Wilton Park

Conference report

Global land use: Policies for the future

Monday 26 – Wednesday 28 September 2011 | WP1116

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This conference was the second in the series 'Agriculture, Food and Land Use: The International Policy Challenges'. The three year programme is a joint partnership between Wilton Park and the University of Exeter. The report for the first conference, 'Global food and agriculture: policy options in response to increased volatility', is available at http://ow.ly/73cdT

The next conference in this series will address diet and nutrition. It will take place at Wilton Park from 23–25 April 2012.

Summary

As a finite resource, land requires careful management and involves complex policy choices at national and international level. Land is at once a global and a local issue. Its uses in the 21st century are affected by many factors including climate change, population growth, increased urbanisation, high energy costs, dietary change, water scarcity, and within agriculture, competition for land between food, feed and industrial uses such as biofuels, making it an increasingly global concern.

The conference considered the world's uneven distribution of arable land; the state and benefits of its soils; the role of ecosystems services; the impacts of biofuel production on land use patterns; technologies such as genetic modification and hydroponics to improve yields and/or reduce the need for land; and investment in land abroad for food production and speculative purposes.

In spite of the relationship between soils and human and plant health, and their role in ensuring food security, soils have been largely neglected in policy and educational spheres due to a lack of political and public interest. Effective soil-related policies require action plans, implementation mechanisms, and international cooperation.

Ecosystems provide a range of services from food to recreational benefits. Ecosystems services are often seen as separate from food production, so integrated policies, which support farmers and take land use determinants into account, are needed. Ecosystems services were also considered from a land manager's perspective, for whom a business approach is the only way to scale up successful initiatives.

The impacts of biofuel production on land use vary, so assessment needs to be crop-specific. Demand for biofuels was seen to be policy- rather than market-driven, as governments have invested heavily, both financially and politically, in the development of biofuel industries. This means their ongoing production is thought to be inevitable, including by environmental campaigners, who now lobby for stringent sustainability standards. Changes in the aviation industry are likely to lead to greater use of biofuels under the European Union Emissions Trading Scheme. Competition for land between food and biofuels is being tackled in Brazil through land management practices such as agro-ecological zoning.

Recent overseas land investments for food and/or biofuel production were discussed with particular reference to Africa. Features of these investments include the scale and speed of

the transactions; the secrecy and power asymmetries often present in the negotiation process; misapprehensions about 'empty' or 'vacant' land; and the lack of awareness by local users that land has been sold or leased. There is growing concern that land acquisitions are taking place in countries with weak land governance, where traditional methods of land ownership and allocation do not involve conventional land titles, which raises complex questions about land ownership, its use, and future food security.

Investment in Africa is welcome but effort needs to be made to ensure that it benefits local populations and that their claims to land and other natural resources are not ignored. The Food and Agriculture Organization-led international voluntary guidelines on the topic, due to be finalised in October 2011, are intended to provide a framework on which investors and local stakeholders can draw. Rwanda's National Land Policy, implemented in 2005, which converts all types of land tenure to one statutory form, was commended.

The conference concluded by looking at the debates surrounding genetic modification. It was seen to be one of several available solutions to raising food production, but overcoming negative, social and political attitudes about the approach is challenging. Hydroponics and aquaponics were also discussed and examples of pioneering work in Saudi Arabia were highlighted.

Introduction

1. Land is both a global and local issue. Factors affecting its uses in the 21st century are complex and interact. They include climate change, population growth, increased urbanisation, high energy costs, dietary change, water scarcity, and growing competition for land, in particular between using it for food, feed and industrial uses such as biofuels.

2. The outcomes of these pressures are manifest in different ways, from impacts on soils and ecosystems, to land investments abroad and ensuing questions of land rights and the ownership of local resources.

3. How land is used is an integral part of food security debates, and, as a finite resource requires careful management. This leads to difficult policy choices, often made in the context of incomplete evidence and significant power asymmetries, based on interacting national and international, cultural and scientific, political and economic criteria.

Global land resources and projections for the future

4. According to the Food and Agriculture Organization's (FAO) analysis of global land use between 2005 and 2007, arable land constitutes 1530 million ha, compared with 4055 million ha of forest, 3374 million ha of meadow and pastures, and 4060 million ha which are devoted to other uses.[1] While land suitable for arable farming can still be found, it is unevenly distributed and affected by many constraints, such as being settled, under forest, protected, or suitable for very few crops.

5. It is estimated that by 2030 an additional 81–140 million ha of arable land will be needed globally for food production and 44–118 million ha for biofuel crops. (In order to predict future arable land uses, projections of food and feed demand, production levels, crop yield developments, trade patterns, and land use changes were used).

6. World population, which is predicted to increase by 2 billion by 2050, and to peak at around 9.5 billion in 2072, is set to be a major factor affecting land use. Yet, such figures mask the fact that population growth will be predominantly in urban areas of developing countries. 'Malthusian islands' are expected to develop in countries such as Niger, whose population is predicted to rise from the 12 million recorded in the year 2000 to 120 million in 2100. Niger is also likely to be affected by climate change and resulting emigration to Europe and elsewhere in Africa.

Soils and soil policies

7. Soil is also a finite natural resource, which is both unequally distributed around the world, and highly sensitive to mismanagement. Although human behaviour has been affecting soil for millennia significant negative impacts have been observed since the Industrial Revolution and have become particularly prevalent since the 1950s. Soils are affected by many things, including over- intensive production methods, water (its scarcity or excess or salinity), deforestation, desertification and land degradation. Types of soil degradation include water and wind erosion, as well as chemical and physical deterioration.[2]

8. The benefits of soils are considerable; supplying nutrients and water to crops and act as buffers against nutrient loss and pollution. Grassland soils, in particular, also act as carbon reservoirs. Organic matter in soil is of particular importance but is being lost, a fact that tends to be ignored, including in food security debates.

9. Soils have been neglected in policy and educational spheres due to a lack of political interest in the topic. Although soils continue to be poorly managed in many parts of the world, more is now known about them and their requirements. Links between soil condition and connections to human health have become better understood as the mechanisms involved in the flow of nutrients from soils to plants and then to humans have been tested out.

10. Various policy-related questions were raised, such as what can be done to foster sustainable soil management and restoration at the international level? What policy interventions are needed to put soil on the global agenda? What soil policies are necessary to create healthy people and a healthy planet? And, the best ways to create public interest in soils. In the case of the latter, it was argued that either the issue needs to be linked to another topic of public interest such as climate change, or, to the natural environments which people enjoy recreationally.

11. Ways to make soil policies more effective include considering both soils' temporal and spatial scale, having specific, soil-oriented action plans at local, regional and global levels, clear responsibilities, quantitative targets, implementation mechanisms, and increased international cooperation and synergism. The Global Soil Forum[3] is working towards such ends and sees food security, climate change mitigation, land degradation, and biodiversity, as examples of issues that can be addressed internationally, linking human and social dimensions.

Ecosystems[4] services

12. The term ecosystems services may be fairly new but the concept is not. Farmers have been delivering and influencing this approach since land cultivation began. Its benefits include: provisioning services such as food, water, fisheries and timber; regulating services, for example water filtration, storm protection and carbon sequestration; supporting services – photosynthesis, soil formation, and nutrient and water cycling; and, cultural services such as recreational and aesthetic environments. The ecosystems services model attempts to unite the natural and social sciences and highlights the importance of ecosystems, which are often taken for granted and undervalued.

13. In developing countries, in particular, many people depend on the benefits derived from ecosystems services. In Niger, for example, around 5 million ha have been brought back into food production through the planting of 200 million trees in the Sahel which has helped reverse the tide of desertification from the Sahara and has allowed the production of an extra half a million tonnes of cereals. It illustrates how land degradation can be reversed without costing billions of dollars. Interestingly, the success of the tree-planting initiatives in Niger was, in part, due to the government being in a weak position following structural adjustment policies. This meant that certain barriers to the re-greening project, such as the Forest Service claiming ownership of the trees, were removed. Some of the success was also down to nature,

as well as changes in the Sahel's climate.

14. Tree-planting initiatives have also occurred in Burkina Faso, Ethiopia, Mali and Rwanda. Their benefits have been particularly evident in border areas when compared to neighbouring countries which have not adopted such policies.

15. Approaches that integrate ecosystems services and food production are required in the future, so that they cease to be viewed as separate issues. Integrated approaches include supporting farmer innovations, scaling up small investments that can be replicated elsewhere, and providing training and information.

16. It was argued that debates about ecosystems services are often lost when high-tech solutions are applied. This is compounded by the fact that benefits derived from farming, such as culture and community, are notoriously hard to measure.

Ecosystems services from a land management perspective

17. Land management is central to debates concerning the demand for food and fuel, carbon management, development, and human health. The ecosystems services approach provides the opportunity to recalibrate public and private sector relationships, and to integrate existing regulatory and market drivers. However, if the ecosystems services model is to become the norm, improved communications and understanding are required. Policymakers need to recognise that adaptation takes time and costs money if engagement with farmers is to be achieved. In the case of the UK, it was argued that land managers do not need further initiatives but opportunities to bring existing ones together, so that they have a consistent set of policies.

18. How to work successfully with farmers was also discussed with reference to Cuba,[5] where farmers have become aware of their capacity to generate knowledge, and researchers have realised that they need to share their experiments with farmers in order to understand how they work in local contexts and conditions.

19. Land management is critical to the success of ecosystems services as there are necessary trade-offs, which may be influenced by the values of decision-makers. It was argued that a business approach to ecosystems services is required, as those managing land aim to operate for the long term, whereas governments tend to focus on shorter-term objectives. Business dynamics are also important to enable successful initiatives to be scaled up.

Biofuels and impacts on land use

20. Biofuels sit at the intersection of several policy areas including agriculture, energy and transport. Policies supporting biofuel production are not new. Brazil, the European Union and the United States have been developing biofuel industries for the purpose of energy security for several decades. Environmental rhetoric has only been invoked more recently. The motivations for the production of biofuels included energy security, climate change, mitigation strategies (through emission reductions) and agricultural support mechanisms.

21. A new driver for biofuel production is the aviation industry. From 1st July 2011, airlines have been permitted to use up to 50 per cent of hydro-processed esters and fatty acids (HEFA)[6] blended with Jet-A kerosene. Airlines such as KLM and Lufthansa now operate certain routes using this blend of fuels. From 2012, Europe's airlines will be required to reduce their emissions by 3 per cent under the European Union Emissions Trading Scheme. The fastest way to do so will be to start using HEFA. Emissions from burning HEFA, unlike other biofuels such as ethanol and biodiesel whose life-cycle emissions are compared to those of petrol and diesel, are assessed to be carbon-free. However, the emissions associated with the indirect land use changes that may follow these developments have yet to be ascertained fully.

22. In terms of assessing the impacts of biofuel production on land use analysis needs to be crop-specific. Also, the effects of different crops are not easy to compare. Jatropha, for example, can be grown on degraded land but the economic costs of doing so are

very high.

23. The question of whether biofuels reduce CO_2 emissions was raised. Again, comparison is difficult, as emission levels vary between crops and so, in turn, do consequences for land use. The demand for biofuels can lead to a domino effect of land use change around the world. For example, land use patterns in the Ukraine have been influenced by demand for rapeseed oil from the European Union.

24. Demand for biofuels is predicted to increase in the future. Some argue that the demand will rise if significant amounts of agricultural land are diverted to biofuel production. This prediction is based on the Jevons Paradox, which argues that as technological developments increase the efficiency with which a resource is used, consumption of that resource also increases. A comparison was made with demand for coal in Britain in the 19th century which rose, rather than fell, when furnaces became more efficient.

25. Others argue that demand for biofuels is policy- rather than market-driven. Governments have invested financially and politically in the development of biofuels and so are unlikely to reverse their approach. Policymakers have become locked in by decisions made before scientific evidence drew attention to any of the disadvantages of biofuels. It was argued that neither governance nor evidence has been well-used in this area.

26. The continued production of biofuels is seen as inevitable, including among environmental lobbyists, who now campaign for stringent sustainability standards. There is a proliferation of voluntary guidelines to this end, which can make it difficult for policymakers to choose between them. Moreover, as long as only certain countries demand sustainably produced biofuels, producers not meeting such criteria will simply sell to less demanding markets. Voluntary standards are also no substitute for government policy, as they tend not to take macro-level issues into account.

27. When considering the demand biofuels place on land, it is important to look at what is actually taking place. The speed at which changes in the industry are occurring, combined with the industry's role in promoting biofuels and the ongoing scientific disputes about environmental impacts, render it challenging for policymakers to catch up with developments and to devise settled policies.

28. As the on-going expansion of biofuel production, combined with other factors, may exert pressure on domestic food prices, safety net policies and programmes need to be considered to protect vulnerable groups. Ensuring open agricultural commodity markets and subsidy reductions was also recommended. Although biofuels have destabilised markets due to the rapid increase in their production, price volatility cannot be attributed to them exclusively, as it results from several different factors.

29. The international policy orientation needs to be towards promoting harmonious policies for food and biofuel production, but how this challenge is addressed will vary by country.

Biofuel production and land use in Brazil[7]

30. Two questions were addressed with reference to Brazil. First, whether there are land management systems that can make food and biofuel production more compatible. And second, what policies are appropriate for the sustainable production of both food and biofuels.

31. In response to the first question, the example of agro-ecological zoning (AEZ), practised in Brazil for sugar cane production since 2009, was given. It has many benefits for the environment and biodiversity and promotes the rational utilisation of natural resources, technology and financial capital.

32. Certain areas are excluded from AEZ, such as those with native vegetation, indigenous land and that located in the Amazon and Pantanal biomes. Such exclusions mean that the expansion of sugarcane[8] AEZ will include areas already under agricultural production. Thus, potential conflict between food and biofuel production via direct land

use change in sugarcane AEZ areas will be avoided.

33. Indirect land use change – when crops displaced by sugarcane encroach on other land – is being addressed by policies to complement sugarcane AEZ such as the Soy Moratorium and the Forest Code, among others.

34. Regarding the second question of which policies are appropriate for the sustainable production of both food and biofuels, the zero tillage integrated livestock system was proposed, as it can enhance the production of food and fuel and help to mitigate environmental degradation. Other solutions include double cropping, i.e. cultivating crops that are planted sequentially in the same area in a single cropping year.

Land and national self-sufficiency

35. The Chinese government is aiming for food self-sufficiency by 2030, with the exception of soya beans where in 2010 China imported 56 per cent of the world's soya bean trade (55 million tons). Government policies to achieve even higher levels of self-sufficiency in China include: land reform, the liberalisation of grain markets, agricultural subsidies, the preservation of arable land, investment in irrigation,[9] such as the Joint Water Diversion Project, and the promotion of agricultural science with high levels of spending on research.

36. Some argued that, in general, notions of national self-sufficiency are illusory, as no country can expect to be entirely self-sufficient. Even when levels of self-sufficiency appear high, animal feed is often being imported. This needs to be taken into account in self-sufficiency definitions.

37. Some countries are currently seeking ways to become more self-sufficient, having discovered that they could not rely on global markets during the recent food crises for several reasons, including the application of export restrictions.

Land use and increasing production

38. Seventy per cent of the world's land is only a quarter to a third as productive as it could be. There is therefore a lot of scope for intensification. For this to be sustainable, however, the challenge is to increase yields while using fewer inputs, reducing use of fresh water, finding ways to decrease air, land and water pollution. Crops need to adapt to a hotter, drier environment, as the temperature range in which they were domesticated has changed in some parts of the world.

Genetic modification (GM)

39. GM is one of several available technologies, which it is believed could lead to significant increases in production. Examples of genetically modified (GM) crops were given, including Bt maize, which is genetically altered to express a toxin poisonous to insects and animals, and potatoes modified to resist blight. The major benefit of such modifications is the reduced need for pesticides and herbicides.

40. There is a consensus among all credible scientific bodies that genetic modification presents no greater risks than conventional plant breeding. However, debates are replete with 'urban myths' about the negative effects of using GM. Public concern over the issue, particularly in Europe, has led to ever more complex regulation. How to relax the regulatory environment is unclear, as it reflects social and political, rather than scientific, opinion.

41. After 25 years of research, no hazards associated with GM crops have been identified. However, after this time, there are only four main GM crops available – canola, corn, cotton and soya beans. This is, in part, because it costs around US$100 million to bring one genetic 'event' or 'transfer' to market. Twenty-nine countries now grow GM crops and 90 per cent of the producers are smallholders.

42. Concerns raised about genetic modification include questions of intellectual property rights and corporate power and control in the food chain. It was argued that the debates would appear quite different if GM technology were in the hands of the public,

rather than private, sector. However, others stated that biotechnology companies offer the only viable route for developing and marketing GM crops.

43. Some felt that GM products need to be assessed on a case-by-case basis. Concern about the use and consumption of GM crops is not limited to Europe. Instances of African governments rejecting food aid containing GM products were cited due to pressure from the EU in that their ability to export agricultural products to the EU would cease if they permitted GM crop production. An example was cited of Kenyan produced fruit and vegetables; Kenya is likely to remain GM free for the foreseeable future for fear of losing the EU market. India, on the other hand, has been particularly successful at producing GM cotton, in spite of a strong, national anti-GM lobby. It is now the world's second largest cotton exporter. China has also developed its own GM cotton variety which is widely used within China.

44. GM is only one of several scientific developments which could lead to increased productivity in the future. Debate needs to be broadened to include other technologies.

Other agricultural approaches

45. Some other approaches were outlined, including hydroponics – a method of growing plants in water using nutrient solutions and without soil. An example of hydroponic production in Quebec was given, where lettuce is grown on Styrofoam floats with carefully monitored water and nutritional inputs. Examples of greenhouses on the top of office buildings[10] and those producing tomatoes on strings,[11] where water is recycled and energy used highly efficient, were shown.

46. Aquaponics, which combines aquaculture with hydroponics, grows fish and plants in a symbiotic balance. Waste from the fish provides nutrients for the plants, which in turn filter the water. Aquaponics has a long history in Asia with people growing fish in rice paddies but today it is becoming more sophisticated. There are now systems that work in both indoor and outdoor environments.

47. Fertigation, a drip method of irrigation designed to deliver fertiliser and water in required amounts as necessary, was also discussed as a way of reducing water usage for crops while ensuring that necessary fertiliser levels are achieved.

48. King Abdullah University of Science and Technology (KAUST)[12] in Thuwal, Saudi Arabia, is at the cutting-edge of many such initiatives. The Saudi Arabian government, which subsidised wheat production until 2008 and in which the country was self-sufficient until this point, has since invested in other forms of agriculture. Greenhouses for the region have been designed to stay cool, while salt water is either desalinated or used to grow halophytes.

49. As many countries are unable to afford the initiatives being undertaken in Saudi Arabia, questions were raised regarding the best steps to close yield gaps in poorer countries. Aligning the objectives of large food companies and smallholder farmers was one response, and increasing collaboration between the public and private sectors was another.

Overseas land investments[13]

50. Often called 'land grabbing', investment in land in one country to grow commodities for another is not new. But there has been a recent spate of investments, especially in Africa, which has led to large swathes of land being sold or leased to foreign parties. The intended land use is not always clear, but the production of food, feed and biofuel crops to be exported to the investor country, and, land acquisitions for speculative purposes also appear common.

51. Salient features of these investments include their scale;[14] the speed at which transactions occur; the levels of secrecy in the negotiation process and the lack of transparency regarding contracts and their terms; the length of leases (often up to 99 years); power asymmetries between investors and host governments, and between host-country negotiators and local populations. These relationships have a colonial

resonance for many countries; while there is the threat of food exports from some of the most food insecure countries in the world.

52. The need to invest in agriculture, particularly in Africa, is clear and often discussed. African governments can find themselves blamed for the lack of agricultural investment in recent years. But the context in which this underinvestment occurred – such as during structural adjustment programmes – is largely forgotten and then often used to justify granting land to outside parties in the name of global and local food security.

53. Investors often come from regions with limited arable land and/or water, and food security concerns, such as the Middle East and Eastern and Southern Asia, among others. Investments are agreed between a range of public and private sector actors from both the host and investor countries, including national governments, food traders, representatives from agribusiness, and speculators.

54. Host countries often receive promises of infrastructure development, employment opportunities, technology transfer, and other benefits to the local population, such as health centres, but there is to date little evidence of these commitments being realised.

55. There is growing concern that large-scale land acquisitions are occurring in countries with weak land governance, which raises complex economic, political, legal and ethical questions regarding land ownership and host-country food security. Local populations are often unaware that their land has been leased or sold.[15] Moreover, smallholders have few legal rights, while investors can rely on over 3000 bilateral investment treaties and tend to be armed with resources and information.

56. The case of corruption on the part of host-country governments, which sell or lease land with no regard for the local population was discussed. But some felt this was only part of the picture, as governments have also been criticised for not selling land or allowing populations to do so. They can face difficult questions of how much to liberalise land markets and the extent to which local people should be granted land titles with the resulting freedom to sell their land, as they may later find themselves destitute. A distinction needs to be made between corrupt deals and those in which governments attempt to do their best to engage with investors. Risks for investors were also noted.

57. Governments often fear losing out on investment to other countries, so they are prone to accept what investors offer. The International Senior Lawyers Programme[16] can now provide advice to help governments negotiate more favourable terms. In Liberia and Kazakhstan, for example, governments have successfully renegotiated contracts with the help of lawyers expert in these types of arrangements. Some argued that communities also need this can kind of support and legal assistance.

58. Communities affected by land deals are heterogeneous but this is rarely acknowledged in the discussion. Also, land that is leased or sold is often perceived inaccurately to be 'vacant' or 'idle',[17] when in fact it is often settled or used by pastoralists and/or indigenous groups. These groups usually lack official land title, furthering investor perceptions that land is unclaimed.

59. As the rights of indigenous people are protected under international law, questions were raised about whether their identity is recognised in African contexts. Indigenous people are seen as distinct in Africa based on their way of life. But, some argued that it is unhelpful to perpetuate ideas that certain groups have greater rights to an area than others.

Land rights and ownership: The Rwandan example

60. Rwanda implemented a National Land Policy in 2005, under which all types of land tenure are being converted to one statutory form. Land registration became mandatory and customary land holders are being granted long-term leases. Key principles behind these developments include: the reaffirmation of land as the natural heritage of all Rwandans, the adoption of land management practices, and gender equity. Rwandan

women now have equal land rights to men.[18]

61. By the end of August 2011, over 80 per cent of land parcels had been demarcated and provisional land certificates issued. The demarcation process for the whole country will be completed in June 2012.

62. The policy represents a new chapter in Rwanda's land history which has been spurred by the high population density. Land policies had ceased to be implemented following the 1994 Genocide and the collapse of formal institutions. Prior to this, land had been nationalised after Independence, granting usufruct[19] rights to the population. Under colonial rule, which was preceded by long periods of customary tenure, registered land title for foreigners was combined with existing customary arrangements for locals.

63. Rwanda was commended for its courage in undertaking the land registration process. Some thought Rwanda's small size facilitated such developments, which would not be possible in larger countries. One concern, however, is that people may be tempted to sell their land to speculators. The World Bank recently evaluated the new system and published its findings in August 2011.[20]

International voluntary guidelines for land investment

64. Security of land tenure is only one facet of international land investment debates. Others include land use, the demand on other natural resources, and questions of governance. Access to land and types of land use are of course mutually influential. They need to be based on principles of accountability, equity, non-discrimination, participation, sustainability, transparency and the rule of law.

65. There have been calls for international guidelines and codes of conduct to regulate foreign land investment. To this end, the *Principles for Responsible Agricultural Investment that Respects Rights, Livelihoods and Resources* (RAI Principles) have been developed under the stewardship of the World Bank, the FAO, the United Nations Conference on Trade and Development (UNCTAD), and the International Fund for Agricultural Development (IFAD).[21] In addition, *Voluntary Guidelines on Responsible Governance of Tenure of Land and Other Natural Resources*[22] are currently being negotiated by the FAO in partnership with member nations, civil society, IFAD and other United Nations agencies. They were due to be finalised in October 2011 and are intended to guide land policies by providing frameworks on which investors and national and regional stakeholders can draw.

66. The voluntary guidelines have been developed over the last two years through a process of consultation in different parts of the world, including with civil society organisations and the private sector. One thousand experts have been involved in their production.

67. Contentious issues in the development of the guidelines include the definition of natural resources, which was narrowed to include fisheries and forests but to exclude water. This is significant as some argue that land 'grabs' are in fact water 'grabs'. Another difficult issue concerned the special treatment accorded to indigenous people.

68. The fact that the guidelines will be voluntary inevitably limits their potential effectiveness. Some questioned how local communities will be able to access the guidelines and who can help to implement them. The possible involvement of FAO regional offices to provide advice to governments is being explored. It was also noted that the guidelines might be helpful for the future but will not affect land transactions that have already occurred.

69. Overall, increased international investment in Africa was viewed positively. However, considerable effort is needed there and elsewhere to ensure that such investment benefits local populations and that their claims to land remain intact.

Conclusion

70. Policies concerning land need to take account of geographical diversity and to integrate the many policy areas that affect its use. Links between food production and ecosystems, for example, need to be made in policy terms, as well as to broader issues of public interest.

71. The sustainable intensification of food production can be achieved through both high- and low-tech solutions, such as those seen in Saudi Arabia and Niger respectively. Policies need to be context-appropriate.

72. Investment in Africa is welcome but attention is needed to ensure that local populations are among the beneficiaries. Voluntary guidelines, whether concerning land investment or biofuel production, are an important global development, but their effectiveness lies in their implementation. The appetite for more enforceable forms of governance remains weak.

73. A reduction in consumption in developed countries would have significant impacts on land use around the world. However, this is thought to be an unpalatable message, which governments are unlikely to endorse.

74. Future research agendas need to consider the use of both traditional and modern technologies to enhance the efficient use of energy, nutrients and water, and to increase research into soils.

Samantha Pearce
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[1] This includes land unusable for agriculture because of natural constraints – too mountainous or covered by desert – or because it has been used for human habitation or industry.

[2] For country-specific soil assessments, see Global Assessment of Soil Deterioration (Glasod) http://www.fao.org/nr/land/information-resources/glasod/en/.

[3] The Global Soil Forum's goals are being implemented through the Institute of Advanced Sustainability Studies http://www.iass-potsdam.de.

[4] For more information see: the Millennium Ecosystem Assessment http://www.maweb.org/en/index.aspx ; World Resources Institute http://www.wri.org/ecosystems; Ecosystems for Water and Food Security http://www.unep.org/pdf/DEPI-ECOSYSTEMS-FOOD-SECUR.pdf ; African re-greening initiatives http://africa-regreening.blogspot.com/ ; the UK's National Ecosystem Assessment http://www.defra.gov.uk/environment/natural/uknea/ and White paper, June 2011, http://www.defra.gov.uk/environment/natural/whitepaper/

[5] Following the collapse of the USSR, levels of petroleum, fertilisers and chemicals imported by Cuba declined by 53 per cent, 77 per cent and 62 per cent respectively between 1989 and 1992. This led to an increase in organic farming, which could ultimately lead Cuba to become the largest supplier of organic produce to the US market.

[6] HEFA, derived from plant oils and animal fats, is used as a kerosene substitute.

[7] See http://www.embrapa.br/english

[8] The area for expansion is estimated to be about 64 million ha. At present, the amount of land under sugarcane cultivation is 9.2 million ha, but this is predicted to rise to 11.5 million ha in 2020/21.

[9] Fifty per cent of China's farmland is now irrigated.

[10] https://lufa.com/en

[11] http://www.houwelings.com/

[12] http://www.kaust.edu.sa/research/research.html

[13] For forthcoming and recent reports on the topic see:

The Land Matrix Partnership will publish information on land investments – which it has been collating since

2009 – in November 2011 http://www.commercialpressuresonland.org/research-papers/main

Oxfam (2011) http://www.oxfam.org/en/grow/policy/land-and-power 'Land and power: The growing scandal surrounding the new wave of investments in land'.

Journal of Peasant Studies Special Issue on New Frontiers of Land Control (2011) http://www.commercialpressuresonland.org/research-papers/journal-peasant-studies-special-issue-new-frontiers-land-control

IIED (2011) http://pubs.iied.org/12568IIED.html?c=law/globgov 'Land deals in Africa: What is in the contracts?'

For further resources, including detailed bibliographies (updated every six months), on land rights in Africa, global land grabbing, and biofuels http://www.oxfam.org.uk/resources/learning/landrights/general.html

For a repository of mainly journalistic material see http://farmlandgrab.org/

[14] The scale of investments in individual countries is immense. For example, recorded land transfers between 2004 and 2009 amount to 4 million ha in Sudan, 2.7 million ha in Mozambique, 1.2 million ha in Ethiopia, and 1 million ha in Cambodia. Globally the extent of farmland investments is unknown but estimates range from 40 to 227 million ha, which are either under negotiation or already leased or sold.

[15] There are many examples of this from Africa, South East Asia and elsewhere.

[16] http://www.islp.org/

[17] Research in the Democratic Republic of Congo found that so-called vacant land was actually occupied by villages with populations of between 500 and 7000 people. Other cases were highlighted, including in Mali where 10 per cent of the irrigated land, comprising thirty villages, is now in Libyan hands.

[18] Of the nearly four million land parcels registered to date, 84 per cent list women as the sole or co-owners.

[19] The right to use and derive benefits from property belonging to another party; provided the property is not damaged or destroyed.

[20] http://www.wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2011/08/18/000158349_20110818104704/Rendered/INDEX/WPS5765.txt

[21] http://www.responsibleagroinvestment.org/rai/node/256

[22] www.fao.org/nr/tenure/voluntary-guidelines/en/ and www.fao.org/docrep/012/i0955e/i0955e00.htm