SPRINGER BRIEFS IN GLOBAL UNDERSTANDING

Peter Jackson · Walter E.L. Spiess
Farhana Sultana *Editors*

Eating, Drinking: Surviving

The International Year of Global Understanding — IYGU

GLOBAL understanding
International Year of Global Understanding (IYGU)

OPEN

Springer

SpringerBriefs in Global Understanding

Series editor

Benno Werlen, Department of Geography, Friedrich Schiller University Jena, Germany

The *Global Understanding* Book Series is published in the context of the 2016 International Year of Global Understanding. The books in the series seek to stimulate thinking about social, environmental, and political issues in global perspective. Each of them provides general information and ideas for the purposes of teaching, and scientific research as well as for raising public awareness. In particular, the books focus on the intersection of these issues with questions about everyday life and sustainability in the light of the post-2015 Development Agenda. Special attention is given to the inter-connections between local outcomes in the context of global pressures and constraints. Each volume provides up-to-date summaries of relevant bodies of knowledge and is written by scholars of the highest international reputation.

More information about this series at http://www.springer.com/series/15387

Peter Jackson · Walter E.L. Spiess
Farhana Sultana
Editors

Eating, Drinking: Surviving

The International Year of Global Understanding - IYGU

OPEN

Springer

Editors
Peter Jackson
Department of Geography
University of Sheffield
Sheffield
UK

Farhana Sultana
Department of Geography
Syracuse University
Syracuse, NY
USA

Walter E.L. Spiess
Karlsruhe Institute of Technology
Karlsruhe
Germany

ISSN 2509-7784 ISSN 2509-7792 (electronic)
SpringerBriefs in Global Understanding
ISBN 978-3-319-42467-5 ISBN 978-3-319-42468-2 (eBook)
DOI 10.1007/978-3-319-42468-2

Library of Congress Control Number: 2016948243

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Series Preface

We are all experiencing every day that globalization has brought and is bringing far-flung places and people into ever-closer contact. New kinds of supranational communities are emerging at an accelerating pace. At the same time, these trends do not efface the local. Globalization is also associated with a marked reaffirmation of cities and regions as distinctive forums of human action. All human actions remain in one way or the other regionally and locally contextualized.

Global environmental change research has produced unambiguous scientific insights into earth system processes, yet these are only insufficiently translated into effective policies. In order to improve the science-policy cooperation, we need to deepen our knowledge of sociocultural contexts, to improve social and cultural acceptance of scientific knowledge, and to reach culturally differentiated paths to global sustainability on the basis of encompassing bottom-up action.

The acceleration of globalization is bringing about a new world order. This involves both the integration of natural-human ecosystems and the emergence of an integrated global socio-economic reality. The IYGU acknowledges that societies and cultures determine the ways we live with and shape our natural environment. The International Year of Global Understanding addresses the ways we live in an increasingly globalized world and the transformation of nature from the perspective of global sustainability—the objective the IYGU wishes to achieve for the sake of future generations.

Initiated by the International Geographical Union (IGU), the 2016 IYGU was jointly proclaimed by the three global umbrella organizations of the natural sciences (ICSU), social sciences (ISSC), and the humanities (CIPSH).

The IYGU is an outreach project with an educational and science orientation whose bottom-up logic complements that of existing UN programs (particularly the UN's Post-2015 Development Agenda and Sustainable Development Goals) and international research programs. It aims to strengthen **transdisciplinarity** across the whole field of scientific, political, and everyday activities.

The IYGU focuses on **three interfaces** seeking to build bridges between the local and the global, the social and the natural, and the everyday and scientific

dimensions of the twenty-first-century challenges. The IYGU initiative aims to raise awareness of the global embeddedness of everyday life; that is, awareness of the inextricable links between local action and global phenomena. The IYGU hopes to stimulate people to take responsibility for their actions when they consider the challenges of global social and climate changes by taking sustainability into account when making decisions.

This Global Understanding Book Series is one of the many ways in which the IYGU seeks to contribute to tackling these twenty-first-century challenges. In line with its three **core elements** of research, education, and information, the IYGU aims to **overcome the established divide** between the natural, social, and human sciences. Natural and social scientific knowledge have to be integrated with non-scientific and non-Western forms of knowledge to develop a global competence framework. In this context, effective solutions based on bottom-up decisions and actions need to complement the existing top-down measures.

The publications in this series embody those goals by crossing traditional divides between different academic disciplines, the academic and non-academic world, and between local practices and global effects.

Each publication is structured around a set of key everyday activities. This brief considers issues around the essential activities of eating and drinking as fundamental for survival and will complement the other publications in this series.

Jena, Germany Benno Werlen
May 2016

Contents

Contributors

Ann E. Bartos School of Environment, The University of Auckland, Auckland, New Zealand

Trevor Birkenholtz Department of Geography and GIS, University of Illinois, Champaign, IL, USA

Rutgerd Boelens Department of Environmental Sciences, Wageningen University, Wageningen, The Netherlands

Jonathan Cloke Department of Geography, Loughborough University, Leicestershire, UK

Olivier Graefe Department of Geosciences, University of Fribourg, Fribourg, Switzerland

Peter Jackson Department of Geography, University of Sheffield, Sheffield, UK

Matthew Kelly Department of Global Health, Research School of Population Health, ANU College of Medicine, Biology and Environment, The Australian National University, Acton, ACT, Australia

Kathleen O'Reilly Department of Geography, Texas A&M University, College Station, TX, USA

Walter E.L. Spiess Institute of Food Process Engineering, Karlsruhe Institute of Technology, Karlsruhe, Germany

Farhana Sultana Department of Geography, Maxwell School, Syracuse University, Syracuse, NY, USA

Jeroen Vos Department of Environmental Sciences, Wageningen University, Wageningen, The Netherlands

Marisa Wilson Geography Building, School of Geosciences, University of Edinburgh, Edinburgh, UK

Elizabeth Young School of Sciences (Geography and Environment), Staffordshire University, Stoke-on-Trent, UK

Abstract

This publication addresses the global challenges of food and water security in a rapidly changing and complex world. The essays highlight the links between bio-physical and socio-cultural processes, making connections between local and global scales, and focusing on the everyday practices of eating and drinking, essential for human survival. Written by international experts, each contribution is research-based but accessible to the general public.

Keywords IYGU · Eating · Drinking · Food security · Water security · Development · Well-being · MDGs · SDGs

Introduction: Understanding the Complexities of Eating, Drinking, and Surviving

Peter Jackson, Walter E.L. Spiess and Farhana Sultana

Abstract This introduction to a series of essays on the global challenges of food and water security, commissioned as part of the International Year of Global Understanding, provides a definition of key terms and an historical context to these contemporary issues. It discusses the human right to adequate food and water, outlining some of the political struggles that have arisen over accessing these vital resources. Patterns of 'under-' and 'over-consumption' are discussed and analyzed, measured against the targets set in the Millennium Development and Sustainable Development Goals. The essays share a common approach, linking global challenges to the realities of everyday life and emphasizing the connections between biophysical and socio-cultural processes. The essays also address a number of cross-cutting themes including gender, ethnic and religious diversity, and the emotional and affective dimensions of life, going beyond questions of survival to incorporate the more qualitative dimensions of human well-being and quality of life.

Keywords IYGU · Eating · Drinking · Food security · Water security · Malnutrition · Obesity · Well-being · MDGs · SDGs

P. Jackson (✉)
Department of Geography, University of Sheffield, Sheffield S10 2TN, UK
e-mail: p.a.jackson@sheffield.ac.uk

W.E.L. Spiess
Institute of Food Process Engineering, Karlsruhe Institute of Technology,
Kaiserstr. 12, 76128 Karlsruhe, Germany
e-mail: rose-walter.spiess@t-online.de

F. Sultana
Department of Geography, Maxwell School, Syracuse University,
144 Eggers Hall, Syracuse, NY 13244-1020, USA
e-mail: sultanaf@maxwell.syr.edu

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_1

The Global Challenges of Food and Water Security

According to the UN Food and Agriculture Organization, food security can be said to exist '*when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*'.[1] While food insecurity was once associated mainly with low income countries, cast within a 'development discourse', it is increasingly seen as relevant to high- and middle-income countries as a result of a particular combination of circumstances. Commonly referred to as a 'perfect storm' (Beddington 2010), experts have warned of the combined effects of climate change (increasing extreme weather events such as floods and droughts), the pressures of population growth and urbanization on the availability of agricultural land, and the increasing global demand for meat and animal products, which are threatening to undermine the ability of current agri-food systems to feed a global population which it is estimated will increase from around 7.4 billion today to around 9.6 billion by 2050 (UN 2013). The need for sufficient clean water to meet the needs of both thirsty people and crops have also put enormous pressure on dwindling water resources, creating water crises in drinking water systems and irrigation systems, bringing into question how we manage surface and ground water sources. To cope with future challenges innovative solutions have to be sought. Within the same time period it is also estimated that there will be a quadrupling in the global economy, a doubling in the demand for food and fuel, and a more than 50 % increase in the demand for clean water (Foresight 2011).

The spectre of population growth outstripping available resources especially in food insecure environments has been debated for many years. Writing before the Industrial Revolution had transformed the economies of Western Europe and North America, Malthus (1798/2008) described the tendency of population, when unchecked by war and famine, to increase geometrically while agricultural outputs tended to increase arithmetically. Responses to the imbalance of population and resources have varied from calls to restrict population growth by contraception and other means that Malthus would not have countenanced, to an emphasis on increasing agricultural yields through scientific and technological innovation. Whether increased outputs can be achieved without having an adverse effect on the environment is currently being debated by advocates and critics of 'sustainable intensification' (Garnett et al. 2013).

Periodic crises, such as the 2007–8 'spike' in food prices which was driven by the increasing cost of agricultural commodities (including key inputs such as pesticides and fertilisers), led to social unrest, food riots and trade restrictions, precipitating what UN Secretary General Ban Ki Moon called '*the worst food crisis in a*

[1]The full definition can be consulted at http://www.fao.org/docrep/005/y4671e/y4671e06.htm (accessed 20 April 2016). As might be imagined, each clause in the definition has been fought over since the initial formulation was advanced at the World Food Summit in 1996. See Midgley (2013) for a genealogy of this complex process.

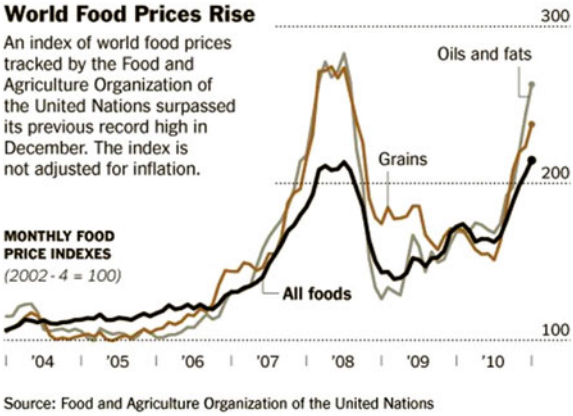


Fig. 1 The 2007–8 spike in food prices. *Source* FAO

generation' (April 2008) (see Fig. 1). These issues reflect an underlying scarcity of food, water, and energy sources—to some extent because of a poor management of the available resources—as the world enters the period of 'peak oil' production. Magazines such as *The Economist* have reported on 'The end of cheap food' (6 December 2007) and 'The silent tsunami: the food crisis and how to solve it' (19 April 2008), while think-tanks such as the New Economics Foundation have discussed the dire consequences of future food shortages, predicting that even the most food-secure places might be as little as 'nine meals from anarchy' (Simms 2008).

While growing food requires water, more importantly for us to survive as a species we need to consume water. Water is the biologically-necessary and non-substitutable resource that makes life on this planet possible. To reproduce our own beings requires that humans have adequate access to clean, safe potable water. For societal growth, water has to be available for a variety of societal needs—sanitation, industry, irrigation, ecosystem reproduction. Water is thus a political, economic, cultural, legal, and spiritual entity, and it seeps across all boundaries, natural and social. Water has been fought over through history, but it has also been regulated through communal, religious, and political means. As water sources become contaminated, polluted, and depleted, the global demand on water has continued to rise. Growing water crises around the world have meant that some have easier access to necessary water while others do not. Over 800 million people do not have access to clean drinking water on a daily basis. This astounding number indicates the daily suffering that individuals and societies must endure for basic survival. To address this, the United Nations declared in 2010 that water was a human right. UN Resolution 64/292 states unequivocally that '*The right to safe and clean drinking water and sanitation is a human right that is essential for the full enjoyment of life and all human rights*'. This means that states have an obligation to fulfil the right for their citizens. Global water justice movements, policymakers, citizens, and scholars worked hard to get the UN to ratify the resolution, and have been rallying stakeholders to ensure water security of individuals, households, and communities are met. However, ensuring water of adequate quantity, quality,

reliability, affordability, and accessibility remain significant challenges around the world (Sultana and Loftus 2012). This is particularly true of the Global South, but increasingly so in wealthy countries (e.g., Flint, Michigan, USA).

Controlling water, whether through technology or market mechanisms, has resulted in increasing suffering of many. The steady rise in commodification and privatization of water around the world has meant that poor people are marginalized in accessing a basic human right. Governments often privatize water supply systems as part of loan conditionality of international aid donors. Poor communities often cannot afford the water they need for survival, thereby resorting to accessing contaminated water sources. More than 2000 children under the age of five die daily from water-related illnesses, especially from lack of sanitation and hygiene. The need to make clean water more accessible to all could not be more profound. The priorities to meet the daily water needs of a thirsty population are important for nation-states, but such concerns are often neglected until crises unfold (e.g., water-borne disease outbreaks). Cities and municipalities struggle to provide safe potable water in the face of infrastructural, financial, and coverage challenges. The famous Cochabamba Water Wars in Bolivia in 1999 resulted in global attention to the commodification and privatization of water that hurt the poor, demonstrating the interconnections between geopolitics, international aid, urban governance, and citizen disenfranchisement. In understanding the role that water plays in mobilizing people (when there is insufficient water) as well as creating apathy (when water is not of concern) can help us see the ways water is valued, managed, and how societies relate to one another.

As the preceding comments suggest, the scarcity of resources is compounded by problems of unequal access, whether in terms of gender disparities in access to food and water or in terms of the twin problems of 'over-consumption' (mainly in the Global North) coupled with 'under-consumption' (mainly in the Global South). For at the same time as there are more than 900 million undernourished people worldwide, there are growing numbers of overweight and obese people described by many as reaching epidemic proportions.[2] The World Health Organization noted that more than 1.9 billion adults were overweight in 2014 (using the medical definition of those with a Body Mass Index of 25 or above), of whom more than 600 million were classified as obese (with a BMI of 30 or above).[3] That 'under-consumption' is not restricted to the Global South can be demonstrated by the alarming rates of food poverty in even the most affluent countries.[4] These issues have led to calls for a shift in emphasis from food charity to food rights (see, for example, Riches and Silvasti 2014).[5]

---

[2]Malnutrition is considered the greatest risk to public health (greater than HIV-AIDS, malaria and TB combined).

[3]For further details of how obesity and overweight are defined, see http://www.who.int/mediacentre/factsheets/fs311/en/ (accessed 20 April 2016). For a critical account of the obesity 'epidemic', see Guthman (2011).

[4]For a discussion of First World food poverty, see Riches and Silvasti (2014).

[5]The right to an adequate standard of living, including adequate food, clothing and housing, was affirmed under the International Covenant on Economic, Social and Cultural Rights, a multilateral

'Halving hunger' by 2015 was one of the UN's Millennium Development Goals (MDGs) which also included specific targets for improving child health, water and sanitation, women's reproductive health, reductions in epidemic diseases and improvements in education and networking. According to the UN's own evaluation and despite considerable progress in some areas, high levels of hunger were still found in sub-Saharan Africa and Southern Asia, with moderate level of hunger persisting in Western, Eastern and South-Eastern Asia, in Oceania, the Caucasus and Central Asia, and in Latin America and the Caribbean. The MDGs also sought to halve the proportion of the world's population without improved drinking water but, by 2015, 'low coverage' was still recorded in sub-Saharan Africa and Oceania, with only 'moderate coverage' reported in the Caucasus and Central Asia. Poor progress or deterioration was also noted in several parts of the world.[6] The MDGs have now been superseded by a series of equally ambitious Sustainable Development Goals (SDGs) which include specific commitments to 'end hunger, achieve food security and improved nutrition and promote sustainable agriculture' and to 'ensure availability and sustainable management of water and sanitation for all' by 2030.[7]

Approaching the Issues

Our approach in this publication is to emphasise the relationship between the global challenges of food and water security and the realities of everyday life for people in different parts of the world. We emphasise the practicalities of eating and drinking as social processes, undertaken in households and communities, besides the more abstract approaches to food and water taken by food scientists or hydrologists. Without underestimating the power of agri-food corporations and global trade agreements in shaping contemporary food systems, we emphasise the agency of ordinary people in meeting the daily challenges of 'feeding the family' (De Vault 1991). We also focus on the challenges involved in managing water which enables food to be grown, for families to have their right to water met for drinking, cooking, sanitation and survival needs, and for societies to access water that enables them to flourish and develop.

As with the other publications in this series, we emphasise the links between bio-physical and socio-cultural processes, and the connections between different geographical scales, from the most local decisions taken at household level to the

(Footnote 5 continued)

treaty adopted by the UN General Assembly in 1966. Several countries, including the US, have not yet ratified the Covenant.

[6]For an assessment of progress in achieving the MDGs, see http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20PC%20final.pdf (accessed 20 April 2016).

[7]For further information on the Sustainable Development Goals, see https://sustainabledevelopment.un.org/?menu=1300 (accessed 20 April 2016).

actions of transnational corporations that have truly global consequences. The authors and editors have experience of researching in many parts of the world (though we acknowledge the risk of ethnocentrism implicit in the current balance of power in academia reflected in the places from which the majority of our authors are drawn). We hope to increase the reach of our work through translating this English edition into Spanish and Portuguese (with further editions planned as soon as the necessary funds are secured). We also hope the Regional Action Centres associated with the IYGU will use this publication as a resource, debating its applicability to their own circumstances and proposing new avenues for future work to increase its global relevance.

Each essay has been written by someone with academic expertise in the area discussed but we have encouraged them to write in a style that is accessible to the general public, including an audience of students and teachers. With the cooperation of Ben Hennig and his colleagues at Oxford, we have included a series of illustrations from the Worldmapper project which uses specially-designed maps to highlight the extent of social and spatial inequalities that characterise our current agri-food systems.[8] The maps provide a way of visualizing existing differences, making connections, thinking across scales and imagining alternative worlds, demonstrating the power of 'thinking geographically' (Jackson 2006). Authors have also been asked to explore alternative framings that challenge the conventional wisdom of orthodox ideas and approaches. How, for example, might the language of 'food security' shape the way we think about food poverty and inequality? How might these ideas be reshaped by adopting the language of food justice or food sovereignty? Each essay adopts a lively and argumentative approach, using evidence to make a case rather than being purely polemical.

Besides our substantive emphasis on eating and drinking, the essays also address a series of cross-cutting themes including gender, ethnic and religious diversity, and the emotional and affective dimensions of life which take the argument beyond questions of survival (as might be suggested by our title) into the more qualitative dimensions of human well-being and quality of life.

Introducing the Essays

The essays begin with an outline of the global inequalities that affect people's daily access to food and water in the Global North and South. **Elizabeth Young** highlights the 'cruel paradox' at the heart of the current agri-food system where under-nutrition in some places co-exists with obesity as a major public health problem in other places. She outlines the geographically uneven nature of hunger and the need to disaggregate data to reveal the various scales at which inequalities occur including social inequalities by age and gender. Young's essay raises

[8]For further information, see http://www.worldmapper.org (accessed 20 April 2016).

questions of equity and entitlement, approaching food as a human right rather than as a matter of national and international security.

Trevor Birkenholtz takes a similar approach to the world's unequal access to drinking water, the scarcity of which disproportionately affects women. Drawing on the concept of 'modern water' as a calculable physical entity, divorced from its socio-cultural context, Birkenholtz argues that this technocratic way of thinking about water may exacerbate the problems of scarcity it was designed to eradicate. He suggests that the 'hydrosocial cycle' may be a preferable concept to the geo-engineering construct of the 'hydrological cycle', acknowledging the way that water supply development is embedded within wider issues of climate change, food security, natural disasters, healthy ecosystems, and livelihood well-being. While access to water has been improved in many parts of the world, the UN estimates that water scarcity affects around 40 % of the global population, urban-rural disparities persist and new conflicts have arisen over the privatization and commodification of this most basic resource.

Jeroen Vos and Rutgerd Boelens mobilise the concept of 'virtual water' in their discussion of the relationship between water resources, agriculture and trade. The idea is to measure the amount of water 'embedded' in specific products, representing the water used (or contaminated) in its production. While the concept has academic and political value, drawing attention to the amount of water consumed in the production of export crops, frequently traded across considerable distances, it can draw attention away from local situations in which real as opposed to virtual water is a matter of life or death, where few if any alternative sources are available. The needs of agri-food corporations for water to produce high-value fruits and vegetables or other water-intensive crops such as bio-fuels put them in competition with the resource needs of local small-holders and other less powerful rural communities. As the regulation of water resources becomes increasingly transnational, these political struggles are likely to intensify.

In his essay on integrated water resources management, **Olivier Graefe** asserts that the problem of access to water is not primarily due to an overall scarcity of water, nor is it primarily a technical or ecological issue. Rather, Graefe maintains, it is a management problem whose roots extend back to colonial times and whose solution must be found in political-economic terms. Despite major achievements in increasing global access to water, Graefe highlights failures in policy initiatives such as the structural reform programmes that followed the Bretton Woods agreement and which gave rise to competition between the agricultural, industrial and drinking water sectors. Examining the 'new paradigm' of integrated water management which advocates the river basin as the most appropriate scale for water management, Graefe shows how water transfers between river basins, which currently affect some 120 million people worldwide, undermine this approach. Attention therefore turns to questions of governance and the reliance on environmental experts who may lack political and democratic legitimacy.

Focusing on water, sanitation and hygiene, **Kathleen O'Reilly** highlights the consequences of unequal access to these key resources for people's health and wellbeing. She shows how safe disposal of human waste and effective hygiene

standards are key issues in the survival of vulnerable populations, especially children, where conditions at the household level have repercussions at the regional and national scale, ultimately affecting global-level inequalities in infant mortality. O'Reilly also shows how poor sanitation and access to clean water impact disproportionately on women, increasing the risks of bodily harm and emotional stress. A Community-Led Total Sanitation approach is one means of combatting these environmental health issues, providing people with the dignity of reasonable access to safe water and effective sanitation.

Walter Spiess outlines the present availability and outlook for food supply in the next decades based on data compiled by FAO working groups. Differentiating global data highlights the availability of major nutrients in food secure and disadvantaged insecure regions of the globe. A major problem is the increasing length and complexity of supply chains which has led to a growing disconnection between food producers and consumers, one of the major reasons for the current low levels of consumer trust in food (Kjaernes et al. 2007).[9] Factors with a pronounced impact on food supply include the growing middle class in Developing as well as Transitional Countries who desire more animal-based food components like dairy and meat products and increased biofuel production. Both realities diminish the supply especially of grains for consumers; the increased meat production requires large amounts of grain-feed and is related to an increased emission of greenhouse gases while biofuel production diverts valuable raw materials from the human food chain. The increased demand for more raw materials to support the food supply for the growing world population requires the use of so far underutilized land reserves but also a more intelligent use of available resources.

Marisa Wilson contrasts the moral economy of food in socialist and post-socialist countries with countries that espouse a market-led neoliberal approach. She argues that the production and consumption of food raises moral issues because it is a social necessity rather than simply a commodity that is produced and traded for profit. Her essay raises ethical issues about 'eating well', often cast in terms of quality, taste and sustainability, all of which have moral implications. Through her research on Cuba, Wilson shows how the way people produce, exchange and consume food have impacts on their everyday lives. Throughout its history, food production in Cuba has been tied into a global economy, whether producing sugar for export to the US in the period before 1959 or for the Soviet Union after the Revolution. Today, Cuba relies heavily on imported food and it is unclear how the current period of normalization in its relations with the US will play out. Drawing on her own ethnographic work, Wilson suggests that (neo)liberal and (post)socialist moral economies currently co-exist in uneasy tension with practical consequences for people's everyday lives.

[9]Following a recent outbreak of Foot and Mouth Disease in the UK, the Policy Commission on the Future of Farming and Food (2002) argued that the current agri-food system was 'dysfunctional' because farming had become detached from the rest of the economy and the environment. Emphasising the need for reconnection along the supply chain, the report's authors argued that consumers no longer knew enough about what they eat and how it is produced.

Turning attention to East and Southeast Asia, **Matthew Kelly** explores the process of change from a predominantly rice-based diet to one that includes an increasing volume of processed food, high in fats, salt and sugar. While famine and malnutrition have been reduced as a result of this so-called 'nutrition transition', it has had severe consequences in terms of rapidly increasing rates of obesity and associated non-communicable diseases such as diabetes, cardiovascular problems and diet-related cancers. Kelly debates the extent to which these changes have been driven by the expansion of industrialized agriculture and the growing reach of transnational corporations, keen to sell energy-dense foods to an expanding middle-class consumer market who aspire to Western-style diets. The dilemma, he suggests, is whether economic growth and food security can be achieved while avoiding the negative health and environmental impacts of large-scale dietary change.

In the following essay, **Ann Bartos** outlines an alternative framing to the dominant food security discourse, tracing the origins of the concept of 'food sovereignty' in the global social movement associated with La Via Campesina. Focusing on the case of Aotearoa New Zealand, Bartos argues that these concepts have a distinctive history as they travel between different places. She shows how Tourism NZ and the dairy company Fonterra have mobilised a particular 'geographical imaginary' in their marketing strategies based on the model of '100 % Pure New Zealand'. She then uses this framework to examine three basic premises of the food sovereignty discourse regarding the provision of safe, sufficient and nutritious food; its cultural appropriateness; and its encouragement of domestic production and self-sufficiency. Bartos concludes that each of these issues is problematic in the New Zealand case, undermined by inequalities of provision, the speciousness of 'consumer choice' in a national context that is dominated by two supermarket chains; and a range of environmental issues including the pollution of agricultural land and freshwater ecosystems.

In the final essay, **Jonathan Cloke** raises some fundamental questions about current levels of food waste, arguing that these are not a regrettable side-effect of current systems of production, distribution and consumption but that they are intrinsic to the profit-driven motives of contemporary agri-business.[10] Advocating a food-systems approach, Cloke argues that over-supply is a systemic rather than an accidental feature of food businesses that seek to avoid empty shelves, insisting on cosmetic standards for the shape and appearance of produce, encouraging the purchase of larger pack-sizes and using promotional strategies such as buy-one-get-one-free—all of which are likely to lead to food waste either in-store or in people's domestic environments. The resulting food waste is often sent to landfill where it contributes to anthropogenic global warming through the generation of methane emissions and other greenhouse gases. Cloke challenges the 'productivist'

[10]A recent report by the Institute of Mechanical Engineers (IME 2013) estimated that between 30 and 50 % of food produced globally never reaches a human stomach because of wastage on farm, during harvesting, processing and transportation, or in store and at home.

orientation of contemporary food policy calling for more attention to corporate profits as the engine driving food and other resource waste.

While these essays are by no means comprehensive in their global or topical coverage, we hope they provide a useful overview of the current challenge of securing sufficient, safe food and water to meet the needs of the world's rapidly expanding population. We have sought to advance a critical perspective on these issues, emphasising political questions about distribution and equality as much, if not more, than questions of absolute scarcity. We have outlined a range of alternative formulations to conventional thinking about food and water security, such as food sovereignty and the hydrosocial cycle, discussing the moral and political economies of current agri-food systems and the need to take account of geographical variations in issues that are often cast at the global or national scale. We have emphasised the differential impacts of resource scarcities on men and women and on younger and older people, challenging conventional solutions that are cast in technocratic terms that ignore their socio-cultural, political and ethical dimensions. In calling for greater understanding of the challenges of food and water security, we advocate the need for theoretically informed, empirically grounded research that addresses questions of scale, focusing on the inter-connections between bio-physical and socio-cultural systems. These are some of the fundamental themes that underpin the International Year of Global Understanding and they are key to addressing the challenges of eating, drinking and surviving, now and in the future.

References

Beddington, J. (2010). *Food, energy, water and the climate: A perfect storm of global events?*. London: Government Office for Science.

De Vault, M. L. (1991). *Feeding the family: The social organization of caring as gendered work*. Chicago: University of Chicago Press.

Foresight. (2011). *The future of food and farming: Final report*. London: Government Office for Science.

Garnett, T., Appleby, M. C., Balmford, A., Bateman, I. J., Benton, T. G., Bloomer, P., et al. (2013). Sustainable intensification in agriculture: Premises and policies. *Science, 341*, 33–34.

Guthman, J. (2011). *Weighing in: Obesity, food justice and the limits of capitalism.* Berkeley and Los Angeles: University of California Press.

IME. (2013). *Global food: Waste not, want not*. London: Institute of Mechanical Engineers.

Jackson, P. (2006). Thinking geographically. *Geography, 91*, 199–204.

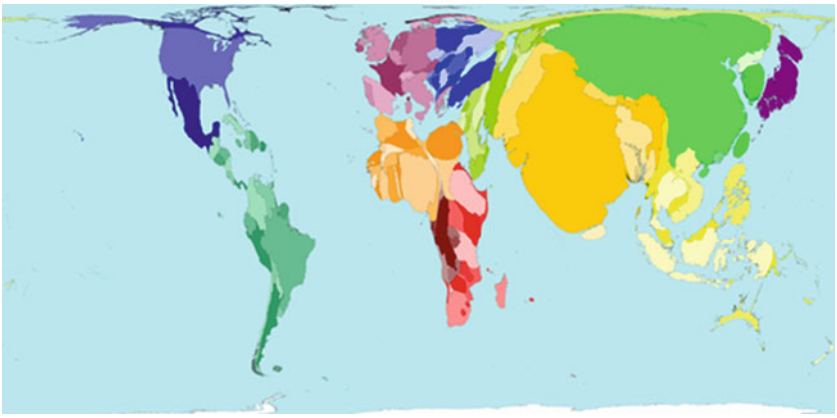
Kjaernes, U., Harvey, M., & Warde, A. (2007). *Trust in food: A comparative and institutional analysis*. Basingstoke: Palgrave Macmillan.

Malthus, T. R. (1798/2008). *An essay on the principle of population*. Oxford: Oxford University Press (World Classics).

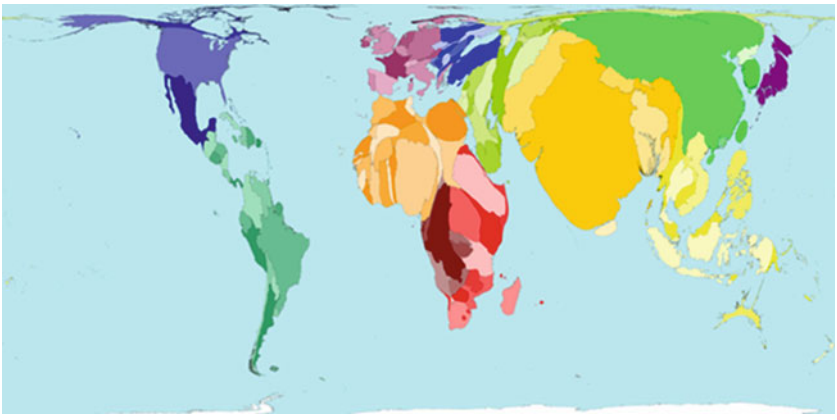
Midgley, J. L. (2013). Food (in)security in the global 'north' and 'south'. In A. Murcott, W. Belasco, & P. Jackson (Eds.), *The handbook of food research* (pp. 425–438). London: Bloomsbury Academic.

Policy Commission on the Future of Farming and Food. (2002). *Farming and food: A sustainable future*. London: Cabinet Office.

Riches, G., & Silvasti, T. (Eds.). (2014). *First world hunger revisited: Food charity or the right to food?*. Basingstoke: Palgrave Macmillan.
Simms, A. (2008). *Nine meals from anarchy*. London: New Economics Foundation.
Sultana, F., & Loftus, A. (2012). *The right to water: Politics, governance and social struggles*. London and New York: Routledge.
UN. (2013). *World population prospects: The 2012 revision*. New York: United Nations, Department of Economic and Social Affairs, Population Division.



Total population. The distribution of the earth's population is shown in this map. **The size of each territory shows the relative proportion of the world's population living there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Population 2050. By 2050 it is estimated that the earth's human population will be 9.07 billion. 62 % of the people will live in Africa, Southern Asia and Eastern Asia **This map shows the predicted distribution for the estimated world population in 2050**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Globalization and Malnutrition: Geographical Perspectives on Its Paradoxes

Elizabeth Young

Abstract This chapter maintains that the food system is one of the most important globally embedded networks of production and consumption; its integral connections with the petroleum industry and global security confirm its significance. The chapter establishes the complex nature of mapping and measuring malnutrition. It reviews significant shifts in the incidence of malnutrition but argues that disaggregating statistics is vital to understanding trends. Changes in theorizations of the problem of malnutrition and associated solutions are then considered, including conceptual shifts from food security to food sovereignty. The global food chain is embedded in contentious political, economic, and scientific debates. Volatility in local food prices are influenced by global factors: oil prices; energy policies; dietary changes, foreign direct investments associated with "land grabs" or financial speculation. The chapter concludes with a call for a fundamental rethinking of global food provisioning to establish a more socially equitable and environmentally sustainable system.

Keywords Global food system · Geography of malnutrition · Conceptualization malnutrition · Mapping and measuring malnutrition · Food security · Food sovereignty · Politics and malnutrition · Food provisioning

The current food system has evolved in response to specific historical, political, and economic circumstances; it is not a natural system but a socially constructed one which reflects patterns of power and privilege. It is a dynamic system which has changed dramatically in the past and will in the future (Rosegrant et al. 2012). Goodman and Sage (2013) assert that "there is almost nothing more geographical than food in the ways that it intimately interlinks production and consumption, nature and society, bodies and landscapes, the global and the local, and indeed spaces, places, and everywhere in between" (p. 3). This chapter maintains that the

E. Young (✉)
School of Sciences (Geography and Environment), Staffordshire University,
Leek Road, Stoke-on-Trent ST4 2DF, UK
e-mail: l.young@staffs.ac.uk

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_2

food system has become one of the most important globally embedded networks of production and consumption; its integral connections with the petroleum industry and global security only serve to confirm its centrality and significance (Le Billon et al. 2014a, b; Goodall 2008; Weis 2009).

Geographical perspectives on food illuminate a cruel paradox at the heart of contemporary globalization. Why do millions of people still die from hunger and hunger-related diseases while the health of millions is threatened by an obesity pandemic? In a world where millions enjoy a more varied diet than ever before and waste nearly as much as they eat, why does food scarcity still haunt millions? Meanwhile countries as varied as China, Mexico, Saudi Arabia, and Egypt now suffer a "double burden" where under nutrition coexists with obesity as a major public health problem; a strange world too where "some people destroy food because prices are too low, and others literally eat dirt because food prices are too high" (Angus 2008: 1). Understanding these paradoxes requires analysis of unprecedented changes in global food provisioning in the last 40 years, but we start with a review of malnutrition statistics which establishes the contentious nature of the "food debate."

> [A]bout 805 million people are estimated to be chronically undernourished in 2012–14, down more than 100 million over the last decade……In the same period, the prevalence of undernourishment has fallen from 18.7 to 11.3 percent globally (SOFI, 2014 introduction).

So, time to celebrate? Maybe, but first it is vital to consider some problems associated with measuring malnutrition (Lappé et al. 2013; IFPRI 2014). The FAO (2012, 2014) employs a limited definition of hunger based on a diet of 1800 kilocalories per day, the minimum for someone who is not active. If we assume people are active and need more calories, then these estimates are a gross underrepresentation. They also ignore "hidden hunger," diets sufficient in calories but which lack essential minerals and vitamins, such as iron, vitamin A, iodine and zinc. A recent estimate holds that 2 billion people suffer from this form of malnutrition and associated health problems (IFPRI 2014, p. 5).

Such statistics also ignore the geography of global hunger. While there has been a marked decline in under nutrition between 1990 and 2014, the process has been very uneven. Advances "by two countries, China (−96 million) and Viet Nam (−24 million) amounts to 91 % of the net numerical reduction in undernourished people between 1990 and 2012" (Lappé et al. 2013, p. 1). Such geographical disaggregation is vital for understanding global trends. It is also vital for identifying successful and unsuccessful national policies. Examining regional trends is complex too—examples from Africa exemplify this point.

The 2012 FAO Report remarks that "we are losing the battle in Africa." However, if we disaggregate the statistics, a more nuanced picture emerges; countries in this region exemplify best and worst practice. Ghana's success is dramatic and illustrates what can be done to reduce hunger by dedicated political interventions (Curtis 2011). In contrast, the Democratic Republic of Congo exemplifies the worst case situation and helps explain the poor performance of Sub Saharan Africa (SSA) in aggregate; extract this one country and the "picture" from

SSA is less depressing. These examples exemplify the importance of scale to analyses of malnutrition; it is always instructive to disaggregate data whether at the global, regional or national scale.

Disaggregating statistics based on other variables is also illuminating, as populations which are economically and political marginalized dominate national statistics. Rural populations have a higher incidence of malnutrition than urban populations; females and children more than males; ethnic minorities and people with disabilities more than the general population (Young 2012). Finally, world food prices are volatile and subject to changes associated with social and natural factors, so numbers vary seasonally and the specific geography of their impacts are notoriously complex (Cohen and Smale 2012).

Recently malnutrition due to overconsumption has emerged, diets with too many calories, sugar, and fats are a major global public health problem. Once considered a problem for small numbers of people in affluent societies, obesity has now reached epidemic proportions.[1] Globalization since the 1970s helps explain the nutritional transition in the global south and the emergence of obesity there (Hawkes 2006). Countries formerly concerned only with under nutrition now suffer from a 'double burden' where under nutrition coexists with obesity (FAO 2006). Alarming headlines appear regularly across the globe, there is no escape from the "obesity pandemic" (Popkin 2007; Frenk 2012). However, measuring obesity is problematic and its incidence, as well as its implications, is contested. The discussion above establishes the controversial and contentious nature of mapping and measuring malnutrition; explaining the causes and evaluating solutions are more politically charged, it is indeed a "battle for mouths, minds and markets" (Lang and Heasman 2004). How do we explain the patterns of malnutrition and how may they be reduced?

Proximate factors may be responsible for volatile food prices and increases in the number of hungry people, but the nature of these has changed markedly as the food system has become more global in character. In the past, unpredictable weather, pests and conflict often resulted in local food price increases and associated food shortages. Today, local food prices are more often influenced by global factors: oil prices; energy policies; dietary changes, foreign direct investments associated with "land grabs" or financial speculation (Saturnino et al. 2011; Goodall 2008; Geary 2012; GRAIN 2008; IATP 2008; Ghosh 2009; Jarosz 2009; Wahl 2009; Swaminathan 2013). To understand the extensive and protracted nature of global malnutrition we must examine the profound changes in the structure and nature of global political economy (Clapp 2012; Clapp and Cohen 2009; von Braun 2007; Weis 2007; Young 2012; Le Billion et al. 2014a, b; McMichael 2009; Magdoff 2004, 2008, 2013; Magdoff and Tokar 2010).

Conceptualisations of the problem and their associated policy recommendations are diametrically opposed and reflect divergent political perspectives. At one

[1]Describing obesity as an 'epidemic' is controversial as, unlike most epidemics, it is not a communicable disease.

extreme are those who advocate more industrial food production and urge us to embrace new technologies emerging from corporate research laboratories. This vision triumphs the technological revolution that has transformed agricultural production since the end of the 1950s and argues that the revolution should be extended and intensified (World Bank 2008; Beddington 2010; DuPont 2014; Monsanto 2014). This perspective employs a narrow interpretation of food security:

> food security, at the individual, household, national, regional and global levels is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (World Food Summit 1996).

Traditional approaches have emphasized producing more food from a more or less stable resource base, a process sometimes referred to as 'sustainable intensification'. But transformations of the global system over the last 60 years mean that the food security concept has limited purchase to tackle the myriad problems associated with the food system today; namely, human rights abuses, international trade and aid policy, global governance and development policy, equity, access and ownership of resources, public health, and environmental issues, for example (Pretty et al. 2010; Sage 2012; Mittal 2009; Young 2010; Carolan 2011). Conceptualizing 'the food problem' as a simple 'production' issue, where 'we need more food' ignores the complex reasons that some people are hungry. This 'productionist' approach still dominates debates about the problem of hunger and is allied to Malthusian interpretations where "too many people" are understood to be the problem. Such simplistic interpretations are untenable; the problem is much more complex and politically charged. As Maxwell and Slater (2004, p. 3) conclude '[A] preoccupation with food security is no longer sufficient'.

At the other end of the spectrum, are those who argue that the nature of contemporary food production is the cause of the current crisis and that its promotion will exacerbate the problem (Wise and Sundell 2014). This vision calls for a fundamental rethinking of global food provisioning, and argues for changes at every stage of the food system to establish a more socially equitable and environmentally sustainable system (Clapp 2012; Paarlberg 2010; Thurow and Kilman 2009; von Braun 2007; Weis 2007; Lang and Heasman 2004; Holt-Gimenez and Patel 2009; Young 2012). This interpretation emphasizes the central role of corporate control and the political manipulation of trade and subsidy regimes. At present corporate profits increase while millions remain hungry, others become obese and the environment suffers. World Watch (2010) suggest that instead of producing more food a more effective way to address food security issues and climate change would be to encourage self-sufficiency and waste reduction, in wealthier and poorer nations alike. Such perspectives reject the narratives emanating from agribusiness interests and their allies in governments; instead they emphasize securing "entitlements" and promoting "food sovereignty" (see Bartos, this volume).

Sen (1981) introduced the concept of entitlements and transformed the debate about food security and hunger. He argued that "[S]tarvation is the characteristic of some people not having enough food to eat. It is not the characteristic of there not

being enough food to eat" (Sen 1981, p. 1); as is the case today when we produce more than enough food to feed everyone. However, millions do not have the capacity to access the food in their midst, their assets (financial and social) are insecure or minimal; food follows customers, whether people or pets. Processes operating at every scale influence how food is distributed and how entitlements are constructed (Young 2012, p. 22). The ability of some people to command food reflects their political, economic, or social status. The role of gender is an obvious example; female entitlements are frequently constrained by discrimination which privileges male access to land, capital, and education (Action Aid 2010; IFAD 2012; Tsikata and Golah 2010; IDS 2014; FAO 2013).

Food sovereignty (Nyelini Declaration 2007) is another concept employed to explain malnutrition; it draws attention to how and where decisions about the food system are implemented. Unlike food security, it puts the question of power and politics at the center of the debate (Schanbacher 2010). Food sovereignty "is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Nyeleni Declaration). The concept has been adopted by myriad groups who want radical changes to the contemporary food system (Anderson and Bellows 2012; GRAIN 2014).[2] Major themes include: securing livelihoods; gender equity; environmental objectives; land and property rights and agrarian reform policies; local autonomy; democratic systems of governance; and it urges resistance to corporate control of the food system. Food sovereignty establishes politics at the heart of the food debate. It is about who controls the food system and about human rights (Valente 2014). This perspective challenges the power of corporations, other special interests and the institutions of global governance (World Trade Organization, World Bank and International Monetary Fund) that deliver their agendas. Instead, they demand that the food system be more democratically governed and locally embedded; for them, neo-liberal, market-based solutions—hegemonic since the 1950s—are not working and business as usual is not an option (Wise 2013).

Every stage of the modern food chain is embedded in contentious economic and scientific debates; these are political because they are about the role of markets and the state, about global trading regimes and the ability of governments to control their agricultural and food policies. They are political because food security is the most basic expectation that citizens have of their government; failure to provide a decent diet is associated with autocratic or corrupt regimes or conflict ridden political situations. Finally, they are political because scarcity leads to food riots which have been associated with radical regime change in the past and food is now embedded in global security debates.

Given the complexity of the food system, employing various scales for analysis helps illuminate some otherwise obscure interactions. Processes which operate at

[2]The right to adequate food and freedom from hunger is also inscribed in international law through Article 11.2 of the 1966 International Covenant on Economic, Social, and Cultural Rights.

the global scale are mediated by national processes and these, in turn, are modified by a variety of internal variables. Global processes establish the context within which national processes operate and create distinctive national geographies of food production and consumption (Wise and Murphy 2012). The limitations of national analyses are obvious; however, most of us still consume our food in national contexts and, rightly or wrongly, still presume that national governments can intervene to improve food provisioning systems or the nature of our diets. Then local and household variables further help explain entitlements, culturally and regionally specific variables generate local diversity. Clearly there are multiple political spaces where challenges to the contemporary food system and its socially and environmentally unsustainable character can be resisted. Realizing alternative visions will require vigorous political activism by diverse interests at global, national and local scales (Sage 2013, 2014; Horlings and Marsden 2011). Positive changes have been detailed, their implementation is urgent (Wise and Murphy 2012). The political landscapes of agriculture and food are changing and one might ask whether, as the main players of the past (USA and EU) are replaced by the emerging agricultural giants, namely, Brazil, China and India, will this herald a new more equitable vision for global food security?

References

Action Aid (2010) Her mile: Women's rights and access to land. http://www.landcoalition.org/en/publications/her-mile-women%E2%80%99s-rights-and-access-land. Accessed 8 January 2015 at 17.11 GNT.

Anderson, M. D., & Bellows, A.(2012) Introduction to symposium on food sovereignty: Expanding the analysis and application. *Food Sovereignty 29*(2), 177–184.

Angus, I. (2008). 'Food crisis: The greatest demonstration of the historical failure of the capitalist model' global research. http://www.socialistvoice.ca/?p=274. Accessed 7 January 2015.

Beddington, J. (2010) Global food and farming futures. *Philosophical Transactions Royal Society B 265*, 2767.

Carolan, M (2011) *The real cost of cheap food*. London: Routledge.

Clapp, J. (2012). *Food*. Cambridge: Polity Press.

Clapp, J., & Cohen, M. (Eds) (2009). *The global food crisis: Governance challenges and opportunities* (pp. 1–12). Canada: The Centre for International Governance Innovation and Wilfrid Laurier University Press.

Cohen, M. J., & Smale, M. (2012). *Global food-price shocks and poor people: Themes and case studies*. Oxon: Routledge.

Curtis, M. (2011). Country successes in reducing hunger: How they did it, and why other donors and governments should change policy. http://www.actionaid.org/sites/files/actionaid/country_successes_in_reducing_hunger_mark_curtis_nov_2011_0.pdf. Accessed 6 January 2015.

DuPont. (2014). Food solutions. http://www.dupont.com/corporate-functions/our-approach/global-challenges/food.html. Accessed 19 November 2014.

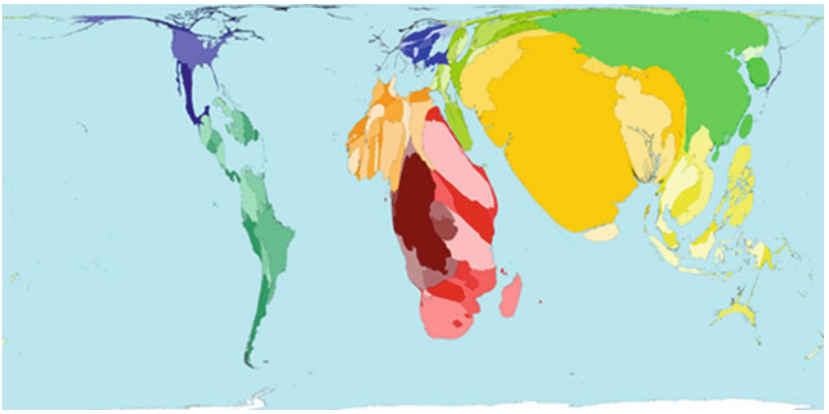
Food and Agricultural Organization. (2006). *The double burden of malnutrition: Case studies from six developing countries*. Rome: FAO.

Food and Agricultural Organization. (2012). State of food insecurity in the world. http://www.fao.org/docrep/016/i3027e/i3027e00.htm. Accessed 8 January 2015.

Food and Agricultural Organization. (2013). Gender equality and food security: Women's empowerment as a tool against hunger. http://www.fao.org/wairdocs/ar259e/ar259e.pdf. Accessed 9 January 2015.
Food and Agricultural Organization. (2014). State of food insecurity in the world. http://www.fao.org/3/a-i4030e.pdf. Accessed 8 January 12015.
Frenk D. J. (2012). The obesity prevention source globalization. http://www.hsph.harvard.edu/obesity-prevention-source/obesity-causes/globalization-and-obesity/. Accessed 9 January 2015.
Geary, K. (2012) Our Land, Our Lives: Time out on the global land rush. *Oxfam Briefing Paper*. http://policy-practice.oxfam.org.uk/publications/our-land-our-lives-time-out-on-the-global-land-rush-246731. Accessed 9 December 2014.
Ghosh, J. (2009). The unnatural coupling: Food and global finance. *Journal of Agrarian Change, 10*(1), 72–86.
Goodall, C. (2008) *Burning food: Why oil is the real villain in the food crisis*. Guardian, May 30th
Goodman, M., & Sage, C. (2013) *Food transgressions: Ethics, governance and geographies*. Environment, Politics and Development Working Paper Series Department of Geography, King's College London No 52. http://www.kcl.ac.uk/sspp/departments/geography/research/epd/GoodmanSageWP52.pdf Accessed 9 December 2014.
GRAIN. (2008). Seized. The 2008 land grab for food and financial security briefings. October http://www.grain.org/article/entries/93-seized-the-2008-landgrab-for-food-and-financial-security. Accessed 8 January 2015.
GRAIN. (2014). Food sovereignty: 5 steps to cool the world and feed its people. http://www.grain.org/article/entries/5102-food-sovereignty-5-steps-to-cool-the-planet-and-feed-its-people. Accessed 9 January 2015.
Hawkes, C. (2006) Uneven dietary development: Linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. *Globalization and Health 2*. http://www.globalizationandhealth.com/content/2/1/4. Accessed 9 January 2015.
Holt-Gimenez, E., & Patel, R. (2009). *Food rebellions: Crisis and the hunger for justice*. Oxford: Fatamu Books.
Horlings, L. G., & Marsden T. K. (2011). To-wards the real green revolution? Exploring the conceptual dimensions of a new ecological modernisation of agriculture that could feed the world. *Global Environmental Change 21*, 441–452.
Institute of Development Studies. (2014). Gender and food security: Towards gender-just food and nutrition security. http://bridge.ids.ac.uk/ids-document/A69889?lang=en#lang-pane-en. Accessed 3 December 2014.
IATP. (2008). *Commodities market speculation: The risk to food security and agriculture*. http://www.iatp.org/files/451_2_104414.pdf. Accessed 4 January 2015.
International Fund for Agricultural Development IFAD. (2012). Gender equality and female empowerment: Policy. http://www.ifad.org/gender/policy/gender_e.pdf. Accessed 6 January 2015.
International Food Policy Research Institute. (2014). Global nutrition report. http://www.ifpri.org/publication/global-nutrition-report-2014.Accessed 24 November 2014.
Jarosz, L. (2009). Energy, climate change, meat and markets: Mapping the coordinates of the current world food crisis. *Geography Compass, 3*, 2065–2083.
Lappé, F. M., Clapp, J., & Wise, T. (2013) *Framing hunger: A response to the state of food insecurity in the world 2012*. Cambridge: Small Planet Institute. http://www.ase.tufts.edu/gdae/Pubs/rp/FramingHunger.pdf?u=74907371d448da77287940e4d&id=0f773fe487&e=c42ae444af. Accessed 28 October 2014 at 12.23.
Le Billon, P., Sommerville M., & Essex J. (2014a). Introduction: Global food crisis. *Geopolitics 19*(2), 235–238
Le Billon, P., Sommerville, M., & Essex, J. (2014). The 'global food crisis' and the geopolitics of food security. *Geopolitics, 19*(2), 239–265.

Lang, T., & Heasman, M. (2004). *Food wars: The global battle for mouths, minds and markets.* London: Earthscan.
Magdoff, F. (2004). A precarious existence: The fate of billions?. http://www.monthlyreview.org/0204magdoff.htm. Accessed 12 November 2009.
Magdoff, F. (2008). *The world food crisis: Sources and solutions*. Monthly Review. http://www.monthlyreview.org/080501magdoff.php. Accessed 12 November 2009.
Magdoff, F. (2013) Twenty-first-century land grabs: Accumulation by agricultural dispossession. *Monthly Review*. http://monthlyreview.org/2013/11/01/twenty-first-century-land-grabs/. Accessed 7 January 2015.
Magdoff, F., & Tokar B. (Eds) (2010). *Agriculture and food in crisis: Conflict, resistance and renewal*. New York: Monthly Review Books.
Maxwell, S., & Slater, R. (2004). Food policy old and new. In S. Maxwell & R. Slater (Eds.), *Food policy old and new*. Oxford: Overseas Development Institute, Blackwell Publishing.
McMichael, P. (2009). A food regime analysis of the world food crisis. *Agriculture Human Values, 26*, 281–295.
Mittal, A. (2009).The blame game; Understanding the structural causes of the food crisis. In J. Clapp & M. J. Cohen ibid., (pp. 13–28).
Monsanto. (2014). Producing more. http://www.monsanto.com/improvingagriculture/pages/producing-more.aspx. Accessed 19 November 2014.
Nyeleni Declaration (2007) http://nyeleni.org/spip.php?article290. Accessed 7 January 2015.
Paarlberg, R. L. (2010). *Food politics: What everyone needs to know*. Oxford: Oxford University Press.
Pretty, J. et.al. (2010). The top 100 questions of importance to the future of global agriculture. *International Journal of Agricultural sustainability 8*(4), 220–236.
Popkin, B. M. (2007). The world is fat. *Scientific American, 297*, 88–95.
Rosegrant, M. W., Tokgoz, S., Bhandary, P., & Msangi, S. (2012) Looking ahead: Scenarios for the future of food. *International Food Policy Research Institute*. http://www.ifpri.org/publication/2012-global-food-policy-report?print. Accessed 29 October, 2014 at 12.27.
Sage, C. (2012). Addressing the Faustian bargain of the modern food system: Connecting sustainable agriculture with sustainable consumption. *International Journal of Agricultural Sustainability 10*(3), 204–207.
Sage, C. (2013). The inter-connected challenges for food security from a food regimes perspective: Energy, climate and malconsumption. *Journal of Rural Studies, 29*(1), 71–80.
Sage, C. (2014). The transition movement and food sovereignty: From local resilience to global engagement in food system transformation. *Journal of Consumer Culture 14*(2), 254–275.
Saturnino Jr. M. B., Hall, R., Scoones I., White, B., & Wolford, W. (2011). Towards a better understanding of global land grabbing: An editorial introduction. *The Journal of Peasant Studies 38*(2), 209–216.
Schanbacher, W. D. (2010). *The politics of food: The global conflict between food security and food sovereignty*. Santa Barbara: Praeger.
Sen, A. (1981). Poverty and famine: An essay on poverty and deprivation. Oxford: Clarendon Press.
Swaminathan, M. S. (2013). Biofuels and food security. http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-5_Biofuels_and_food_security.pdf. Accessed 9 December 2014.
Thurow, R., & Kilman, S. (2009). *Enough: Why the world's poorest starve in a world of plenty*. New York: Public Affairs.
Tsikata, D., & Golah, P. (Eds) (2010). *Land tenure, gender and globalisation: Research and analysis from Asia, Africa and Latin America*. Ottawa: International Development Research. http://www.idrc.ca/EN/Resources/Publications/openebooks/463-5/index.html. Accessed 6 January 2015.
Valente, F. L. S. (2014). Towards the full realisation of the human right to adequate food and nutrition. *Right to Food Journal 9*(1). http://www.fian.org/fileadmin/media/publications/Right_to_Food_Journal_2014_web.pdf. Accessed 7 January 2015.

Von Braun, J., & Díaz-Bonilla, E. (Eds.) (2007). *Globalization of food and agriculture and the poor*. New Delhi: Oxford UniversityPress.
Wahl, P. (2009). *Food speculation: The main factor of the price bubble in 2008*. Berlin, Germany: World Economy, Ecology & Development.
Weis, T. (2007). *The global food economy: The battle for the future of farming*. London: Zed Books.
Weis, T. (2009). Fossil energy and biophysical roots of the food crisis. In J. Clapp & M. J Cohen ibid. (pp. 145–160).
Wise, T. (2013). Can we feed the world in 2050? A scoping paper to assess the evidence. *GDAE Working Paper No. 13-04, September 2013.* http://www.ase.tufts.edu/gdae/policy_research/FeedWorld2050.html
Wise, T., & Murphy, S. (2012). *Resolving the food crisis: Assessing global food policy reforms since 2007*. Institute for Agriculture and Trade Policy (IATP) and Global Development and Environment Institute (GDAE). http://www.ase.tufts.edu/gdae/Pubs/rp/ResolvingFoodCrisis.pdf
Wise, T., & Sundell, K. (2014) To feed the world in 2015 we have to change course. Accessed 6 Jan 2015. http://foodtank.com/news/2014/10/to-feed-the-world-in-2050-we-have-to-change-course
World Food Summit. (1996). Rome Declaration on World Food Security.
World Bank Development Report. (2008). *Agriculture for development*. Washington: World Bank.
World Watch. (2010). State of the world 2011 innovations that nourish the planet. http://www.worldwatch.org/system/files/NtP-Innovations-in-Action.pdf. Accessed 8 January 2015.
Young, E. M. (2010) Deadly diets. *Geography 95*(part 2), 60–69.
Young, E. M. (2012) *Food and development*. London: Routledge.



Undernourishment. Over the ten year period from 1990 to 2000, the number of people in the world that lived on an inadequate amount of food increased from 840 to 858 million. Due to the population increases over this period, the percentage of the population that is undernourished simultaneously decreased from 16 to 14 %. **Territory size shows the proportion of all undernourished people worldwide, that live there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

International fast food. This map shows the distribution of one major brand of fast food outlet, 45 % of which were located within the United States. The next highest number of these outlets was in Japan, Canada and Germany. **Territory size shows the proportion of all McDonalds restaurants that were open in 2004, that were found there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Drinking Water

Trevor Birkenholtz

Abstract This chapter examines the ongoing global struggle to supply potable drinking water to the world's population. The chapter begins with a brief history of 20th century efforts to expand drinking water supply but argues that these efforts only resulted in partial successes. This was due to rapid demographic growth and to a dominant understanding of water scarcity as a technical problem to be solved through centralized engineering works. This paradigm is being challenged in the 21st century by an understanding of water as enmeshed in a hydrosocial cycle where social elements—including politics and economics—are intrinsic to the successful expansion of drinking water supply. Yet many issues remain, including (1) multiple kinds of water scarcity; (2) competition between different sectors; and (3) contestations surrounding cost recovery, commodification, and privatization. The chapter concludes with a discussion of water's future governance. People are no longer waiting for drinking water supplies to expand but are contesting water's meaning and engaging in participatory resistance to modes of water supply that undermine the human right to water.

Keywords Water scarcity · Technocratic paradigm · Commodification · Privatization · Hydrosocial cycle · Human right to water · Resistance

Introduction: Waiting for Water

Many of the world's poorest people are waiting for water. Most of these people are in the Global South, living in Asia and Africa (UNICEF 2014). They've been waiting for 20th century modernist development to deliver on its promise of bringing safe drinking water by centralized piped networks to every home in every corner of every country of the world. But they are still waiting for this promise to

T. Birkenholtz (✉)
Department of Geography and GIS, University of Illinois, 255 Computing Applications Building, 605 E. Springfield Avenue, Champaign, IL 61820, USA
e-mail: trevbirk@illinois.edu

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_3

materialize. They wait for this larger project but they also wait on a daily basis in water collection lines at public stand posts (Birkenholtz 2010), for water supplied intermittently to emerge from household taps (ibid; Loftus 2006), for water to be released into canals (Barnes 2014), and for groundwater to slowly trickle back into dug wells and tubewells (Birkenholtz 2013; Sultana 2006). This waiting disproportionately affects women, who bear the primary responsibility for ensuring household drinking needs, and children, who do much of the waiting and collection alongside their mothers (Hawkins et al. 2011; Nightingale 2011; Sultana 2009; Truelove 2011; Birkenholtz 2013). In both cases, this happens at the expense of the self-development of their other capabilities (e.g., literacy, empowerment) that come from education, employment, and the like (Sen 1999).

Developing Drinking Water?

Drinking water is defined as potable water that is safe for household use, including food preparation and drinking. Most drinking water comes from an "improved source." An improved source is defined as rainwater, water from a well that is protected, or any water that is treated and piped into a home or public standpipe. According to the United Nations (UN), 91 % of the world's population has access to an "improved source" of drinking water (UN 2015b). Yet many improved sources in developing countries have some degree of contamination, particularly seasonally, due to heavy rains and flooding, which leads to comingling of drinking water with raw sewage from sanitation systems (UNICEF 2014). When these periodically contaminated, improved sources are taken into account, about 20 % of the world's population, mostly those living in developing countries, do not have complete access to safe drinking water (UN 2015a). This periodic contamination affects the poor the most and leads to heightened incidences of diarrheal and other water-borne diseases, particularly for vulnerable populations (i.e. children, the elderly and the malnourished) (Escamilla et al. 2013). These are ongoing issues that have long histories.

The global problem of access to safe drinking water emerged on the international development agenda in the late 1970s with the UN declaring 1981–1990 the "International Drinking Water Supply and Sanitation Decade." The project's goal was to secure safe water and sanitation for all by 1990. The project had many successes. Most notably, it improved access to water for over 715 million people (Appleton and Black 1990). In rural areas in particular, this was achieved through the development and diffusion of the India Mark 2 hand pump in the late 1970s that tapped shallow aquifers (<150 feet). Now used in countries throughout the developing world, it is a reliable community-level groundwater pump. Yet there were also many unintended consequences. One of the most glaring examples was the proliferation of these shallow hand pump tubewells in Bangladesh. These shifted the source of drinking water from surface water contaminated with fecal matter to what was thought to be safe groundwater, but in the early 1990s it was accepted that

these shallow aquifers contain high levels of arsenic and have been contaminating millions people over a longer period (Sultana 2006). So, one form of contamination was traded for another, more sinister form.

In addition to unintended outcomes such as this, the ambitious global project ultimately failed to deliver on its goals to secure water and sanitation for all for two primary reasons. First, rapid demographic growth and rapid urbanization over that period undermined countries' abilities to keep up with demand. But second, the project was based on a technocratic paradigm of water supply as an engineering problem. This approach, dominant in the 20th century, discursively and materially produced "modern water" as a way of knowing, quantifying, and representing water as a calculable physical entity, divorced from its socio-cultural contexts (Linton 2010). This understanding of water was reproduced in the offices of country-level water bureaucracies, which were largely managed by western-trained hydraulic engineers (Birkenholtz 2008; Akhter and Ormerod 2015). Ultimately, this has led to the proliferation of new modern ecological technologies (e.g., dams, treatment facilities, distribution networks, etc.) that drastically reworked existing water supply systems, sometimes in undemocratic ways. Together, the inherent goal in expanding drinking water supply was the development of centralized water supply technologies that would overcome the vagaries of nature.

In rural contexts, this incentivized people to abandon their traditional sources of drinking water supply and shift their reliance towards these new systems, which proved to be unreliable (Birkenholtz 2013). So too, in urban settings these systems have led to spatially uneven supplies that have focused on expanding supply to neighborhoods with the ability to pay to underwrite cost recovery (Loftus 2006). These efforts have evolved in tandem with the growing dominance of neo-classical economics in natural resource management that attempts to allocate water as a scarce economic good rather than as a public trust. This has systematically excluded the poor and informal areas (Truelove 2011), led to skyrocketing prices for water (Bakker 2003), and actually produced water scarcity (Loftus 2009; Birkenholtz 2010). This continues into the present period, but progress is being made both with respect to increasing access to water and on changing the way water is understood. Scholars are increasingly arguing that water is a part of a "hydrosocial cycle" where social elements, including politics and economics, are intrinsic to the circulation and provision of water (Budds 2012).

Following on the partial successes of its water decade, in 2000, the UN established the Millennium Development Goals (MGDs). The MGDs established eight "Goals" aimed at eliminating extreme poverty, globally. Goal 7 focused on "Ensuring Environmental Sustainability" and, among other objectives, attempted to halve the proportion of people without sustainable access to safe drinking water and sanitation by 2015. This specific target intersected with a second UN program: the "International Decade for Action: 'Water for Life' 2005–2015." Together, the MGDs and the "Water for Life" campaign's goals were broader than previous efforts insofar as the UN inter-agency group UN-Water was charged with the goal of helping to ensure long term sustainable management of water by coordinating between development donor agencies, countries, and water-related organizations to

ensure cooperation in meeting their water supply and management commitments. Drinking water supply development, therefore, is now embedded within broader issues of water scarcity, climate change, food security, natural disasters, healthy ecosystems, and livelihood well-being. In a way, the UN is moving towards understanding and developing water as a "hydrosocial" entity.

The UN has had many successes, but challenges remain. The MGD goal was achieved in 2010, yet 748 million still lack access to safe drinking water (World Bank 2015). So too, significant unevenness in access continues. 44 % of the population in Oceana and 32 % in Sub-Saharan Africa, for instance, do not have access to an improved drinking water source (UN 2015b). Rural-urban disparities also exist. Among UN targeted developing regions, 96 % of urban populations use improved sources, compared to 84 % of people in rural areas (ibid). 75 % of urban dwellers have access to piped drinking water, while only 33 % in rural areas enjoy the same (ibid). Today, the UN's Sustainable Development Goals (2015–2016), picks up where the MGDs left off to "ensure access to water and sanitation for all," while also focusing on water's intersection with ecosystem services, poverty alleviation and a number of other long-running development concerns (UN 2016).

Even though the UN is attempting to foster a more holistic view of water, a technocratic view of water prevails at the level of many countries' water engineering departments. This exacerbates these discrepancies, while the continued gaps in the development of centralized water supply networks is leading to (and perhaps being supported by) informal means of accessing water, including household rainwater harvesting, private water tankers, and wastewater recycling (Meehan 2013).

21st Century Drinking Water

The above processes continue to intersect with a number of ongoing challenges. At the beginning of the 21st century, some of the main issues surrounding drinking water include: (1) multiple kinds of water scarcity; (2) competition between urban and rural areas, and between domestic, agricultural and industrial sectors; and (3) cost recovery, commodification, dispossession and privatization, and resistance to these efforts.

Water scarcity has the potential to undermine the gains made over the last 40 years in drinking water supply development. Currently, 40 % of the global population is affected by water scarcity (UN 2015b). This percentage is expected to grow in the future due to climate change and over reliance on non-renewable supplies (UN 2015b). Scarcity can be physical (insufficient quantity or quality of supplies), economic (lack of infrastructure and/or financial means to develop water supplies), or institutional (insufficient formal or informal institutions to ensure reliable and equitable supplies). Scarcity is often a combination of these elements. For instance, as part of meeting the MDGs, the UN and its partners have promoted the use of groundwater away from surface water because groundwater is generally

less contaminated (though arsenic and fluoride continue to be an issue), readily available and easier to manage with local institutions (UN 2015b). This has resulted in regional aquifer depletion due to over-extraction, leading to new forms of scarcity. Scarcity has also been shown to be socially constructed as a rational for privatization (Kaika 2003), increasing costs to users or reallocating water towards uses that produce more capital surpluses (Mehta 2010; Birkenholtz 2016). These forms of economic and institutional scarcity also have the potential to undermine the continued expansion of drinking water supplies.

Second, this economic logic has been shown to exacerbate tensions between urban and rural drinking water supply development, leading to water grabbing by urban areas. Water grabbing is typically defined as the process through which existing users of water are dispossessed of both its use and their entitlement to it, through both legal and extra-legal means, often in tandem. As urban areas become centers of both population growth and capital accumulation, they are expanding the area over which they divert water (Brenner 2013), leading to spatially and temporally uneven rural drinking water supplies (Celio et al. 2010). Sectoral competition is also a growing issue with agriculture currently accounting for 70 % of global water withdrawals, while municipal and industrial demand is expected to increase by 50–70 % and up to 85 % in the energy sector over the next 30 years (World Bank 2016). This has led to many calls to reduce agriculture's share of water, which may have negative effects on food security.

Third, related to both of the above points, pressure from development donor agencies and cash-strapped public water utilities is resulting in the commodification of water. This is the process of using free market logics to transform water from a public good into a tradable commodity, often through the attempted establishment of private property rights over water (Bakker 2000). This is argued to result in the more economically efficient allocation of water and enhance cost recovery. These processes are leading to dispossession of access to drinking water (Swyngedouw 2005) and/or vastly increasing prices (Boelens and Zwarteveen 2005; Bakker 2001). The result is in higher prices paid by the poor for drinking water and the continued informalization of drinking water supplies.

Resistance: Waiting on Water, Waiting on Development

These threats to the continued expansion of economically affordable drinking water have spurred people around the world to stop waiting and start resisting. They resist through formal protest movements (Harris and Roa-García 2013), informal everyday practices (Ranganathan 2014), and so-called theft (Meehan 2013). These efforts, like the hydrosocial cycle, seek to (re)place people at the center of water's future governance.

Finally, in 2010 the UN declared a Human Right to Water, recognizing that access to safe drinking water is central to the realization of all human rights (Sultana and Loftus 2012). Taken together, we are witnessing a participatory redefinition of

drinking water away from something to be managed as a "scarce natural resource" towards water as emerging from the center of competing meanings and values (Levine et al. 2013). Rather than drinking water as a subject of modern, technocratic expertise it is now the subject of constant negotiation. If the vision of "drinking water for all is to be realized," we must all participate in shaping this discussion and stop waiting.

References

Akhter, M., & Ormerod, K. (2015). The irrigation technozone: State power, expertise, and agrarian development in the U.S. West and British Punjab, 1880-1920. *Geoforum, 60*, 123–132.

Appleton, B., & Black, M. (1990). The Decade Flows On. *new internationalist*.

Bakker, K. (2000). Privatizing water, producing scarcity: The Yorkshire drought of 1995. *Economic Geography, 76*, 4–27.

Bakker, K. (2001). Paying for water: Water pricing and equity in England and Wales. *Transactions of the Institute of British Geographers, 26*, 143–164.

Bakker, K. (2003). Archipelagos and networks: Urbanization and water privatization in the South. *Geographical Journal, 169*, 328–341.

Barnes, J. (2014). *Cultivating the Nile: The everyday politics of water in Egypt*. Durham and London: Duke University Press.

Birkenholtz, T. (2008). Contesting expertise: The politics of environmental knowledge in Northern Indian groundwater practices. *Geoforum, 39*, 466–482.

Birkenholtz, T. (2010). "Full cost recovery": Producing differentiated water collection practices and responses to centralized water networks in Jaipur. *India Environment and Planning A, 42*, 2238–2253.

Birkenholtz, T. (2013). On the network, off the map: Developing inter-village and intra-gender differentiation in rural water-supply. *Environment and Planning D: Society & Space, 31*, 354–371.

Birkenholtz, T. (2016). Dispossessing irrigators: Water grabbing, supply-side growth and farmer resistance in India. *Geoforum, 69*, 94–105.

Boelens, R., & Zwarteveen, M. (2005). Prices and Politics in Andean Water Reforms. *Development and Change, 36*, 735–758.

Brenner, N. (2013). Theses on urbanization. *Public Culture, 25*, 85–114.

Budds, J. (2012). *Use, evaluation and allocation of water in La Ligua river basin* (pp. 167–184). Chile: A political ecology analysis. Revista De Geografia Norte Grande.

Celio, M., Scott, C. A., & Giordano, M. (2010). Urban-agricultural water appropriation: The Hyderabad, India case. *Geographical Journal, 176*, 39–57.

Escamilla, V., Knappett, P., Yunus, M., Streatfield, P., & Emch, M. (2013). Influence of latrine proximity and type on tubewell water quality and diarrheal disease in Bangladesh. *Annals of the Association of American Geographers, 103*, 299–308.

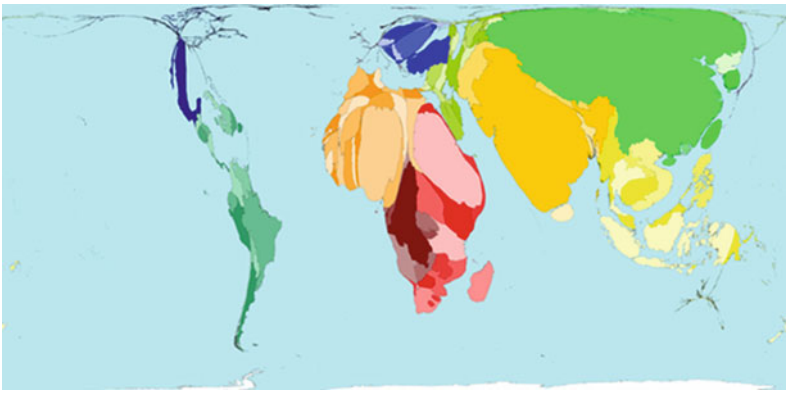
Harris, L., & Roa-García, M. (2013). Recent waves of water governance: constitutional reform and resistance to neoliberalization in Latin America (1990–2012). *Geoforum, 50*, 20–30.

Hawkins, R., Ojeda, D., Asher, K., Baptiste, B., Harris, L., Mollett, S., et al. (2011). Gender and environment: critical tradition and new challenges. *Environment and Planning D-Society & Space, 29*, 237–253.

Kaika, M. (2003). Constructing scarcity and sensationalising water politics: 170 days that shook Athens. *Antipode, 35*, 919–954.

Levine, G., Solanes, M., & Dikito-Wachtmeister, M. (2013). Introduction—voices of water professionals: Shedding light on hidden dynamics in the water sector. *Water Alternatives, 6*, 148–153.
Linton, J. (2010). *What is Water: The History of a Modern Abstraction*. Toronto: UBC Press.
Loftus, A. (2006). Reification and the dictatorship of the water meter. *Antipode, 38*, 1023–1045.
Loftus, A. (2009). Rethinking political ecologies of water. *Third World Quarterly, 30*, 953–968.
Meehan, K. (2013). Disciplining de facto development: Water theft and hydrosocial order in Tijuana. *Environment and Planning D-Society & Space, 31*, 319–336.
Mehta, L. (2010). *The limits to scarcity*. Earthscan: Washington D.C.
Nightingale, A. J. (2011). Bounding difference: Intersectionality and the material production of gender, caste, class and environment in Nepal. *Geoforum, 42*, 153–162.
Ranganathan, M. (2014). Mafias in the waterscape: Urban informality and everyday public authority in Bangalore. *Water Alternatives, 7*, 89–105.
Sen, A. (1999). *Development as freedom*. New York: Anchor Books.
Sultana, F. (2006). Gendered waters, poisoned wells: Political ecology of the arsenic crisis in Bangladesh. In K. Lahiri-Dutt (Ed.), *Fluid bonds: Views on gender and water* (pp. 362–386). India: Stree Publishers with Austrialian National University.
Sultana, F. (2009). Fluid lives: subjectivities, gender and water in rural Bangladesh. *Gender Place and Culture, 16*, 427–444.
Sultana, F., & Loftus. A. (2012). The right to water: Politics, governance and social struggles. In *Earthscan water text*. London: Routledge.
Swyngedouw, E. (2005). Dispossessing H2O: The contested terrain of water privatization. *Capitalism, Nature, Socialism, 16*, 81–98.
Truelove, Y. (2011). (Re-)Conceptualizing water inequality in Delhi, India through a feminist political ecology framework. *Geoforum, 42*, 143–152.
UN. (2015a). International decade for action 'Water for Life' 2005–2015.
UN. (2015b). *The millenium development goals report, 2015*. New York: United Nations.
UN (2016). UN sustainable goals.
UNICEF. (2014). Progress on drinking water and sanitation. World Health Organization.
World Bank. (2015). Millenium development goals—Ensure environmental sustainability by 2015.
World Bank. (2016). High and dry: Climate change, water and the economy.

Water use. Four thousand cubic kilometers of water are used by people each year around the world, for domestic, agricultural and other industrial purposes. Whilst everybody needs water, people use hugely varying quantities. On average, people living in Central Africa each use only 2 % of the water used by each person living in North America. **Territory size shows the proportion of worldwide water use occuring there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Poor water. Drinking water is essential to live, but dirty drinking water is also a major cause of disease. Whilst most people living in Western Europe can access safe water, only 50 % of people living in Central Africa can do this. **Territory size shows the proportion of all people without reliable access to safe water that live there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

The Politics and Consequences of Virtual Water Export

Jeroen Vos and Rutgerd Boelens

Abstract Virtual water is the water used or contaminated to produce a good or a service. With the large increase of export of agricultural produce during the last decades the amount of virtual water export has grown as well. Increased water contamination and water extraction for export from relative dry areas affects local ecosystems and communities. Simultaneously, the increased virtual water trade has weakened the local control over water resources by local communities, to the expense of multinational agribusiness and retailer companies. This repatterning of water control is fomented by numerous national governments, and at the same time contested by local communities. Partly as reaction to the critics on water depletion, agribusiness and retailers have created a number of water stewardship standards. Notwithstanding the possibilities for local communities to articulate their demands with these standards, until now most water stewardship standards have had little – or even negative – effects.

Keywords Virtual water · Agro-export · Communities · Water stewardship · Contestation

Virtual water represents the water used and contaminated to produce a product or service. Virtual water can be seen as "embedded" in products. It is an indicator of the amount of fresh water that evaporated or was contaminated during the production and transport of a product. Though the concept has been framed recently (e.g., Allan 1998), obviously, the practice of "virtual water trade" is as old as people have engaged in trade relations. Ancient empires as the Roman traded and transported large volumes of food throughout their territory and thereby, implicitly, conveyed huge quantities of virtual water across geographical scales (Dermody et al. 2014).

J. Vos (✉) · R. Boelens
Department of Environmental Sciences, Wageningen University,
Droevendaalsesteeg 4, 6708 PB Wageningen, The Netherlands
e-mail: jeroen.vos@wur.nl

R. Boelens
e-mail: rutgerd.boelens@wur.nl

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_4

Nevertheless, traditionally, even in the Roman Empire, food and water security were strongly location-fixed. Local communities and societies aiming for food security, therefore, needed to work on their local water security and availability, with local supply matching local demands (Vos 2010). With the huge expansion of global food trade throughout the last centuries and especially, over the last decades, this relationship between local water availability and food supply to the population of that same geographical location has been challenged profoundly: expansion of the global food trade implies virtual water export, it disconnects the place where water and food are produced from the place where it is consumed (Roth and Warner 2008; Sojamo et al. 2012).

First theories on virtual water (Allan 1998) presented it consequently as a potential solution to water scarcity, as these predicted that global market forces would direct virtual water flows from relatively wet to relatively dry regions. It would make use of regions" comparative advantages (water abundance) and solve other regions" disadvantages (lack of water to produce food). Evidence shows, however, that many water-poor countries like India, China, Kazakhstan and Tanzania are now net exporters, whereas water-rich countries like the Netherlands, UK, and Switzerland are net importers of virtual water (Hoekstra and Chapagain 2008; Ramirez-Vallejo and Rogers 2010). Clearly, the direction of virtual water flows is not primarily determined by water availability (Allan 2003). Recent critiques also point out the dangers of thinking in terms of "virtual water," as the concept is an abstraction and thus conceals how economic power relationships and real water politics influence real livelihoods (Roth and Warner 2008).

One main drawback of the virtual water concept is that virtual water volumes do not express the social, environmental nor economic value of the water to local communities. For example: one cubic meter of soil water to produce pasture in the Netherlands for dairy and then export cheese, cannot be compared easily with one cubic meter of groundwater in the desert of Ica in Peru used to grow export asparagus. In the last case local communities rely on this water and do not have alternative ways to guarantee access to water for their survival and livelihoods, while in the Netherlands the cubic meter has very different social, environmental, and economic value, and is politically also contested but in very different ways. Nevertheless the concept of virtual water flow can be used to draw attention to an increasing use of water resources in regions where water is scarce. In that case the virtual water used for export agriculture is an indicator for social, political, and environmental risks. It can also be used to highlight the connectedness between producers and consumers of different regions in the world at different scales.

Some authors have suggested to add a water scarcity factor to include impact into the water footprint analysis: the so-called "stress-weighted water footprint" (e.g., Ridoutt and Pfitser 2010; Kounina et al. 2013). Examples of impact-based indicators of water footprints are those indicators that relate water use to water availability. Three examples are presented by Berger et al. (2014: 4523):

- Risk of Freshwater Depletion (RFD): which defined by the Effective Water Consumption (WC) multiplied by Water Depletion Index (WDI). The WDI is an indicator of the irrigation water consumption related to the available water for irrigation in a river basin.
- Consumption-to-availability (CTA), which relates annual water consumption with annual water availability.
- Withdrawal-to-availability (WTA), which relates annual water withdrawal with annual water availability.

However, relative water scarcity is not a direct and universal indicator of ecological damage nor directly related to local economic opportunity costs of annual water use. For example, geographic and temporal scale effects make it difficult to assess social and ecological effects from comparing annual consumption (or withdrawal) and water availability. For example, water availability might be unequally distributed with a water basin, within the year, and among years. This makes that on the one hand water scarcity might be felt in certain places and periods when annual averages do no indicate any water scarcity problems. On the other hand transfer and storage of water can alleviate water scarcity. Moreover, other important local circumstances like cultural value of water and unequal distribution of benefits and costs of the use of the water are not included in the virtual water impact indicator.

The impact indicators are (explicitly or implicitly) claimed to be "universal" and therefore allow for comparison ("benchmarking") among all places of the globe. However, the "impact indicators" do not take into account local history, justice nor ecological values. The indicators are not defined by local stakeholders or deprived groups, thus impeding those stakeholders to include evaluation criteria that would include their views and suite their needs and interests (see also Boelens and Vos 2012; Vos and Boelens 2014).

International trade of "luxury" products like fresh vegetables, fruits, and flowers doubled during the past decade, while also the export of for example biofuel crop production is booming. In dry and semi-arid regions, these high-water-consuming crops have in common that they compete for water and land with local communities, deplete and degenerate local ecosystems, worsen local and national food sovereignty, and alter existing modes of production and income distribution. For example, Peru increased tenfold its export of fruits and vegetables from the dry desert coast from 2001 to 2015 (Fig. 1). Ecuador tripled its flower export from the fragile—drought prone—Andean hill slopes North of Quito in the same period, and is now the third flower exporting country in the world (Fig. 2). Multinational and national companies have also acquired land and water rights to start large-scale production of sugarcane for biofuels in the desert North Coast of Peru showing sharp increase of export since 2008 (Fig. 3).

Increased virtual water use by water-intensive crops in dry and semi-arid regions by agro-export companies increases the environmental consequences of depletion of surface and groundwater resources. Many river basins are "closing" (in closing river basins the river does no longer reach the sea in most part of the year) and

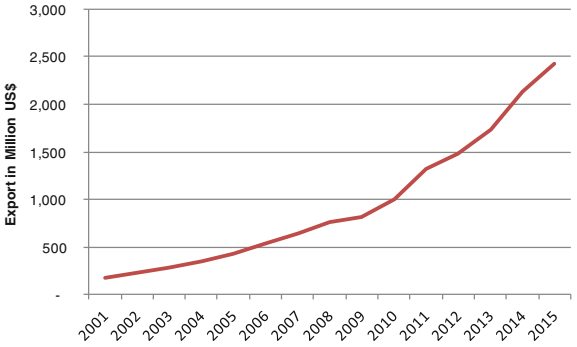


Fig. 1 Export of fruits and vegetables from Peru (http://comtrade.un.org/db/)

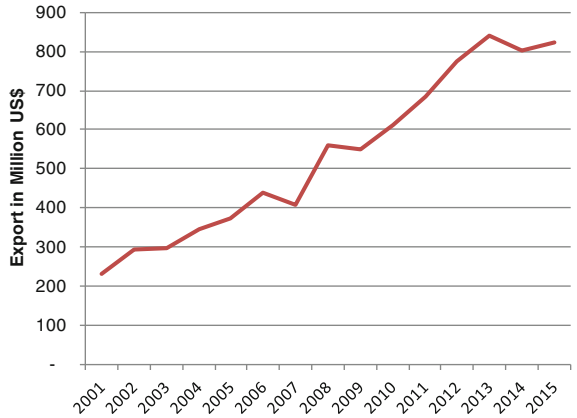


Fig. 2 Flower export from Ecuador (http://comtrade.un.org/db/)

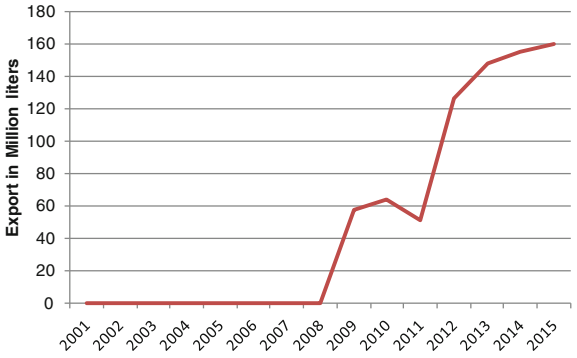


Fig. 3 Ethanol export for biofuels from Peru (USDA 2014)

groundwater tables are falling. In the North of Mexico, the Coast of Peru, the West of India, and many other parts of the world water tables drop with several meters per year. The dwindling water resources affect local communities and ecosystems (Hoogesteger and Wester 2015). Surface and ground water contamination by

fertilizers and agrochemicals further affects local communities and ecosystems. Water supply to urban areas is also affected (see Oré et al. 2009; Woodhouse 2012; Yacoub et al. 2015). In all cases the poor suffer most from deteriorating water resources.

Political consequences of virtual water export by agribusiness companies are associated with the increase of control over water resources by the private sector companies, and consequently decrease of control by local communities and local and national governments. Many studies express how, more than ever before and regionally often in explosive trends, companies obtain water rights in legal and illegal ways, supported by Free Trade Agreements (Solanes and Jouravlev 2007). This supports water grabbing, affecting many smallholders in Africa, Asia, and Latin America (see, e.g., Mehta et al. 2012; Smaller and Mann 2009; Sultana and Loftus 2012; Venot and Clement 2013; Zoomers and Kaag 2013).

Multinational agribusiness and retailers react to the critiques, for instance, by developing water stewardship certification (Vos and Boelens 2014). Consumers in the North are increasingly aware of, and concerned about, their ecological footprint. Their pressure has led multinational companies to engage in Corporate Social Responsibility (CSR) mechanisms and claim "carbon-neutrality," "ecological" production, or "fair trade." Major agro-export companies use labels such as GlobalGAP and BRC, to certify product quality and the environmental sustainability of the production processes, as required by international supermarket chains (Fulponi 2007).

Recently, water has become "certifiable" as well. For example, the *Alliance for Water Stewardship* initiative by the WWF and other international organizations develops standards certifying that extracted water comes from sustainable sources (AWS 2011). For example, the widely used GlobalGAP scheme, but also the Rainforest Alliance, IFOAM, MPS-ABC flower industry certificate, and the standards of the multi-stakeholder "round tables" of the *Better Cotton Initiative* (BCI), *Better Sugarcane Initiative* (BSI), *Round Table on Responsible Soy* (RTRS) and the *Roundtable on Sustainable Biofuels* (RSB) include water criteria (Vos and Boelens 2014). These standards can potentially protect ecosystems and water users" communities against "water mining" and contamination by agro-export companies. However, it is worrisome that the social and environmental norms are set and monitored nearly exclusively by labeling entities from the North, without space for the voices and demands of local water users" collectives (see Bond 2008). Indeed, as we have detailed elsewhere (Vos and Boelens 2014), current certification practices bear the risk of exclusion, and reinforcement of existing social inequity. Important questions also remain about what certification schemes mean for the possibilities of (heterogeneous) smallholders to participate in international trade chains, which demand uniform production conditions and product qualities. Next is the question whether such schemes allow for monitoring and compensation of off-farm impacts of farm-based water extraction and pollution practices. Standards mainly focus on the farm level and not on the watershed nor community; and standards reinforce local inequalities by favoring and legitimizing presumably "efficient" water use technology like drip irrigation (mainly used by big land

owners) and formal water rights (excluding communities with customary water rights). Discussion also continues on whether standards are effective to mobilize consumer power and actually hold companies accountable (Blowfield and Dolan 2008).

The Politics of Virtual Water Control

Many national governments develop new policies, including Free Trade Agreements and subsidies, to augment agricultural export. In different countries of the world, like Chile, Peru Ecuador, Mexico, Ghana, Senegal, Ethiopia, and Malaysia the development of roads, ports, airports, and/or irrigation systems is especially geared towards the agro-export sector. For example, the Peruvian Majes, Chavimochic and Olmos projects have invested more than 4000 million dollars of public resources in infrastructure to irrigate 225,000 ha, allocated mainly to a tiny minority of large (inter)national agribusinesses (Oré et al. 2009). Agribusiness companies also obtain water rights buying land with water rights from indebted smallholders, pressuring water authorities to grant new water rights for these arid lands, or (illegally) drilling deep tube wells. For example, in Piura, in the Peruvian dry North Coast, two large companies obtained water rights for 20,000 hectares of ethanol-oriented sugarcane production, part of which was exported. Simultaneously, local water user groups are denied water rights to expand their irrigated areas (Urteaga 2013).

In general, at an unprecedented scale, the "dis-embedding" of natural resources from public and common property rights frameworks (Boelens and Seemann 2014; de Vos et al. 2006), and their individualization and/or privatization and commoditization is a key mechanism allowing foreign agro-export companies to acquire the land- and water rights they need for profitable production (Achterhuis et al. 2010; Boelens and Vos 2012; Mehta et al. 2012; Swyngedouw 2005). The common strategy of transnational agribusiness enterprises is to maximize economic returns on investment by carefully identifying where they can obtain the cheapest and most timely supply of inputs (Smaller and Mann 2009). These "techno-institutional empires" (van der Ploeg 2008, 2010) therefore tend to invade territories to acquire low-costs resources, while permissive environmental and social legislation, combined with large subsidies, favor such strategies. The resulting repatterning of hydrosocial territories (Boelens et al. 2016) and its respective property relations also implies a thorough restructuring of labor relations and livelihoods to enable this accumulation process to occur (Zwarteveen and Boelens 2014; Swyngedouw 2005). While many people find employment in the new agro-export production sector—which may provide relatively stable incomes—the labor conditions

(especially for women, as important employees) are often poor and insecure. When resources are depleted, when operations become less profitable, or when laborers are more organized, production moves to other regions.

Local and Multi-scalar Reactions

The growth of virtual water exports and the increased production of water-intensive crops by agro-businesses have important implications for how and where water is governed. Contestations over water resources that seem only local, sometimes "transnationalise" to become part of international debates over "fair" production. Reactions and resistance do not just include on-the-ground protests. To be successful, affected local actors need to forge multi-actor alliances that work on multi-scalar levels, thus creating civil society networks that are internally complementary while connecting the local, national, and global struggles for water justice. Examples exist in the mining sector [e.g., Bogaert (2015) for Morocco; Bebbington et al. (2010) for Peru, Bolivia, Ecuador; Ochoa (2006) and Stoltenborg and Boelens (2016) for Mexico; Urkidi (2010) for Chile]. Compared to mobilizations against mining sector extraction, so far, grassroots actions against water-extractive agribusiness exports have been limited at best, largely because of strong and deeply asymmetrical dependency ties within the sector (Vos and Boelens 2014). Local protests by water users" communities against water extraction by agribusiness have been documented in Ethiopia, Senegal, Tunisia, Mexico, Chile, Peru and Ecuador (Vos and Hinojosa 2016). In Spain the "New Water Culture" movement has had large influence in the change in national water policies, abandoning the National Hydrological Plan to bring water from the Ebro in the North of Spain to the South of Spain for export agriculture (Swyngedouw 2013, 2014).

Globalizing water extraction and virtual water exports deeply change existing labor-and property relations, weakening reaction capacity and generating new patterns of political control over water resources. Generally, at local scales, local collectives do devise strategies to cope with this repatterning of their livelihoods (Boelens 2015; van der Ploeg 2008). Increasingly, however, they now also aim to articulate their demands with international producer-consumer networks, fair trade and CSR initiatives at higher scales. Through such multi-actor networks they may complement their actions with advocacy and policy actors and strive to balance negotiation power, in order to defend their water and food sovereignty.

References

Achterhuis, H., Boelens, R., & Zwarteveen, M. (2010). Water property relations and modern policy regimes: Neoliberal utopia and the disempowerment of collective action. In R. Boelens, D. Getches, & A. Guevara-Gil (Eds.), *Out of the mainstream. Water rights, politics and identity* (pp. 27–55). London and Washington DC: Earthscan.

Allan, J. A. (1998). Virtual water: A strategic resource. Global solutions to regional deficits. *Ground Water, 26*(4), 545–546.

Allan, J. A. (2003). Virtual water. The water, food, and trade nexus: Useful concept or misleading metaphor? *Water International, 28*(1), 106–113.

AWS. (2011). *The Alliance for Water Stewardship water roundtable process*. Final draft, April 20, 2011. London: Alliance for Water Stewardship.

Bebbington, A., Humphreys, D., & Bury, J. (2010). Federating and defending: Water, territory and extraction in the Andes. In R. Boelens, D. Getches, & A. Guevara (Eds.), *Out of the mainstream: Water rights, politics and identity* (pp. 307–327). London: Earthscan.

Berger, M., van der Ent, R., Eisner, S., Bach, V., & Finkbeiner, M. (2014). Water accounting and vulnerability evaluation (WAVE): Considering atmospheric evaporation recycling and the risk of freshwater depletion in water footprinting. *Environmental Science & Technology, 48*(8), 4521–4528.

Blowfield, M., & Dolan, C. (2008). Stewards of virtue? The ethical dilemma of CSR in African agriculture. *Development and Change, 39*(1), 1–23.

Boelens, R. (2015). *Water, power and identity. The cultural politics of water in the Andes*. London and Washington DC: Earthscan, Routledge.

Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., & Wester, P. (2016). Hydrosocial territories: A political ecology perspective. *Water International, 41*(1), 1–14.

Boelens, R., & Seemann, M. (2014). Forced engagements. Water security and local rights formalization in Yanque, Colca Valley, Peru. *Human Organization, 73*(1), 1–12.

Boelens, R., & Vos, J. (2012). The danger of naturalizing water policy concepts. Water productivity and efficiency discourses from field irrigation to virtual water trade. *Agricultural Water Management, 108*, 16–26.

Bogaert, K. (2015). The revolt of small towns: the meaning of Morocco"s history and the geography of social protests. *Review of African Political Economy, 42*(143), 124–140.

Bond, P. (2008). Social movements and corporate social responsibility in South Africa. *Development and Change, 39*(6), 1037–1052.

de Vos, H., Boelens, R., & Bustamante, R. (2006). Formal law and local water control in the Andean region: A fiercely contested field. *International Journal of Water Resources Development, 22*(1), 37–48.

Dermody, B. J., et al. (2014). A virtual water network of the Roman world. *Hydrology and Earth System Sciences, 18*, 5025–5040.

Fulponi, L. (2007). The globalization of private standards and the agri-food system. In J. Swinnen (Ed.), *Global supply chains, standards and the poor* (pp. 5–18). Wallingford: CABI Publications.

Hoekstra, A., & Chapagain, A. (2008). Globalization of water: Sharing the planet"s freshwater resources. Blackwell Publishing.

Hoogesteger, J., & Wester, P. (2015). Intensive groundwater use and (in)equity: Processes and governance challenges. *Environmental Science & Policy, 51*, 117–124.

Kounina, A., Margni, M., Bayart, J., Boulay, M., Berger, Bulle, C., et al. (2013). Review of methods addressing freshwater use in life cycle inventory and impact assessment. *The International Journal of Life Cycle Assessment, 18*(3), 707–721.

Mehta, L., Veldwisch, G. J., & Franco, J. (2012). Introduction to the special issue: Water grabbing? Focus on the (re)appropriation of finite water resources. *Water Alternatives,* 5(2), 193–207.

Ochoa, E. (2006). Canadian mining operations in Mexico. In L. North, et al. (Eds.), *Community rights and corporate responsibility: Canadian mining and oil companies in Latin America* (pp. 143–160). Toronto: Between the Lines.

Oré, M. T., Del Castillo, L., Laureano, Orsel, S., & Vos, J. (2009). El agua, ante nuevos desafíos. Actores e iniciativas en Ecuador, Perú y Bolivia. Lima, Perú: IEP; Oxfam International.

Ramirez-Vallejo, J., & Rogers, P. (2010). Failure of the virtual water argument: Possible explanations using the case study of Mexico and NAFTA. In C. Ringler, A. K. Biswas, & S. A. Cline (Eds.), *Global change: Impacts on water and food security (Chap. 6)*. Berlin: Springer.

Ridoutt, B., & Pfitser, S. (2010). A revised approach to water footprinting to make transparent the impacts of consumption and production on global freshwater scarcity. *Global Environmental Change, 20*, 113–120.

Roth, D., & Warner, J. (2008). Virtual water: Virtuous virtual impact? *Agriculture and Human Values, 25*, 257–270.

Smaller, C., & Mann, H. (2009). *A thirst for distant lands: Foreign investment in agricultural land and water*. Winnipeg: IISD.

Sojamo, S., Keulertz, M., Warner, J., & Allan, J. A. (2012). Virtual water hegemony: The role of agribusuness in global water governance. *Water International, 37*(2), 169–182.

Solanes, M., & Jouravlev, A. (2007). *Revisiting privatization, foreign investment, international arbitration, and water*. Santiago: UN/ECLAC.

Stoltenborg, D., & Boelens, R. (2016). Disputes over land and water rights in gold mining. The case of Cerro de San Pedro, Mexico. *Water International, 41*(3), 447–467.

Sultana, F., & Loftus, A. (2012). *The right to water: Politics governance and social struggles*. Earthscan, Routledge: London and NY.

Swyngedouw, E. (2005). Dispossessing H2O: The contested terrain of water privatization. *Capitalism, Nature, Socialism, 16*(1), 81–98.

Swyngedouw, E. (2013). Into the sea: Desalination as hydro-social fix in Spain. *Annals of the Association of American Geographers, 103*(2), 261–270.

Swyngedouw, E. (2014). "Not A Drop of Water…": State, modernity and the production of nature in Spain, 1898–2010. *Environment and History, 20*, 67–92.

Urkidi, L. (2010). A glocal environmental movement against gold mining: Pascua-Lama in Chile. *Ecological Economics, 70*, 219–227.

Urteaga, P. (2013). Entre la abundancia y la escasez de agua: discursos, poder y biocombustibles en Piura, Perú (Between water abundance and scarcity: the cultural politics of biofuels in Piura, Northern Peru). *Debates en Sociologia, 38*, 55–80.

USDA Foreign Agricultural Service, (2014) *Peru Biofuels Annual 2014.* GAIN Report: Washington.

van der Ploeg, J. D. (2008). *The new peasantries. Struggles for autonomy and sustainability in an era of empire and globalization*. London: Earthscan.

van der Ploeg, J. D. (2010). The food crisis, industrialized farming and the imperial regime. *Journal of Agrarian Change, 10*(1), 98–106.

Venot, J. P., & Clement, F. (2013). Justice in development? An analysis of water interventions in the rural South. *Natural Resources Forum, 37*, 19–30.

Vos, J. (Ed). (2010). Riego campesino en los Andes. Seguridad hídrica y seguridad alimentaria en Ecuador, Perú y Bolivia, IEP, Lima.

Vos, J., & Boelens, R. (2014). Sustainability standards and the water question. *Development and Change, 45*(2), 1–26.

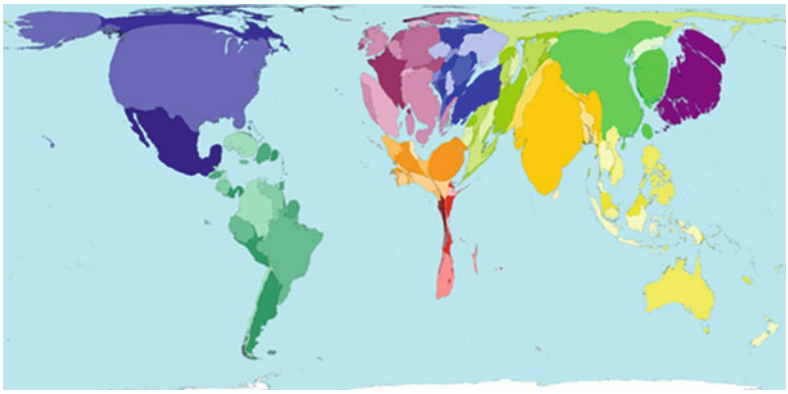
Vos, J., & Hinojosa, L. (2016). Virtual water trade and the contestation of hydro-social territories. *Water International, 41*(1), 37–53.

Woodhouse, P. (2012). New investment, old challenges. Land deals and the water constraint in African agriculture. *Journal of Peasant Studies, 39*(3–4), 777–794.

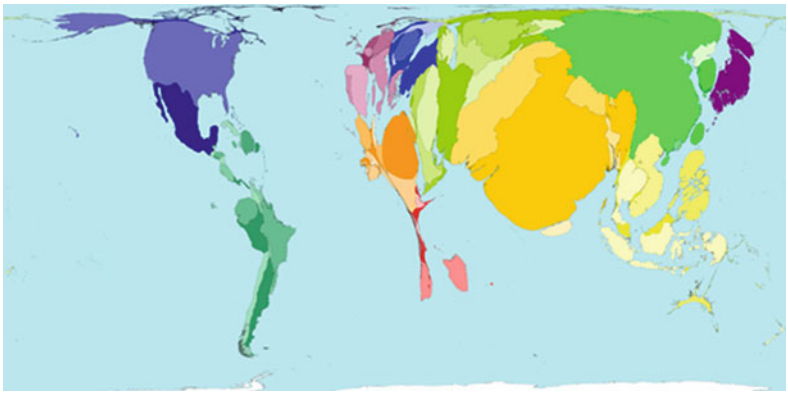
Yacoub, C., Duarte, B., & Boelens, R. (Eds.). (2015). *Despojo del Agua y Ecología Política. Hidroeléctricas, industrias extractivas y agro-exportación en Latino América*. Quito: Abya-Yala.

Zoomers, A., & Kaag, M. (Eds.). (2013). *Beyond the hype: A critical analysis of the global "land grab"*. London: ZED.

Zwarteveen, M., & Boelens, R. (2014). Defining, researching and struggling for water justice: Some conceptual building blocks for research and action. *Water International, 39*(2), 143–158.



Domestic water use. Water for domestic purposes includes drinking water, use for public services, commercial service (such as hotels), and homes. There is huge variation in water use per person. **Territory size shows the proportion of all water used for domestic purposes that was used there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Agricultural water use. Between 1987 and 2003, on average 2.4 trillion m^3 of water were used for agricultural purposes a year. Agricultural water includes that for irrigation and for livestock rearing. **Territory size shows the proportion of all water used for agricultural purposes that was used there, 1987–2003**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Integrated Water Resources Management as a New Approach to Water Security

Olivier Graefe

Abstract Access to safe water is a worldwide problem facing three quarters of a billion people every day. The problem of access to water is not primarily due to an overall scarcity of water, but rather the unequal geographical and seasonal distribution of the water resources. The key issue at stake here is, how to make water available. The new approach presented by international institutions for improving water access is Integrated Water Resource Management. This chapter questions this new approach and highlights the depoliticizing implications.

Keywords Access to water · Political ecology · Water scarcity · Water transfers · Water governance

Access to safe water is a worldwide problem facing three quarters of a billion people every day. In other words, one in ten people lack access to safe water according to the United Nations, a number which will increase in the future. By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity and two-thirds of the world population could live in regions under water stress conditions (UN 2009, 2015). The problem of access to water is not primarily due to an overall scarcity of water, but rather the unequal geographical and seasonal distribution of the water resources. The key issue at stake here is, how to make water available. Techniques to divert water to places where there is little or none or to store water for times of shortages have been developed since antiquity. The Roman aqueducts and the Ma'rib Dam in the ancient Kingdom of Saba' (8th century BC) are impressive examples of human ingenuity and engineering in order to overcome hydrological conditions. However, the issue today is not only of a technical or an ecological nature. Access to water for all is a question of investment, a question of financial means and thus the capacity of the different national, regional or local authorities to mobilize the means necessary to overcome the geographical

O. Graefe (✉)
Department of Geosciences, University of Fribourg, 4, Chemin Du Musée, 1700 Fribourg, Switzerland
e-mail: olivier.graefe@unifr.ch

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_5

and seasonal disparities of water availability. It is thus a question of political will and of power relationships between stakeholders, the state and the people; essentially a question of the politics of controlling water sources like rivers and aquifers.

Water Availability Is not an Ecological Issue, but a Management Problem Solved at High Social and Ecological Costs

That water availability is not dependent on ecological conditions is particularly obvious in regions such as Africa, Central Asia, the USA, as well as in China. Neighboring countries with similar ecological conditions in North- as well as in West Africa have very different access rates to safe water sources. In the Democratic Republic of Congo only three quarter of the population is provided with safe drinking water, despite holding nearly a quarter of all renewable water resources and represents the water richest country of the entire continent. In contrast, in very dry countries like Egypt or Namibia, nearly 100 % of the population has access to safe drinking water (MDG 2015). The problems of water supply are obviously not of an ecological nature but are the outcome of the political economy specific to these countries. The importance of the political economy to understand water availability is also evident in the American West, where the water supply for drinking water, irrigation, and the industry of not only California, but also of the western states like Nevada, Arizona, and Utah has been developed in a particular socio-economic and political context presented in famous books like "Rivers of Empire" by D. Worster (1985) and "Cadillac Desert" by M. Reisner (1986). Other famous examples of how limited hydrological conditions are overcome on a large scale in order to enable urban, agricultural, and industrial development can be seen in the control and exploitation of the Amou-Daria and the Syr-Daria in Central Asia or the Yangtse in China. Rivers here have been tamed, controlled, and managed in order to exploit them in the service of the economy, the people and the state. But the control and the exploitation, (i.e. the management patterns of these rivers) have created social and economic inequalities, sometimes even dramatic ecological consequences. Of major concern is the removal of people and the loss of properties due to the construction of dams. According to the World Commission on Dams, between 40 and 80 million people have been displaced worldwide since the 1940s often without recovering their livelihoods (World Commission on Dams 2000). The displacement of people, as well as the consequences downstream leads to an increase of social and economic disparities. Very few people (mostly the national elites) actually benefit from these dams and the economic wealth created by it, while the majority of people loose their livelihoods, triggering oppositions and sometime virulent resistance. Another issue created by the construction of dams is the unequal water share riparian states can use, despite treaties, and agreements. Successive treaties over the use of Nile water between Egypt, Ethiopia, and Sudan

f.e. have resulted in inequitable rights in favor of Egypt and thus to recurring tensions between these neighboring countries (Tafesse 2001). Finally, the approach of making more water available for drinking, irrigation, and industry has lead to significant ecological disasters. The depletion of water resources f.e. has significantly shrunk the Tchad Lake and the Aral sea and thus led to the salinization and the sterilization of vast areas that surround the sea. Furthermore, rivers do not carry sufficient water downstream of dams leading to the disappearance of aquatic and non-aquatic species. While new initiatives like the EU Water Framework Directive do try to reduce the ecological impacts, many damages are still to be addressed.

Because of the resistance and tensions at various scales, international institutions advocated a new water management approach in order to better integrate various national, regional, local stakeholders, as well as users from the agricultural, industrial, and drinking water sectors. The division and competition between these sectors led to conflicts and to the depletion of the resources as the water supply has been raised to solve or anticipate the conflicts between users.

The new approach thus is the "Integrated Water Resource Management", which is closely linked to the river basin as the privileged territorial management unit.

IWRM: The New Water Management Paradigm

The choice of the river basin as the geographical reference for the Integrated Water Resource Management (IWRM) has been promoted by the most prominent institutions involved in the water sector [f.e. Global Water Partnership (2010); UNESCO (2009); UN (2009); World Water Council (2015), etc.]. The EU in particular, has taken this scale as the new reference unit for the Water Framework Directive, which all EU member states implement. As such, it was praised in 2002 at the Earth summit Rio + 10 conference in Johannesburg. Since then, the relevance of the river basin has been promoted repeatedly in strategy papers, reports, and policies. River basins across national borders are subject of an increasing number of international river treaties or management organizations. Famous examples include the Danube River Protection Convention signed in 1994, the Mekong River Commission created in 1995 and the Nile Basin Initiative created in 1999. In total 167 international cooperation conventions or treaties for river basins are in place today (Blanchon 2009). In particular, the Global Water Partnership is a strong advocate of the basin approach as management unit and brings forward the key argument for the river basin as reference scale: "Water flows according to natural characteristics and does not respect administrative boundaries—therefore the question arises: should water be managed and management structures be defined according to existing administrative boundaries or according to natural boundaries, usually taken to be river basins? From a pure water resource point of view might there be a logic to adopting a river basin approach, or at least considering the river basin as the logical planning unit" (Global Water Partnership 2010: 47). This rhetorical question tries to establish the choice of the water divide as a boundary,

because it is given by nature and therefore most relevant for ecological sound management (Blomquist and Schlager 2005). Nevertheless, this choice ignores that the choice itself is neither natural, nor self-evident. The high complexity of today's water management practices and the multiple connections of river basins through water transfers make this territorial management unit as geographical reference only partially appropriate.

Water Management Practices: Plumbing and Pumping

The emphasis on the river basins neglects the widespread practice of water transfers, even though these practices are well known since the beginning of irrigation techniques. The construction of dams allows the transfers of extensive water quantities in the Americas, but also in Asia and Africa. The most prominent example at a large scale in Africa is the Lesotho Highlands Water project in South Africa. Another example is the transfer of water from the Kunene River into the Cuvelai basin thanks to the Calueque dam for the supply of North Namibia. Today, 120 million people worldwide depend on water transfers for their water consumption. It is estimated that 1000 km^3 of water will be transferred between basins every year for the next 20 years, especially after the completion of projects in India and China like the South-North Water Transfer Project diverting water from the Yangtse thanks to the Three Gorges Dam to the Yellow river basin (Blanchon 2009; Niemann 2008; Kluge 2005). The connectivity of rivers, water transfers, and diversions are well established and contradict the dominant conception of IWRM and the correlated scale of the river basin.

Water Governance as the New Panacea

The river basin is seen as a possibility to overcome or circumvent existing administrative and political boundaries (Molle 2009). Using the river basin as the territorial management unit is an attempt to impose a new and "natural" territory, which is justified and legitimized by (natural) sciences. It is an attempt to enforce a new scale for the water management and hence to bypass existing political and administrative instances and the related power relationships. The global actors like the Global Water Partnership, UNDP, the World Bank, and the EU try to convey in this way the political question of resource management in a managerial and technocratic frame of governance (Moss 2003). Water governance can be understood in the framework of the debate around the meaning of governance. For several critical authors, the concept of governance serves as a substitute for concepts of government through the reduction of social and political features in the processes of decision-making. Governance hence, refers to mechanisms and to coordinated activities directed towards problem solving. By contrast for government and non government governance is an attempt to minimize the political, e.g., debates,

conflicts and politically binding and transparent decision-making processes, to replace them by a defined policy, i.e. guidelines, (bench markings, best practices etc.) and parallel instances. The beneficiaries of management decisions according to critics are not individual people any more seen as collective political subjects, but rather the population as a mass, which are the victim of external environmental problems. This depolitization reduces decisions concerning resource allocation to policy definitions and a consensus oriented and procedural management beyond democratic representative instances (Swyngedouw 2010). From this perspective, water governance and the correlated IWRM approach resemble a take-over of the public water management by environmental experts without political and democratic legitimization (Graefe 2013).

The exclusive choice of the river basin as territorial management unit is questioned in light of the increasing importance of water transfers. To privilege one specific scale in order to control the growing interconnectivity of basins and the overall complexity of water management seems not only naive and wrong, but is also misleading to find appropriate solutions to gain water security. The problems are neither of technical nor hydrological nature but are above all political.

The challenge of access to water for drinking, irrigation, and industry all depends on the political choices of national and international authorities. Investments are necessary in order to apply existing technologies and more efficient management strategies reducing the water demand and consumption. It is estimated that 100 billion dollars per year would suffice to secure water access to all, including the poor in the Global South (Blanchon 2009). It is finally a question of national and international understanding and solidarity, which will secure the fundamental right to safe drinking water.

References

Blanchon, D. (2009). Atlas mondial de l'eau. De l'eau pour tous? Autrement, Paris.

Blomquist, W., & Schlager, E. (2005). Political pitfalls of integrated watershed management. *Society & Natural Resources, 18*(2), 101–117.

Global Water Partnership. (2010). Integrated Water Resources Management (http://www.gwp.org/en/The-Challenge/What-is-IWRM/Dublin-Rio-Principles/. Access 7 January 2011).

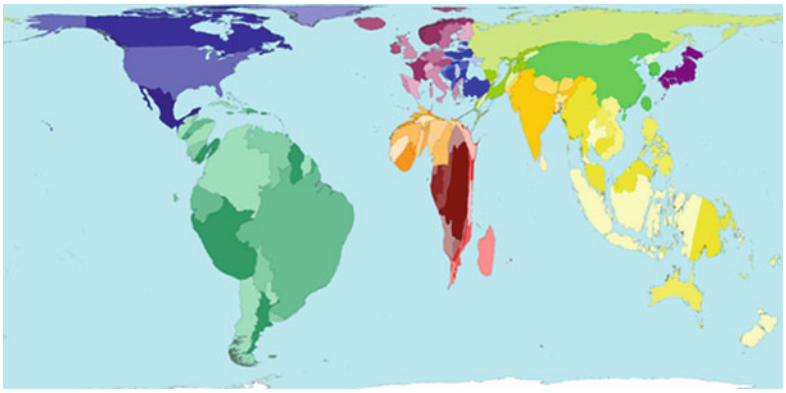
Graefe, O. (2013). The river basin as territorial water management unit. Towards post-political water management. In G. Arnaud-Fassetta, E. Masson & E. Reynard (Eds.), *European continental hydrosystems under changing water policy* (pp. 11–16). München: Friedrich Pfeil Verlag.

Kluge, T. (2005). Kritische Betrachtung des Ansatzes "Integriertes Wasserressourcen-Management" (IWRM). In S. Neubert, W. Scheumann, A. van Edig & W. Huppert (Eds.), *Integriertes Wasserressourcen-Management (IWRM). Ein Konzept in die Praxis. Deutsches Institut für Entwicklungspolitik* (pp. 31–43). Baden-Baden: Nomos.

Molle, F. (2009). River-basin planning and management: The social life of a concept. *Geoforum, 40*(3), 484–494.

Moss, T. (2003). Solving problems of 'fit' at the expense of problems of 'interplay'? The spatial reorganisation of water management following the EU Water Framework Directive. In H.

Briet, E. Engles, T. Moss, & M. Troja (Eds.), *How institutions change: Perspective on social learning in global and local environmental concerns* (pp. 85–121). Opladen: Leske + Budrich.
Niemann, S., 2008. Spatial aspects of supply: Migration, water transfer and IWRM. In: D. Hummel (Ed.), Population dynamics and supply systems. A transdisciplinary approach (pp. 99–128). Frankfurt a.M.
Reisner, M. (1986). *Cadillac desert: The American west and its disappearing water*. New York: Viking Penguin.
Swyngedouw, E. (2010). Apocalypse Forever?: Post-political Populism and the spectre of climate change. *Theory, Culture & Society, 27*, 213–232.
Tafesse, T. (2001). *The nile question: Hydropolitics, legal wrangling*. Modus Vivendi and Perspectives: London, Transaction Publishers.
UNESCO. (2009). *IWRM guidelines at River Basin level, part 1. Principles*. Paris: Unesco Publishing.
United Nations. (2009). *United Nations World Water Development Report 3. Water in a changing world*. Earthscan, Paris: Unesco Publishing.
United Nations. (2015). Millennium Development Goals Report 2015, New York.
World Commission on Dams (2000). *Dams and development. A new framework for decision-making*. London and Sterling, Earthscan Publications.
World Water Council. (2015). *Integrated Water Resource Management: A new way forward*. A Discussion Paper of the World Water Council Task Force on IWRM. http://iucn.org. Access 11 May 2016.
Worster, D. (1985). Rivers of empire. Water, aridity, and the growth of the American West. Oxford: Oxford University Press.



Water resources. Water resources here include only freshwater, because saline (sea) water requires treatment before most uses. **Territory size shows the proportion of all worldwide freshwater resources found there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Water depletion. This map shows those territories that use much of their internal water resources, measured with a threshold of people using more than 10 % of renewable water resources. Each territory is resized based on the volume of water used beyond 10 %. **Territory size shows the proportion of all water used that is more than 10 % of the renewable internal freshwater resources of that territory**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Surviving as an Unequal Community: WASH for Those on the Margins

Kathleen O'Reilly

Abstract The Sustainable Development Goals intend to address populations "missed" by the Millennium Development Goals for safe water and sanitation access. To capture these populations, programs need to attend to community norms for usage and the groups most marginal in those communities. Policies should include a focus on ways to eradicate socioeconomic and political marginality.

Keywords Water · Sanitation · Sustainable Development Goals · Social inequality

Water and Sanitation

The Millenium Development Goal (MDG) for access to improved drinking water was met in 2010, ahead of schedule. However, the MDG for sanitation was missed by 700 million people, meaning 2.4 billion people lacked access to "improved" or "hygienic" sanitation in 2015. As with drinking water, rural populations are less likely than urban dwellers to have access to improved sanitation (7 of 10 globally). Regionally, South Asia, East Asia, and Sub-Saharan Africa are where most of those without access to improved sanitation reside. Rural dwellers are most likely to defecate in the open (9 of 10 open defecators globally). Open defecation includes defecating in fields, train tracks, garbage dumps, forests, bodies of water, and plastic bags that are then thrown onto rubbish heaps ("flying toilets"). Approximately 1 billion people defecate in the open, and most of these people live in India (WHO/JMP 2015).

Sanitation, simply put, is the proper disposal of human waste. This can include trash, wastewater, and disposal of human feces. The simplest way to safely dispose of human feces is to deposit them somewhere where they will not come in contact

K. O'Reilly (✉)
Department of Geography, Texas A&M University, MS 3147,
College Station, TX 77843, USA
e-mail: koreilly@geog.tamu.edu

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_6

with water and food or with humans, animals, or insects that might transfer contaminants to eyes, mouths, water, and food. Sanitation can be simply digging a hole, defecating in it, and then covering the hole and the feces in it ("cat sanitation"). When latrines are built, the construction and maintenance of the units can matter a great deal about their ability to reduce the spread of disease. For example, a latrine with a dirt floor can harbor harmful parasites, while a latrine built with a slab has been found to be less contaminating. However, if the slab is cracked or broken, then the ability of the latrine to provide better protection to users is compromised (Exley et al. 2015). Safe sanitation is more than the building of hygienic latrines, it includes maintaining them, and having the ability to do so.

The Survival of the Most Vulnerable

Diarrheal disease kills three-quarters of a million children under the age of five every year. Although preventable, it is the second leading cause of death, and the leading cause of malnutrition in children under five years old. Malnutrition is linked to childhood stunting and underdevelopment. An estimated 165 million children have stunted growth, which may have short and long-term impacts for physical health and cognitive development. Recent evidence suggests that children's height is linked to household hygiene practices, especially in situations where children ingest fecal bacteria through unwashed hands, contaminated utensils, and contaminated drinking water (Lin et al. 2013; Pickering et al. 2012). Subsequent gastrointestinal infections impact nutrient absorption, leading to malnutrition that contributes to stunting.

Other research undertaken at the household scale indicates additional factors that put children at risk of infection. In parts of Africa, for example, young children may not be expected to use the household latrine, in which case they defecate in the family courtyard. As they learn to use the latrine they may not be using the unit hygienically, as might be expected for a new user of any age. Third, anal cleansing may not take place in the unit, but instead outside it, in the family courtyard. In combination, these three practices put feces in the public domain and put children and others at risk of infection (Exley et al. 2015).

It is common knowledge that access to clean water and sanitation will lead to improvements in public health. But this conventional wisdom requires some unpacking. For example, clean water may be clean at the source, but can easily become contaminated by unwashed hands, unhygienic storage, and flies. It is well-known in the Indian context that access to sanitation does not necessarily mean that family members will use it, and may chose to defecate in the open instead (Mara et al. 2010). Evidence suggests that high levels of coverage and use at the community level are necessary to reduce disease associated with fecal contamination (Emerson et al. 2001).

Beyond Surviving to Living with Dignity

As Sanjay Wijesekera, head of UNICEF's global water, sanitation, and hygiene (WASH) programmes stated, "Although it is the poor who overwhelmingly do not have toilets, everyone suffers from the contaminating effects of open defecation, so everyone should have a sense of urgency about addressing this problem (UNICEF)." Eliminating open defecation could significantly diminish the spread of diarrheal diseases (and others) that can lead to death, malnutrition, and stunting. Handwashing can halt the spread of diarrheal disease through the fecal-oral route, but discussions of handwashing necessarily come back to provision of clean water that can be used for this purpose.

If communities are responsible for environmental health, then both quantitative and qualitative research can shed light on community norms of sanitation behavior (Mehrotra and Patnaik 2008). This begins with an understanding that vast differences exist across populations, across states, and across regions. It is clear from the WHO/JMP (2015) MDG report that the rich begin with greater access to WASH services and are those who enjoy the greatest improvements in services. By contrast, the poorest of the poor are the least likely to have services and remain the most underserved. All regions with the least access to sanitation exhibit large inequalities between the richest and the poorest 20 %, and these broad categories can be additionally parsed into rural/urban dwellers and the kind of services they receive (WHO/JMP 2015).

The reasons for why the world's poorest *are* the poorest can be explained by geographic factors, political-economy, and social marginality. Cross-cutting inequalities like widowhood and caste, geographical remoteness and indigeneity, homelessness and language barriers make social marginality difficult to untangle. They suggest that provision of WASH services to marginal communities requires a concerted, long-term effort. However, the effort goes beyond outreach to these poor communities. Efforts *inside* communities to address social inequalities are also required. For example, Community Led Total Sanitation approaches that galvanize rural communities into latrine building for all and community monitoring of open defecators have had great success in Bangladesh, where CLTS was developed (Kar and Chambers 2008). But strategies for behavior change like CLTS that include shaming of open defecators can add to stress already felt by the poor and those on the margins (Hirve et al. 2015). What's more, in rural areas, both the poor and the wealthy may be contributing to contaminated landscapes through open defecation, even those who have individual household latrines.

Wijesekera's clarion's cry that "everyone should have a strong sense of urgency" sounds reasonable, but such statements are not wholly benign. Middle class urban residents malign the poor for contaminating their cities, without acknowledging how social and political inequalities generate the disparities of class often found contained within the cities of developing countries. Not only do the urban poor struggle to meet their livelihood needs, they struggle to meet their hygiene and sanitation needs without an infrastructure that supports either (Joshi et al. 2011).

Lack of access to sanitation may be especially difficult when social norms require greater levels of privacy for women's defecation than for men. Without access to a

latrine, women and girls must defecate in the open, bringing with it possibilities of attack, harassment, or public shame. Women speak of avoiding going for defecation by reducing food or water consumption, or disciplining their bodies so that defecation occurs at predetermined times and places (O'Reilly 2010). While the overall impact of psychosocial stress related to inadequate sanitation and water access is not well-known, recent work finds that women's stress surrounding defecation and menstrual hygiene management include worry, rushing, irritation, depression, and tension (Sahoo et al. 2015). Overall well-being, survival and health includes mental health, and increasingly research is beginning to explore the impact of women and girls' emotional stress due to absence of adequate sanitation at community and household scales, and at schools and public places like markets.

Available sanitation does not necessarily lead to lower stress levels, and may not contribute to improvements in community health. In urban India, poor women will reject substandard public or community latrines in favor of open defecation if they perceive the bodily harm or the risk of gender-based violence to be greater using the latrine (Kulkarni et al. 2014). Women's fear and stress then, is not a problem with sanitation, but with social inequalities that put women at risk of gender-based violence (O'Reilly 2016). Having access to sanitation does not mean being able to use it due to fear; lack of access to water; or the inability to manage fecal sludge when the latrine pit is filled. Community survival goes beyond provision of water and sanitation, as communities comprise diverse membership, not all of whom have equal access to resources and a community that supports their access.

The Sustainable Development Goals

In 2010 the United Nations recognized safe water and sanitation as a human right. The Sustainable Development Goals (SDGs) intend to address the populations "missed" by the MDGs. But much more needs to be understood as to who those populations are, and if they are on the social margins, what are the socioeconomic and political structures that produce this distance from mainstream society? Answers to these questions can lead to policies and practices that seek to eradicate social inequalities. Furthermore, the SDGs assume that those who were counted as having access to safe water and sanitation by 2015, continue to have access. But do they? Evidence suggests that access and use of a latrine once initiated, will not necessarily be maintained (Kwiringira et al. 2014).

Disease preventative programs include improving hygiene such as handwashing, increasing access to safe water and safe sanitation, and education campaigns. These same programs need to include attention to community norms for sanitation usage, access to water, and the most marginal in the community to assure not simply surviving through greater environmental health, but surviving with dignity.

References

Emerson, P. M., Bailey, R. I., Walraven, G. E., & Lindsay, S. W. (2001). Human and other faeces as breeding media of the trachoma vector Musca sorbens. *Medical and Veterinary Epidemiology, 15*, 314–320.

Exley, J. L., Liseka, B., Cumming, O., Ensink, J. H. J. (2015). The sanitation ladder: what constitutes an improved form of sanitation? *Environmental Science & Technology, 49*(2), 1086–1094.

Hirve, S., Lele, P., Sundaram, N., Chavan, U., Weiss, M., Steinmann, P., et al. (2015). Psychosocial stress associated with sanitation practices: Experiences of women in a rural community in India. *Journal of Water, Sanitation and Hygiene for Development, 5*(1), 115–126.

Joshi, D., Fawcett, B., & Mannan, F. (2011). Health, hygiene and appropriate sanitation: Experiences and perceptions of the urban poor. *Environment and Urbanization., 23*(1), 91–111.

Kar, K., & Chambers, R. (2008) *Practical Guide Triggering Community-Led Total Sanitation (CLTS)*. Brighton: Institute of Development Studies.

Kulkarni, S., O'Reilly, K., & Bhat, S. (2014). No Relief. Online video. http://www.soppecom.org/publications-vedios.htm. Society for the Promotion of Participative Ecosystem Management. Accessed 7 May 2016.

Kwiringira, J., Atekyereza, P., Niwagaba, C., & Günther, I. (2014). Descending the sanitation ladder in urban Uganda: Evidence from Kampala Slums. *BMC Public Health., 14*, 624.

Lin, A., Arnold, B. F., Afreen, S., Goto, R., Huda, T. M. N., Haque, R., et al. (2013). Household environmental conditions are associated with enteropathy and impaired growth in rural Bangladesh. *American Journal of Tropical Medicine and Hygiene, 89*(1), 130–137.

Mara, D., Lane, J., Scott. B., & Trouba, D. (2010). Sanitation and health. *PLOS Medicine*. *7*(11).

Mehrotra, N., & Patnaik, S. M. (2008). Culture versus coercion: Other side of Nirmal Gram Yojana. *Economic and Political Weekly., 43*(43), 25–27.

O'Reilly, K. (2010). Combining sanitation and women's empowerment in water supply. *Development in Practice, 20*(1), 45–56.

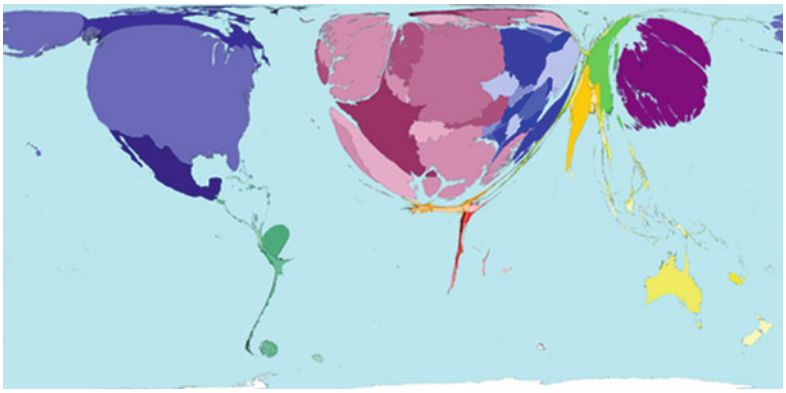
O'Reilly, K. (2016). From toilet insecurity to toilet security: Creating safe sanitation for women and girls. *WIREs Water, 3*, 19–24.

Pickering, A. J., Julian, T. R., Marks, S. J., Mattioloi, M. C., Boehm, A. B., Schwab, K. J., et al. (2012). Fecal contamination and diarrheal pathogens on surfaces and in soils among Tanzanian households with and without improved saniation. *Environmental Science and Technology, 46*, 5736–5743.

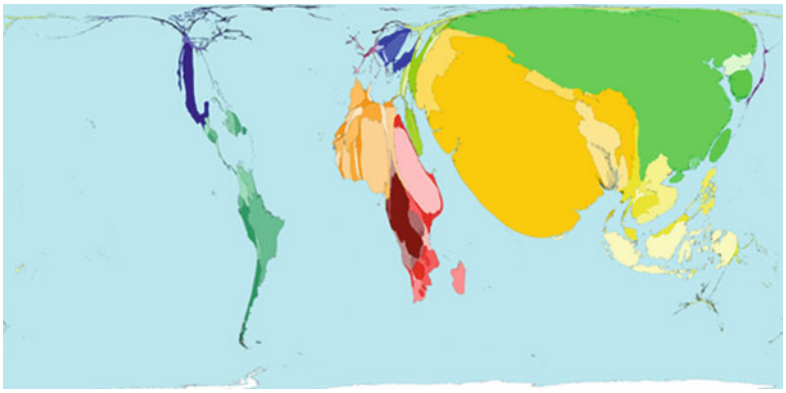
Sahoo, K. C., Hulland, K. R., Caruso, B. A., Swain, R., Freeman, M. C., Panigrahi, P., et al. (2015). Sanitation-related psychosocial stress: A grounded theory study of women across the life-course in Odisha. *India. Social Science and Medicine., 139*, 80–9.

UNICEF. http://www.unicef.org/media/media_77952.html. Accessed 7 May 2016.

World Health Organization/ Joint Management Program. (2015) JMP Update Report 2015. http://www.wssinfo.org/fileadmin/user_upload/resources/JMP-Update-report-2015_English.pdf. Accessed 7 May 2016.



Sewerage sanitation. In more that three quarters of territories fewer than 10 % of the population has access to toilets that are connected, via sewers, to a waste water treatment plant. In 8 regions less than 5 % of people are connected to sewerage systems. **Territory size shows the proportion of all people that have their toilets connected to public sewerage systems (and thus waste water treatment) that live there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Poor sanitation. Of all the people in the world, 39.8 % of us do not have access to basic sanitation. This means living within walking distance of private or shared (not public) latrines or toilets that effectively prevent human and animal contact with excreta. **Territory size shows the proportion of all people without access to basic sanitation (toilets) that live there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Challenges to Food Security in a Changing World

Walter E.L. Spiess

Abstract The next decades will see dramatic climatic changes and a pronounced population growth Asia—accompanied by the formation of huge human agglomerations, megacities—followed by increasing numbers of people in Africa, Latin America and the Caribbean; North America and Oceania will experience a moderate population growth whereas the EU will face a shrinking population. Unfortunately regions with the highest population growth are those were most people are living in precarious conditions especially in SS Africa and to some extent in South East Asia. To feed the 9 billion people any effort has to be undertaken to utilize and exploit the available resources in a sustainable way and to minimize the interventions into the environment. Factors of relevance are competitive biofuel production, the extension of the Food Chain into the Mega-City household, minimizing of food losses by applying new communication systems and supporting Food Sovereignty efforts of Developing countries.

Keywords Climate change · Population growth · Food Security · Growth of agricultural production · World Fruit and Vegetable Production · Source of caloric food intake · Consumption · Global beverage market

Introduction

The coming decades pose a multitude of problems to the global community. The most prominent challenge to be faced is certainly increasing demand for food given the increasing world population; however new technological and socials developments also have to be addressed by politics, science, and commerce.

To Rose-for her lifelong dedication to support and promote global understanding

W.E.L. Spiess (✉)
Institute of Food Process Engineering, Karlsruhe Institute of Technology,
Kaiserstr. 12, 76128 Karlsruhe, Germany
e-mail: rose-walter.spiess@t-online.de

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_7

Competent forecasts anticipate that the most pronounced population growth will occur ß Asia followed by Africa, Latin America, and the Caribbean; North America and Oceania will experience a moderate growth whereas Europe will face a shrinking population. The population growth especially in East Asia, India, and South West Africa will be accompanied by the formation of huge human agglomerations resulting in megacities. For example, it is expected that in China alone over 220 cities with over one million inhabitants will be formed.

Accompanying growing economic prosperity especially in Asia, a broad middle class will be formed which is likely to adopt general lifestyle values of highly industrialized countries increasing its demand for food including meat-intensive diets. Population patterns of the next decades will also be characterized by growing segments of elderly people in developed industrialized countries and large numbers of younger people in developing and emerging countries. This situation may lead to precarious conditions especially in Sub-Saharan Africa.

It is a well-based assumption that the growing world population can be supplied with sufficient quality food at least to 2050, but present climates may undergo rather negative changes with adverse impacts on agricultural production. To feed two to three billion more people will require not only an extension but also an upgrading of the present share of farmland for food production. Furthermore, higher productivity of the agricultural sector is necessary and requires amongst other factors fertilizing already highly stressed soils, improving irrigation systems, and developing plant materials which are adapted to changing environmental conditions including less water. In producing the required amount of food, the global and local ecosystems are likely to be further compromised negatively impacting biodiversity and hastening climate change.

The efforts, however, to produce sufficient food for 10 billion people who every day require 3000 calories—on an average base—will likely not be enough. It will be important to make the food available at the place of demand. Clearly the production centers are, with regard to location and time, not congruent with the centers and times of demand forcing food to cross country frontiers and social frontiers and to be stored. This requires that major amounts of food have to be shelf stable to allow for long transport times and to compensate for times of underproduction. In addition, these more technological requirements demanded for food have to be affordable and meet social, cultural, religious, and physiological requirements and needs.

Optimistically, many of the above requirements can be met, delivered by the agricultural and food science sector. However, the basic parameters and surrounding conditions are largely political requiring those in charge to act responsibly taking into account political class and global and local social movements. Given that the scientific community is not in a position to coordinate political actions, regulate production, or provide incentives, the scientific community can point to problems and recommend solutions. In this exposé some aspects of the present day food supply chain together with some projections into the future are presented together with some thoughts as to what may impair the global provision of food. The data in most cases represent average values over rather broad data sets, and, therefore, the picture drawn is very general and requires further detailed analysis.

Furthermore, some facts with an impact on the global food supply are discussed from a food science or more precise food engineering point of view. The material offered is far from complete but may help to understand and explain problems facing humanity.

Food Availability and Food Sovereignty

In his book, **The Population Bomb**, published in 1968, Paul R. Ehrlich wrote, "*The battle to feed all of humanity is over. In the 1970s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date nothing can prevent a substantial increase in the world death rate….*".

Although Ehrlich's scenario did not materialize, the question as to whether global agriculture can be in a position to feed the 8 to 9 billion people expected in the coming decades is today being asked in a different way. It is well understood that there will be—based on a statistical average—enough food available to feed up to 10 billion people. Therefore, the question is, "Is it possible to distribute the resources in a way that Global Food Security can be achieved not only in the privileged parts of the globe but also in the disadvantaged parts of the globe."

According to the World Food Summit in 1996 (FAO 1996), food security exists when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life." In this definition, emphasis is obviously on "all people." From Table 1, during the late 1970s the Calorie supply steadily increased, and in the early 1980s the threshold of a minimum caloric intake of 2500 kcal was, on average, surpassed again. Although data from other sources are not exactly congruent—a general observation which is even true for data regarding the earth surface—the tendency in all data sets points in the same direction. A more detailed and differentiated picture reveals, however, that presently Sub-Saharan Africa (SS Africa) is still below the 2500 kcal threshold level and in South Asia also millions of people do not enjoy an adequate food supply. In 2015 hunger hotspots in Africa were identified in Angola, Namibia, Zambia, United Republic of Tanzania, Madagascar and in neighboring countries in Asia including Tajikistan, Democratic People's Republic of Korea, and, with some restrictions, India (Table 1 and Fig. 1). It is feared that especially in SS Africa food insecurity will persist beyond the next decade.

The catastrophic situation for large contingents of the global population is rooted in many factors including poverty in countries with an adequate food production (which is the case to some extent in South East Asia), lack of education in countries with an underdeveloped infrastructure, and/or poorly developed agricultural systems. In many cases, each of these situations may be traced back to total failure of the responsible national governments and international institutions to cope with the critical situations. In only a very few cases can food insecurity situations be

Table 1 Hotspots of malnutrition: food availability/consumption (kcal per capita per day)

Region	1964–1966	1974–1976	1984–1986	1997–1999	2015	2030
World	**2358**	**2435**	2655	2803	2940	3050
Developing countries	**2054**	**2152**	**2450**	2681	2850	2980
Near East and North Africa	**2290**	2591	2953	3006	3090	3170
Sub-Saharan Africa[a]	**2058**	**2079**	**2057**	**2195**	**2360**	2540
Latin America and the Caribbean	**2393**	2546	2689	2824	2980	3140
East Asia	**1957**	**2105**	2559	2921	3060	3190
South Asia	**2017**	**1986**	**2205**	**2403**	2700	2900
Industrialized countries	2947	3065	3206	3380	3440	3500
Transition countries	3222	3385	3379	2906	3060	3180

[a]Excludes South Africa
Figures below 2500 kcal per capita per day are in bold
Source Alexandratos and Bruinsma (2012)

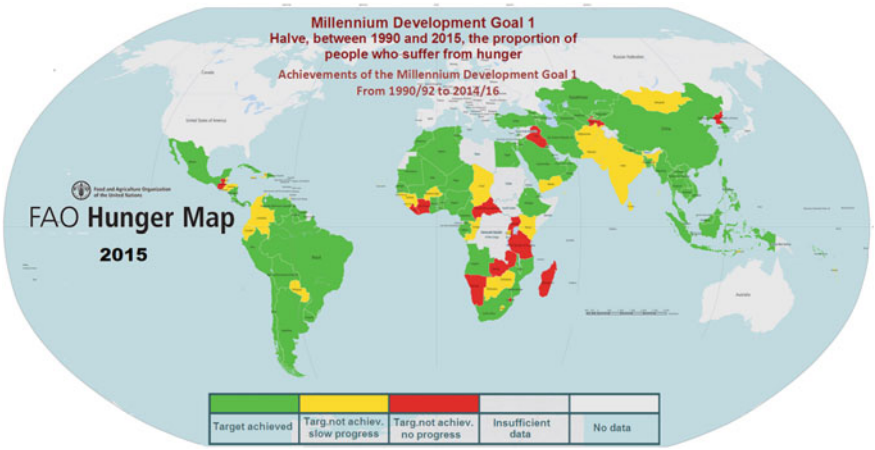


Fig. 1 Hunger Hotspots 2015. *Source* http://www.fao.org/fileadmin/templates/hunger-map/images/FAO_HUNGER_MAP_2015_sm.jpg (Accessed: 2016-04-10)

attributed to climatic factors or factors which are not under control of local or regional authorities.

The expected overall positive development in the provision of food is based on the fact that the growth rates of agricultural production have surpassed the population growth rates, Fig. 2.

However, adequate caloric provision of food is a requirement that, in itself, is not sufficient. It is equally important to provide a well balanced diet. The

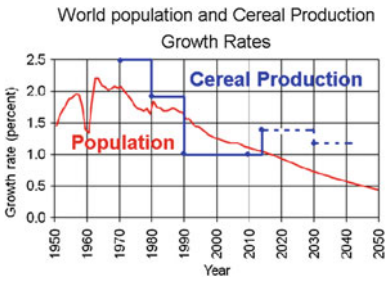


Fig. 2 Population and cereal production growth rates. *Source* Alexandratos and Bruinsma (2012), http://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf (Accessed: 2016-04-10)

recommendations for a healthy diet are globally valid, for any cultural situation, and can be adapted to any catering situation. The demand and the availability of food will certainly differ from continent to continent, from country to country. However, for a rough estimation, some average figures can provide further insight into the availability of different types of food demanded and consumed. The data for the present situation and the projections for the future (2030) indicate, for example, that especially the developing countries and to some extent the transition countries have a higher demand for food and feed than they are producing.

It should be mentioned that the "Demand" data in Table 2 include losses and waste which amount to roughly 20–30 %, and therefore these are "low" estimates. Intelligent processing and handling and utilization of currently underutilized product and components as feed or even as food could help to reduce the "Demand" considerably and result in saving natural resources.

As illustrated in Fig. 3 for wheat and in Table 2 for important food items, the Developing Countries rely on imports for most staple foods, mainly from the developed countries. In the case of wheat it is expected that the trade deficit will grow from the present 22–25 %. Similar developments are expected for coarse grains, fresh milk, and dairy products. However, beef and veal, mutton and lamb, pig meat, and pulses for the Developing Countries rely significantly on imports from industrialized countries and to some extent from Transition Countries. For paddy rice, roots and tubers, and oilseed the group of Developing Countries can be considered self-supporting.

This separation of the production centers from centers of demand does however not only exist on a global macro-scale (transport from developed/transitional countries to developing countries) it also exists at a micro-scale between agricultural production centers in developing/transition countries (e.g., China, Brazil) and huge agglomerations of a million people within those countries. Long supply chains especially in the case of perishable produce like fruit and vegetable are prone to severe losses; despite considerable progress in produce/product stabilization supply chains are a true challenge to food science and technology. Sterile long distance bulk transports of liquids and pastes or in-city indoor agriculture are some of the revolutionary solutions which point to new horizons.

This situation certainly will prevail over the present time horizon. Considering the population growth in Developing Countries, it is expected that in the

Table 2 Changes and balance in the commodity composition of food by major country groups

Produce	Balances for selected commodities (million tones)									
	Year	Developing countries			Industrial countries			Transition countries		
		Demand all uses	Production	Net trade	Demand all uses	Production	Net trade	Demand all uses	Production	Net trade
Wheat	2015	462	358	−104	159	263	104	110	114	4
	2030	566	425	−141	165	299	133	120	132	12
Rice (paddy)	2015	679	685	5	23	24	0.4	3	2	−1
	2030	771	778	7	24	23	−1	4	2	−2
Coarse grains	2015	628	539	−89	424	508	83	125	133	8
	2030	837	709	−128	471	585	115	139	154	15
Milk and dairy (fresh milk eq.)	2015	375	346	−29	240	268	28	97	100	3
	2030	523	484	−39	251	286	36	99	104	5
Beef and veal	2015	42	41	−1	25	27	2	7	6	−1
	2030	56	55	−1	25	27	2	8	7	−1
Mutton and lamb	2015	42	41	−1						
	2030	17	15	−2	2	3	1	1	1	0
Pig meat	2015	70	69	−1	31	32	1	8	8	–
	2030	84	83	−1	32	33	1	8	9	1
Poultry meat	2015	61	59	−2	33	38	5	5	4	−1
	2030	97	94	−3	39	44	5	6	6	–
Roots and tubers	2030	808	818	69	100	88	−12	94	95	1
Pulses	2030	64	62	−2	13	13	1	3	4	1
Vegetable oils/seed	2030	152	156	4	53	52	−1.3	9	9	0.0

Source Alexandratos and Bruinsma (2012)

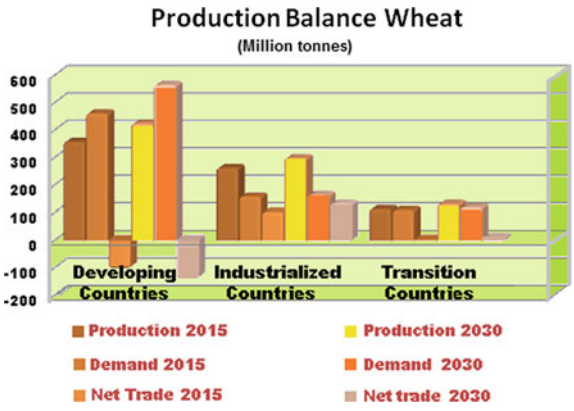


Fig. 3 Production balance of wheat. *Source* Alexandratos and Bruinsma (2012)

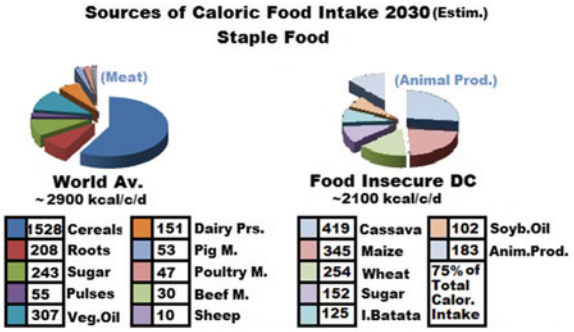


Fig. 4 Source of caloric intake. *Source* Alexandratos and Bruinsma (2012)

foreseeable future Developing Countries will not gain desired food sovereignty. On the contrary, the dependence on imports from developed countries will most probably grow.

The Daily Intake[1]

As mentioned above it is estimated (Table 1) that in 2030, on average, globally the threshold level of 2500 kcal/person/day is surpassed. When the anticipated figures on the available feedstock (Table 2) are broken down into virtual consumption data [kg/person/year] a more detailed [kcal/person/day] virtual meal—referred to as Standard Diet in this exposé—can be composed. That analysis can reveal details of the daily energy provision of approximately 3000 kcal/person/day. In 2030 less privileged areas especially in Africa will face a deficient food supply to 2100 kcal/person/day and consequently malnutrition (Fig. 4).

[1] http://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/

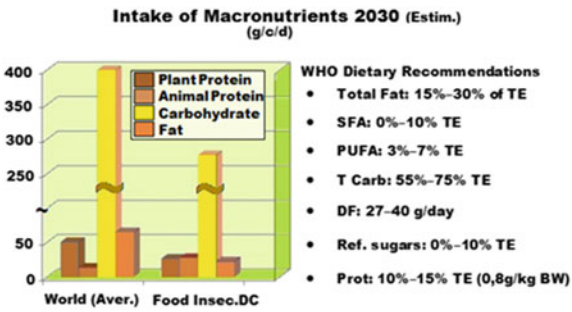


Fig. 5 Intake of macronutrients with reference to TE (Total Energy). *SFA* Saturated Fatty Acid, *PUFA* Polyunsaturated Fatty Acid, *T Carb* Total Carbohydrates, *DF* Dietary Fiber, *Ref. sugars* Refined Sugars, *Prot* Protein, *BW* Body Weight

The major component in the virtual meal is carbohydrates as important sources of energy (e.g., cereals, roots and tubers, and sugar) which are available to the majority of the global population. To some extent those products are also valuable sources of proteins and minerals (Fig. 5).

Important Sources of Energy—Carbohydrates

Cereals

The major supplies of carbohydrates are cereals. For many years the most important cereal is maize (corn) which constitutes together with other coarse cereals about 45 % of the world cereal production; wheat has a share of 28 %; and paddy rice has a share of 27 %. Cereals are being used for a great variety of products. In addition to providing the major energy source in human nutrition, carbohydrates are used as animal feed and feedstock for many chemical products like alcohol or plastics. Maize is used in traditional ways of consumption including breakfast cereal, popcorn, corn oil, and corn syrup production. Similar to other starch-containing produce, corn flour/starch is used as thickener in all types of food preparations.

Wheat is the main cereal in bread. Wheat flour is also the basis for pasta production, is an important breakfast cereal, and wheat germ is used for oil production. Rice is prepared in a multitude of forms and dishes, mainly as parboiled, pre-cooked, cooked or steamed, as porridge, cake or pudding, and noodles. By genetic modification, rice is enriched in Beta-Carotene (Pro-Vitamin A) to compensate for Vitamin A deficiency, a problem under which millions of people in East Asia are suffering.

Barley, a coarse grain, is the most important raw material for worldwide beer production. Other cereals suitable for the production of beer and other alcoholic beverages are maize, wheat, rice, and millet (see also Fig. 8).

Roots and Tubers

In addition to cereals, roots, and tubers are also a very important pillar in the world's food supply. Approximately half the global production of roots and tubers is destined for human consumption, the remaining half is used as animal feed, production of starch for various purposes, production of ethyl alcohol, and industry products of various nature. The group comprises five major crops: cassava, sweet potato, potato, yams, and taro. Roots and tubers are all rich in starch but low in proteins. Cassava, sweet potato, potatoes, and yams contain modest amounts of vitamins and minerals. Because of their rather poor shelf life, they are in general processed quickly after harvest into a variety of preparations, including boiled, fried, fermented, and, as flour, in the form of porridge and finally as beer. The cassava tuber contains small amounts of cyanides which have to be removed before consumption by grating, fermenting, drying, and roasting, a process which is not required in the case of modern sweet varieties.

Building the Body: Proteins

Proteins are indispensable to any human diet. It is estimated that a healthy adult person, on average, requires about 0.8 g/kg body weight (BW). The main sources of protein in the standard diet are cereals with about 50 g/person/day. Plant derived proteins should be (but there are exceptions in case of special plant protein combinations) complemented by proteins of animal origin to provide the necessary amount of essential amino acids. Meat and dairy products contribute in the standard, balanced diet about 30 g/person/day.

With increasing global economic growth and income, the demand for meat increased and meat production grew disproportionately. However, the rather high growth rates especially in Developing Countries in the 1980s and 1990s have not been maintained at the start of the 21st century primarily because of a slowdown of the world economy. The production growth rates for meat are, however, still almost twice as high as the growth rates of cereals. The main consumers of meat are the growing middle class in Developing Countries especially in China and India, where consumers are turning away from plant-based traditional diets to higher meat consumption (Fig. 6). These changes in dietary habits not only have an impact on the environment—raising animals especially cattle is associated with the production of methane—but stresses the availability of cereals because animal production is mainly based on cereal such as soy feed (Tables 3 and 4). For ruminants, pasture feeding contributes also to the production of meat.

The large amounts of cereals required for the production of meat and dairy products are the reason for their high Virtual Water Footprint (VWF) compared to the VWF of cereals and vegetable produce. The high VWF of animal products stresses to a high degree the scarce water resources especially in developing counties.

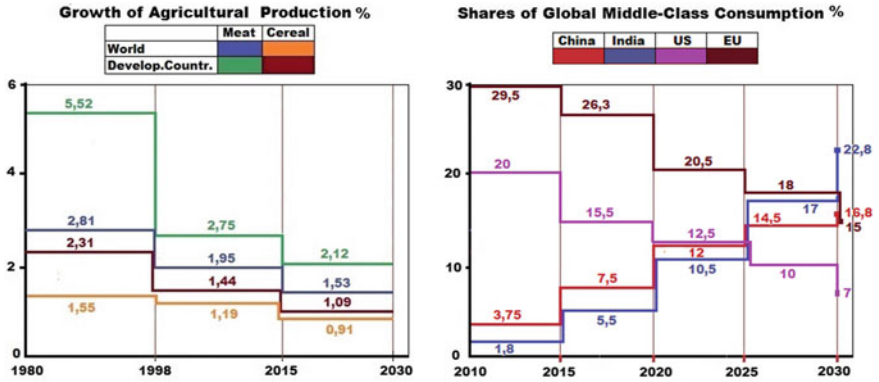


Fig. 6 Growth of agricultural production versus development of middle-class consumption. *Source* Alexandratos and Bruinsma (2012)

Table 3 Amount of plant-based feed to produce meat

Animal	Beef	Sheep	Pig	Chicken/Turkey
Amount of cereal/soy feed [kg] to produce 1 [kg] of meat (FCR)	5–16	3–6	3–6	3–4

The FCRs (Feed Conversion Ratio) presented in the literature differ considerably depending on the background and interests of the sources; objective reasons are especially the quality of the feed
Source http://www.beefusa.org/CMDocs/BeefUSA/Resources/cc2012-Beef-Feed-Efficiency–Dan-Shike.pdf, https://en.wikipedia.org/wiki/Feed_conversion_ratio (Accessed: 2016-04-10)

Table 4 Water footprint (m^3/ton) of selected Produce for the global farming system, weighted averages

Products	Total virtual water footprint (m^3/ton)	Products	Total virtual water footprint (m^3/ton)	Products	Total virtual water footprint (m^3/ton)
Beef	15,415	Maize (corn)	1222	Sweet potatoes	383
Pig meat	5988	Rice, paddy	1673	Beans, green	561
Chicken meat	4325	Wheat	1827	Groundnuts shelled	3974
Egg	3265	Manioc	564	Peas, green	595
Milk	1020	Potatoes	287	Soya beans	2145
Butter	5553				
Milk powder	4745				

Source Mekonnen and Hoekstra (2012)

People living in less privileged, food insecure areas, and a condition likely to also be present to 2030, will not be able to participate in the extension of the meat market and may still have restricted sources of proteins, currently at approximately 27 g/person/day proteins of plant origin and 28 g/person/day of animal origin.

The Backup Source of Energy: Fat

Fat and lipids are essential as nutrients for human survival and healthy life. Major oils which make up most of the global fat production are not only used as food ingredients but also for cosmetic and medical products. Palm, soya bean, and canola oils are used in large quantities as fuel. Such use has spurred the development of monocultures of oil producing plants. Prominent examples are oil palm plantations which have been expanded to some extent at the cost of virgin forests and peat lands, releasing large amounts of Greenhouse Gases and impairing biodiversity. The most produced and consumed oils are palm oil (35 %), soya bean oil (27 %), canola oil (16 %), and sunflower oil (9 %); oils from olives, cotton seed, corn, coconuts, sesame, and safflower seeds make up 13 %. Plant or cooking oils are liquid at room temperature with the exception of coconut and palm oil. In many countries specific preferences are observed with regard to the use of oil. Most oils are used in preparation of salad dressing and as ingredients in sauces, crèmes, and baking products. Oils with smoke points above 200 °C are especially suited for deep frying and include avocado oil, corn oil, olive oil, and sunflower oil; an important outlet for plant oils are margarines (*Source* Accessed: 2016-04-10).

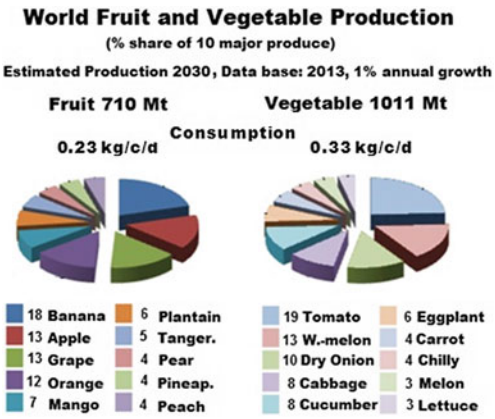


Fig. 7 World fruit and vegetable production. *Source* IBISWorld Industry Report: Global Fruit & Vegetables Processing, September 2015

Table 5 Share of preservation processes of vegetable and fruit

	Process			
	Canning	Freezing	Drying	Juice/precut vegetable ready-made salads
Share %	40	36	10	14

Source IBISWorld industry report: global fruit and vegetables processing, September 2015

Micronutrients—Nature's Wonder Drugs

Micronutrients are key players in metabolism and maintaining tissue function and are required in small quantities. Macro- and micro-minerals as well as Vitamins and phyto-chemicals are needed lifelong with vegetables and fruits being the most important natural sources. Vegetables and fruits are processed and consumed in a variety of products according to their suitability (Fig. 7; Table 5).

In a world where place of production and place of consumption are increasingly distant from each other, food processing is essential especially for perishable food. Globally, canning or more technologically advanced heat preservation is the most widely used preservation method (Table 5). It is interesting to note that in countries with a traditionally high consumption of canned products, fresh fruits, and vegetables are gaining considerable market shares; on the other hand, canned products find a ready market in Developing Countries. A product category which comes close to canning is processing in flexible pouches, a process which is finding more and more applications especially for fruit and pasta preparations.

Clearly distinct from heat processing is packaging of slightly processed and/or simply trimmed products. Those products which are also partially packed under a gas atmosphere attract the health conscious consumer. Favorites are cut salads and fresh fruit preparations.

Increased consumption is also true for frozen products. With the expansion of the middle class in Developing Countries, the frozen food market expanded which was paralleled by increasing sales of home-freezers. In the industrialized countries the demand for semi-processed products is still growing. A reasonably priced alternative to intensively processed products are dried products. Mainly dried fruits together with nuts and to some extent dried vegetables and mushrooms are globally available.

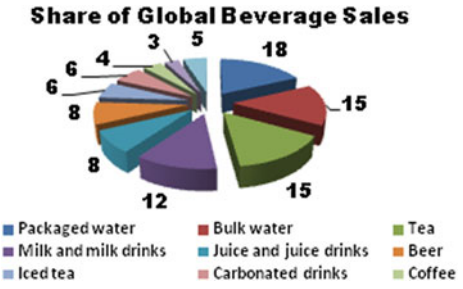


Fig. 8 Share of global beverage sales. *Source* http://www.statista.com/statistics/232773/forecast-for-global-beverage-sales-by-beverage-type/World

Drinking

A healthy diet not only consists of a sufficient food intake but also sufficient liquid intake, on the average roughly 1–2 L a day. On a global average of processed beverages, plain water is the most frequent potable liquid source followed by tea, milk, and juice, with the share of beer rather small at 8 % (Fig. 8).

All together in 2013 about 794.6 billion liters of beverages were globally marketed to 7,136,796,000 people. The average growth rate in the last few years was about 4.5–4.6 %. It is anticipated that the beverage market will develop at this pace in the near future. When global average consumption is broken down to daily consumption, the consumption of processed beverages per capita per day is about 0.3 L. This figure is very hypothetical because especially in industrialized countries safe potable tap water is easily accessible; on the other hand, in Transition and Developing Countries large segments of the society are not able to participate in global market activities and have only limited access to potable water resources, either freely accessible or commercialized. Despite the many shortcomings, packaged water can be found in the most remote corners of the globe, a phenomenon which, in addition to the positive aspect that a safe potable water source is almost universally available, also has negative implications. The most obvious problem in the distribution of packaged potable water is that packaging materials must be disposed after usage. A second point is that processing/packaging generates costs which have to be recovered. For people living in limited financial conditions it means exclusion or even abstinence. A third point is that packaged materials have to be moved and transported which causes environmental stress especially if packaged water is transported around the globe. Finally, a point of serious concern is that packaging water is usually done by private companies which rely in most cases on privatized water resources. In many cases this is disadvantageous for local populations, for whom privatized water resources have been freely accessible over generations.

Biofuel: A Threat to Food Security?

In Developed and Developing Countries, worldwide pressure to reduce the emission of greenhouse gases has initiated legislation to introduce sustainable fuels—biofuels—in the national array of power sources to partially substitute for classical combustible fossil fuels. For example, the EU has passed legislation setting a minimum target of 10 % for biofuels within transport energy consumption by 2020, and Malaysia has passed legislation that all diesel fuel sold in Malaysia must contain 5 % palm oil.

Presently biofuels are produced largely from agricultural produce (Table 6). In the discussion on biofuel, however, the fact that considerable quantities of energy have to be invested for biofuel production itself and other negative effects are very

Table 6 Feedstock requirements and land use for biofuel production

Feedstock requirements for 1000 L alcohol (ethanol) (average sugar/starch content, wet basis)/ bio-diesel and land area required					
Produce (product)	Amount kg/1000 l fuel	Biofuel production 2030 (Billion L)	Raw material equi. (MMT)	Spec. requirements (L/ha/year)	Required land resources (km^2)
Maize (ethanol)	2350	68	156	1960	346,938
Wheat (ethanol)	2700	68	190	952	714,287
Sugar-beet (ethanol)	10,000	53	530	5060	104,743
Sugarcane (ethanol)	11,000	53	689	4550	116,483
Rapeseed (bio-diesel)	2700	38	102	954	595,611
Biomass (to liquid) (bio-diesel)	2000	57	114		
Cellulosic materials (Ethanol)	3000	98	294	990	

Source Vogelbusch (2008)

often hidden or neglected; this means that the entire biofuel production is not available for transportation energy. Major producers of biofuels are USA and Brazil for ethanol and the EU and Malaysia for bio-diesel.

To provide the necessary amounts of feedstock for biofuels, major agricultural areas traditionally used for production of cereals for food stock have been dedicated to the production of raw materials suited for the production of "first generation" biofuels. Current research is focused on efficiency of biofuel from these feed stocks and on other underutilized feedstock such as more complex biological materials like wood or algae, so called "second generation production." Given the complexity of these transformations, it may take 5 to 10 more years before this conversion will have a significant influence on biofuel production. Hopefully agricultural areas can at some future point in time again be available for food production.

The use of agricultural produce such as fruits and vegetables as feedstock for biofuel has provoked a discussion as to whether their extensive production would jeopardize food security especially in developing countries. However, estimates by FAO and other competent agencies conclude that our planet has capacity to provide food and feed stock for 12 billion people. Nonetheless, the use of edible produce for industrial purposes such as biofuel competes with consumption by humans and animals. With inadequate production, caused by, for example, unfavorable climatic conditions, prices escalate to levels which make it extremely difficult for the poor of the world society to cover its needs.

Production pressure on land presently used for agricultural production can, of course, be alleviated by putting more land under production and increasing cropping frequency, using higher yielding species, and improving yields through improved agricultural methods. The limiting factor in all cases is the availability of water.

To produce the anticipated amounts of biofuel and the required additional agricultural production to feed the growing world population would require about 2 million km^2 additional productive cultivated lands. Currently about 50 million km^2 of the global land area of 130 million km^2 can be used for agricultural purposes. About 14 million km^2 are used as arable land, 33,585,676 km^2 are used as permanent pastures and 1,537,338 km^2 for permanent crops. Reserves which could be used for expanding agricultural land are mainly located in the Southern Hemisphere. For example, Brazil and other South American countries could contribute, and in Southern Africa Mozambique amongst others can contribute. In Asia reserve acreage is limited. On the other hand, China has the potential to expand its agricultural land if those areas can be sufficiently irrigated. In North America the lack of water is also the limiting factor. In Europe the land reserves are close to zero.

Availability of water is the Achilles heel in all efforts to expand agricultural production. Without the necessary water supply all efforts to expand agricultural production are in vain. The possibilities of extending the present irrigation practices are therefore limited since water resources of sufficient quality become scarce or too expensive to use for agricultural production. The problem will increase significantly in the future because of ongoing and accelerating climate change.

One action that needs to be taken is more efficient use of rainwater to enhance rain-fed agriculture. This requires more scientific attention. In addition, more stress-tolerant varieties of crop plants have to be developed through genetic engineering. All the factors with an impact on soil, water, climate and crop have to be focused on in more detail because they each play an important role in optimizing the use of rainwater.

Conclusion

In conclusion, there are clearly sufficient resources available to meet the needs of the growing world population for more food and to produce raw materials for the required amounts of biofuel to reduce global greenhouse gas emissions. Water continues to be a limiting natural resource but we are getting better at intelligent utilization of this invaluable resource. Data on the growth of the global population indicate that a moderate population increase is expected in the next twenty years; however, this increase and a slightly growing demand for biofuel can be absorbed by a more pronounced increase in agricultural production. Unfortunately expansion of agricultural production will not be uniformly distributed geographically. Increased production in industrialized and transitional countries is insufficient

because of frequent production shortfalls in developing countries. As a result, major parts of the global society are not able to participate in an improved food supply or in increased standards of living. In the coming decades an improved food supply will not only rely on linear perpetuation of current exploitation of natural resources but also on intelligent and new approaches to solve existing problems. Many of these solutions are very simple and easy to implement such as using underutilized raw materials and food resources and initiating small-holder farmers in developing countries to grow biofuel crops such as Jatropha (Jatropha curcas) or Pongam (Pongamia pinnata). Some of this production can occur on underutilized land to improve their financial situation by generating cash income. Other more sophisticated solutions are waiting in the Silicon Valleys around the globe for their utilization, solutions like in vitro-meat or fruit-based vaccines and similar approaches. Although rational thinking and reliance on science are essential for solutions, social distortions and imbalances coupled with religious and ideological intolerance, hate, and lack of education and insight must be addressed and resolved. Thus the solutions require not only science but also fundamental changes in the social dimensions.

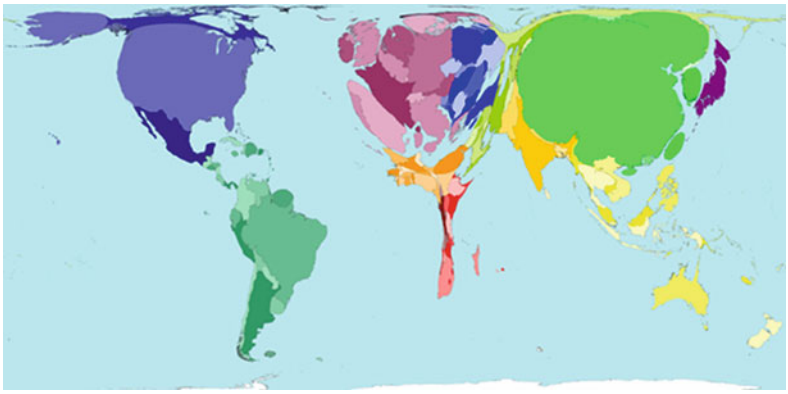
References

Alexandratos, N., & Bruinsma, J. (2012). *World agriculture towards 2030/2050: The 2012 revision.* ESA Working paper No. 12-03, FAO, Rome.

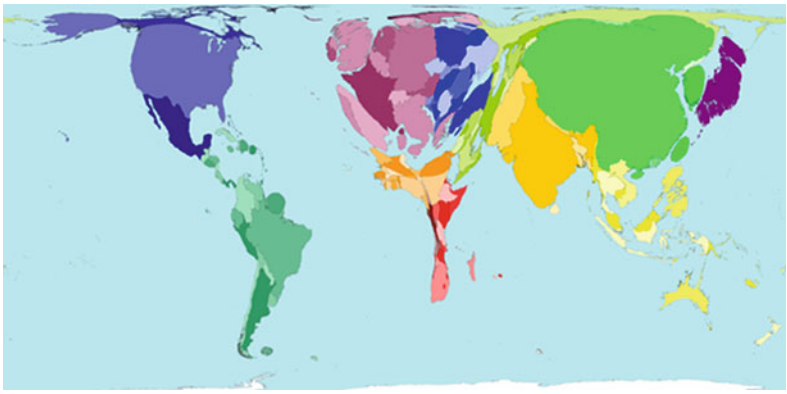
FAO. (1996). Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit. 13–17 Nov 1996, Rome

Mekonnen, M. M., & Hoekstra, A. Y. (2012). A global assessment of the water footprint of farm animal product. *Ecosystems, 15*, 401–415.

Vogelbusch. (2008). The state of food and agriculture: Biofuels. *Prospects, risks and opportunities FAO, Rome*. http://www.bioethanol.vogelbusch.com/en/faq.php



Meat production. China, the United States and Brazil produce the most meat in the world. Together these three territories produce half of all the meat that is produced in the world. **Territory size shows the proportion of worldwide meat production that occurs there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Meat consumption. Meat, as shown here, refers to all animal products that are consumed by people. Meat consumption per person is highest in Western Europe, while the most meat is consumed in China, a quarter of the world total. **Territory size shows the proportion of worldwide meat (including animal products) consumption that occurs there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Moral Economies of Food in the Socialist/Post-socialist World

Marisa Wilson

Abstract This chapter explains how economic activities become associated with moral understandings such as the 'right' way to provision food. It shows how such moral economies developed in Western Europe under the headings "liberalism" and "socialism" and gives examples of ways each is actualised in the production, exchange and consumption of food. Historical and present-day ideas about "the right way" to provision food have real-life effects, illustrated by the way fruit is traded globally. The chapter concludes with a detailed example of the socialist moral economy of food in Cuba, showing how socialist ideas about how food "should be" provisioned affect people in everyday life.

Keywords Moral economy · Neoliberalism · Socialism · Cuba · Food sovereignty · Comparative advantages · Commodities

Introduction

Moral economy can be defined as the way economic activities are influenced by moral dispositions and norms, and how those norms may be compromised, overridden or reinforced by economic pressures (Sayer 2000). In this view, markets and moralities are not mutually exclusive or opposing forces—they involve reciprocal relations whereby markets depend on and influence moral sentiments, while social norms, moral conventions and other ethical considerations exert a powerful influence on economic behavior (Jackson 2013). This essay contrasts the moral economy of food in socialist and post-socialist countries with countries that espouse a liberal or neoliberal approach to the production and consumption of food. In the first two sections I provide a very general outline of two common moral economies of food that stem from the history of European philosophy. In the third I provide a

M. Wilson (✉)
Geography Building, School of Geosciences, University of Edinburgh, Drummond Street, Edinburgh EH8 9XP, UK
e-mail: marisawlsn@gmail.com

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_8

more detailed account of socialist moral economies of food with an example of ideals and practices of food sovereignty in Cuba. I conclude by relating socialist moral economies of food in Cuba to post-socialist food economies in other places such as Russia and Eastern Europe.

Neoliberal Moral Economies of Food

The most common theory of economic life is market liberalism or neoliberalism. This is a moral economy because it is based on certain moral norms such as the idea that the best economy is a *global* economy, according to which each country (and individuals within each country) *should be* treated as distinct entities, competing in terms of their own self-interest. Neoliberal moral economies of food are based on the idea that food is best treated as a commodity that acquires an increasing amount of (monetary) value with each additional processing or marketing stage. The 'should be'—the moral element—comes from the belief that this kind of economy is best to ensure the General Welfare of all people on the planet (Myrdal 1953/2002). However, the ever-increasing production, processing and consumption of food commodities has been criticized as detrimental to both bio-physical and socio-cultural processes (e.g., Friedmann 2004).

One of the first proponents of the market liberal moral economy of food was Ricardo (Ricardo 1817/2004), who wrote that it was an advantage to all countries for each to trade in that wherein it specialized. A contemporary example is the idea that the European Union, or parts of it, are better suited to trade in certain commodities such as wheat and sugar, while other places (including parts of the EU itself) are better placed to trade in fresh fruits and vegetables. At the global level, this means (theoretically) that the United Kingdom may buy organic apples from New Zealand at a better rate than producing them for herself, though apples can grow all over the UK.

In everyday life, the neoliberal moral economy of food is evidenced in consumers' regular trip to the supermarket, which contains food from all over the world including French beans from Zambia or Kenya (Freidberg 2004), avocados from Chile or Mexico, bananas from Costa Rica and St Lucia. The persistence of long-distance trade over more localized producer-consumer networks stems in part from a history in which land and labor in formerly colonized places, such as New Zealand, were used to ensure basic foodstuffs for former imperial places, such as the United Kingdom and its former colonies, based on Ricardo's theory of comparative advantages. Yet forms of resistance to this dominant moral economy of food continue to emerge alongside it, in the former imperial world as well as the formerly colonized world.

Socialist Moral Economies of Food

Like the market liberal moral economy, the socialist moral economy emerged in Europe during the Industrial Revolution (c. 1760–1840) as an alternative theory of economic life. Its earliest and most famous proponent was Marx (1818–1883). Although the two moral economies originally developed from similar lines of thought (Dumont 1986), the socialist moral economy developed in opposition to the market liberal moral economy. In the socialist moral economy, economic life *should be* more than just individuals or countries trading in markets for their own self-interest. Social anthropologists have argued that this is indeed the case, since *both* self-interested *and* caring relationships (e.g., based on trust or friendship) are present even in the most market liberal societies (Parry and Bloch 1989; cf. Polanyi 1944). Human geographers make similar arguments, as both market-based and "socialist" behaviors (e.g., a market vendor gifting produce) make up producer-consumer relationships in places like the UK.

The socialist moral economy of food provides an alternative to the production and trade of food commodities based on comparative advantages. In this theorisation, food is more than just a commodity or something to be produced and traded for profit. Rather, food is a social necessity produced through the combined workings of humans and nature. Land and labor are needed to produce food, but its production need not lead to the exploitation of workers and nature (cf. Moore 2014). Recently these ideas have been taken up in movements for *food sovereignty*, a concept that derives from the worldwide Via Campesina movement (see Desmarais 2007; Bartos, this volume). Food sovereignty means that people and communities have the right to determine who produces food, what is produced, why it is produced, how it is produced, and where the final products are destined. Food sovereignty attempts to make up for the "democratic deficit" in neoliberal ideas of food security based on comparative advantages, which, as Raj Patel argues, may be 'entirely compatible with a dictatorship—as long as the dictator provided vouchers for McDonald's and vitamins, a country could be said to be "food secure"' (Patel http://rajpatel.org/2009/11/02/food-sovereignty-a-brief-introduction).

Food Sovereignty and Everyday Life in Cuba

In Cuba, for example, food sovereignty is tied to a particular version of socialist moral economy with a number of implications for people's everyday lives. In *Everyday Moral Economies: Food, Politics and Scale in Cuba* (Wilson 2014), I attempt to explain how ordinary people in rural Cuba shift between two "imagined communities" (Anderson 1983/2006): the socialist nation (based on the tenet: 'From each according to his capacity, to each according to his needs')[1] and global

[1]This has recently changed to: 'From each according to his capacity, to each according to his work', as I explain in chapter 4 of my book (Wilson 2014).

capitalist networks. I show how moralities attached to these scales play out in "ordinary" economic life and how socialist values, which are really nationalist values in Cuba (cf. Kapcia 2000, 2008), shape the ways people produce, exchange and consume food. For instance, Cuban farmers often justify their shift to more labor-intensive agroecological production in terms of the *lucha* (fight or struggle) to "defend" Cuba's national interests. Consumers often speak of an everyday "fight" to provision food for their families. In contrast to the outside world of consumer capitalism, much of the moral landscape in Cuba is shaped by this "inside" world of Cuban socialism-nationalism.

The moral interplay between local, national and global scales of food provisioning in Cuba is even more interesting when one considers its colonial history. Like other colonies, in pre-1959 Cuba land and labor were geared towards the production of food-as-commodities for export (especially sugar), which led to the need to import food. Ironically this pattern of comparative advantages continued into the post-1959 socialist period, as Cuba exported sugar to the Soviet Union in return for key food staples and energy supplies. After the fall of the Soviet Union, Cuba faced an acute economic crisis that saw drastic reductions of food and energy imports from the USSR. Low-input food production for domestic consumption became a symbol of a collective "fight" for national food sovereignty (Funes et al. 2002) and small-scale food production became a moral economic activity that allowed small farmers to regain dignity (and incomes) after decades of Leninist discrimination. The counterpart to Cuba's emphasis on food production was another nationalist *lucha* to "resist" the temptations of market liberal forms of consumption by enduring food scarcities (Wilson 2009).

The Cuban food economy remains closely tied to the global neoliberal food economy, however, since the Cuban government continues to import a large amount of food from its powerful neighbor, the United States. The continued *moral* separation of these market-led and socialist networks for food production and consumption has led to scarcities in the socialist food sector, as high-priced commodities entering from the outside are unaffordable to workers receiving their "due" in Cuban pesos and subsidized food (both of which continue despite recent reforms and calls to "normalize" Cuban-US relations). Yet even in the face of extreme food scarcities of the post-1990s period, many Cubans continue to uphold emotional and affective values of the national *lucha*, which makes food provisioning in Cuba more than a simple matter of survival.

Conclusion: Socialist and Post-socialist Moral Economies of Food

In everyday life, Cubans must produce, exchange, and consume food under the practical confines of *both* neoliberal and socialist moral economies of food. Yet they often do so by maintaining nationalist values such as collective resistance against outside economic interests. The continuing socialist moral economy of food in

Cuba contrasts with post-socialist countries of the former USSR, including many that have entered the European Union under a (theoretically)[2] neoliberal food economy. While Cuba remains somewhat isolated from its status as a supply zone, food commodity exports from post-socialist countries like Lithuania and Bulgaria (Jung et al. 2014) are encouraged under a market liberal regime. Cuba continues its drive for national food sovereignty; yet both Cuba and post-socialist countries have the comparative *dis*advantage of unequal access to food's commodification.

This essay has shown how access to food and other everyday necessities is shaped by the prevailing moral economy. Whether (neo)liberal or (post)socialist, these apparently abstract forces have real consequences for people's everyday lives.

References

Anderson, B. (1983/2006). *Imagined communities.* London: Verso.

Desmarais, A. A. (2007). *La Vía Campesina: Globalization and the power of peasants*. London and Ann Arbor: Pluto Press.

Dumont, L. (1986). *Essays on individualism: Modern ideology in anthropological perspective*. Chicago and London: The University of Chicago Press.

Freidberg, S. (2004). *French beans and food scares: Culture and commerce in an anxious age*. Oxford: Oxford University Press.

Friedmann, H. (2004). Feeding the empire: Pathologies of globalized agriculture. In L. Panitch & C. Leys (Eds.), *The empire reloaded*. London: Merlin.

Funes, F., García, L., Bourque, M., Pérez, N., & Rosset, P. (Eds.). (2002). *Sustainable agriculture and resistance: Transforming food production in Cuba*. Oakland: Food First.

Jackson, P. 2013. Moral economy. In P. Jackson & The CONANX group, *Food words* (pp. 139–146). London: Bloomsbury.

Jung, Y., Klein, J. A., & Caldwell, M. L. (Eds.). (2014). *Ethical eating in the post-socialist and socialist world*. Berkeley and London: University of California Press.

Kapcia, A. (2000). *Cuba: Island of dreams*. Oxford and New York: Berg.

Kapcia, A. (2008). *Cuba in revolution: A history since the fifties*. London: Reaktion Books.

Moore, J. (2014). The end of cheap nature, or how I learned to stop worrying about 'the' environment and love the crisis of capitalism. In C. Suter & C. Chase-Dunn (Eds.), *Structures of the world political economy and the future of global conflict and cooperation* (pp. 285–314). Berlin: LIT.

Myrdal, G. (1953/2002). *The political element in the development of economic theory.* London: Routledge and Kegal Paul Ltd.

Parry, J., & Bloch, M. (1989). Introduction: Money and the morality of exchange. In J. Parry & M. Bloch (Eds.), *Money and the morality of exchange* (pp. 1–32). Cambridge: Cambridge University Press.

Polanyi, K. (1944). *The great transformation: the political and economic origins of our time.* New York: Holt,Rinehart & Winston.

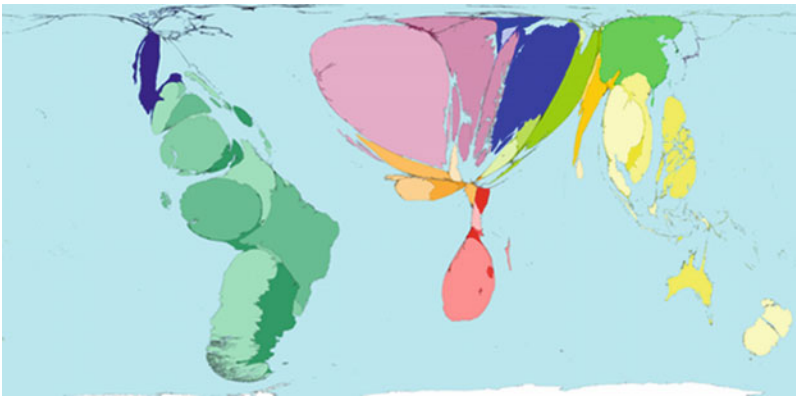
[2]Like the ideal socialist moral economy (of food), neoliberalism is an ideal rather than a reality since places like the EU continue to implement mercantilist policies including subsidies on key commodities such as sugar.

Ricardo, D. (1817/2004). *The principles of political economy and taxation.* London: Dover Publications Inc.

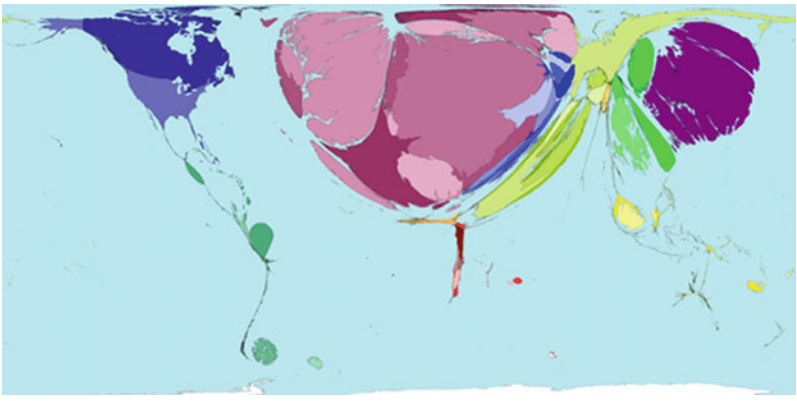
Sayer, A. (2000). Moral economy and political economy. *Studies in Political Economy, 61*, 79–104.

Wilson, M. (2009). "¡*No tenemos viandas*!" Cultural ideas of scarcity and need. *International Journal of Cuban Studies, 2*(1), 1–9.

Wilson, M. (2014). *Everyday moral economies: Food, politics and scale in Cuba*. Oxford: Wiley-Blackwell.



Fruit exports. South American territories export twice as much fruit (net) as territories in any other region, except for Western Europe. **Territory size shows the proportion of worldwide net exports of fruit (in US$) that come from there. Net exports are exports minus imports. When imports are larger than exports the territory is not shown**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Fruit imports. The net fruit imports of Western European territories are four times greater than the combined net fruit imports of territories in any other region. **Territory size shows the proportion of worldwide net imports of fruit (in US$) that are received there. Net imports are imports minus exports. When exports are larger than imports the territory is not shown**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

The Nutrition Transition in Developing Asia: Dietary Change, Drivers and Health Impacts

Matthew Kelly

Abstract This chapter reviews the likely consequences of dietary change for human health and wellbeing in Asia where a transition is occurring from diets dominated by low fat, high fibre foods to increased consumption of processed and packaged convenience foods. These foods are higher in fats, sugars and salt and are linked to increased rates of diet-related non-communicable disease. The chapter traces between-country differences and considers the drivers of dietary change including economic growth and rising incomes, the effects of urbanization and changing family size, the industrialization of food systems and the liberalization of world trade. While levels of malnutrition have declined throughout the region, rates of obesity ad overweight have increased raising challenging questions for nutrition policy planners.

Keywords Nutrition transition · Dietary change · Population health · Obesity · Asia

What Is the Nutrition Transition?

Throughout human history there have been profound shifts in population diets and these shifts inevitably have impacted on nutritional status and population health. In recent decades a particularly rapid process of change has been observed, first in high income countries but now also in low and middle income settings (Popkin 2002a, b; Drenowski and Popkin 1997; Popkin et al. 2012; Kearney 2010). Diets dominated by starchy, low variety, low fat, high fiber foods are being replaced by consumption of processed foods higher in fats, sugars and salt, and accompanied by rises in diet-related non-communicable disease. These changes in population diet

M. Kelly (✉)
Department of Global Health, Research School of Population Health,
ANU College of Medicine, Biology and Environment,
The Australian National University, Acton, ACT 2601, Australia
e-mail: matthew.kelly@anu.edu.au

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_9

are referred to by Popkin as "Nutrition Transitions" (Popkin 2002a, b, 2006). Asia which is home to half of the world's population and which is the fastest growing region economically is particularly susceptible to the negative aspects of this nutrition transition and will be the focus of the remainder of this chapter.

Dietary Change in Asia

Across countries and regions within Asia there is substantial variation in the manifestation of the nutrition transition. However, there are several key changes that have been observed in most settings:

(1) The most common change in the region is a dramatic increase in the proportion of dietary energy derived from oils and fats, mainly oilseed based, replacing complex carbohydrate sources. World production of edible oilseeds has almost tripled in the last half century. The demand for this production increase has been most important in East and Southeast Asia (Drenowski and Popkin 1997). For example, China increased annual vegetable oil consumption per capita from 1 kg in 1963 to 11 kg in 2003, and in middle income Asia overall per capita annual consumption rose from 1.5 kg to nearly 6 kg in a similar time period. The change in animal fat consumption has been more modest, rising from around 0.2 kg/person/year to around 1.5 kg (Kearney 2010).

(2) The proportion of energy derived from caloric sweeteners in Asian diets has also been increasing. In the last half of the 20th Century the middle income countries of Asia increased their annual per capita refined sugar consumption from 12 to 31 kg, the highest income groups increased their consumption from 4 to 36 kg and even in the poorest Asian countries consumption increased from 3 to 9 kg (Popkin et al. 2001).

(3) The predominant rice based diets of Asia are changing with wheat consumption taking its place. This is not a universal process however with increasing incomes in the poorest Asian countries leading to increased rice consumption while middle income transitional countries move away from rice. For example in China rice consumption increased rapidly in the 1960s and 1970s from 172 grams/capita/day in 1963 to 260 in 1983 before falling again to 213 in 2003. In the same 40 years wheat consumption increased from 71 grams/person/day to 167 (Kearney 2010).

(4) Along with wheat, consumption of other temperate zone products has also been increasing in Asia. Imports of temperate zone fruit, vegetable, dairy and other animal products has increased by 13 times in the last 4 decades and is also driving dietary change and homogenisation to a more western style diet. Potato consumption has been particularly interesting with Asia's share of world output increasing from 8 to 28 % since the 1960s (Pingali 2007).

(5) Consumption of meat has also been increasing as part of a nutrition transition in Asia. The largest change here has been seen in pork and poultry consumption. In China for example, from 1990 to 2014 pork consumption more than doubled from 15 to 31 kg/capita/year and poultry from 2 to 11.5 kg (Meat consumption 2016).
(6) Possibly the most important dietary change, and one which incorporates the 5 changes described above, is the increase in consumption of processed, packaged and convenience foods. These foods generally high in fat, salt or sugar, are scientifically designed to be hyper palatable. In China consumption of processed foods increased from 20 kg/capita annually in 1999 to over 80 in 2012, and in Thailand from 60 to 110 kg. Substantial increases in just one decade. Between country differences in the composition of processed food consumption is noteworthy. In Thailand and the Philippines soft drink consumption is particularly high and approaches high income country levels, in Malaysia and Indonesia processed high fat foods were most problematic. In higher income Asian countries such as Japan consumption of processed foods has plateaued since the 1990s, at a much higher level than in middle and low income Asia, but is growing fastest in the upper-middle income countries such as Thailand and China (Baker and Friel 2014).

Drivers of the Asian Nutrition Transition

Asia, with some exceptions, has enjoyed substantial economic growth in recent decades and this is reflected in rising incomes and increased consumer purchasing power. Many studies have observed the markers of the nutrition transition in decreased complex carbohydrate consumption and increased fat, salt, sugar and processed food consumption corresponding with rising national incomes (Drenowski and Popkin 1997). This situation however is beginning to change. For reasons which will be discussed below nutrition transitions are now being seen at lower and lower levels of income (Popkin et al. 2012). Equally as important as income growth is the rapid pace of urbanization in Asia. By 2020 half of the world's population will live in urban centers and half of these urbanites will live in Asia. Urban settings provide both access to novel "modern" foods and cultural and lifestyle change. An important aspect of urban life is increasingly time poor consumers, particularly as more women enter the work force. Time poor consumers increase demand for convenience processed foods. As well, smaller families are more common in urban Asia inducing changes in eating patterns with large family meals requiring home cooking becoming less common (Pingali 2007).

The major supply factor enabling the nutrition transition is the industrialization and globalization of food systems (Hawkes 2006; Hawkes et al. 2012). The post-World War II period saw the expansion of industrialized agriculture and trade in agricultural products across much of the world. Over subsequent decades this

trade increasingly came to be in more processed food products and transnational corporations began to control each stage of the food system (Clapp 2013). Integral to this process has been the rapid expansion of bilateral, multilateral, and regional free trade agreements which have opened markets to food imports and importantly also to foreign investment in food industries (Hawkes 2005). This has included food retail sectors and Asia has seen supermarkets expand rapidly since the 1990s again increasing consumer access to globalized foods and in particular making processed energy dense foods more easily affordable and available (Kearney 2010; Kelly et al. 2014).

Overall we can observe that greater global market integration, measured by percentage of Gross Domestic Product (GDP) provided by foreign direct investment, correlates strongly with exposure to unhealthy food products (Stuckler et al. 2012). Trade liberalization has induced prices for animal fats, dairy products, sugars, and oils to fall worldwide. Thus the processed, energy dense foods which drove the nutrition transition in western countries become more available but also cheaper (Hawkes 2006). As well, globalized food chains have the largest comparative advantage in supplying processed foods high in sugar, salt, and oil which are cheaper to produce and transport and have longer shelf lives than do raw unprocessed foods (Popkin 2006; Hawkes 2008; Chopra et al. 2002).

Health Effects of the Nutrition Transition

The nutrition transition does not have to have negative outcomes. Rising incomes and food availability can and do have substantially positive outcomes on population health. In fact famine and malnutrition have receded in many developing countries with a global average rise of 400 kcal per person per day in the last 3 decades (Kearney 2010). However while malnutrition has been receding in Asia overall, rates of overweight and obesity are rising rapidly, particularly in Southeast Asia (Popkin 2006; Chopra et al. 2002). For example from 1980 to 2008 prevalence of adult overweight and obesity combined increased from 12 to 39 % in Thailand, from 15 to nearly 50 % in Malaysia and from 5 to around 25 % in Indonesia (Stevens et al. 2012). As well the burden of diet-related disease including diabetes, cardiovascular disease and diet-related cancers is also rising. Non-communicable diseases such as these already account for more than half of deaths in Southeast Asia and have steadily increased over the last two decades replacing infectious diseases and maternal and child mortality (World Health Organisation 2011).

The health effects of the nutrition transition can be more severe in developing countries where economic change has happened more rapidly than in European countries. People born into an environment of low nutrition, who later in life experience a surplus of energy dense food are more likely to develop heart disease, diabetes, and hypertension. At a very young age, or even before birth, bodies adapt to the nutritional situation they find themselves in meaning when more energy becomes available the body is maladapted to cope with it (Godfrey and Barker

2001). This has already been found to have an influence on public health in the Asia-Pacific region where low birth weights and childhood malnutrition were highly prevalent just 20–30 years ago (Binns et al. 2001). This problem may be exacerbated even further in Asian populations who have been observed to have higher body fat ratios and higher disease risk at a lower body mass index than European populations (WHO expert consultation 2004).

Conclusions

Dietary change in Asia over recent decades has had many positive effects. The late twentieth century globalized food system has increased food availability overall and thus improved one aspect of food security, the production or supply of sufficient food to meet the aggregate energy requirements of the population. However, sufficient caloric availability does not equate to optimal nutrition, particularly, where the globalized food trade makes energy dense processed foods cheaper than fresh healthy foods (Pinstrup-Andersen 2009). The main target of food policies in the context discussed in this paper should be to achieve economic growth and food security while avoiding the negative impacts of the nutrition transition. One important consideration in fast developing settings like much of Asia is that countries will not move through transitional stages sequentially as predicted by nutrition transition theory. Changes in the affordability and availability of problematic processed foods are occurring at lower and lower levels of income. It will therefore be particularly important in transitional settings in Asia to remain aware of the common dual-burden of under and over nutrition in the same country and sometimes even the same household. This requires approaches which maintain dietary energy availability while ensuring it comes from health promoting sources.

How this is to be achieved is still unclear and there are very few models of success in modifying dietary change and related health impacts, particularly in developing Asia. However there is a growing awareness that effective food policy must address the food system in an integrated ecological manner (Carlisle and Hanlon 2014; Lang 2009; Lang et al. 2009). This includes addressing upstream influences on consumption and nutrition including the relative price and availability of energy dense, processed foods. Also important is addressing the effect of agricultural policies on population diets, for example by encouraging a move away from edible oil production towards greater fruit and vegetable production thus

improving local availability of health promoting foods as is currently been trialed in China. Perhaps most effective may be support for the retention of traditional Asian diets, both to decrease the impact of the nutrition transition, but also to support local food producers. There is some evidence from Southeast Asia indicating that making traditional diets more convenient and affordable may, particularly among younger generations, encourage resistance to western, transitional diets (Seubsman et al. 2009). This approach has also enjoyed some success in South Korea which has maintained healthier eating patterns than most other Asian countries and has also enjoyed lower levels of underweight and obesity than other countries at comparable stages of economic development. These achievements have been in part linked to intensive government publicity and education campaigns combined with subsidies and support for local food product production and consumption (Lee et al. 2002). Such integrated food policies may be the most promising avenue for nutrition policy planners in Asia.

References

Baker, P., & Friel, S. (2014). Processed foods and the nutrition transition: Evidence from Asia. *Obesity Reviews, 15*(7), 564–577.

Binns, C. W., Lee, M., & Scott, J. A. (2001). The fetal origins of disease hypothesis: Public health implications for the Asia-Pacific region. *Asia Pacific Journal of Public Health, 13*, 68–73.

Carlisle, S., & Hanlon, P. (2014). Connecting food, well-being and environmental sustainability: Towards an integrative public health nutrition. *Critical Public Health, 24*(4), 405–417.

Chopra, M., Galbraith, S., & Darnton-Hill, I. (2002). A global response to a global problem: The epidemic of overnutrition. *Bulletin of the World Health Organisation, 80*(12), 952–958.

Clapp, J. (2013). *Food*. Hoboken: Wiley.

Drenowski, A., & Popkin, B. M. (1997). The nutrition transition: New trends in the global diet. *Nutrition Reviews, 55*(2), 31–43.

Godfrey, K. M., & Barker, D. J. P. (2001). Fetal programming and adult health. *Public Health Nutrition, 4*(2b), 611–624.

Hawkes, C. (2005). The role of foreign direct investment in the nutrition transition. *Public Health Nutrition, 8*(04), 357–365.

Hawkes, C. (2006). Uneven dietary development: Linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. *Globalisation and Health, 2*(1), 4.

Hawkes, C. (2008). Dietary implications of supermarket development: A global perspective. *Development Policy Review, 26*(6), 657–692.

Hawkes, C., Friel, S., Lobstein, T., & Lang, T. (2012). Linking agricultural policies with obesity and noncommunicable diseases: A new perspective for a globalising world. *Food Policy, 37*(3), 343–353.

Kearney, J. (2010). Food consumption trends and drivers. *Philosophical Transactions of the Royal Society B: Biological Sciences, 365*(1554), 2793–2807.

Kelly, M., Seubsman, S. A., Banwell, C., Dixon, J. & Sleigh, A. (2014). Thailand's food retail transition: Supermarket and fresh market effects on diet quality and health. *British Food Journal*, *116*(7), 1180–1193.

Lang, T. (2009). Reshaping the food system for ecological public health. *Journal of Hunger and Environmental Nutrition, 4*(3), 315–335.

Lang, T., Barling, D., & Caraher, M. (2009). *Food policy: Integrating health, environment and society*. Oxford: Oxford University Press.

Lee, M.-J., Popkin, B. M., & Kim, S. (2002). The unique aspects of the nutrition transition in South Korea: The retention of healthful elements in their traditional diet. *Public Health Nutrition, 5*(1a), 197–203.

Meat consumption [Internet]. (2016). [cited April 27, 2016].

Pingali, P. (2007). Westernization of Asian diets and the transformation of food systems: Implications for research and policy. *Food Policy, 32*(3), 281–298.

Pinstrup-Andersen, P. (2009). Food security: Definition and measurement. *Food Security, 1*, 5–7.

Popkin, B. M. (2002a). What is unique about the experience in lower and middle income less-industrialised countries compared with the very-high income industrialised countries: The shift in stages of the nutrition transition in the developing world differs from past experiences. *Public Health Nutrition*, *5*(1A), 205–214.

Popkin, B. M. (2002b). An overview of the nutrition transition and its health implications: The Bellagio meeting. *Public Health Nutrition*, *5*(1A), 93–103.

Popkin, B. M. (2006). Global nutrition dynamics: The world is shifting rapidly toward a diet linked with noncommunicable diseases. *American Journal of Clinical Nutrition, 84*(2), 289–298.

Popkin, B. M., Adair, L. S., & Ng, S. W. (2012). Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Reviews, 70*(1), 3–21.

Popkin, B. M., Horton, S. H. & Kim, S. (2001). The nutrition transition and prevention of diet-related diseases in Asia and the Pacific. *Food and Nutrition Bulletin*, *22*(4 supplement).

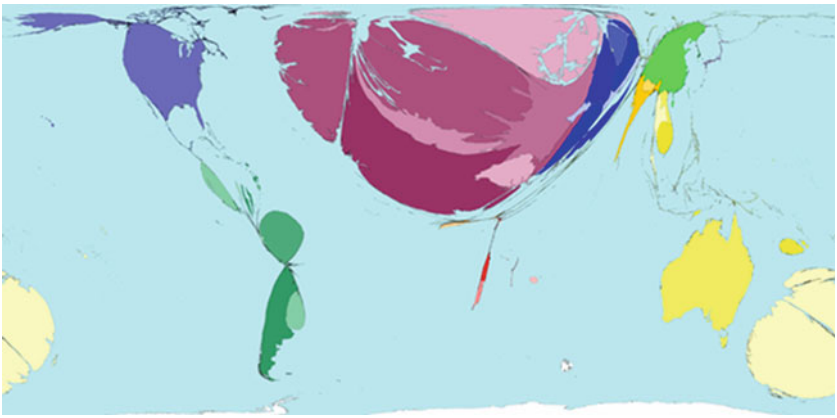
Seubsman, S., Kelly, M., Yuthapornpinit, P., & Sleigh, A. (2009). Cultural resistance to fast food consumption? A study of youth in North Eastern Thailand. *International Journal of Consumer Studies, 33*, 669–675.

Stevens, G. A., Singh, G. M., Lu, Y., Danaei, G., Lin, J. K., Finucane, M. M. et al. (2012). National, regional, and global trends in adult overweight and obesity prevalences. *Population Health Metrics*, *10*(22).

Stuckler, D., McKee, M., Ebrahim, S., & Basu, S. (2012). Manufacturing epidemics: The role of global producers in increased consumption of unhealthy commodities including processed foods, alcohol, and tobacco. *PLoS Med, 9*(6), e1001235.

WHO Expert Consultation. (2004). Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet, 363*, 157–163.

World Health Organisation. (2011). Non-communicable diseases in the South East Asia region: Situation and response. *New Delhi: WHO, Regional Office for Southeast Asia*.



Dairy exports. Dairy products include milk, butter, cheese and eggs. As with many trade maps, Europe is large and Africa is very small on this map. **Territory size shows the proportion of worldwide net exports of dairy produce (in US$) that come from there. Net exports are exports minus imports. When imports are larger than exports the territory is not shown**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Dairy imports. Dairy imports exceed exports in every region except for Asia Pacific, Eastern Europe and Western Europe. The Middle East, Northern Africa and Japan have the largest regional net imports. **Territory size shows the proportion of worldwide net imports of dairy produce (in US$) that are received there. Net imports are imports minus exports. When exports are larger than imports the territory is not shown**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Food Sovereignty and the Possibilities for an Equitable, Just and Sustainable Food System

Ann E. Bartos

Abstract The concepts of food security and food sovereignty help explain some of the problems associated with the global economy and global agricultural production. However, these concepts are expressed differently due to the specific economic, social, political, and environmental geographies in which they exist. Any locale around the globe will face challenges in implementing and ensuring food security and food sovereignty due to a variety of issues including the changing nature of land usage, the ever-expanding commodity chains of agricultural products, the trends and whims of the global consumer, and accessibility of healthy and adequate resources for the entire population. This chapter addresses the specific challenges that one particular locale, Aotearoa New Zealand, needs to negotiate in order to achieve a more secure and sovereign food landscape. Challenges include socioeconomic disparity, cultural appropriateness, and domestic agricultural self-sufficiency, all of which are further troubled by discourses of a "pure" Aotearoa New Zealand.

Keywords Food sovereignty · Food security · Aotearoa New Zealand · Inequality · Purity · Sustainability · Agriculture · Dairy · Diversity · Minority World

The complicated nature of food and eating in the 21st century is a crucial area of academic inquiry, provides consumers with too much and not enough choice, and stimulates a variety of social movements near and far from where food is produced. Such concerns have historically been raised through both academic and development discourses and frequently through the lens of food security: "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life" (articulated at the World Food Summit of 1996). Originally coined in the mid-1970s as a reaction against an international food crisis, food security

A.E. Bartos (✉)
School of Environment, The University of Auckland,
Private Bag 92019, Auckland, New Zealand
e-mail: a.bartos@auckland.ac.nz

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_10

quickly became an important and pervasive issue across the developing world. The problem was seen as related to both a lack of available food and a lack of purchasing power; short-term solutions included increasing production of export-oriented crops and increasing the reliance on food aid. Such an approach did, in fact, reduce hunger in some locations, but hunger is still a prominent global issue that has grown since the 1970s at alarming rates and remains a dire issue in the most recent *State of Food Insecurity in the World 2015* UN report (http://www.fao.org/3/a-i4646e.pdf). Governments, NGOs, charities, activists, and ordinary citizens around the world remain challenged by what seems an uphill battle to bring their communities secure and ample food supplies.

Critics of a food security approach to reducing hunger draw attention to the resultant social, economic, and political impacts of a development approach that favors exports and a cash economy. One specific critique and alternative to a food security approach arose during the 1990s while the developing world was undergoing major economic restructuring under the guise of neoliberalization. Attributed to La Via Campesina, or "The Peasants' Way," the concept of food *sovereignty* became an impassioned global social movement to redress some of the problems that resulted from neoliberal food security approaches to reducing hunger. Some of the basic tenets of a food sovereignty approach include the argument that food is a basic human right, that people should be free to produce culturally appropriate food that preserves plant and diet biodiversity, and that food production should be largely intended for domestic consumption and self-sufficiency. Food sovereignty approaches to reducing hunger have become popular in the recent past and currently inspire a variety of grassroots social movements throughout the developed world as well (for more discussion on the distinction between food sovereignty and food security, see Jarosz 2014).

Scholars and activists alike believe that incorporating a food sovereignty approach to hunger reduction has the potential to lead to positive economic, political and social transformations. However, others argue that food sovereignty is a more complicated issue than most advocates are willing to admit and requires a critical investigation of its underlying premises (e.g., Edelman 2014). Moreover, food security and food sovereignty are concepts that have legs; they travel farther and wider than where they were originally anchored. But the particularities of how these concepts take shape or the potential they carry with them in various geographies remain hidden and largely ignored. Rather than trying to adopt vague and perhaps outdated definitions of concepts that proliferate throughout academic and popular literature, there is a growing need to explore how these concepts get reconfigured in light of a particular *somewhere's* unique social, cultural, political, and environmental geography. In the remainder of this essay, I will discuss some such complications within Aotearoa New Zealand[1] as a way to demonstrate that

[1]It is common for academic literature to cite both the indigenous and settler term for the country: Aotearoa New Zealand. The combination of the two terms draws attention to the contentiousness of colonial histories and the resulting multiple ethnicities and identities prevalent throughout the country today.

food security and food sovereignty are not just ideas but present specific challenges for their adoption based on the very geographies where they are located.

To begin, in order to better understand Aotearoa New Zealand's relationship to food and eating, it is important to explore the pervasive reliance on a particular geographical imaginary of the country that perpetuates a myth of environmental paradise. A relatively small and isolated island nation, the photogenic countryside has been an important feature of Tourism NZ's "100 % Pure New Zealand" marketing campaign since 1999. Utilized to attract backpackers, retirees and immigrants primarily from India, China and the UK, the Pure brand inspires adventure and settlement amongst the rolling green paddocks, the imposing mountain glaciers, or the seemingly endless miles of coastline. Evolving over time to include the Academy Award winning Peter Jackson Tolkien films, the current "100 % Middle Earth" campaign continues to increase tourism revenue making it a significant contributor to the country's GDP and "one of the world's most well-respected tourism brands" (Tourism NZ, n.d.).

The concept of purity suggests both freedom from environmental contamination and also correlates to ideas of morality and virtuousness. While the brand may have allured unsuspecting travelers and immigrants to settle in an unspoiled beautiful geographical location, it also does important work for food politics within the country. By strongly relying on and employing the purity discourse to smooth over any contradictions or evidence of an *impure* Aotearoa New Zealand, the resultant geographical imaginations harbor immense power. Arguably, this power is reflected in the country's food politics and perpetuates ideas that food in Aotearoa New Zealand is plentiful, apolitical, local, and environmentally sound. Such a perspective makes it difficult for the ordinary eater to unpack larger issues around food security and even more challenging to conceptualize a food sovereign Aotearoa New Zealand. To elucidate this challenge, I highlight the implications of the purity discourse in relation to three basic premises of food security and food sovereignty.

The first basic premise is that a food secure and sovereign nation should have plenty of food for all its citizens; this food should be safe, sufficient, and nutritious. While most people in Aotearoa New Zealand are able to purchase enough food to feed their families, there is also a growing population of people who do not have the financial resources to consume enough or healthy food. Across the Minority World, obesity rates are often used to demonstrate people's precarious opportunities for eating well (c.f. Guthman 2011). Aotearoa New Zealand is proving to be no different from these other countries with an obesity rate of 31 %, or almost one in three (Ministry of Health 2014/2015). However, this rate is unequally distributed and Maori and Pacific populations are much more likely to be obese than other populations at 47 and 66 % of adults respectively (ibid.). Furthermore, adults who live in areas of high socioeconomic deprivation are more likely to be obese and overweight (Ministry of Health 2015). The Ministry of Health suggests that this rise is due to changes in our food environment including the promotion of inexpensive, high caloric, and nutrient poor foods (ibid.). It is also suggested that people spend less time engaging in physical activity, which would help keep them at healthier weight levels (ibid.).

These disparities, however, are hidden within the purity discourse. As the purity discourse focuses almost exclusively on environmental beauty, it largely silences social and cultural realities of a highly diverse population and the social inequality associated with such diversity. For example, the country is comprised of 15 % Maori and has the largest Pacific population in the world at 7 %. Furthermore, Aotearoa New Zealand's population is growing due to immigration mostly from Asian countries (Statistics New Zealand 2015). Environments that are highly diverse, such as Aotearoa New Zealand, need to take issues of diversity seriously: in the case of Aotearoa New Zealand, such diversity pay attention to the ways that diversity and inequality are interlinked; within the political food landscape, the linkages between diversity and inequality often result in some people being food secure while others are not. Furthermore, in acknowledging that food insecurity is not only about having enough food but also about having healthy and affordable food, a food secure Aotearoa New Zealand would need to significantly take into consideration the quality and accessibility of available food so that all people, regardless of ethnicity or socioeconomic opportunities, have the same opportunities to eat well and live healthfully.

Secondly, one of the most common underlying premises of food sovereignty is that food should be culturally appropriate. With such a diverse population, deciding cultural appropriateness is challenging. Not only is there a problem about what exactly is culturally appropriate, but perhaps more challenging is determining who decides. In Aotearoa New Zealand, for example, the challenge of cultural appropriateness is evident in the supermarket landscape. While there are several fresh produce and specialty shops throughout the main urban areas catering to niche consumers such as particular immigrant communities, two supermarket companies dominate the market share. Such a duopoly results in a variety of political realities that consumers face on a daily basis including the displacement of a more diverse food landscape represented by local ownership, and the exploitation of workers in both the consumption and production ends of the supermarkets' ever lengthening commodity chains. However, low prices and the speciousness of "choice" do the important work of placating the consumer to keep such unpalatable politics hidden and uncontentious (Dixon and Isaacs 2013). In our modern society, supermarkets may in fact be the most culturally appropriate way to provide (mostly urban) people with eating options. However, they compromise other opportunities for eating more culturally appropriate foods and promoting an economy which produces and processes foods that do not make their way to the supermarket aisles. It is these other foods and these other people involved in the production of such foods that are ignored in the purity discourse.

Finally, notions of food sovereignty emphasize a preference for domestic production and self-sufficiency. This last premise is perhaps the most troubling for Aotearoa New Zealand due to its cooption of the purity discourse. Firstly, Aotearoa New Zealand is an exporting nation. As a former colony, food was originally produced for and exported to Britain. The terms of trade changed when Britain entered the European Economic Community (EEC), and Aotearoa New Zealand's agricultural sector expanded to where currently 95 % of all agricultural production

is slated for export (New Zealand Trade and Enterprise, n.d.). The dairy sector is the most significant actor and accounts for roughly one third of the global dairy trade (ibid.) through exporting nearly 95 % of its milk production (Dairy Companies Association of New Zealand, n.d.). The results of this over-reliance on agricultural exports for economic security are visible throughout the country where over 50 % of the land is used for agriculture, predominantly in the form of pasture (Statistics New Zealand 2008).

In terms of food sovereignty, one must question whether a country that uses so much of their land for agricultural exports can increase their potential to produce more food for local consumption (Burnett and Murphy 2014). This is not straightforward as the land that has historically been used for intensive agriculture is often too contaminated from synthetic inputs to be used for agriculture today; this is particularly evident in Auckland where much of the land used for market gardens prominent in the early 20th century contains large amounts of heavy metals which can limit the productivity of urban agriculture (Gaw 2002). However, Fonterra, the leading dairy cooperative in the country, promotes the pure discourse in order to set Aotearoa New Zealand dairy apart from other dairy exporters. Images of the rural idyll countryside and cattle poised in pastures of green grass imply an environmentally sound dairy production and a commitment to "producing high-quality dairy products [starting with] the clean, green pastures of New Zealand" (Fonterra, n.d.). Furthermore, Fonterra also draws on the purity discourse to set itself apart as a cooperative of "family farmers" as opposed to a more traditional agribusiness firm. However, the dairy industry continually comes under attack from environmental scientists who expose its environmental contradictions, particularly in regards to freshwater ecosystems (Foote et al. 2015). Intensification of agricultural farmlands, increased dependence on synthetic fertilizers, and urbanization all play a role in the declining health of Aotearoa New Zealand's freshwater ecosystems and significantly challenge the popular imaginations of environmental superiority (Anderson 2012). In other words, the Fonterra brand is as successful as the 100 % Pure brand in promoting a sense of moral and environmental superiority.

While the concepts of food security and food sovereignty seem relatively straightforward at first glance, when coupled with Aotearoa New Zealand's particular geographical imagination catalyzing purity, we can see how complicated these concepts truly are. Despite the brand's success in the tourism and agricultural export economies, Aotearoa New Zealand is most likely no more and no less "pure" than its competitors. However, the emphasis on maintaining this myth is unsettling for the social critic and results in a failure to imagine a more food secure or sovereign Aotearoa New Zealand. Beginning with the more innocuous concept of food security and its emphasis on ensuring sufficient and nutritious food to all people is problematic in a society underpinned by significant socioeconomic disparity masked by an image of purity. Similarly, this diversity challenges a straightforward concept of cultural appropriateness, important for food sovereignty. A reliance on only two supermarket chains in the country further stifles a more creative understanding of cultural appropriateness and opportunities for both diverse diets and diverse economic actors in food production. And lastly, while

agricultural exports believed to be more environmentally sustainable are essential for Aotearoa New Zealand's role in the global economy, they significantly challenge possibilities for self-reliance and domestic consumption, essential for developing a food sovereign economy.

Aotearoa New Zealand is not unique in its challenges towards a more food secure and food sovereign agenda, as many other nations (particularly in the Minority World) face their own array of obstacles (e.g., Alkon and Mares 2012). However, rather than assuming these obstacles are easily traversed, it is important to deconstruct them for their particularities. I have argued that Aotearoa New Zealand's reliance on discourses of purity provides specific challenges for the country in achieving food security or sovereignty. In an attempt to move ahead and come closer to achieving these goals, it is important to better understand the obstacles in order to effectively evaluate strategies to overcome them. Such an attempt exposes the political nature of everyday acts of eating and realizes the potential for more radical social change through food and agriculture.

References

Alkon, A. H., & Mares, T. M. (2012). Food sovereignty in US food movement: Radical visions and neoliberal constraints. *Agriculture and Human Values, 29*, 347–359.

Anderson, C. (2012, November 16). New Zealand's green tourism push clashes with realities. *The New York Times*.

Burnett, K., & Murphy, S. (2014). What place for international trade in food sovereignty. *The Journal of Peasant Studies, 41*(6), 1065–1084.

Dairy Companies Association of New Zealand. (n.d.). About NZ dairy industry. www.dcanz.com. Accessed February 10, 2016.

Dixon, J., & Isaacs, B. (2013). There's certainly a lot of hurting out there: Navigating the trolley of progress down the supermarket aisle. *Agriculture and Human Values, 30*(2), 283–297.

Edelman, M. (2014). Food sovereignty: Forgotten genealogies and future regulatory challenges. *Journal of Peasant Studies, 41*(6), 959–978.

Fonterra. (n.d.). From nature straight to you. Indonesia: Fonterra Brands. www.fonterra.com. Accessed February 10, 2016.

Foote, K., Joy, M. K., & Death, R. G. (2015). New Zealand dairy farming: Milking our environment for all its worth. *Environmental Management, 56*(3), 709–720.

Gaw, S. (2002). Pesticide residues in horticultural soils in the Auckland region. Auckland Regional Council. Working Report No. 76. ISSN 1175-2971.

Guthman, J. (2011). Weighing. In: Obesity, Food Justice and the Limits of Capitalism. Berkeley: University of California Press.

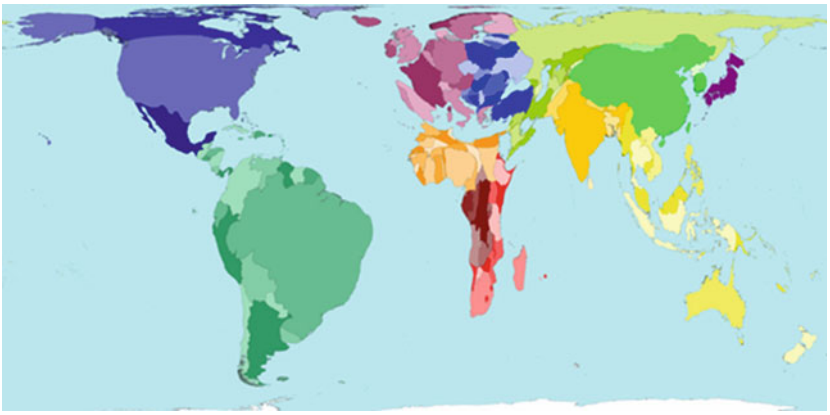
Jarosz, L. (2014). Comparing food security and food sovereignty discourses. *Dialogues in Human Geography, 4*(2), 168–181.

Ministry of Health. (2014/2015). Obesity data and stats. www.health.govt.nz. Accessed February 10, 2016.

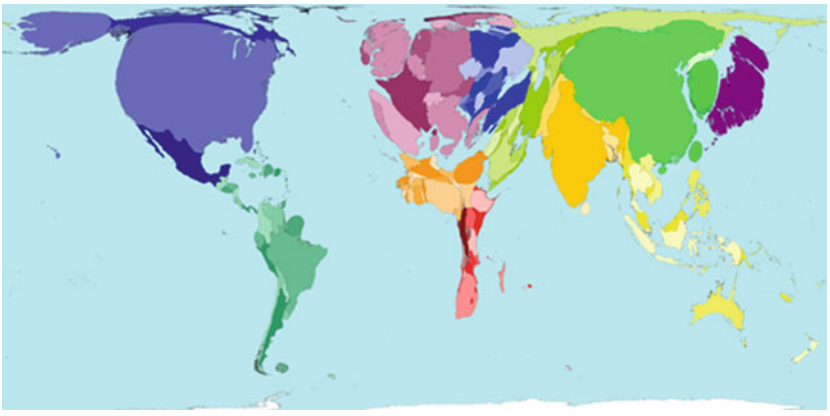
Ministry of Health. (2015). *Understanding excessive body mass weight: New Zealand health survey*. Wellington: Ministry of Health.

New Zealand Trade and Enterprise. (n.d.). Buy: Dairy. www.nzte.govt.nz. Accessed February 10, 2016.

Statistics New Zealand. (2008). Measuring New Zealand's progress using a sustainable development approach: 2008. www.stats.govt.nz. Accessed August 10, 2016.
Statistics New Zealand. (2015). National ethnic population projections: 2013 (base)–2038. www.stats.govt.nz. Accessed February 26, 2016.
Tourism New Zealand. (n.d.). About. www.tourismnewzealand.com. Accessed February 10, 2016.



Biocapacity. Biocapacity measures how biologically productive land is. Biologically productive land includes cropland, pasture, forests and fisheries. **Territory size shows the proportion of all biocapacity that is found there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Ecological footprint. The ecological footprint is a measure of the area needed to support a population's lifestyle. This includes the consumption of food, fuel, wood, and fibers. Pollution, such as carbon dioxide emissions, is also counted as part of the footprint. **Territory size shows the proportion of the worldwide ecological footprint which is made there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)

Food Security and Food Waste

Jonathan Cloke

Abstract The chapter is aimed at providing a practical framework for a reconsideration of the themes behind the term "food security." The analysis illustrates that since the term gained popular currency in the mid-1990s it has been restricted in focus to a few, narrow angles of research revolving around individual citizens, households, and the nation-state without consideration of global food production systems, the socio-environment that dominates food production globally. There is an urgent need for a relational understanding of food production and consumption in research on food security that understands how and why food is consumed; a biopolitical take based on understanding global mass consumption and the drivers of food capitalism, over- and -under-consumption.

Keywords Waste · Vastogenic · Food regime · Corporate · Security · Production · Consumption · Obesity

In 2013, I wrote an article on food security (Cloke 2013) analysing the difficulties involved in defining that concept. The article looked at the evolution of the term, not by taking it on its own terms,[1] but by examining what it could mean in a world dominated by corporate food production and distribution networks that waste a substantial portion of the food produced globally and profit from that waste, systems referred to in the literature as global food production regimes. It seemed a logical absurdity that in a world already producing enough food to feed the global population (OECD 2009), so much academic, political and corporate effort has gone into constructing forms of food security that effectively ignore the

[1]See here for a reprise of the difficulties involved according to the FAO—TRADE REFORMS AND FOOD SECURITY: Conceptualizing the Linkages, Chapter "Globalisation and Malnutrition: Geographical Perspectives on its Paradoxes": Food security: concepts and measurement, http://www.fao.org/docrep/005/y4671e/y4671e06.htm#fn21.

J. Cloke (✉)
Department of Geography, Loughborough University, Leicestershire LE11 3TU, UK
e-mail: J.M.P.Cloke@lboro.ac.uk

P. Jackson et al. (eds.), *Eating, Drinking: Surviving*,
SpringerBriefs in Global Understanding, DOI 10.1007/978-3-319-42468-2_11

overwhelming importance of what I referred to as vastogenic (waste-creating, waste-profiting) systems.

The article went on to cover research pointing out that over the 70 years since the end of World War II, a determinable set of political and social initiatives have shaped global corporate food regimes in Europe, the US, and elsewhere into social systems that sit outside the control of all but a few of the most powerful nation-states—social food mobilizing systems that profit from their vastogenic components. Food security (however defined) is increasingly dependent on the internal structures and processes of a diminishing number of corporate food wholesalers and retailers, plus those controlling the production factor chains of global agriculture such as seeds, fertilizers, and pesticides. Critically, food waste is not just some regrettable side effect of these systems that will be taken care of by technical, regulatory, and organizational fixing; it has become a core component of the way these systems have developed—waste speeds up the profitable through-flow of food and is an increasing part of the profit mechanism.

To combat the official and institutional systemic myopia, a shift of global geographical vision is required, away from the productivity and population biases that comprise the current food security discourse, and towards the spatiality and biopolitical aspects of these vastogenic systems (including their social, political and economic embeddedness), what Misselhorn et al. (2012) describe as a food systems approach. Global food production systems for instance do not just passively distribute food from zones of mass food production to an increasingly spatially diverse and growing range of zones of mass food consumption, they are dynamic systems with the agency, power and profit-motive to ceaselessly create new appetites and diets, particularly now amongst the fast-growing consumer classes of South and East Asia. Essentially, the profitability of these systems is built on the gradient between higher priced means of delivery in higher income zones and lower cost methods of production in low-income areas—areas where food insecurity is a substantial issue. That gradient can be made steeper by a contractual dominance over small food producers acting to cheapen production factor costs, and through a range of measures to speed up food waste (and thus turnover) once it exits the doors of the system.

It is worth reviewing some of the figures to illustrate the size of (and increase in) food waste. The EU points out that up to 50 % of the edible food passing through them is wasted by European households, supermarkets, and restaurants each year; a quantity which it is estimated will grow by 40 % by 2020 under current circumstances (European Parliament 2012). In the US 40 % of all food production is wasted, 25 % of which is thrown away by Americans when they get home (Buzby and Hyman 2012)—the quantity being wasted in the US has also increased by about 50 % since the 1970s from 30 % of the total to 40 % (Hall et al. 2009). Globally, the figure for overall waste is about one third of all food (Hall et al. 2009; FAO 2011), but food waste is overwhelmingly dominated by consumers in zones of mass food consumption: “Consumers in rich countries waste almost as much food, 222 million tonnes, as the entire net food production of sub-Saharan Africa (FAO 2011: 5).” In some food categories (seafood, fresh vegetables), the systemic

conduits over-supplying the US, Canada, Australia, and New Zealand already waste more than half of the food produced designated to feed the people in these countries (NDRC 2012).

Food waste systems also act as epicentres emitting global ripples of other, different kinds of waste; food waste in the US wastes 25 % of all fresh water consumption and 4 % of total US oil consumption, for instance, and food rotting in landfills in the US constitutes some 25 % of US methane emissions (Hall et al. 2009). In the UK it is estimated that avoidable food waste in 2010 led to emissions of CO2 equivalent to a fifth of all the cars on roads in the UK, and the water used in that waste equalled 5 % of UK drinking water needs (WRAP 2011). Food production systems are a major source of resource waste in a world of finite resources, and the actions and processes involved in operationalizing that waste are themselves important drivers of anthropogenic global warming, whether from the waste of fuel oil used to transport food straight into the landfills and spoil tips of the EU and North America, or from the millions of tons of greenhouse gases created by that waste. These drivers of waste are accelerating, moreover; as per-capita consumption of meat doubled in China between 1990 and 2005 (Fritschel 2008) for instance, the complexity of effects in terms of demand for feedgrain, resource waste, competition with biofuels, land availability, and environmental degradation have been immense and global in extent.

Despite these biopolitical, overconsumption, and systemic drivers of food insecurity and shortage, food waste is inexplicably left out of the official discourses on supplying food to a growing global population, in much the same way that systemic, consumption-derived food waste is left out of the official discussions on food security. In addition, just as the official take on food security remains firmly fixed at the nation-state and household level with no analysis of corporate food production systems allowed to muddy the waters, so the official take on global food supply is unrelentingly productivist; feeding a growing global population and those currently malnourished and starving is only ever an issue of increased investment and production. In this take:

> Food security for all could be within reach. The conditions under which this can be achieved are strong economic growth, global expansion of food supplies by about 70 percent, relatively high production growth in many developing countries achievable through growing capital stock, higher productivity and global trade helping the low income food deficit countries to close their import gaps for cereals and other food products at affordable prices. (FAO 2009: 14)

In this Panglossian vision, no mention is made of how much of the 70 % increase in production will be wasted, even though under current trends this would be more than half of that increase. The FAO does admit that "the whole structure of market chains is likely to continue its dynamic change towards a further concentration of supermarket chains" (2009: 6), but for the main part where corporations are mentioned in institutional and official literature it is as part of the solution, not the problem. Corporate agribusiness particularly is written into the literature on food security as a white knight, a blend of biotechnological and commercial

biopower acting as a panacea to the threatening Malthusian 'dystopia' (Duffield 2009) of immanent food shortages. GMOs and biotechnology are increasingly viewed as inevitable and vital in the productivist vision through a range of political and institutional optics, not least through the agency of those corporations themselves.

Meanwhile, in the rapidly increasing zones of mass food consumption, for consumers a plethora of food management technologies, ranging from the technical such as cheaper and more efficient refrigerators and freezers to the legal such as hygiene regulations and sell-by/best-before dates persuade households to store more (and therefore waste more) food. These technologies are reinforced by sustained advertising campaigns dedicated to behavioral change through which consumers are sold images of dietary sophistication at the same time as being inundated with persuasive images to just buy (and hence waste) more food. The US obesity epidemic for instance results at least as much "from a 'push effect' of increased food availability and marketing with Americans being unable to match their food intake with the increased supply of cheap, readily available food (Hall et al. 2009: 2)" as it does from demand derived from consumers themselves.

Within global food production systems, waste derives from a similarly wide range of profit-related factors, beginning with sales agreements with small farmers driving lower prices in buyer-dominated markets for foodstuffs which must meet demanding quality standards for shape and appearance (FAO 2011, Op. cit.)—such contracts often stipulate quantity guarantees and the ability to change orders at the last minute. Once inside food production systems which must take the financial hit from losses and waste, losses drop dramatically; whereas average production loss for all types of food is 7.8 % globally, post-harvest, handling and storage losses are only 1.55 %, processing and packaging losses 4.1 % and retail losses average 5.55 % (NDRC 2012, Op. cit.)—it is at the retail/consumer interface that the truly dramatic wastage takes place.

A vast array of mechanisms maximizes food waste in shops, restaurants, and stores and therefore through-flow in retail/consumption spaces—overstocked product displays; learned behavior concerning cosmetic perfection; pack sizes that are too large; the availability of fresh, ready food until store closing; damaged goods, outdated promotional products, and unpopular items; bulk discounts; merchandising encouraging impulse buys and high-volume promotions (buy one, get one free) all persuade consumers to purchase food they are unlikely to consume (NDRC 2012, Op. cit.): "Other drivers of waste in food service include large portions, inflexibility of chain-store management, and pressure to maintain enough food supply to offer extensive menu choices at all times" (Kantor et al. 1997: 2–12).

Meanwhile, official bodies continue to frame food waste as an ethical, moral, and social problem (European Parliament 2012, Op. cit.) and to mount campaigns such as "European year against food waste" and "Love Food Hate Waste" to mobilize political will and get food retailers to sign up to voluntary codes of practice. The global reality, however, is that an increasing percentage of a rapidly increasing global food supply is being wasted (along with the resources it takes to produce,

transport, and sell that food), in a major part because the way in which the world's corporatized global food regimes have developed makes it profitable to do so:

> The reality as a regional grocery manager is, if you see a store that has really low waste in its perishables, you are worried. If a store has low waste numbers it can be a sign that they aren't fully in stock and that the customer experience is suffering. Industry executives and managers view appropriate waste as a sign that a store is meeting quality control and full-shelf standards, meaning that blemished items are removed and shelves are fully stocked (Alvarez and Johnson 2011; quoted in NDRC 2012).

There is a virtual absence of research and analysis into corporate profit as the driving engine for food and resource waste, however, as well as the role it plays in global climate change. In the US, the most comprehensive analysis on US food waste was done by the USDA in 1997 and little has been done since; the situation in other developed market economies is little better and overall food waste continues to be treated as a curious, sad, but in the end side issue, rather than the mainstream phenomenon of consumer capitalism that it is. Above all, the corporate food regime as a profiteer from waste is the Macavity of research subjects; when the time comes to do a realistic analysis of the driving forces behind food waste, it isn't there ….

References

Alvarez, J., & Johnson, R. (2011, November). Doug Rauch: Solving the American Food Paradox. *Harvard Business Review*, N9-012-022.

Buzby, J., & Hyman, J. (2012). Total and per capita value of food loss in the United States. *Food Policy, 37*, 561–570.

Cloke, J. (2013). Empires of waste and the food security meme. *Geography Compass, 7*(9), 622–636.

Duffield, M. (2009) Liberal interventionism and the fragile state: Linked by design? In M. Duffield & V. Hewitt (Eds.) *Empire, development and colonialism: The past in the present* (pp. 116–129). Suffolk: James Currey.

European Parliament. (2012). *Parliament calls for urgent measures to halve food wastage in the EU*. Press Release Reference No: 20120118IPR35648.

FAO. (2009). How to feed the world in 2050. *Paper from the high level expert forum—How to feed the world in 2050, Rome June 2009*. Available at http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf. Accessed February 5, 2015.

FAO. (2011). *Global food losses and food waste—Extent, causes and prevention*. Rome: FAO.

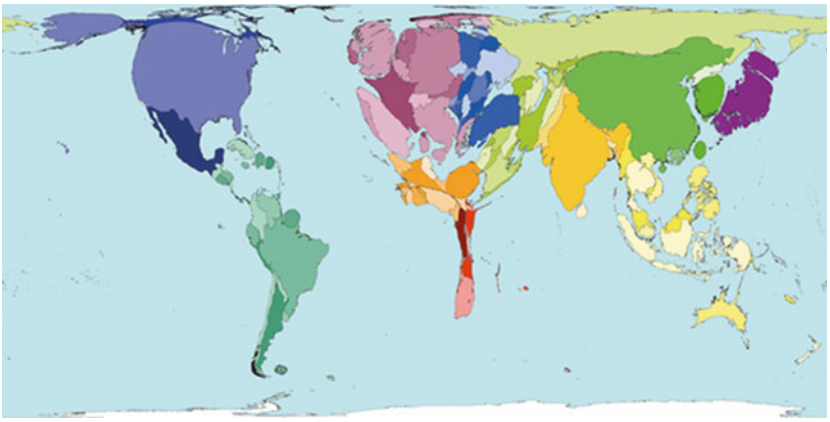
Fritschel, H. (2008). *The price of food: Ingredients of a global crisis, Open democracy*. Available at http://www.opendemocracy.net/article/globalisation/. Accessed March 28, 2011.

Hall, K., Guo, J., Dore, M., & Chow, C. (2009). The progressive increase of food waste in America and its environmental impact. *PLoS ONE, 4*(11), e7940.

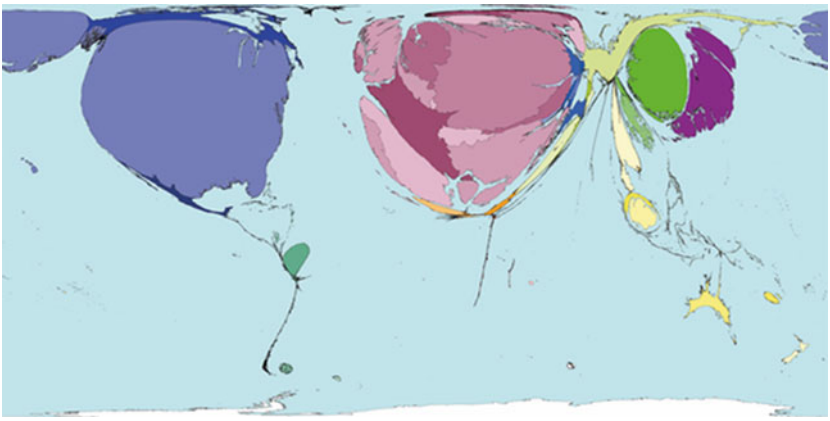
Kantor, L., Lipton, K., Manchester, A., & Oliveira, V. (1997). Estimating and addressing America's food losses. *USDA Food Review* (pp. 2–12), January–April 1997.

Misselhorn, A., Aggarwal, P., Ericksen, P., Gregory, P., Horn-Phathanothai, L., Ingram, J. and Wiebe, K. (2012). A vision for attaining food security. *Current opinion in environmental sustainability, 4*(1), February 2012, 7–17.

NDRC. (2012). Wasted: How America is losing up to 40 percent of its food from farm to fork to landfill. *NDRC Issue Paper*, August 2012 IP:12-06-B.
OECD. (2009). The bioeconomy to 2030: designing a policy agenda. *OECD International Futures Project*. Available at http://www.oecd.org/futures/bioeconomy/2030, Accessed April 29, 2011.
WRAP. (2011). *New estimates for household food and drink waste in the UK*. Final Report version 1.1.



Waste collected. This map shows waste collected from homes, schools and businesses. The most waste is produced in China, where the biggest population lives. The most waste produced per person is generated in the Russian Federation. **Territory size shows the proportion of all municipal waste generated worldwide that is generated there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)



Waste recycled. Worldwide, in 2002, 6.6 % of municipal waste produced was recycled. Recycling means reusing 'waste' in the production process. Those territories where much waste is recycled are mainly in North America, Western Europe, but also include Japan and the Republic of Korea. **Territory size shows the proportion of all municipal waste that is recycled, that is recycled there**. *Source* www.worldmapper.org. Published with kind permission of © Copyright Benjamin D. Hennig (Worldmapper Project)