

NORMAN BORLAUG

- Blaut, J.M. (1959) 'A Study of Cultural Determinants of Soil Erosion and Conservation in the Blue Mountains of Jamaica', *Social and Economic Studies* 8: 403–20.
- (1967) 'Geography and the Development of Peasant Agriculture', in: Cohen, S.B. (ed.), *Problems and Trends in American Geography*, N.Y: Basic Books, pp. 200–20.
- (1969) 'Jingo Geography: Part I', *Antipode* 1, 1: 10–13.
- (1970a) 'Geographic models of imperialism', *Antipode* 2, 1: 65–85.
- (1970b) 'Realistic Models of Peasant Agriculture', in Field, A.J. (ed.), *Town and Country in the Third World*, Boston: Schenkman, pp. 213–24..
- (1974) 'The Ghetto as an Internal Neocolony', in: Morrill, R. and Eichenbaum, J. (eds), *New Perspectives in Urban Location Theory*, special issue of *Antipode*, 6, 1: 37–42.
- (1976) 'Where Was Capitalism Born?', *Antipode* 8, 2: 1–11.
- (1979) 'Some Principles of Ethnogeography,' in Gale, S. and Olsson, G. (eds), *Philosophy in Geography*, Dordrecht: Reidel, pp. 1–7..
- (1991) 'Natural Mapping', *Transactions, Institute of British Geographers*, NS 16, 1: 55–74.
- Blaut, J. and Figueroa, L. (1988) *Aspects de la cuestion nacional en Puerto Rico*, San Juan: Editorial Claridad.
- Blaut, J.M. and Stea, D. (1974) 'Mapping at the Age of Three', *Journal of Geography* 73, 7: 5–9.
- Matthewson, K. and Stea, D. (2003) 'James M. Blaut (1927–2000)', *Annals of the Association of American Geographers*, 93, 1 (March): 214–22.
- Rostow, W.W. (1960) *The Stages of Economic Growth: A Non-Communist Manifesto*, Cambridge: Cambridge University Press.
- Sachs, W. (1999) 'Archeology of the Development Idea', in Sachs, W. (ed.) *Planet Dialectics: Explorations in Environment and Development*. Zed Books: London, chap 1, pp. 3–22.
- Said, E. (1988) *Orientalism*, New York: Vintage.
- Sowden, S., Blaut, J., Stea, D., Blades, M. and Spencer, C. (1997) 'Children Can', *Annals of the Association of American Geographers*, 87, 1: 152–58.
- Stea, D., Blaut, J.M. and Stephens, J. (1996) 'Mapping as a Cultural Universal', in Portugali, J. (ed.), *The Construction of Cognitive Maps*, Boston: Kluwer.
- Wisner, B. and Matthewson, K. (eds) (2005) *The Work and Legacy of J. M. Blaut*, special issue of *Antipode*, 37(5), November.

Ben Wisner

NORMAN BORLAUG (1914–)

During the 1960s, rapid increases in agricultural yields, particularly in wheat and rice, in parts of Asia and Latin America were heralded as a solution to the problems of hunger facing millions of the world's poorest people. The use of high-yielding varieties (HYVs), chemical fertiliser, irrigation and machinery was termed 'the Green Revolution'. Debates about the relative successes and failures of these changes in agricultural

production continue, but Norman Borlaug, sometimes termed ‘the Father of the Green Revolution’, remains almost unknown.

Borlaug was born in Cresco, Iowa, USA on 25 March 1914 and grew up on a farm. His future interests were strongly influenced by this environment. During the 1930s he studied at the University of Minnesota, where he gained a BSc in Forest Management in 1937, followed by a Masters in Plant Pathology in 1939 and a doctorate in 1942. His doctoral thesis was on a common fungus, rust, which attacks a wide variety of crops. His work focused on the movement of rust spores and found that they could travel vast distances. He then worked as a microbiologist for the du Pont de Nemours Foundation in Delaware, where his research concentrated on agricultural chemical products such as fungicides and bactericides.

Borlaug’s scientific research focused on how technology could improve agricultural yields. His convictions regarding the role that science could play in agriculture were based not only on this work, but also on his observations growing up in the US Midwest. The ‘Dust Bowl’ of the 1930s is often used as an example of how farming methods inappropriate for a particular physical environment can cause long-term environmental, as well as social, damage. As the economic depression of the 1930s worsened, farmers sought to increase yields by intensifying production. This left large areas of land without appropriate vegetation cover, leading to high levels of soil erosion. Borlaug observed that it was not the use of scientific agricultural techniques which caused these problems, but their misuse or lack of use. He argued that those farmers who adopted appropriate scientifically informed practices did not suffer the same losses.

The 1940s saw the beginning of large-scale ‘development assistance’ from the global North to global South. In 1943, the Rockefeller Foundation, in conjunction with the Mexican government, set up the Comparative Wheat Research and Production Program in Mexico. Borlaug went to Mexico in 1944 to become head of this Program. This provided him with the opportunity to put his ideas into practice.

The Program was meant to concentrate on teaching Mexican farmers how to improve their agricultural techniques, but under Borlaug’s leadership it also developed a very strong focus on innovation. Borlaug was determined to breed new forms of wheat that would help increase yields and reduce risk for poor farmers. These innovations included developing a strain of wheat (*ceredo*) which was insensitive to the number of hours of sunlight in a day and, most famously, varieties of dwarf wheat. Borlaug and his fellow researchers argued that traditional wheat’s long stalks limited yields, partly because of the energy expended on growing the inedible long stalks rather than the ears of wheat, and also because tall stalks often got damaged in wind or rain, so making harvesting more difficult. Dwarf

strains had much higher yields if grown with appropriate fertiliser and irrigation. Experiments on dwarf rice strains were being conducted at the same time at the International Rice Research Institute in the Philippines and at China's Human Rice Research Institute.

In 1963 the Mexican Program was transformed into a new institution known as the International Centre for the Improvement of Maize and Wheat, often referred to by its Spanish acronym CIMMYT (Centro Internacional de Mejoramiento de Maiz y Trigo). Given the success of the dwarf wheat programme in Mexico, Borlaug was impatient to transfer the technology and practices to other parts of the world where starvation and hunger were much more widespread. This led him to focus on India and Pakistan. At that time, seed distribution was controlled by state companies, so he focused his attention on these organisations. Borlaug's focus on wheat, rather than indigenous crops of the subcontinent, was driven not because he felt that wheat was intrinsically better than lentils or other local staples, but rather because high-yielding varieties of indigenous crops had not been developed, wheat can grow in a wide variety of physical environments, and it provides significant calories. This latter point was key as Borlaug's mission was to address the perceived mismatch between population size and food supply.

Unsurprisingly, there were significant obstacles to his attempts to introduce HYVs to India and Pakistan as it represented a mammoth shift in cultural acceptance and understandings of the role of particular foodstuffs, as well as farming methods. Borlaug would not give up and eventually the governments agreed to limited adoption of HYV wheat because of the widespread famine in parts of their countries. Borlaug often argued that the military hostilities between India and Pakistan in 1965 meant that he was able to introduce his ideas with little government interference once approval had been given. As well as using HYVs, irrigation was important, as was the use of inorganic fertiliser.

Yields increased very rapidly and by 1968 Pakistan was self-sufficient in wheat and by 1974 India was self-sufficient in all cereals. These figures were particularly timely as neo-Malthusian ideas about the 'population timebomb' were becoming increasingly widespread in the global North. India was often used as an example of how rapid population growth was outstripping food supply and would lead to widespread famine, disease and war. Borlaug argued that Malthus' predictions did not take into account scientific advances in food production such as those he promoted. However, Borlaug was, and continues to be concerned about population growth and implications for food security.

In 1970, Borlaug was awarded the Nobel Peace Prize. This reflected the awareness that precarious food supply can lead to major tensions and

violence between individuals, communities and countries. In his acceptance speech, Borlaug stated that 'food is the moral right of all who are born into this world'. He acknowledged that people had other rights as well, but that 'without it [food] all other components of social justice are meaningless'. The acceptance speech demonstrates his passion for practical and effective research, and his drive to address problems of food supply throughout the poorest regions of the world. His commitment to developing research capacity in the countries of the South is also apparent. For example, in his overview of the early work of the Mexico Program, he stressed the provision of training and fellowship programmes, emphasising that 'researchers in pursuit of irrelevant academic butterflies were discouraged' (Borlaug 1970). Borlaug's own career focus on the practical implementation of scientific developments, rather than the writing of academic papers, perhaps partially explains his low profile among the academic community working on 'development', particularly in the global North.

Borlaug retired in 1979, but this did not represent an end to his work. Since then he has been particularly involved with research and projects to promote improved agricultural practices in sub-Saharan Africa. Despite earlier financial support from charitable organisations such as the Rockefeller and Ford Foundations and multilateral agencies including the World Bank, a significant amount of Borlaug's more recent work has been funded by a Japanese foundation. In 1986 he helped launch the Sasakawa-Global 2000 Program. The work of this Association involves Green Revolution-style projects in numerous countries in sub-Saharan Africa. Borlaug is also Distinguished Professor in the Soil and Crop Sciences Department at Texas A & M University.

Borlaug and supporters of his methods claim that the increasing reluctance of US-based organisations to fund his work reflects the growing power of environmental movements. The use of non-indigenous crops and HYVs, as well as the increased use of irrigation, pesticides and inorganic fertiliser has been blamed for decreasing soil fertility, water pollution, soil erosion and other environmental problems, particularly in marginal environments. In addition, while the Green Revolution may have made dramatic increases in yields at the start, these increases are impossible to sustain. Finally, the social impacts of the Green Revolution have been highlighted. In the vast majority of cases Borlaug is not criticised directly, but rather the changes in agricultural practices which he promoted. For example, given the costs of HYVs, pesticides and inorganic fertilisers, the Green Revolution, it is argued, has often exacerbated existing class and caste divisions. While richer farmers can afford these new inputs and benefit from increased yields, poorer farmers are left behind and may have to sell their land and become landless labourers or urban migrants.

Hunger and starvation remain daily realities for millions of people in the global South today. New agricultural technologies and the possibilities opened up by genetic modification are, some argue, the answers to these problems. Borlaug supports the use of genetic modification, arguing that opponents who claim such processes are ‘unnatural’ fail to understand the genetic mixing that happens in nature without human interference. He is also passionate in his criticisms of many groups and individuals who, he claims, lobby against the use of pesticides, fertilisers and GM crops from the ‘comfort’ of Europe or the USA.

These views, however, do not necessarily reflect the criticisms that certain forms of agricultural practice and the use of GM seeds, in particular, have received from people living in the global South. In India and Mexico, for example, despite past crop yield increases, there have been widespread protests against GM crops. Borlaug admits that at times scientists have not been successful in presenting their work effectively, implying that if people were presented with the ‘facts’ then there would be no protests.

When discussing his current work in sub-Saharan Africa, as in an interview in 2000 (Bailey 2000), Borlaug mentions continued obstacles to meeting individuals’ food needs. While agricultural technology may improve yields, there are issues of distribution to consider. This involves not only physical distribution in terms of infrastructure, but also social distribution, encompassed in Amartya Sen’s ideas of entitlement. Sufficient food may be produced, but if you do not have enough money to buy it then you will still starve. For some development theorists and practitioners, it is these issues of distribution which should now get far greater attention than the focus on increasing global food supply.

Norman Borlaug’s commitment and passion in addressing a key development debate of how to feed an increasing population with a finite amount of land is admirable. His focus on implementing projects, influencing governments and working with local people demonstrates not only his scientific credentials, but also his ability to adapt and work within specific social and cultural contexts. While the enthusiasm that greeted the ‘Green Revolution’ in the 1960s and 1970s may have been overly optimistic, the Green Revolution’s contribution to saving millions of people from starvation cannot be underestimated. Borlaug’s Nobel Prize acceptance speech stressed that he was just one part of a large team which deserved recognition. This is certainly true, but without Borlaug’s vision and determination the team’s results may have been less successful and much less widely implemented.

Major works

- Borlaug, N. (1970) 'The Green Revolution: Peace and Humanity', speech on the occasion of the awarding of the 1970 Nobel Peace Prize. Available from www.theatlantic.com/issues/97jan/borlaug/speech.htm.
- (2002) 'Agriculture and Peace: The Role of Science and Technology in the 21 Century', U Thant Distinguished Lecture Series, United Nations University Tokyo, October. Available from www.unu.edu/uthant_lectures/.

Further reading

- Bailey, P. (2000) 'Billions Served', *Reason*, April. Available from reason.com/0004/fe.rb.billions.shtml.
- CIMMYT www.cimmyt.org/.
- Easterbrook, G. (1997) 'Forgotten Benefactor of Humanity', *The Atlantic*, January 1997. Available from www.theatlantic.com/issues/97jan/borlaug/borlaug.htm.
- The Norman Borlaug Heritage Foundation: www.normanborlaug.org.
- The Sasakawa Africa Association: www.saa-tokyo.org.

Katie Willis

ESTER BOSERUP (1910–99)

Ester Boserup was a development economist, who worked as a civil servant for two decades and later as an independent researcher and consultant for the United Nations and its agencies concerning issues and problems in developing countries.

Boserup was born in Copenhagen on 18 May 1910, joined the University of Copenhagen in 1929 and graduated in 1935 as 'cand. polit.'. The main emphasis of her studies was theoretical economics but she also attended lectures in sociology and agricultural policy. Part of her degree work led to a paper comparing Marx and Keynes, a shorter version of which was published in the Danish economic journal *Nationaløkonomisk tidsskrift* (Boserup 1936). She involved herself for a time with a small group of independent socialist intellectuals and later continued to participate in the socialist Danish *Clarté* movement.

After graduation she worked for twenty years as a civil servant, first a decade in the Danish economic administration¹ and then, from 1947, in Geneva with the Research and Planning Division of the Economic Commission for Europe, where her work contributed greatly to the early success of the annual Economic Surveys.

In 1957 she and her husband, Mogens, moved to New Delhi, accepting a proposal from **Gunnar Myrdal** to engage in a joint study of South and Southeast Asian agriculture. She travelled extensively within India,