

GREEN FIELDS: FEEDING THE HUNGRY, RAISING THE POOR AND PROTECTING NATURE IN AFRICA

■ ROBERT (BOB) SCHOLES

Abstract

Several of the key branching-points on the road to a sustainable human future in the 21st century will play out on the continent of Africa. This is for several reasons: Africa is the last continent to begin its demographic transition, therefore much of the future growth in the human population will take place there; Africa is the last place with large areas of agriculturally-suitable soil and climate conditions for major extension of croplands; and many aspects of inequity, from global to local scales, find expression there. This convergence of factors presents threats of highly undesirable outcomes for the global climate, biodiversity loss, widening poverty, hunger and disempowerment. It also offers opportunities to embark on a different development path with much more optimistic consequences. An advantage of being last in the development sequence is that it is possible to learn from those who have been before – Africa commences its phase of rapid change with more available knowledge than at any time in the past. Will the same dysfunctional dynamics that have unfolded in the past and in other places continue to dominate in the future in Africa, or will it be possible to transition to a better path? What would it take to do so?

The New Scramble for Africa

Large parts of tropical Africa are on the cusp of major social and land transformation. In the next three decades the continent will be in a comparable situation to the Amazon and Southeast Asia over the past three decades: the locus of major conversion of forest to croplands, simultaneous migration of people into cities, and potentially large and rapid improvements in nutrition and income. These rapid changes, which are already underway, have both internal and external drivers.

The world as a whole faces a substantial food crisis by mid-century (Beddington *et al.* 2011). The increase in the global population from the current 7.2 billion to an estimated 9–10 billion by the second half of the century (United Nations 2013) will inevitably increase demand, but less so than the shift in dietary preferences among the billions of people propelled

by the wave of human development in South and East Asia. As incomes increase, there is a seemingly inexorable increase in demand for animal proteins – beef, pork, mutton, poultry and fish – whose production requires larger areas of land than diets predominantly based on vegetable proteins. Furthermore, the rising cost of energy, and the risks to the climate posed by fossil fuel use, are driving and increased allocation of land to bioenergy crops. As a result, it is estimated that global agricultural production will need to increase by about 70% above 2010 levels by mid-century (FAO 2009), equivalent to about 1.8% per year. A similar doubling was achieved between 1960 and 2000, partly due to crop breeding and agronomic improvements (a third to three quarter of the effect was due to the vastly increased use of synthetic fertilisers), but to a large degree by expansion of the global cropped area, from 12.8 million km² in 1960 to 48.9 million km² in 2010 (Faostat 2014). While continued incremental improvements in crop genetics can be expected, the returns on effort are diminishing as the fundamental ceiling of biological potential is approached. The unintended consequences of high fertiliser use are now becoming apparent, in climate impacts and the eutrophication of inland and coastal waters. Therefore it is unlikely that the necessary increase in global agricultural production will occur on the current cropland footprint. Lateral expansion of the cropped area is inevitable; and the most likely location is sub-Saharan Africa.

The last major world region that combines high-potential soils with suitable climates for agriculture is in Africa, and specifically the nearly eight million km² (not all arable) that lie between the wet equatorial rainforests and the Sahara desert to the north, and between the rainforests and the Kalahari desert to the south. The rainfall in this zone is above the cropping limit of 600 mm/y, but less than the approximately 1500 mm that supports rainforests but is also associated with high cloud cover, swampy and nutrient-impooverished soils, making it less suitable for short-duration crops. The landforms are mostly high granitic plateaus with deep soils, which while acid and deficient in nutrients such as phosphorus and nitrogen, can be made highly productive through liming and fertilisation. They naturally support savanna woodlands, rather than closed evergreen forests. In south-central Africa (the Angola-to-Tanzania belt) the landscape is relatively sparsely populated, partly because of the historical presence of tsetse fly and the trypanosomiasis it carries, and partly due to soil nutrient deficiencies. The equivalent zone north of the equator, the Guinea-to-Sudan belt, is relatively densely populated and much is already under low-input-low-output agriculture.

The recent well-publicised ‘land grabs’, (Oxfam 2011: allegedly 0.33 million km² in the 2001–2011 period) involving countries and large cor-

porate agribusiness interests from outside Africa, are a manifestation of the realisation that land resources are globally limited, and that Africa offers the last opportunities. The soils and climates in the areas described above are very similar to those in the *cerrados* of Brazil, which underwent rapid transformation to soybean and maize cultivation between 1970 and the present. With known, tested and available agricultural technologies, a similar transformation is likely in Africa. It brings with it substantial opportunities to address longstanding African issues of undernourishment, poverty and ill health. The journey to more diversified, higher-income economies worldwide has generally started with agricultural development. However, the linked land and social transformation also holds the possibility of accelerating climate change, loss of biological diversity and ecosystem services, and increased social inequity and conflict.

Demographic Dividend or Population Explosion?

Populations worldwide grew dramatically when the pre-modern balance between high birth rates and equally high mortality (especially among juveniles) was upset by a reduction in death rates, largely driven by improved sanitation, and secondarily by improved medical care and nutrition. The experience, again worldwide and across cultures and circumstances, is that the birth rate gradually falls to equilibrate with the new expectations of survival and longevity. This process takes several generations. It is accelerated by improved wellbeing, specifically education and economic opportunities for women. Most regions of the world have gone through this ‘demographic transition’ or are in the midst of it; most of sub-Saharan Africa has not. It can therefore be predicted, with a high degree of confidence, that the population of sub-Saharan Africa will rise from its present 800 million to about 2 billion by about mid-century (United Nations 2007), a growth rate of about 2.6% per annum.

At the same time as growing overall, Africa (like other developing countries, and like the developed countries before them) is undergoing rapid urbanisation. The urban growth rate is about 3.9% per annum, the highest in the world. The cities growing fastest are often not the largest ones currently: Ouagadougou, Niamey, Kampala and Dar es Salaam are among the emerging metropolises, joining Kinshasa, Lagos, Luanda, Abidjan, Addis Ababa and Nairobi.

The urban migration is apparently driven by the usual combination of diminishing livelihood opportunities in rural areas coupled with better access to jobs and services in urban areas, dire as those might be. A third element is increasingly common – the movement to the cities of domestic

and international refugees, displaced by lawlessness in failed states, environmental disasters such as famines and floods, or by the loss of access to lands on which they formerly lived.

Rapid population growth is typically seen as a challenge to those responsible for job provision, education, food security and the avoidance of environmental degradation. Those more focussed on the availability of labour and the growth of markets see it much more positively. Countries with static and aging populations find it increasingly difficult to service the needs of the elderly, and can only grow their economies through technical innovation. The large cohort of young people in fast-growing Africa, on the other hand, represents a potential market for goods, from beer to cell phones, the demand for which has already saturated elsewhere in the world. This is the 'demographic dividend'. A third viewpoint is that, in the event that economies do not grow at a commensurate rate, a large pool of unemployed young men is often a precursor to violent conflict.

Darkest Africa: a worst-case scenario

This scenario is an extrapolation of tendencies currently underway, and the unfolding in Africa of patterns that were displayed elsewhere in the world. In this scenario, a self-serving and corrupt political elite alienate large portions of the land from those who currently live there and turn them over to better organised, wealthier actors (either international or national) whose objectives are overwhelmingly the maximisation of short-term shareholder profit. The government agencies charged with the enforcement of environmental and social welfare regulations are understaffed, under-resourced and under-trained to exercise their responsibilities effectively, and the legal system is insufficiently strong to defend the rights which are infringed. Because of the uncertainties of tenure and the absence of a land ethic, agricultural development is unplanned and deliberately ignores social and environmental externalities, while enjoying positive externalities such as tax holidays and subsidies on agricultural inputs. The fullest possible portion of the land concession is converted to agriculture, as quickly as possible, with export of high value timber and burning of the rest, resulting in a large transfer of carbon dioxide to the atmosphere.

Since the local agricultural markets are weak, the production is devoted to globally-traded commodities such as cereals, industrial starches, sugar and soybean, many of them destined for use in biofuels and animal feedlots, rather than human consumption. The farm scale is very large, and since the management is technically complex, it is dominated by expatriate skills. A small fraction of the displaced rural population finds employment in low-

paid, unskilled tasks on-farm and an even smaller fraction in skilled positions such as machine operators. The remainder join the urban poor, leaving only the elderly and the very young in the rural areas, scratching a living from small plots wherever they can settle. The shrinking area of woodland landscape is cut over repeatedly for charcoal production for use in the towns, a trade that is facilitated by the building of roads to supply inputs to the farms and to take their produce to the coast for export.

The cultivars used are bred specifically for the scale and type of agriculture, and sourced from one of a small group of seed producers. They are not viable for use outside this context and are generally not fertile in the second generation. Fertilisation (and irrigation, where irrigation is used to bridge dry seasons) is at the level which will result in maximum enterprise profit. This is well in excess of the amount of nutrients taken up by the plants, so the surplus is emitted as the powerful greenhouse gas nitrous oxide, and accumulates in the groundwater and rivers. Since the price of the water used for irrigation is just the price of pumping it out of the river, inefficient forms of irrigation are used, leading to flow reductions in the rivers and their pollution with silt, salts and nutrients in the return flows. River, lake and coastal fisheries decline as a result. Tropical pests and weeds are combatted with large doses of biocides, often using products whose use has been discontinued in developed countries. The explosion of seed-eating birds is combatted by aerial spraying of the wetlands where they nest. Large herbivores and primates are incompatible with the cropping system, so they are shot on farmland and restricted to national parks, where they are poached by the rural poor.

There is a great increase in agricultural production, but the largest part of the value addition is captured by the corporations who operate the value chain, and by the elite who service them. The commodities produced are exported in near-raw form, except in cases where it makes sense to process them under a lax set of environmental or health regulations. There is a proliferation of industrial-scale feedlots and poultry production facilities, with wastes producing methane in open lagoons and spilling into the rivers.

This development path is clearly detrimental to both natural resources and to the welfare of a large number of people. Its proponents justify their actions by arguing that exploitation is a necessary first phase of development – there must be wealth accumulation, economies of scale and globally competitive terms of trade. Natural capital will be drawn down temporarily, but will be restored once the overall wealth level increases, and with the growing appreciation for nature by the urban population. However, that time never comes in Africa, because the overloaded cities do not manage to enter a virtuous

cycle of rising education, improving education and improving services. Instead they polarise into gated communities of the wealthy, in a sea of lawless slumlands. Exporting the environmentally-damaging industries to the developing world is no longer possible, because this is the end of the line.

Living Landscapes: a more positive vision

We have the knowledge and tools to take a different path to the one painted above. Rather than repeat mistakes, African leaders can choose to leapfrog or bypass them. Africans, as much as anyone, deserve the chance to reduce the number of undernourished people and to provide economic benefits to the poor; denial of the opportunity to use their natural resources to achieve these ends amounts to a different kind of injustice. But it needs to be done with an eye to sustainability and equity.

In this scenario, several million hectares of Africa undergo a 'green revolution', leading to sustained higher agricultural production, agro-industries, better infrastructure, reduced hunger and rising incomes. However, it happens in an integrated way, rather than haphazardly, and within the social and environmental limits determined by experience elsewhere in the world. Critical ecosystem service resource areas are protected from the start, and within the landscapes that are prioritised for transformation, corridors of semi-natural ecosystems remain. The agriculture is diverse in scale, tenure and product, and there is an emphasis on value addition and nutritional security. There are commercial-scale farms interspersed with family-scale enterprises, sharing infrastructure; many are devoted to vegetable, fruit and timber crops. The landscape is multi-functional, providing food, fibre, fuel, water, biodiversity habitat and amenity. There is a net movement of people to regional towns and cities, where development is also planned and integrated with urban agriculture, green spaces and water, energy, health and education service provision. The economy is diverse, including agriculture, mining, manufacturing, services and tourism, and both the absolute number of poor and the relative levels of inequality are declining.

What will it take to reach a sustainable African future?

The Living Landscapes scenario makes several assumptions: that a combination of a spreading awareness of rights in Africa, the growth of a skilled middle class, and international ethical pressures reduces the power of elites and their clients to help themselves to resources in Africa; that good governance and rule-of-law become the norm; and that international economic and political circumstances permit the space for Africa to develop. A market-led approach is the one most likely to unlock and spread the benefits, but it needs

to be within a framework of social responsibility. The key issue is that the surpluses generated from the exploitation of the abundant African natural capital must be retained in Africa and efficiently converted to social capital.

The first step is to base the spatial pattern of agricultural development (including its location, scale and spatial arrangement) on a sound knowledge of the resource potential of the landscape, rather than to allow it to occur haphazardly. The potential is defined both in terms of agricultural productivity and in terms of the other ecosystem services it presently or potentially supplies – such as timber, water and wildlife habitat (Scholes and Biggs 2003). These potentials are not homogeneously distributed in the landscape at any scale. Therefore it is possible to achieve better tradeoffs between competing land-uses, by placing the developments where they achieve most benefit for least cost. The techniques to do so have been developed for the converse problem – trying to protect fragments of biodiversity in already largely transformed landscapes (Murgulis and Pressey 2001) – but it can achieve more by being applied before development, to the optimal placement of areas which are to be transformed. The logic applies at scales all the way from global (growing crops where they are best suited, rather than where history or subsidies promote them, means that the global production per unit land can be maximised), through the national (defining priority development nodes and protected area networks) to the landscape (leaving buffers around rivers to help suppress floods and absorb pollutants).

The second insight involves a clear understanding of the form and nature of tradeoffs when a given parcel of land is transformed to cropping. Most of the *in situ* loss of biodiversity and non-agricultural services occurs with the act of transformation (Green *et al.* 2005). The further loss of local natural capital and biodiversity as agricultural intensification proceeds on the transformed land is relatively smaller. The off-site impacts, on the other hand, rise with agricultural intensification, also in a non-linear way. Typically they increase steeply above a certain point – for instance the point at which crop growth can no longer absorb the applied nutrients efficiently, or where applied irrigation exceeds the profile water holding capacity. The benefits of intensification in terms of crop yield generally show the opposite non-linear pattern – they rise most steeply for the initial increments of inputs, and then saturate as other factors become limiting. Therefore a window exists for intensification, where the onsite benefits outweigh the offsite costs; furthermore, the onsite benefits (within this window, in terms of increased production) spare the highly detrimental transformation of further land area. Therefore agricultural intensification *per se* is not the problem, but inappropriate intensification – either too much or too little – is.

The third step is to place natural resource-based development within a strongly equity and rights-based framework, and establishing the institutional machinery to enforce it. Firstly, the minimum benefit flows from nature are recognised as a right of all people in the country, both now and in future. About a fifth of the land and ocean area needs to be set aside as protected areas, both for the protection of biodiversity and to ensure flows of critical ecosystem services, in a targeted way rather than just using those fragments seen as useless for other purposes. Minimum ecological flow regimes in rivers must be established and water, food and air quality standards must be enforced. Secondly, the distribution of benefits accruing from the use of natural resources must be made broad-based. This can be achieved by ensuring that use allocations are transparent, law-based, recognise valid prior use rights, and have a fair mechanism for subsequent redistribution. The playing field in terms of access to capital and skills needs to be levelled through the formation of cooperatives, co-ownership and extension schemes. Resource rentals must be set and adjusted to permit reasonable return on capital, effort and risk; but not to encourage wasteful use and windfall profits. The income generated from resource rentals should accumulate in a sovereign fund, whose profits are used to protect and restore natural capital and grow social capital, particularly through education. Thirdly, externalities must be minimised by ensuring that the cost of off-site damages accrue, as far as possible, to the account of those who caused them and benefited from the actions.

To achieve this outcome, most of the internal and external interest groups will need to modify long-cherished notions. The conservation community will need to accept that Africa as a giant game reserve or climate buffer for the rest of the world is neither viable nor equitable; that large areas of natural vegetation will be transformed; and some species and wilderness will be lost. The development community will need to abandon its fixation with the ideal of a self-sufficient peasant farmer, using only organic production techniques; and accept larger scale, more intensive enterprises as a necessary part of the equation.

References

- Beddington J, Asaduzzaman M, Fernandez A, Clark M, Guillou M, Jahn M, Erda L, Mamo T, Van Bo N, Nobre CA, Scholes R, Sharma R, Wakhungu J. 2011. *Achieving food security in the face of climate change: Summary for policy makers from the Commission on Sustainable Agriculture and Climate Change.* CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org/commission.
- FAO 2009. *How to feed the world in 2050.* United Nations Food and Agriculture

- Organisation, Rome.
- FAOStat. 2014 *Global database of agricultural areas*, <http://faostat.fao.org/> accessed 8 April 2014.
- Green, RE, SJ Cornell, JP W Scharlemann and A Balmford. 2005. Farming and the Fate of Wild Nature *Science* 307, 550-555. DOI: 10.1126/science.1106049
- Oxfam 2011. *Land and power. The growing scandal surrounding the new wave of investments in land* ISBN 978-1-84814-970-0 in September 2011.
- Margules, C.R. and Pressey, R.L. 2000. Systematic conservation planning. *Nature* 405, 243-253 <http://dx.doi.org/10.1038/35012251M3>
- Scholes, RJ and R Biggs (eds). 2004. *Ecosystem services in southern Africa: a regional assessment*. CSIR, Pretoria.
- United Nations 2007. *Demographic Yearbook 2003*. Demographic Yearbook (Ser. R), No. 34 ISBN 13: 9789210510974 836 pp. United Nations, Department of Economic and Social Affairs.
- United Nations 2013. *World Population Prospects: the 2012 Revision*. Vol. 1 and 2. United Nations Department of Economic and Social Affairs.