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Editorial

Seeds and places: The geographies of transgenic crops in the global south ☆

1. Introduction

The global supply of dietary energy reached 121 per cent of the global requirement in 2010–2012, continuing a steady rise from 114 per cent 20 years earlier.[1] This substantial increase in the food surplus occurred during a period when the global population swelled from about 5.3 billion to an estimated 6.9 billion.[2] Over the same period, the daily amount of protein available per person increased from 69 g (1990–1992) to 78 g (2007–2009)[3] – the latter is about 139 per cent of the amount recommended by the US Centers for Disease Control for male adults.[4] Evidently there is plenty of food.

Still, many responsible decision-makers, policy analysts and media commentators take it for granted that humanity must take urgent steps to produce much more food (Tomlinson, 2013). This is because we live in a global society where about 850 million people are undernourished (FAO, 2012). The population is still growing, too, albeit at a reducing rate; recent projections suggest the number of humans will surpass 9.5 billion in 2050.[5] Increasing the food supply might seem like the obvious answer, yet the world is also a place where 1.4 billion people are overweight and, surprisingly, an increasing proportion of these overweight people are relatively poor (FAO, 2012; Patel, 2007). Apparently, the situation humanity faces is not a simple shortage of food, but something much more complex.

With profound socio-economic, geo-political and demographic changes under way, there is no room for complacency on the question of how the global population will be fed thirty years from now. A recent study warns that the yields of four major crops are not increasing fast enough to match a projected doubling in demand by 2050 (Ray et al., 2013). Climate change presents an additional challenge (Wheeler and von Braun, 2013). Even without these 'exogenous' concerns, there is widespread anxiety about the ecological harm and long-term unsustainability of present and future agricultural production systems, such as grain-fed meat production, intensive capture fisheries, and the cultivation of biofuel crops (Foresight, 2011).

A problem with public discourse about global food security is that it occurs at a high level of abstraction. A 2011 special report published by *The Economist* is a good example. The report is sprinkled with passing references to particular situations and places, yet its authors address themselves sedulously to the macro question of how 'the world' or 'nine billion people' can be fed (The Economist, 2011). This global food security discourse presents a kind of 'view from nowhere': a sweeping perspective on food (in) security as an undifferentiated global concern, rather than a spatially differentiated phenomenon that actually has very local characteristics, causes and likely solutions. Instead of addressing this local specificity, a singular solution to the hunger problem is envisaged crudely as a matter of increasing food supply to match projected demand at a highly aggregated scale. But food shortages and malnourishment are unevenly distributed between regions and nations,[6] rural and urban populations, socio-economic classes, genders, and age cohorts (Patel, 2007).

The dynamics of agricultural production and patterns of food consumption are also inescapably local, for reasons of agro-ecology, demographics, socio-economics, history and culture. Candidate solutions to the hunger problem need to be tailored to target groups of people in particular places or they will not work. This is a central reason why the genetic modification of crops and livestock is controversial. Critics fear that transgenesis is being touted as a singular technological fix when a proper diagnosis of the hunger problem suggests that technology alone cannot be sufficient and that diverse, locally adapted solutions will be needed (Rosset, 2006; McAfee, 2003).

Into this debate, geographers bring an important, spatial perspective (McAfee, 2004). In particular, a productive tension is created when geography's concern with the locality of knowledge is brought into dialogue with science's claim to generate universal truths (Shapin, 1998; Powell, 2007). Like Shapin (1998) and Powell (2007), some of the contributors to this special issue use concepts and literature from the sociology of science, a field in which the popular separation of science (discovery and pure knowledge) from technology (applied science) is widely abjured in favour of the term *technoscience*. Technoscience is a concept which recognises that scientific knowledge is inseparable from scientific practice and therefore also from the instruments and tools scientists use to do their work. Instruments and artefacts such as journals, patents and thermometers are vehicles that allow the efficient transfer of

☆ The editors contributed equally to this article and to the editing of the special issue which it introduces.

[1] Data from the FAO's Food Security Indicators, Economic and Social Development department, 24 January 2013 release, available from http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/ (accessed 2 August 2013).

[2] United Nations, Department of Economic and Social Affairs, Population Division, Population Estimates and Projections Section, World Population Prospects: The 2012 Revision, available from http://esa.un.org/unpd/wpp/index.htm (accessed 2 August 2013).

[3] FAO Food Security Indicators, op. cit.

[4] US Centers for Disease Control and Prevention > Nutrition for Everyone > Protein, available from http://esa.un.org/unpd/wpp/index.htm (accessed 2 August 2013).

[5] UN Population Estimates and Projections, op. cit.

[6] FAO Food Insecurity Indicators, op. cit.

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standardised knowledge and practices out of the laboratory and around the world (Latour, 1987; Shapin, 1998). Yet this is only part of the story. As a necessary step on its pathway out of the laboratory, a successful technology is taken up by communities and incorporated into local systems of knowledge and practice. In the process, the technology may be transformed in ways that the designer or inventor has not anticipated. In resource-poor communities and post-colonial settings, introduced technologies are liable to be adapted creatively and hybridised or creolised into striking new forms. One can think of examples such as industrial packaging materials repurposed for housing, or the diverse types of three-wheeled scooter-taxis (auto-rickshaws, tuk-tuks, etc.) that have been developed in Asian and African countries (Edgerton, 2007; Powell, 2007).

Compared to journal articles or thermometers, living organisms such as transgenic crops may be especially unreliable vehicles for transferring standardised scientific knowledge and practices. Living organisms have their ideal habitats and individual strategies and prospects for survival. Crops, in particular, depend heavily on selection and cultivation by farmers. This is the reality faced by plant breeders and genetic engineers when they send new crop varieties out of the laboratory, expecting that they will help particular farmers solve local agronomic problems and boost productivity in particular places. Transgenic technologies need to perform locally, embedded within agro-ecological settings and cultivation systems that are shaped and influenced by unpredictable weather patterns, farmers' practices, institutional and cultural frameworks, government policies, and markets (Stone, 2011; Glover, 2010a; Tripp, 2009).

Geographical perspectives on science, knowledge and practice therefore have much to offer to contemporary debates about transgenic crops. These debates are typically dominated by scientific claims relating to a narrow range of technically defined questions. Proponents suggest that the evidence is quite clear: in the global South, transgenic cotton boosts yields and increases profits by reducing pest damage and minimizing pesticide use (Qaim, 2009; Smale et al., 2009). Empirical studies undertaken in Argentina (Qaim and Traxler, 2005), Burkina Faso (Vitale et al., 2010), South Africa (Thirtle et al., 2003), Pakistan (Ali and Abdulai, 2010), India (Kathage and Qaim, 2012), and China (Huang et al., 2009) corroborate claims that transgenic technology improves crop yields, profits and farmer livelihoods.

Within these discussions, the dominant framing is that science alone should guide decision-making (e.g. Walsh, 2013; Nature, 2013). Criticisms of the technology have been interpreted as purely ideological or political, and bitterly condemned (Paarlberg, 2008; Potrykus, 2010). Yet the impacts of transgenic crop technology have not been singular or uniform. Claims that the impacts have been broadly beneficial and attempts to curtail further debate are therefore inescapably political (Glover, 2010b; Stone, 2002, 2011).

Politics and geopolitics intrude at every turn. Recent leaks of diplomatic cables have confirmed that the US government has used vigorous 'science diplomacy' to improve the public image of transgenic crops and to lobby foreign governments to adopt them (Food and Water Watch, 2013; see also McAfee (2008)). These revelations strengthen the claims of scholars who argue that transgenics symbolise a 'bio-hegemonic' geopolitics that involves complex networks of actors, organisations and institutions that support simplistic interpretations of the scientific 'consensus' (Newell, 2009; Schnurr, 2013). Other scholars argue that, in the context of the neoliberal transformation of global agriculture and trade systems, transgenics transfer control over seed reproduction and agricultural decision-making from southern-based farmers to northern-based corporations (Fitting, 2006; Otero, 2008; McAfee, 2003). The consequent damage to farmers' skills and rural knowledge systems may pose a profound threat to agricultural resilience and sustainability (Stone, 2010). Other scholars agree that institutional arrangements strongly mediate transgenic crop outcomes (Smale et al., 2009; Tripp, 2009; Glover, 2010a).

The papers in this special issue answer a call in the literature for studies that situate transgenic technologies, farmers and their practices within the specific biophysical, political, and economic contexts of particular places in the global South (Harsh and Smith, 2007; Thompson and Scoones, 2009). The authors explore how transgenic crops are shaped and embedded historically, institutionally, politically and materially.

Several of the contributors situate transgenics within longer-term processes of technological interventions, showing how the past makes itself felt in the present. As Stone (2011, p. 388) reminds us, farms are not 'ahistoric laboratories': farmer decision-making today is shaped by decisions made in the past and influenced by the legacy of previous technological interventions (Schnurr, 2012). In this issue, Leguizamón (2014) traces the triumphant rise of transgenic soybean in Argentina within the country's longer-term history of neoliberal economic restructuring and rural depopulation, associated particularly with the political and economic priorities of the Kirchner administrations.

The contributions by Dowd-Uribe (2014) and Harsh (2014) also begin by laying out the historical context – of institutions and cotton growing in Burkina Faso in the former case, and of the political economy of Kenyan agriculture in the latter. Dowd-Uribe and Harsh thus offer important reminders that the potential for transgenic crops to transform agriculture in particular parts of the global South is strongly influenced by local histories of agricultural innovation, institutional transitions, and socio-political change. In particular, Dowd-Uribe's (2014) contribution makes clear that contextual factors such as governance and policy frameworks, credit availability and seed markets, as well as local agro-ecological factors such as insect pests, shape outcomes with transgenic crops.

Science policy analyst Andy Stirling argued recently that politicians' and policy makers' continuing fascination with transgenic technologies (neglecting a wide range of technological alternatives) 'has more to do with the economic and institutional power associated with this technology than with its performance' (Stirling, 2013). Other scholars have argued that power relations ensure that certain narratives are privileged over others, and even debates over 'sound science' are imbued with sticky issues of identity, culture and subjectivity (Gibbs et al., 2008). Contributors to this special issue agree that power and politics are overlooked yet vital elements of transgenic crop success stories. Argentina's soybean boom is a good illustration of this, where political choices have led to the adoption of transgenic technology as part of an export-led growth strategy that has privileged large-scale, mechanised monocultures while creating social and ecological disruption for rural communities (Leguizamón, 2014).

Matthew Harsh (2014) pays particular attention to the actors and networks that structure political debates in particular settings. In his study of Kenya's biotechnology politics, Harsh uses the notion of 'techno-civil society' to show how networks of pro-biotech non-governmental organisations (NGOs) seek to influence public perceptions and policy debates. He notes that NGOs have invoked two somewhat conflicting ideologies – the notion that the advancement of technology is critical to societal progress, and the view that a strong civil society underpins a healthy democracy. These NGOs thus draw simultaneously on one narrative rooted in scientific authority and a second rooted in political freedom.

Harsh's analysis of the role of NGOs in biotechnology debates draws attention to the crucial role of trust as a mechanism that allows scientific knowledge to move from one place to another. Since scientific experiments and empirical data are witnessed directly by only a few initiates, it matters a lot who conveys scientific claims into the public realm, how well they are trusted, and how transparent, complete and balanced their information is (Shapin, 1998).

The final contribution to this special issue adopts a different perspective on the way agricultural knowledge and practices travel. Glover (2014) argues that any new agricultural technology – be it conventional, agro-ecological or transgenic – must be adapted locally if it is to produce its desired benefits, and that this has to be achieved through the situated knowledge and management skills of farmers. Glover places transgenic technologies on an equal footing with agro-ecological approaches to crop intensification, arguing that promoters of both types of technology are liable to underestimate the importance of end users in any technological system.

With this collection of papers, we hope to contribute to a significant and necessary broadening of academic and public debates about transgenic crops and the future of agriculture in the global South. We believe that those debates should renounce globalising rhetoric about 'feeding the world' and reject simplistic assumptions about food scarcity and the supposed need to raise yields and produce more food. Geographers can steer the discussion in more appropriate directions by insisting on the importance of place, politics and history, and affirming the need for a fine-grained analysis of patterns and dynamics of food production and consumption that are inescapably local.

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Guest editors
Brian Dowd-Uribe
Department of Environment and Development, University for Peace, Campus Rodrigo Carazo, El Rodeo de Mora, P.O Box: 138-6100, San José, Costa Rica

Dominic Glover *
Knowledge, Technology and Innovation Group (formerly the Technology and Agrarian Development Group), Wageningen University, Building 201, Hollandseweg 1, 6706 KN Wageningen, The Netherlands
* Corresponding author.
E-mail address: dominic.glover@wur.nl

Matthew A. Schnurr
Department of International Development Studies, Dalhousie University, Room 339, Henry Hicks Administration Building, 6299 South Street, Halifax, Nova Scotia B3H 4H6, Canada

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