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ECONOMICS

The Appropriation of Ecological Space

Agrofuels, unequal exchange and
environmental load displacements

Kenneth Hermele



The Appropriation of Ecological Space

Although it is recognized that Thomas Robert Malthus was wrong when he posited a contradiction between population increase and agricultural growth, there are increasing signs that he could be proved right in the future. Perhaps Malthus was both too late and too early in his prediction.

He was too late, because he did not foresee the shift from land-based resources to fossil fuels, which did away with the limits of agricultural growth, at least temporarily; and he was too early to witness that fossil fuels would come up against their own limits in terms of supply as well as in terms of global warming.

This study deals with land-based resources and the role they play in the global socio-ecological metabolic regime, both today and in the future. In particular, the controversial use of agrofuels as a solution to coming scarcity is subjected to close scrutiny.

As a global society we are entering an era where land areas and land-based resources are coming to the fore once again for capital accumulation and economic growth after two centuries of fossil fuel dominance.

But land areas are limited, especially if we wish to curb deforestation to fight climate change. Then peak oil coexists with peak soil, and finding the land areas needed to supply food, feed, fibres and fuels to sustain a global population of nine, ten billion people will not be easily achieved.

On the contrary, this study maintains that economic power will translate into the appropriation of ecological space, land and land-based resources in various ways, through trade and environmental load displacements.

Kenneth Hermele is a Lecturer at the Universities of Lund and Gothenburg, Sweden. He received his PhD in Human Ecology from the University of Lund.

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First published 2014
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Simultaneously published in the USA and Canada
by Routledge
711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor and Francis Group, an informa business

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British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data

A catalog record has been requested for this book

ISBN: 978-0-415-85834-2 (hbk)

ISBN: 978-0-203-79768-6 (ebk)

Typeset in Times New Roman
by Werset Ltd, Boldon, Tyne and Wear

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Abbreviations

APP	Área de Preservação Permanente [Area for Permanent Preservation]
BNDES	Banco Nacional do Desenvolvimento [Brazilian Development Bank]
BRIC	Brazil, Russia, India and China
CBD	common but differentiated responsibilities
CF	carbon footprint
CSO	civil society organization
DTA	domestic technology assumption
E	exa, quintillion, 10^{18}
ECLA	United Nations Economic Commission for Latin America
EF	ecological footprint
ELD	environmental load displacement
Embrapa	Empresa Brasileira de Pesquisa Agropecuária [Brazilian Agricultural Research Corporation]
EPA	Environmental Protection Agency
EROI	energy return on energy invested
EUE	ecologically unequal exchange
FAO	United Nations Food and Agriculture Organization
FDI	foreign direct investment
G	giga, billion, 10^9
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GFN	Global Footprint Network
GHG	greenhouse gases
glha	global hectares
ha	hectare
HANPP	human appropriation of net primary production
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
J	joule
kcal	kilocalorie
km	kilometre

LCA	life cycle analysis
M	million, 10^6
MA	Millennium Ecosystem Assessment
MFA	materials flow analysis
Mtoe	million tons of oil equivalents
NAC	new agricultural country
NGO	non-governmental organization
NIC	newly industrializing country
OECD	Organization for Economic Cooperation and Development
PPP	purchasing power parity
PSH	Prebisch–Singer hypothesis
PTB	physical trade balances
RED	Renewable Energy Directive
REDD+	reduced emissions from deforestation and forest degradation
RL	Reserva Legal [Legal Reserve]
RSB	Roundtable on Sustainable Biofuels
t	ton
T	tera, trillion, 10^{12}
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICA	União Nacional da Indústria de Cana-de-açúcar [Brazilian sugarcane industry association]
USDA	United States Department of Agriculture
W	watt
WEF	World Economic Forum
WF	water footprint
WTO	World Trade Organization
WWF	World Wildlife Fund

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The argument

The return of Malthus

It is a commonplace to say that Thomas Robert Malthus was wrong when over two hundred years ago he predicted an ever-wider gap between the need for food of a rapidly increasing population, and the restricted possibility of providing that food from a slowly growing rural economy. However, his thoughts are too often dismissed out of hand without pondering why he erred. Thinking about the “why” helps us understand that he was not so much wrong as too late *and* too early in his prediction.

Malthus was too late because he did not realize that the global socio-ecological metabolism – the dominant energy and resource flows of a society – was about to shift from renewable land-based sources to a regime based on fossil fuels, which did away with the limit to agricultural growth, at least temporarily; and he was too early to witness that fossil fuels would come up against their own limits in terms of supply as well as in terms of global warming. Put differently, Malthus was wrong when he posited an unresolvable contradiction between population increase and agricultural growth, but he may well be proven right in the future.

My hypothesis is that the last two hundred years – say from 1798 when Malthus anonymously published his *Essay on the Principle of Population*, until 1992 when the United Nations Framework Convention on Climate Change, UNFCCC, was launched – constitute an exception to the predominance of land-based resources, a respite created by reliance on fossil fuels. This way out of the Malthusian trap was complemented by the appropriation of ecological space – land areas – overseas, through trade and colonial occupation.

This exceptional period *could* be prolonged if we replace oil by coal or other fossil sources, such as “unconventional” oil and gas, but I will rule out this option on account of the negative climate impact such a turn would have. Likewise, I will disregard the appropriation of *more* forested land areas anywhere on the globe to produce agrofuels to replace fossil energy carriers, on the same ground: deforestation is one of the main drivers of climate change. As a consequence, we as a global society are limited to the land areas which already have been cleared for human use.

With these self-imposed limitations, peak oil co-exists with peak soil: today’s five billion hectares of crop land and pastures have to suffice for the global

2 *The return of Malthus*

socio-ecological metabolic needs of renewable resources for the production of food, feed, fibres and fuels.

However, to make do with these areas will not be easy, as a number of drivers are simultaneously increasing the demand for these very same areas: to meet economic, demographic, dietary and environmental needs will require more land areas. Against this background, one does not have to be Malthus to predict a conflict between the socio-ecological metabolic needs of a larger, wealthier and more meat-consuming global population, and the land areas available to produce the goods to satisfy these needs.

The global conflict over land and land-based resources is already playing itself out. Land areas are being “grabbed” in Africa, Asia, Latin America and Eastern Europe by an assortment of resource-hungry actors: pension and sovereign wealth funds, agro-businesses and energy conglomerates, states and local or international speculators, an appropriation of ecological space that is facilitated by international financial institutions.

Land grabbing is frequently a violent and conflictual process of “resolving” competing claims for land and land-based resources, violating the rights of the present holders and users of the land. This may be one explanation why land grabbing, as a particularly clear case of appropriation of ecological space, has gained a fair amount of attention recently. But two other forms of appropriation of ecological space have not: ecologically unequal exchange, and environmental load displacement, including trade in waste. I view these movements as essential vehicles for accessing land-based resources: importing ecological resources and disposing of waste – two land-based movements – underline the centrality of land areas to the global socio-ecological metabolic regime.

Agrofuels are illustrative of the conflicts concerning land areas and land-based resources which lie ahead of us. Agrofuels are promoted as energy-efficient, environmentally friendly, economically viable and geopolitically cautious, and they are held to be non-competitive with present land uses. But the opposite is true on every count: they are energy-doubtful, ecologically destructive, unviable without subsidies, and geopolitically risky, and they initiate a process of dramatic land-use change locally, nationally and globally, thus fanning global warming while further endangering biological diversity.

Of course, my argument is based on my two limiting assumptions: no fossil fuels, no deforestation. But even if we as a global system use coal or unconventional fossil sources to replace today’s use of oil, the appropriation of ecological space will continue – although at a slower pace – and cause further deforestation. The various drivers looking for land areas are strong enough to keep up the pressure on the Earth’s surfaces even without factoring in a substitution of agrofuels for fossil fuels. Just consider that as you have been reading this introductory argument, 247 forested hectares have been cleared somewhere around the globe (assuming that you have spent ten minutes by now: the global deforestation rate is approximately 13 million hectares annually; FAO 2005).

In what follows I will investigate the importance of land areas and land-based resources in three related aspects. [Part I](#) looks into the use of land in the global

socio-ecological metabolic regime prior to the advent of fossil fuels, during the dominating reign of fossil energy, and into a hypothetical future of a re-emerging land-based socio-ecological metabolism. The focus is upon agrofuels, with a case study of Brazilian sugarcane ethanol.

Part II then turns to ecologically unequal exchange of land areas and land-based resources through various non-monetary metrics. If land has re-emerged as a strategic resource, as I argue, then gauging ecologically unequal exchange is one way to understand how power – purchasing power, economic power, military power – translates into appropriation of strategic space.

In **Part III**, I discuss the implications of this appropriation of ecological space and suggest that we are witnessing the emergence of a new agro-regime, where the fungibility of land and land-based resources – their substitutability, their multiple uses – explains their central role in providing ever more of food, feed, fibres and fuels.

Before I set out, a few basic data concerning global land use are given in [Table I.1](#) for easy reference.

In what follows, I will use rounded figures – 1,500 million hectares of crop lands, 3,500 of pastures, and 5,000 of forests – in order to underline that my argument is based on simplifications regarding the trajectory – past, present, and future – of the global socio-ecological metabolic regime.

Table I.1 Global land use, 2009–2010, million hectares

Global land area	13,003
Crop lands	1,534
Pastures	3,355
Forests	5,257

Source: FAO 2012, Tables 3 and 48.

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Part I

Land use and agrofuels

Many demands are directed towards the limited land areas of the globe, and the possibility of meeting them all has been hotly debated. Do we, as a global society, live in a win-win world, or are we restrained by having to make stark choices, a situation best characterized by trade-offs? To be somewhat more specific: can the global desire for land to provide food, feed, fibres and fuels be met simultaneously; or will one kind of land use by necessity clash with, and rule out, other equally pressing needs?

No single kind of land use is more representative of the conflicting stances of “win-win” versus “trade-off” than the growing of feedstocks for agrofuels. This has nothing to do with the importance of agrofuels today – agrofuels are still quite insignificant in terms of both land use and energy volumes – but rather with the promise they hold out of being ecologically sustainable and climate neutral, a promise I will question in the following chapters.

To show the immensity of the task which we are confronting, I will start by returning to the metabolic shift which took place in the late 1700s and early 1800s from land-based energy sources to coal, and ask what a second transformation – now from fossil to renewable sources – would entail in terms of land-use change and conflicting demands on land.

From that vantage point I go on to look at today’s most advanced producer of agrofuels, Brazil. We will see that agrofuels are being promoted by a coalition of energy and climate scientists, environmental non-governmental organizations, global corporations, international financial institutions, pension and sovereign wealth funds, and states in search of a win-win energy future.

These may sound like formidable opponents when even thinking about alternative future pathways for the socio-ecological metabolism, but I will show that accepting my two limiting assumptions does not preclude the possibility of imagining a future with many people living decent lives – if only we accept changing some of the basic assumptions of what such lifestyles entail. A future where the consumption of meat and the production of feedstocks for animals play a less dominating role than today would liberate huge swathes of land which could be used for agrofuels without entering into direct conflicts with the present use of the same lands.