HUNGRY FOR LAND

Contrary to widely held belief there is arable land that could be cultivated without risking further encroachment on our forests. Impetus for developing the potential has been provided by climate change. What is at stake is how to resolve tensions that will arise as competing demands are made on land resources. These will arrive from many directions not always related to satisfying demand for food and include non-food,

Through much of our recent history concerns have been raised over whether the earth is actually capable of supporting its ever expanding population. Over two centuries ago Malthus noted that “the power of population is indefinitely greater than the power in the earth to produce subsistence for man.” His observations have been hotly contested almost from the moment they appeared on both their foundations (in particular because technical progress is omitted) and for their political and moral implications. What cannot be denied however is that the specter raised by Malthus through the economic lens with which he viewed the world has nourished generations of bleak conclusions on the question of sustainability. In our world this has led his supporters to raise their voices on the dangers of runaway growth and in more extreme cases has provided a rationale behind measures to encourage demographic decline.

A less apocalyptic view should not be confused with an unwillingness to acknowledge the pertinence of the very real crisis we face when confronted with the earth’s capacity to satisfy our needs, whether food related or not, in the face of exploding economic and demographic growth. The cost of many basic foodstuffs threatened to spiral out of control in the latter part of 2007 and early 2008, and again as recently as early 2011, raising the issue of food security for policymakers worldwide who have been forced to confront the tensions that arise as multiple demands are placed on overburdened land. Agriculture is no longer limited to simply supplying food but has also been drafted into the service of industry as a viable substitute for dwindling petroleum resources. Moreover, the role of agriculture in the deployment of environmental services is essential and is made all the more complicated as well-functioning markets to remunerate these services remain poorly developed. The combined effect of rapid development of biofuels since the dawn of the new millennium and the trend where foreign countries are grabbing land in developing countries in order to ensure future food supplies or profit has contributed to make the issue more visible on the political and media agenda. Taking the long view, increasing numbers of voices have been raised to draw attention to myriad other issues including the reduction of arable land through over-exploitation, shrinking water supplies, and the negative impact of climate change on land with the potential for agriculture.

The current state of affairs

The land surface of our planet is equal to roughly 13 billion hectares of which 38% is given over to agriculture and 30% to forest. The rest of the total is rounded out through a combination of man-made infrastructure, inland water systems, and land that is unsuited for agriculture and forestry or is difficult to exploit for that end because of a variety of factors including climatic, topographic, or soil quality-related issues. Of the 4.9 billion hectares of land used for agricultural purposes worldwide close to one-third is suited to annual or permanent crops whereas just over two-thirds are allocated to permanent meadows or pasture. Irrigated land is limited to 287 million hectares; this amount may seem modest but in fact represents a doubling of what was irrigated 50 years ago.

Much of the close to 500 million hectares of total agricultural expansion that has taken place over the last 50 years has come at the expense of forested land. The growth has been spread between annual and permanent crops for one third, and permanent meadows and pastures for the rest. However there has been a slight decline in cultivable land since 2001.

Estimation on land potential suitable for pluvial agriculture

According to research conducted by the International Institute for Applied Systems Analysis (IIASA) close to 4.2 billion hectares of land possesses the potential for the development of pluvial (rainfed) agriculture, equal to slightly less than one-third of the earth's total land area. Of this total, 1.6 billion hectares are already being exploited by agriculture which leaves 2.6 billion hectares of untapped potential. The geographic distribution of this land is spread unevenly throughout the world and while it is abundant in Latin America, Sub-Saharan Africa, and in some countries of the developed world it is rather less so in East and South Asia, North Africa and the Near- and Middle-East. Two-thirds of untapped land worldwide is concentrated in only 13 countries all of which, with the notable exception of Indonesia, are located in Latin America and sub-Saharan Africa.

The extent of usable land that is not yet cultivated throughout the world seems thus considerable. The compelling fact that over two-thirds of this land has been identified as either 'favorable' or 'very favorable' to development could lead one to some wildly optimistic claims about the capacity of the world to meet the food needs of the future. However, this ignores the fact that much of the land identified is subject to competing demands. Studies have indicated that maintaining forest, along with protected and artificialized areas at current levels, could limit the potential for agricultural development to a range that varies between 0.5 and 1.5 billion hectares depending on the study. Concentrating solely on permanent meadows or pasture for future development of crops is fraught as it does not take into account the required evolution of livestock production systems and the increasing demand for animal products.

The impact of climate change

The impact climate change will have on the potential of land targeted as ripe for agricultural purposes remains hazy. It helps if we limit ourselves to predicting some possible scenarios. By testing a combination of three hypotheses dealing with uniform increases in temperature (respectively 1, 2, and 3 degrees Celsius) and three hypotheses relating to increases in precipitation (respectively 0, +5%, +10%) it is estimated that climate change could raise the availability of land currently identified as either very favorable, favorable, or moderately favorable to rainfed cultivation of grains (wheat, corn, and rice) over a range that varies between 1.1% to 5.9%. Despite the fact that in each scenario the global average masks some rather sharp regional disparities we can nevertheless identify two clear trends: as the amount of arable land in the developed world expands the less developed world will witness a corresponding reduction in access to this vital resource. The geographical areas that will witness a decline in arable land are found mainly in South and South-East Asia, as well as Sub-Saharan Africa while Latin America and Central Asia are likely to experience increases. The result of these two simultaneous currents will be to increase the dependence of Africa and Asia on agricultural exports from the OECD countries (with the possible exception of Australia), Central and Eastern Europe.

Does the development of biofuels represent a threat to the supply of land given over to food cultivation?

The first generation of biofuels (1G) currently in use are primarily derived from the storage organs of crops that have historically formed a major component of the diet of humans and animals alike : sugar producing crops (sugar cane, sugar beets), cereals (corn, wheat, etc.), and oleaginous crops (soy, rape, palm, etc.). Because of competing demands made on limited resources the growth of the biofuel sector poses a direct threat to global food security and has become a very real concern for policymakers worldwide. The conflict reached a paroxysm as recently as 2007-2008 when the price of basic foodstuffs threatened to spiral out of control. The trauma of this recent experience has lingered in a context that is permeated with concerns over how to feed a population that is expected to surpass 9 billion by the year 2050 without destroying the environment in the process.

Without excusing the role played by 1G biofuels in fanning the flames of the runaway agricultural price increases witnessed in 2007-08 it would be a mistake to lay the blame entirely on the new technology’s door. Numerous other factors also contributed to this agricultural price spike. What is perhaps just as concerning is the fact that 1G biofuels have also been criticized for the negative impact they are having on the environment when land use changes are taken into account. When one hectare of arable land used for producing energy crops requires the appropriation of one hectare of grassland or the destruction of a corresponding amount of forest, the impact in terms of greenhouse gas (GHG) emissions can become negative. To this instantaneous damage the redeployment of land previously given over to meadows or forests is having on GHG emissions, should be added a dynamic one linked to the loss of biological production by meadows and forests. Furthermore, the threat of change in land produces no reduction of GHG emissions. Issues like biodiversity loss or the use of fertilizers and pesticides beyond the land’s ability to absorb them should be taken into account. Finally, the effectiveness of 1G biofuels is being called into question because of modest energy efficiency and their relatively high cost when viewed through the prism of public policies put in place to encourage their development which remain disproportionate in relation to their expected benefits, economic or otherwise.

In response to the current climate much hope is being placed in second generation biofuels (2G) which are designed to exploit the energy potential of (non-edible) lignocellulosic biomass. Three principle sources that could be developed are (i) residues or leftover material from crops, forests, industry, cities, and households, (ii) wood, and (iii) annually produced crops such as wheat or corn (used stalks and all) ; or, perennials (herbaceous or forages) ; or, bushy plants using short or very short rotation techniques. A number of contributing factors have made developments in this area promising. For one, untapped sources of the primary feedstocks are (extremely) widespread. Additionally the impact of these sources on our ability to produce food would be negligible if they consist mostly of agricultural residues, wood, or other forms of agriculture unsuited for human consumption needs. Finally, the superior energy efficiency (and corresponding economic efficiency) in terms of biomass produced per unit of land combined with a higher conversion rate for transforming this biomass into liquid fuel creates a compelling case when added to other factors in favor of cellulosic fuel. Nevertheless, the leap of faith required in order to bridge the gulf between mere promise and concrete reality should be taken with care. Particular prudence is required when confronting the question of indirect competition for land resources that the development of biofuel capacity could encourage and the implications this could have on global food supply.

Confronting the problem head on it becomes clear that where the primary material is a residue, waste product, or wood from forests for a given forestry area the question of competition can be conveniently sidestepped as there is no direct or indirect conflict with land used for the production of food. Of more pressing concern is the tension that arises over dedicated crops that can be used for food or energy needs alike. Consideration for the latter use should adhere to the same logic applied to the debate that surrounds 1G biofuels. Supporters of increased development of dedicated energy crops as a source for 2G biofuels have made the case for the exploitation of land in marginal environments considered unsuitable for food production. However, the potential these under-explored areas represent is largely unknown. Furthermore what should not be forgotten is that economic necessity dictates that land should be capable of producing at least minimal benefits; this very simple reasoning would lead one to logically suppose that at least some of the feedstock should be grown on land fertile enough to be capable of producing a decent profit.

A thorough analysis of the implications of increased competition for arable land is imperative when we acknowledge that the demand for biomass to be used for fuel is set to skyrocket over the coming decades and that energy crops grown specifically as feedstock for fuel production are likely to be the primary source. A comprehensive review of the literature surrounding the issue reveals that substituting first generation with second generation biofuels will only facilitate a reduction of the negative impact biofuel development poses toward food security (measured in terms of agricultural production available for human or animal consumption, and the corresponding prices) and the environment (measured in terms of GHG emissions and biodiversity preservation). The higher the yields of 2G biofuels (both in terms of biomass and energy) and greater the use of marginal lands, the more limitations will be placed on damages. What remains to be accomplished is a thorough analysis and quantification of this marginal land currently classified as unsuitable for agriculture and of its potential for sustainable development according to economic, social and environmental criteria.

No foregone conclusion

Drawing on the previous observations could lead us to the conclusion that first and second generation biofuels represent a threat to future global food security if expanded beyond their current stage of development; that their environmental impact in terms of GHG emissions would lead to negative consequences which could spring from an excessively drastic redeployment of land resources; and, that the political will and investment required to promote the expansion of the biofuel sector is far too costly when weighed against the potential benefits it could bring. The list of concerns is long but it’s useful to draw a line in the sand at some point and note that we beg to differ.

What many arguments against expansion conveniently fail to mention is the uphill struggle we face to meet ever growing demands for energy within a context of dwindling fossil fuel deposits. Surely this represents a challenge of equal proportions to the hurdles we face in the realms of food security and environment. To meet the looming energy crisis a concerted effort will be required to both increase fuel efficiency as well as identify possible alternative sources of energy to oil. That these alternative fuel sources must adapt to the rigorous demands of both economic and environmental sustainability goes without saying and it is at the crossroads between the paths leading to diverse food, environmental, and energy solutions that the development of biofuels emerges as a credible way forward. Indeed, finding solutions to these problems, not to mention others such as economic and social inequality at a domestic as well as international level will require a global approach in which issues are interwoven and form synergies that positively reinforce each other.

Discovering that the supply of cultivable land worldwide is not just adequate but in fact relatively abundant should not blind us to the challenge posed by the very real competition that exists now, and will exist in the future, between a wide range of interests for land resources. In market economies, decisions on whether to develop land are based almost exclusively on whether significant returns on investment can be made. The profit motive is a key factor in the determination of how to allocate land and it is by a similar yardstick that all other motivations connected to land usage should be measured. Decisions over whether to develop land for food and feed production or non-food use; how to respond to the needs of the environment as well as urban development; the risks posed by cultivable land loss due to an array of factors including water scarcity, salinization, erosion, or over-development; all these questions are intimately linked and will need to be addressed jointly as we continue to struggle with the challenge of creating a sustainable future.

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