force influencing global demand for livestock products. Compared with the less diversified diets of the rural communities, city dwellers have a varied diet rich in animal proteins and fats, and characterized by higher consumption of meat, poultry, milk and other dairy products.

There has been a remarkable increase in the consumption of animal products in countries such as Brazil and China, although the levels are still well below the levels of consumption in North American and most other industrialized countries.

As diets become richer and more diverse, the high-value protein that the livestock sector offers improves the nutrition of the vast majority of the world. Livestock products not only provide high-value protein but are also important sources of a wide range of essential micronutrients, in particular minerals such as iron and zinc, and vitamins such as vitamin A. For the large majority of people in the world, particularly in developing countries, livestock products remain a desired food for nutritional value and taste. Can the demand be met through sustainable improvements in production systems?

Despite fluctuations in supply and demand caused by the changing state of fisheries



resources, the economic climate and environmental conditions, fisheries, including aquaculture, have traditionally been, and remain an important source of food in many countries and communities. After the remarkable increase in both marine and inland capture of fish during the 1950s and 1960s, world fisheries production has levelled off since the 1970s. With the majority of stocks being fully exploited, it is very unlikely that substantial increases in total catch will be obtained in the future.

In contrast, aquaculture production has followed the opposite path. Starting from an insignificant total production, inland and marine aquaculture production has been growing at a remarkable rate, offsetting part of the reduction in the ocean catch of fish. Currently, two-thirds of the total food fish supply is obtained from capture fisheries in marine and inland waters, while the remaining one third is derived from aquaculture. Any recent increases in per capita availability have been obtained from aquaculture production, from both traditional rural aquaculture and intensive commercial aquaculture of high-value species.

It is clear that any future increase in protein supply from fish will have to come from increases aquaculture production. Can the demand be met through sustainable improvements in production systems? This is the context for the discussion that is the focus for the TAA branch meeting hosted by the Institute of Aquaculture at the University of Stirling. Four speakers offered their perspectives on the challenges and opportunities in meeting projected growth in demand for meat and fish.

### **1. Addressing the protein gap: the role of livestock?** *(Steve Sloan, Global Alliance for Livestock Veterinary Medicine – GALVmed)*

About 70 per cent of people in the world's poorest 62 countries depend on livestock; improving livestock systems would potentially

have important contributions towards poverty reduction and enhanced sustainability of livelihoods. Although SSA countries are gradually scaling up their budgetary allocations to agriculture, very limited financial flows actually reach livestock and fisheries sectors. It is important to improve access to animal proteins through better animal husbandry, genetics, and more investment in animal health, particularly to enhance quality control. GALVmed works collaboratively with various organizations in making livestock vaccines, diagnostics and medicines accessible and affordable to many local people whose sustenance depends on livestock, more so in the tropics. Currently, GALVmed and its partners are focusing on scaling up the production and addressing weak links in the distribution channels of effective vaccines (which may exist but are not accessible), particularly targeting five priority diseases: East Coast Fever, sheep and goat pox, Newcastle disease, Rift Valley Fever and Porcine cysticercosis. Promoting uptake of research to strengthen the livestock health supply chains is also critical. But development process needs to incorporate greater participation of diverse local communities and governance institutions, better data generation, simple innovations, donor consistency, harmonised regulatory framework, and increased advocacy for livestock.

For more details on GALVmed. Contact:  
[info@galvmed.org](mailto:info@galvmed.org)

### **2. Increasing sustainability of livestock production systems through better use of locally available animal feed** *(Peter Rowlinson, Newcastle University)*

Over the last decade, demand for animal products has increased rapidly; annual growth rates of the livestock sector have been around 3.8% compared to 2.7% for food crops and 1.2% for non-food crops. Demand has been met to a large extent by specialised and intensive production systems. Questions have to be asked about their sustainability given



their dependence on expensive and scarce inputs. What will happen when the oil runs out? On the other hand, livestock contributes to the livelihoods of 70 per cent of the world's rural poor. Questions have to be asked also about how they can benefit from the increased global demand for meat and milk.

It is important that the developing world increases its livestock production as that is where much of the increased demand is going to occur. To achieve this, production per animal needs to rise considerably (Table 1). Of all the factors that currently limit performance, without doubt one of the most important is animal nutrition.

Table 1: Beef production per animal

	<i>Developed countries</i>	<i>Developing countries</i>
Cattle numbers (millions)	410	858
Meat production (million tonnes)	34.6	15.2
Meat production per animal (kg)	84.3	17.7

Emphasis in tropical animal husbandry is changing towards sustainable systems of livestock production based on locally available feed resources (rather than imported grains and supplements). Greater notice is being given to the biodiversity of plant materials and their role in integrated farming systems as a way of improving sustainability. There is a need for increasing knowledge of available feedstuffs and also for a better understanding of anti-nutritive factors in these materials. Considerable potential exists for improving performance of ruminants and non-ruminants.

### 3. Constructing the Neoichthysic –10,000 years on: time for a new revolution? *(Graham Haylor, Natural Resources International)*

Demand for fish has steadily increased as the human population grows, but the bulk of supply still comes from natural water bodies;

recent trends in climate change show that production might decline considerably in the future. A paradigm shift is inevitable if fisheries resources are expected to make significant contributions in the widening proteins gap. Perhaps it might be worthy to incorporate fish production within irrigation projects, seasonal ponds and rice paddies. However, in order to assure sustainability, it is important for relevant stakeholders to clearly define and monitor implementation of regulations necessary to govern the quality of inputs and production methods.

### 4. Turning to the land to grow fish: moving from marine fish meals and oils to vegetable protein and lipids *(Gordon Bell, University of Stirling)*

By 2012 it is likely that 90 per cent of global fish oil production will be consumed in feed for aquaculture systems. This cannot continue. EU restrictions on dioxins and PCBs in feeds could limit use in the near future. In any event, there is an urgent need to counter excessive exploitation of marine resources. We need to find alternative aqua-feeds based on vegetable proteins and oils.

Recent EU-funded research shows what is possible. In salmon and trout systems, replacement of fish oil (FO) with vegetable oil (VO) up to 100% did not affect fish growth or feed conversion. In sea bass and sea bream, replacement of up to 60% of FO with VO had no detrimental effect. Greater levels of substitution were less successful but delaying introduction of the VO diet until fish size reached 250g was successful.

In salmon fed 100% VO, flesh docosahexaenoic acid (22:6n-3; DHA) and eicosapentaenoic acid (20:5n-3; EPA) concentrations were reduced by ~65% while in trout the reduction was ~50%. In sea bass and sea bream fed 60% VO DHA and EPA were reduced by ~50% while in bream fed 100% VO the reduction was ~65%. Generally, reduction of flesh DHA and EPA was less in fish fed diets with a low PUFA content (e.g. olive oil or a VO blend of



rapeseed, palm and linseed oils) than when fed a single VO high in PUFA.

Currently rapeseed, soya, palm and linseed oils dominate the potential FO substitutes based on fatty acid composition, price and availability. New strains of high oleic/low PUFA oils including sunflower (Sunseed), soya and rapeseed may be suitable in the future. However, there are a number of currently underexploited plant oils that could replace some or all of the above and have better compositions and possibly prices. These include, *Camelina sativa*, *Limnanthes alba*, *Cuphea* species and synthesised triglycerides.

Most of the nutrients found in the edible portion of fish are derived from feed. Farmed fish can therefore be “tailored” to deliver optimal levels of fatty acids, vitamins and

minerals to human consumers. By careful selection of feed raw materials, levels of undesirable substances can be limited and controlled. This gives aquaculture produce a distinct advantage over wild fish.

Complete replacement of both fish meal and fish oil will be difficult in carnivorous species but significant reductions of both should be possible with careful raw material selection. Recent studies suggest that farmed salmon could become a net fish protein producer by using low fishmeal/high plant meal diets. We must ensure that essential micronutrients, that may be reduced in diets with high levels of FM & FO replacement, continue to provide adequate levels to ensure fish and consumer health.

For more information:  
[www.rafoa.stir.ac.uk](http://www.rafoa.stir.ac.uk)



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**Summaries of three papers presented at the TAA South-West Group seminar on 'Climate Change: Water Management and Politics' at Cannington Centre for Land-based Studies, 12th March 2010**

# Irrigation charges as an economic instrument for water management

## Introduction

For this presentation irrigation charges (often termed Irrigation Service Fees or Irrigation Service Charges) are defined as the charges made to farmers on Government irrigation schemes for the irrigation supply service provided by the agencies managing such schemes. Improved irrigation charging can contribute to improved water management in two ways: (i) more effective cost recovery by the irrigation agency should, in principle at least, increase the funds available for scheme O&M (operation and maintenance) and thereby bring about improved scheme performance and water use efficiency, and (ii) suitably structured irrigation charges (e.g. a charge per m<sup>3</sup> of water supplied) can possibly reduce farmers' water demand.

The presentation is based largely on work carried out for the DFID-funded China Water Resource Demand Management Assistance Project in 2006/07. Northern China in particular has an extremely serious water resource problem and reducing water demand is one obvious means of combating it. The Chinese were keen to hear about experience

with demand management and related measures from other countries. The main source of information on irrigation charging was the HR Wallingford DFID-funded research project on "Guidelines for Irrigation Charging", which was undertaken in 2002-04. This covered more than 50 countries and included field studies in five countries (India, Macedonia, Morocco, Nepal and Pakistan).

## Irrigation in world agriculture and water use

Irrigation is of crucial importance to world agriculture and also world water use. In 2000 the total world irrigated area was around 280 million ha. This accounted for 19% of the world crop area and provided some 40% of the world's food (yet irrigated agriculture, as a subject seems to feature little in TAA proceedings). About 68% of the irrigated area is in Asia. Interestingly, only 5% is in Africa, most of this being in the north of the continent (Egypt, Sudan, the Maghreb, etc.) rather than Sub-Saharan Africa. Irrigation is much the largest user of water, with 68% of the world total.

**Chris Finney**

**Chris Finney is an agricultural and water resources economist who has spent many years working in development consultancy in Asia, Africa and Latin America. He has particular experience in irrigated agriculture. [chrisefinney61@yahoo.co.uk](mailto:chrisefinney61@yahoo.co.uk)**

## Principal instruments for effective water resource management (WRM)

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There are three types:

- Regulatory Instruments, such as abstraction licensing and water allocations
- Economic Instruments: the use of prices and charges to raise revenue and/or influence users' water use
- Persuasive Instruments or 'soft' measures (e.g. awareness raising), relying on voluntary compliance

Irrigation charges are one particular type of economic instrument. There are various forms of irrigation charge, of which the commonest in developing countries is per crop hectare, variable with the type of crop grown. Since crop hectare charges are usually higher for crops which use more water, like paddy rice, they can in theory influence water demand. Charging per m<sup>3</sup>, by volumetric measurement or sometimes by length of time of water delivery, is the most direct form of irrigation charging demand management tool. Volumetric charges for individual farmers, rather than for water user associations or large commercial farms, are, however, little used except in some high income countries. This is because a volumetric charging system is generally very expensive to operate, owing to the infrastructure, equipment, staff and good management required for accurate measurement of the actual water used.

## Key components of an effective irrigation charging system

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These are:

- Setting the structure and level of the irrigation charge (IC). This is the easiest bit.
- Accurate assessment of the IC revenues due, by, for example, recording the areas and types of irrigated crop grown by each

farmer; a time-consuming operation, prone to inaccuracies and malpractice.

- Efficient collection of the IC revenues due, another demanding part of an IC system's operation.

## Objectives of irrigation charging

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The two main objectives are cost recovery and demand management. Despite the theoretical usefulness of ICs for demand management, in practice cost recovery is the main charging objective in almost all countries. Its advantages include its ease of assessment (with reasonable standards of accounting it is not difficult to calculate the costs to be recovered) and its transparency and acceptability to farmers; since the charges reflect the actual costs incurred they have a greater chance of acceptance than if the charges were based on an estimate of what level of charge would be needed to influence water demand.

For full irrigation scheme sustainability the ICs should include replacement capital costs (pumps, vehicles and equipment, etc), i.e. depreciation costs, as well as the annual O&M costs. In most developing countries, however, only the O&M costs are included. In developed countries ICs normally include depreciation, but even in the higher income countries recovery of the original non-replacement capital costs (canals, dams, etc) is usually not attempted.

## Farmer response to volumetric charges

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In principle, volumetric ICs based on charges per m<sup>3</sup> used or proxies like duration of flow delivery time should influence farmers' water use to a significant degree. That is act as an effective demand management tool. In practice, however, they have little impact. The reason is that in most countries ICs make up only a small proportion of the total costs of crop production, often less than 5%.

According to some estimates, volumetric ICs would need to be 10-20 times above cost recovery levels to reduce farmer water demand substantially. A major IWMI (International Water Management Institute) study covering many countries estimated that charges per m<sup>3</sup> would need to increase 7-10 times to reduce demand. Charges so far above the level of actual costs incurred would normally be socially and politically unacceptable.

*Examples of irrigation charges in different countries, from the HR Wallingford study: -*

	US\$/ha
India, Nepal, Pakistan large gravity schemes	<\$10
Sudan	\$20-35
Italy	\$20-75
Turkey	\$20-100
Colombia	\$20-65
China	\$50-150
Syria	\$50-60
Two Morocco examples	\$155-230
Macedonia example	\$180
Tunisia	\$125-535

This table illustrates the huge range of ICs between different countries, reflecting the large differences in both irrigation costs and irrigation charging policies. In countries like India and Pakistan governments are reluctant to charge farmers the full costs of irrigation supply, for socio-political reasons.

*Data on the actual collection of irrigation charges, from the HR Wallingford study:*

	Collection %	O&M costs recovered
India	N/A	20%
Philippines	58%	46%
Jordan	N/A	50%
Colombia	76%	52%
Turkey	72%	70%
Mexico	92%	85%
Greece	N/A	60%-75%
Argentina, USA, Japan	N/A	100%+more
Australia, New Zealand	N/A	100%

These figures illustrate the unsatisfactory public sector irrigation cost recovery performance in many low and middle income countries. Only in the high income countries shown does the irrigation charging system recover the full O&M costs of public sector irrigation supply. Given this situation, in most countries irrigation charging cannot make its potential contribution to improved water management – its effectiveness as a water management tool is blunted by the inefficient operation and management of the charging system. Even where it is operated efficiently, irrigation charging is not an effective demand management instrument, for the reason given.



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*Overall, there is a need to move away from the tendency of government and donors to attribute all hydrologic changes in Bangladesh to climate change by recognising the dynamic nature of the active flood plains and separating the long-term changes that are happening anyway from additional changes that may happen due to climate change.*

# Can communities living in the active flood plains of Bangladesh adapt to climate change?

Bangladesh is a vast delta formed by silts deposited by three major river systems. The country is subject to significant natural hazards such as floods and, in coastal areas, cyclones but much of the land is stable from year to year. In contrast, land in the active flood plains of the major rivers, locally known as charland, is dynamic as the land is subject to the same range of floods but also experiences erosion and accretion making an extremely hazardous environment. The land area of Bangladesh is 144,000 km<sup>2</sup> (about the same as the United Kingdom) and an estimated 8,450 km<sup>2</sup> falls within the active flood plains. The country's population is about 140 million of which about 6.0 million live in the active flood plains. Most charland households are extremely poor and struggle to survive in the harsh environment on meagre returns from low-productivity crop production and rearing livestock, and day labouring.

Floods are annual events and major floods happen about once in every ten years. During major floods, over 90% of charland is submerged. The braided channels of the major rivers are widening and shifting with the result that an estimated 87,000 ha of land were lost to bank erosion over a decade, while some 50,000 ha of land was accreted. Households living in the active flood plains have adapted to the local environment but they are facing increasing difficulties in maintaining their livelihoods, and their situation will be made worse by possible negative impacts of climate change.

Predicted regional impacts of climate change include rising sea levels, more intense but less frequent rainfall, more frequent and higher flood levels, and increased incidence of draught. The challenge is to interpret these regional changes into what may happen locally while recognising the dynamic nature of an environment where the courses of the major rivers have changed significantly over the centuries. The difficulties in identifying local impacts are compounded by the lack of data and analysis to determine how the hydrologic system is presently changing before factoring in potential climate change impacts.

Charland communities can be supported in adapting to climate change through a range of measures. These including raising the level of homestead compounds to be above flood levels, developing more durable and portable materials for shelter construction to facilitate moving when erosion threatens, household storage of rainwater to ensure access to adequate water for domestic use during droughts, developing drought and flood resistant crop varieties and improving livestock production. Whether charland communities will survive depends on the severity of climate change impacts, but if the worse case climate change scenarios are correct, living in the active flood plains may become unsustainable.





# Adapting to life in a changing world

## Introduction

Tearfund is a Christian relief and development agency building a global network of local churches to help eradicate poverty. Our ten-year vision is to see 50 million people released from material and spiritual poverty through a network of 100,000 local churches. We work directly in response to disasters and in partnership with over 300 organisations in more than 60 countries. On climate change our aim by 2015 is to enable communities to protect themselves from disasters and successfully adapt to climate change in the 26 areas most vulnerable to disaster. International agreement to cut emissions in order to keep global warming below two degrees – and to help poor communities adapt – will cost at least US\$200 billion per year. The importance in Tearfund's approach of working with local communities is to organise and empower them to address the problems they face.

## Three examples of projects

### Bihar India

Details and pictures can be viewed on <http://tilz.tearfund.org/webdocs/Tilz/Topics/Case%20study%20Bihar%20-%20smaller.pdf>

This project worked with communities in the Dharbanga district of North Bihar. A community of landless, low cast agricultural workers was stuck in a cycle of poverty caused by annual floods which meant they had to evacuate their village for up to three months each year often losing houses and possessions in the process. Their problems had been made worse over recent years by flood

defences elsewhere and raised roads to the local town. Working with a local NGO the village development committee (VDC) prepared and implemented a Disaster Mitigation and Preparedness programme that included:

- Construction of escape routes to higher ground
- Provision and maintenance of boats for evacuation
- Building of a bridge with culvert to allow flood waters to flow away
- Installation of raised hand pumps (low level pumps were previously damaged in the flooding)
- Tree planting and changing crops to those with a shorter growth cycle.

These physical interventions improved the situation and saved lives but for longer term the VDCs are working towards:

- Negotiating better conditions with the land owners (challenging the caste system)
- Setting up community saving schemes to pay for development
- Making representations to local government.
- Raising the status of women in decision making.

### Rajasthan India

Details and pictures can viewed on

<http://tilz.tearfund.org/webdocs/Tilz/Topics/DRR/Drought%20Mitigation%20in%20Rajasthan.pdf>

This project works with a community facing recurrent drought. The community has few resources, small plots of land and uses farming practises that depend on fertilizers and irrigation. Village development

## Richard Fisher

**Richard Fisher works for Tearfund, a Christian Relief and Development NGO working in over 60 countries. A retired teacher of Economics and Business Studies, he has worked for Tearfund on projects in Sierra Leone and Afghanistan. In the last year he has visited Zambia (mission hospital and sustainable agriculture projects) and Sierra Leone (education and community projects).**

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committees were set up and these implemented improved water storage. Rainwater is collected and stored in concrete cisterns (each 3-4 meters wide, 4 m deep) and can store sufficient drinking water for 3 families in the dry season. Rainwater bunds (low earth banks) were built around a field to retain rainwater and prevent soil erosion.

### Conservation Farming in Zambia

Details and pictures can viewed on

<http://tilz.tearfund.org/Publications/Footsteps+71-80/Footsteps+77/>

This project aims to encourage farmers to farm in a more sustainable way and reduce dependence on artificial fertilizers.

The main changes from the conventional method of growing maize are:

- Preparation of seed basins (to trap water and fertilizer) in the dry season so planting can begin with the first rains instead of ploughing the whole area after the first rains have arrived.
- Leaving crop residues on the ground to retain moisture and improve soil structure as they break down instead of burning off at the end of the season.
- Crop rotation of nitrogen fixing crops such as cowpeas instead of application of artificial fertilizer.
- Planting trees to trap moisture and prevent soil erosion.

On average this programme leads to increased yields of 1.5 tonnes of maize per hectare.

### Tackling climate change

Despite these and many other good examples of local projects globally there remains a huge problem. It has been estimated that by 2025 the proportion of the world's population living in significantly water-stressed countries will increase from 34 % (1995) to 63 % – some 6 billion people (Simms et al., 2004). About 1.2 billion people – almost one-fifth of the world's population – live in areas of physical water scarcity, and nearly 1.6 billion people

face economic water shortage. Nearly all of them live in developing countries (Comprehensive Assessment of Water Management in Agriculture, 2007).

Tearfund is undertaking policy work on climate change and the water sector. The report 'Separate streams? Adapting water resources management to climate change, Tearfund 2008', aims to identify how climate change adaptation can be integrated within the water sector to benefit the most poor and vulnerable people. A link to the summary is:

<http://tilz.tearfund.org/webdocs/Tilz/Topics/watsan/Separate%20Streams%20summary.pdf>

The report identifies four actions that need to be urgently undertaken:

- Integration between sectors is critical to development planning and for ensuring that action is sustainable in the long term.

Governments and donors must integrate climate risk-based approaches, which address climate variability and climate change, within international and national water policy frameworks. Work towards linking up cross-sectoral approaches (e.g. synergy with land, agricultural, mining and energy sectors) to water resource planning – and ensure that climate risk is considered systematically within these approaches.

- To move towards an integrative approach. Institutions need to be strong enough to allow effective cross-department synergy and policy development, and to draw on lessons learnt from local level.

Governments and donors must give technical and financial support to government institutional frameworks in the water sector at national and local levels. They must support the decentralisation process for the water sector, including efforts to strengthen related institutional, legal and regulatory components and build technical and financial capability.

- The latest science, existing and predicted impacts of climate change, and the current experience and needs of the poorest and most vulnerable communities, all demand



substantially scaled up investment in adaptation.

Governments and donors must invest in targeting differentiated solutions to managing water resources according to the needs of different groups prioritising the most vulnerable groups. They must strengthen local adaptive capacity by supporting localised water resources approaches and by exploring options for how to replicate them on a larger scale

- We cannot make plans without information, and we must ensure that the voices of the most vulnerable communities inform our planning.

Governments and donors must ensure that climate risk information, where available, is made widely accessible and is used to inform international and national water policy and strategic planning. Communities must be empowered to participate in water resources planning and management, so that the poorest people can actively use political systems to meet their water needs. Planning for change is essential as livelihoods and cultures alter as a result of climate change and water scarcity, e.g., provide information on income diversification.

## What progress has been made?

### Mitigation

The Copenhagen Accord decided that we should attempt to limit the global warming effect to 2°C but failed to address how that should be achieved. At least the 'big' players of the US and China were engaged and much has already been written and posted on the web about the failure of these talks to produce a significant and binding agreement which could impact global carbon emissions.

### Adaptation

Some progress was made to help developing countries adapt and mitigate the effects of climate change. \$30 billion fast-start funding

for 2010-2012 with a commitment to \$100 billion per year from 2020. But this is still too little; most estimate \$200 billion per year is needed. It is not clear whether this is a commitment of new money in addition to existing overseas aid budgets. Remember that many nations have still not met the 1972 target of 0.7% of GDP for overseas aid. The new fund also bundles the adaptation needs of the world's poorest nations with calls for compensation (known as Response Measures) for the oil-producing countries which claim they will lose revenue when the world shifts away from fossil fuels.

## Conclusion

The situation today is that there is a lot of good work going on at community level. We are getting better at helping people but education and attitude changes take time. There is a lack of large-scale financial support to meet the expected scale of the problem. The world's leaders have lacked the political will to tackle the source of the problem. Politicians need to take the problem of climate change more seriously and increase funding to help the poor and vulnerable who will be the first to suffer.

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# Newsflash

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## Improved maize for African soils: better harvests and livelihoods

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CIMMYT launched in February this year a new public-private collaborative project for improved food security in Africa. The initiative, known as Improved Maize for African Soils (IMAS), will spearhead the creation and sharing of new maize varieties that use fertilizer more efficiently and help smallholder farmers get higher yields, even where soils are poor and little commercial fertilizer is used. For this project, CIMMYT is partnering with the DuPont Business, Pioneer Hi-Bred; the Kenya Agricultural Research Institute (KARI); and the South African Agricultural Research Council (ARC). IMAS is funded with US\$ 19.5 million in grants from the Bill & Melinda Gates Foundation and USAID.

The launch, which took two days of IMAS stakeholder meetings, was held in Nairobi. The panel of speakers included KARI Director Ephraim Mukisira, Shadrack Moephuli, President and Chief Executive Officer, and Mohammed Jeenah, Executive Director for Research and Development, ARC; Lloyd Le Page, Senior Manager, Technology Acceptance and Sustainable Development, Pioneer Hi-Bred; and Marianne Bänziger and Wilfred Mwangi from CIMMYT. “Like many sub-Saharan African countries, Kenya must optimize the use of its soils for

agriculture to increase food security, and do this while facing climate change, escalating input costs, and a deteriorating natural resource base,” Mukisira said as he officially announced the project. He said that the IMAS project will apply scientific innovations to provide long-term solutions for African farmers, developing maize varieties suited to Kenya’s diverse farming ecologies.

*The project will be led by Gary Atlin, associate director of CIMMYT.*

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## Kernels of co-operation

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Seed security is important for farmers everywhere; it enables them to have access to quality seeds and new varieties at fair prices at the right time. Lindiwe Majela Sibanda, a spokesperson for the Farming First coalition, describes a new system to be piloted in four countries – Malawi, Swaziland, Zambia and Zimbabwe and overseen by FAO and the Natural Resources Policy Network with funding from the Swiss Agency for Development and Co-operation. SADC recently agreed to implement a harmonised seed regulatory system, which should make it easier for seeds to be sold across borders, with less bureaucracy and at lower prices. The scheme will align domestic and regional policies in regard to seed production and distribution, require

staff to be trained in seed inspection and certification, laboratories to be refurbished and upgraded. It will also create a seed catalogue for the whole region and a database and publish updates of the latest crop varieties and production techniques. The seed security project aims to create a more harmonised regional market by integrating smaller seed markets into a larger SADC one, allowing easier movement of quality seeds between countries and reducing cost to farmers of accessing them when needed. Ultimately, the programme should result in a secure SADC-wide system to provide farmers with a stable supply of seeds. In particular, it addresses the needs of resource-poor farmers whose seed systems have been affected by recurrent disasters and inappropriate policies.

*(Source: Guardian Weekly 21.5.10)*

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## Soil organisms aid crop productivity by increasing yields

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Soil-living bacteria and fungi can be used to boost crop yields by more than 50 % without the use of fertilizers, an international research project has found. In combination with fertilizers, yields of key crops such as beans, can more than double, the scientists from seven countries discovered. The findings, the result of an international effort to unravel the mysteries of so-called ‘below ground biodiversity’, are

likely to have important implications for food security and farmers livelihoods and incomes.

The amount of fertilizer needed to boost yields is far less than using inorganic fertilizer on its own. Other important findings are that some of the micro-organisms assist in fighting crop diseases which in turn can reduce the need for pesticides. For farmers switching to organic agriculture – whose produce commands higher premiums on world markets – this could prove especially valuable.

The findings were announced at a May conference at the World Agroforestry Centre, Nairobi. The conference outlined how soil organisms work, where they live and how they are extracted from the soil and packaged to

work in the farmers' fields and in other ecosystems.

The research project, entitled the Conservation and Sustainable Management of Below Ground Biodiversity (CSM-BGBD), has involved scientists from Brazil, Cote d'Ivoire, India, Indonesia, Kenya, Mexico and Uganda. The eight-year project (see [www.bgbd.net](http://www.bgbd.net)) has been coordinated by the Tropical Soil Biology and Fertility Institute of CIAT (TSBF-CIAT) with co-financing from the Global Environmental Facility (GEF), and implementation support from the United Nations Environment Program (UNEP).

Studies in Kenya indicated that inoculation with Rhizobium bacteria increased soybean yields by 40%, 60% and 54% in Homabay, Kabete and Mtwapa, respectively, without the use of fertilizers. However, when the organisms like Trichoderma are used in combination with fertilizers

like Mavuno, from the Athi River Mining Company with added micro-nutrients, bean yields more than doubled. The findings of this project also show significant economic returns. Using Rhizobia as bio-fertilizers, for example, in combination with Triple Super Phosphate (TSP) fertilizers can produce a benefit to cost ratio of 2.3 that translates to a net benefit of US\$253 after cost deductions for one hectare of land. Using the fertilizer on its own has a cost benefit ratio of 1.9 with a net benefit of US\$170 and deploying Rhizobia alone gives a similar cost-benefit ratio with a net benefit of US\$143.

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## Western Kenya cassava project

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Many farmers in Nyanza province in western Kenya struggle to produce enough food to feed their families on land that is degraded and unproductive. Thanks to the support of the National Farmers Union (NFU) through the Africa 100 Appeal, FARM-Africa is working with Community Mobilisation Against Desertification to help farmers in Ugenya and Nyanza districts grow

larger and disease-free harvests of the staple crop cassava. Cassava is essential to feed families but any excess can be processed into cassava chips or flour that can fetch a good price at market.

Devastating plant diseases have ruined cassava harvests in recent times but thanks to this new project farmers are receiving new varieties of disease-resistant cassava that mature faster than traditional varieties enabling them to produce larger harvests. A farmer-managed factory will be established in each district to help farmers earn more money from their cassava by processing it.

Currently, farmers in Nyanza who grow cassava produce 1-3 tonnes per hectare. Their crop takes 12-18 months to mature and has high levels of toxicity. New varieties can produce between 10 and 15 tonnes with low levels of toxicity in just 9-12 months. For an average family, two healthy cassava plants are enough for the day's meals. With 1,000 healthy plants a family will have enough food for the whole year and surplus to sell to improve their household income. The introduction of new variety of cassava aims to enable 3,825 households with around 23,000 family members to produce more.



## BIOTIK

### **Biodiversity Informatics and co- Operation in Taxonomy for Interactive shared Knowledge base ([www.biotik.org](http://www.biotik.org))**

The project aims at creating a first network of South Asian and European partners interested in sharing their knowledge in applied computer science for taxonomy and in the preparation of two CD-ROMs for identifying trees species in two “hotspots” of biodiversity: the rain forests in the Western Ghats of India and in the northern Annamite Mountain range of Lao PDR. The project work plan is divided into 6 overlapping activities over a period of 3 years

#### **Project Abstract**

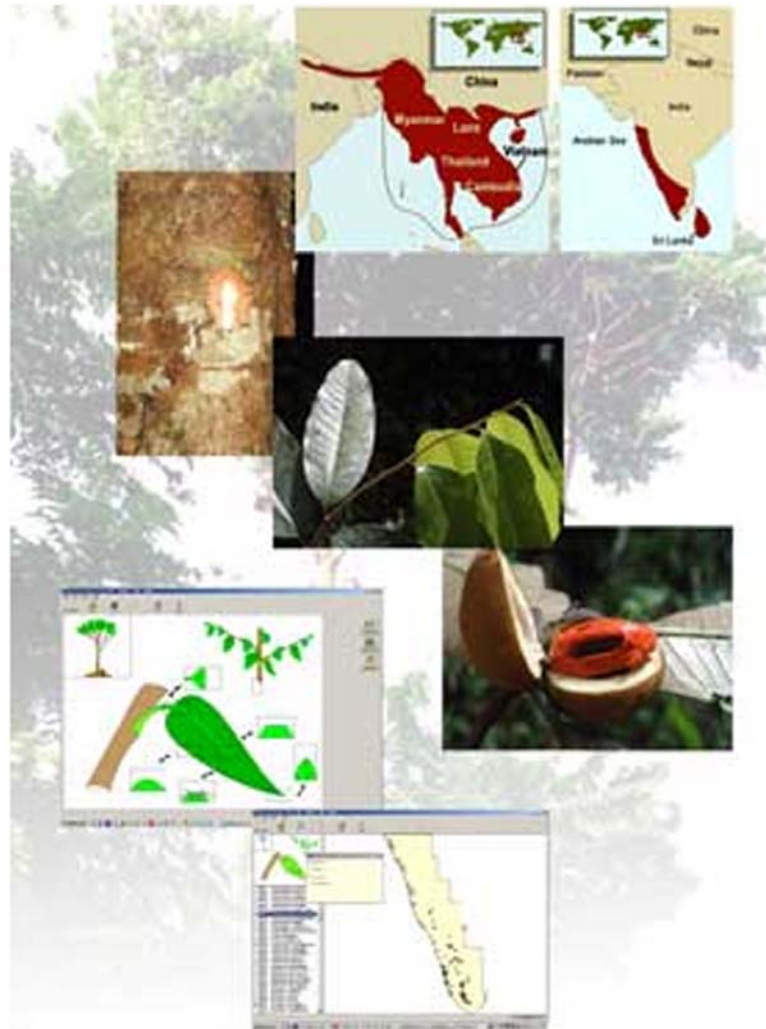
Human pressure on the environment has steadily increased throughout the last few decades, especially in South and Southeast Asia. This part of the world is also particularly rich in biodiversity such that sustainable methods for managing the environment, based on appropriate biological knowledge are in high demand.

The present project is an initiative in the emerging area of biodiversity informatics and aims to develop a knowledge base on two major “hotspots” of biodiversity: the rain forests in the Western Ghats of India and the Northern Annamite rain forests of Lao PDR. The knowledge base, built on a tree species identification system (IDAO), will be instrumental in understanding and assessing the biodiversity

of these highly significant areas, as it would provide and facilitate dissemination of scientific and traditional knowledge. The knowledge base will draw from existing reference herbariums, which will however need to be completed with extensive field trips. Developed as an open source web-based application, the knowledge base will be made available online, on CD-ROMs for personal computer platform as well as on Simputer, a PDA operating on Linux with local language support.

The result would primarily address the needs of stakeholders that are involved in maintaining and preserving these diverse rain forests, including the large scientific community working in these geographical areas and also the government agencies. The partnership builds on the foundations of the pre-existing scientific collaboration

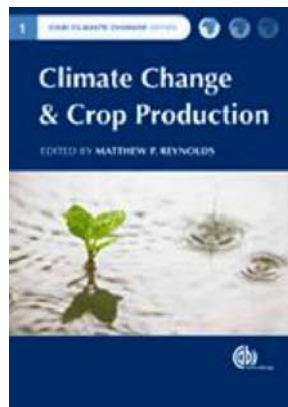
between the various partners who have specialized in developing IT&C applications for taxonomy (IDAO) on one hand, and taxonomy itself on the other hand. The existing collaborative efforts are both at institutional level and through regional networks like European Tropical Forest Research Network (ETFRN). The project also brings together the partners’ demonstrated capabilities in implementing similar actions, viz. a) the development of IDAO, the core module of the identification system by CIRAD, a French agricultural research and development centre, and b) the application of IDAO in the field of mangroves species, funded by the European Commission and implemented by the IFP (French Institute of Pondicherry) and CIRAD.





# Bookstack

## Climate Change & Crop Production



**CABI Climate Change Series, Vol. 1**  
**Edited by M P Reynolds, CIMMYT, Mexico, 2010**  
**304pp, hardback**  
**ISBN 978 1 84593 6334, £85.00**

Current trends in population growth suggest that global food production is unlikely to satisfy future demand under predicted climate change scenarios unless rates of crop improvement are accelerated. In order to maintain food security in the face of these challenges, a holistic approach that includes stress-tolerant germplasm, sustainable crop and natural resource management, and sound policy interventions will be needed. The first volume in the CABI Climate Change Series, this book will provide an overview of the essential disciplines required for sustainable crop production in unpredictable environments. Chapters include discussions of adapting to biotic and abiotic stresses, sustainable and resource-conserving technologies and new tools for enhancing crop adaptation. Examples of successful applications as well as future prospects of how each discipline can be expected to evolve over the next 30 years are also presented. Laying out the basic concepts needed to adapt to and mitigate changes in crop environments, this will be an essential resource for researchers and students in crop and environmental science as well as policymakers.

# Mailbox

## Crop residues for animal feed or mulch

I have a very serious problem with Brian Sims's articles in the last two issues of *Agriculture for Development*, where he writes about Conservation Agriculture. There is no doubt that technically he is right, as we all know and have experienced that the practices he suggests enhance yields. However, I see a very serious problem if crop residues are used for mulching as this deprives animals of off-season feed. Let it be remembered that all East African agriculture has taken, and does take, place in what was grazing land and therefore, potentially, deprives animals of food. Add to this the vastly expanding human population along with the inevitable increase in livestock; what will the animals eat in the dry season if stover, grown on land on which before they grazed, is used for mulch? In Somalia it became mandatory, very strictly enforced by local custom, to harvest the sorghum, maize or bulrush millet and to leave the stems on the fields – not for mulch but for animals, excluded from what was grazing area, to eat in the dry season when grazing was short or absent elsewhere. Let me draw attention to page 36 of the Spring 2010 issue of *Agriculture for Development*, where Richard Smith refers to my obituary of Norman Borlaug, in which I recall how Borlaug forgave me for saying that the flagleaves of his Green Revolution wheat have to be cut off to feed the starving cattle and buffaloes. As for the crop residues to which I have referred, let me quote from Richard Smith's letter in the last Journal: "its unused presence in the field either incorporated or laid down denies livestock a valuable dry-season feed source..." I am supported by both Borlaug and Smith!

Andrew Seager

Whitchurch-on-Thames, Oxon

# TAA Forum

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## Tomato production at Cornerways

TAA East Anglia arranged a very successful visit to Cornerways Nursery, near Kings Lynn. Not exactly 'tropical' for the party of 17, but inside the vast greenhouse the environment was certainly sub-tropical, designed to emulate the South American homeland climate of the tomato.

Nigel Bartle enthralled us for two hours as he talked about his tomatoes, production methods, marketing and plans to expand their 11 ha glasshouse. During their season (February to November) the glasshouse draws waste heat from the adjacent sugar beet factory, as well as CO<sub>2</sub> that would have been emitted to the atmosphere: using such CO<sub>2</sub> doubles the tomato yield. We also saw how the tomatoes are grown up strings from their hanging nutrient blocks of rockwool and wrapped around along the rows as they grow, so that the

ripe fruit are always at waist height. The stems can reach up to 12 m length by the end of the season!

We also observed eggs of white fly on the leaves and the natural predator moth that they use to control the white flies. We inspected bumblebees in their cardboard hives, which pollinate the tomato flowers: there are even coloured flags to show the bees where their hives are!

Thanks to the local supply of virtually free heat and CO<sub>2</sub>, Cornerways can easily compete with Spanish producers, who benefit from extra warmth and sun but are increasingly becoming deficient in irrigation water and turning to distilling seawater. At Cornerways, rain water harvested from the roof is normally sufficient for the growing season and they rely on natural sunlight. Cornerways are proud to be able to offer consumers in the UK fruit that is usually less than a day old, compared with imported tomatoes that may be up to seven days, and with a far lower carbon

footprint (0.5 kg compared with 4.5 kg for Spanish fruit). Cornerways fruit also contain no toxic agro-chemicals.

The moral, according to Nigel, is to buy UK-produced tomatoes, especially those from Cornerways. Another lesson learnt was that one should never put tomatoes in a fridge, if you want to retain their flavour!

Keith Virgo



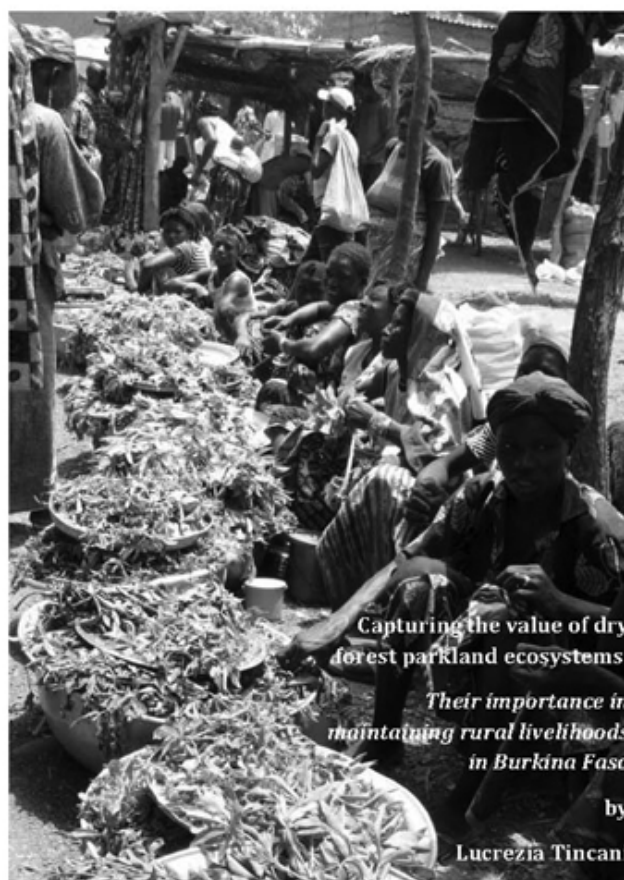


# TAAF News – the View from the Field

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## TAAF currently has three long-term awardees in the field:

**Lucrezia Tincani**, whose study on the poverty-mitigating role of forest resources in Burkina Faso was described in Issue No 8 of *Agriculture for Development*, continues her work with forest-dependent households in two locations to the north and south of Ouagadougou. She is collecting data on the sources of food used by poor households in wet and dry seasons. When grain is in short supply there is greater dependence on the young leaves of tree species including balanites and lelongo: these are mixed with small quantities of sorghum or millet to prepare a meal called “leaf couscous”.



Women selling Baobab leaves in Tschertiba market. ©Tincani 2008.

Capturing the value of dry forest parkland ecosystems:  
*Their importance in maintaining rural livelihoods in Burkina Faso*  
by  
Lucrezia Tincani

Acquisition of land by absentee landowners is reducing the access of poor rural families to forest resources. The data Lucrezia has collected is being used by the NGO Tree Aid to design their poverty-alleviating programmes.

**Simon Howard** has just completed a 9-month assignment with the Lao Institute for Renewable Energy (LIRE) in Vientiane. His initial focus was on the viability of *Jatropha curcas* as a source of biofuel and as an income-generator for small farmers. His conclusions indicate that *Jatropha* cultivation is a desirable option for small farmers only where sufficient land is available for food production as well as cash crop cultivation, where labour costs are low and where surplus manure is available for fertilising the plants. Even in such situations dependence on external markets with fluctuating prices makes *Jatropha* a risky enterprise, for small farmers and even for large-scale plantations.

While working at LIRE Simon was co-opted to a team which prepared a document “Biofuel Policy and Strategy

Recommendations for Lao PDR” (December 2009). Following this assignment he has just moved to a new job in Port Vila, Vanuatu, helping the Government to develop its policy for rural electrification. Further details of Simon’s work in Laos and Vanuatu will follow in a later issue of *Agriculture for Development*.

**Louise Glew** spent 5 months in Kenya last year, evaluating the effectiveness of community-based conservation initiatives as a mechanism for biodiversity conservation and sustainable development. She worked with a local NGO, Northern Rangelands Trust, which supports pastoralists in the arid and semi-arid lands of Northern Kenya. Louise’s work was disrupted by the acute drought which has led to some households in Kenya losing up to 95% of their livestock. She has just returned to Kenya to complete her study, and will report on the outcome in a later issue of the journal.

**A fourth long-term awardee, Katie Hogg**, will commence a one-year assignment in

August 2010 with the Foundation for Protection of Marine Megafauna in Inhambane, Mozambique. The Foundation is responsible both for scientific research and for managing the conservation of this part of Mozambique's coastline. It aims to balance protection of the marine environment (this is an important habitat for whale sharks, manta rays, sea turtles, humpback and bottlenose dolphins) with the sustainable development and livelihoods of indigenous communities. Katie is well placed to undertake this assignment having completed in 2009, with support from TAAF, an excellent dissertation on Participatory Governance of Natural Resources in Utila Island, Honduras, for her MSc degree in Tropical Coastal Management at Newcastle University. For her work in Mozambique Katie is supported by funds contributed to TAAF by our partner organisation Triple Line Consultants Ltd.

**Ten TAAF awards to MSc students were made in April 2010.** This year's call for applications generated a larger number of high quality proposals than ever before. 20 shortlisted applications were submitted by MSc students at 10 UK universities – Bangor, Cranfield, Edinburgh, Imperial College, Newcastle, Oxford, Reading, SOAS, University College London and University of East Anglia. The TAAF Committee selected the best 10 of these applications and made awards of up to £1,000 to each of the students listed in the table.

The calibre of the candidates and the standard of applications received was extremely high. It reflects the eagerness of students to grasp the opportunity that TAAF awards offers for undertaking overseas research, plus the weeding out by their supervisors of non-serious applicants. Presentations made earlier this year at several universities, jointly by past TAAF awardees and a TAAF or TAA representative, also played a part in making TAA and TAAF better known among MSc students.

The MSc awardees are currently in the field: they will be submitting their reports to TAAF in September. Some of these will appear in later editions of Agriculture for Development.

**Financially,** TAAF finds itself in a very difficult position. The budget for 2009/10 was £17,500 (including £2,500 pledged by Triple Line Consulting), with £3,796 held in reserve. Of these sums £15,070 have been spent or committed, leaving £5,726 to be carried forward to 2010/11.

Despite strenuous efforts to seek additional sources of funding for TAAF, the only success registered has been a 3-year grant of £2,500 pa from Triple Line

Consulting, and two personal donations of £3,000 each from TAA members. These supplement TAA's own annual subvention to TAAF, currently standing at £3,000 pa.

To enable TAAF to continue the valuable work that it does, responding to a growing demand from young graduates, supplementary financial contributions must be found. This is no easy task in the current economic climate. An urgent appeal to TAA members to make further individual contributions to support TAAF's work, either as legacies or as immediate donations, will be included in the next issue of Agriculture for Development (alternatively donations can of course be made immediately by

Applicant	University	MSc Course	Research Topic	Country
James Brockington	Bangor	Agroforestry	Assessing effects of agroforestry adoption in the drylands of Karnataka	Karnataka State, South India
Andrew Hughes	Cranfield	Environmental Water Management	Estimation of water transfers in an East African Wetland System	Masaka District, Uganda
Sarah Marriott	Edinburgh	African Studies	Impact of fair trade on livelihoods of smallholder tea growers	Rungwe District, Tanzania
Greta Dargie	Reading	Agricultural and Environmental Science	Quantifying black carbon in Brazilian Amazonia soils under slash-and-burn agriculture	Maranhao State, Brazil
Judith Schleicher	Oxford	Biodiversity, Conservation and Management	Sustainability of bushmeat hunting in Central Gabon	Ogooue-Lolo Province, Gabon
Alice Karpinski	Oxford	Water Science, Policy and Management	Vulnerability of rural communities to glacier retreat in Peru	Rio Santo Catchment, Peru
Gemma Holloway	Reading	Social Development and Sustainable Livelihoods	Assessing long term sustainability of farmer groups and implications for agricultural extension	Mbarara District, Uganda
Lauren Blake	SOAS	Anthropology of Food	Tackling malnutrition among poor agrarian communities in Guatemala	Quetzaltenango Department, Guatemala
Clara Greenwood	UCL	Anthropology, Environment and Development	Ethno-veterinary investigation of tick-killing methods	Swaziland
David Martin	UCL	Anthropology, Environment and Development	Community management of irrigation water in Sikkim	Sikkim, North-East India

# Obituary

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## Peter Walker 1932-2009



Peter Walker, who was born in Leeds and died in Mexico aged 77, spent his working life applying statistical methods to the problems of tropical agriculture. A popular and dedicated scientist, he trained and inspired younger statisticians in the potentialities of good experimental design and modern computing techniques.

Peter graduated in mathematics and statistics at Pembroke College, Cambridge in 1956 and began his overseas career in Nigeria, first for the Ministry of Agriculture at Zaria in the north and then for the Federal Department of Agricultural Research at Moor Plantation, Ibadan. In 1966 he went to Rothamsted to head a section, funded by the Ministry of Overseas Development, to give statistical and computing support to agricultural

research institutes in developing countries. His work took him on assignments abroad, to Ibadan in 1970, the International Maize and Wheat Improvement Center (CIMMYT) in Mexico in 1975, the International Center for Agricultural Research in the Dry Areas at Aleppo, Syria in 1980, and later to Harare, Zimbabwe and to Sri Lanka, again to the International Institute of Tropical Agriculture at Ibadan, and finally retiring to Mexico in 1994. He formally left Rothamsted in 1977, but kept in regular touch with colleagues there.

This adventurous career was even more remarkable because in 1968 he suffered a horrendous accident. An articulated lorry jackknifed across the central barrier of the M1 near Mansfield and crushed the car he was driving. His

wife Yvonne was killed and he received severe injuries. His recovery from this tragedy was slow and painful, and he showed remarkable resilience in returning to his full-time and demanding career in enervating climates.

Peter was a lover of classical music, and with a brilliant mathematical brain it is not surprising that he was a first-class bridge and chess player.

He is survived by Nick and Paul from his first marriage, his daughters Amanda and Polly from his second marriage to Vivienne, and by his third wife Nydia. For his colleagues and friends around the world his departure is a great loss.

# Upcoming events

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## LIST OF EVENTS:

### 26 October 2010:

“Trees: the untapped agricultural asset”. Seminar at Royal Agricultural College, Cirencester (TAA South-West with Rural Enterprise Solutions)

### 9 November 2010:

The Nyika-Vwaza (UK) Trust’s annual lecture by Prof. Anthony Young on “Thin on the Ground: Land Resources Survey in Malawi and the Commonwealth”. Royal Geographical Society, London

### 24 November 2010:

TAA AGM and 28th Annual Ralph Melville Memorial Lecture. Royal Over-Seas League, Park Place, St James’s Street, London

### 15-16 December 2010:

Water and nitrogen use efficiency in plants and crops. Olde Barn Hotel, Grantham, Lincs (Association of applied Biologists)

### 6 January 2011:

TAA South-West Annual General Meeting. Exeter Golf and Country Club, Topsham Road, Exeter

### 6 January 2011:

Cambridge Conservation Forum. 12th Annual Symposium, Judge Business School, Cambridge

## South-West

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### Tuesday 26th October 2010.

*A joint seminar with Rural Enterprise Solutions at the Royal Agricultural College, Cirencester is being worked on. The subject is “Trees: the untapped agricultural asset”. Details will be put on the website.*

**Contact: George Taylor-Hunt on e-mail: [gtaylorhunt@talktalk.net](mailto:gtaylorhunt@talktalk.net) and tel. 01626 362782 or Tim Roberts on e-mail: [robtimk@btinternet.com](mailto:robtimk@btinternet.com) and tel. 01761 470455.**

### Thursday 6th January 2011.

*SW Branch AGM, short presentations, keynote address and luncheon. This will follow the format of previous years at the Exeter Golf and Country Club presenting both current work and a thought-provoking address following the luncheon.*

**Contacts: George Taylor-Hunt on e-mail: [gtaylorhunt@talktalk.net](mailto:gtaylorhunt@talktalk.net) or tel. 362782 or Bill Reed on e-mail: [bimareed@btinternet.com](mailto:bimareed@btinternet.com) or tel. 01258 8202445**

## CCF 12th ANNUAL SYMPOSIUM, 2011

Thurs 6<sup>th</sup> January 2011

Judge Business School



### Preliminary Circular

*The organising committee for the 2011 Annual Symposium is preparing initial plans for the event. We are now seeking potential speakers from member organisations of the CCF.*

*The venue has been booked at Judge Business School. The purpose of the Annual Symposium is to provide an opportunity for member organisations to share topical*

*aspects of their recent research and activities with the wider CCF membership, and to highlight important issues for the coming year.*

*The format will be similar to the successful 2009 & 2010 Symposia. It is expected to include:*

*An introductory overview of the challenges facing conservationists.*

*Presentations from CCF member organisations (20 minutes each, plus 10 mins*

*questions/discussion), with a total of about 10 speakers.*

*A break-out session after lunch for participant interaction.*

*A wine reception and networking opportunity at the end of the Symposium.*

**For more information, please respond to:**

**David Allen**  
**david.allen@iucn.org**

**or Keith Virgo**  
**consultancy@keithvirgo.co**  
**m**

## THE NYIKA-VWAZA (UK) TRUST

*This year's Lecture and Social Evening hosted by the Nyika-Vwaza (UK) Trust will be held at the Royal Geographical Society (Exhibition Road Entrance), London SW7 2AR on Tuesday 9th November 2010. The annual lecture (starts at 6.45 p.m.), entitled "Thin on the Ground: Land Resources Survey in Malawi and the Commonwealth", will be given by Professor Anthony Young. It tells the story of how the agricultural potential of Malawi was assessed, as a contribution both to colonial history and to the history of science. This will be a "must-not-miss" evening for all interested in the capacity of Malawi's land to feed its people.*

*All proceeds from the sale of Malawian merchandise will be invested in the conservation of the Nyika National Park and the Vwaza Marsh Wildlife Reserve, both in northern Malawi.*

**Application forms for Tickets at £18 per person can be downloaded from [www.nyika-vwaza-trust.org](http://www.nyika-vwaza-trust.org) (just click on the "Events/RGS Evening 2010" button) or from Harry Foot at Stowford Farm, Harford, Ivybridge, Devon, PL21 0JD. Email [stowfoots@southdevon.org](mailto:stowfoots@southdevon.org). Tel: 01752-892632.**



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