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From Exploitation to Sustainability? Global Perspectives on the History and Future of Resource Depletion

Bernd Herrmann and Christof Mauch (Eds.)



Deutsche Akademie der Naturforscher Leopoldina –
Nationale Akademie der Wissenschaften, Halle (Saale) 2013

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From Exploitation to Sustainability? Global Perspectives on the History and Future of Resource Depletion

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From Exploitation to Sustainability? Global Perspectives on the History and Future of Resource Depletion

Workshop

Rachel Carson Center for Environment and Society
DFG Research Training Group “Interdisciplinary Environmental History”
German National Academy of Sciences Leopoldina

Munich
6–7 December 2010

Editors:
Bernd HERRMANN (Göttingen)
Member of the Academy
Christof MAUCH (Munich)

With 28 Figures and 1 Table



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Clearing the forest for makeshift huts, Democratic Republic of the Congo. Source: Julien HARNEIS on Flickr.

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Introduction

Christof MAUCH (Munich)

Director, Rachel Carson Center for Environment and Society

This special issue of the *Nova Acta Leopoldina* is the fruit of a conference that took place on 6–7 December 2010 at the Rachel Carson Center for Environment, LMU Munich (*Ludwig-Maximilians-Universität*). It documents the research of a global group of established scholars, as well as of younger scholars from both LMU Munich and *Georg-August-Universität* Göttingen who were present at the conference. In order to convey the spirit of the event, and in the tradition of other *Nova Acta Leopoldina* volumes, this one will begin with the opening speeches of the conference sponsors: Bernd HUBER, President of LMU Munich; Wolfgang HEUBISCH, Bavarian State Minister for Sciences, Research and the Arts; and Martin LOHSE, Vice President of Leopoldina.

This volume takes a look at the evolution of the concept and practice of sustainability throughout history in a global context. Instrumental to this is the broad range of topics represented here. Some are purely historical in focus, and some extend their analysis to the present and even to the future. These studies, including those which look at early modern times (before the emergence of the concept of sustainability), will help us to direct scholarly interest towards the many blank spots on the historical timeline and on the global map.

The first part of the volume is dedicated to a selection of articles by the scholars who presented their work at the conference. While this selection cannot be comprehensive, it, nonetheless, gives an idea of the very different directions in which research in environmental history is going.

John McNEILL's essay, *Envisioning an Ecological Atlantic*, characterises the early modern age as an age of exploitation. While scholars such as Richard GROVE (*Green Imperialism*) argue that there were conservation efforts on the part of colonisers—especially those living on islands—as a result of shortages, McNEILL argues that the mindset of the time was such that the focus was firmly on exploitation rather than sustainability.

In *Vanishing Herds?* Jane CARRUTHERS argues that, when it comes to the management and utilisation of South African wildlife, it has not been a clear choice between exploitation and sustainability; rather, the two have historically co-existed. She goes on to trace the emergence of the modern sustainable wildlife industry from its twentieth-century roots.

The cutting-edge study by Libby ROBIN, *The Love-Hate Relationship with Land in Australia*, is the first to consider the question of exploitation, sustainability, and Australian identity through the lens of the national museum. Her article should be of keen interest to museum professionals and historians alike.

In *The Politics of Forest Conservation in Brazil*, historian José Augusto PADUA brings us a combination of scholarly rigour and political engagement which allows us a valuable insight

into the particular dynamics of conservation and land use in modern Brazil; both their historical roots and their current expression.

Ranjan CHAKRABARTI's contribution, *History and Future of Water in South Asia*, sketches out an initial approach to the history of water in the region and advocates for greater scholarly engagement with this essential topic. The import of his argument reaches far beyond the history of Asia, and should provide any environmental historian with food for thought.

An older version of Alexander CHIBILEV and Sergei LEVYKIN's paper, *Virgin Lands Divided by an Ocean*, had already been published in Russian, but it took on its current shape under revision. David MOON, a prominent environmental historian of Russia who participated in the conference, was involved in translating and reconceptualising it for the *Nova Acta Leopoldina*.

Mark ELVIN's trenchant contribution, *Sustainability versus Adaptation*, takes a truly *longue durée* approach. Considering the experience of climatic change and human adaptation in China from 15,000 BP onwards, he assesses the country's current situation and asks: how might China adapt next?

Finally, in his study *Coping with Abundance Revisited*, Martin MELOSI considers American energy choices past and present, and questions the traditional concept of "energy transitions" commonly used to frame and explain these choices.

The second part of the volume showcases twenty-five doctoral projects currently underway both in the newly created international doctoral programme "Environment and Society" of the Rachel Carson Center, LMU Munich, and at the Graduate Training Centre (*Graduiertenkolleg*) of the *Georg-August-Universität* in Göttingen. This is entirely in the spirit of the *Leopoldina*, which is a great sponsor of younger scholars and their projects – something for which we are deeply thankful. As both programmes demonstrate, environmental studies must be informed by the social and natural sciences as well as the humanities.

The Graduate Training Centre in Göttingen deserves a special mention here, in particular with regard to its founder, Bernd HERRMANN. Bernd HERRMANN, who is a member of the National Academy of Sciences *Leopoldina*, represents all that is best about the tradition of fostering new scholarship in the field. Bernd HERMANN initiated the teaching of environmental history in Germany more than twenty five years ago and was instrumental in integrating the sub-discipline into our academic landscape. This volume, which showcases the fruits of a dynamic network of organisations and exciting scholarship, is due in no small part to Bernd HERRMANN himself, and we express our deep gratitude to him.

This volume would not have been possible without the generosity of the *Leopoldina*, both in supporting the conference and in subsidising this special issue of the *Nova Acta Leopoldina*. We would also like to acknowledge the tremendous work Kirsty MCCLUSKEY has put in as editor and copyeditor; many thanks to her, Katie RITSON, Rachel SHINDELAR, and Claudia WHITEUS of the RCC editorial staff, as well as to Annika LIEPOLD, who provided invaluable support.

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Opening Speeches

Welcome

Bernd HUBER (Munich)

President, Ludwig-Maximilians-Universität München

Good morning, Ladies and Gentlemen. The usual thing to do at a welcome address is that you run through all the names and welcome all the guests. The difficulty with this morning's workshop, however, is that it combines various events: the opening workshop at the Rachel Carson Center, the start of the PhD programme, the beginning of the partnership between students in Göttingen and Munich, and numerous other activities which start today. This reflects the dynamism of the Rachel Carson Center, and especially of Professor Christof MAUCH who works hard and makes a great effort in order to increase and maintain this dynamism. Therefore, I would like to congratulate you: the University is full of admiration for the activities you have undertaken in the few years you have been with us in Munich, and we are very proud of your success and the establishment of the Rachel Carson Center here at LMU. Congratulations for this, and thank you for the invitation to this workshop.

It is now my pleasure to welcome our State Minister, Dr. Wolfgang HEUBISCH, who will also give a speech. I know that your schedule is extremely tight, and so we appreciate it very much that you are spending this morning with us.

We have numerous guests from various distinguished research institutions. Therefore, I would like to welcome Manfred JAKUBOWSKI-TIESSEN from the DFG Research Training Group; of course Professor Martin LOHSE, Vice President of the Leopoldina, and Jane CAR-RUTHERS, Chair of the Academic Advisory Board of the Rachel Carson Center. If I understand it correctly, the Advisory Board is also taking up its work today. Then I would like to welcome Professor Geneviève MASSARD-GUILBAUD, President of the European Society for Environmental History, and Professor RANJAN CHAKRABARTI, President of the Association of South Asian Environmental Historians who has come to us from Kolkata, not the most direct way to get to Munich. Also Professor Bernd HERRMANN from the University of Göttingen is with us today, and I would like to welcome and thank him. Of course, there are numerous doctoral students and many other people with us, and I am sorry that I cannot welcome everyone individually. I wish this workshop and the Rachel Carson Center in particular, good luck and a broad academic and scientific development, and I am very confident that the Rachel Carson Center will become one of the greatest research centers at our university. Thank you.

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Address

Wolfgang HEUBISCH (Munich)

Bavarian State Minister of Sciences, Research and the Arts

President HUBER, Professor MAUCH, ladies and gentlemen,

On behalf of the Bavarian Government I welcome you to Munich, the capital of Bavaria. Welcome to the workshop “From Exploitation to Sustainability: Global Perspectives on the History and Future of Resource Depletion.”

How does humankind respond to the challenge of diminishing resources? There is no simple answer to this question you have asked yourselves. Experts from around the world have come here to talk about the responses of different societies to natural resource shortages. Leading environmental historians have gathered to share their research findings and discuss a host of questions regarding the cultural aspects of ecological sustainability. The distinctive natural features of single regions of our planet are the focus of each presentation today. The result is a very sophisticated and comprehensive picture of how mankind reacts to natural resource depletion. Ladies and gentlemen, the great response to this workshop cannot only be attributed to the significance of the topic. It also proves the excellent work of the Rachel Carson Center in Munich. This joint initiative of LMU Munich and the *Deutsches Museum* has firmly established itself as a fixture in the capital of Bavaria within less than one and a half years. It has forged close collaborations with the City of Munich, the *Ökologisches Bildungszentrum*, the Bavarian State Library, and many other local, regional, and state organisations. Thanks to the two directors’ intensive efforts, this outstanding humanities research project has already developed into a major international institution.

Global networking is at the core of the center’s activities and outreach programme. Scholars from more than twenty different countries have been selected as Carson Fellows so far. Besides the brilliant research they accomplish at the center, the fellows act as disseminators of information in their home countries. I think that is a great and highly innovative idea. Former and current fellows are in constant contact. They profit from the exchange of new insights and ideas and develop collaborative research projects as well as further conference and publication projects. Professor MAUCH, Professor TRISCHLER, thank you very much for your pioneering endeavours. Your hard work and your fellows’ excellent accomplishments enrich the humanities and Munich as a location of humanities research. We are fortunate to have such a superb institution here in Bavaria. As a meeting place of expertise and creativity, the Rachel Carson Center is significant not just in Munich, not just in Germany but around the world.

The academic board illustrates the international excellence that the Rachel Carson Center promotes. The members are distinguished experts in their fields from all corners of the globe.

Wolfgang Heubisch

I have just only welcomed Professor Jane CARRUTHERS, who chairs the board as its representative. To do environmental research from a humanities perspective is a fascinating approach to advancing this significant field; it makes it more comprehensive. In this respect, workshops like today's are a crucial step forward. It is important to guarantee the continuation of such research. For this reason, LMU Munich has started a new PhD programme, "Environment and Society." Its official kick-off is today, and I wish the programme all the success it deserves. Ladies and gentlemen! "The human race is challenged more than ever before to demonstrate our mastery, not over nature, but of ourselves." That is what Rachel CARSON said. Today and tomorrow we can learn more about the ways various societies tried to do that and might try in the future. I wish all of you two interesting days here in Munich. Thank you very much.

Dr. Wolfgang HEUBISCH
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Welcome Address

Martin J. LOHSE ML (Würzburg)

Vice President, German National Academy of Sciences Leopoldina

Lieber Staatsminister, lieber Herr HUBER, ladies and gentlemen: it is a great pleasure for me to welcome you on behalf of the Leopoldina, the National Academy of Sciences, here at this symposium which — among others — the Leopoldina is happy to support. Science is about developing and exchanging ideas, and to further this at times when this way was more difficult than today, the Leopoldina was founded by a small group of enthusiasts: four physicians in a little city called Schweinfurt, about 250 km north of here, an industrial city today; four physicians, who were curious beyond their daily work and who wanted to meet and discuss scientific matters. And just as you are discussing science today, to exchange questions and ideas and to promote further work and hypotheses, they started to do so in the mid-seventeenth century. Today, the Leopoldina is the oldest continuously existing scientific academy in the world. Over its long history, it gained momentum and size. Already in 1687, it was named imperial academy of sciences by privileges accorded by the Habsburg Emperor of Vienna, and even earlier, in 1670, it started the *Ephemerides* as a medical and science journal. Since then, the Leopoldina has seen its task in fostering science and furthering the development and promulgation of scientific ideas, mostly in the fields of medicine and natural sciences but more recently also in the humanities and social sciences.

The Leopoldina has a long and varied history. Notably, it was able to maintain contacts between East and West after the World War II. Not only has it continuously included members from Western Germany, Austria and Switzerland while it maintained its seat in Halle, but it has managed to retain its political independence and to keep contact with members and other scientists in many countries of the world. Today, the Leopoldina counts about 1400 members, mostly in medicine and science, and increasingly also in the social sciences and humanities. Having lost the status of imperial academy when the empire broke down, it was (re-)named “National Academy” two years ago, with the particular aims of representing Germany internationally and of advising society and politicians about how to transform scientific knowledge into practical terms; how to deal with challenges; how to deal with problems; and how to identify questions that will be important in the future. For example, we work on the topic of the aging society; we may perceive it as a problem — but we may also see it as positive. “Gewonnene Jahre” — in English “more years, more life” — is therefore the title of the work that we published and delivered to the President of Germany.

Your science concerns detailed problems of fundamental issues that are being debated by specialists. But it also develops and outlines a clear and, I believe, well-defined perspective on how society should behave. In this respect, science looks back at the past and attempts to predict the future. We — and I should add here that I am an experimental medical researcher — do

experiments and try to predict how the body will behave. Researchers in physics do experiments and try to predict how nature behaves. But we can also look back at our own history, at the history of our earth and of the universe, and try to predict and imagine how their and our future might be. And we can, even more daringly, attempt to predict how we should behave to allow the Earth to remain a hospitable place.

So I wish you all the success that you deserve. All the success that we, as a society, deserve — in order to find out what we can learn from our history, what we can learn from the history of our environment, and how we can predict what we should be doing in the future.

The Leopoldina supports a large number of workshops all over the country as well as globally that deal with various issues. With our support we would like to combine an expectation. It is not very explicit but, since I personally like to be outspoken, I will say it more directly than we would put it in writing: we hope that these workshops can be translated into something that we can give back to society. So what we hope for, for example, is that we can establish small working groups that may give policy advice on issues that are of general interest; that we can publish proceedings that will serve as an orientation in defining such public policy. And I hope that also this symposium will lead to new results, to new questions, new problems and new challenges that need to be researched. I hope that your results will should be discussed in society, and that they might have an impact on our everyday actions and long-term planning. If that can be derived from this workshop, I think that will be its greatest success, and I hope it will attain this.

Welcome again and I hope you will have a fruitful and enjoyable workshop.

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Lectures

Envisioning an Ecological Atlantic, 1500–1850

John R. McNEILL (Washington, DC, USA)

With 3 Figures

Abstract

In his article about the ecology of the Atlantic world, John McNEILL demonstrates that the epoch from COLUMBUS's arrival in the New World to the mid-nineteenth century was characterised by climate change (Little Ice Age, drought), the plantation system, and the ecological exchange of flora and fauna. McNEILL uses the term "Neo-Africa" for those regions with a high proportion of African slaves (particularly Brazil and the Caribbean). The concept of sustainability was entirely alien to the plantation economy of North and South America, where a parallel and extreme exploitation of people (African slaves) and land took place, motivated by economic interests.

Zusammenfassung

In seinem Aufsatz über die Ökologie der atlantischen Welt demonstriert John McNEILL, dass die Epoche zwischen der Ankunft von KOLUMBUS in der Neuen Welt und der Mitte des 19. Jahrhunderts von Klimawandel (Kleine Eiszeit, Trockenheit), Plantagensystem und dem ökologischen Austausch von Flora und Fauna im Atlantikraum gekennzeichnet war. Für die Regionen mit einem hohen Anteil afrikanischer Sklaven (insbesondere Brasilien und die Karibik) verwendet McNEILL den Begriff „Neoafrika“. Der Plantagenwirtschaft in Nord- und Südamerika war der Gedanke der Nachhaltigkeit völlig fremd; angetrieben von ökonomischen Interessen kam es in Amerika zur simultanen und extremen Ausbeutung von Menschen (afrikanischen Sklaven) und Land (Böden).

1. Introduction

This volume is dedicated to the theme “from exploitation to sustainability,” but this contribution addresses only exploitation. There was no transition to sustainability in the Atlantic world before 1850. Nor, indeed, has sustainability arrived as yet. This essay is concerned with an immense region — the whole of the Atlantic basin — and spans three and a half centuries. It begins with a short overview of the concept of Atlantic history, and then turns to the only real feature of environmental change that is pan-Atlantic: climate change. It proceeds to propose a revised and amplified version of the Columbian Exchange, a concept that will be familiar to many readers, and ends with an examination of the role of the plantation system and the slave trade, which together form both the heart of the matter and the most interesting aspect of the ecological Atlantic during the centuries from 1500 to 1850. Generating both immense misery and immense wealth, for a few centuries the slave plantation system featured a double exploitation: of people and of soils.

The past two decades have seen historians — both in Europe and North America — begin to change their frames of reference (or, rather, return to older frames of reference) and adopt the Atlantic basin as a unit of historical analysis. This is particularly the case for historians

working on the centuries between the voyages of COLUMBUS and the abolition of the slave trade, which encompasses the years from 1492 to 1888. The reason for this shift in perspective is, in essence, the rise of a historiography connected to slavery and the plantation system, something that, as historians have quite rightly argued, needs to be understood in its transatlantic framework involving Atlantic Africa, Atlantic Europe, and Atlantic America. By bringing these coastal regions into a single analytical framework, we can examine the essence of Atlantic history, something which represents an increasingly popular approach among historians (BUTEL 1999, BAILYN 2005, GAMES 2006, BENJAMIN 2009, GREENE and MORGAN 2009).

2. The Little Ice Age in the Atlantic World

There is only one feature of environmental change that expressed itself throughout the Atlantic basin and across these centuries, and that is climate change. In the sixteenth and seventeenth centuries, the ocean was a good deal cooler than today, especially the shallow littoral waters, the estuaries, bays, and continental shelves. The temperatures of Chesapeake Bay water, for example, fell by two to four degrees Celsius from their levels of the previous few centuries during the Little Ice Age. Chesapeake waters were at their warmest around 900 CE and their coldest around 1700, with sharp fluctuations in between. This heightened instability played havoc with the Bay's abundant marine life, including oysters and crabs useful in human diets. Caribbean waters likewise were 2 to 3°C cooler by the eighteenth century, to judge from evidence gathered off of Puerto Rico. In the deep sea, the effects of the Little Ice Age were more muted. On average, it seems, sea surface temperatures from Maine to Bermuda were about 1 to 1.5°C cooler than during the so-called Medieval Climate Anomaly (c. 900–1300).

Sea surface temperatures, not a popular concern among historians, had historical consequences. Chillier temperatures lured schools of codfish to more southerly waters off of New England in the seventeenth and eighteenth centuries, bringing fishermen in their wake, quickening the settlement and enhancing the prosperity of lands from Newfoundland to Massachusetts. Changes in Atlantic sea surface temperatures probably also affected the risks of navigation. During the Little Ice Age, icebergs were longer-lived and floated further afield than in the warmer centuries before (c. 900–1300) or since (post 1800). Sea ice added to the dangers of ship voyages, especially in waters often shrouded in mist. It may even be — this is uncertain, but what climate science would expect — that cooler Little Ice Age sea surface temperatures in tropical latitudes meant that hurricanes were fewer and weaker in the sixteenth to eighteenth centuries than before or after. It is a reasonable conclusion that Little Ice Age conditions in the Atlantic raised the hazards of navigation in northern waters but lowered them somewhat in tropical latitudes (KEIGWIN 1996, GROVE 2001, WATANABE et al. 2001, CRONIN et al. 2004, 2010, GRAHAM 2010).

European historians have long been keenly aware of the Little Ice Age and its consequences on land in the sixteenth and seventeenth centuries. Its coldest decades came in 1590–1610, the 1640s, 1690s, and 1780s. The Little Ice Age in Europe saw glaciers grind their way downhill in the Alps, occasionally scraping away pastures and villages as they went. Shorter growing seasons spelled more frequent crop failure and famine in the northern lands of Scotland and Scandinavia. The onset of the Little Ice Age may have brought down the curtain on the era of Norse settlement in southern Greenland in the fifteenth century (PATTERSON et al. 2010,

CONKLING et al. 2011). The Thames froze over fairly often, allowing for so-called frost fairs, and even the Ebro in Spain froze from time to time. The Little Ice Age in Atlantic Europe was, in general, significant mainly for the hardship brought on by its colder temperatures and shorter growing seasons.¹

In other parts of the Atlantic world, the climatic phenomenon of the Little Ice Age might perhaps be better called the Big Drought Age. Evidence suggests that in West Africa, for example, the dry frontier of the Saharan fringe, known as the *Sahel*, pushed southward in the sixteenth and seventeenth centuries, causing a greater frequency of droughts in West Africa. Drier conditions in West Africa restricted the range of the tsetse fly, the vector for trypanosomiasis, or sleeping sickness. Trypanosomiasis is a dangerous human disease, but even more so for horses; the retreat of the tsetse fly allowed successful horse breeding in the Sahel, which had previously been unsustainable due to extreme equine mortality. These ecological changes, in turn, encouraged the emergence of cavalry and new styles of warfare, which underwrote the creation of larger and larger political units, including some of the great empires of West African history such as Mali and Songhai. Both these empires owed some of their strength to equestrian forces and some of their prosperity to slave raiding against peoples lacking cavalry forces. At the same time, more broadly in Atlantic Africa — from Senegambia to Angola — greater frequency of drought probably increased the supply of captives for the transatlantic slave trade, both through the creation of circumstances in which some had horses and cavalry while others did not, and through the tragic sequence of crop failure, destitution, and the desperate sale of children and other dependents to slavers. Drought narrowed the range of subsistence strategies available, making the capture of slaves and selling of anyone who could be sold more attractive alternatives (LAW 1981, MILLER 1988).

It is important to emphasise, for anyone not already well-versed in the numbers involved in the slave trade, the sheer volume of people trafficked across the ocean in the years from 1500 to 1850: it borders on eleven million. Slaves came from many parts of Africa between Senegal and Angola. They were shipped mainly to northeast Brazil and to the Caribbean. The numbers involved reached their highest levels in the 1780s and again in the 1840s. The slave trade will figure again in this essay, especially in its connections to the Columbian Exchange.

If the tree rings can be trusted, North Africa, or at the very least the Atlas Mountains of Morocco, showed a counter-trend during the Little Ice Age. The cedars of the Atlas record less frequent drought, 1450–1980, than either during the centuries before or the decades after (ESPER et al. 2007). Conceivably, conditions during these wetter centuries helped make agriculture more rewarding, providing revenues for the establishment and territorial expansion of the Saadian dynasty (1554–1659) in Morocco. The Saadian state was one of the pioneers of the sugar-and-slave complex, using irrigation water from the Atlas peaks and slaves imported from the West African Sahel to grow plantation sugar.

On the American side of the ocean, evidence for an age of drought appears in tree rings and other forms of paleoclimatic evidence from the Caribbean to Canada. In Mexico, for example, tree rings show that the most searing droughts any time in the past 600 years occurred between 1545 and 1580, and may have led to disease outbreaks in 1545–1548 and 1576–1578. According to one interpretation, these outbreaks were rodent-spread diseases, hemorrhagic fevers termed *cocoliztli* in the Nahuatl language. These epidemics compounded the devastation experienced by local populations already reeling under the impact of newly acquired infections from

¹ For a general study see GROVE 1990 and BEHRINGER 2009; and for a Nordic one, OGILVIE and JONSSON 2010.

Europe and Africa (ACUNA-SOTO et al. 2002). Recurrent droughts of lesser severity haunted Mexico — or New Spain, as it then was called — throughout the Little Ice Age, culminating in another deep and devastating one in 1785–1787, which brought starvation to the northern regions of the Spanish colony as far as Texas (THERELL 2005, ENDFIELD 2008).

Tree rings also provide powerful evidence of extraordinary droughts during the Little Ice Age in what would become the southeastern United States. These droughts brought serious consequences for the early colonisation of the Atlantic coasts of North Carolina and Virginia by Europeans. The famous story of the “lost colony,” associated with Sir Walter RALEIGH, dates from this period: RALEIGH sponsored a group of colonists to settle on the shores of North Carolina in 1585, just before the region would suffer from the worst drought within a thousand years (Fig. 1). By 1590, no trace of these unfortunate colonists remained, and ever since, in the absence of evidence, hypotheses concerning their fate have abounded. But whatever other difficulties these colonists might have faced, the severity of the drought probably doomed them to fail in their endeavours (STAHLE 1998).

Another drought victim was the settlement at Jamestown, along the James River in Virginia at the mouth of the Chesapeake Bay. It has iconic significance for Americans as the earliest establishment of the English colonial presence in North America. Settlers arrived in 1607. Unluckily for them, that was the second year of the most severe drought (1606–1612) at any time in the last 770 years in the Jamestown region. Roughly two-thirds of the colonists died in their first year. Additional colonists (some of them from Germany and Poland) arrived in 1608, but in 1609–1610, in what colonists called “the starving time,” most of those remaining died. By the end of the drought in 1612, about 80% of all those who disembarked at Jamestown over the previous six years were dead. Although they surely suffered somewhat from diseases, malnutrition was certainly a large part of the equation as far as the mortality rate was concerned, and the drought was thus probably a significant factor in the setbacks they suffered in the first five years. Moreover, some of their disease difficulties apparently stemmed from shortage of fresh water, a situation exacerbated by the record drought. Indeed, the colonists’ troubled relations with the local Powhatan Indians were also affected by drought, since the English had hoped to trade for food and the Powhatan had too little food to spare. The colony there did survive, but only just (STAHLE 1998, BLANTON 2000).

The Little Ice Age expressed itself differently in different landscapes around the Atlantic. In some places it took the form of colder climate and in other places of drought. In few places around the Atlantic, perhaps only in Morocco, did it manifest itself in the form of a wetter climate. Whatever the form it took, the Little Ice Age played some role everywhere in the economic and political fortunes of peasants and kings, slaves and settlers from Argentina to Iceland.

3. A Revised and Expanded Version of the Columbian Exchange

The era of colder and drier climate around the Atlantic was also the time of the Columbian Exchange, another fundamental feature of Atlantic history. Some forty years ago Alfred CROSBY wrote a book, the title of which has colonised the vocabulary of historians in a way that very few book titles succeed in doing (CROSBY 1972). In North America, at least, every historian uses the phrase “Columbian Exchange” to refer to the transatlantic transfers of pathogens, plants, and animals that followed the voyages of COLUMBUS in 1492. CROSBY drew attention to the tremendous importance of these transfers for the economic and social



Fig. 1 Map of the Roanoke area drawn c. 1587 by John WHITE

history of the Americas, of Europe, and to some extent also Africa. CROSBY did not do full justice to the African components of the Columbian Exchange. The main reason for this is that African historiography was much less developed in the 1960s, when he was working on his book, than it has since become; the kind of information that he might have used was much harder to come by for Africa than it was for Europe or the Americas, perhaps even impossible in some instances.

CROSBY's own presentation of the Columbian Exchange, and almost all subsequent ones, underplay African involvement in the process.

To take the example of food crops: sorghum, millet, bananas,² yams, and watermelons, to mention just a few, were all brought to the Americas from Africa. Some of these were significant in terms of the agricultural history of the Americas after 1492, although none of them are central to that history.

The geographer Judith CARNEY insists that, together with all these food crops, specialised agronomic knowledge about how to make them prosper was imported, particularly as regards African rice (CARNEY 2003, CARNEY and ROSOMOFF 2009). Her remarks are in some respects controversial (ELTIS et al. 2007), and there is as yet no single convincing viewpoint. But at a minimum, she demonstrates that it is not just the movements of crops and animals which matter, but also the transfers of agricultural techniques, technologies, and understanding. Crops do not normally grow of their own accord.

The Columbian Exchange also included one important transfer of animals that escaped CROSBY's notice — not surprisingly, perhaps, since the creatures in question were tiny and, moreover, their importance remained unknown until the twentieth century. In the context of the slave trade, a species of African mosquito managed to migrate to the Americas. *Aedes aegypti*, the vector for yellow fever and dengue fever, is among the world's most deadly animals. The viruses it carried killed thousands upon thousands in the warm latitudes of the Americas, shaping the settlement, warfare, and politics of the region (MCNEILL 2010). The mosquitoes and their viruses proved more lethal to adults without prior experience of yellow fever or dengue than to those who had grown up with, and survived, these diseases as children. Yellow fever, in particular, is much less serious in children than in adults, and survival of a single bout with the disease confers lifetime immunity. In practice, this meant that upon moving to the West Indies or the American tropics generally, adults from Europe stood a greater risk of illness and early death than did people from West Africa, so once yellow fever was firmly established in the Americas, by the 1640s, African slavery made more economic sense than did the indentured servitude of Europeans (KIPLE 1984). When CROSBY was writing in the late 1960s, many people thought yellow fever was American in origin and that *A. aegypti* might also be an American species, which is not the case. But since there is no decisive written evidence whatsoever on this subject, it has taken genomic evidence, available only in the last ten years or so, to clear up the controversy.

There are some further respects in which CROSBY could not fully take the measure of the effect of the Columbian Exchange. When he wrote about American food crops on the eastern side of the Atlantic, he had a great deal to say about potatoes, especially in Europe, and about maize in Europe and in Africa. He even mentioned the eventual importance of maize in other places, such as China, and noted that maize became a staple in broad regions of southern Africa. But there are some interesting historical developments which have only been brought to light by subsequent scholarship. Here are two hypotheses which have been advanced by Africanist historians: one concerns the political significance of maize, especially on the West African coasts; the other that of cassava, or manioc, as it is otherwise known.

2 Strictly speaking, bananas are not originally an African crop, but come from Southeast Asia. We can, however, be pretty sure that they were introduced to the Americas *via* Africa, the evidence in this case being genetic rather than textual, a source which was not available to CROSBY at the time he wrote his book.

The first record of maize in Africa dates from 1548, although it might have arrived decades earlier. While the older African food crops — millet, sorghum, yams — were productive, and eminently suited to the climates and landscapes in which they grew, they did not store nearly as well as maize. Dried maize kernels keep for months, meaning that maize was much more suitable as a portable food supply — certainly compared to yams, the staple food in much of West and Central Africa, but also to the native grains such as millet and sorghum. Military forces could be sustained on prolonged campaigns with dried maize, something which had previously been next to impossible in the history of Atlantic Africa. This constraint on military activity also hindered the development of large-scale polities, which, after all, depend on the exertion of military force. The arrival of maize seems to correlate with the extension of state building beyond its earlier origins into larger and more militarised states. Moreover, because of its portability, dried maize served as a suitable food for slave ships and slave caravans. Farmers turned to it along long-distance trade routes and around slave embarkation ports. The arrival of maize in Africa improved the economics of slavery, making lengthy voyages more practical than ever before (McCANN 2005).

The second hypothesis concerns cassava, which originated in Brazil, probably in Amazonia. Cassava is a root crop that requires a tremendous amount of labour before it can be turned into edible food. In its raw form it contains poisonous compounds, forms of cyanide, of which forty milligrams can kill large mammals. So-called bitter manioc, the preferred variety, contains much more of the poisons than the less often cultivated “sweet” manioc. To remove the toxins, people soak cassava root, roast it, pound it into flour, and sometimes do other things to it as well. Cassava is rich in carbohydrates, but poor in protein and most useful nutrients. Despite its labour requirements and modest nutritional payload, cassava has become one of Africa’s staple foods. One of the reasons for that is that it does well in drought and in thin soils; another is that it suits farmers’ needs in politically unstable landscapes, especially those where the threat of violence is never far off — such as those areas where slave raiding thrived.

The spread of cassava can be connected to the geography of enslavement. Just as in Northern Europe, where potatoes recommended themselves to peasants and landlords in times when armies were sweeping across the landscape requisitioning grain, cassava met a particular need in the population. Potatoes have the advantage that they can remain in the ground for a while, rather than needing to be harvested at a particular time and stored, and thereby becoming more vulnerable to roving armies and quartermasters. The same is true of cassava — it does not need to be harvested at a fixed moment, but can remain underground until needed. Whereas dried maize stores well once harvested, cassava stores well before being harvested. So for those whose lives were often imperilled by slave raiders — Africans who might at a moment’s notice need to drop everything and run into the bush to hide for weeks at a time — cassava was ideal. The evidence uncovered by Jan VANSINA (1997), among others, suggests that cassava became the most common crop in areas where slave raiding was frequent.

These two hypotheses concerning maize and cassava are examples of the ways in which the Columbian Exchange affected the social and political landscapes of Atlantic Africa. With the respective impacts of maize and cassava upon the political and economic possibilities in Atlantic Africa, it might make sense for historians to speak of pre-Columbian Africa — at least on the Atlantic side of the continent — as they routinely do of pre-Columbian America.

4. The Ecology of the Atlantic American Plantation Economy

The final part of this essay concerns the plantation system (Fig. 2), which was the destination of the majority of enslaved Africans who crossed the Atlantic Ocean. It extended from north-eastern Brazil in the south to the hinterlands of Chesapeake Bay in the north, and represented a huge zone of Atlantic America in which the slave plantation was the primary, if not the only, mode of production. The ecological significance of the plantation system has several aspects. The first point is the simplest one, one historians and geographers have been making for twenty or thirty years now, which is that every plantation, whether of tobacco, cotton, rice, sugar, or coffee, typically required the clearing of forests to make room for planting crops.

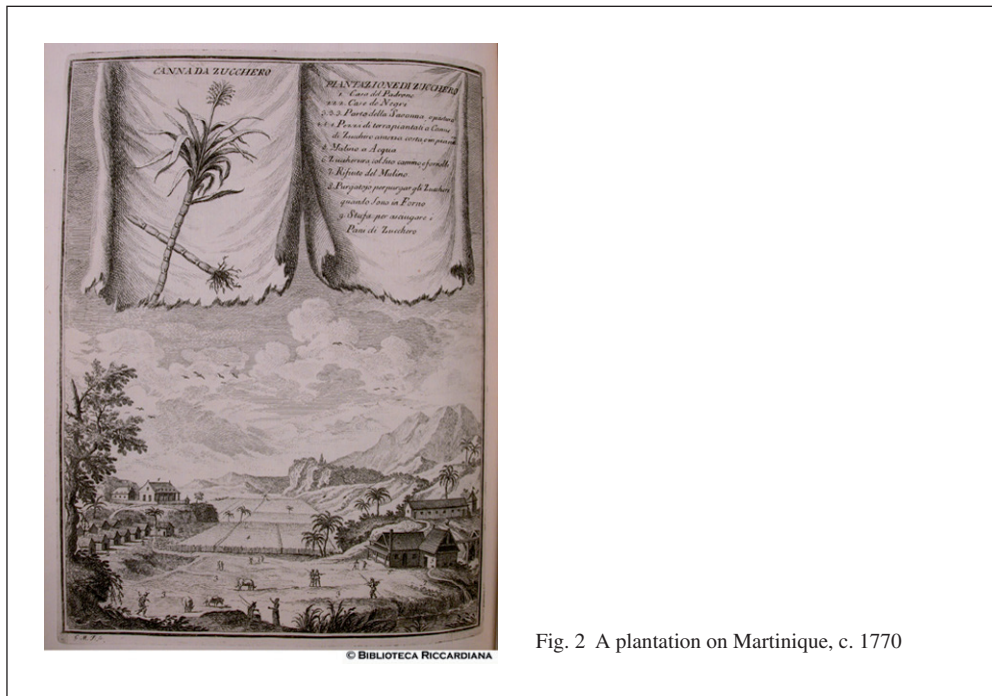


Fig. 2 A plantation on Martinique, c. 1770

So, beginning in the smaller islands of the eastern Caribbean and the coastlands of north-eastern Brazil, a sweep of deforestation was launched, motivated by the desire to clear more space for plantation crops. This deforestation sweep characterised the West Indies in the sixteenth, seventeenth, and eighteenth centuries and climaxed in Cuba in the nineteenth century (WATTS 1987, FUNES 2008). The same process was underway on a very considerable scale in the American South, where tobacco and cotton plantations likewise required the clearing of forests. One interesting and entirely inadvertent consequence of this process in the Caribbean was that it improved the breeding and survival conditions for two kinds of mosquitoes, the vectors of malaria and yellow fever. With respect to Anopheles mosquitoes, the vectors of malaria, deforestation in the Caribbean islands with mountains and hills changed the hydrological situation by increasing runoff, floods, siltation, and deposition in the lowlands,

which in turn created more marshland, swamps, and wetlands around the coasts of the islands. Montserrat and Martinique, just to give two examples, became the perfect breeding grounds for *Anopheles* mosquitoes, which thrive in swampy terrain (MCNEILL 2010).

Deforestation also reduced levels of predation upon mosquitoes, by reducing or eliminating bird populations. There is textual evidence for this, especially in the case of Barbados. Visitors to the island in the 1630s and 1640s remarked on the abundance of bird life; those who arrived in the 1650s or later noted the paucity of birds (LIGON 1657, VON UTCHERITZ quoted in GRAGG 2003, pp. 22–23).

The *Aedes aegypti* mosquito, the above-mentioned vector for yellow fever, provides a more complex and perhaps therefore more interesting example. It is particularly connected to the sugar plantation, rather than to plantations in general. *A. aegypti* is a most peculiar mosquito, unique among its (very numerous) kind; it has a strong preference for breeding in artificial water containers, e.g. buckets, pots, barrels, cisterns, and wells. It is therefore effectively a domesticated mosquito, which thrives on its association with human beings—it almost never lays its eggs in puddles, ponds, or ditches, as most mosquitoes do. This is the reason for its link to sugar plantations, because every sugar plantation had a great number of pots that were used during the initial sugar refining phase. A large plantation might have had ten thousand or more pots, in use for a few months of the year after the sugar harvest. For the rest of the time the pots stood empty, or broken, collecting rainwater, thereby providing ideal conditions for this particular kind of mosquito to lay its eggs. On top of that, all mosquitoes like sweet liquids, which provide them with much of their energy, and female mosquitoes also require blood meals in order to reproduce. Individual mosquitoes can survive on cane juice, but a population of mosquitoes requires blood meals if it is to last more than a few weeks. So a sugar plantation was a veritable smorgasbord for *A. aegypti*—all of the sweet liquid they could possibly want was easily accessible, as were the blood meals needed for their reproduction, due to the proximity of the human and livestock populations. The conditions for the survival and expansion of *A. aegypti* mosquito populations were rapidly improved by the installation of plantations, specifically sugar cane plantations, in the Caribbean (MCNEILL 2010).

The plantation system also had far-reaching consequences as far as soils were concerned. In the wake of the Columbian Exchange, the indigenous populations of the Americas—not just Atlantic America, but across the continent—entered into severe decline for reasons associated with infectious disease, with brutal exploitation, and with loss of land and livelihood. Population declined by 50 to 95% in most areas, and in others, mainly coastal lowlands, indigenous populations gradually became extinct. This human calamity provided an opportunity for forest growth and regrowth. In almost all cases, the indigenous populations of the Americas had been dependent on using forests and forest soils, and their use included widespread forest burning, either for agricultural purposes, or else to favour the proliferation of the grazing animals which they hunted. Following the population decline, between 1500 and 1650, forests in Atlantic America grew bigger and taller than they had been for a very long time.

There is written evidence for this, but also ecological evidence in the form of tree rings and palynological data. It is no longer a disputed notion. These gigantic forests were often mistaken by visitors to the Atlantic American coastal regions for ancient, primeval forests, but in fact they were usually only a century or two old, even when they included gargantuan specimens such as the American chestnut (*Castanea dentata*, Fig. 3). The tissues of these trees contained gigantic quantities of potential soil nutrients. In effect, for one or two hundred

years the trees had been drawing up nutrients from the soil and sub-soil from depths which crops simply could not reach. They were the functional equivalent of the water towers which are such a familiar sight in North America, pumping up ground water from the depths and storing it for later distribution.



Fig. 3 American chestnut trees. Photograph c. 1910

The success of plantation agriculture was, in some measure, dependent upon the nutrients in these mammoth and majestic trees. Felling and burning trees was the chief occupation of most slaves early in the career of every plantation. Char and ashes were full of nutrients, and thus ensured the prospering of tobacco, cotton, or sugar for several years afterwards. In particular, plantation prosperity depended on the quantities of nitrogen, phosphorus, and potassium that had been stored up in these arboreal nutrient towers. Soon, however, the nutrient bonus was gone, carried off in tobacco leaf or cotton thread. Planters had to move their operations at certain intervals—after twenty, then ten or even five years—as the key nutrients that limit plant growth became ever scarcer. Evidence of this enforced mobility can be found on a small scale, on individual plantations, in the way in which landowners deforested new areas of land within their holdings and planted them with tobacco, cotton, or sugar. It can also be seen on a large scale, in the migration of the centre of the plantation economy from the small islands of the eastern Caribbean to the bigger islands of the western Caribbean, including Jamaica and ultimately Cuba. The same pattern prevailed in the American South, where the cotton plantation regime migrated from the eastern seaboard of Georgia and the Carolinas into Alabama, Mississippi, Louisiana, and East Texas. Similarly, tobacco plantations moved from the Chesapeake area to the piedmont region of North Carolina, and even further west

into Kentucky and Tennessee. Plantations in the Americas were a form of shifting agriculture on a macro scale. In many environments, soils quickly became too poor to ensure profitability once the subsidy of nutrients in forest ash wore thin. Plantation agriculture, as practiced in the Atlantic Americas, was decidedly unsustainable due to its demands on soils.

5. Conclusion

In this quick overview of certain topics concerning the ecological Atlantic, we have noted the importance of the Little Ice Age, the Columbian Exchange—especially its underappreciated African components—and the centrality of the plantation system based on African labour. Four of every five persons who crossed the Atlantic to the Americas prior to 1820 were Africans. The connections between Atlantic Africa and Atlantic America were at least as strong as those between Atlantic Europe and Atlantic America. This is especially applicable to the connections at the latitude of Angola-Brazil, and at the latitude of West Africa and the Caribbean. These axes are the sites where most of the economic action and interaction took place. To express it in Neo-Crosbyian terms, we might refer to a Neo-Africa in the Americas: in another book, entitled *Ecological Imperialism* (1986), CROSBY coined the term “Neo-Europes” to describe Australia, New Zealand, Argentina, Uruguay, and the northern United States and Canada, all lands where European people, plants, animals, and pathogens became established and largely replaced the previous societies and ecologies. The northeastern part of Brazil, the Caribbean, and parts of the American South (in particular the lowlands of Georgia and South Carolina), we can describe as Neo-Africas. Not only were the populations of these lands substantially African in origin, but they lived amidst a new post-Columbian Creole ecology, with a mix of African, American, and European elements.

This essay has touched on the ecological and environmental implications of the slave trade in Africa itself and of the slave plantation economy in the Americas. Both are areas in need of more research. But provisionally, until that research is done, a plausible way to envision the Atlantic as an ecological space in the early modern centuries—the era of the transatlantic slave trade—is the one offered at the beginning of this essay: the ecological Atlantic as the story of exploitation, in particular, the very brutal dual exploitation of both soils and people. Indeed, the one exploitation encouraged the other: planters, especially in the West Indies, understood the fragility of their situation and tried to make their money as fast as possible. They knew that yellow fever and other diseases might end their lives at any time; they knew that their slaves had short life expectancies too; and they knew that their crops despoiled their soils and so their land was a wasting asset declining in value over the years. These circumstances and this knowledge conspired to motivate them to work their slaves hard and to exploit their soils with no thought for tomorrow. Neither the thought nor the practice of sustainability had a place in such a world.

References

- ACUNA-SOTO, R., CLEAVELAND, M., STAHL, D., and THERRELL, M.: Megadrought and megadeath in 16th century Mexico. *Review of Biomedicine* 13, 289–292 (2002)
- BAILY, B.: *Atlantic History. Concepts and Contours*. Cambridge, MA: Harvard University Press 2005
- BEHRINGER, W.: *A Cultural History of Climate*. London: Polity Press 2009

- BENJAMIN, T.: *The Atlantic World. Europeans, Africans, Indians and Their Shared World*. Cambridge: Cambridge University Press 2009
- BLANTON, D.: Drought as a factor in the Jamestown Colony, 1607–1612. *Historical Archaeology* 34, 74–81 (2000)
- BUTEL, P.: *The Atlantic*. London: Routledge 1999
- CARNEY, J.: *Black Rice. The African Origins of Rice Cultivation in the Americas*. Cambridge, MA: Harvard University Press 2003
- CARNEY, J., and ROSOMOFF, N.: *In the Shadow of Slavery. Africa's Botanical Legacy in the Atlantic World*. Berkeley: University of California Press 2009
- CONKLING, P., ALLEY, R., BROCKER, W., and DENTON, G.: *The Fate of Greenland*. Cambridge, MA: MIT Press 2011
- CRONIN, T., DWYER, G., KAMIYA, T., SCHWEDE, S., and WILLARD, D.: Medieval Warm Period, Little Ice Age and 20th Century Temperature Variability from Chesapeake Bay. USGS Webpage: <http://www.geology.er.usgs.gov/cepsteam/Atlantic/GPCabs.htm> (2004)
- CRONIN, T., HAYO, K., THUNELL, R., DWYER, G., SAENGER, C., and WILLARD, D.: The medieval climate anomaly and the little ice age in Chesapeake Bay and the North Atlantic Ocean. *Paleogeography, Paleoclimatology, Paleoecology* 297, 299–310 (2010)
- CROSBY, A.: *The Columbian Exchange. Biological and Cultural Consequences of 1492*. Westport, CT: Greenwood 1972
- CROSBY, A.: *Ecological Imperialism. The Biological Expansion of Europe, 900–1900*. Cambridge etc.: Cambridge University Press 1986
- ELTIS, D., MORGAN, P., and RICHARDSON, D.: Agency and diaspora in Atlantic history. Reassessing the African contribution to rice cultivation in the Americas. *American Historical Review* 112, 1329–1358 (2007)
- ENDFIELD, G.: *Climate and Society in Colonial Mexico. A Study in Vulnerability*. Malden, MA: Blackwell 2008
- ESPER, J., FRANK, D., BÜNTGEN, U., VERSTEGE, A., LUTENBACHER, J., and XOPLAKI, E.: Long-term drought variations in Morocco. *Geophysical Research Letters* 34, L17702, doi:10.1029/2007GL030844 (2007)
- FUNES, R.: *From Rainforest to Cane Field in Cuba. An Environmental History since 1492*. Chapel Hill: University of North Carolina Press 2008
- GAMES, A.: Atlantic history. Definitions, challenges, and opportunities. *American Historical Review* 111, 741–757 (2006)
- GRAGG, L.: *Englishmen Transplanted. The English Colonisation of Barbados, 1627–1660*. New York: Oxford University Press 2003
- GRAHAM, N., ANNMANN, C., FLEITMANN, D., COBB, K., and LUTENBACHER, J.: Support for Global climate reorganization during the “Medieval Climate Anomaly.” *Climate Dynamics* 10, <http://www.springerlink.com/content/g4w18p0400188572/fulltext.pdf> (2010)
- GREENE, J., and MORGAN, P. (Eds.): *Atlantic History. A Critical Appraisal*. Oxford: Oxford University Press 2009
- GROVE, J.: *The Little Ice Age*. London: Routledge 1990
- GROVE, J.: The initiation of the little ice age in regions round the North Atlantic. *Climatic Change* 48, 53–82 (2001)
- KEIGWIN, L.: The little ice age and medieval warm period in the Sargasso sea. *Science* 274, 1504–1508 (1996)
- KIPLE, K.: *The Caribbean Slave. A Biological History*. New York: Cambridge University Press 1984
- LAW, R.: *The Horse in West African History*. Oxford: Oxford University Press 1981
- LIGON, R.: *A True and Exact History of the Island of Barbados*. London: Parker 1657
- MCCANN, J.: *Maize and Grace. Africa's Encounter with a New World Crop, 1500–2000*. Cambridge, MA: Harvard University Press 2005
- MCNEILL, J.: *Mosquito Empires. Ecology and War in the Greater Caribbean, 1620–1914*. New York: Cambridge University Press 2010
- MILLER, J.: *The Way of Death. Merchant Capitalism and the Slave Trade in Angola, 1730–1830*. Madison: University of Wisconsin Press 1988
- OGILVIE, A., and JONSSON, T. (Eds.): *The Iceberg in the Mist. Northern Research in Pursuit of a “Little Ice Age.”* Dordrecht: Springer 2010
- PATTERSON, W., DIETRICH, K., HOLMDEN, C., and ANDREWS, J.: Two millennia of North Atlantic seasonality and implications for Norse colonies. *Proceedings of the National Academy of Sciences USA* 107, 5306–5310 (2010)
- STAHLE, D., CLEAVELAND, M., BLANTON, D., THERRELL, M., and GAY, D.: The Lost Colony and Jamestown Droughts. *Science* 280, 564–567. doi:10.1126/science.280.5363.564 (1998)
- THERRELL, M.: Tree rings and “el Año del Hambre” in Mexico. *Dendrochronologia* 22, 203–207 (2005)

- VANSINA, J.: Histoire du manioc en Afrique Centrale avant 1850. *Paideuma* 43, 255–279 (1997)
- WATANABE, T., WINTER, A., and OBA, T.: Seasonal changes in sea surface temperature and salinity during the little ice age deduced from Mg/Ca and $^{18}\text{O}/^{16}\text{O}$ ratios in corals. *Marine Geology* 173, 21–35 (2001)
- WATTS, D.: *The West Indies. Patterns of Development, Culture and Environmental Change since 1492*. Cambridge: Cambridge University Press 1987

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Was ist Leben?

Vorträge anlässlich der Jahresversammlung
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Es gibt nur wenige Fragen, welche die Menschheit seit Beginn ihrer geistigen Auseinandersetzung mit sich selbst und der sie umgebenden Welt unaufhörlich begleitet haben. „Was ist Leben?“ zählt zu diesen Grundfragen des menschlichen Daseins. Angesichts der beeindruckenden Erfolge der empirischen Forschung an Lebewesen wird die Schwierigkeit immer offenkundiger, eine allgemein überzeugende Antwort auf die Frage nach den grundlegenden Eigenschaften derjenigen Systeme zu geben, die wir „lebendig“ nennen. Diese Rätselhaftigkeit fasziniert Natur-, Geistes- und Kulturwissenschaftler und bringt sie dazu, gemeinsam das Wesen des Lebens zu erkunden. In dem Band behandeln hervorragende Vertreter der unterschiedlichsten Wissenschaftsdisziplinen den noch nicht zufriedenstellend geklärten Ursprung des Lebens. Sie untersuchen das neue, umfassende Verständnis der molekularen Grundlagen von Lebensprozessen aus der Sicht der Genomforschung und beschreiben die Möglichkeiten, Leben in Analogie zu Maschinen zu modellieren. Sie behandeln die ungeheure Vielfalt des Lebens, die Beeinflussbarkeit des Lebens durch menschliche Eingriffe und die Grenzen des Lebens aus biologischer, psychologischer und philosophischer Sicht. Dabei wird deutlich, wie hartnäckig sich die Frage nach dem Leben durch die Wissenschaftsgeschichte, ja durch die ganze Geistesgeschichte zieht und welche Brisanz sie angesichts aktueller Forschungsergebnisse erhalten hat.

Vanishing Herds? Transformations in Wildlife Hunting in Southern Africa, 1830–2000

Jane CARRUTHERS (Tshwane)

Abstract

In her contribution on wild animals in South Africa, Jane CARRUTHERS examines the stages in the development of utilisation of game from the early nineteenth century until the present day. She posits the thesis that exploitation and sustainability are not concepts which cancel out or oppose one another, but rather ones which can co-exist. The game herds of South Africa, once decimated by exploitative hunting, were conserved both by national parks and by breeding programmes, so that today, albeit thanks largely to game reserves and the game ranching industry, there are more wild animals living in South Africa than there were at the beginning of the “age of exploitation.”

Zusammenfassung

In ihrem Beitrag über Wildtiere in Südafrika geht Jane CARRUTHERS der Frage nach, welche Entwicklung die Nutzung von Wildtieren vom frühen 19. Jahrhundert bis in die Gegenwart durchlaufen hat. Dabei stellt sie die These auf, dass Ausbeutung und Nachhaltigkeit keine sich ablösenden oder sich gegenseitig ausschließenden Prinzipien sind, sondern dass sie gleichzeitig vorkommen können. Die einst durch Jagd extrem dezimierten Herden Südafrikas wurden sowohl durch die Einrichtung von Nationalparks als auch durch Zucht erhalten, so dass heute – wenn auch hauptsächlich durch Wildtierhaltung und Herdenindustrie – mehr Wildtiere in Südafrika leben als zu Beginn der sogenannten „Ära der Ausbeutung“.

1. Introduction

The idea of sustainability is an environmental mantra that gained political purchase after the 1970 Earth Day, the 1972 Stockholm Conference, and its successors such as the Rio Conference in 1992 and the Johannesburg World Summit on Sustainable Development in 2002. Advocating more than “conservation” or “preservation,” with their connotations of Western middle class values, sustainability is an idea that links the developed and the developing world, the rich and the poor, state and non-state actors, and is a powerful modern ideology with global ramifications. The aim of this article is to explain the transition in South Africa from the conservation of wildlife only in national parks and other protected areas and its eradication on private property, to the current situation in which sustainable game farming—for hunting and for eco-tourism—has outstripped agriculture in terms of its contribution to GDP.

It has been estimated that there are some 1.7 million large mammals on 13.3% of the land formerly designated for agriculture (VAN DER MERWE et al. 2004), and this should be compared with the 1966 estimate of about 340,000 animals (DU TOIT 2007, p. 17). The *Amalgamated Banks of South Africa* (ABSA) report (2003) states that there are about 5,000 game

ranches in South Africa and more than 4,000 mixed game and livestock ranches, covering some 13 % of the land area, in comparison with 5.8 % for all officially declared conservation areas, of which the national parks comprise 2.8 %. In addition to its economic importance, in terms of biodiversity conservation it has been estimated that 80 % of nature conservation in South Africa takes place on privately owned land (VAN DER MERWE et al. 2004). Thus, over 17 million hectares are used for wildlife production, with a conversion rate of 2–2.5 % annually from livestock to wildlife production (*Republic of South Africa* 2005, p. 7).

As elsewhere in Africa, urbanisation is currently expanding and agriculture is declining in South Africa. In the period from 1998 to 2002, tourism (principally eco-tourism) accounted for some 6 % of GDP. The decline in agriculture is remarkable: from some 20 % of GDP in the 1920s, it had shrunk to just 3.4 % in 2004. A significant factor for this is that South Africa's agricultural subsidies are currently among the lowest internationally, at about 4 %. Moreover, net earnings from agriculture continue to drop in South Africa, from R110 per hectare in 1990 to around R80 in 2000 (*Republic of South Africa* 2005, p. 7). Consequently, the sustainability of game ranching — whether for trophy hunting, tourism or meat production — is of considerable importance to the economy.

2. Wildlife Utilisation until 1910

Although pre-colonial African communities utilised wildlife extensively in southern Africa, a combination of a relatively small population, some spiritual and religious taboos, the absence of modern firearms and the lack of a large market meant that mass extermination did not take place. Hunting was often a cooperative enterprise, ensuring food, skins and other by-products, and valuable items — including ivory — were reserved for the chief. Tribute was often paid with ivory. Trade in ivory, hides, and horn was linked to the Indian Ocean *via* the Portuguese settlement at Delagoa Bay.

The advent of firearms, combined with the specific industrial economy of Europe and the United States of America, decimated the antelope and other wildlife herds. Radiating outwards from Cape Town, the frontier of settlement and commercial hunting worked its way northwards and eastwards, exterminating a number of species (e.g. the bloubok *Hippotragus leucophaeus* and the quagga *Equus quagga*) and greatly reducing others (e.g. elephant *Loxodonta africana*) as it did so. From the late 1700s and early 1800s, small parties of *trekboers* (itinerant pastoralists) and traders penetrated the northern interior in search of ivory and other commercial products of the hunt. Also destructive were the large *Voortrekker* (Boer) parties, which, dissatisfied with British rule at the Cape, left the colony in the 1830s to become potential settlers in the interior.

As wildlife of all kinds diminished and African groups lost their land and independence, habitats were transformed by modern agricultural enterprise and the establishment of towns. Thus the era of southern Africa's greatest wildlife slaughter began in the mid-nineteenth century, spearheaded by colonial expansion and the proliferation of firearms. Hunting provided employment for many Africans as well as the opportunity to acquire firearms and intensify their own hunting activities. Some figures indicate the rate of wildlife slaughter. In 1824, ivory exports from Cape Town were around 9,072 kg and by 1836 had risen to 48,080 kg (ELLIS 1998). The value of hides also increased from £2,324 in 1820 to £23,544 in 1825 (MACKENZIE 1988). Very little of this hunting was done for pleasure: this was a commercial venture.

Blame for the “vanishing herds,” a phrase that resonates through the literature, is frequently laid at the door of nineteenth-century sportsmen. Often recreational, the initial expeditions of visiting hunters such as William Cornwallis HARRIS (1852), whose books were extremely popular, were followed by many European visitors who sought adventure and freedom in hunting the wildlife of South Africa. In 1855, it was estimated that 90,000 kg of ivory was exported from the Transvaal, together with vast quantities of hide and horn (CARRUTHERS 1995a, p. 21). In the 1830s, HARRIS had so much ivory that at one stage he was forced to abandon it (MACKENZIE 1988). Certain species, such as black wildebeest (*Connochaetes gnou*), which occurred in thousands, were slaughtered like the bison (*Bison bison*) of North America. In 1866, a single firm in the small town of Kroonstad exported some 157,000 black wildebeest and blesbok (*Damaliscus pygargus*) skins; by 1900, both species were almost extinct (VRAHIMIS 2001). Recreational sport-hunting added substantially to the destruction. It did not take long for the herds to “vanish.” In the early 1850s, when Thomas BAINES visited the Transvaal, he was hard pressed to find any wildlife to shoot (CARRUTHERS and ARNOLD 1995).

Until much later in the century, after the wildlife had been virtually exterminated by hunting and disease (the rinderpest epizootic of the mid-1890s played a very large role), minerals discovered, and settled agriculture and private property established, the entire wealth of the region was predicated on the products of the hunt. By the end of the 1800s, there were game reserves in many parts of the sub-continent; but, by then, there was very little left to protect. In 1896, rinderpest killed many hundreds of thousands of wildlife together with nearly all the livestock herds in the subcontinent, and soldiers on both sides of the Anglo-Boer War (1899–1902) slaughtered whatever wildlife they could as alternative sources of food (CARRUTHERS 1995a, b).

A common South African traditional food is *biltong*—dried meat—and people on whose private properties wildlife survived, even if in small numbers, continued to hunt for biltong. Because biltong is a portable and long-lasting form of animal-derived protein, the demand was large, some 7,000 kg being exported from a single railway station in the Waterberg in 1907 alone. One lone voice on the Legislative Council in the Transvaal at the time argued that prohibiting the sustainable use of game was wasteful and that the principle of saving it merely for the “benefit of the leisured” and land-owning classes, as was happening *via* the hunting laws, needed to be questioned. NICHOLSON even went further, averring that “to say that this food product of the country [biltong] is to be wasted in such a fashion is, I think, bringing legislation to a ridiculous pass,” but he was over-ruled by his colleagues and selling biltong was outlawed (CARRUTHERS 1995a, p. 111).

3. Game and Livestock: 1920s and 1930s

In the 1920s and 1930s, there were two attitudes to wildlife in South Africa. One was their strict protection within state-owned game reserves and national parks. The other was the philosophy that the existence of wildlife was detrimental to the development of a modern agricultural industry because wild animals harboured animal diseases that threatened the nation’s livestock herds and thus compromised food security and modernisation. In short, the conservation of indigenous megafauna and the prosperity of the South African agricultural industry were regarded as being inimical to one another.

Nonetheless, there were always some white farmers in South Africa who tolerated the presence of antelope on their land, provided they did not impact negatively on livestock and other farming operations. In the grassland savannas of the Orange Free State (now Free State province), blesbok were the most common animal (VON RICHTER 1971, VON RICHTER et al. 1972, VRAHIMIS 2001), while in the more arid areas around the districts around Colesberg and Graaff-Reinet where properties were extensive, the most abundant indigenous antelope to be found among the sheep was the springbok (*Antidorcas marsupialis*) (BEINART 2003, p. 328).

However, a new philosophy was beginning to emerge. E. B. WORTHINGTON, a renowned ecologist, expressed concern in *Science in Africa* (1938) that the diminution of game in Africa resulted from state-sponsored “anti-game campaigns.” He argued that agricultural scientists were on the wrong track in trying to improve African livestock breeds or introducing strains from Europe, rather than studying indigenous African mammals in terms of what protein they could provide on a sustainable basis for local people (WORTHINGTON 1938).

4. Changing Ideas: the 1950s and 1960s

Ideas such as those expressed by WORTHINGTON did not come into their own until the 1960s. The 1940s had been very dry years, and by the 1950s there were farmers in the arid and semi-arid areas of South Africa who had noticed that springbok had not been as badly affected by the drought period as had livestock. They began to harvest them (BEINART 2003, pp. 328, 386). In the northern parts of the country there were similar developments: “One or two species are [...] kept in a semi-natural state on some farms in the Transvaal and produce a useful supply of venison for the market” (WORTHINGTON 1958, pp. 331–332).

While farmers might have been pleased by the increase in venison consumption, some conservationists decried the change in values around wild animals, resenting the rise of a utilitarian perspective. Cape naturalist C. J. SKEAD (1948), for example, wrote that it was a pity that “we have to think of our wild animals as objects of price quotations, but some of this meat must have come from farmers who have protected it.” But another saw the potential, and A. D. THOMAS argued that conservation would succeed better if it were based on economic principles, rather than only on values that were aesthetic and idealistic (LUNDHOLM 1952, p. 122).

While the role of local wildlife experts is important, there is a strong argument that it was the influence of scientists from outside Africa that tipped the balance towards sustainable game ranching in South Africa. Together with WORTHINGTON (1958), Frank Fraser DARLING was another internationally renowned British scientist with similar ideas, and his work contained a warning about future shortages of protein for a growing world population, a shortfall that could be remedied through game ranching (DARLING 1960, OVERTON 1963, SKINNER 1970, APPS et al. 1994). Mervyn COWIE (1961, p. 217), an East African game warden, also wrote at the time: “When the Africans realise that some land is more valuable for producing wild animal products than for ranching useless scrub cattle or trying to grow very scanty crops, they will appreciate that our endowment of wild life is an asset of great value.” But as well as research expertise, technical innovation was required. In this regard, a breakthrough came with the aerial census, and with developments in tranquillizing and immobilizing drugs that would enable the translocation of wild, even dangerous animals (EBEDES 1994, DU TOIT 2007, pp. 19–20).

Thus, in the second half of the twentieth century, a new philosophy arose to answer the following question: why could wildlife not deliver the economic and food benefits on private

property that cattle could? Exploiting wildlife might be sustainable in a way that cattle ranching could not. The change in attitude towards wildlife on private property has been attributed to two Fulbright scholars from the United States, Raymond DASMANN and Archie MOSSMAN, who worked on a very large (54,000 ha) remote Rhodesian cattle ranch between 1959 and 1961 with a mission to save “some part of the magnificent wild fauna of tropical Africa” (DASMANN 1959, DASMANN 1964, p. xi). These researchers demonstrated that, not only could wildlife survive on cattle ranches, but that, in itself, game ranching held enormous potential for augmenting Africa’s protein supply.

5. A New Industry Develops

The work of the British scientist Fraser DARLING, as well as that of the Fulbright scholars, was timely in terms of the incipient new thinking around pastoral issues in Africa, including South Africa. These included an emphasis on a population in need of protein, which the Food and Agriculture Organisation estimated in 1966 was growing at a rate of twenty million a year. This population explosion was occurring at a time when agricultural production was falling by 5% on a per capita basis in the developing countries, causing malnutrition in as much as one-third of the world’s population (OVINGTON 1963, CRAWFORD 1968). Fundamentally, DASMANN and MOSSMAN recognised that much of Africa was arid or semi-arid and that, because of a “preference for a tame meat and milk supply in place of a wild one,” livestock had been encouraged to spread into unsuitable habitats that, in turn, created overgrazing of the vegetation and led to substandard animals and breed deterioration (DASMANN 1964, p. 21; NELL 2003, p. 65). In these marginal areas, game was exterminated and livestock protected, necessitating expensive infrastructure to support cattle by way of fencing, water supply, additional feed, and—very often—agricultural subsidies. Referring to wasting the “wild” meat only to support a “tame” supply as “government sponsored madness,” DASMANN began from the premise that wild animals “produce” meat in the same way as livestock. He hypothesised that wild game (i.e. antelope, particularly ungulates) would eventually be shown to be more efficient producers, because different species used the veld differently in their feeding habits (i.e. they found nourishment in distinct vegetation niches) and could survive the ingestion of many species of poisonous plants. They were also disease- and tick-resistant, could travel further distances than cattle without losing condition, and they had a much reduced need for water. In theory, therefore, wild ungulates were the perfect “farm” animal (DASMANN 1964).

The prospects were promising, but there were legal obstacles that combined with real practical and scientific challenges around transmitting disease to domestic stock and marketing a new meat product (DASMANN 1964, pp. 39, 48, 53–56, 60). One was the “unpleasant business” of market-hunting: the emotionally disturbing nature of large-scale game slaughter done in a manner so as not to spoil the meat. Those involved apparently remained at their dreadful task only by reminding themselves that the alternative to finding a solution to the cattle-wildlife dilemma was the extermination of game. In addition, there were problems with dressing the carcasses and storing them hygienically in a hot climate with makeshift facilities that could not be shared with cattle. The first efforts at commercial biltong-making were failures, and an initial marketing success was mitigated by the quick saturation of the venison demand among whites and the too-high cost of the product for blacks (DASMANN 1964, p. 56; WESTCOTT 1984). Many of these conclusions and characteristics were later to apply to South Africa too.

Animal husbandry in South Africa was advanced, and experts were well-poised to take up and test DASMANN's ideas and turn them into scientifically valid projects. Some of these results were publicised and show the enthusiasm with which game/wildlife ranching/farming were debated. Many articles emphasised the fact that farmers often pursued inappropriate livestock practices and that stocking with game would be fitting in many marginal areas (STEYN 1961). Ungulates—blesbok, springbok, and impala (*Aepyceros melampus*)—were already being “farmed” by some landowners, despite the extremely low prices live animals had fetched in 1961: dead springbok were fetching R4, and alive R12 per animal, impala dead R10, and live up to R40 (KETTLITZ 1962, RINEY and KETTLITZ 1964). These were not prices that would encourage commercial farmers. By 1966, in the height of the drought that characterised that decade, prices had not improved; in the Pretoria public market, duiker (*Sylvicapra grimmia*) went for R4–R4.20, springbok R6–R10, blesbok R8–R14, impala R7–R16, blue wildebeest (*Connochaetes taurinus*) R17–R20 and kudu (*Tragelaphus strepsiceros*) R30–R55 (STEYN 1966).

By the mid-1960s, the aesthetic and emotional value of wildlife was well established, but, given the sums of money mentioned above, the commercial prospects were still the subject of debate. The drought conditions of the 1960s had contributed to raising the profile of ranching with game, but, as STEYN (1966) cautioned, many of the claims were exaggerated. Moreover, game ranching was not only a scientific problem that required detailed and controlled experimentation and data. Many scientists in the highly economically developed circumstances of South Africa appreciated that it would only be successful if there was adequate marketing and a strong profit motive. In this regard, STEYN (1966) considered that opening areas up for sport hunting might bring in more income to farmers than ranching for meat, a prediction which eventually proved to be correct—according to DU TOIT (2007, p. 60), recreational hunting today is generating R3.1 billion in comparison with meat production of only R42 million.

Together with considering how best to manage game productively went new ideas and developments around transport and sale. South Africa is one of the few areas in the world in which the sale of indigenous wildlife is legal. Today, game auctions are a regular feature of the South African agricultural enterprise, with both private sellers and sales from game reserves and national parks: this was a 1960s novelty that took off at once (EBEDES 1994), and it currently has a monetary value of some R94 million (DU TOIT 2007, pp. 52, 60).

Important in the South African context, however, was the retarding role played by the Department of Agriculture, the organ of state tasked with protecting the country's farming industry and which had, throughout previous decades, been opposed to any interface between game and domestic stock. Essentially, the Department regarded its duty—and it was involved principally with white farmers, not black Africans—as creating a neo-Europe, giving attention to export crops and agrarian research rather than promoting the use of indigenous fauna and flora. Locked in the mindset of the 1920s, the Department of Agriculture was averse to game ranching, no doubt over real fears of disease and veld management, but also because it was determined to protect vested interests and traditional operations. Moreover, the South African game meat market was principally driven by biltong rather than fresh, high-quality venison. The commercial biltong market had been reinvigorated in the 1960s as many of the prohibitions on its sale were removed, and part of the Department's reluctance to support the industry may well be related to the fact that effort invested in research into low-quality meat was simply not rewarding, scientifically or economically (NELL 2003, pp. 109–110).

There was much to be done in terms of research to confirm, or even elucidate and replicate, the initial conclusions of DASMANN and MOSSMAN. In the first instance, it was not sci-

entifically proven that wild animals do not compete with each other for grazing although this was often stated as a fact. Second, interest had begun because poor people in Africa required additional sources of protein, but there was cultural resistance from black Africans to purchasing game meat. Game ranchers, however, obtained far more income from supplying meat to high-quality outlets or to Europe and receiving foreign currency in exchange (KYLE n. d.). Then, some species were disappointing, despite a high level of research (VAN ZYL and SKEAD 1964, VAN ZYL 1962, 1968, SKINNER 1971a, b, 1975, 1984). The euphoria of the early 1960s in connection with the advantages of game ranching in terms of disease resistance, a broader spectrum of primary production, highly fecund species, high dressing out percentage, lower fat levels and, overall, less demanding husbandry soon dissipated in the face of more detailed studies (GROSSMAN et al. 1999, pp. 262–263).

Despite the fact that game ranching was envisaged as a solution to a number of challenges facing livestock farmers at this time, government support was not forthcoming (SKINNER 1984). The costs were high. Restraining animals that could jump over high fences demanded an enormous investment in high-quality fencing. Methods of slaughter were more expensive than merely transporting docile live animals to accredited hygienic abattoirs, as could be done with cattle. The use of costly helicopters was proving to be the most effective means of mustering game and, at times, shooting from the air was the most efficient manner in which to kill large numbers. Alternatively, game could be driven into bomas (enclosures), but skills were involved in doing this, and these were not generally available. The actual shooting was also problematic, because, in the act of killing, bullets that entered or damaged the gut of the animal spoiled the carcass. The costs of dressing the carcass and cold storage and transport were also impossible for a farmer to carry without financial assistance from the government. In South Africa at that time there was tax relief, easy Land Bank credit facilities, and government support for white farmers who wanted to fence for livestock; there were subsidies for marketing, transportation, and infrastructural development. In addition, export drives were government-led, and there was a reputable extension and research service that provided advice and information. None of this support was available for game ranching—legally, wildlife was not even the property of the landowner—and the Department of Agriculture was very reluctant to tamper with the status quo. Nonetheless, in 1977, the overseas venison trade (particularly to Germany) was worth R4 million, by 1980, R9.7 million; but it then collapsed to only R8.3 million in 1981, and was down to a mere R5.5 million in 1982 (BAARD 1984). No substantial domestic market had been encouraged, and there was accordingly a large local oversupply that seemed to herald very poor economic prospects (BIGALKE 1984). Exports recovered slightly in the later 1980s, only to be hard hit again after the reunification of Germany in 1989, when venison from the Eastern Bloc became available to Europe (*Wildlife Trade Monitoring Unit* n. d.).

The government could not ignore the developing game ranching industry indefinitely, particularly as the country's game reserves and national parks were producing wildlife at an increasing rate and either culling it or selling it to get rid of the "excess." Moreover, by the 1970s, wildlife tourism was a growing economic sector in South Africa. Other pressure came from farmers who wanted tax concessions if they fenced their properties, because only by "enclosing" wildlife behind physical constraints could any kind of control be exercised over it, as ownership was not legally possible. Moreover, sustainable management ideas were new, as was the notion—after centuries of destructive activity—that wildlife had a growing economic value similar to that it had enjoyed almost a century before. Changing the traditional mindset was extremely difficult. The growth of venison exports was greatly helped by the fact

that more efficient field harvesting techniques were being employed. Increasingly, helicopters were effectively used, and most killing was done at night using spotlights, which had been shown to stress the victims less and thus did not detrimentally affect the quality of the meat. Apparently as many as eight springboks could be killed every hour by a single person from a vehicle at night using a spotlight and a high-powered rifle (CONROY n. d.). In addition, not only was it catalysed by a growing tourist industry, game ranching was also given an impetus by political circumstances in South Africa, because at that time the African “homelands” and “Bantustans” were being consolidated with significant boundary changes; there was general rural insecurity, higher labour costs, and a rise in stock theft (NELL 2003, pp. 100–102).

6. Conclusion

In South Africa today, ostrich meat and venison is increasingly easily available. However, it is the biltong industry that currently drives game ranching (VAN RENSBURG 1994, HOFFMAN et al. 2004). Given the figures for this product from the late nineteenth century, one might argue that the wheel has come around full circle and the trajectory from utilitarian appreciation for wildlife to the aesthetic and ideological has reverted back to the utilitarian—but also the sustainable—with biltong as the major product. It might well be argued that, despite some of the promising scientific research programmes that were instituted, venison was never able to fulfil its promise to replace beef, mutton, and pork in the popular diet. While international visitors comprise a large number of hunters in South Africa (7,000), a survey in *Farmer's Weekly* emphasises why local white South Africans—among them some 200,000 biltong hunters—engage in the sport. The survey showed that international hunters were after trophies and locals after meat, particularly for biltong; but that this was often a pretext for a sense of belonging, of a return to the romance of the “old days,” of excitement and of relationship-building and identity (especially among males). Some of the motives were summarised by respondents, one reported: “I think that it makes a difference that I can provide my own meat [...] that I can say I made my own biltong. It makes you proud.” (DU TOIT 2007, pp. 56–57.)

The statistics are worth recording. Some 99% of biltong hunters (springbok is the preferred quarry, although kudu generates the most income) are well educated males (89% of them married), 79% are Afrikaans-speaking, and by far the majority is in the age group 40–64. Most of them (35%) live in the province of Gauteng, compared with 4% in Limpopo and just 2% in the Northern Cape. The preferred biltong-hunting destinations are 37% for Limpopo Province, 15% for the Northern Cape and the least preferred is the Western Cape, a mere 3% (VAN DER MERWE and SAAYMAN 2008). The economic impact of this type of hunting on the rural economy is thus considerable. It is a lucrative industry for a landowner, and the popular magazine *Wild en Jag/Game and Hunt* (February 2008, pp. 46–47) advertises prices of animals available for hunting: for example, blesbok R1,500, zebra R5,000, kudu R2,300, and blue wildebeest R2,400. In addition to providing this “cultural” outlet, game ranching employs some 63,000 people (VAN DER MERWE et al. 2004).

In comparison with the extermination programmes instituted by the Department of Agriculture in the first decades of the twentieth century both in South Africa and elsewhere on the continent, a complete revolution has come about in the economic value of wild animals. Prices of wildlife have continued to rise since the 1980s, auction sales from 1991 showing a turnover of R8,999,871 had increased to some R102,420,445 by 2003, an average increase of

9% (VAN DER MERWE et al. 2004, DU TOIT 2007). A recent issue of *Wild en Jag/Game and Hunt* gives a list of the average prices for wild animals over the three years 2005 to 2007, almost all of which show a marked increase. Record prices over the period include a roan antelope (*Hippotragus equinus*) for R205,000; disease-free buffalo R285,000; eland R27,000; blesbok R3,100; springbok R2,400; and impala R3,550 (DU TOIT 2007, pp. 52–53; CLOETE and TALJAARD 2008). A further benefit has been in terms of ecosystem (of biodiversity) conservation. More than 80% of nature conservation occurs on privately owned land, some of it for tourism, but increasingly also for the breeding of rare and endangered species for sale (DU TOIT 2007).

Game ranching has changed the face of the South African agricultural landscape. From being objects of extermination, wild animals are now husbanded for a variety of purposes. There have also been specific and fundamental structural drivers of game ranching in South Africa that could not have been foreseen in those early decades, specifically the loss of subsidy to commercial farming and the deregulation of the agricultural sector, the loss of political power of white farmers, the increase of livestock theft and the rising costs of labour, the cost impact of animal disease control, as well as HIV/AIDS and the re-emergence of malaria, land restitution claims, and climate change (*Amalgamated Banks of South Africa* 2003, pp. 1–2; VAN DER MERWE et al. 2004). Import duties on meat have disappeared, and South African farmers are not protected against cheaper imports (*Amalgamated Banks of South Africa* 2003, p. 3). About 450 tons of game meat are exported annually (mainly to Europe), the value of which is about R15 million, three times as much (1,350 tons) as is consumed locally (DU TOIT 2007, p. 58).

In South Africa today, there is more wildlife than there was forty years ago, and perhaps even as much as there was when early traders, trekboers, explorers, and travellers ventured into the interior in the early nineteenth century. By conceptualizing game as a commodity, by giving it an economic value both within the formal protected estate and on private land, the number of wild animals has increased and the threat of extinction except in national parks, so realistic until the 1960s, no longer exists in South Africa.

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References

- Amalgamated Banks of South Africa* (ABSA) (Ed.): *Game Ranch Profitability in Southern Africa*. Rivonia: The SA Financial Sector Forum 2003
- APPS, P., VAN JAARSVELD, A., RICHARDSON, P., KNIGHT, M., KERLEY, G., and MCKENZIE, A.: From ranching to farming. Moving the goalposts to fill Africa’s protein gap. In: VAN HOVEN, W., EBEDES, H., and CONROY, A. (Eds.): *Wildlife Ranching. A Celebration of Diversity*. Proceedings of the Third International Game Ranching Symposium; pp. 241–244. Pretoria: Promedia 1994
- BAARD, C. R.: The game commodity and the department of agriculture. In: *South African Agricultural Union, National Game Committee: Report of the 2nd National Game Congress*; pp. 10–17. Pretoria: 13–15 September 1984

- BEINART, W.: The Rise of Conservation in South Africa. Settlers, Livestock, and the Environment, 1770–1950. Oxford: Oxford University Press 2003
- BIGALKE, R. C.: Utilisation of game. In: RICHARDSON, P. R. K., and BERRY, M. P. S. (Eds.): Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land; pp. 32–47. Pretoria: Southern African Wildlife Management Association 1984
- CARRUTHERS, J.: Game Protection in the Transvaal 1846 to 1926. Pretoria: Archives Yearbook for South African History 1995a
- CARRUTHERS, J.: The Kruger National Park. A Social and Political History. Pietermaritzburg: University of Natal Press 1995b
- CARRUTHERS, J.: “Wilding the farm or farming the wild”: The evolution of scientific game ranching in South Africa from the 1960s to the present, *Transactions of the Royal Society of South Africa* 63/2, 160–181 (2008)
- CARRUTHERS, J., and ARNOLD, M.: The Life and Work of Thomas Baines. Cape Town: Fernwood Press 1995
- CLOETE, P., and TALJAARD, P.: Tendense van Lewende Wildverkope op Wildveilings. *Wild en Jag/Game and Hunt* 14/2, 21–25 (2008)
- CONROY, A.: A personal view of the requirements and management techniques for the ranching of springbok (*Antidorcas marsupialis marsupialis*) for the production of venison on Karroo Rangeland. Unpublished manuscript (n. d.)
- COWIE, M.: Fly, Vulture. London: Harrap 1961
- CRAWFORD, M. A.: Possible use of wild animals as future sources of food in Africa. *The Veterinary Record*, 16 March 1968, 305–314 (1968)
- DARLING, F. F.: Wildlife husbandry in Africa. *Scientific American* 203/5, 123–124 (1960)
- DASMANN, R.: Environmental Conservation. New York: Wiley 1959
- DASMANN, R. F.: African Game Ranching. Oxford: Pergamon and Macmillan 1964
- DU TOIT, J. G.: Report. Role of the Private Sector in the Wildlife Industry. Tshwane: Wildlife Ranching SA/Du Toit Wilddienste 2007
- EBEDES, H.: Going, going, gone. An appraisal of game auctions. In: VAN HOVEN, W., EBEDES, H., and CONROY, A. (Eds.): Wildlife Ranching. A Celebration of Diversity. Proceedings of the Third International Game Ranching Symposium; pp. 74–80. Pretoria: Promedia 1994
- ELLIS, B.: The Impact of the White Settlers on the Natural Environment, 1845–1870. MA thesis. History, University of Natal. Pietermaritzburg 1998
- GROSSMAN, D., HOLDEN, P. L., and COLLINSON, R. F. H.: Veld management of the game ranch. In: TANTON, N. (Ed.): Veld Management in South Africa; pp. 261–279. Pietermaritzburg: University of Natal Press 1999
- HARRIS, W. C.: The Wild Sports of Southern Africa. London: Henry Bohm 1852
- HOFFMAN, L. C., MULLER, M., SCHUTTE, D. W., and CRAFTORD, K.: The retail of South African game meat. Current trade and marketing trends. *South African Journal of Wildlife Research* 34/2, 123–134 (2004)
- KETTLITZ, W. K.: Game on farms. *Fauna and Flora* 13, 19–24 (1962)
- KYLE, R.: Meat production in Africa. The case for new domestic species. Unpublished mimeograph (n. d.)
- LUNDHOLM, B.: Game farming. Is it a feasible proposition? *African Wildlife* 6/2, 121–128, 137–138 (1952)
- MACKENZIE, J. M.: The Empire of Nature. Hunting, Conservation and British Imperialism. Manchester: Manchester University Press 1988
- NELL, D. D’A.: The Development of Wildlife Utilisation in South Africa and Kenya, c.1950–1990. Unpublished D. Phil. Thesis, University of Oxford 2003
- OVINGTON, J. D. (Ed.): The Better Use of the World’s Fauna for Food. London: Institute of Biology 1963
- Republic of South Africa*: Final Draft. Report to the Minister of Environmental Affairs and Tourism. Department of Environmental Affairs and Tourism. Panel of Experts on Professional and Recreational Hunting in South Africa 2005
- RICHTER, W. VON: Past and present distribution of the black wildebeest, *Connochaetes gnou* Zimmermann (Artiodactyla: Bovidae) with special reference to the history of some herds in South Africa. *Annals of the Transvaal Museum* 27/4, 35–48 (1971)
- RICHTER, W. VON, LYNCH, C. D., and WESSELS, T.: Status and Distribution of the Larger Mammal Species on Farmland in the Orange Free State. Nature Conservation Research Report 1. Bloemfontein: O. F. S. Provincial Administration 1972
- RINEY, T., and KETTLITZ, W. L.: Management of large mammals in the Transvaal. *Mammalia* 28, 188–248 (1964)
- SKEAD, C. J.: What price your game? *African Wildlife* 3/2, 18–21 (1948)
- SKINNER, J. D.: Game-ranching in Africa as a source of meat for local consumption and export. *Tropical Animal Health and Production* 2, 151–157 (1970)

- SKINNER, J. D.: Productivity of the eland: An appraisal of the last five years' research. *South African Journal of Science* 67, 534–539 (1971a)
- SKINNER, J. D.: The real lowdown on farming with game. *Farmer's Weekly* 3 December 1971, 12–17 (1971b)
- SKINNER, J. D.: Game farming in South Africa. *Journal of the African Biological Society* 6, 8–15 (1975)
- SKINNER, J. D.: Mating and calving seasons, sex ratios and age groups, and monitoring ungulate populations for game farming. In: RICHARDSON, P. R. K., and BERRY, M. P. S. (Eds.): *Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land*; pp. 64–69. Pretoria: Southern African Wildlife Management Association 1984
- STEYN, T. J.: Farm planning and nature conservation. *Fauna and Flora* 12, 4–7 (1961)
- STEYN, T. J.: Game farming and hunting areas. *Fauna and Flora* 17, 1–3 (1966)
- VAN DER MERWE, P., and SAAYMAN, M.: *National Profile and Economic Impact of Biltong Hunters in South Africa*. Potchefstroom: University of the North West, Institute for Tourism and Leisure Studies 2008
- VAN DER MERWE, P., SAAYMAN, M., and KRUGELL, W.: Factors that determine the price of game. *Koedoe* 47/2, 105–113 (2004)
- VAN RENSBERG, L. R. J.: A cost evaluation of game cropping methods and certain necessary cost factors in the marketing of venison. In: VAN HOVEN, W., EBEDES, H., and CONROY, A. (Eds.): *Game Ranching. A Celebration of Diversity. Proceedings of the Third International Game Ranching Symposium*; pp. 206–211. Pretoria: Promedia 1994
- VAN ZYL, J. H. M.: The meat production of South African game animals 1. The eland. *Fauna and Flora* 13, 35–40 (1962)
- VAN ZYL, J. H. M.: Vleisproduksie van Suid-Afrikaanse Wildsoorte 3. Die Springbok. *Fauna and Flora* 19, 51–57 (1968)
- VAN ZYL, J. H. M., and SKEAD, D. M.: The meat production of South African game animals 2. The African buffalo. *Fauna and Flora* 15, 34–40 (1964)
- VRAHIMIS, S.: Black wildebeest (*Connochaetes gnou*) conservation success. An historical perspective. In: PENZHORN, B. L. (Ed.): *Proceedings of a Symposium on the Relocation of Large African Mammals, Onderstepoort, 12 and 13 October 2001*; pp. 42–45. Onderstepoort: Wildlife Group of the South African Veterinary Association 2001
- WESTCOTT, J.: Meat production and marketing. In: RICHARDSON, P. R. K., and BERRY, M. P. S. (Eds.): *Proceedings of the July 1982 Workshop on the Conservation and Utilisation of Wild Life on Private Land*; pp. 48–53. Pretoria: Southern African Wildlife Management Association 1984
- Wildlife Trade Monitoring Unit* (Ed.): *Game Farming*. Unpublished mimeograph (n. d.)
- WORTHINGTON, E. B.: *Science in Africa. A Review of Scientific Research relating to Tropical and Southern Africa*. London: Oxford University Press 1938
- WORTHINGTON, E. B.: *Science in the Development of Africa. A Review of the Contribution of Physical and Biological Knowledge South of the Sahara*. N. p.: 1958

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Nachhaltigkeit in der Wissenschaft

Leopoldina-Workshop

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Im Mittelpunkt der weltweiten Überlegungen zur Bewältigung zentraler Herausforderungen des 21. Jahrhunderts steht das Konzept der Nachhaltigkeit. Damit dieses Prinzip sich in konkreten Handlungsvorschlägen widerspiegeln kann, bedarf es der Präzisierung. Der Band untersucht daher die Nachhaltigkeit in der Wissenschaft, der wichtigsten Informationsquelle der Gesellschaft. Dabei wird Nachhaltigkeit sowohl der Strukturen als auch der Aktivitäten in Forschung und Lehre betrachtet. Behandelt werden die „Erforschung von Nachhaltigkeit“, die Strategien zum besseren Verständnis liefern soll, der Komplex „nachhaltig forschen“, der Voraussetzungen, Verläufe und Folgen von Forschung gemäß den Kriterien der Nachhaltigkeit analysiert, und die „Nachhaltigkeit von Forschung“, die Wesensprinzipien der Wissenschaft – etwa die Falsifizierbarkeit ihrer Resultate – im Lichte der Idee der Nachhaltigkeit untersucht. Schwerpunkte der Analyse bilden in allen Bereichen einerseits das Spannungsverhältnis zwischen Freiheit und Nachhaltigkeit der Wissenschaft sowie andererseits die Auswirkungen der Debatte auf die Strukturen des Wissenschaftssystems.

The Love-Hate Relationship with Land in Australia: Presenting “Exploitation and Sustainability” in Museums

Libby ROBIN (Canberra, Australia)

With 1 Figure

Abstract

Libby ROBIN’s article about the Australian love-hate relationship to land considers the question of how sustainability and exploitation are presented in Australian museums. At the centre stands the National Museum of Australia, where the author herself works. ROBIN emphasises that the previously strongly social-history focus of national museums must be completed by an environmental perspective. Additionally, it is important to present the narrative of sustainability not only in a national, but in a continental and global context. Against this background, the concept of land is, on one hand, too narrow (because it is regionally limited); on the other hand, it is useful in illustrating larger questions, such as the negative influence of land use on soils, fresh water bodies, and the ocean, or its effects on CO₂ emissions. The histories of a national museum must therefore be framed not only nationally, but also globally: the consequences of human actions on human life all over the world.

Zusammenfassung

Libby ROBINS Beitrag über die Hassliebe der Australier zum „Land“ geht der Frage nach, wie Ausbeutung und Nachhaltigkeit in australischen Museen präsentiert werden. Im Zentrum steht das *National Museum of Australia*, an dem die Autorin selbst tätig ist. ROBIN betont, dass der bisher stark sozialgeschichtliche Fokus von Nationalmuseen durch die Kategorie der Umwelt ergänzt werden muss. Außerdem sei es wichtig, Narrative zur Nachhaltigkeit nicht nur in einem nationalen, sondern in einem kontinentalen und globalen Rahmen darzustellen. Der Begriff „Land“ ist vor diesem Hintergrund einerseits eine zu enge (weil regional beschränkte) Kategorie, andererseits eignet er sich dazu, größere Fragestellungen zu illustrieren, etwa den negativen Einfluss von Landnutzung auf Böden, Gewässer und Ozeane oder deren Auswirkungen auf CO₂-Emission. Die Geschichten eines Nationalen Museums müssten demnach nicht nur Nationales, sondern auch Globales – die Folgen menschlichen Wirkens für das menschliche Leben auf dem gesamten Planeten – berücksichtigen.

1. Scholarship in the Public Domain

There are some intriguing intellectual opportunities in the new partnerships between scholarly and cultural institutions, such as those in Munich between the Rachel Carson Center for Environment and Society established at LMU Munich (*Ludwig-Maximilians-Universität*) in July 2010 and the *Deutsches Museum*, Munich. My own work benefits from a partnership between the Fenner School of Environment and Society, at the Australian National University and the Centre for Historical Research at the National Museum of Australia in Canberra. Since 2007, I spend 50% of my time in each place. My graduate students have frequent opportunities to participate in the life of a museum research centre, and my curatorial colleagues, many of whom are adjunct appointees to the Australian National University, join

academic forums and colloquia in the University and work on joint projects funded by major research grants. Environmental history is one of three central themes in the National Museum of Australia. There is a practical reason to bring my museum and its intellectual architecture to this meeting of distinguished international environmental historians. Future developments at the National Museum of Australia will include the redevelopment of environmental history exhibitions. Environmental history offers unusual opportunities to combine historical scholarship and public audiences through University-Museum partnerships in Canberra, Munich, and other places as well.

2. From Exploitation to Sustainability?

I want to take the theme of this conference, “from exploitation to sustainability,” and consider how it might provide museum storylines, using the National Museum of Australia as an example. A trip through any museum gallery follows a narrative, or storyline. In a history museum, such a story often follows time’s arrow. The theme “from exploitation to sustainability” implies a historical arrow. It opens up many apposite questions about our present society and possible futures. As museums are called on to be relevant, politically aware (but not biased) and alert to present concerns, without short-changing good historical scholarship, such a narrative could enable public forums as well as inform the gallery stories and the objects chosen to illustrate these.

“Exploitation” is a loaded word.¹ It may need to be implicit rather than explicit in such an exercise. In an Australian context, “land use” or “resource development” might be more descriptive and less negative than exploitation. The philosophy of “wise use” has a moral tone that is closer to the historical motivations for exploitation, and such wisdom is important to giving credit to our forebears’ motivations for developing the country. Sustainability is also loaded, but usually positively so, in our present era.² The path from wise use philosophies to sustainability is a historical description of philosophical change rather than a “judgement.” The motivations for such a change have been driven by a growing awareness of planetary limits. A museum needs to open up discussion, not set up conflicting dialogues, and the “history of ideas” approach enables reflection on change rather than judgement of the past. This is consistent with the view that sustainability is a journey, rather than a destination. A museum is ideally positioned to sponsor conversations about how such a journey should be approached, rather than focusing on an idealised and futuristic destination.

Sustainability needs a historical context, for example: Where have sustainable initiatives come from in our own era and in past eras? How have they been framed? What are the elements that they seek to balance in different historical eras? Such questions are more important than answers or explicit “lessons from history.” And an empirical foundation for the context is essential to avoiding a museum full of “future scenarios” that date quickly. There is nothing quite so quaint and old-fashioned as past futures! The famous Futurama ride at the 1939–1940 New York World’s Fair, part of the General Motors Pavilion, gave riders a taste of the transport options in “the world of tomorrow”—the year 1960. Twenty years ahead is not a “deep future,”

1 “Exploitation” is more descriptive and less judgemental in French and German than in English.

2 In past eras, where “progress” was a fundamental aim, a “sustainable” society was one that made no progress: therefore was regarded negatively.

and transport was not an ambitious subject, but as part of the “space age” it can look very old-fashioned indeed. The National Museum of American History in Washington now displays “the world of tomorrow” as a museum piece in its newest gallery. It is also a commentary on its own earlier museology: the Museum of History and Technology (established in 1964), a precursor of the National Museum of American History (NMAH), has been described by NMAH museologist James B. GARDENER (2010) as “a palace of progress” (ANKER 2010).

One could follow a storyline “from exploitation to sustainability” through the last two hundred years of Australia’s settler history. But the assumption that we are “moving forward” would be fraught with hazards: progress is an old-fashioned idea. Although Australians might aspire to having such a national story, it is clear that exploitation continues to dominate, and that sustainability often borders on tokenism. Not only are the Australian economy and society nowhere near close to sustainable, but there is a counter-narrative in which new exploitative measures are increasingly masked in soft green language. Australia’s efforts at sustainability initiatives can hardly be said to be successful in global terms. The Australian lifestyle is expensive because the continent is isolated. Within the country, there are long distances between settlements that affect travel and food miles, while urban centres have poor public transport and Australians (on average) live in very large houses in sprawling suburbs. It is one of the least sustainable lifestyles, *per capita*, in the world. In ecological footprinting, the average Australian lifestyle uses the equivalent of about four planets, even without counting the carbon emissions that are exported with coal and other minerals and with agricultural products.³

A discourse of sustainability must get beyond changing light bulbs, as Donna GREEN and Liz MINCHIN (2010) put it in their book, *Screw Light Bulbs*. All of this is controversial and provocative and, therefore, suitable for a museum; but it is a great challenge to work out how to present it through objects and in galleries that potentially must remain entertaining and fresh for ten years or more. A museum gallery has to wear its historical and scientific scholarship lightly and use objects to do the telling. Storylines have to be crafted in a way that is not too close to any political agenda, and should reveal “analysis,” rather than advocate specific outcomes.⁴ Exploitation is a “right” that is difficult to question. The thriving mining sector that drives the Australian export economy claims to need a competitive advantage in global trade. The agricultural sector has a much smaller share of export profits, and contributes rather more to carbon emissions, but, because it has a long history of being close to Australian national identity, it is also hard to move agriculture onto more sustainable pathways that might change its place in society. Sustainability is something *someone else ought to do*: it is a public good. Exploitation, by contrast, is now a *private right*, exempt from planetary responsibilities. Historically, exploitation was once a public obligation. (For example, in the era of settlement, private leaseholders were “required” by government to clear trees off land for stock or lose their leaseholds. Clearing was called “improvement,” although, with hindsight, it is clear that this was not an ecological public good.) Putting the private and the public together, and recognising the historical context of each of these, is something that this storyline demands and that museums are well positioned to do through forums as well as exhibitions.

3 Like the rest of the world, Australia does not count the emissions cost of our exports in these ecological foot-printing statistics. Coal accounted for 23 % of our export economy in 2009. Coal exports have doubled since 1992 and are set to double again by 2020. Much of the carbon emissions for coal and iron ore, another great Australian export, will count against China and our other receiving countries, even though Australia is digging it out of the ground.

4 The other reason to avoid a political agenda is that it can become dated quickly, which can render obsolete an expensive installation at a museum.

3. Ten Years On

In 2011, the National Museum of Australia (NMA) celebrated its tenth birthday. No longer burdened by being a new museum seeking a niche among established museums around the country, it now stands as Australia's foremost national history museum. The NMA has demonstrated its leadership in travelling exhibitions that enable it to reach beyond Canberra, particularly to regional Australia, and on-line exhibitions, which are accessible all over the world. The NMA has exceeded expectations from day one. It attracted twice as many visitors as expected in its first year, and visitor numbers have been healthy ever since. Over the first seven years of operation (2001–2007), on average, 700,000 visitors per year came through the door: about the same number that visited the new permanent exhibition at the German Historical Museum, Berlin, in its first year (2006–2007) (DOUGLAS et al. 2010, OTTOMEYER 2010).⁵

As it moves into its second decade, the exhibits of ten years ago, however, need to be re-freshed and enriched with newer scholarship. The issue of climate change, for example, was peripheral when the first environmental history gallery was designed in the late 1990s, but it is now a major popular concern. When the Director Andrew SAYERS was appointed in June 2010, he stated that his mission was to make the museum responsive, relevant, and topical—a hive of activities and events, as well as excellent exhibits. Any renewal of exhibitions needed to provide “hooks” for public debates and performances, for engaging special live audiences, as well as passing visitor traffic. The NMA Research Centre, a scholarly group of curators and researchers within the museum, contributes actively to this process: this discussion with a distinguished international environmental history audience is part of the process.

Environmental history has many new themes and strengths in this new millennium that can inform and shape developments. Changes to the environment gallery must stimulate debate and public discourse in this changing context. Objects need to inspire active responses, not just passive “viewing”: they must be alive to the big debates of our times. The ten-year moment in the museum's history also invites the wider environmental history community to reflect on disciplinary and cultural developments over the same period. The first decade of the new millennium has brought a number of new environmental issues to the fore, and has re-shaped the idea of “sustainability” significantly since it first became popular through the forum of the United Nations Conference in Rio in 1992, and the book *Our Common Future* (United Nations World Commission on Environment and Development 1987).

4. Environmental and Other Histories in a Museum

The NMA is a museum of environmental history, social history, and Indigenous history—land, nation and people are its themes. Most of all, however, it has been a social history museum, highlighting “the experience and agency of ordinary everyday people,” in the words of heritage academic Kylie MESSAGE (2010), who identified a social history trend in other museum developments at the same time, including the Melbourne Museum (est. 1998), the Museum

5 This is spectacular in the small city of Canberra (350,000 people), in a nation about a third the size of Germany. Only 9% of NMA visitors are international tourists, so over 90% are Australian visitors. Attendances are higher in the first year than in subsequent years in most places.

of Sydney (est. 1995), and Te Papa (Wellington, New Zealand) (est. 1998). The discourse of "stories of ordinary people" also motivated the National Museum of American History (est. 1980) (GARDENER 2010).

The museum drew on the original vision for a Museum of Australia put forward in the 1970s by a Committee of Enquiry on Museums and National Collections, chaired by businessman Peter PIGOTT (PIGOTT 1975, CONDÉ 2011). One of the Pigott Committee's most innovative recommendations was that Australia should have a museum to fill a perceived gap between its natural history museums, which were established in the nineteenth century in all the Australian colonies (now states), and the emerging issues of the twentieth century. The museum was to use history as a method, but consider people and nature together. The brief emerged from the intellectual context of the 1970s, which included rising environmental consciousness (something evident all over the world) and archaeological discoveries about the longevity of Australian Aboriginal culture. Before the 1970s, Aboriginal people were "stone age", and their society was regarded in simple terms amenable to the categories of "natural history." The archaeological revolution in Australia revealed some of the complexity of a hunting and foraging society and its adaptation to the ecological limits of the land. Aboriginal people's stories began to be regarded as history, rather than natural history. Since this time Aboriginal people themselves have increasingly become subjects and authors of history rather than objects of scientific scrutiny.

Environmental history in Australia is deeply informed by the rise of Indigenous history, and many of Australia's most important global stories come from the extraordinary archaeological discoveries of the past three or four decades. The notion of "fire-stick farming," explicated by Rhys JONES (1969), showed the way a people without traditional agriculture had managed and shaped the land. "The land the English settled was not as God made it. It was as the Aborigines made it," wrote Sylvia HALLAM (1979). This revelation has complicated the idea of "wilderness" in Australia, and Australia's path towards a "National Estate" (which includes national parks) has increasingly diverged from that adopted in the United States, where "saving nature" acquired nationalist significance. Increasingly, Australians are "co-managing" biodiversity with partnerships between different people, including Indigenous people. Then, over the next two decades, the technique of thermoluminescence dating established a human presence of 55,000 years. No longer was Australia a "young" country; it was suddenly, by global standards, an *old* one, where much had happened before the Europeans arrived. Indeed, Australia was settled by fully modern humans long before Western Europe. Because there was little glaciation in Australia during the last glacial maximum (when all of Europe was under ice), Aboriginal people had developed a very long continuous relation with the land: with "country," as they prefer to say. No glaciation also means no ice scraping of the rock surface to create fresh top soil, so the soils, unrefreshed in the Ice Age, are now poor and low in the nutrients needed for the style of agriculture that grew up in Europe in the post Ice-Age era.

Five years, and several federal governments after the Pigott committee commenced work, a *Museum of Australia Act* was passed in 1980. This created a National Historical Collection, but provided no money for a building. Nearly two further decades passed before funding was found for a new Museum building through the national celebrations of the Centenary of Federation. The museum opened in 2001, exactly one hundred years after the birth of the nation, and the Centenary of Federation was its *raison d'être*. It was not the Museum of Australia, as envisaged, but the National Museum of Australia, with the nation as a central precept.

5. The Problematic “Nation”

National museums in Europe are most often about art, antiquities, natural history or science and technology. National museums with social history as a focus are often the choice of “problematic” nations—or new ones, struggling to create an identity. The new building for the National Museum of Scotland, opened in association with the nationalism that established the Scottish Parliament in 1999, greets its visitors with a translation of the 1320 Treaty of Arbroath:

As long as but a hundred of us remain alive,
we will never under any conditions
be brought under English rule.⁶

The National Museum of Finland was established in 1916. It became “National” at the point of Finland’s independence from Sweden in 1917. Like the NMA and the new Scottish museum, it is very rich in social and national history. But a sense of “nation” is not always the same as the nation state—as the Bavarian National Museum in Munich testifies. Nonetheless, it is fair to say that a focus on social history is common for “problematic” nations, where the “nation” is uncomfortable for its citizens. Iceland, with the world’s oldest parliament—“Althing” (930 AD)—and sagas (national stories) (twelfth–thirteenth century), has a national museum that “reveals” the antiquity of its national values through archaeological sources and national documents, rather than a social history approach that “constructs” a national identity.

But national moments date quickly. Ten years on, we were not as bound to the “national” in Australia as we were at the Centenary of Federation, and our national museum is free to consider itself in more international ways. In a global world, it makes more sense to refocus Australian environmental history for the museum in a framework of postnational concerns. As Australian biologist-writer Tim FLANNERY (2010) comments in *Here on Earth*, the nation itself is an outmoded category in environmental thinking: “the inventions of the internet, mobile phones, and cheap air travel are dramatically challenging the boundaries and capabilities of the old human superorganisms—the nations. [...] Humanity’s rise from hunter-gatherer societies [where the largest functioning unit was the clan] to twenty-first century [global] civilisation appears instantaneous [in geological time, and, in] a million years from now, [there will be] little or no evidence of it [...] in the geological record. [...] [O]ur largest functioning unit [now] includes almost every human being on Earth.”

Australian environmental storylines are part of global human history, and we need to understand the case of Australia—which, of course, is a continent as well as a nation—within global frameworks in the twenty-first century. The museum also needs truly local stories at scales smaller than the continental. Whatever we understand globally, most of us can only act locally. One possible philosophy is to choose exhibits that enhance our global imagination and empower our local actions (ROBIN 2012). These will elicit different responses from local, interstate, and international visitors, and create the opportunity for conversations across different scales. Whatever new ideas we come up with will, of course, benefit from the earlier work, particularly the collections and storylines developed for the first exhibition, *Tangled Destinies*.

⁶ The museum building opened in 1998. The Declaration of Arbroath was originally in Latin.

6. An Environmental History Gallery: Tangled Destinies 2001

In the decades between the passing of the *Museum of Australia Act* and the building of the museum, budgets and staffing were limited and the national collections assembled patchy rather than systematic. The NMA’s best foundation collection was one of Aboriginal art work on bark, arguably better than any other museum or gallery in the world in this category. Much of this collection was assembled in the 1970s, before Aboriginal art of the *Papunya Tula* school became famous. The collections were built with support from the Aboriginal Arts Board of the Australia Council, established in 1973, and its Director, archaeologist Robert EDWARDS, who was concerned that “mainstream” art galleries were not collecting important Aboriginal work at the time. When the National Historical Collection was established, EDWARDS facilitated the transfer of works on bark, and encouraged the study of conservation of such work (BERRELL 2009).⁷ Bark works pose a serious conservation challenge to museums still.

The National Historical Collection included a range of objects suitable for galleries of historical British settler nationalism, but very little collecting was done in the period from 1980 to the late 1990s for a “people and the environment” gallery, apart from objects about “environmentalism” and green politics.⁸ In 1998, I joined a team of about nine curators with various qualifications, led by archaeologist Mike SMITH, to develop a brief for the exhibition first known as *Tangled Destinies*. We had to develop a collection for environmental history in order to make this possible. As we wrote the storylines, we looked for objects to support them. We followed the style of the museum as a whole, which was to tell stories in ways that give weight to Aboriginal voices as well as settler (British and Irish) Australian and twentieth-century migrant groups that made up “multicultural Australia” (DOUGLAS et al. 2010). Sometimes this meant telling parallel stories about places or events. The destinies of the first people were “tangled” with those of the later arrivals, and both shaped the destiny of the land: this was the origin of the title for the exhibition.

Tangled Destinies was the first permanent gallery that visitors encountered in the new Museum. The exhibition design had to be developed in parallel with the building works, which was difficult because the shape and space of the exhibitions changed, with major architectural adjustments being made even as the display was installed. Over that very intensive year, working with designers (from New York and Boston), we developed philosophy, storylines, and object collections together. The tight deadlines were the first of the challenges. Another was that it was the first ever gallery of environmental history in Australia—and possibly the world—so there were no obvious models on which to draw. New Zealand had planned a gallery of People and Environment for its big national museum, Te Papa, but, because of a financial shortfall, this gallery was postponed for a decade. Under the guidance of curator Kirstie Ross, a very successful environmental gallery, *Blood, Earth, Fire /Whāngai Whenua Ahi Kā*, opened in 2008.

⁷ The exhibition *Papunya Painting: Out of the Australian Desert* was part of the Year of Australian Culture in China and was displayed at the National Art Museum of China from June until August, 2010. See JOHNSON 2007.

⁸ Central to the environmental collections were the objects donated by Robert James BROWN, Tasmanian green activist and inaugural Parliamentary Leader of the Australian Greens (since 1996). The campaigns for Lake Pedder (unsuccessful) and the Franklin River (successful) were crucial to green politics in Tasmania (from the 1970s) and subsequently to the rest of Australia.



Fig. 1 *Blood Earth Fire Whāngai Whenua Ahi Kā* (Environmental History Gallery) 2008, Te Papa, Wellington NZ. Photo: Libby ROBIN

Land, People, and Nation were the overarching principles of the NMA—and the defining features of the national in the museum. The love-hate relationship between people and land in Australia was implicated in national identity. The museum has presented more on the social and literary history of relations with the land than the economics of working the land over its first ten years. One of our great nineteenth-century writers, Henry LAWSON (1896), promoted the Australian bush identity in many of his stories. For example, his 1896 story entitled *His Country—After All* was about an Australian exiled in well-watered New Zealand, who was caught by surprise when the scent of gum smoke curling from a rabbit trapper’s fire “brought a wave of memories with it.” He determined to return to his homeland, even though he had a low opinion of it: “Why, it’s only a mongrel desert, except some bits round the coast. The worst dried-up and God-forsaken country I was ever in.” Being Australian meant working with poor soils and drought and making a livelihood despite these. Adapting the British agricultural dream to “mongrel country” was to forge civilisation in Australia. In a place where anxiety about degeneration in tropical climates and embarrassment about a convict heritage coloured national pride, national identity demanded tough citizens, who could rise above the limitations of land to remake it according to the rules of Old Europe.

So the themes of environmental history suggested a focus on the great agricultural dream, and the support of governments and science in its service, rather than the private enterprise of mining. Exploitation meant using, not wasting, the vast “empty” lands and, in the southern parts, the forests that clothed them. Agriculture and forestry have been prominent themes in Australian environmental history, building on imperial histories of Australia, but mining

has been much less celebrated.⁹ The other important focus for the museum was "country." Country, for Aboriginal people is a "place that gives and receives life," as anthropologist Deborah ROSE (1996, 2004) put it. Much that happened on the land in the two hundred years of British settlement affected Aboriginal people, and the land itself, a "nourishing terrain," is inalienable from Aboriginal culture.¹⁰ In more recent developments at the museum, especially *Australian Journeys* (2008) and *Creating a Country* (2009), the notion of "place" has been identified as a device that unifies indigenous, multicultural, and settler stories (DOUGLAS et al. 2010). Increasingly the *continent* is taken as the nation, thus avoiding the politics of the national imagination (ROBIN 2007). These new galleries encapsulate a more "global" view of the nation, including how Australia has been imagined by those who come to it from outside, especially those who later become Australian citizens.

7. History of Ideas

Another trajectory in environmental history is its close alliance with the history of ideas: Donald WORSTER's *Nature's Economy* is a classic example of this genre (1977). One of the ways we internationalised our people and environment theme within the constraints of a "national" museum was to arrange the modules of the *Tangled Destinies* (1999) exhibition to reveal how the global history of ideas played out in Australia. In our first section we "arrived," so we opened our gallery with exhibits that focused on British ideas of the country in the late eighteenth century, particularly the idea of strange nature. A biological cringe—embarrassment about a primitive and inferior fauna—shaped the way British Australians valued natural history in the eighteenth and nineteenth century. One of the surprises that European settlers confronted on arrival in Australia was a platypus, with the beak of a duck, and the fur of a mammal: a confusing antipodean animal in a category—monotreme—that was new to the Linnaean hierarchy. It was immediately regarded as *inferior* to placental mammals. The exhibition's first object was a platypus's nest; a platypus lays small yellow eggs in a nest that could have belonged to a bird. The bird-mammal confusion of categories is still a "surprise" even for Australians today, who know about the animal, but seldom see either a platypus or its nest in the wild. The nest was a way of confronting "strangeness" for all the museum's visitors, local and international.

The next section focused on "settlement," so the tools for taming the land were its objects. The stories were about making the landscape look more European—for example, through the introduction of animals and plants. One of our popular exhibits is a neon map of the country

9 Mining histories tend to be commissioned histories written by public historians outside academia. Geoffrey BLAINEY, a distinguished Australian historian has written several important mining histories (including on commission), and is the major exception to this point. He is also the Patron of the Mining History Association of Australia, the professional group in this area. Nineteenth-century goldfields have been an important part of Australia's social and "national" history. "Mining histories" beyond the nineteenth-century goldfields, however, fall outside university and school curricula. Mainstream environmental history scholarship in Australia has been remarkably silent on this subject.

10 Some of the historical documents used in *Tangled Destinies* were Aboriginal and ancient, and may well appear again in the new gallery: for example, Aboriginal rock art in the Northern Territory was used to show climate changes in the last Ice Age had affected shore lines. Images of fish and other sea creatures are painted in rock shelters far inland in Kakadu National Park where coastlines used to be. The refreshment may not need to be in substance but rather in technologies of presentation after 10 years of exhibition.

showing biological invasions creeping across the continent over time. Making a European-style living from the Australian land involved a huge investment by government in science and in community building, much of which was closely linked to nationalistic rhetoric: particularly the soldier settlement schemes, which rewarded returned soldiers with parcels of land. Before the arrival of the British, there were no hooved animals in Australia and the only indigenous Australian plant to make it to the commercial markets before the recent explosion of “bush tucker” was the Macadamia nut; and this was not until well into the twentieth century, and was actually cultivated in Hawaii.

One of my favourite exhibits in the section on “Settling” is a display of three tall tubes of wheat. Next to these are a reap hook and a family Bible. The idea of agriculture as a civilising force, so explicit in the Bible, was very evident in the foundation of many wheat-growing communities on the edges of desert Australia. The wheat itself was grown for the museum by CSIRO from its seed bank. The first tube contained a wheat strain brought from England in the late eighteenth century. It was very tall and straight, because thatch was an important side-product for English agriculture at this time. The variety in the next tube—“Federation” wheat, first grown in 1903—was significantly shorter (SMITH et al. 1999). The wheat strain, patriotically named by experimental scientist William FARRER, was developed to be resistant to rust, a major wheat disease of the late nineteenth century. The final tube in the exhibit displayed a 1999 variety of genetically modified wheat with a very short stalk (no need to waste energy on stalks) and a big fat head; the wheat grains were huge by comparison with the first variety. This was (and still is) just an experimental crop: GMOs have still not been used in the Australian wheat industry. But CSIRO was interested in the science of producing such wheat. Perhaps the museum will be the only place where this wheat is “used.” The display shows clearly how wheat changes with history and with people’s aspirations. Although wheat crops were present from the first European settlement, wheat was not a single commodity, but, rather, a changing one that made different demands on the land over time. Many of the cultivars—for example, Federation wheat—although not “natural” to Australia, became regarded as part of our cultural heritage.

So we arrived, and we settled. Finally, in the twentieth century, we began to *understand* this land that was so strange in European terms. The third part of the gallery featured many of the Big Ideas of the twentieth century: Australia was part of Gondwana, the great south land; the continent had shifted on the planet in geological time, migrating towards the equator; plants and animals had been evolutionarily isolated from the rest of the world. The biggest story was the ancient human history of the land. It was not until the 1980s that there were firm dates showing 50,000 years of occupation. The archaeological findings reveal that the same humans have had continuous culture in the land up to the present. No longer were we a New Land, but rather an Old one, certainly older than old Europe, which was under ice for much of this 50,000 year period. This particular big idea took the fancy of the Museum council in the Carroll review (2003). On the recommendation of this committee, the exhibition was modified slightly, and renamed *Old New Land*.

This “history of ideas” approach is a legacy that new galleries will build on. There are, ten years on, many new big ideas about life on this continent and on the planet. The question is how to show them in a museum and what sorts of objects might reveal them to visitors. The present environmental history exhibition charts a story of the love-hate relationship with land in Australia, including a settler narrative that moved from bafflement at the biota, to development (or exploitation) of the land, to environmental action and concern. Aboriginal relations

with the land continued, too; sometimes their traditional expectations led to warfare on the frontier, but much of the “living on the land” has been a shared partnership, particularly in the cattle industry and in the semi-arid pastoral lands and northern monsoon country, where skilled Aboriginal people have provided a major part of the labour. Some of the stories and objects in the original galleries will undoubtedly remain. But there is scope to sharpen the notion of environment, to consider sectors beyond agriculture, pastoralism, and forestry and to look at key issues like fire and urbanisation in global as well as local terms.

8. Changing Ideas of Environment

The Pigott report commented in 1975 that “to divorce man from nature in the new museum would be to perpetuate a schism which the nineteenth century, in the interests of science, did much to foster” (PIGOTT 1975, pp. 70–71). There was a strong awareness in the Pigott Committee of initiatives like the 1955 Princeton symposium *Man’s Role in Changing the Face of the Earth*, but this has been slow to translate to cross-disciplinary professionalism among curators in museums (THOMAS et al. 1955). In the 1980s and 1990s, the museum’s staff comprised historians, not scientists, and the opportunities to overcome the schism were limited. The environment was the subject of science, people were the subject of history, and the gap between the two was large. Few curators attempted both. Environmental history itself had some significant silences. It was a relatively new field in Australia in the 1990s, and its silences inevitably became the silences in our exhibition concepts.

The gallery was about land—Australia’s national obsession. There was not much about either the sea or the built landscape, although, historically, most people arrived in Australia in boats and today live in cities. National identity still starts with the “bush” (this includes rural country, and does not necessarily include trees), even though we are an overwhelmingly urban nation; or, perhaps more accurately, a *suburban* nation of people living on quarter-acre (~1000 m²) blocks. At the birth of the Australian nation in 1901, the first capital, Melbourne, had more than a million people (which was then about 40% of the population of the state of Victoria). By 1944, 60% of Victorians lived in the state’s capital. Now, as our population has tripled from seven million in the 1940s to twenty-one million, over 80% of Australians live in cities of a million or more people.¹¹ Yet we rarely tell urban stories as our national stories. Urban design was not part of the first “environment” gallery.¹²

Mining history was also neglected, despite the importance of mining to the economy. Economic history was phased out of most Australian universities during the 1980s and 1990s, and this gap is a problem for environmental history. Much of what has been written about mining has been commissioned accounts of single mines and settlements, often paid for by the mining companies themselves. There is a lot more about nineteenth century gold rushes than current gold mines, which, like coal and iron ore, are dramatically changing the look

11 Generally speaking, over 80% of Australians live in one big sprawling city in each state, the former colonial capitals, except for Tasmania and the territories where in each case the total population is much less than 1 million altogether.

12 The attempt to tell a series of stories about cities was limited by the objects available. Iconic city objects are regarded as important to city museums; at the time of opening both Melbourne and Sydney had brand new museums where these objects were already displayed. Melbourne Museum in 2011 has a whole gallery dedicated to the period when Melbourne was the national capital – so this story is told elsewhere.

of the landscape as it is transformed by huge open-cut operations (PEARCE 2010). Much of the action is in the desert and remote northern Australia, and all twenty-first century mining operations are highly mechanised, rather than major employers of people. It is not easy to approach the subject from a social history perspective in the present era. However, Newcrest goldmine, one of the largest in the southern hemisphere, is right in the middle of some of New South Wales prime pastoral country, not far from Canberra. The landscape is being transformed from sheep farms into arsenic-affected mountains of soil, left over in heaps after the gold is extracted. Some twenty-six major properties, each of which was, a family's livelihood for many generations, have been razed already. The different dreams of the Australian economy are sometimes at odds with each other.

The NMA did begin with a mining story. Its first "blockbuster" exhibition was *Gold and Civilisation*, which ran from March to June 2001 (MCCALMAN et al. 2001). From 2002 onwards, however, the museum was left with very little about mining history in its permanent galleries and equally little to suggest that mining is still of central importance to Australian life. This is an area that can be rethought with new development. It could now even have an Indigenous dimension, uncovered in the last decade. New archaeological work on Aboriginal mining of ochres shows that, in an era long before European settlement, Aboriginal people were mining tonnes of red ochre, an iron-based pigment used in ceremonies and traded over distances comparable to those between the major cities on the famous "Silk Road." This is a new understanding developed over just the last decade: there may have been no "Iron Age" in the sense of smelting iron-ore in pre-British Australia, but the mining of ferrous ochres was a major operation that could be said to have been undertaken on an *industrial* scale, and traded across vast distances between different Aboriginal nations (SMITH 2013). Thus, we have an intriguing challenge to the "universality" of categories that potentially undermines the linear progressive story of Stone Age / Iron Age / Bronze Age / Agricultural/Industrial in world history.

There are now people and environment galleries in many of Australia's state museums, as the gap between history curators and science curators has closed significantly in the past decade. Environmental history has also developed more varied stories and a wider range of writers — in Australia, as elsewhere. The NMA's environmental history gallery remains more history-minded than in places where science curators led gallery development, but there is generally less defensiveness about natural history among social history curators, and social history among natural history curators, than there was a decade ago.

9. Scales of History

The story of the planetary history of the environment and its relations with people has become increasingly rich and scientifically informed in the ten years since the museum was built. One thing that is inevitable: for new environmental history galleries and exhibits, the NMA is going to engage more with science, economics, and planetary conceptions. National history is not enough. The national scale is just one of many chosen for writing history now, although it has been dominant in the discipline, and is an obvious choice in a "national" museum. Thinking on multiple time scales enables different histories to be told, and the subjects of these histories can include more than "national" figures. Bigger and smaller frames create startling new agents of history. Australian world historian David CHRISTIAN (2005) describes

“microhistories” as the equivalent of street maps rather than the whole atlas. The microscale is very much part of the “place” and bioregional thinking that informs the museum’s newest galleries. CHRISTIAN is also interested in scales bigger than the national: a “global” scale (five hundred years)—the *longue durée* of Fernand BRAUDEL; a “world” scale (five thousand years)—the lifespan of the agricultural revolution; a “human” scale (one hundred thousand to four million years)—the rise of modern humans; and a “planetary” scale of 4.6 billion years. This sort of history is usually beyond “social history;” but environmental stories can have social ramifications, and a multi-scale approach to storylines enables new perspectives on present concerns.

There are many new players in the history field. People are implicated in abiotic environments like air quality, in biological extinctions in our own time and in past times, and as forces for changing the land, not just through conventional western-style exploitation, but also, on a longer time scale, through fire management, vegetation changes, and so forth. A study of one or two hundred years of life on the Australian continent is not enough for the global and planetary scale questions, yet these longer-term questions are increasingly important in daily life, and are very much at the forefront of the “history of ideas.”

I want to finish with just a few big ideas in global environmental history that have gathered pace in the last decade, which I believe museums that deal in environmental history need to engage with.

10. Anthropocene Concept and What it Means for Life, Earth, and History

Life is no longer separate from Earth: life makes the planet—and destroys it. So, not only are people and environments part of the same system, there is no biophysical system of Earth that does not in some sense reflect *human* history. The Anthropocene is a new division of the Holocene geological era, which reflects the idea of people as a *geological* force. There is strong evidence that, since the industrial revolution, traces of the activities of *Homo sapiens* can be found in nearly every biotic and abiotic system on Earth. History is embedded in Earth and it is now the business of science as well as cultural historians (ROBIN and STEFFEN 2007).

Climate change is one prominent aspect of the interrelatedness of Earth’s systems. It has different effects in different places. Australia is facing massive drying out on the immediate time scale. There is well-documented evidence already of permanent changes in weather patterns in southwestern Australia since the 1970s, and on the east coast of Tasmania—places where it is decades since the “average” amount of rain fell. The Murray-Darling Basin, covering four states and a territory, grows 70% of food crops for export and domestic use with 6% of the water that falls. It has, some say, collapsed as a system in the first decade of this century, which was characterised by drought. This is possibly a climate-change-accelerated collapse. The Murray-Darling system is also a story of overexploitation—in this case, the overallocation of water in a highly variable river system, where people grow all sorts of crops including water-hungry rice and cotton. Climate change is also affecting the timing and severity of monsoon summer rains in the northern third of Australia. These are relatively local or continental effects. But if we move onto a planetary scale, the peoples of Australia have an extraordinary history of living with variability.

11. Living with Variability: A Case Study for the World?

All over the planet, climate change is producing unpredictable effects, bigger storms and longer droughts, and is shifting the timing of rainfall in ways that make annual cropping problematic. How did the hunter-gatherer societies survive in the Australian desert thirty-five thousand years ago, at the height of the last Ice Age, in conditions at the extreme end of the scenarios predicted by climate change modellers? How can such Australian stories speak to the big global narratives of our day?

The oldest dates for human settlement—over fifty-five thousand years—come from Malakunanja in the Northern Territory. In the early 1990s, thermoluminescence was a very new technique that revealed the antiquity of Australian civilisation (ROBERTS et al. 1990, 1994). One of the new Museum's research priorities is to go back to the region and cross-check these now 20-year-old dates with newer techniques. We need to know how people actually lived in the arid centre through the Ice Age period, when conditions were drier than today—this is not a hypothetical model of future society, but rather social history, using different sources. There is an urgent need to document more of the context of life so long ago, and tell the stories for museum visitors. This is one of the current projects of our Centre for Historical Research.

Mike SMITH's (cf. 2013) archaeological work suggests that we should be looking carefully at the period from 21,000 BP to 7,000 BP. This was the period of the glaciation of the northern lands, but, on our continent, we had people living with the colder, drier, resource-poor conditions. If, instead of starting our history in the present, we imagine ourselves in a society living 21,000 years ago at the last glacial maximum—we have to come to terms with a temperature increase of ten to twelve degrees and a sea-level rise of 136 metres as the ice sheets melted, which reduced the size of the continent by a third. Fourteen centuries is a long time, but some of these changes happened rapidly. And archaeological evidence is now emerging that can cast light on how people coped and what strategies helped them survive.

12. A Land of Biodiversity in Collapse?

Extinction has been an important story for museums all over the world; dinosaur exhibits are often the best known and most popular with the youngest museum visitors in natural history museums. In the NMA, the demise of the megafauna, including the giant wombat-like marsupials called *Diprotodons*, for example, was part of the story of continental drying out that foreshadowed the last glacial maximum—and the megafauna co-existed with people. Dinosaurs were, of course, long gone when people arrived, as elsewhere. Biodiversity, however, can be conceived in other ways. The story of extinctions in Australia and New Guinea, “beyond Wallace's Line,” are also stories of the places that met people last. Because *Homo erectus* never made it to these countries, the Wallacian ecosystems first encountered hominid species in their most potent form, as *Homo sapiens*, fully modern people, unlike almost everywhere else (FLANNERY 2010).

The great story of the Australian continent is its long isolation—then the dramatic arrivals of people, who changed the environment in Australia to suit themselves, twice, as the environmental historian George SEDDON once observed (GRIFFITHS 1997). The first people arrived some fifty-five thousand years ago and spread throughout the land. Then there was the second European invasion in 1788. This brought simultaneous agricultural and industrial

revolutions to a land that had been previously managed by fire for hunting. The environment changed irreversibly, and birds and other animals, plants, and people have all had to adapt to live with these changes. The extinction of the megafauna was part of this story. People altered landscapes — particularly through introducing fire — and the animals that did not eat the plants adapted to the new fire regimes died out. There is great potential for debate here: did the hunters eat out the megafauna or just change their environments? This is a big Australian story that fascinates the rest of the world.

Biodiversity conservation has also changed radically in the first decade of the twenty-first century; we have seen a rise of philanthropic and not-for-profit groups buying into nature reserves, Indigenous Protected Areas (where the National Estate is managed through partnerships with traditional owners, Aboriginal people living in remote areas) and other community-led initiatives. The big idea here is that “people are good for conservation,” something that has changed since the early days of national parks activism, when the aim was often to remove all traces of human “interference” with nature (and thereby to eliminate cultural heritage in places of natural importance).

13. Conclusions: Getting beyond Land

Thinking in terms of whole Earth systems makes a focus on land alone too narrow. Land, however, can be a tool for thinking beyond the local too: for example, one can look at carbon emissions through agricultural land clearance, and emissions mitigation through planting trees. Land use affects soil quality, and the use of phosphorus for fertiliser and the rise of acid sulphate soils in agricultural areas in the humid tropical parts of Queensland has dramatically affected more than the land. Coral bleaching, one of the planet’s big disaster areas, has a direct link to land practices. The Great Barrier Reef is only one of the important coral zones in the region. Just to the north of Australia, in Indonesian waters, is the Coral Triangle, a biodiversity hotspot that one hundred million people depend on for their livelihoods. Here there are a range of threats including destructive fishing and overexploitation of marine resources, ocean warming, and acidification, but it is land-based activities that enhance nutrient and sediment loads threatening up to 35% of coral reefs.

Land is the remit of the nation, and an obvious focus for a national museum. But environmental history suggests we should get beyond the nation. The planet is the remit of humanity. Earth is a superorganism beyond nation, as is humanity. This is no longer about loving and hating “land:” it is all about ourselves and the extent to which people are implicated in Earth’s futures.

Life on Earth is history’s new big story.

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References

- ANKER, P.: *From Bauhaus to Ecohouse. A History of Ecological Design*. Baton Rouge: Louisiana State University Press 2010
- BERRELL, N.: Inroads offshore. The international exhibition program of the Aboriginal Arts Board, 1973–1980. *reCollections. Journal of the National Museum of Australia* 4/1, 13–30 (2009)
- CARROLL, J. (Chair): *Review of the National Museum of Australia*. Canberra: National Museum of Australia 2003
- CHRISTIAN, D.: Scales. In: HUGHES-WARRINGTON, M. (Ed.): *Palgrave Advances in World Histories*; pp. 64–89. Basingstoke, New York: Palgrave Macmillan 2005
- CONDÉ, A.: A 'vigorous cultural movement'. The Pigott inquiry and country museums in Australia, 1975. *reCollections. Journal of the National Museum of Australia* 6/2 (2011)
- DOUGLAS, L., COGHLAN, R., and TRINCA, M.: An Australian journey. Building a National Museum in a multicultural society. In: MADSEN, P., and JØRGENSEN, L. (Eds.): *The National Museums in a Globalised World*; pp. 68–77. Copenhagen: National Museum of Denmark 2010
- FLANNERY, T.: *Here on Earth. An Argument for Hope*. Melbourne: Text Pub Company 2010
- GARDENER, J. B.: Should the parts add up to a whole? In: MADSEN, P., and JØRGENSEN, L. (Eds.): *The National Museums in a Globalised World*; pp. 48–59. Copenhagen: National Museum of Denmark 2010
- GREEN, D., and MINCHIN, L.: *Screw Light Bulbs. Smarter Ways to Save Australians Time and Money*. Nedlands: University of Western Australia Press 2010
- GRIFFITHS, T.: Ecology and Empire. Towards an Australian history of the world. In: GRIFFITHS, T., and ROBIN, L. (Eds.): *Ecology and Empire. Environmental History of Settler Societies*; pp. 1–16. Edinburgh: Keele University Press 1997
- HALLAM, S.: *Fire and Hearth. A Study of Aboriginal Usage and European Usurpation in South-Western Australia*. Australian Institute of Aboriginal Studies. Canberra: Preamble 1979
- JOHNSON, V. (Ed.): *Papunya Painting. Out of the Desert*. Canberra: National Museum of Australia 2007
- JONES, R.: Fire-stick farming. *Australian Natural History* 16, 224–228 (1969)
- LAWSON, H.: *While the Billy Boils. His Country After All*. Sydney: Angus and Robertson 1896
- MCCALMAN, I., COOK, A., and REEVES, A. (Eds.): *Gold. Forgotten Histories and Lost Objects of Australia*. Cambridge: Cambridge University Press 2001
- MESSAGE, K.: The museum of Australian democracy. A house for the people? *Australian Historical Studies* 41/3, 385–395 (2010)
- OTTOMEYER, H.: The German Historical Museum in Berlin. In: MADSEN, P., and JØRGENSEN, L. (Eds.): *The National Museums in a Globalised World*; pp. 14–21. Copenhagen: National Museum of Denmark 2010
- PEARCE, G.: Land of the long black cloud. *The Monthly* September 2010, 20–25 (2010)
- PIGOTT, P. H. (Chair): *Museums in Australia 1975. Report of the Committee of Inquiry on Museums and National Collections including the report of the Planning Committee on the Gallery of Aboriginal Australia 1975*. Canberra: Australian Government Publishing Service 1975
- ROBERTS, R. G., JONES, R., and SMITH, M. A.: Thermoluminescence dating of a 50,000 year-old human occupation site in northern Australia. *Nature* 345, 153–156 (1990)
- ROBERTS, R. G., JONES, R., SPOONER, N. A., HEAD, M. J., MURRAY, A. S., and SMITH, M. A.: The human colonisation of Australia. Optical dates of 53,000 and 60,000 years bracket human arrival at Deaf Adder Gorge, Northern Territory. *Quaternary Science Reviews* 13/5–7, 575–583 (1994)
- ROBIN, L.: *How a Continent Created a Nation*. Sydney: UNSW Press 2007
- ROBIN, L.: Seasons and nomads. Reflections on bioregionalism in Australia. In: LYNCH, T., GLOTFELTY, C., and ARMBRUSTER, K. (Eds.): *The Bioregional Imagination. New Perspectives on Literature, Ecology, and Place*. Georgia, F. L.: University of Georgia Press 2012
- ROBIN, L., and STEFFEN, W.: History for the Anthropocene. *History Compass* 5/5, 1694–1719. doi:10.1111/j.1478-0542.2007.00459.x (2007)
- ROSE, D. B.: *Nourishing Terrains. Australian Aboriginal Views of Landscape and Wilderness*. Canberra: Australian Heritage Commission 1996
- ROSE, D. B.: *Sharing Kinship. How Reconciliation Is Transforming the NSW National Parks and Wildlife Service*. Sydney: National Parks and Wildlife Service of NSW 2004
- SMITH, M. A. (Curator): *Tangled Destinies Exhibition at the National Museum of Australia*. Canberra: National Museum of Australia 1999
- SMITH, M. A.: *The Archaeology of Australia's Deserts*. Cambridge: Cambridge University Press 2013
- SMITH, M. A., WILLIAMS, A., TURNEY, C., and CUPPER, M. L.: Human-environment interactions in Australian drylands. Exploratory time-series analysis of archaeological records. *The Holocene* 18/3, 389–401 (2008)

The Love-Hate Relationship with Land in Australia: Presenting “Exploitation and Sustainability”

THOMAS, W. L., SAUER, C. O., BATES, M., and MUMFORD, L. (Eds.): *Man’s Role in Changing the Face of the Earth*. Chicago: Chicago University Press 1955

United Nations World Commission on Environment and Development (WECD): Our Common Future. The Brundtland Report. Oxford: Oxford University Press 1987

WORSTER, D.: *Nature’s Economy. A History of Ecological Ideas*. Cambridge: Cambridge University Press 1977

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The Alternatives Growth and Defense: Resource Allocation at Multiple Scales in Plants

Internationales Leopoldina-Symposium

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Die Beiträge eines internationalen Symposiums greifen den Konflikt auf, unterschiedliche ökophysiologische Anforderungen an Pflanzen im Prozessgeschehen der Ressourcenallokation auszubalancieren. Der Schwerpunkt liegt dabei auf dem Trade-off zwischen Wachstum und Stressabwehr mit jeweiligen Kosten-/Nutzen-Bewertungen. Wachstum stellt die Voraussetzung dar, um kompetitive Ressourcenakquirierung sicherzustellen, und Abwehr die Voraussetzung, um die Ressourcen nach Inkorporation für die Pflanze zu erhalten. Diese integrierte Betrachtungsweise erfordert in der Erkenntnis des intensiven Ressourcenaustausches der Pflanze mit ihrer abiotischen und biotischen Umwelt eine räumlich-zeitliche Prozessskalierung. Dies wird hinsichtlich des mechanistischen und zugleich ökologisch relevanten Klärungspotenzials geprüft. Die Analyse der Prozessvernetzung zwischen funktionalen und strukturellen pflanzen- und ökosysteminhärenten biologischen Organisationsebenen (Skalen) wird dabei als Voraussetzung für räumlich-zeitliche Musteraufdeckung im Allokationsgeschehen identifiziert. Die Beiträge erreichen so eine neue Qualität eines umfassenden, prozessbasiert integrierenden Verständnisses von „Systembiologie“.

The Politics of Forest Conservation in Brazil: A Historical View

José Augusto PADUA (Rio de Janeiro, Brazil)

With 6 Figures

Abstract

In his essay on the conservation of the rainforest in Brazil, José Augusto PADUA shows how the politics of deforestation in the Amazon region have changed since the 1970s; in the years between 2004 and 2009 alone, there was an 80 % reduction in rainforest clearing, signalling the enormous success of the Brazilian nature conservation movement. The fundamental problem is that other regions, in particular the savannah area which borders on the Amazon forest, the *cerrado*, are being systematically destroyed by overcultivation; the preservation of one ecosystem rests on the destruction of another. PADUA makes a persuasive argument for a politics of conservation that does not lose sight of ecological balance and that values a range of different landscapes.

Zusammenfassung

In seinem Aufsatz über die Erhaltung von Wäldern in Brasilien zeigt José Augusto PADUA, dass die Politik der Entwaldung im brasilianischen Amazonasgebiet seit den 1970er Jahren enorm zurückgegangen ist; allein zwischen 2004 und 2009 kam es zu einer 80 %igen Reduktion der Abholzung und damit zu einem unerhörten Erfolg der brasilianischen Naturschutzpolitik. Problematisch ist freilich, dass andere Regionen, insbesondere die an das Amazonasgebiet angrenzenden riesigen Savannengebiete, die *Cerrados*, durch Maisanbau und Übernutzung systematisch zerstört werden. Die Zerstörung eines Ökosystems steht in unmittelbarem Zusammenhang mit der Bewahrung eines *anderen* Gebiets. PADUA plädiert vor diesem Hintergrund dafür, nicht nur zu bewahren und zu schützen, sondern das ökologische Gleichgewicht und die Nutzung unterschiedlichster Landschaftstypen im Blick zu behalten.

The situation in Brazil is marked by a huge contrast: between the historical lack of action in terms of forest conservation, and the clear growth in the movement to protect forests that have characterised the last three decades. In particular, we should note the frenetic swing towards conservation in the last ten years, when Brazil was responsible for around 74 % of the protected areas created worldwide after 2003 (JENKINS and JOPPA 2009).

In order to analyse this situation, we need to understand the historical framework, in particular with regard to this last decade. Brazilian history is not rich in examples of land conservation; in fact, until 1934, when the first forest law was created, and 1937, when the first national park was created, we can hardly find a single example of significant conservation policies or measures in Brazil. There was, of course, a very interesting intellectual debate on the need for forest protection that started at the end of the eighteenth century — something which I have explored in some detail in my book *Um Sopro de Destruição* [A Wind of Destruction] (PADUA 2002)—but this debate had very few practical consequences indeed. For

the most part, it remained a topic for discussion within the academies and institutes and did not come to have real political or economic consequences.¹

In the 1930s, we started to see a slow growth of conservation initiatives, but it wasn't until the end of the 1970s, with the emergence of a new national and international environmental debate, that this development became stronger. The 1980s saw growth in terms of the creation of federal conservation areas, which dipped again in the 1990s, but grew again in the first decade of the new millennium at the highest rate yet.

This paper will go on to explain how this growth is reflected in terms of the actual area turned into protected reserves; but first it is important to note that there is a very clear Amazon bias in these conservation measures. In fact, the Amazon rainforest makes up more than 80 % of the protected areas created in Brazil in recent decades. Looking at the very short period from 2004 to 2010, we can see the emergence of genuine territorial barriers against deforestation, with different kinds of protected areas—including Indian lands as well as traditional national parks—and some innovation in terms of protected areas created in response to social defiance, such as the extractive reserves created as a direct result of the rubber tappers' campaign and Chico MENDES' murder in 1988 and the consolidation of the *quilombos*, the land belonging to the black communities, into protected areas. These different kinds of conservation initiatives combine to make a whole, which, when shown on a map on the following page, looks really rather impressive. We can see how the mosaic of protected lands helps to halt the course of deforestation.

This concentration of protected areas in the Amazon region is one of the reasons for a rather unexpected development in relation to the preceding historical trends, one which does not seem to have had much coverage in the international press. Deforestation of the Amazon region is falling at an astounding rate. Between 2003—when President LULA's government (a leftwing coalition headed by the Workers' Party) came to power—and 2009, deforestation of the Amazon was reduced by more than 70 % (from 27,800 to 7,500 km²). A further reduction occurred in the period 2010–2011, reaching the level of 6,200 km². This enormous reduction in the deforestation of the Amazon is something I would have held to be impossible a decade ago. It is an important lesson for us to take note of: there is no such thing as the end of history. New technologies, new political moves, and new social consensus can and should produce real change in the way societies interact with their territories and environment. Moreover, the whole debate on the fate of the Amazon forest since the 1970s did produce concrete historical results.

Of course, the creation of this system of protected areas is not the only reason for the reduction of deforestation, and this essay will go on to examine some further factors. If we take a longer view of the history of the Amazon rainforests, we will see that there were other moments in recent history that saw reductions in deforestation. But these were directly linked to economic recession; whereas, in 2010, Brazil had economic growth of 7.5 % and yet a significant additional reduction in deforestation of the Amazon. This new dissociation between deforestation and economic growth is really fascinating and without precedence in Brazilian history.

¹ A successful reforestation project was implemented in the mountains of Rio de Janeiro after 1862. The idea was to restore the forested hills destroyed by coffee plantation and charcoal production in the former decades. But the main goal of the monarchical government was to conserve the sources of fresh water to the country's capital and not to restore the forests as such (DRUMMOND 1996).

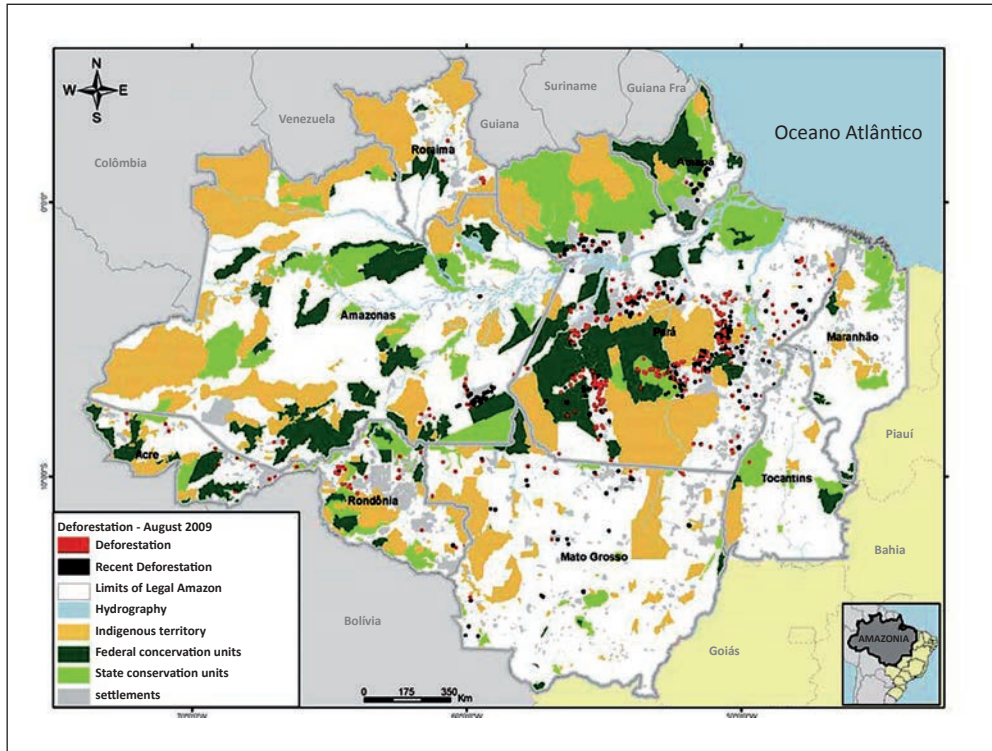


Fig. 1 Map of protected areas and deforestation spots in the Brazilian Amazon 2009. Source: Agência Brasil, Wikimedia Commons, modified

Let me try to sketch the broad geographical and historical context of this development. The ecological diversity of the Brazilian territory includes many different kinds of ecosystems that, today, are generally aggregated in six big biomes. When the Europeans arrived in the eastern part of South America there were two large areas of tropical rainforest: the Atlantic forest, comprising 1.3 million km²; and the Amazon forest with 4 million km² in what is now Brazilian territory. The Amazon forest had its uniquely complex hydrological system; the Atlantic forest, with its chains of mountains, was referred to by European settlers as the “green wall”; and between these two big tropical forest areas were different kinds of savannas. It’s important to note the savanna in the exact middle of the country, the so-called *Cerrado*: it consists of around 2 million km² of semi-dry savanna with a lot of trees, and there is some discussion as to whether it can be considered forest or not. We need to be aware of this, because this area is becoming one of the most important agricultural frontiers in the world.

The Cerrado is widely used for food production, especially soy beans, and it is important that we make the link between this fact and the conservation of the Amazon forests; the Cerrado serves as a kind of sacrificial zone for the protection of the Amazon. In my debates with government officials, I frequently heard arguments that run like this: we must save the Amazon forest, since this is our national geopolitical interest and the desire of national and international public opinion. But we do not need it for agriculture or cattle ranching anyway, because we have a potential 100 million ha of Cerrado to advance our agribusiness. Currently,

Brazilian policymakers are running into problems because there are many people, including myself, advocating for the ecological relevance of the Cerrado—which is very impressive in terms of biodiversity and environmental services—and the government, having taken some time to be convinced of the need to save the Amazon forests, is not willing to sacrifice a second huge area to appease environmentalists. But the debate goes on. So, one of the challenges we now face is to develop a more balanced approach between economic development and the conservation of these different biomes.

Here, I believe that a historical approach to Brazil might help us to move forward in finding solutions. We should keep in mind that, if the Portuguese crown was able to negotiate the formal recognition of such an enormous colonial territory despite the fact that the actual occupation of this territory in terms of population and economic activity was small, then this indicates an important feature of Brazilian history: the contrast between a relatively small population



Fig. 2 Map showing the progress of anthropisation in the Brazilian territory 1960. Source: TORRE 2010, modified

and a very large formal territory. This historical context created a sense of open frontiers and inexhaustible resources that is still quite strong in the Brazilian political and cultural mentality (PADUA 2010). In 1822, when Brazilian became an independent country, the spread of land occupation was a kind of mosaic, an archipelago of regional societies inside the state: the total population itself was relatively small (around 4 million people). It was a historical challenge to include all of these diverse regional populations in the building of a single state.

Even later, by 1900, Brazil had a population of approximately 17 million, compared with 76 million in the United States. But this picture underwent a clear change in the course of the twentieth century when the Brazilian population and economy increased impressively (with a marked acceleration in the last six decades). This movement was reflected in the pattern of territorial occupation and in the destruction of native biomes. Until the 1960s, as we can see in the following maps (TORRE 2010) designed with data from the Brazilian Institute of



Fig. 3 Map showing the progress of anthropisation in the Brazilian territory 2000. Source: TORRE 2010, modified

Geography and Statistics (IBGE), the occupation of the Cerrado was small and that of the the Amazon forest likewise. Brazilian population and economic activities were concentrated in the Atlantic forest area, along the littoral. At this point in time, the acidic soils of the Cerrado were still considered to be non-arable land. The biome was only opened for agriculture as a result of scientific research during the seventies, promoted by the Brazilian Agricultural Research Corporation (EMBRAPA). Thus, from the 1960s onwards, the growth of the Brazilian economy correlates to the large increase in the occupation of Brazilian territory.

As we can see, the destruction of the Amazon forest is also a recent historical phenomenon. Moreover, the Amazon is being destroyed from the south, in what is known as the deforestation arc. A comparison of the fate of the Atlantic forest with the deforestation of the Amazon holds an interesting lesson for us in terms of environmental history. In 1850, the Atlantic forest still covered more than 90 % of its original area; today, there is only 7.5 % left. During the twentieth century, therefore, the rate of destruction was very rapid (DEAN 1995, PADUA 2010). The remainder of the forest is indeed extremely beautiful, even the parts near the larger cities such as Rio de Janeiro; but most of the land that once constituted the Atlantic forest is now completely desolate. We can gain insight into this by comparing the image of the original landscape of the Paraíba valley, as preserved in the Itatiaia national park, and the average scenery of this south-eastern part of Brazil, between the cities of São Paulo and Rio de Janeiro.

The Brazilian population is left in no doubt that this kind of deforestation had many negative results, even in economic and social terms; numerous areas of the former Atlantic forest have little to offer, few jobs and poor rural economic development—for the most part they are abandoned, the soil in poor condition, and any recovery is extremely difficult.² The following map, designed by SOS *Mata Atlântica Foundation*, shows the original Atlantic forest juxtaposed with a map of its remainder today, giving us an overview of the sheer scale of the destruction. But it must be acknowledged that further deforestation of the Atlantic forest, with very few exceptions, was forbidden by a federal government decree of 1993 that became federal law in 2006. The destruction is no longer significant, and attempts at illegal deforestation are normally closely watched by governments, the media and environmental NGOs. In fact, the forest is starting to grow again in various states of the federation.

But the Amazon forest is a rather different affair (PADUA 1997). Until 1978, 97 % of the original Amazon rainforest in Brazilian territory still existed. There was, of course, the famous rubber boom at the end of the nineteenth century, but this did not cause extensive deforestation, one of the reasons being that the rubber trees cannot be felled, instead, rubber trees are maintained and the rubber harvested daily. The trees surrounding the rubber trees also have to be maintained, in order to preserve the rubber trees themselves (DEAN 1987). This biophysical reality helped to conserve the rainforest during the rubber boom; there is no doubt that, had the trees needed to be felled in order to harvest the rubber, many parts of the forest would have been razed to the ground.

The Amazon forest still covers around 80 % of its original territory, which might not sound too grave; but the area destroyed by the deforestation arc of the last three decades totals 700,000 km²—an area around twice the size of unified Germany, just to give an idea of the

2 The best method of recovery would probably be through reforestation and the creation of a new forest-based economy, which combines environmental services, tourism, family agroforestry and the sustainable cutting of planted trees. Interesting projects are being implemented in different regions along the Brazilian coast in an attempt to create this kind of development pattern.

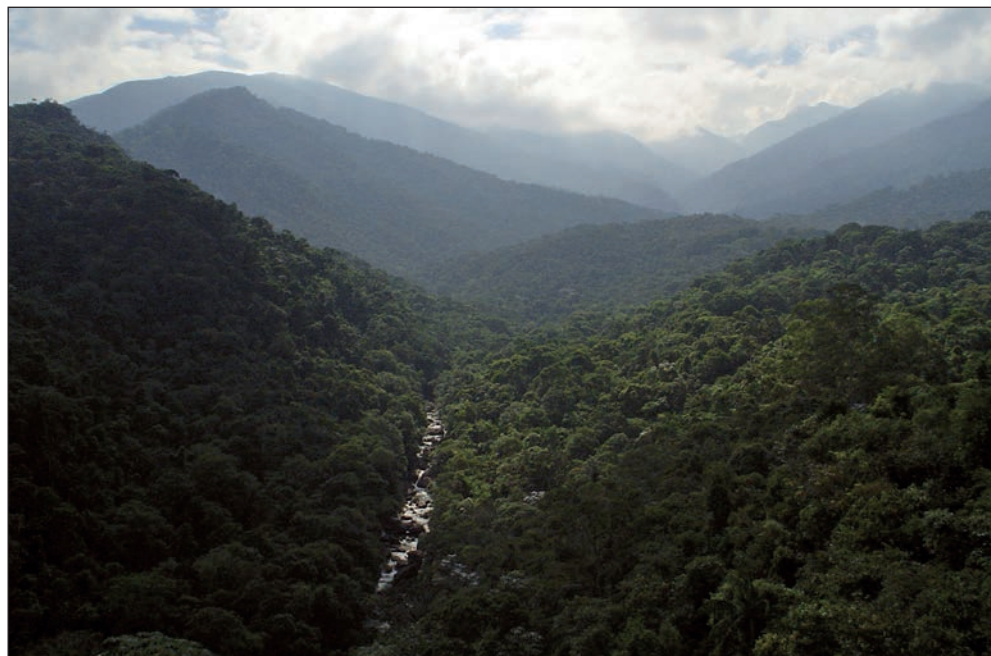


Fig. 4 Serrinha do Alambari mountain range, Itatiaia National Park. Photo: PEDROIVAN, Wikimedia Commons

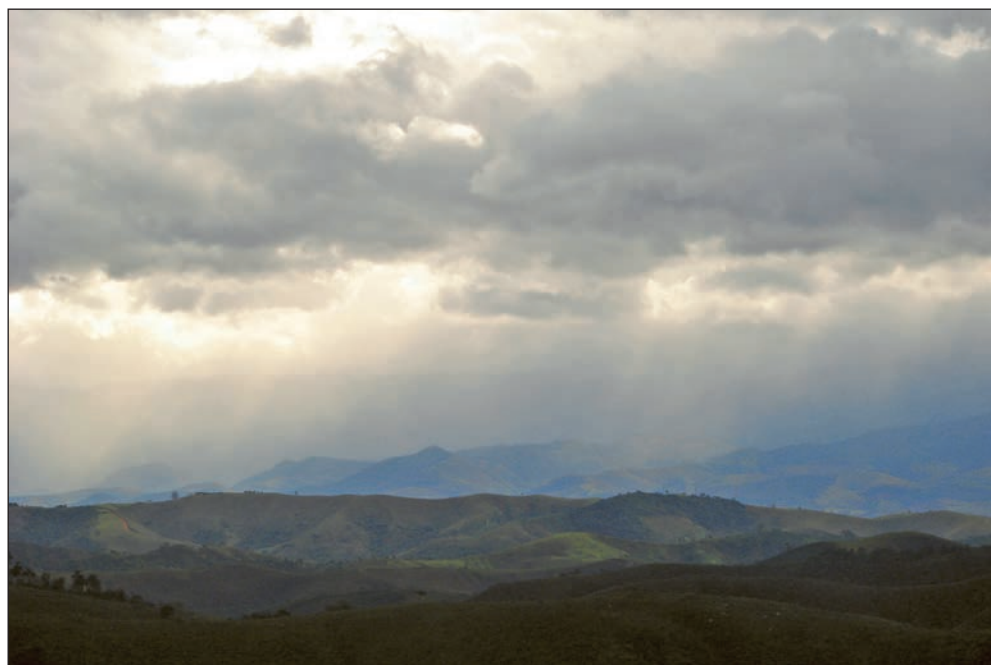


Fig. 5 Partial view of the Paraíba Valley. Photo: Glauco UMBELINO, Flickr



Fig. 6 Atlantic forest deforestation. Source: *Fundação SOS Mata Atlântica* 2010

scale. How was such a high level of deforestation possible? To begin to answer this question, we need to grasp the perception of nature, and this territory in particular, for broad swathes of the Brazilian population. In the popular imagination, the Amazon was seen as a vast ocean of trees: nature at its most abundant. We have already noted the historical contrast between the relatively small population and the large formal territory of Brazil, and this perception remains today, even with the demographic growth of the twentieth century—which suffered a turning point in the second half of the century, when the birth rate fell from 6.2% (1960) to 2% (2009). Brazil is often associated with the emerging economies of China and India, but its population density (190 million people in 8.5 million km²) is more comparable with the Russian Federation than the big Asian economies. Russia is very different, but there, too, one finds the perception of limitless nature in the Siberian forests. The prevalence of this attitude in the Amazon is reflected in the local saying “*muito mato*,” too much wood—the trees are seen as almost infinite.

But this perception is changing in Brazil. And this is where environmental history comes in. The many historical discussions about the fate of the Atlantic forest, and about the social and economic consequences of such widespread destruction, are feeding into a new culture of reflection about the future of the Amazon. Political debate is now influenced by this culture of reflection; the link between exploitation and sustainability has become a tangible feature of current discussions. Historically, the sense of the unending frontier in the Brazilian Atlantic forest was present since the initial building of the Brazilian territory. It was strengthened by native depopulation—caused by violence and a strong epidemiological shock (COOK 1998)—and the migration of Amerindians to the hinterland far from the littoral, often giving settlers the impression that they were advancing into an almost empty landscape. It is also important to realise that colonial agriculture was dependent on the burning of biomass. This is a change of historical perspective that only recently became clear to me: settlers did not see the forest only as a hindrance to be cleared, but as an integral part of their agricultural method. Forest destruction can be agriculture; it is therefore wrong to imply that regional agricultural practice did not use the forest in any way—it was used constantly, the biomass burnt in order to fertilise the land. As deforested soils became exhausted after a few years of use, the frontier moved ahead with new burnings (PADUA 2010). The lack of concern for the future of this resource—except in the mind of a few members of the intellectual elite after the end of the eighteenth century—was based on the image of the Atlantic forest as an endless green ocean. An image that was replicated in the Amazon of the last decades. But, as environmental history is showing, the Amazon forest can be lost in the same way as the Atlantic one. This perception is an interesting bridge between historical analysis and political debate.

Brazilian economy and society, then, were created by means of an archipelago of regional settlements, of regional economies based on the exploitation of natural resources. The central state was weak; during the reign of the monarchy in the nineteenth century, the state was dependent on regional oligarchies, in particular because of the absence of land taxes. It had insufficient fiscal capacity. The federal republic, which succeeded the monarchy in 1889, was even more clearly a system of political control by regional oligarchies. This helps to explain why the growing intellectual debates about the problem of deforestation after Brazilian independence, with the participation of some important government officials, had very little influence on landowners. State power, even if it was convinced of the need for more rational agricultural techniques, was simply not sufficient to regulate and to enforce changes in the rural economies.

From the 1930s, when the state began to gain in strength and capacity to regulate and intervene in the economy, the ideology of growth became hegemonic and remained so for the whole of the twentieth century. The lack of concern about nature conservation was evident; the first national park in Brazil, Itatiaia, in the state of Rio de Janeiro, was created in 1937, and yet, the diaries of the then-President, Getúlio VARGAS, do not mention so much as a single word about it. His diaries record meetings with members of the public and local politicians, but nowhere does he note the fact that a national park has been created (CORREA 2003). Clearly, he regarded the foundation of the park as a mere bureaucratic duty, a game of catch-up with the governments of the United States and Argentina, who had already established national parks. From 1940 to 1980, Brazilian GNP was growing at an average rate of 7% each year. Forests and other natural resources were being extensively exploited, almost without complaint from the media or the civil society. The legislation about natural resources was ambiguous and loosely applied. The political authorities, at the federal and regional levels, had almost no political tools to regulate or contest this reality.

How, out of this, was the conservation turn born after the 1970s–1980s? This is the crux of this essay: the way in which conservationism emerged. At this point, we must consider that ideas do have a historical impact. All of these debates about the Amazon rainforest, the global environment—they are more than just words. Their impact in different countries has differed according to the domestic political debate and the political forces in place; but these ideological battles always have the potential to influence the path that history takes in different societies. We should take this as our inspiration. It would, however, be wrong to assume that the debate about the Amazon rainforest was just a global one, an external one that muscled its way onto the Brazilian political agenda. It was an interaction between the international debate and Brazilian domestic politics; the turn towards conservation was at least as much the result of domestic political conflicts and discussions (PADUA 1992, HOCHSTETLER and KECK 2007).

Following the 1980s and 1990s, ecological debate became a marked feature of the political agenda in Brazil. There are manifold reasons for the important role of ecology: the focus on the Amazon forest; the concentration of biodiversity and fresh water in the Brazilian territory; the Earth Summit held in Rio de Janeiro in 1992 and its considerable impact; as well as the social defiance, both rural and urban, that began to arrive from different parts of the country as a result of the rapid urbanisation and industrialisation that took place after the 1940s and trailed many social and environmental conflicts in its wake. Of course, the growth of democratic debate and participation during and after the military dictatorship, from 1964 to 1984, also played its part. The 1988 Constitution, which was drawn up following the fall of the military dictatorship, is one of the most progressive in the world. Recent years have seen a climate in Brazil of hope, of social change, of new ideas—a fruitful climate for debates about the need to overcome exploitation and achieve sustainability.

Given the widespread (and growing) political consensus about the geopolitical necessity of preserving the Amazon forest, it's ironic to note the lack of short-term economic advantage that the forest provides—excepting some profit made by regional elites through the exploitation of timber, and the use of local forest resources like Brazil nuts and native rubber by local communities and a few local industries. There is simply no short-term substantial gain to be had from this ecological treasure. Of course, my analysis follows the patterns and scales of conventional economic calculus. There are, for sure, long-term economic potentials that are being considered in geopolitical terms. The abundance of potable water, biodiversity, and concentration of carbon in the forest could become economically important in the future

considering the shortage of water, the developments of biotechnology and the international carbon-credit markets. At the moment, there is a limited market for fresh water, but what does the future hold? But the Amazon forest is not a big player in the current Brazilian economy. The mining industry is a big player with a strong presence in the Amazon region, but does not have a direct link with the forest, except through the deforestation dynamics, direct and especially indirect, that mining activities can produce.

In fact, neither was the Amazon forest an important economic player in the 1970s, when the frontier was being pushed back by the military governments. This opening of the frontier, the provision of roads and infrastructure into the forest, never served immediate economic motivations. Rather, it was fuelled by military geopolitical concerns different from those being discussed today. The economic and social occupation of the Amazon forest was a political move by the government, who feared losing the region to bigger powers because of its low population density and lack of central control. In those days, the forest was occupied without any sense of the ecological or social damage that might be done. But today, the new and still imperfect consensus we find is based on an ecological awareness that permeates various sectors of society. Today's geopolitical calculus is orientated towards the importance of the Amazon region for the future. There is a new perception that the short-term economic small gains, which can be had by deforestation, are simply not worth it compared with the potential for the future of maintaining this vast forest and its complex ecology. Of course, many regional economic and political actors in the Amazon, with influence on local public opinion, do not subscribe to this idea and want short-term conventional growth through cattle ranching, timber exploration, etc. But the national political consensus is going in the opposite direction, creating a political cleavage. The marked reduction in deforestation mentioned above is due almost completely to federal policies, not to regional ones. But, at the same time, there is a growing ecological awareness in local societies and many social forces that contest the benefits of the old patterns of deforestation and economic exploitation. There are also new political leaders, aware of the changing historical context and defending new patterns of regional sustainable development based on applied scientific research, green technologies, tourism, environmental services, etc.

The national paradigm change in relation to the Amazon forest is giving rise to new scientific understandings of the economic value of the rainforest. One example of this is provided by what have been termed the "flying rivers." New research has shown that the Amazon forest pumps vast amounts of water through the air as water vapour, and this vapour is responsible for much of the rainfall in the main agribusiness regions to the south. As we have already seen, the main area of agricultural production and development in Brazil is the Cerrado, the centre-west; the destruction of the Amazon forest could damage the Cerrado's agriculture (TRIVED et al. 2005). This kind of research shows that we need to change and renew our visions of the link between ecological and economic realities.

After the 1990s, a number of innovations began to appear in the Amazon that help to explain further the significant shift in the deforestation curve. One of the most important was the raising of the percentage of privately-owned forested land that legally had to be conserved from 50 to 80 %. This decision was taken by the federal government in 2001 and is still a matter of passionate political debate. The idea that the law can force private owners in the forest regions to keep a percentage of their properties as forest reserves came from the Forest Law of 1934. Later, with a new Forest Law in 1965, the percentage was raised to 50 % in the frontier areas with old growth forests. In 1998, this percentage was designated a "legal reserve," with

different levels according to the ecological realities of the various Brazilian regions. In the Amazon, the traditional level in the decades of high deforestation was 50%. But, as we can imagine, the enforcement of this principle was weak, with many ways of evading it by legal or illegal means. In any case, after 2001 a new paradigm was established with the definition that private landowners are able to clear a maximum of 20% of their forested lands in the Amazon (for the properties in the Cerrado, the level for protection was established as 35%, which means that 65% of the properties could undergo clearcutting).³ Of course, this measure met with considerable opposition from landowners and conservative politicians, since it represents a sizeable state intervention in private property. But it stands nonetheless, and in the last decade it was reinforced by closer surveillance. The historical significance of this principle is crucial, because it indicates a kind of national consensus for the conservation of around 80% of the Amazon forest. Since we are now close to this level, many social actors are talking about the need to achieve “zero deforestation” in the Amazon.

A further step in the direction of this new paradigm was the inauguration, in 2002, of the *Sistema de Vigilância da Amazônia* (SIVAM), the Amazon Surveillance System. This system, which began to be designed in the 1990s, is a sophisticated satellite system that monitors the whole of the Amazon forest on a daily basis. Together with the satellite monitoring of Amazon deforestation by the National Institute for Space Research, these technological tools are giving a new momentum to federal government action in the region. This is highly significant, and it shows how technology also influences the course of history. Federal authorities can check which areas are being burnt and cleared. The availability of military helicopters — many military authorities support the conservation of the Amazon forest for geopolitical reasons — and the new capacities of the federal agencies mean that anyone involved in forest clearance can be quickly tracked down and their authorisations checked. This is an enormous step forward in monitoring deforestation; and it is not the result of federal agents acting as environmental heroes, but of enabling technology that reinforces a new political will.

Another important development was the creation, in 2000, of the *Sistema Nacional de Unidades de Conservação* (SNUC, the National System of Conservation Units). Today, 1.52 million km², around 18% of Brazilian territory, enjoys different levels of protected status in 919 federal or regional reserves. These reserves include conventional models of integral protection, like national parks and biological reserves, and innovative models where local populations can live in the protected areas and explore it according to sustainable principles (DRUMMOND et al. 2011).

An example of the latter case is the 87 extractive reserves created in the wake of Chico MENDES’ murder in 1988 (the world famous rubber tappers’ union leader and defender of the forest). The extractive reserve is an important concept: it allows the human population to remain living in the forest reserve and to harvest forest products (i.e. fruit, Brazil nuts, cashew nuts, rubber) but it forbids deforestation. The term extractivism has more negative associations in other contexts, but in this Brazilian model it means a way of facilitating a sustainable mode of living within the biomes (HECHT and COCKBURN 2010).

We must also consider other innovative models of protected lands that are not formally part of the National System of Conservation Units as tools for forest protection. The most important case, by far, is represented by the 517 Indian lands that were recognised after the 1988 constitu-

³ The legal reserves can be economically explored through selective logging, tourism etc., but they cannot undergo clearcutting.

tion. In fact, the constitution says that the state has to demarcate, protect and preserve Indian lands: that is, lands that are traditionally occupied by Indians as a permanent dwelling and for their productive activities. Of course, there is a deeper issue at heart that makes an interesting point about the geography of law. If we take the above principle literally, the big cities of São Paulo and Rio de Janeiro—in fact, almost every single part of Brazil—would need to be designated Indian land. Around the big cities mentioned, for example, there are still some remains of the settlements of Indians who traditionally lived on and worked the land. Some Indian groups live near some of the Brazilian main cities even today. This goes to show that this legislation was in fact drafted with the abundant forest areas of the Amazon region in mind; moreover, it suggests that forest conservation was one of the chief motivations when legislation was being drawn up. It was an additional means of preserving parts of the rainforest and the Indian tribes that still live in it in a semi-traditional way. The amount of demarcated Indian Lands in the Amazon today is very impressive, representing around 20% of the Amazon forest and 13% of Brazilian territory. If we add the 13% of lands that are designated Indian Lands to the 18% of Brazilian territory that is protected federal or regional reserves, then we see that over 30% of the country is protected in some way by conservation legislation. Landowners and conservative politicians always complain about the Indian Lands legislation, arguing that the country is reserving “too much land for too few Indians.” The Yanomani Land, for example, has a population of around ten thousand and a reserve which totals around 12 million ha. Other Indian Lands are also very large, reflecting the statements by the assessing anthropologists that “they use this land traditionally for their survival.” We must bear in mind, however, that the Constitution is also considering the need for forest conservation, and also that the conservatives do not complain about the fact that some landowners in the Amazon have properties of more than 1 million ha; implicitly, this latter form of landowning is proportional, but the Indian reserve was not, illustrating that the ecological management of the Amazon region is also a question of social and cultural perceptions.

Another example of innovative protected areas formally outside of the National System of Conservation Units is the *quilombos*. These are rural settlements of Afro Brazilian communities that were supposedly created by former escaped slaves, and which, according to the Constitution, must be demarcated and protected by the federal state. There are around two thousand quilombos in total, constituting approximately 0.13% of Brazilian territory. These are managed, not by the Ministry for the Environment, but by the Ministry for Racial Equality. Even if the total amount of quilombo land is just a fraction of size of the Indian land, it is also a subject of political debate. Conservative critics are always complaining that any rural community including many black people can be self-designated as a quilombo and thus get land from the state. Even if many local cases are disputable, the generous policies in relation to quilombos are moving ahead as part of the general progressive trend of current Brazilian politics and as a way of paying part of the nation’s historical debt in relation to the heritage of slavery and the disfavoured condition of the Afro Brazilian population.

Taken together, the different policies and models of protected areas mentioned above in relation to the Amazon forest—there are many others that I did not have space to analyse—help us to understand the reason for the dramatic fall in deforestation rates observed in the last decade. Of course, the conservation measures are far from perfect. There are many weak points in the legislation and in the policies of forest conservation. The protected lands are also vulnerable; there is some deforestation inside the different models of reserve. But, on the whole, the federal policies and territorial barriers of protected lands have helped consider-

ably in halting the progress of the destructive frontier. Only a decade or two previously, this frontier was moving at an uncontrolled speed.

This is good news for the global environment and for humanity, as well as interesting to historians as an example of the way that people and political institutions perceive their environments, and the means by which these perceptions are altered, sometimes in a positive way. But there are, of course, fresh challenges ahead. We need to strive for a better balance in the conservation of different biomes. There is now too much of an Amazon bias in a problem which is much more complex. We need to work towards conserving the ecological system of the Cerrado, too. Most importantly, we need to challenge the political forces who are engaged in attacking what they call the “frozen territory menace.” As a consequence of the advances in the forest conservation laws and in the measures brought in to enforce it, there is a strong political and economic reaction against the above mentioned policies emerging in Brazil, backed by agribusiness. The landowners and agricultural exporters are intent on making as much quick money out of the land as possible, taking advantage of the growth in the prices and in the international demand for crops that must continue in the near future. They complain that Brazil is doing far more to conserve forest than the other countries, and thereby losing out as a competitor in the world agricultural markets. The facts do not support this idea, since, in the last decade, the marked reduction in deforestation did not halt the remarkable growth of Brazilian agriculture in the global scenario (even more so if we take in account that this growth did not happen in the Amazon region). Anyway, the political representatives of the agribusiness sector have significant power in the National Congress. They are leading — with the support of the conservative parties and also of some parties and politicians from the left of the political spectrum, including members of the governing centre-leftist coalition — an immediate attempt to change the forest code and to reduce the strength of the current forest policies. But this would not be easy. Even though this effort has already achieved some important partial victories in the National Congress, the counter-reaction in defence of the forests has been increasing strongly in Brazilian society. The final outcomes of this political fight are still unclear. The same can be said of the ultimate position that the federal government will take in relation to the concrete results of the anti-environmental legislative moves. President Dilma ROUSSEFF made a public commitment to veto any changes in the law that could produce an increase in the deforestation process. But her position is not easy, considering the current economic and political force of Brazilian agribusiness. In any case, any future major changes in the political coalition ruling the country could also change the positive picture described in this article.

But there are clear signals that a new environmental paradigm has been gaining impetus in Brazilian political culture. Let’s take a look at the woman who created the system of deforestation reduction that has been in place since 2004. President LULA’s Minister for the Environment, Marina SILVA, is an interesting figure. Illiterate until she was sixteen, she grew up in the Amazon forest, where she experienced at close hand the struggle of Chico MENDES and the rubber tappers; later, she was elected and re-elected to the Brazilian senate. As Minister for the Environment, she was responsible for creating the system of monitoring the Amazon forest that helped to produce the impressive results discussed here. In 2009, she resigned from the government and as one of the main leaders of the Workers Party in order to join the small Brazilian Green Party, and she has since proposed an even more extensive system of environmental management and a new vision of sustainable development for the country as a whole. In the presidential elections held in October 2010, SILVA got around twenty million votes:

almost 20% of the total vote. Even though this was not enough to win her the presidency, it indicates the widespread support for new environmental policies. The centre-leftist coalition in power, including the new president—sometimes accused of not being environmentally sensitive—did take into account the remarkable support for Marina's message and reinforce its formal commitment to environmentally sound policies.

The support for a new environmental direction is not just widespread, it is growing. It will not be so easy to destroy the conservation measures that have been brought in up to now. But, looking to the future, we need to move on from focusing the debate around conservation, and move towards implementing an ecological paradigm of development for all the parts of the country, including the restoration of the lands that have been left degraded as a result of deforestation. It's not just about the Amazon, but about the Atlantic forest, the Cerrado and the other biomes, parts of which can be recovered in a move that would combine economic and social benefits with environmental services. In the twenty-first century, when talking about sustainability, it will not be enough simply to conserve or preserve: we need to move to restore, as far as possible, the health and ecological balance of rivers, bays, lands, of all the areas which were degraded in the course of the last centuries. Environmental history will be essential to this change. In moving forward, we will need many a backward glance.

References

- COOK, N. D.: *Born to Die. Disease and New World Conquest*. Cambridge: Cambridge University Press 1998
- CORREA, M. S.: *Itatiaia, o Caminho das Pedras*. Rio de Janeiro: Metalivros 2003
- DEAN, W.: *Brazil and the Struggle for Rubber*. New York: Cambridge University Press 1987
- DEAN, W.: *With Broadax and Firebrand. The Destruction of the Brazilian Atlantic Forest*. Berkeley: University of California Press 1995
- DRUMMOND, J.: *The Garden in the Machine. An Environmental History of Brazil's Tijuca Forest*. *Environmental History* 1/1, 83–104 (1996)
- DRUMMOND, J., FRANCO, J. L., and OLIVEIRA, D.: *Uma Análise sobre a História e a Situação das Unidades de Conservação no Brasil*. In: GANEM, R. (Org.): *Conservação da Biodiversidade – Legislação e Políticas Públicas*. Brasília: Edições Câmara dos Deputados 2011
- Fundação SOS Mata Atlântica* (Instituto Nacional de Pesquisas Espaciais): *Atlas dos Remanescentes Florestais da Mata Atlântica. Período 2008–2010*. São Paulo 2010
- HECHT, S., and COCKBURN, A.: *The Fate of The Forest. Developers, Destroyers and Defenders of the Amazon*. Chicago: Chicago University Press 2010
- HOCHSTETLER, K., and KECK, M.: *Greening Brazil. Environmental Activism in State and Society*. Durham: Duke University Press 2007
- JENKINS, N., and JOPPA, L.: *Expansion of the global terrestrial protected area system*. *Conservation Biology* 14/2/10 (2009)
- PADUA, J. A.: *The birth of green politics in Brazil. Exogenous and endogenous factors*. In: RUDIG, W. (Ed.): *Green Politics II*; pp. 134–155. Edinburgh: Edinburgh University Press 1992
- PADUA, J. A.: *Biosphere, history and conjuncture in the analysis of the Amazon problem*. In: REDCLIFT, M., and WOODGATE, G. (Eds.): *The International Handbook of Environmental Sociology*. London: Edward Elgar 1997
- PADUA, J. A.: *Um Sopro de Destruição. Pensamento Político e Crítica Ambiental no Brasil Escravista (1786–1888)*. Rio de Janeiro: Jorge Zahar Editor 2002
- PADUA, J. A.: *European colonialism and tropical forest destruction in Brazil*. In: PADUA, J. A., MCNEILL, J. R., and RANGARAJAN, M. (Eds.): *Environmental History. As If Nature Existed*. New Delhi: Oxford University Press 2010

- PETRONE, P.: Povoamento e colonização. In: AZEVEDO, A. DE (Ed.): Brasil: a Terra e o Homem. São Paulo: Editora Nacional 1965
- TORRE, W.: Almanaque Habitat. São Paulo: Comdesenho 2010
- TRIVED, M., MITCHELL, A., MARDAS, N., PARKER, C., WATSON, J., and NOBRE, A.: REDD and PINC. A New Policy Framework to Fund Tropical Forests as Global "Eco-Utilities." IOP Conference Series: Earth and Environmental Science 8/1, doi:10.1088/1755-1315/8/1/012005 (2005)

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History and Future of Water in South Asia: A Preliminary Probe

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Abstract

In his article about the history of water in south-east Asia, Ranjan CHAKRABARTI argues that the cultural, social, and political dimensions of the water economy have been insufficiently historicised until now. The meanings people attribute to water (for example, purity or change) can only be understood against the background of cultural context and historical development. Water systems and water economies arose in close conjunction with material, religious, and cultural conditions. The technocratic idea of water as a static resource rather than as part of a cycle affects both exploitation and sustainability. Above all, the changes in water supply due to global climate change (snow melt in the Himalayas, the rising sea level) must become a central focus in the environmental history of south-east Asia.

Zusammenfassung

In seinem Beitrag über Wasser in Südostasien argumentiert Ranjan CHAKRABARTI, dass die kulturelle, soziale und politische Dimension von Wasserwirtschaft bislang zu wenig historisiert wurde. Die Bedeutung, die Menschen dem Wasser zuschreiben (z. B. Reinheit oder Veränderung), könne nur auf der Folie kultureller Vorgaben und historischer Entwicklungen verstanden werden. Wassersysteme und Wasserwirtschaft seien in enger Abhängigkeit von materiellen, religiösen und kulturellen Prämissen entstanden. Die technokratische Vorstellung von Wasser als statische Ressource und nicht als Teil eines Kreislaufs habe Auswirkungen auf Ausbeutung und Nachhaltigkeit. Vor allem die Veränderung des Wasserhaushalts aufgrund globaler Klimaveränderungen (Schneeschnmelze im Himalaya, Anstieg des Meeresspiegels) müsse zu einem zentralen Thema der Umweltgeschichte Südasiens werden.

1. Introduction

The present essay offers an outline of the history of water and the contemporary issues and challenges that confront both nations and communities of South Asia, particularly India. Here, control over water has traditionally been a sign of social and political power. This chapter explores the adequacy of the competing and/or complementary explanations for the worrisome challenges of water management in one of the most densely populated parts of the world with a long history and a rich tradition of profound understanding of the value of water. Why do we need another paper on the history of water at this point in time? It is necessary as ground water levels are falling fast everywhere in South Asia and China and certain important political and social problems of global and local magnitude are increasingly unfolding as a result of this resource crunch. There is no dearth of publications on water and water-related issues in recent times; indeed, the literature on water is expanding at a great pace.¹ However,

¹ The recent scholarship on water, gender, environment and power is fast expanding. (Cf. LAHIRI-DUTT and WASSON 2008, LAHIRI-DUTT 2006, MOSSE 2003, DONAHUE and JOHNSTON 1998, MILLER 2001). At present there are

there has been very little attempt to historicise some of the crucial social, cultural or political issues connected with water in the context of Asian history. The present essay seeks to address some of these issues, which are somewhat neglected in the literature relating to water history. The article is divided into two broad sections. The opening section reviews some of the broader questions and facts related to water history and the currently unfolding water crunch in South Asia. The second segment of the essay unveils how the age-old concern for water in South Asia has always been intimately tied up with a remarkable cultural consciousness about climate and climate change. As a whole, the essay insists on the need to open up a new debate as to the historical link between water and climate and draws attention to a hitherto neglected area of historical research.

2. Historicising the Water Crisis

Water is a unique resource, appearing in different forms and shaping all physical and biological processes. Known for its changeability and celebrated for shape-shifting and taking new forms, water also plays an extraordinary role in social and cultural representations, and these values and norms are reflected in the ways water is perceived, used, governed and treated. Water is commonly seen only as a part of the physical environment and of biology, and is studied by tracking the pathways of the hydrological cycle and its role. Water history enhances our understanding of the nexus between the human and physical worlds within specific temporal and spatial settings. Water is always a symbol of social, economic, and political relationships—a barometer of the extent to which identity, power, and resources are shared. In recent times, we have witnessed a growing concern over water. The current environmental agenda, including the questions associated with climate change, are related to the question of sustainable management of water. Concern for water has been constant in past human societies. One of the earliest, if not the earliest, textually documented wars was fought between the Mesopotamian city states of Lagash and Umma over a canal and its associated irrigated fields (COOPER 1983, WINTER 2010).

Groundwater levels are falling throughout northern China. In India, they are dropping one to three metres (three to ten feet) per year. They are declining in most states, including the Punjab, the country's breadbasket. In the US, water levels are falling throughout the south and southwest. With one thousand tons of water required to produce one ton of grain, food scarcity is closely tied to water scarcity. 70 % of world water use is for irrigation, 20 % is used by industry and 10 % is for residential use. As urban consumption of water is on the rise, farmers are faced with a dwindling share of a lessening water supply (BROWN 2004).

China is facing an acute water shortage in current times. Since 2009, the news relating to the ongoing construction of Chinese dams in Brahmaputra has featured markedly in both print and television media. Most of the reports mention that China is planning to sort out its water crisis by diverting some of the Brahmaputra's water towards the eastern region. The Brahmaputra River is very important for both India and Bangladesh. This cross-border water resource issue may escalate into a conflict involving India, China and Pakistan in the long run.

several journals including *Water History*—the official journal of the International Water History Association—which address various issues relating to water and its historical interactions with humans. Out of a huge literature on water only a few examples have been mentioned.

The river is vital to northeastern India and Bangladesh, providing clean water and fertile silt for farming.² Agriculture in this part of the world is heavily dependent on traditional “overflow irrigation.”³

Yet water, whether or not it is manipulated by human agency, is not necessarily beneficial. Widespread flooding can be devastating, as the Asian tsunami and the flooding of New Orleans have proved once more. Hurricane Katrina has two predecessors almost equal in magnitude, the Mississippi floods of 1927 and 1937; events that feature prominently in American history and in important works in the written history of the global environment (GROVE and DAMODARAN 2006). Again, the east coast of India is particularly exposed to severe tropical cyclonic storms that bring high tidal waves and floods in the Indian and Bangladesh Sundarbans. Many instances of water as calamity can be found in history.

Humans attribute a variety of meanings to water, and this differs according to culture and time. Water is widely connected with concepts such as purity and change. Classic examples are the preference of Hindu people to die near the river Ganges and have their ashes put in the river, the ritual of baptism which symbolises the conversion to Christianity, and the body washing of Muslims to cleanse themselves before praying. The combination of material, cultural, and religious uses and meanings of water has shaped water systems and has emphasised the intrinsic proximity and hybridity of the natural and human worlds.

In addition to its physical properties, the movement of water through the larger hydrological cycle (and, through that, the global energy cycle as well) adds a unique chronological element. Water in its different forms is in steady motion through time and space—it evaporates from the oceans, falls to the ground, is absorbed into the soil or stored in frozen icecaps, and eventually returns to the oceans. The timescale for each droplet of water can differ greatly. Groundwater can be thousands of years old. The water we experience today has most likely come into contact with humans before (SHIVA 1991). The recent state of research on water confirms that water history has developed into a vibrant historical subfield—one that incorporates and contributes to environmental history, urban history, and the history of technology and landscape.

At the beginning of the twentieth century, a substantial percentage of scientists believed that the global climate had been essentially constant over at least five thousand years. In the next hundred years, this assumption collapsed. The possible effects of past climatic shifts on human activities are yet to be explored. Historians paid little attention to this aspect until the 1950s and 1960s. A number of historians, notably Fernand BRAUDEL (1995) and Emmanuel LE ROY LADURIE (1966), showed some willingness to pay serious attention to the possible effects of climatic change in historical situations (NAG Forthcoming). In a subsequent article, the “History of Rain and Fine Weather,” the *Annales* historian LE ROY LADURIE (1988) stated that “the aim of climatic history is not to explain human history nor to offer simplistic accounts of this or that remarkable episode, not even when such episodes prompt us with good

2 The Brahmaputra river basin in India has a fabulous water wealth that accounts for nearly 30% of the water resources and about 40% of the total hydropower potential of the country (cf. SENGUPTA et al. 2006).

3 Radhakamal MUKHERJEE and others attributed Bengal’s social ecology to “overflow irrigation,” which once nourished Bengal’s agricultural prosperity, and held the colonial policy of construction of railroad and roadway embankments as the root cause of the decline of this prosperity. The decline of Bengal’s economy has also been ascribed to the eastward shift of the Ganges. However, “overflow irrigation” still remains the main basis/support of agriculture in modern northeastern India and Bangladesh (MUKHERJI 1938, MAJUMDER 2001). The collapse of Bengal’s prosperity in the eighteenth and especially in the nineteenth centuries came as the result of significant interference with the delta’s ecology. Central and western Bengal were especially hard hit. Murshidabad and especially Burdwan were impoverished and turned into malaria stricken tracts (see EATON 1994, IQBAL 2010).

reason to reflect upon the great disasters of history [...] (these are merely) spin-offs of the history of climate.” LE ROY LADURIE was concerned only with producing a picture of the changing meteorological patterns of the past ages.

Like any valuable asset, the global water cycle delivers a steady stream of benefits to society. Rivers, lakes, and other freshwater ecosystems work in concert with forests, grasslands, and other landscapes to provide goods and services of great importance to human society. The nature and value of these services can remain grossly underappreciated, however, until they are all destroyed or gone (POSTEL 2006).

Today, human beings are tempted to think that their globalised and technologically sophisticated world is immune to harm from deteriorating natural systems. But there is no side-stepping human dependence on the water cycle. More than 99% of the world’s irrigation, industrial, and household water supplies comes directly from rivers, lakes, and aquifers. Wetlands and river floodplains protect people from floods, provide spawning habitat for fish, recharge groundwater supplies, renew soil fertility, and purify water of contaminants (POSTEL 2006).

3. South Asia

In South Asia, water is at the heart of politics between the nations as they increasingly face the challenge of meeting the growing needs of their populations. Within nations, the disputes and conflicts over the control of flowing waters are evidence of the increasing demand for water. The relationship between water and society is significant. It is a complex historical and sociological problem, and the keystone on which social theories of civilisation and state, community and collective action rest. Social and political organisations have been directly influenced by the ecology of water flow throughout the ages. Water resources of all kinds are never simply there, but are produced, used, and given meaning by shifting social and political relationships. As MARX understood, the natural world is always “humanised nature,” providing a visible proof of the labour and history that shaped it. This is the view of David MOSSE (2003), as expressed in one of the important contributions to the history of water in South Asia. MOSSE argues for the fundamental importance of systems of water control to Tamil social and cultural life. Before MOSSE, the focus was primarily on irrigation and its economic importance. Water flows have not only shaped social and political institutions, they have also legitimised them. MOSSE shows how medieval kings and chiefs exercised their power on the water flows they had dominion over, creating landscapes which inscribed their power into the hydrology and thus naturalised it. He cites the example of a Maravar King throwing flowers into the flowing water of a channel he had dug, and using their passage to resolve an inter-village conflict over water rights by disclosing the water’s natural flow—political rule was naturalised into the drainage (MOSSE 2003). It is high time to open up the frontier of a hybrid history of water and society. This will be a turning away from the dominant model of the economic history of irrigation towards a new kind of ethno-history or socio-cultural history of water.

Rivers and water resources have been central to the prosperity and survival of human civilisation in South Asia. Environmental science has established that water has a very complex relationship with soils, plants, and human needs. Indian cultural heritage also endorses this. Resource-insensitive utilisation of water may lead to the rapid disruption of the essential ecological processes that recharge and renew water resources and make them available perennially for the generation of plant, animal, and human life. Modern water management

in capitalist economies looks upon water as a stock to be tapped. Such an approach to water resource management, viewing water as a static resource and not as part of the water cycle, leads to a misconception that water resources can be augmented through large man-made structures. However, water resources cannot be created. They can be stored, diverted, used, and polluted, but their overall availability cannot be enhanced (SHIVA 1991).⁴ The ecological understanding of water thus involves the following:

- An understanding of the relationship between water and other elements of the ecosystem.
- An understanding of the limits on water use enforced by the water cycle (SHIVA 1991).

Climate history calls for an in-depth understanding of the inner connections between water resources on the one hand, and deforestation, rainfall, soil erosion, climatic change, global warming, drought, famine, and various natural calamities on the other.

Since 1970, the earth's average temperature has risen by 0.8 °C, or nearly 1.4 °F. During this time span, the rise in temperature each decade was greater than in the preceding one. Meteorologists note that the twenty-two warmest years on record have come since 1980. And the six warmest years since recordkeeping began in 1880 have come in the last eight years. Three of these six—2002, 2003, and 2005—were years in which major food-producing regions saw their crop yield decrease in the face of record temperatures (BROWN 2004).

Snow/ice masses in mountains are nature's freshwater reservoirs—a way of feeding rivers during the waterless season. Now, they are being threatened by the rise in temperature. Even a one-degree increase in temperature in mountainous regions can notably reduce the share of precipitation falling as snow, causing it to fall as rain instead. This, in turn, increases flooding during the rainy season and reduces the snowmelt to provide rivers during the dry season (BROWN 2004).

Reduced snow, and therefore reduced water feeding the Yellow River flow, will reduce China's wheat harvest, the largest in the world. India's wheat harvest, second only to China's, will be affected by the flow of both the Indus and the Ganges. The shrinking of glaciers in the Himalayas could affect the water supply for hundreds of millions of people. In countries like India and China, the water stored during the rainy season as snow and ice for discharge in the desiccated season would be reduced. There are many more mountain ranges where snow or ice patterns are changing, including the Alps and the Andes. If we continue to raise the earth's temperature, we risk losing these reservoirs in the sky on which great cities and farmers depend (BROWN 2004).

4 Vandana SHIVA has drawn our attention to the negative effects of the engineering bias in water management. It fails to perceive the natural river flows as critical to drainage, to recharge of groundwater, to the maintenance of the balance between fresh water and sea water. The engineering bias in water use results in large projects, which produce serious ecological instabilities and generate conflicts. The Gangetic delta covers a huge area in Bengal. The delta has been formed by the action of three great rivers, the Ganges, Brahmaputra, and Meghna. The Ganges in particular has remarkable social, cultural, and economic significance. Writing in the last quarter of the eighteenth century (1786–1788), Ghulam Hussain SALIM, the author of *Riyazu-S-Salatin*, New Delhi, 1975 (translated by Abdus SAMAD), commented: "Hindus have described volumes on the sanctity of this river. Considering the water sacred they fancy that bathing there washes the sins of a lifetime, especially bathing at certain ghats, like Benaras, Allahabad, Hardwar. The rich among the Hindus bring the water of the Ganges from long distance, take particular care of it, and on auspicious days, worship it. The truth of the matter is, that the water of the Ganges, in sweetness, lightness and tasteness has no equal, and the water of this river, however long kept, does not stink."

Global high temperature and melting glaciers may lead to rising seas and wash away human settlements across the world. But rising seas are not the only threat that comes with elevated global temperatures. Higher surface water temperatures in the tropical oceans mean more water radiating into the atmosphere to drive tropical storm systems, leading to more frequent and more destructive storms. Cyclones, storms, and erratic weather are making considerable headway all over the world in recent years. The recent trends suggest that the regions most vulnerable to more powerful storms in Asia are East and Southeast Asia, including the Philippines, Taiwan, Japan, China, and Vietnam, which are likely to bear the brunt of the powerful storms crossing the Pacific. Further west, the Bay of Bengal, the east coast of India, and Bangladesh are particularly vulnerable. The east coast of India is particularly exposed to severe tropical cyclonic storms that bring high tidal waves and floods in the Indian and Bangladeshi Sundarbans. The monsoon in this part of the world consists of a series of cyclonic depressions, which follow each other in more or less close succession up the Bay of Bengal. The late October cyclones are examples of the most intense tropical storms. Such cyclonic storms resulted in the frequent flooding of this region in 1909 and again in 1919. The cyclone of 1919 features prominently in the forestry department records (CHAKRABARTI 2001).⁵

The modern world has extensive experience with political and economic refugees. We are now seeing a swelling flow of refugees driven from their homes by environmental pressures. It has been suggested by experts that the largest potential displacement may come in low-lying Bangladesh, where even a one-metre rise in sea level would not only inundate half of the country's rice land, but would also force the relocation of forty million people. In a densely populated country of 142 million people, internal relocation would not be easy, and the country worst affected by displacement would be neighbouring India (BROWN 2005). A similar scenario may result in cases of more intense cyclones in densely populated regions all over the world.

Climatic changes through a *longue durée* period and their impact on the rise or decline of civilisations are now worth investigating. Rising or falling temperatures, monsoon behaviour, melting of snow on the mountains, rising sea levels, and more powerful storms and cyclones may have a message to convey regarding human interaction with the natural world. In South Asia in particular, climate has been central to the growth or prosperity of human civilisations. It was crucial to rice production and settled agriculture. Consider the images of gods like Indra or Varuna, who are supposed to be in control of rain, water or climate. We are also aware how the change of climate and decline of monsoon in northwestern India possibly led to the fall of the Indus Valley civilisation. Recent research suggests that drought, rising temperatures, and desertification led to its collapse (CHAKRABARTI 2006). A group of scientists at IIT Kharagpur and fellow American scientists have analysed monsoon behaviour in South Asia over thousands of years through geological studies and connected it to archaeological findings. They say that changes in the Indian monsoon over the past ten thousand years may explain the spread of agriculture in South Asia as well as the rise and fall of the Harappan civilisation (*The Telegraph*, 30 April, 2006). Again, in different periods of Indian history we have references to rulers and Kings granting the exemption of land revenue to peasants hit by severe drought. Human societies had found ways to adapt to the hydrological regimes and

5 The colonial authorities attributed the increase in the number of men killed by tigers in 1919 to the cyclone and the tidal wave which made the tiger's natural food scarce. Instances of such cyclones are numerous in the official papers of colonial and post-colonial India. South Asian cyclones now await their historians.

processes in South Asia—the variabilities, scarcities, and excesses that occur over space and between seasons (CHAKRABARTI 2006).

The remarkable concern in Indian society for water or water bodies and rainfall pattern continued during the Mughal period. Societies in South Asia discovered ways to adapt to hydrological regimes and processes which varied over regions and between seasons. They also created complex institutional systems of water management, some of which continue even today (LAHIRI-DUTT and WASSON 2008). In Mughal Bengal, an independent department with a separate budget, the *pulbandi daftar* (public works department also known as *pushta-bandi*), was set up by the Mughal provincial government to supervise embankments, roads, bridges, and river dredging. In dry Balochistan, for example, people made the best use of available water for irrigation through the *khuskaba* (dry farming with direct use of rainwater) and *sailaba* (flood irrigation from runoff) systems of water management. In the mountainous areas in the north and northwest, where rapidly flowing natural streams run downhill to supply daily household needs, irrigation systems such as those through *kuhls*—small, often lengthy, leaky channels—are usually constructed and maintained by the farmers collectively under a cooperative system (LAHIRI-DUTT and WASSON 2008). The tank system in south India and Sri Lanka served for hundreds of years as effective insurance against droughts, providing irrigation water and flood protection. Some of these structures of water management and the institutions that developed around the structures, after surviving for thousands of years, are now at threat from ill-defined ownership and user rights with ever-increasing demands. At times of scarcity, i.e. droughts, or surplus water, i.e. inundations, victims are invariably divided along lines of class and gender, the poor being affected first and hit hardest, turning them into “environmental refugees.” For example, in Bangladesh, where poor water quality affects entire communities, women from poorer communities suffer more than men, reflecting an unequal power balance (LAHIRI-DUTT and WASSON 2008).

Ancient India made an important contribution to science. In ancient India, religion and science were linked. Astronomy and astrology made progress because the planets came to be regarded as gods, and their movements began to be closely observed (SHARMA 1990, CHATTOPADHYAY 1991). I will argue that the study of astronomy and astrology in ancient India became imperative because of their connection with changes in seasons and weather conditions necessary for agricultural activities. Two of the most notable scholars of astronomy were ARYABHATTA (fifth century) and VARAHMIHIRA (sixth century). ARYABHATTA discovered the causes of the lunar and solar eclipse. He concluded that the sun is stationary and the earth rotates. It would be plausible to argue that even the progress of mathematics in India was prompted by the need to understand climate behaviours (SHARMA 1990, CHATTOPADHYAY 1991, SHARMA 2004). The construction of large-scale hydraulic structures has come to be synonymous with development in today’s South Asia. They are used, rarely, for flood control and also for hydropower production, although their contribution to the total electricity supply is not key. Rainwater harvesting, watershed development, traditional irrigation systems, small hydel projects or low and temporary embankments for dealing with floods are some of the traditional principles and techniques of water resource management that continue in some form or other. One central topic intimately connected with the issue of water management and governmentality in South Asia is the question of water ownership. This question is posed on different planes: between the state and communities in general, between the central government and respective states and between local and state governments. In India water is a state subject, but the states and central governments continue to assert their rights over water

resources. Over the years, water resource development in India has come to be characterised by a multiplicity of bodies. This multiplicity of administrative bodies creates obstacles to the sustainable management of water and has also resulted in contradictory and conflicting claims on water (LAHIRI-DUTT and WASSON 2008).

Richard GROVE has already shown the connections between drought in South Asia and the institutional responses to it and the beginnings of modern scientific understandings of the climatic teleconnections between global-scale tropical circulation and the strength of the Asian monsoon (GROVE 1995, GROVE and DAMODARAN 2006). In colonial India, repeated droughts and famine sparked off institutional innovations and a Famine Code. It also triggered a sharp debate among British officials about the connection between deforestation and rainfall change. It is necessary to historicise the debate in light of the pre-colonial traditional perceptions of climate as it existed in India and South Asia. This may not be very well documented, but we must understand that there are scattered and indirect references to climate and rainfall, patterns of tropical monsoon and cyclonic depressions (which are important to quantify the available water resources and their historical role), in many ancient and medieval texts such as the *Mahabharata* and the *Ramayana*, Chinese accounts and the writings of Mughal court historians. The ancient Greek sources relating to ALEXANDER's invasion may be of some help, too. Cultural representations of natural calamities or climate as found in literature or various visual arts are also worth investigating. It is high time to embark on the project of constructing a comprehensive history of water and climate in South Asia.

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References

- BRAUDEL, F.: *The Mediterranean and the Mediterranean World in the Age of Phillip II*. 2 Vols., Berkeley, Los Angeles: University of California Press 1995
- BROWN, L.: *Outgrowing the Earth*. New York, London: W W Norton & Company 2004
- BROWN, L.: *Plan B 2.0. Rescuing a Planet Under Stress and a Civilization in Trouble*. Hyderabad: Orient Longman 2005
- CHAKRABARTI, R.: *Tiger and the Raj. Ordering the man-eater of the Sundarbans 1880–1947*. In: CHAKRABARTI, R. (Ed.): *Space and Power in History. Images, Ideologies, Myths and Moralities*; pp. 66–80. Kolkata: Penman 2001
- CHAKRABARTI, R. (Ed.): *Does Environmental History Matter? Shikar, Subsistence, Sustenance and the Sciences*. Kolkata: Readers Service 2006
- CHATTOPADHYAY, D.: *History of Science and Technology in Ancient India*. Calcutta: Firma KLM 1991
- COOPER, J. S.: *Reconstructing History From Ancient Sources. The Lagash-Umma Border Conflict*. Malibu: Undena 1983
- DONAHUE, J., and JOHNSTON, B. R. (Eds.): *Water, Culture and Power. Local Struggle in a Global Context*. Washington DC: Island Press 1998
- EATON, R. M.: *The Rise of Islam and the Bengal Frontier 1204–1760*. New Delhi: Oxford University Press 1994
- GROVE, R.: *Green Imperialism. Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism*. Cambridge: Cambridge University Press 1995

- GROVE, R., and DAMODARAN, V.: Imperialism and environmental change, unearthing the origins and evolution of global environmental history from Edmond Halley to John Richards, 1676–2000. In: CHAKRABARTI, R. (Ed.): Does Environmental History Matter? Shikar, Subsistence, Sustenance and the Sciences; pp. 1–34. Kolkata: Readers Service 2006
- IQBAL, I.: The Bengal Delta. Ecology, State and Social Change, 1840–1943. London: Palgrave 2010
- LAHIRI-DUTT, K. (Ed.): Fluid Bond. Views on Gender and Water. Kolkata: Stree 2006
- LAHIRI-DUTT, K., and WASSON, R. J.: Water First. Issues and Challenges for Nations and Communities in South Asia. New Delhi: Sage 2008
- LE ROY LADURIE, E.: History of rain and fine weather. In: AYMARD, M., and MUKHIA, H. (Eds.): The Inheritance. Vol. 1 of French Studies in History. New Dehli: Orient Longman 1988
- LE ROY LADURIE, E.: Times of Feast, Times of Famine. A History of Climate Since the Year 1000. Paris: Persée 1966
- MAJUMDER, S. C.: Rivers of Bengal Delta. Kolkata: Government of West Bengal 2001
- MILLER, C.: Fluid Power. Local Struggle in a Global Context. Washington DC: Island Press 1998
- MOSSE, D.: The Rule of Water. Statecraft, Ecology, and Collective Action in South India. New Delhi: Oxford University Press 2003
- MUKHERJI, R.: The Changing Face of Bengal. Kolkata: Calcutta University 1938
- NAG, S.: 'Rain, rain do not go away'. History of rainfall. Deforestation and water scarcity in Cherrapunji, the wettest spot in the globe. In: CHAKRABARTI, R. (Ed.): History of Waters in South Asia. (Forthcoming)
- POSTEL, S.: Safeguarding Freshwater Ecosystems, State of the World 2006. A Worldwatch Institute Report on Progress toward a Sustainable Society. New York, London: Worldwatch Institute 2006
- SENGUPTA, S. (Ed.): Rivers and Riverine Landscape in Northeastern India. New Delhi: Concept 2006
- SHARMA, P. D.: Hindu Astronomy. Delhi: Global Vision 2004
- SHARMA, R. S.: Ancient India. Delhi: Oxford University Press 1990
- SHIVA, V.: Ecology and the Politics of Survival. London: Sage 1991
- The Telegraph*, 30 April, Kolkata, 2006, pp. 1
- TEMPELHOFF, J., HOAG, H., ERTSEN, M., ARNOLD, E., BENDER, M., BERRY, K., FORT, C., PIETZ, D., MUSEMWA, M., NAKAWO, M., UR, J., VAN DAM, P., MELOSI, M., WINIWARTER, V., and WILKINSON, T.: Where has water come from? *Water History* 1, 1–8 (2009)
- WINTER, I. J.: On the Art in the Ancient Near East. Vol. 2. Leiden, Boston: Brill 2010

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Der Begriff der Natur
Wandlungen unseres Naturverständnisses und seine Folgen
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Das Verhältnis des Menschen zur „Natur“ ist in seiner Geschichte durch unterschiedliche Beziehungen geprägt. Seit der Aufklärung wird die Natur dem Menschen zu seiner Nutzung untergeordnet und zunehmend ausgebeutet. Natur wurde zum Objekt technischen, ökonomischen und politischen Handelns. Spätestens seit Mitte des vorigen Jahrhunderts wissen wir um die akute Gefährdung natürlicher Lebensräume.

Die Gaterslebener Begegnung 2009 widmete sich daher dem Thema „Der Begriff der Natur“ und untersuchte Wandlungen des Naturverständnisses sowie die Folgen der gegenwärtigen Auffassungen von Natur. Behandelt werden unser Bild vom Leben, die Frage „Was ist Natur?“ aus verschiedenen Perspektiven und die philosophische Analyse der Stellung des Menschen in der Natur. Beiträge zum Naturverständnis in der Gegenwartskunst und zum Problemkomplex Naturrecht und Bioethik sowie eine Diskussion „Frieden mit der Natur“ ergänzen den Band.

Virgin Lands Divided by an Ocean: The Fate of Grasslands in the Northern Hemisphere¹

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Translated and annotated by David MOON (York)

Abstract

This article by the geographers Sergei CHIBILEV and Sergei LEVYKIN as seen in this version, translated and annotated by David MOON, assumes a number of parallels between cultivation and exploitation of the Russian steppes and the North American prairie, both past and current. The intense cultivation of the originally fallow expanse of land led to the first global ecological crisis in the nineteenth and twentieth centuries. While the productivity of American soil has reached a limit, there are still enormous fallow regions in Russia. The ploughing of the steppe during the Soviet era was extremely destructive; now the challenge is to increase their productivity whilst maintaining the ecosystem of the steppe.

Zusammenfassung

Die von David MOON übersetzte und kommentierte Fassung eines Artikels der russischen Geographen Sergei CHIBILEV und Sergei LEVYKIN geht davon aus, dass es zahlreiche Parallelen in Kultivierung und Ausbeutung der russischen Steppen und der Prärie in Nordamerika gab und gibt. Die intensive Bewirtschaftung der ursprünglich brachliegenden Großregionen führte im 19. und 20. Jahrhundert zur ersten globalen ökologischen Krise. Während die Produktivität der Böden in den USA eine Grenze erreicht hat, gibt es in Russland, wo das Umpflügen der Steppe in sowjetischer Zeit extrem destruktiv war, noch große brachliegende Flächen, deren Produktivität bei gleichzeitiger Bewahrung des Ökosystems Steppe noch gesteigert werden kann.

1. Introduction

When studying the history of agriculture in the northern hemisphere, it is striking that the steppes of Russia and the prairies of North America were opened up for cultivation at the same time. The practically simultaneous barbaric and disordered ploughing up of the steppes and prairies and the destruction of the trees and shrubs in the two regions, had by the turn of the twentieth century created the conditions for the first global ecological crisis caused by wholesale ploughing up of virgin land. As the crisis approached, it gave rise in Russia to the new scientific discipline of the management of natural resources in the steppes. It was pioneered by Vasilii DOKUCHAEV (1846–1903) and developed by his many students (EVTUHOV 2006). In America, the ecological crisis caused by the continued ploughing up of the Great Plains reached its peak in the 1930s. The dust storms that blew across the region are well

¹ This is a revised, updated and greatly expanded version of an article that first appeared as CHIBILEV and LEVYKIN 1998; a translation of the original article was published as CHIBILEV and LEVYKIN 2000.

known even to people who know little about ecology. The crisis caused a fundamental shift in the attitude of Americans to the prairies, leading to the idea of restoring the prairies, which was similar to ideas devised earlier in Russia. Two decades later in the Soviet Union, however, the sad experience of the American grasslands was ignored and virgin lands were ploughed up during KHRUSHCHEV's Virgin Lands Campaign of 1954–1964, culminating in an ecological crisis on at least the same scale as in the United States in the 1930s. The harmful social and economic—as well as ecological—consequences of the crisis caused by ploughing up the virgin lands are still being felt today. The United States borrowed from Russia the scientific basis for rational use of resources in grasslands, which, to a certain extent, assisted them in building the most advanced agriculture in the world and beating their competitors in the world market. On the other hand, the Soviet Union followed the American example of ploughing up huge areas of land in a short space of time, which led not only to an ecological crisis, but to dependence on imported agricultural produce.

2. Parallel Histories

2.1 North America

The settlement of the American prairies is a classic example of reckless and rapacious human attitudes to nature. On the other hand, the American experience illustrates how timely and decisive actions on a nationwide scale, based on principles of rational land use, could in a short space of time change the situation for the better. The opening up of the Great Plains had very important consequences for the development of the United States and the shaping of the American nation. The agricultural settlement of the region, situated in the centre of the continent, took place in several stages: In the first stage, the pioneers exterminated over one hundred million head of wild, grazing animals—bison and pronghorn antelopes—and defeated the Plains Indians. They were forced off their land and onto reservations. The construction of transcontinental railway lines speeded up the process of settlement. Thus, the stage was set for the development of settled agriculture on the prairies and Great Plains. The next stage, from 1880 to 1910, saw the opening up of the region of the tall grass prairie, which has an average annual precipitation of 600–700 mm. Based on private ownership of land under the Homestead Act of 1862, American farmers created the famous wheat and corn belts of America. This enabled America to become, in time, the world leader in agricultural production (SHEROW 2007).

The First World War (1914–1918) caused a sharp increase in grain prices. The need to feed the armies of the Allies and then the United States' own army led to the ploughing up of sixteen million hectares of short-grass prairie, which has a more arid climate. At this point the rapacious ploughing up of the soil in the United States reached its apogee. The ecological balance of the prairies was destroyed and the great drought began. Livestock overgrazed the pastures, eating the grasses down to the roots, while deep ploughing completely destroyed the structure of the soil. The result was dust storms on a scale not seen before in the country's history that raged over the Great Plains in the mid-1930s. The central states became known as the "Dust Bowl." Farmers were ruined and fled to the west, where they joined the ranks of the unemployed and unfortunate. Thus, the "Dust Bowl" exacerbated the social and economic crisis of the Depression in the United States. Thirty-six million hectares of land were affected

by the ecological disaster, the majority of which was rendered unsuitable for arable farming. Losses to the economy amounted to billions of dollars.²

So great was the natural disaster that it led to a revolution in American attitudes. The federal government launched a programme to repair the damage (*US Great Plains Committee* 1937, WHITE 1986), which was consistent with the conclusions reached earlier by Russian scientists working on the steppe region.³ Lands prone to erosion were taken out of cultivation and planted with grasses (HELMS 1990). Shelterbelts of trees were planted across the Great Plains.⁴ As a result, the Americans were able to restore the short-grass prairies with the help of phytomeliorative measures. Arable farming extends as far west only as the isohyet of four hundred millimetres of precipitation a year; the land to the west, the restored short-grass prairie—the equivalent of the dry steppe in Eurasia—has been used mostly as pasture for around twenty-five million head of cattle. Young beef cattle are brought from the eastern states, where spring and summer pastures are in short supply, and graze on the pastures into the autumn. In October, the cattle that have been fattened on the natural grasses are shipped back east, where they are slaughtered and the meat stored in large freezers. This system of organising beef production is justified both economically and ecologically; it means that it is not necessary to cultivate the soil each year or to gather hay and forage for winter fodder, thus conserving the biota of the prairie.

Good evidence for this is the growth in the numbers of American bison, which were once on the verge of extinction. The species was saved from dying out at the last moment by expedient action by the government of President Theodore ROOSEVELT and private initiatives, which presented the bison as part of the national heritage and also as an animal with commercial potential. As a result, bison have become commonplace in national parks and are raised for sale on ranches. This permits the most effective use of the carrying capacity of the pastures. Today, several hundred thousand wild bison once again roam on the immense short-grass prairies of the western United States. They migrate in the steps of their ancestors, albeit not on such a grandiose scale, in search of fodder (ISENBERG 2000, WOOD 2000). This contrasts with the experience on the Eurasian steppes, where its symbol—the wild horse—was not saved. The last tarpans perished in southern Ukraine in 1879 and 1882 (KEPPEN 1896), and the last wild Przewalskii's horses disappeared from their final refuge in northwestern Mongolia in the mid-twentieth century (BOYD and HOUPPT 1994). At the present time, a project to reintroduce Przewalskii's horses to the Orenburg region in Russia is under active discussion (see below).

2.2 *Russia*

The agricultural opening up of the black-earth steppe region of Russia began to take off at the start of the nineteenth century. By the mid-nineteenth century, this had enabled Russia to take the lead in the world grain market. The process intensified in the decades after the abolition of

2 The classic account, which stresses the role of human agency in causing the crisis, is WORSTER 2004. For a revisionist view that emphasises the role climatic factors, see CUNFER 2005, pp. 143–163.

3 There are striking similarities between the US government's policy in the wake of the "Dust Bowl" and proposals made by Vasilii DOKUCHAEV in the wake of the drought, harvest failure and famine of 1891–1892 in Russia. See DOKUCHAEV 1892. An abridged translation, but without the proposals, was published for the World's Columbian Exposition in Chicago in 1893: DOKUCHAEV 1893. In the 1920s, the US Department of Agriculture adopted the methodology of Russian soil science, devised by DOKUCHAEV in the 1870s and 1880s. See HELMS 2002, pp. 43–46; IARLOV 1947.

4 The shelterbelt programme was devised by Russian-born Raphael ZON and based on Russian experience and forestry science. See RUDOLF and GEVORKIANTZ 1935, pp. 59–76; NIXON 1957, vol. 1, pp. 200–203; DROZE 1977.

serfdom in 1861. By the early 1890s, however, the steppe region of Russia was experiencing a sharp decline in its social and economic situation and degradation of the soil cover as a result of frequent droughts and harvest failures. The main causes were the wholesale ploughing up of the region and the destruction of forests. The results were the growth of ravines, sand drifting over good arable land, and the erosion of the top soil.⁵

It was in this period that the new scientific discipline of the management of natural resources in the steppes emerged in Russia. The founders were the scientists: V. V. DOKUCHAEV, V. I. TALIEV, A. A. IZMAIL'SKII, P. A. KOSTYCHEV, K. A. TIMIRIAZEV, A. I. VOEIKOV, I. P. BORODIN, V. V. ALEKHIN, and D. N. PRIANISHNIKOV. They argued strongly against the total destruction of the steppe landscape. Academician I. P. BORODIN wrote: "Above all, we risk losing the steppe, the virgin steppe."⁶ V. V. DOKUCHAEV founded the famous "Kamennaia Steppe" scientific nature reserve, where he modelled processes of optimal use of the natural resources of the steppes. Initially, he set aside two hundred hectares of the most badly eroded land to allow the soil to recover. Even today, the Kamennaia Steppe is a cultural oasis in the black-earth region. It stands out from the surrounding farms with its bumper harvests. The Kamennaia Steppe has also preserved the biodiversity of the steppe (PARSHUTINA 2000). It was these ideas, pioneered by Russian scientists, that were later implemented across the ocean in the United States. In Russia, however, the First World War, Revolutions of 1917, Civil War of 1918–1921, and continued disorder meant that the problems of the destruction of the steppe landscape were ignored for decades. In the 1920s and 1930s, when the Soviet government was engaged in the "construction of a new society," the heritage of the teachings of the Dokuchaev school was used by the political leadership to formulate doctrines to subjugate nature.⁷

As a result of the extensive development of agriculture in the 1930s, the ploughing up of the steppe region of the European part of the Soviet Union reached its limits. The result was dust storms over the Sal'skii steppe in the south of the Rostov region. Nevertheless, plans were drawn up for the ploughing up of the steppes to the east. The implementation of the plans was postponed by the Second World War. After the war, agriculture in the European part of the country lay in ruins, culminating in the drought and famine of 1947 (ZIMA 1994, GANSON 2009). The situation compelled the country's leadership to turn to the classical works by Russian scientists on the steppes. On 20 October 1948, the Central Committee of the Communist Party and the Soviet government issued the decree "On a plan for planting shelterbelts of trees, introducing field-grass crop rotations, creating ponds and reservoirs, to ensure high and sustainable harvests in the steppe and forest-steppe regions of the European part of the USSR," which became known as the "Great Stalin Plan for the Transformation of Nature." It was based on research by the V. V. Dokuchaev Agricultural Institute of the Central Black Earth region. Work to fulfil the plan developed with great enthusiasm from the autumn of 1948. However, the plan to restore the ecology of the steppe zone was not completed. When the leadership of the Soviet Union changed after the death of STALIN in March 1953, government policy on agriculture changed completely. The field-grass system of crop rotation was criticised for not meeting the "economic interests of socialism," and was prohibited. In the

5 MOON 2005, pp. 149–174. There were also concerns about climate change: see MOON 2010, pp. 251–275.

6 For an analysis of the development of scientific study of the steppes in Russia, see CHIBILEV and GROSHEVA 2004.

7 For detailed analyses of nature protection in the Soviet Union see WEINER 1999, 2000, SHTILMARK 2003. For an alternative view see BRAIN 2010a.

spring of 1953, the shelterbelt stations and other scientific institutions engaged in afforestation and phytomelioration were closed down. Soon afterwards, care for the shelterbelts that had already been planted ceased.⁸

The saddest development, however, was that the new leadership under Nikita KHRUSHCHEV adopted the policy of increasing agricultural production by extensive ploughing up of virgin lands in the east of the Soviet Union, in particular in northern Kazakhstan. This was the last large reserve of land in the country. In March 1954, the plenary meeting of the Central Committee of the Communist Party confirmed the new agricultural policy, which was to prove fatal for the steppe landscape. The Party called on the Komsomol (the Young Communist League) to implement the policy of bringing the eastern steppes into cultivation. They were mostly young people from the cities who were far removed from agriculture and in particular from the idea of rational use of natural resources. Ignoring the recommendations of the Russian founders of the scientific discipline of natural resources management and soil science, and disregarding the experience of other countries (in particular the work in the United States at this time to restore the short-grass prairie), the country embarked on the ploughing up of virgin steppe on a scale not previously witnessed in world history. And the Soviet Union succeeded in becoming the world leader in the speed and extent of ploughing up new lands. For a whole decade, the virgin lands were the centre of the country's economic policy. Ploughing up additional hectares at a faster pace than envisaged in the plan was considered a major achievement. A ruthless hunt for virgin land developed. As a result, over the years 1954 to 1964, all the virgin land suitable for cultivation was ploughed up. In total, forty-two million hectares were ploughed up. This far exceeded the thirteen million in the original plan.

From the point of view of both practical and scientific considerations, taking into account natural conditions, the opening up of the eastern steppes should have entailed ploughing up only selected areas of black earth for grain cultivation and using areas with chestnut soils for the development of beef cattle. However, serious strategic errors and miscalculations were made in opening up the virgin lands. The most important was the wholesale ploughing up of twenty million hectares of chestnut soils in the arid steppes. Thus, the Soviet Union repeated the bitter experience of the Americans in the early twentieth century.

As a result of the Virgin Lands Campaign, the steppe landscape was completely destroyed and replaced by an agricultural one, with all the ensuing consequences. The steppe type of vegetation on the zonal full-profile soils became the rarest ecosystem in the country. Isolated populations of steppe vegetation that had once prevailed in vast areas were degraded by overgrazing, due to the acute shortage of pasture. During the whole era of the Virgin Lands Campaign, not one scientific nature reserve (*zapovednik*) was created. On the contrary, a number that already existed were closed down and ploughed up. Even land on research stations of the Academy of Sciences was ploughed up. The removal of the native grass cover and deep ploughing led to widescale degradation of the land. As a result, in the former Virgin Lands region alone, by 1960, more than nine million hectares of newly ploughed land suffered. In the mid-1960s, dust storms blowing over the steppes of the Soviet Union assumed a global character. Measures to combat the problem were taken. In a number of regions, ploughing without mouldboards was introduced. The most important measure—taking land prone to degradation out of cultivation—was not taken. The political will to do this was lacking. On the contrary, in the 1970s and 1980s, under the pretence of a radical improvement of land,

⁸ For a recent study see BRAIN 2010b.

several million more hectares of rocky and salty land and other land not suitable for arable farming were ploughed up and planted with grain monoculture. This process continued until the start of the 1990s.⁹

The current system of arable farming on the Virgin Lands depletes the soil. In northern Kazakhstan alone, the original reserves of humus in the soil amounted to 4.3 billion tonnes. As a result of various forms of erosion, 1.2 billion tonnes, or 28.3%, of these reserves have been lost on Virgin Lands. The practice of “clean fallow” on an area of as much as 20% of the land leads to the “burning” of the humus. This has led to the decay of 0.7 billion tonnes of humus, and the release of no less than one billion tonnes of carbonic acid into the atmosphere. Thus, the Soviet Virgin Lands Campaign has made a significant contribution to the “greenhouse effect” affecting the planet. To maintain a balance of humus in the Virgin Lands, it would be necessary to apply one hundred and fifty million tonnes of manure to the soil every year. But the numbers of livestock can deliver only sixty million tonnes a year. With this correlation of crop cultivation and livestock husbandry, even if all available organic fertiliser is used, it is possible to cultivate grain intensively on only half the area of Virgin Lands that have been ploughed up.

Vast areas of dark-coloured ploughed soil have become overheated and, as a result of chronic droughts, have contributed to the desertification of the whole steppe zone. This, moreover, has caused rivers and lakes to dry up. The wholesale ploughing up of the land has also had an impact on wildlife in the steppe zone. Numerous animals that were valuable for hunting have been greatly diminished; in places, they have completely disappeared. In the past, steppe wild fowl, such as bustards, partridges, quails, and gyrfalcons, were hunted for sport. This is now just a memory. The natural habitat of the marmot, which was once widespread through the steppes, has declined to a few isolated areas. The *saigak* (or steppe antelope) has been driven off into the semi-desert zone.¹⁰

As a result of the long-term development of monoculture, nature has lost the ability to regulate itself. Therefore, weeds and pests have become a real threat to arable farming in the Virgin Lands region. The poor condition of grain farms in the dry steppe zone can be added to the list of the unfavourable consequences of the ploughing up of the Virgin Lands. They were established in areas where the conditions were unsuitable for dry farming. They suffer from low yields, and at times earnings are not sufficient to cover the costs of production. The amount of grain produced in the dry steppe zone comprises between 3.5 and 8.5 centners per hectare and fluctuates from year to year. At the end of the 1980s, the economically viable level of yields was 7.5 centners per hectare. Therefore, the majority of grain farms in this zone are operating at a loss and are dependent on subsidies from the state. This became critical from the start of economic reforms in the countries of the former Soviet Union after its breakup in 1991.

Ploughing up twenty million hectares of chestnut soils did not solve the country’s shortages of grain and protein. After ploughing up the Virgin Lands, starting in 1964, the Soviet Union imported between twenty-five and forty million tonnes of grain a year, the largest part of which went for fodder.¹¹ This was a high price to pay for the loss of the pastures, which had previously served as the basis for the development of the production of beef cattle, the branch of agriculture that had been traditionally profitable in the dry steppe zone. Deprived of cheap, natural pasture land, livestock had to be kept inside and fed grain, which was depen-

9 McCauley 1976, DRONIN and BELLINGER 2005, pp. 171–217, 223–225, 247–252, 337.

10 On the saigaks and attempts to protect them, see <http://www.saigak.biodiversity.ru/>.

11 DRONIN and BELLINGER 2005, pp. 257, 276–277.

dent on the harvest. Livestock husbandry became a loss-making branch of the rural economy, dependent on subsidies. According to Kazakh scholars, converting ten million hectares of loss-making arable land in the dry steppe zone into pastures would benefit the economy to the tune of two billion rubles a year (measured in prices from the end of the 1980s) as well as solving ecological problems.

The opening up of new lands occurred in a zone that was risky for arable farming on account of the severe climatic conditions. At the same time, central Russia, which was the historic breadbasket of the country, was neglected as human and material resources were channelled eastwards to the Virgin Lands. People migrated from their homes in regions that had been inhabited by Russians for centuries, and where the conditions were suitable for farming, to regions that were alien to them culturally and which had unfamiliar natural conditions, including a sharp continental climate. The majority of migrants to the eastern steppes did not make their homes there, but returned to their old homes. This process is continuing at a greater pace at the present time (POHL 2007).¹²

Another important aspect of the opening up of the Virgin Lands was that the migrants did not have any traditional knowledge of using natural resources in steppe conditions. The destruction of the steppe landscape and its flora and fauna brought the Virgin Lands region to the verge of ecological catastrophe. Only people familiar with other environmental conditions could have had such an impact on nature. In only a few decades of agricultural exploitation, the steppes of the Transvolga and Urals regions of eastern Russia and Kazakhstan suffered greater degradation than central Russia had experienced over several centuries.¹³

The Virgin Lands, as a natural and economic complex, are now a social, ethnographic, and ecological antisystem. The agricultural and productive complex that emerged in Soviet times has existed until very recently only as a result of the unprecedented rate of ruthless exploitation of the natural resources that have accumulated in the biosphere and the political ambitions of individual leaders. Therefore, it was doomed when serious economic reforms were carried out after the breakup of the Soviet Union in 1991. This became especially clear after the collapse of the Soviet administrative and command systems. The introduction of reforms in the early 1990s revealed the full nature of the contradictions in the Virgin Lands, which were especially serious in the dry steppe zone. Farms suffered losses, complications emerged in harvesting, distributing, and selling grain, and it proved impossible to upgrade the existing stock of tractors and machinery. Fertiliser stopped being applied to fields, the main links in the expensive techniques needed for “dry farming” were breached, and the sown area declined.

Scientists and practitioners in the field of steppe resource use have studied the situation that developed in the Virgin Lands in the first half of the 1990s. Their analysis of the situation and concrete proposals were reported in the resolutions of the scientific and practical conferences dedicated to the fortieth anniversary of the launch of the Virgin Lands Campaign in 1994. Discussions of the problems were especially lively in Orenburg region. The result was the organisation of the Steppe Institute of the Urals Division of the Russian Academy of Sciences (Institut stepi UrO RAN).¹⁴ The institute is unique in the former Soviet Union. The concept of steppe resource use developed by the Steppe Institute envisaged a partial restoration of the steppe landscape at the level of the ecosystem and, at the same time, the conversion

12 On the wider issue of reverse migration see FLYNN 2004.

13 On human impact on the environment over the long term see DULOV 1983.

14 See <http://www.uran.ru/structura/institutes/orenb/istep.htm>.

of unproductive arable land to pasture and hayfields. Grain production was to be concentrated on the best land, with the use of the most advanced techniques of cultivation.

The legal basis for the Steppe Institute's actions is the "Regulations on the conservation of degraded farmland, which is polluted by toxic industrial waste and radioactive substances" (ratified by the government of the Russian Federation on 5 August 1992, no. 555). What was then needed was to work out a way to implement these regulations, but, for some time, these processes occurred spontaneously without any scientific basis. And a government programme on resource use in the steppes was lacking. (It would be appropriate here to recall the precedents of the restoration of the American prairies and the Stalin Plan for the Transformation of Nature.) One of the reasons that prevented the implementation of the Russian government's regulations was the lack of resources to convert degraded farmland to grassland. In addition, old fashioned, stereotyped ways of thinking and inertia in structural reform of agricultural production also hindered the conversion of unprofitable agricultural land to long fallow land.

The Orenburg region may serve as a concrete example. Around two million hectares of virgin lands were ploughed up, when a scientifically based plan envisaged the cultivation of eight hundred thousand hectares. 1.2 million hectares were subjected to extensive exploitation without a break and, as a result, lost their fertility and require conservation. The Regional Agricultural Committee, relying on out-of-date instructions from the early 1980s, has set aside only three hundred thousand hectares for conservation. According to official statistics, however, since 1990, only around 134,000 hectares have actually been converted to grassland (LEVYKIN and KAZACHKOV 2010).

At the end of the 1990s, scientists working in the field of steppe land use firmly believed that it was possible to solve the problem of effective conservation of land in the steppe zone of the countries of northern Eurasia. They also believed it was possible to successfully restore the biodiversity of the steppes, just as it had been possible on the prairies across the ocean. They emphasised that an important role in this process could be played by nongovernmental social organisations, which brought together people who were keenly interested in the fate of the steppes, and who were developing scientific ideas and proposals. They also, of course, stressed the need for material resources to implement them. For example, in the Southern Urals, a large role in bringing such forces together was played by the Orenburg branch of the Russian Geographical Society (RGO). The result was the establishment of the first steppe nature reserve (*zapovednik*) in Russia: the Orenburg Reserve.¹⁵ In 1997, moreover, the Orenburg branch of the RGO set up a "Foundation for the Restoration of the Orenburg Steppes." At this time, scientists wanted to believe that, with expedient and joint action by social organisations and government agencies, it would be possible to bring about optimal use of resources in the steppe zone in the foreseeable future. They believed that agriculture in the Virgin Lands could become ecologically less damaging and more profitable—and support a stable population—only when it was based on sustainable use of the natural resources, taking account of the centuries-old culture, traditions, and economy of the indigenous population.¹⁶

At the start of the twenty-first century, the role of state regulation of agriculture in Russia increased. The attempts in the 1990s to quickly adapt the system of agriculture, which had developed in the conditions of the Soviet planned economy, to market conditions have

15 See <http://orenzap.ru/>.

16 For articles by scientists and conservationists on the steppes from 1998, see the important journal *Stepnoi Biulleten*: <http://savesteppe.org/ru/archives/category/library/bulletin>.

been abandoned. All elements of the agricultural and industrial complex in Russia turned out not to be ready for market conditions. In reality, the crisis in the agrarian sector had reached threatening proportions. For example, at that time, forty to fifty million hectares of arable land—around 30 to 40% of the total area in Russia—was left uncultivated. In Kazakhstan, the sown area fell by two-thirds from thirty-five to eleven million hectares. As a result, in the former Virgin Lands at the start of the new millennium, between 30 and 40 million hectares of arable land was not in cultivation. This was similar to the area of virgin land that had been brought into cultivation in the 1950s.

In the first decade of the new century, Russia could not but approach the task of restoring agriculture, in particular arable farming. However, taking into account the high cost and other complexities entailed in the introduction of intensive agricultural technology, the main emphasis was on the cultivation of land left fallow in the 1990s. In both Russia and Kazakhstan, the governments worked out national agrarian policies to resurrect villages and *auls* (Kazakh villages). Both states found significant financial resources and directed them towards reviving such branches of agriculture as grain production and raising poultry and pigs. In the course of these measures, large grain companies and agro-holdings ploughed up the main areas of fallow land which had been set aside in Russia and Kazakhstan. In Russia, in the more favourable climatic conditions of the south and the Volga region, practically all long-fallow land was returned to cultivation. Some remnants of long-fallow land remained in remote places, in the main along administrative borders.

In Kazakhstan, with the active support of the government, in only a few years, large agro-holdings and peasant farms doubled the sown area, which has reached 20–21.5 million hectares at the present time. In northern Kazakhstan, practically all of the more fertile black earth and dark chestnut soils were once again brought into cultivation. In Kazakhstan today, large areas of old fallow land are preserved in the subzone of chestnut and light chestnut soils. This has become practically secondary steppe, with regrown feather grass (*Stipa lessingiana*) and the return of the marmot. In conditions of fluctuating world prices for grain, but with a general upward trend, these remaining areas of fallow land are under threat. Almost every year, the sown area under grain is increased at the expense of fallow land (ASYLBEKOV 2009).

The strong adherence to the extensive development of arable farming has turned out to be stronger than specialists on steppes had supposed in the 1990s. Raising beef cattle, as a specific labour-intensive branch of agriculture, has not developed as expected, not only in Russia but also in Kazakhstan, in spite of its nomadic traditions. Competition on the world market has played a significant role in hindering its development. The scale of the ploughing up of long-fallow land at the start of the twenty-first century allows us to talk about a third virgin lands campaign on the Eurasian steppes. The main difference, however, is the absence of virgin steppe, as the land that was ploughed up was exclusively land that had been left fallow for five to fifteen years and was in various stages of recovery. The rapid and successful revival of arable farming on the Eurasian steppes has allowed Russia and Kazakhstan to claim places as world leaders in wheat exports. The main contradiction in this process is that the grain produced for export is growing on ploughed-up secondary steppe, which is the habitat for a whole range of species of wildlife and plants that are inscribed in the Red Books of endangered species. If for agrarian interests the situation appears to be favourable, then for scientists and members of society interested in conservation, its scale recalls the Virgin Lands

Campaign of the 1950s, which led to a profound crisis in the landscape and biodiversity of the steppes, and in the agrarian sphere in steppe regions.¹⁷

Even in these conditions of the latest round in the extensive development of arable farming, the only Steppe Institute in Eurasia, which is situated in the centre of the Eurasian steppes in the city of Orenburg (see above), has made particular efforts to modify the policy on the use of natural resources in the steppe zone. The institute has urged the intensification of arable farming and its concentration on the best land, the development of cattle rearing on pasture, new forms of conservation and the restoration of the steppe ecosystem. In recent years, the Steppe Institute has held five international symposia on “The Steppes of Northern Eurasia” and written many appeals to the regional and federal government. The efforts of the scientific and conservation communities in the sphere of optimising land use in the steppes have had some results, albeit on a regional level. For example, the government of Orenburg region has responded with understanding to the issue of reordering steppe land use in the Orenburg area. First, it has recognised that there are a whole series of unresolved problems concerning steppe land use, which are inhibiting the conservation and restoration of the steppe ecosystem. Second, the Orenburg Ministry of Agriculture, Food and Processing Industries, in its turn, has proposed concrete measures towards the optimisation of the structure of agricultural land. The area designated as arable land has been reduced by means of the transfer of all unproductive land to hay-fields and pasture. Redesignated land has been set aside and sown with drought-resistant perennial grasses and different types of grasses. The prioritisation of the grain industry has been limited to the most fertile lands. At the same time, land use has been designated on the basis of particular purposes: grain production and grazing land for livestock. Land from regional reserves has been set aside to improve the quality of the land. Melioration of land by afforestation has been developed. The official declaration of intent to take into account the problems that have been identified and the solutions that have been proposed in the regional programme has inspired optimism.¹⁸

In the twenty-first century, the former virgin lands across the ocean in North America have developed in a rather different direction. On the one hand, in the zone where conditions for arable farming are marginal, irrigation — mostly high-technology centre-pivot irrigation — has been introduced. It is likely that this has allowed land that was taken out of production after the “Dust Bowl” to be ploughed up once again. Thus, it is possible to talk of a re-expansion of arable farming on the Great Plains, but at a new intensive level that has allowed high, stable harvests (CUNFER 2005). At the same time, the “buffalo boom,” which originated in the 1970s, has continued to develop, and has led to the flourishing of a new branch of agriculture: raising bison. There are hundreds of thousands of bison in North America, around 95 % of which are kept on private ranges. Regarding this unique phenomenon, it is impossible not to note the leading role played by private initiatives both in saving the bison from extinction and in the subsequent growth in their numbers (POPPER and POPPER 2006).

The level of national awareness of the issues of conservation and restoration of prairies across the ocean in the United States is very high. Nature conservation technologies have been applied to the conservation and restoration of the prairies that would be innovations in Russia. Ted TURNER’s system of prairie reserves, which cover 0.76 million hectares, could serve as an example of an effective nongovernmental system for the system of multiple land

17 Data on the state of Russian agriculture can be found in the agricultural census of 2006: *Itogi ...* 2008.

18 *Strategiia ...* 2007.

use in Specially Protected Natural Territories designated by the Russian law of 14 March 1995.¹⁹ Ted TURNER keeps more than 50,000 head of bison on his reserves (REES 2005). This is the largest private herd of bison in the world. There are plans in North America to build on the success of the restoration of the bison population. Various interested parties—including private business, the states, Native American tribes, enthusiasts—have discussed and elaborated plans to take the ecological restoration of both the bison and the prairie ecosystem further on the Great Plains in the north of the United States and Canada. The plan is to replace unsustainable arable farming with a “bison economy,” which will permit high profits by utilising bison and restoring the grasses of the prairies, from ecotourism to payments for carbon sequestration. North American experts, envisaging the positive scenario of the development of the “buffalo economy,” predict that over the next twenty years the numbers of bison will increase to many millions and that a considerable part of their previous natural habitat will be returned to them.

In Russia, in spite of the real potential, to date there has been only one attempt to raise bison, and that was not in the steppe zone. We consider the plains bison to be a valuable agricultural and ecological object in the development of the rural economy in Russia. The bison, which is already recognised in North America as a “specialist in survival,” would be a very effective user of rough grazing on the steppes. From the perspective of nature conservation, we consider that the plains bison can fill the ecological niche vacated by the steppe ox, which disappeared from the steppe during the Holocene for reasons which are not yet clear. The project “Steppe Tarpaniia” envisages the creation of a range of “living dioramas” with wild steppe ungulates, in particular Przewalski’s horses and plains bison (LEVYKIN and KAZACHKOV 2010).

3. Conclusion

In conclusion, it should be noted that several times over the last million years land bridges between Eurasia and North America have emerged and disappeared. At one point, we were united in one continent and then once again divided into separate continents. Today, we are divided by the shallow Bering Strait but the history and fate of the steppes and prairies are very close. Both in Eurasia and across the ocean, virgin land has been ploughed up, abandoned, then once again ploughed up. Herds of millions of wild ungulates have been destroyed, the king of the steppe fauna, the mammoth, has disappeared without trace, but there remains a huge potential for good deeds in the conservation and restoration of the steppes in Eurasia and prairies of North America, at the same time increasing the productivity of arable farming. In America, the potential for further increase in the productivity of arable farming with the present level of technology is close to its limits. In Russia, in contrast, even at present levels of technology, the productivity of the fields could be increased two or three times over, such is the unutilised intellectual and technological “virgin land.” And, in the interests of this “virgin land,” we are not separated from America by an ocean, but are drawing nearer to it by sharing experience of effective land use in the steppes. The ideas of optimising the use of natural resources in the steppe and prairie ecosystems is the scientific, ideological and political basis for the development of good neighbourliness and partnership between our countries in the twenty-first century.

¹⁹ See http://oopt.info/oopt_statut.html.

References

- ASYLBEKOV, A.: Proekt "Sokhranenie i ustoychivoe upravlenie stepnymi ekosistemami" v Kazakhstane. *Stepnoi Biulleten* 27 (2009) <http://savesteppe.org/ru/archives/1960>
- BOYD, L., and HOUPF, K. A.: Przewalski's Horse. The History and Biology of an Endangered Species. Albany, New York: State University of New York Press 1994
- BRAIN, S.: The Great Stalin Plan for the Transformation of Nature. *Environmental History* 15, 670–700 (2010a)
- BRAIN, S.: Stalin's environmentalism. *Russian Review* 69, 93–118 (2010b)
- CHIBILEV, A. A., and GROSHEVA, O. A.: Ocherki po istorii stepovedeniia. Ekaterinburg: UrO RAN 2004
- CHIBILEV, A. A., and LEVYKIN, S. V.: Tselina, razdeleniia okeanom (aktual'nye zametki o sud'be stepei severnogo polushariia). *Stepnoi Biulleten* 1 (1998)
- CHIBILEV, A. A., and LEVYKIN, S. V.: Virgin lands, divided by an ocean (notes on the fate of steppes in the northern hemisphere). *The Open Country* 1, 5–11 (2000)
- CUNFER, G.: On the Great Plains. Agriculture and Environment. College Station, TX: Texas A & M University Press 2005
- DOKUCHAEV, V. V.: Nashi Stepi prezhde i teper'. St. Petersburg 1892
- DOKUCHAEV, V. V.: The Russian Steppes. Study of the Soil in Russia, its Past and Present. Edited by CRAWFORD, J. M. Spb.: Department of Agriculture, Ministry of Crown Domains 1893
- DRONIN, N. M., and BELLINGER, E. G.: Climate Dependence and Food Problems in Russia, 1900–1990. Budapest: CEU Press 2005
- DROZE, W. H.: Trees, Prairies, and People. Tree Planting in the Plains States. Denton: Texas Woman's University 1977
- DULOV, A. V.: Geograficheskaya sreda i istoriia Rossii. Konets XV-seredina XIX v. Moscow: Nauka 1983
- EVTUHOV, C.: The roots of Dokuchaev's scientific contributions. Cadastral soil mapping and agro-environmental issues. In: WARKENTIN, B. P. (Ed.): Footprints in the Soil. People and Ideas in Soil History; pp. 125–148. Amsterdam: Elsevier 2006
- FLYNN, M.: Migrant Resettlement in the Russian Federation. Reconstructing Homes and Homelands. London: Anthem Press 2004
- GANSON, N.: The Soviet Famine of 1946–47 in Global and Historical Perspective. New York: Palgrave Macmillan 2009
- HELMS, D.: Conserving the Plains. The Soil Conservation Service in the Great Plains. *Agricultural History* 64/2, 58–73 (1990)
- HELMS, D.: Early Leaders of the Soil Survey. In: HELMS, D., EFFLAND, A. B. W., and DURANA, P. J. (Eds.): Profiles in the History of the U. S. Soil Survey; pp. 43–46. Ames, IA: Iowa State Press 2002
- IARILOV, A. A.: V. V. Dokuchaev i K. F. Marbut. *Pochvovedenie* 1, 32–37 (1947)
- ISENBERG, A.: The Destruction of the Bison. An Environmental History, 1750–1920. New York: Cambridge University Press 2000
- Itogi ...: Itogi vserossiiskoi sel'skokhoziaistvennoi perepisi 2006 goda.* 9 Vols. Moscow: I.I.Ts. Statistika Rossii 2008
- KEPPEN, F.: K istorii tarpana v Rossii. *Zhurnal Ministerstva narodnogo prosveshcheniia* 303/1, 125–131 (1896)
- LEVYKIN, S. V., and KAZACHKOV, G. V.: Orenburzh'e. Etalony stepnoi region Rossii. *Stepnoi Biulleten* 28 (2010) <http://savesteppe.org/ru/archives/1953>
- MCCAULEY, M.: Khrushchev and the Development of Soviet Agriculture. The Virgin Land Programme, 1953–1964. London: Macmillan 1976
- MOON, D.: The environmental history of the Russian Steppes. Vasilii Dokuchaev and the harvest failure of 1891. *Transactions of the Royal Historical Society* (6th series) 15, 149–174 (2005)
- MOON, D.: The debate over climate change in the steppe region in nineteenth-century Russia. *Russian Review* 69, 251–275 (2010)
- NIXON, E. B. (Ed.): Franklin D. Roosevelt and conservation, 1911–1945. Vol. 1. Hyde Park, NY: National Archives and Record Service 1957
- PARSHUTINA, L. P.: Kamennaya step. "Prezhde i teper'". *Stepnoi Biulleten* 8 (2000), <http://savesteppe.org/ru/archives/4065>
- POHL, M.: The "planet of one hundred languages". Ethnic relations and Soviet identity in the Virgin Lands. In: BREYFOGLE, N., SCHRADER, A., and SUNDERLAND, W. (Eds.): Peopling the Russian Periphery. Borderland Colonization in Eurasian History; pp. 238–261. Abingdon, New York: Routledge 2007
- POPPER, D. E., and POPPER, F. J.: The onset of the Buffalo commons. *Journal of the West* 45/2, 29–34 (2006)
- REES, A.: The Buffalo commons. Great Plains residents' responses to a radical vision. *Great Plains Quarterly* 25, 161–172 (2005)

Virgin Lands Divided by an Ocean: The Fate of Grasslands in the Northern Hemisphere

- RUDOLF, P. O., and GEVORKIANTZ, S. R.: Shelterbelt experience in other lands. In: *United States Department of Agriculture* (Ed.): Possibilities of Shelterbelt Planting in the Plains Region; pp. 59–76. Washington, DC: Government Printing Office 1935
- SHEROW, J. E.: The Grasslands of the United States. An Environmental History. Santa Barbara, CA: ABC Clio 2007
- SHTILMARK, F.: The History of Russian Zapovedniks, 1895–1995. Translated by G. H. HARPER. Edinburgh: Russian Nature Press 2003
- Strategiia: Strategiia sokhraneniia stepei Rossii. Vzgljad nepravitel'stvennykh organizatsii. Stepoi Biulleten' 23–24* (2007) <http://savesteppe.org/ru/archives/2321>
- U.S. Great Plains Committee* (Ed.): The Future of the Great Plains. Washington, DC: The House of Representatives 1937
- WEINER, D. R.: A Little Corner of Freedom. Russian Nature Protection from Stalin to Gorbachev. Berkeley, CA: University of California Press 1999
- WEINER, D. R.: Models of Nature. Ecology, Conservation and Cultural Revolution in Soviet Russia. 2nd ed. Pittsburgh, PA: University of Pittsburgh Press 2000
- WHITE, G. F.: The future of the Great Plains re-visited. *Great Plains Quarterly* 6/2, 84–93 (1986)
- WOOD, J. H.: The origin of public bison herds in the United States. *Wicazo Sa Review* 15, 157–182 (2000)
- WORSTER, D.: Dust Bowl. The Southern Plains in the 1930s. 25th Anniversary Edition. New York: OUP 2004
- ZIMA, V. F.: Golod v SSSR 1946–1947 godov. Proiskhozhdenie i posledstviia. Moscow: In-t Rossiiskoi istorii RAN 1994

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Auf die „Grenzen des Wachstums“ hatte bereits 1972 der *Club of Rome* aufmerksam gemacht. Seitdem sind die gesellschaftlichen Dimensionen und Folgen eines ungebremsten wirtschaftlichen Wachstums national und international ein zentrales Thema öffentlicher Diskussionen, aber auch politischen Handelns. Auf der Gaterslebener Begegnung 2011 wurde dem quantitativen Parameter „Wachstum“ das qualitative Pendant „Reifung“ zur Seite gestellt und die Thematik in zwei Problemkomplexen „Wachstum in der unbelebten und belebten Natur“ und „Quantitatives und qualitatives Wachstum in der Gesellschaft“ behandelt. Am Anfang stehen „Kritische Anfragen“ an Wissenschaftler, gefolgt von einer sozialwissenschaftlich orientierten Darstellung zu „Wachstum und Nachhaltigkeit“. Die an Natur- und Geisteswissenschaftler, Publizisten, politisch Verantwortliche und interessierte Laien gleichermaßen gerichteten Beiträge umfassen Wachstum und Reifung als grundlegende Eigenschaften organismischen Lebens, aber auch in der Bevölkerungsentwicklung, in der Ökonomie („Wachstum in einer globalisierten Welt“, „Wirtschaftswachstum und Klimawandel“) und sogar im Weltall einerseits sowie in Literatur und Kunst andererseits.

Sustainability *versus* Adaptation: Comments on the Chinese Experience

Mark ELVIN (Canberra, Australia)

With 12 Figures and 1 Table

Abstract

In his contribution about the environmental history of China, Mark ELVIN argues that sustainability is an attractive, but hardly attainable ideal. For one thing, humanity will not alter its approach to the environment quickly or thoroughly enough; for another, environment and climate have always undergone marked fluctuations, which work against the sustainability principle. One example in China is the historical fluctuations in sea level. According to ELVIN, adaptation is key to the past and present of human interaction with the environment. In China more than anywhere else, the emphasis has been on large-scale engineering works (dams, canals, etc.) as well as social adaptation (population policy), both of which bring disasters and new challenges as well as solutions.

Zusammenfassung

In seinem Beitrag zur Umweltgeschichte Chinas vertritt Mark ELVIN die Auffassung, dass Nachhaltigkeit ein zwar attraktives, aber kaum erreichbares Ideal sei. Zum einen würde die Menschheit ihre Einstellung gegenüber der Umwelt nicht rechtzeitig und grundlegend genug ändern; zum zweiten seien Umwelt und Klima – in China sind die historischen Schwankungen des Meeresspiegels ein Beispiel – seit jeher starken Schwankungen ausgesetzt, die dem Prinzip Nachhaltigkeit entgegenstehen. Vergangenheit und Zukunft der menschlichen Auseinandersetzung mit der natürlichen Umwelt stehen, so ELVIN, im Zeichen der Adaption. In China habe man mehr als irgendwo sonst auf große Ingenieursleistungen (Dämme, Kanäle etc.) sowie auf gesellschaftliche Adaptionen (Bevölkerungspolitik) gesetzt, die allerdings neben Lösungen auch Desaster und neue Herausforderungen mit sich gebracht haben.

1. Introduction

“Sustainability” sounds like an attractive way of easing the problems of the environmental pressures now bearing down on humankind. Unfortunately, it is almost certainly a misleading will-o’-the-wisp. Why? For two reasons:

First, it is by now probably too late to be achievable, at least as commonly understood. Most peoples and most leaders are politically unable, thus far, to accept what it really requires. There will almost certainly be widespread suffering and conflict in various forms before the necessary changes in attitudes occur on a wide enough scale. And by this time sustainability will probably be off the menu. Nature does not owe us any entitlements.

Second, over most of human history the environment has been constantly changing. The emergence of the *settled* agrarian-urban, socially stratified complex of civilisation—usually structured around a permanent readiness for, and the intermittent practice of, conflict with rival polities—that gradually took over most of the human world prior to the scientific and industrial revolutions, eventually serving as their future foundation, only became practicable in the exceptionally *stable* climatic conditions that followed the ending of the last ice age

about twelve thousand years ago (BURROUGHS 2004). Over most of its history, the human race has been continually adapting to cope with altering conditions. One aspect of this has been frequent moving around, and a limited amount of this type of activity has continued until very recent times indeed. Adaptability was a bedrock characteristic of *H. sapiens sapiens* in the remoter past. Let us hope that it still is.

There is an unquantifiable but significant likelihood that some increase in climatic instability will sooner or later return. My guess, based on past history, is that therefore—sooner or later—we shall have to start adapting again in a major way. It will be a different game, equipped as we now are with more powerful scientific and technological capabilities, but they are far from omnipotent. There are also critical dimensions other than climate. One is the uncertain ability of human science and technology to continue for an indefinite time in the future to find and make pharmacological defences against the constantly mutating bacteria and viruses infecting the dense human populations typical of civilisation. This was one of the reasons why ZHANG Yixia and I some years ago examined the massively differing effects of differing occupational environments on the likelihood of contracting tuberculosis in China in the first half of the twentieth century (ZHANG and ELVIN 1995/1998).

In this survey I outline some relevant aspects of Chinese history that have some direct or indirect bearing on our understanding of China's present-day environmental situation.

2. Historical Sea Levels

As in many other parts of the world, the withdrawal of the sea during the last ice age gave the land that was to become “China” a dramatically different coastline from that of the present day. Figure 1 shows a historical reconstruction of the huge eastern coastal plain and drainage basin circa 15,000 years BP, most of which today is under the Yellow Sea. It seems likely that it was inhabited, however sparsely, and that the population had to abandon its homes—probably repeatedly—as the ice age warmed and the waters rose again.

The sea had in fact risen several metres *above* its present-day level by around 7,000 BP, as is shown in Figure 2A, and the mean annual temperature could have been as much as 2 °C *above* the present mean. Areas that were later to become the great cities of Suzhou and Shanghai were all under water at this time. A thousand years later, the sea level was beginning to fall once more, though only slightly, as shown in Figure 2B (ELVIN and SU 1998).

The important point to note is that the situation here in 7,000 BP was somewhat “worse” than what is forecast for it by many climate scenarios for the end of the present century. Further, if we estimate the start of sea-rise as 15,000 BP, the mean speed of change over the long run was on the order of 120 m rise in 8,000 years, or ~0.015 m per year, which is roughly the same order of magnitude as that of some forecasts for our present times, but, of course, based on much shorter periods of observation. An example is the ~0.0135 m per year implied by a graph recently presented by James LOVELOCK (2009). We have no knowledge of how the human beings affected coped with the historical change; presumably, it was by moving. But, during the period when sea level had just begun to fall back towards its present height, the well-known Hemudu culture was practising simple irrigated farming near the coast of the newly drowned area. These figures are rough, but they suggest that the default hypothesis has to be that humans could, as humans, survive such conditions again without excessive collective difficulty. Today, however, the options of moving, or of rendering moving unnecessary by

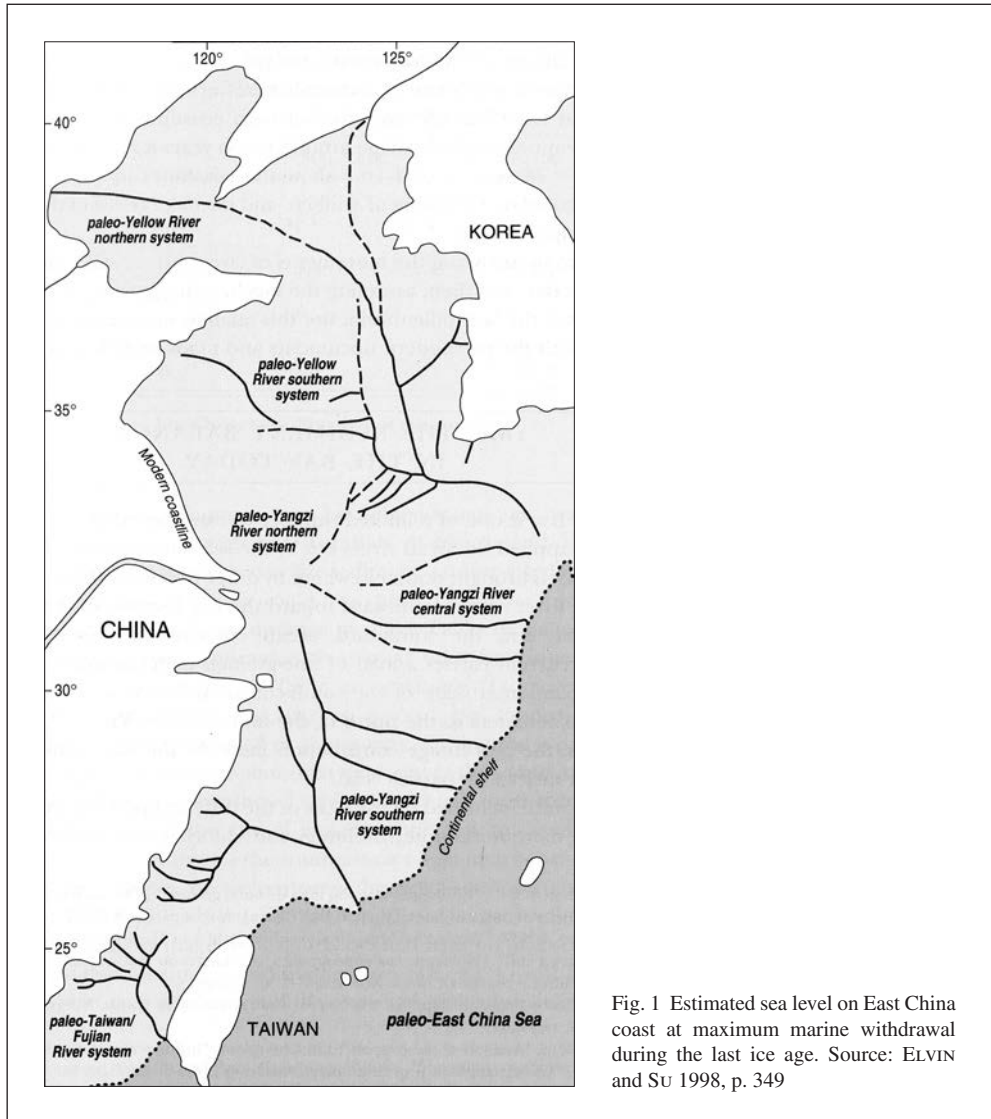


Fig. 1 Estimated sea level on East China coast at maximum marine withdrawal during the last ice age. Source: ELVIN and SU 1998, p. 349

direct physical protection, would both entail much greater difficulties. Where could the Chinese easily “put” Shanghai? Or how could they easily surround it with an adequate sea wall?

3. Early Settlement, Clearance, Drainage, and Shifts in the Yellow River

Let us sketch some of the natural pressures and human responses relating to environmental adaptability through China’s history, focusing on the societies that may be regarded as having been culturally “Chinese.” As of 1300 BCE, this population was centred in a core area defined by the presence of cities and bronze-working, but most distinctively by writing. This core was

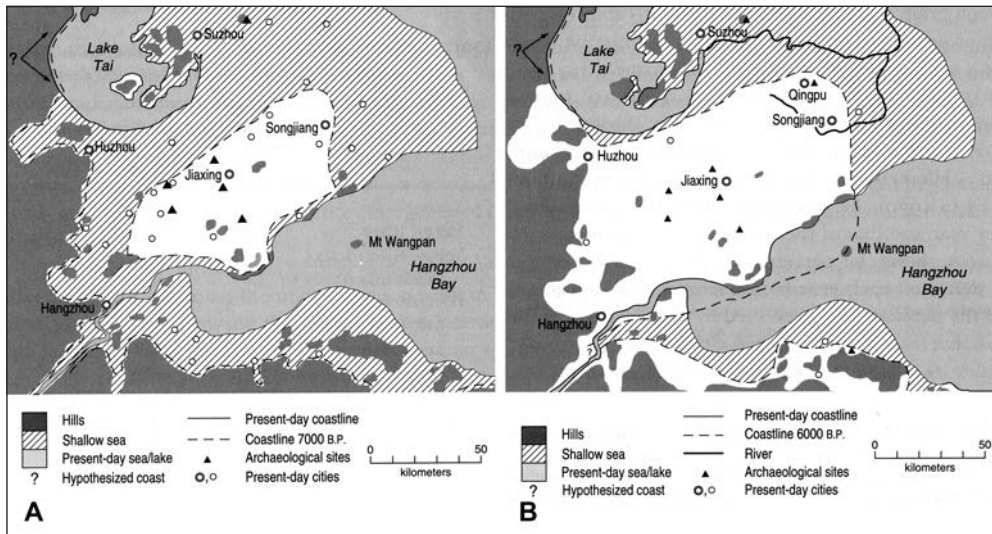


Fig. 2 (A) Estimated maximum post-glacial sea level off the East China coast and (B) during the first phase of post-maximum withdrawal. Source: ELVIN and SU 1998, p. 353

not much more than 200 by 300 km at this time; beyond it, there was a patchy outer zone of “Chinese” cities. It also had long arms that stretched south to the source of the Huai river, and east to the Shandong peninsula, as shown in Figure 3. Some of the non-Chinese inside it and outside it were allies, but many were enemies. Warfare was the fundamental *raison d'être* of the state, and warfare became institutionalised in connection with the spread of settled farming, in which clearing the forests played a crucial role. The combination was essential for increasing the supplies underpinning the growing manpower needed by the armies for fighting.

Much of the present North China plain was a swamp at this time. Some of it, along the present coast, was still under a shallow sea. Draining, reclaiming, and cultivating this land was one of the means of early Chinese expansion. It was the underlying presence of this ancient swampland east of the inland mountains, where many of the ancestors of the early Chinese lived, that made it possible to build the extended central stretches of the various Grand Canals linking the catchments of the Yellow River, Huai River and the Yangzi somewhat later.

Over the last two-and-a-half millennia, the lower course of the Yellow River has swung about on the North China plain. This has been the result of the clearance of the riverside vegetation and the deposition of a portion of the increased burden of eroded sediment that it has carried in consequence. Broadly speaking, around 602 BCE it began shifting further and further south, not unlike the hand of a clock moving irregularly from twelve-thirty to five o'clock. For a brief time at the end of the thirteenth century CE, it even emptied out into the Yangzi River. In 1324, it turned slightly northwards again, but still came out *south* of the Shandong peninsula, the mountainous “thumb” that sticks out into the Yellow Sea. After 1853, it returned to a course north of Shandong, with one short south-course interlude during the Pacific War. See Figure 4 for a simplified version of what happened. It is at once evident what large-scale regular maintenance and intermittent massive reconstruction would have been needed just to safeguard even an approximately stable situation.



Fig. 3 The early heartland of Chinese culture under the Shang dynasty in the later second millennium BCE. Source: BLUNDEN and ELVIN 1998, p. 54

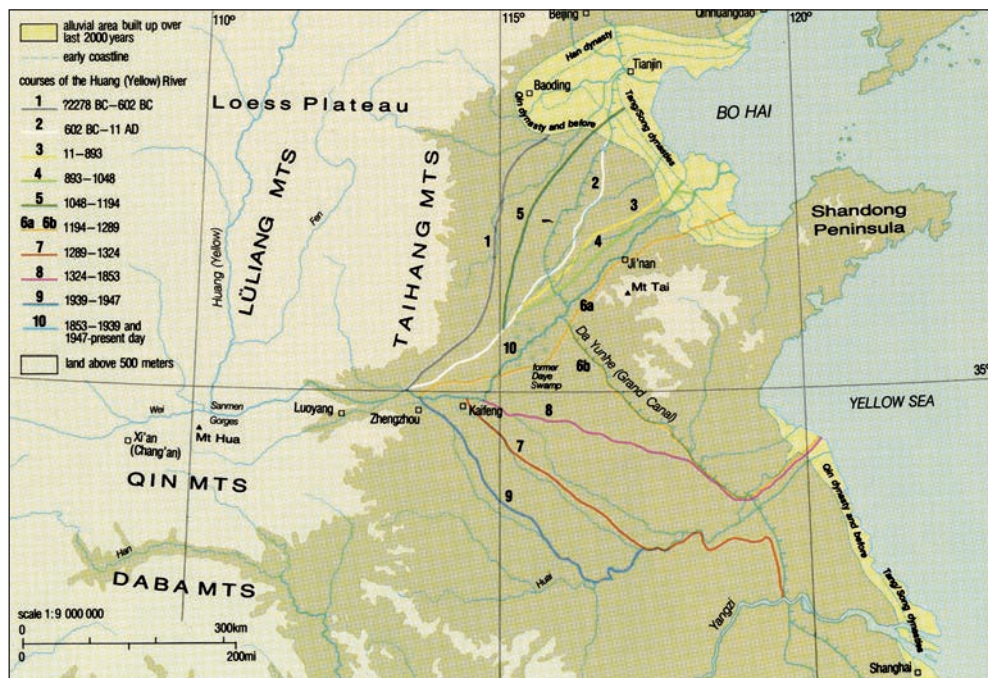


Fig. 4 The main historical shifts in the lower course of the Yellow River after 620 BCE. Source: BLUNDEN and ELVIN 1998, p. 16

It is difficult to calculate in a meaningful way the frequency of breaks in the dykes over long periods. The courses and numbers of channels of the lower Yellow River changed, and this makes it impossible to compare like with like in a strict sense. All the same, it is clear that there was an overall upward trend. During 186 BCE to 153 CE, there was a mean of one serious dyke-break every 16 years. From the later second century CE to the later sixth century CE, the frequency fell to about one serious breach in every 50 years. This was due to the diminished importance of farming when non-Han¹ peoples occupied most of the north of China. In the later Tang dynasty, from 746 to 905, after farming had for some time returned to a flourishing condition, the frequency of serious breaks was one year in every 10. In the mid-tenth century, however, it had risen to one in every 3.6 years. Under the Northern Song, from 960 to 1126, it was one every 3.3 years. Later it was only after the lower Yellow River's irregular shift to a southern course had become to some extent stabilised that useful counting is again possible. From 1645 to 1855, the frequency of serious breaks in the dykes was about one in every 1.9 years (ELVIN 1993). A serious complication in this last period was the need to maintain the course of the Grand Canal linking Beijing with the granaries of the south. Its route had to run across the Yellow River, and higher sediment deposition in the canal meant that the levels tended increasingly to differ.

That changes in course were discontinuous, and stability was mostly due to human efforts to use dykes to keep the Yellow River constant and predictable. Left to its own, it would probably have readjusted in sequences of smaller changes, and used more multiple channels. In a sense, the huge hydraulic works that were gradually put in place were symptoms of a refusal by the Chinese state to adapt appropriately. This was understood by a few perceptive officials, such as the eighteenth-century poet YUAN Mei. He wrote that the tight human constriction imposed on the Yellow River caused it "to form cancers," in other words, massive alluvial bars. Since men had "invaded" the river's territory, it was not surprising that it and humankind had "become enemies." He proposed relinquishing more land to the river and allowing it to move about between much wider bounds (ELVIN 1996). In spite of some ancient late-pre-imperial efforts in this direction, short-term economic pressures in the imperial age stopped this idea, including YUAN's proposals, from ever being seriously considered again.

The inclination to use massive engineering solutions could be said to have become embedded in China's political DNA. It recorded impressive achievements, but also some brutal disasters. The breaking of the Yellow River dykes in 1117 CE led to the deaths of an estimated one million persons (ELVIN 1993). A past event that serves as a warning for the future is the collapse of the relatively unstable central sector of the Yangzi Gorges in 317 CE. It reportedly caused the river to flow backwards for half a day. The new Three Gorges dam downstream will soon make the water level about 90 m higher than it was then. So, if these porous strata disintegrate in similar fashion in the near future due to saturation, there could be an even more serious catastrophe (LIN 1989).

The marshes in the central course of the Yangzi were also drained, though at a somewhat later date than most of their northern counterparts. So were the wetlands by the river mouth on the coast. Massive floods still intermittently occur in the middle course of the Yangzi.

1 "Han" indicates that the people so labeled identified themselves, and were generally identified by others, as descending from the ancestral populations of the archaic Chinese homeland in the near northwest inhabited by the Shang and Zhou peoples, and of being the historical inheritors of their culture. Conversely, the "non-Han" are those outside this world.

Thus, the hydrographic geography of ancient times haunts the region, just as recent human efforts to reclaim more and more farmable land have continued to constrict the waterways and lakes within ever tighter bounds, removing natural “sponges” and overflow reservoirs like wetlands, with the usual consequences.

All historical landscapes are to some degree anthropogenic, but, on a large scale, this was so to an exceptional extent in China. The western Netherlands and Venice—though tiny in comparison—are, of course, indicators that the phenomenon was far from unique.

A central component of the reshaping of the landscape was the deforestation that for millennia accompanied the spread of agriculture (ELVIN 2004). Attempts at reforestation were already being made in late imperial times, but the trend continued. By the 1970s, China had one of the lowest amounts of standing timber per person of any large country in the world: a mere ten cubic metres each. This trend has recently been reversed, as I have myself witnessed in western Anhui. But while replanting trees and bamboos in look-alike, same-age, same-species stands is better than doing nothing at all, it does not bring back lost habitat.

4. Long-Term Trends in Mean Annual Temperature and in Population Size

Figure 5 shows the more detailed part of the trend of mean annual temperature (MAT) for the heartland areas of China after about 400 CE, as derived by ZHU Kezhen and his colleagues using phenological methods. These latter are based on analysing the relative frequency of particular key species of flora and fauna at particular times in particular regions. Though rough, they give the most balanced approximations to general trends available at the moment. Apart from one severe but transient dip around 1000 BCE, the MAT in the two thousand years before Figure 5 starts was 1 to 2°C above the present-day level. This would have provided suitable conditions for the inauguration of urban-agrarian-military civilisation under the Shang. It would obviously be inappropriate, however, to say that these conditions of themselves “caused” this development. The same warning applies to the obvious observation that a high MAT is correlated with the flourishing of medieval Chinese civilisation—notably under the Tang and Northern Song dynasties (roughly 600–1100 CE), arguably culturally pre-eminent in the world of their day—and a lower one with the subjugation of the north of China, or, under the Mongols and the Manchus, of the whole of the empire, by invaders moving down from the steppes and forests. After a prosperous period in the middle of the Manchu-Qing dynasty with a rising MAT, China was also in something of a temporary trough of relatively colder temperature when Western military pressure first became of importance, though the graph soon moved upward again. In general, southern China was more stable with respect to the effects of a changing MAT than the north, a theme that often recurs in China’s history. For example, the popular northern belief in the links between good and bad weather, sent by Heaven, and virtuous or wicked local human behaviour respectively, had far less hold in the South.

The pattern of the climate also had a relationship with the configurations that the Han Chinese population acquired over the millennia. Figure 6A shows the Chinese population according to a census count about 2,000 years ago, when the greater part of it was in the north. Figure 6B shows census results from about 1,300 years ago. The overall total population was about the same in both periods: 65 million. Spatially, though, the distribution has changed. The centre of demographic gravity has begun to shift to the south, and large areas of non-Chinese population that appear in the first map have been filled in.

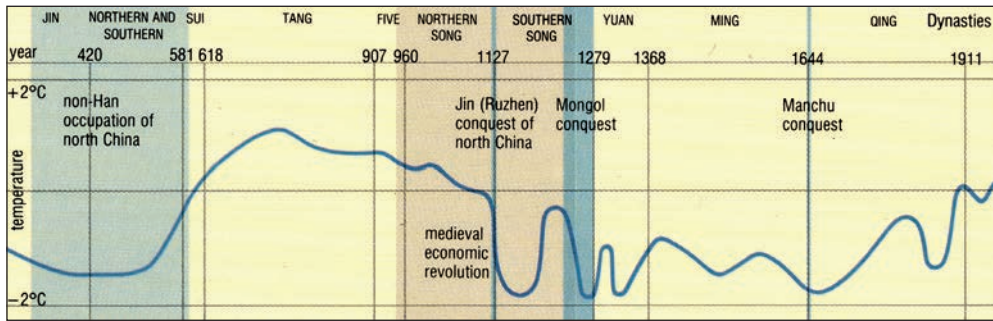


Fig. 5 A broad outline of the probable shifts in mean annual temperature in imperial China after the Han period relative to the current mean (after the phenological analysis by ZHU 1972). Source: BLUNDEN and ELVIN 1998, p. 14

We have no way of telling, though, how much this is the result of the registration of existing populations that were previously outside the registration system, and how far the result of an actual movement of people triggered by a period of cold in the north and non-Han rule there. Both certainly took place. The southern shift was made possible on a permanent basis by the acquisition of a mastery of wet-field rice cultivation, and this has in its turn to be seen as a major adaptation on the part of formerly mostly dry-land farmers of millet and wheat who had moved into a monsoon climate zone from a former northern homeland that was without it. Looking ahead at Figure 7, we can see the population distribution during the following stage around the end of the eleventh century.

Expansion was a complex process. Some of it was linked with military conquest. Some of it was military and political pressure leading formerly independent peoples to adopt the view that their most practical choice was to join the empire. Almost all forms of social and political assimilation by non-Chinese—under varying degrees of conquest and pressure—were followed by a measure of cultural assimilation, sometimes slow, at times relatively eager and rapid. Occasionally there were military breakaways, as by the state of Nanzhao in the southwest, which developed a dual culture. The elite acquired a high mastery of the Chinese language and classics, but kept its own Bai language and independence until overwhelmed by the Mongols and then, again and more disastrously, by the Ming. Following the southwards move, there was also a long later period of collective Chinese migrations to the southwest during the Ming and Qing dynasties, interwoven with warfare, sometimes fierce on both sides, and various types of mixed society. An example is most of what became the province of Guizhou, which by the late Ming and Qing dynasties had become an example of what can only be called “Chinese colonialism.” Somewhat similar processes have gone on in recent times as well, in Tibet and Turkestan.

Figure 7 shows the officially registered “Chinese” population early in 1086. The pattern of demographic distribution is already recognisable as a sketch of the main economic zones of early modern China. The population has grown to about twice the size it was in maps 6A and 6B. In actual numbers it was around 120 million, according to estimates that try to incorporate the non-registered households (notably those having servile and semi-servile status). It was at this moment that the Chinese demographic J-curve took off. Although its rise was far from smooth, by 1600, the total population must have been close to 200 million (YIM 1975). By 1850, it had risen to what most scholars agree was at least four hundred million, though there is controversy over both the precise total and, more interestingly, the shape of the path taken to get there.

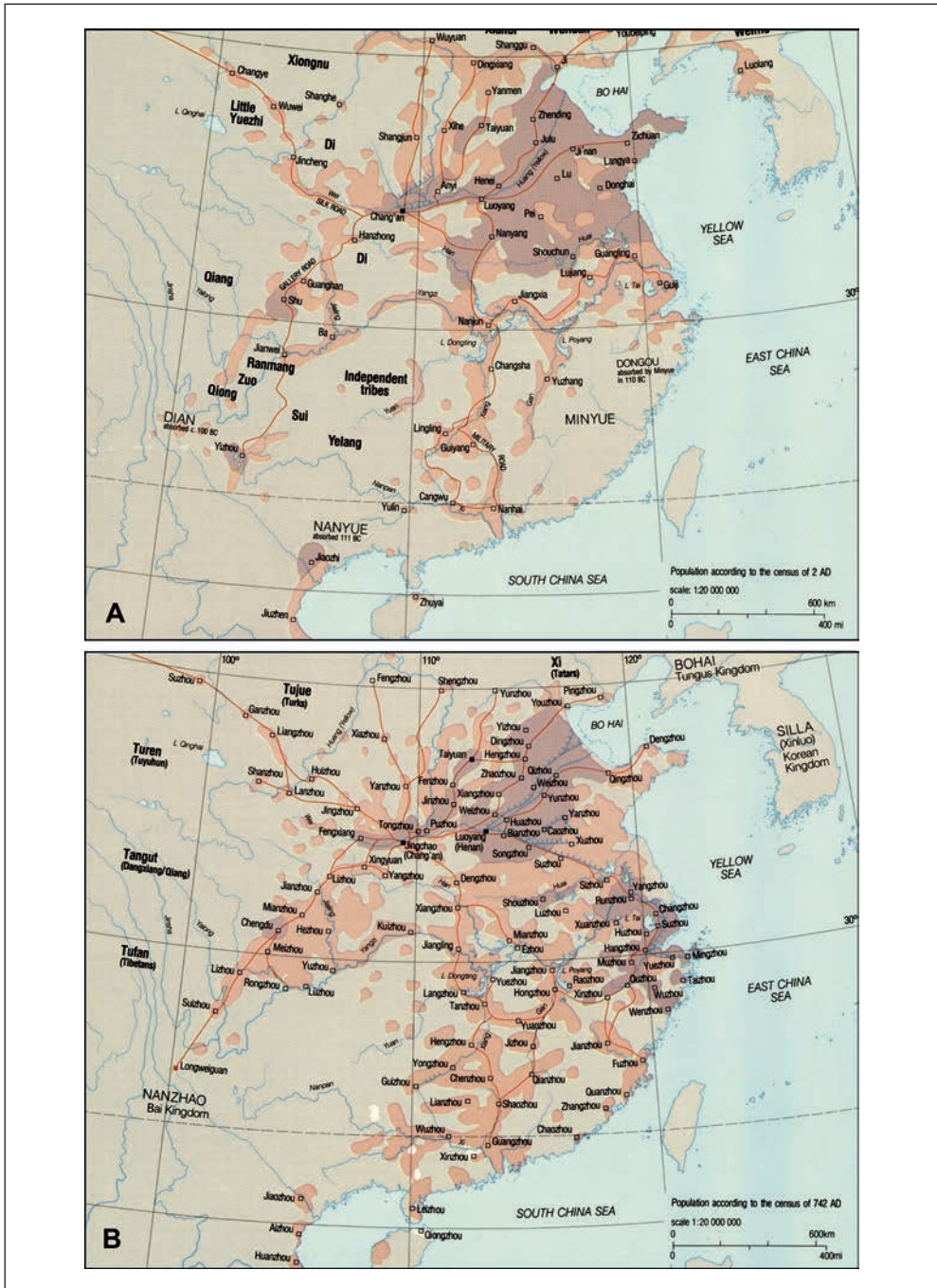


Fig. 6 (A) The population distribution of Han China in 2 CE, showing approximate density and (B) Tang China in 742 CE. Source: BLUNDEN and ELVIN 1998, p. 30. Specified information, such as extensive keys and detailed legends, will be found in BLUNDEN and ELVIN 1998.

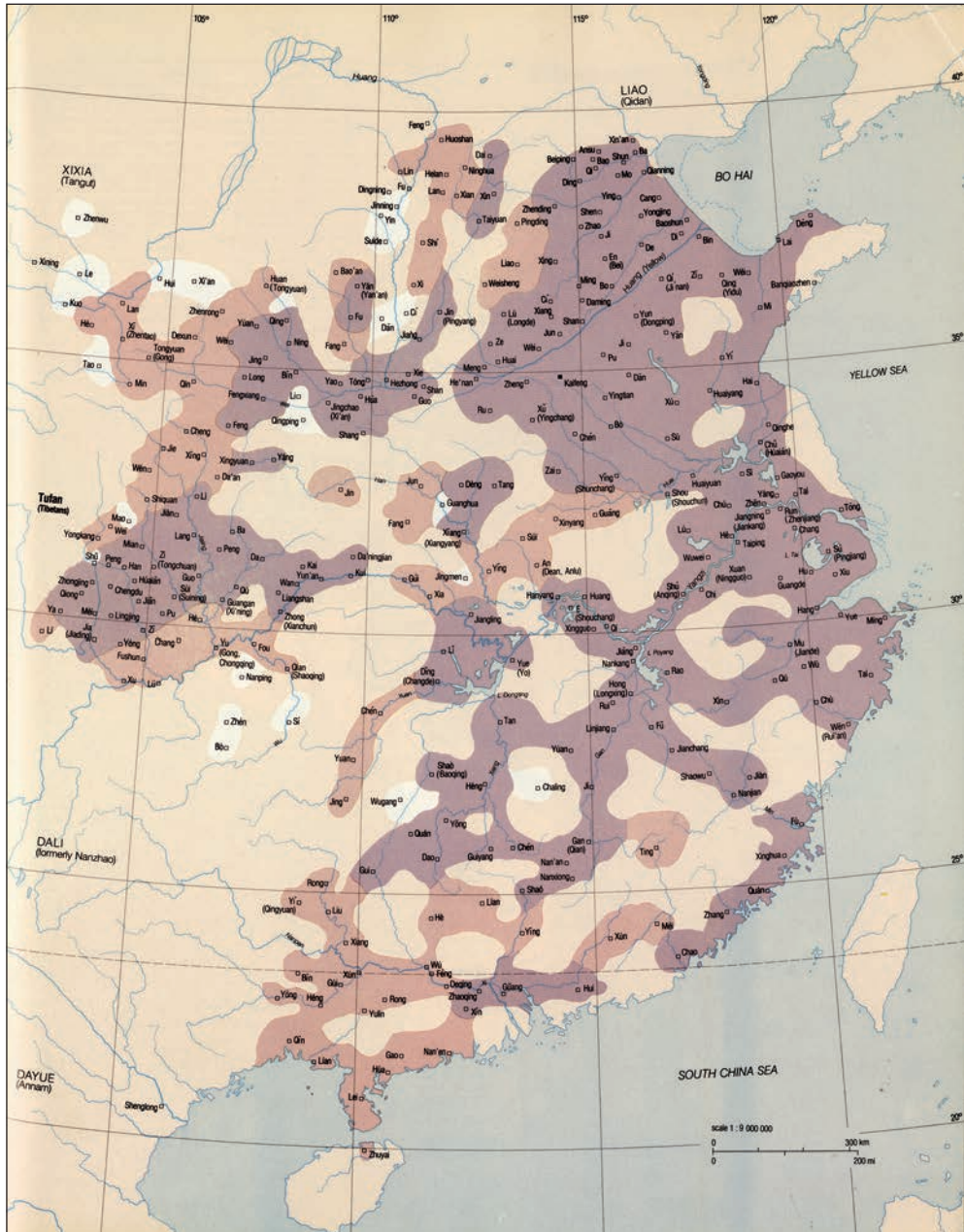


Fig. 7 The population of China under the Northern Song dynasty in 1086. Source: BLUNDEN and ELVIN 1998, p. 31. Specified information, such as extensive keys and detailed legends, will be found in BLUNDEN and ELVIN 1998.

The final premodern phase was a territorial inflation under the Qing or Manchu dynasty in the seventeenth and eighteenth centuries. This more than doubled the geographical size of the Ming empire, by bringing in sparsely peopled areas originally ruled by the Manchus, together with the incorporation of the vast but relatively empty lands of much of Mongolia (whose people were junior allies of the Manchus), and, in due course, the military conquest of Eastern Turkestan. This last was a prolonged and bloody business, and needed to be done again in the early 1870s. This last case shows that, even when beset by Western imperialist pressures from the sea, China could still act as an imperial power along its inland frontier. In the eighteenth century, Tibet became, in basically peaceful fashion, a loosely controlled subordinate. The impact of this peripheral expansion on the size of the total population in premodern times was nonetheless slight compared to the huge Han Chinese core population, but, from the late nineteenth century onwards, these zones became significant goals of Chinese migration. The first of importance was Manchuria, where the inflow climaxed in the 1920s with an annual in-migration that sometimes reached a million a year; it has continued in Tibet and Turkestan under the People's Republic. China in these centuries, even when somewhat weakened in the second half of the nineteenth century, was an international power, the borders of whose empire touched those of the Tsarist and British empires. It is, in fact, the only one of the three which has survived to the present in its nearly original form. Figures 8A and 8B illustrate this process. A separate development, hard to trace in detail, has been the Chinese "diaspora" to numerous areas overseas. These have included migration to the United States and Canada, Southeast Asia, Western Europe, Australia, and parts of Latin America (BLUNDEN and ELVIN 1998).

Keeping a demographically swollen empire together during the Ming dynasty was already financially exhausting and administratively demanding. It was made possible by using the greater economic resources of the south to sustain a northern defensive shield, the last of the several historical systems of Great Walls, reconstructed in sections over more than a hundred years from the late fourteenth century. Early in the fifteenth century, the northern half of the Grand Canal was rebuilt and was used by probably the largest permanent organisation in the world of its day. It had on the order of 160,000 regular military "employees" plus a number of civilians, and carried what was mostly southern rice up to the capital at Beijing (HOSHI 1963/1969). In the middle of the seventeenth century, when Ming government crumbled and the Manchus took over, initially at the invitation of disillusioned Chinese frontier generals, the Wall became unnecessary and was abandoned. Given that the resources of North China were even less able on their own to sustain the control of an empire now doubled in size, the Canal became more important than ever. Beijing turned into the capital of what was culturally a *dual* Manchu-Chinese empire, placed at what was then the approximate line of division between the farmed areas on the one hand, and the forests and steppes on the other. It used different administrative structures for each part: bureaucratism for the Chinese part and a quasi-feudalism for the non-Chinese remainder. In Figure 9, the orange line on the map shows the former Ming dynasty frontier and the yellow line the Manchu-Qing dynasty one. Black perimeter lines show the maximum time permitted to an imperial mounted courier travelling from or to the capital from roughly equidistant points in the provinces. If we regard the old Ming domain plus the nearer parts of Mongolia and Manchuria as the "core" of the empire, it can be seen to have had a communications size of about six weeks between the centre and remotest parts of this core. Beyond this limit, maximum times were not fixed.

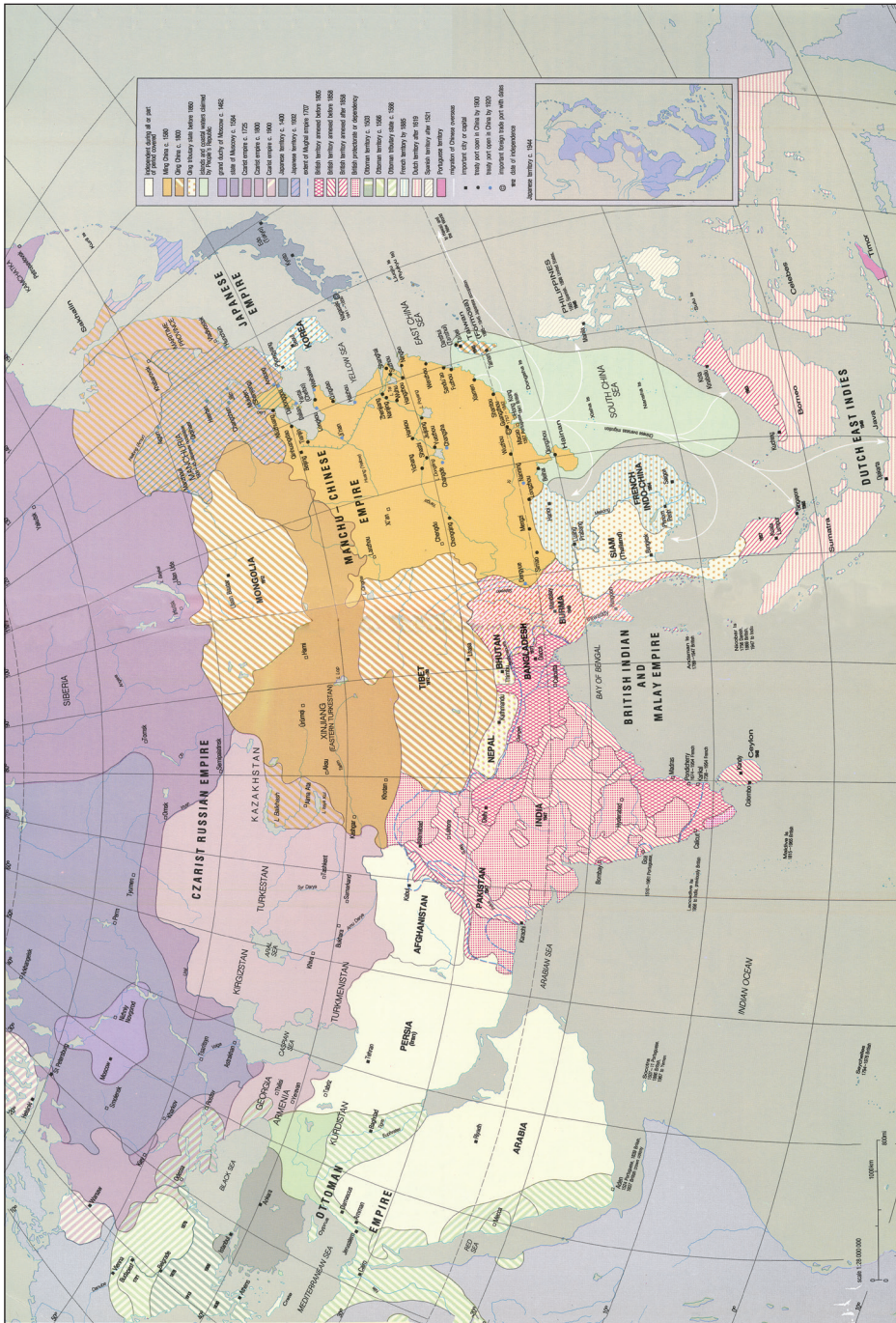


Fig. 8 Competing imperialisms in Asia and Europe from the eighteenth to the twentieth century. Source: BLUNDEN and ELVIN 1998, pp. 34–35

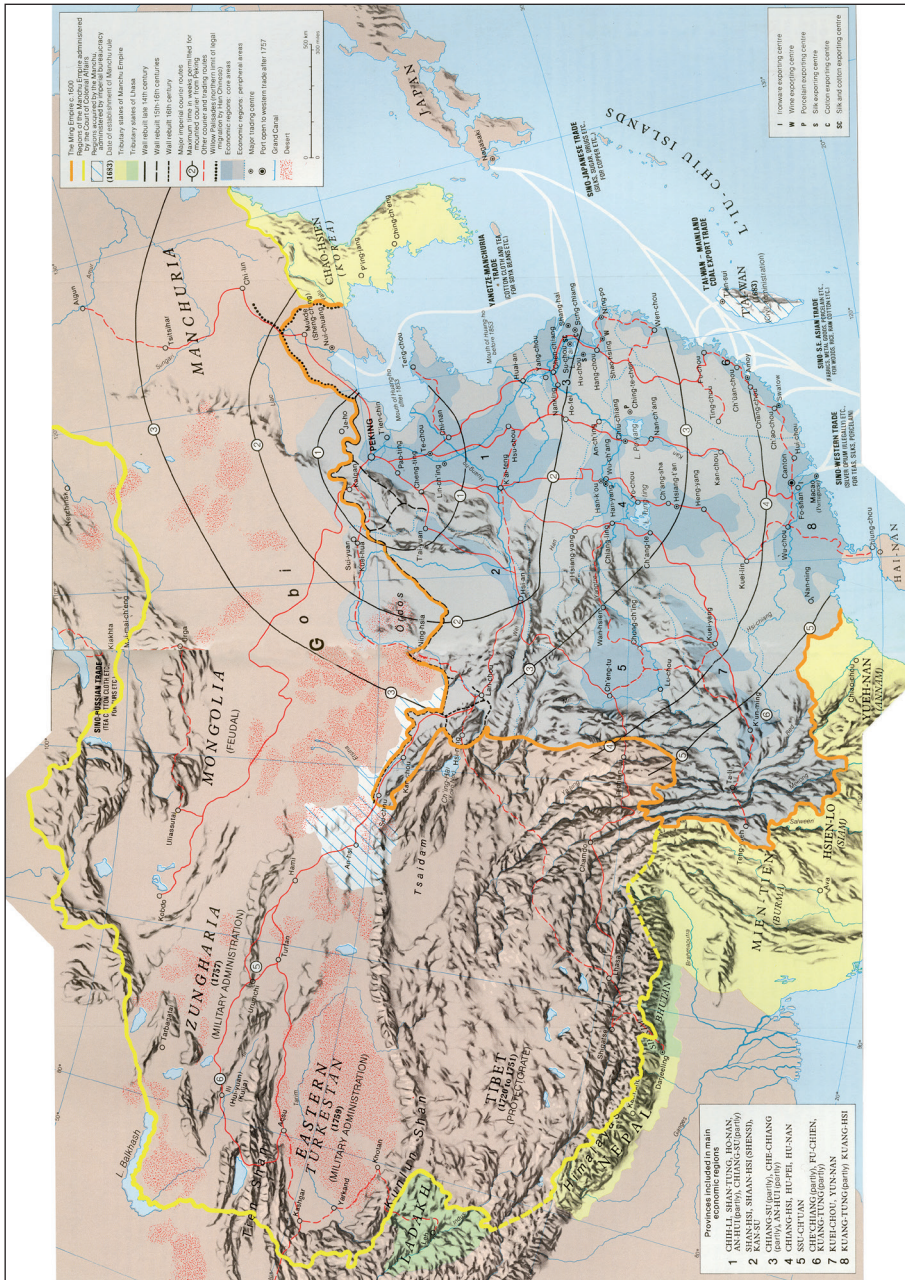


Fig. 9 The maximal boundaries of the Ming Empire (orange) and the Manchu-Qing Empire (yellow) with the maximum travel time in weeks allowed couriers going from Beijing to the provinces (Eastern panel). Note the use of the earlier modified Wade-Giles system of transcription for Chinese place-names. Source: MOORE 1981, p. 40

Rice was brought to Beijing by a combination of tax collection by local civil administrations, and long-distance river and canal transport originally under the control of army battalions, their locations marked by the black triangles in Figure 10. Under the Qing, transport was in part contracted out to merchants. The darker the shading of an area, the more it had to contribute each year. The longest *two-way* boat trip from the farthest part to Beijing was over 4,000 km; this required a speed of about 11 km a day on average for the *round* trip within a year. Such was the fiscal backbone of imperial power.

This raises the question of how an adequate surplus of rice was produced, and this will in its turn eventually lead to the problem of how farming technology, fiscal pressures and population dynamics interacted with each other.

5. The Labour-Intensification of Agriculture, Taxation Based on Farmed Area and Family Reproductive Strategies

The last eight centuries of premodern China saw an ever-greater labour intensification of arable farming. The objective was to increase yields *per unit of area* rather than per hour of work, not that the Chinese were unaware of the importance of this latter (ELVIN 1982). The final result was the ending of fallowing, as also of herds of large animals—except in remoter areas with pastures not suited for cultivation—and also the maximal use of multi cropping and intercropping through the year. Soil fertility was restored where possible by crop rotations, backed up by a nonstop search for manures from human beings and scavenging animals like pigs, plus other fertilisers like river mud and green manures. Especially where rice was concerned—that is, mainly in the Yangzi valley and regions further south—output was sustained by the creation and maintenance of elaborate irrigation schemes of all sizes, but normally requiring some degree of collective labour and collective control of the shares of water allocated to those participating, most commonly under bureaucratic supervision (ELVIN 2003, 2004, 2007, 2009).

It seems likely that this long-term trend was triggered under the Southern Song and the early Ming by the government shifting the system of taxation on farming to one calculated on the basis of the *area farmed*, not on the size of the harvests or the number of people. There was, in principle, a grading of tariffs determined by the state's estimate of the quality of the soil but, once settled, these levels seem to have been revised rarely. The reason for the change to an area-defined system is not clear, but was most likely due to its relative administrative simplicity. Whatever the bureaucratic motivation, the probable consequences of such a system for a farmer are obvious. If he can extract a second or even a third crop from the same field, he pays no extra tax for doing so. If he opens a new field, even if a short period of grace is allowed, as often happened, he pays more. So he will intensify his use of labour on a given existing farmed area to the extent that he can. Labour intensification of this kind entails more hours of work for a given output. Pushing up yields per unit of area as high as economically possible, to save on taxes, will at some point lead to a less than optimal use of *labour* per hour. The adoption of this way of working will also tend to increase the population that can be and is carried by a given farmed area. Other things being equal, population will grow more than it probably would have under a different system. The source of many of China's modern difficulties, the well-known late-imperial demographic overburdening of the cultivable area in China, thus probably had its origin in the search for fiscal convenience.

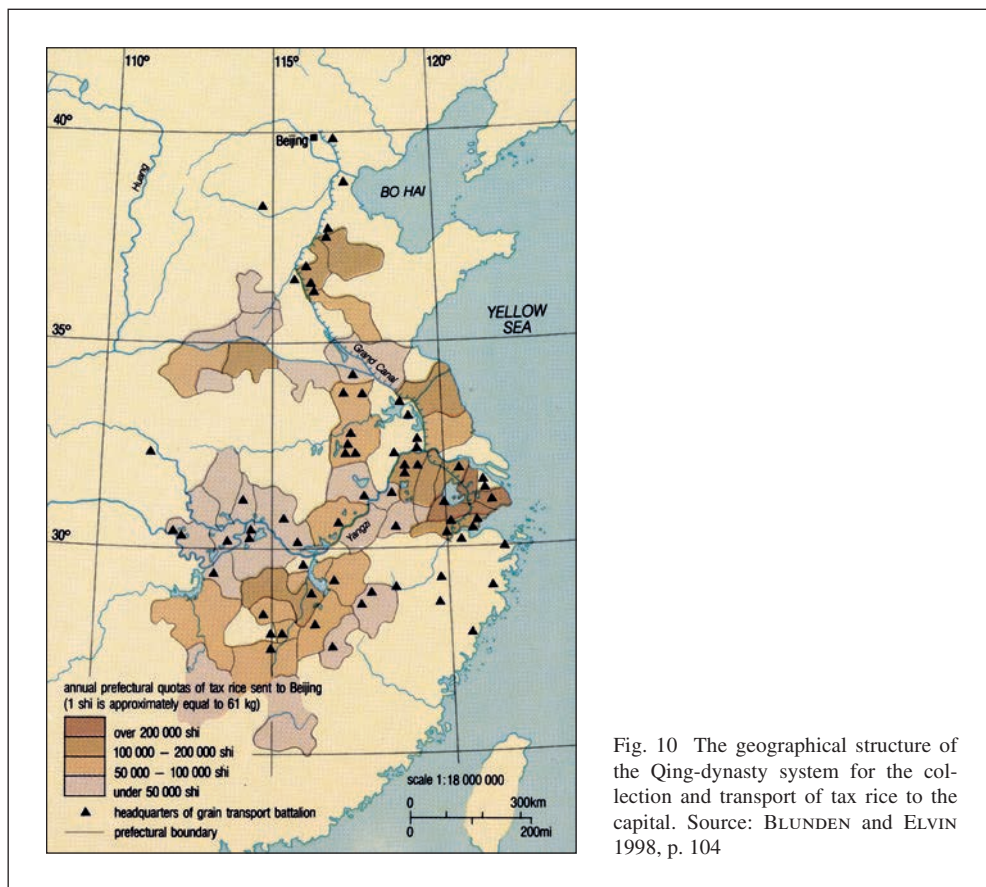


Fig. 10 The geographical structure of the Qing-dynasty system for the collection and transport of tax rice to the capital. Source: BLUNDEN and ELVIN 1998, p. 104

The reader who is not well-versed in Chinese history should be cautioned that this remains a hypothesis. In order to focus on the underlying logic, it also leaves aside complicated and important issues that emerged in and after the seventeenth century relating to the use of silver in the sector of agricultural taxation not serving the grain transport sector (for which taxation had to be in kind). At all events, the most obvious counterargument is that, under the Ming and Qing, the agricultural tax broadly defined—that is, including obligatory labour services to the state—did not represent a large enough proportion of output to have had such an effect as is suggested here. In terms of the formal legal rates this initially seems as if it might be a tenable position. There are, however, two documentable refutations of this position. Without going into the problem of determining plausible estimates of tax relative to output, the first point is that the actual rate of tax was often far above the legal limit according to numerous Qing official reports, indeed at times reaching significant multiples of the proper rate, and was normally increased with a variable number of legal, semi-legal and illegal additional levies (ELVIN 2009). The second is even more important: when agricultural family budgets are examined, which, unfortunately, only becomes possible with good figures at the very end of the imperial period, the burden of tax for an ordinary farm and farm family, at over a third of what would have been the surplus above essential costs if there had been no tax, was mani-

festly heavy (WAGNER 1926). That tax which was an oppressive burden is also supported by qualitative evidence, such as the many Qing poems on the subject, even though most of these contain an element of understandable passionate anger against particular, and therefore not necessarily typical, instances of the maltreatment of peasants (ELVIN 1998). Nonetheless, as the issue stands at the moment, the case for the hypothesis, though powerful, cannot be said to be definitively decided, and there remains a need for more documentation to be identified and for more analysis.

A final issue concerns how tax pressure of the type described may have worked at the tenancy level structure of the rural economy. While owner-cultivators were relatively numerous in the north, the proportion of tenant farmers was much higher in the more productive south, and rents were levied in a variety of ways, including money and sharecropping. In some cases only the main annual cereal crop was subject to rent, but this seems not to have been universal. There is no way that an ordinary landowner could have avoided the general effect of tax based on the area farmed, and it seems clear that the burden would have had to have been largely passed on to his tenants. Nonetheless, the modalities would have been more complex at this second level, and they, too, need more examination.

If we provisionally accept the hypothesis, what would the implications have been for the population dynamics of late imperial times? The overall pattern for the last eight hundred years of the late imperial period is so clear that for present purposes attempting fine-tuning is of little importance. From 1050 to 1600, the annual rate of growth was on the order of one-tenth of 1% a year. From 1600 to 1850, it was of the order of three-tenths of 1% a year. These figures are not for exactly the same geographical entity at all periods, but given the demographic preponderance of the core, it is unlikely to be too far from the mark to assume that the rate of growth *tripled*. Feeding these increased numbers during the period of accelerated growth was made possible in the first place by multiple cropping that pushed the labour intensification of weeding and manuring to the limit, or—where climate permitted—the growing of interstitial crops of pulses or rape to restore fertility to exhausted soils, together with the further development of strains of cereals, notably rice, that could be planted and harvested at different times of year. The introduction of crops from the New World such as maize (*Zea mays*) and sweet potatoes (*Ipomoea batatas*) also made possible the utilisation of upland areas formerly little used for farming often on a shifting basis. Except in parts of the far south and southwest, relatively little new permanently cultivable land seems to have been opened, as opposed to an increase in the shifting cultivation of uplands, and not all that many important new irrigation schemes were started. There were, however, a very large number of small technical improvements that, in aggregate, must have significantly eased the pressure on subsistence, though without in any way leading to any revolution in farm productivity (ELVIN 1975/1996).

We know something, in a tentative way, about the details of premodern population dynamics—that is, age-specific birth rates, the pattern of ages at marriage, and age-specific death rates—for the full life span of both sexes in the lower Yangzi valley during the later eighteenth century and the first half of the nineteenth, with the overall focus on the years around 1814: see Table 1 and Figure 11 (ELVIN and FOX 2008, 2009). The trouble is that we have only a little comparable knowledge for the other parts of China, and even less for the preceding period. James LEE and his colleagues have produced some good figures for some of the Manchu soldiers and their families, but these can hardly be regarded as typical. For our work, the reason for the problem is the lack, for most places outside the lower Yangzi area,

of enough of our special sort of data: namely those provided by the short life-histories of so-called “faithful widows” printed in local gazetteers. At their best, these contain information, not just about the widow herself and her ages at marriage, widowhood and death, but also about the survival of male children and of her parents-in-law when she was widowed at a given age. We thus have a window into the earliest years of life, and a rough method of linking the two sexes, since we have good information on the distribution of the relative ages of husbands and their first wives. Dr. Josephine Fox and I were able to use our—at times individually fragmentary—19,000 cases to reconstruct full-length life tables for the lower Yangzi region as a whole (see Fig. 11). Some small samples for a number of individual counties required using this regional pattern as a *standard model*, from which parts of local variant life tables for which good data were insufficient could be derived when needed by exploiting a simple mathematical transformation.² Local variation was marked. Female life expectancy at birth ranged from 22.1 Western years in Jiaxing (a very large sample) to 35.1 for Rugao (a precariously small one). The patterns of mortality and the tightly peaked age-distribution of marriages (this latter very solid) were integrated, *via* computer calculations of the best fit for a gross reproductive rate (GRR), using the standard patterns for the GRR identified by Heather BOOTH, matched against our data on the number of sons alive when their mothers were widowed at a known age. The result was a virtually complete demographic profile. However, to make calculation possible, we had to assume that these populations were not affected by net migration either in or out.

The female mortality findings are what one might call “reality as it happened,” hence of sociological relevance, but not a sure guide to the “potential” of the females, as we could not find quantitative data that covered female infanticide, which qualitative evidence indicates did occur. On the assumptions (*a*) that there was no male infanticide, and (*b*) that the girl babies survived at the same rate as their brothers (though worldwide experience suggests they probably did slightly better), we estimated that between 10 and 11 % of the high perinatal mortality among females was due to infanticide.

In general, Table 1 shows that, by the ages from five to ten, the initially high mortality for both sexes had dropped sharply, and that, to a surprising degree, the two sexes had very similar survival curves until at least fifty to sixty. Though parents-in-law data give us some control over the later years of males (the data for females at these ages being extremely abundant, and also accurate, as one can see by the exceptional smoothness of the unadjusted rates by individual years of age), for the very last part of the male curve we had to rely on mimicking the females’ pattern, and the result is almost certainly a slight overestimate of the old men’s rates of survival.

Many interesting conclusions can be drawn, however tentatively, from these analyses, but the one that matters for the present topic is that they seem to show that late-imperial Chinese families were limiting their birthrates *within marriage* after four to seven years of being married. See Figure 12, where the black arrow indicates a drop in the annual increase in the probability of having *exactly* two surviving sons given that a wife has at *least* one surviving son. This slightly devious approach is required by difficulties inherent in the data, but is rigorous so far as it goes, though it does not, of course, give a comprehensive picture. It looks as if the

2 The Brass two-parameter logit system. It was used to measure in what ways the reliable parts of a local life table diverged from the regional pattern, and this variation was then applied to the regional model to reconstruct the missing sections of the local table.

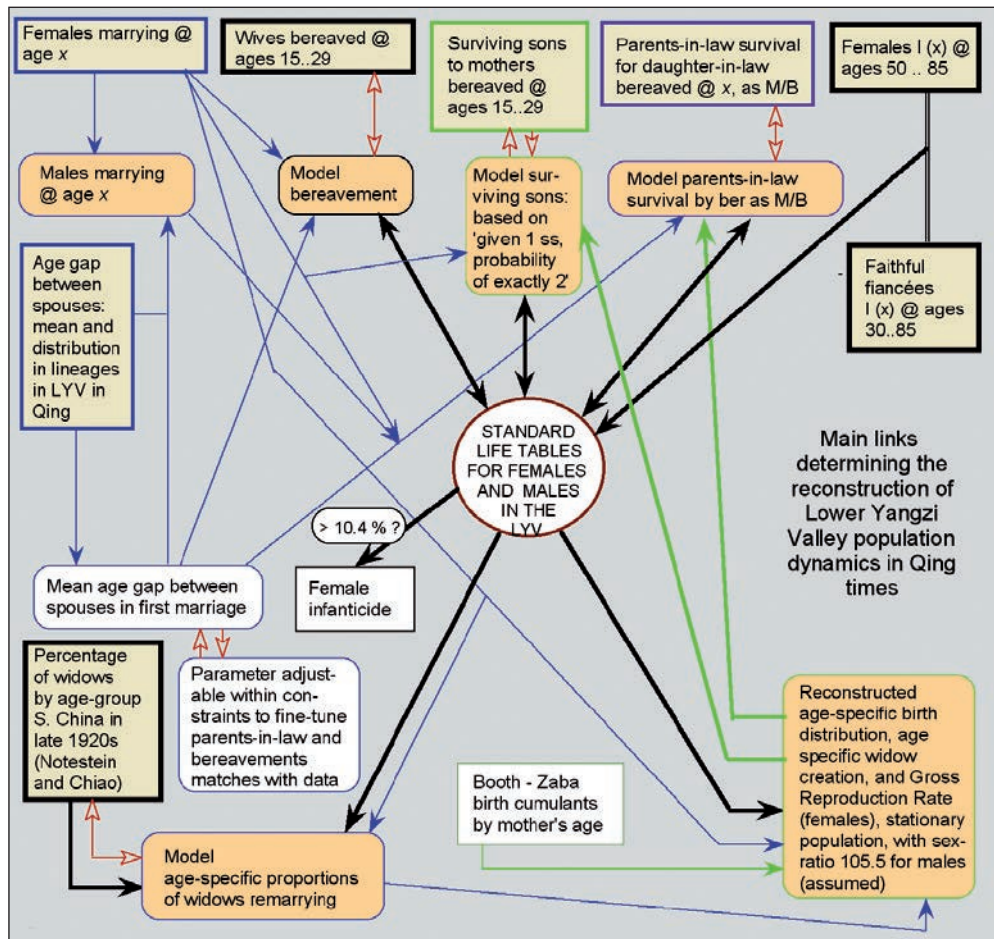


Fig. 11 Overview of the interlinking of the data from various sources in Lower Yangzi Valley populations (mean date 1814) on faithful widows and members of their families to reconstruct a two-sex demographic model for the region. Source: ELVIN and Fox 2008, p. 371

survival of at least one son to around the age of five was the criterion; this age was the point after high infant mortality was at an end, and a son was likely to have a life of about four more decades. (The apparent later pick-up of a higher rate again after ten years of marriage, as shown, is questionable, as the sample sizes get too small at this point to be relied on.)

If this finding is true and not an artefact, there is a plausible hypothesis to explain it. A middle-aged couple operating a small farm on a labour-intensive basis will want to ensure replacement of their labour supply as soon as they can. Hence, there was marriage for daughters at the low mean Western age of just over seventeen, and, it seems, a rapid start to bearing children. Once a son was over five years of age, his chances of survival improved dramatically, so childbearing was slowed down to ease the economic pressure from extra dependents. Seen in this light, Chinese behaviour was a rational adaptation at family level to specific circumstances. Collectively, however, it probably sent the growth of the population

Tab. 1 Provisional standard life table for Lower Yangzi Valley circa 1814. Key: $l(x)$ proportion surviving at exact age x ; $e(x)$ expectation of further years of life at exact x ; $q(x)$ probability of dying during year following exact age x . Note: Female infanticide at or near birth has been omitted as we have no quantitative measures for it. On the most conservative assumptions, it would have been >10.4%, which would have made $l(1)$ more or less the same for both sexes (using the original unrounded data). Source: ELVIN and Fox 2009, p. 102

Age	Fem $l(x)$	$e(x)$	$q(x)$	Male $l(x)$	$e(x)$	$q(x)$
0	1.00	27.25	0.31	1.00	28.43	0.28
1	0.69	38.47	0.16	0.72	38.35	0.15
5	0.57	42.00	0.03	0.58	43.22	0.03
10	0.52	41.20	0.01	0.53	43.31	0.01
15	0.51	36.98	0.00	0.52	38.08	0.01
20	0.49	32.84	0.01	0.50	34.15	0.01
25	0.46	29.70	0.01	0.48	30.88	0.01
30	0.43	27.06	0.02	0.44	28.14	0.02
35	0.39	24.52	0.02	0.40	25.54	0.02
40	0.35	21.87	0.02	0.37	22.86	0.02
45	0.32	18.83	0.03	0.33	20.03	0.02
50	0.28	16.41	0.03	0.29	17.26	0.03
55	0.23	13.84	0.04	0.25	14.58	0.04
60	0.19	11.66	0.05	0.21	12.27	0.05
65	0.14	9.54	0.06	0.16	10.03	0.05
70	0.10	7.24	0.08	0.12	7.61	0.08
75	0.06	5.41	0.11	0.08	5.65	0.10
80	0.03	3.16	0.16	0.04	3.26	0.15
85	0.01	0.02

up,³ and made for serious long-term environmental trouble by increased demographic pressure on resources. Unfortunately, there seems to be little reliable evidence, at least as yet, that would let us see something of the preceding period and how and when this distinctive pattern developed.⁴ The technical means used for the limitation of births is not known, though there were effective contraceptives and abortifacients (BRAY 1995), but, in a sample from a mainly farming population (perhaps ~75%), it is likely that simpler methods like *coitus interruptus* were the most commonly used.

The later seventeenth and the eighteenth century saw two other changes that were also adaptations. The first was the increasing part played by women (and perhaps also children) in farm work (ELVIN 1982, 1998, 2004), in addition to their more traditional tasks of spinning

3 By shortening the gap between successive generations.

4 The calculations shown in the graph have required a graded adjustment of those cases in the data which record, in effect, the information: “when she was widowed at age x she had at least one son but possibly more surviving,” these being some ~37.35% of the 10,894 data cases used here. The percentage of these ambiguous cases recoded age-by-age for use during the running of the programme to shift them from the imprecise “one son or more surviving” to “exactly two sons surviving” was increased linearly from 0% at age twelve (the age for which the first births are listed) to a maximum of 28% at age thirty, as this gives the best fit to the data from the fertility figures generated by the demographic model established (via annual proportions getting married at the appropriate age-distribution and BOOTH’s GRR patterns) to provide for an exact replacement of the mean population lost each year through mortality, as determined from separate data.

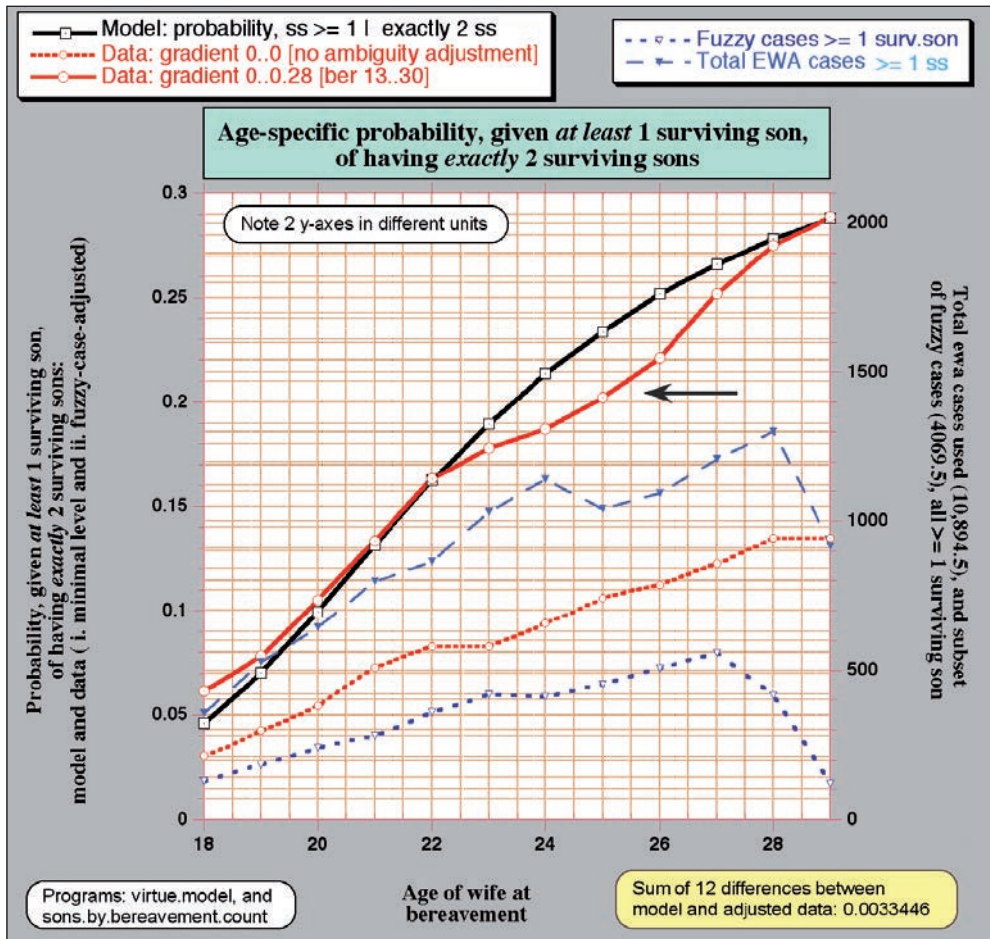


Fig. 12 The evidence (see the black arrow) of probable birth control *within* marriage over wife's ages 22 to 28 in the Lower Yangzi Valley (mean date 1814). Data for the last year are thin. Source: ELVIN and FOX 2008, p. 377

and weaving. This was, so to speak, an intensification of intensification. The second is harder to pin down, but, in the southern half of China at least, there seems during Qing times to have been rather greater personal freedom than during the Ming, when tenant-serfdom still lingered. This was presumably at least in part the result of the tenant-serf uprisings, most in the Yangzi valley, during the last years of the Ming. Some of them, like the so-called "Levelling Kings," were explicitly motivated by a desire for great social equality (ELVIN 1973). I would also guess that labour intensification is more likely to be effectively pursued by someone who is working for himself or herself rather than for others. The Jesuit Fathers in China certainly remarked that "[the lands] of peasant proprietors are of an astonishing fertility, in contrast with the large estates" (*Les Missionnaires de Pékin* 1786).

6. Speculation on the Future

It should be apparent that, as individuals, over the course of their history, the Chinese have often shown an impressive ability to adapt rapidly. It is also apparent that, when a conceptual and organisational world begins to fall apart they can abandon it with surprising suddenness (ELVIN 1999). Of probably no other major culture in the present-day world can it be said that they have abandoned *two* major systems of belief in less than a century, in the Chinese case scriptural Confucianism and Maoist Communism. Other lesser, but still impressive, systems have gone even more quickly; the Sinified Christianity of the rebellion of the Heavenly Kingdom of Great Peace in the middle of the nineteenth century is only the most spectacular example. Passionate belief in the magic of the Boxers in 1899 and 1900 in Shandong and what is now Hebei province, in their invulnerability to firearms, and the capacity of the female Boxers, the Red Lanterns, to fly overnight to Western capitals, wreak destruction there, and be back as the dawn was breaking, gripped all but the most level-headed, even if it was gone like a forgotten dream before 1901 was over. No wonder the current leadership is so fearful of the sectaries of the Falungong.

It has been obvious for some time that environmental problems are going to be one of the two major challenges to the stability of the political and social order in China. The other is the contradiction between the need for a further liberation of creative energy and the dangers of internal anarchy. So what is likely to happen? Here are some reflections.⁵

Short-term political considerations suggest that, for as long as possible, those with power in China are going to strive not to abandon their current efforts to promote high-speed modern economic growth. They will fairly certainly make concessions to public dissatisfaction with widespread pollution and related ill-health, but they are most unlikely to alter the basic strategy of growth for as long as they can avoid doing so. They will certainly continue to make efforts to use China's growing financial and military power to guarantee their access in the world outside China to crucial raw materials. They have already been doing this in various ways, these include: setting up long-term deals where they can, as they have long been doing in parts of Africa, and buying—if they can—controlling shares in useful non-Chinese companies, or else establishing a resource-extraction presence, as has begun to happen in Afghanistan. They will presumably go as far as they can to avoid yielding to international tensions and pressures over actions such as diverting water from the headwaters of rivers that have historically supplied other peoples' economies. This may be the case in the middle term with the Lancang-Mekong and perhaps the Yarlung-Brahmaputra, though we have yet to see. It will also be useful for them, as the Hubble peak approaches for coal not extracted by fracking, that their northern neighbour, Russia, has the world's second-largest reserves of such coal, after the United States. They are, however, strategically short of oil within their own frontiers, as shown by a long enquiry some years ago by the former French oil giant Elf-Aquitaine (personal communication).

They will probably do their best to *seem* helpful and reasonable in international negotiations while being determined to concede almost nothing of substance. Why such probable intransigence? Their best scientists are well aware of what is going on environmentally. Science, however, does not make policy. At stake, in the immediate future, are both the legitimacy of the political system and the wealth of the present interlocking politico-economic ruling stra-

⁵ Partly based on ELVIN 2000, which is, however, already a little dated.

tum. This class of powerful Chinese has more substantial interests in business than did their counterparts in the People's Republic of China's (PRC) past, now that the profitable parts of the former state-owned enterprises have been privatised, mostly, it would seem, into the hands of politically favoured individuals. The polite term currently used for this by economists is "ownership transformation" (GARNAUT et al. 2005). It creates yet another roadblock to more than superficial change in environmental policy.

Further, according to HUANG Yasheng (2008), income inequality in the PRC is now rather greater than in the US and approaching that of Latin America. Internal disruptions from the discontented countryside are also such a frequent problem that, for some years now, the government has stopped publishing the figures. Thus, for the rulers and their associates at all levels, holding on to the legitimacy conferred by being able to present themselves as being the only possible guarantors of a better conventional-growth-based future for everyone is politically indispensable. If rapid major adaptation is nonetheless clearly necessary, the central authorities will take action as a last resort. But could it ever face the tsunami of hatred from producers and consumers that it would meet if it ever tried to impose an economically rational use of water on farming? Yet, at least in the north, water is visibly running short (ELVIN 2003).

My guess is that environmentally needed improvements worldwide have been being made so slowly up till now that, in the end, radical adaptation is increasingly likely to be essential. Is the central government still powerful enough to *compel* the provincial governments to comply with its orders? At the moment, probably yes; in the future, who knows?

It is worth recalling that China since the 1970s has made at least one major adaptation that is probably without equal in the modern world. This is the dramatic slow-down in the rate of population growth associated with the enforcement of the government's one-child-per-family population policy. We can use this policy, which now seems to be weakening, to illustrate the mixture of admirable and dangerous results that can result from such simple objectives. On the good side, population control has helped increase the mean standard of living, though, as this took place, the distribution of income and wealth became much *less* equal: not necessarily unavoidably so, but that's what happened. By reducing the number of younger-age dependents that each family had to care for, limiting births enabled married people to work harder and for longer hours, thus accelerating export-led national economic growth. On the less desirable side, it correspondingly reduced the numbers of the younger generation available, as they grew up, to look after the old, who have also been steadily living rather longer. To make it worse, there is no general adequate provision for a state-funded retirement pension. The well-known result has been a strong preference on the part of married couples to have sons, whom they hope will care for them when they stop work; yet, as an economy modernises, it is usual for labour, especially sons, to be geographically more mobile. This son-preference, often facilitated by antenatal tests for a baby's sex followed by selective abortion, has thrown the ratio between the sexes at birth seriously out of balance, and created a potentially socially disruptive bachelor or, reportedly, sometimes polyandrous class of young males, as well as the kidnapping of young women for sale. To complete the circle, some analysts now think it possible that the growing burden of more and more inadequately cared-for old people may in the end slow down economic growth, though I think it is too soon to say.

In sum, the crystal ball seems to show the likelihood of some uncomfortable but necessary adjustments in the immediate future, some alarming but uncertain possibilities in the middle term, and — indubitably — a cat's cradle of riddles both for actors and observers.

References

- BLUNDEN, C., and ELVIN, M.: *Cultural Atlas of China*. Revised Edition. New York, NY: Checkmark 1998
- BRAY, F.: *Technology and Gender. Fabrics of Power in Late Imperial China*. Berkeley, CA: University of California Press 1995
- BURROUGHS, W. J.: *Climate Change in Prehistory. The End of the Reign of Chaos*. Cambridge: Cambridge University Press 2005
- ELVIN, M.: *The Pattern of the Chinese Past. A Social and Economic Interpretation*. Stanford, CA: Stanford University Press 1973
- ELVIN, M.: Skills and resources in late traditional China. In: PERKINS, D. (Ed.): *China's Modern Economy in Historical Perspective*; pp. 85–114. Stanford, CA: Stanford University Press 1975. Reprinted In: ELVIN, M.: *Another History. Essays on China from a European Perspective*. Sydney: Wild Peony Press 1996
- ELVIN, M.: The technology of farming in late-traditional China. In: BARKER, R., SINHA, R., and ROSE, B. (Eds.): *The Chinese Agricultural Economy*; pp. 13–35. Boulder, CO: Westview Press 1982
- ELVIN, M.: Three thousand years of unsustainable growth. China's environment from archaic times to the present. *East Asian History* 6, 7–46 (1993)
- ELVIN, M.: The bell of poesy. Thoughts on poems as information on late-imperial environmental history. In: CARLETTI, S. M., SACCHETTI, M., and SANTANGELO, P. (Eds.): *Studi in Onore di Lionello Lanciotti. Vol. 1*, pp. 497–523. Napoli: Istituto Universitario Orientale 1996
- ELVIN, M.: Unseen lives. The emotions of everyday existence mirrored in Chinese popular poetry of the mid-seventeenth to the mid-nineteenth century. In: AMES, R., KASULIS, T., and DISSANAYAKE, W. (Eds.): *Self as Image in Asian Theory and Practice*; pp. 113–199. Albany, NY: SUNY 1998
- ELVIN, M.: How did the cracks open? The origins of the subversion of China's late traditional culture by the West. *Thesis Eleven* 57, 1–16 (1999)
- ELVIN, M.: El medio ambiente. In: FISAC, T., and TSANG, S. (Eds.): *China en transición. Sociedad, cultura, política y economía*; pp. 323–360. Barcelona: Ediciones Bellaterra 2000
- ELVIN, M.: Water in China past and present. Cooperation and competition. *Nouveaux mondes* 12, 117–120 (2003)
- ELVIN, M.: *The Retreat of the Elephants. An Environmental History of China*. London: Yale University Press 2004
- ELVIN, M.: Economic pressures on the environment in China during the 18th century seen from a contemporary European perspective. Insights from the Jesuit Mémoires. In: SHIBA, Y. (Ed): *80-Year History of the Toyo Bunko. Vol. 2*, pp. 13–17. Tokyo: Toyo Bunko 2007
- ELVIN, M.: Why intensify? The outline of a theory of the institutional causes driving long-term changes in Chinese farming and the consequent modifications to the environment. In: SÖRLIN, S., and WARDE, P. (Eds.): *Nature's End. History and the Environment*. London: Palgrave Macmillan 2009
- ELVIN, M., and FOX, J.: Local demographic variations in the lower Yangzi valley during mid-Qing times. In: HIRZEL, T., and KIM, N. (Eds.): *Monies, Markets, and Finance in China and East Asia*; pp. 333–378. Berlin: Lit Verlag 2008
- ELVIN, M., and FOX, J.: Marriages, births, and deaths in the lower Yangzi valley during the later eighteenth century. In: HO, C. (Ed.): *Windows on the Chinese World. Reflections by Five Historians*; pp. 67–111. Lanham, MD: Lexington Books 2009
- ELVIN, M., and LIU, T. (Eds.): *Sediments of Time. Environment and Society in Chinese History*; pp. 344–410. New York, NY: Cambridge University Press 1998
- ELVIN, M., and SU, N.: Action at a distance. The influence of the Yellow river on Hangzhou Bay since A.D. 1000. In: LIU, T., and ELVIN, M. (Eds.): *Jijian suo zhi. Zhongguo jianjing-shi lunwenji. 2 Vols*. Taipei: Academia Sinica 1995. Also in: ELVIN, M., and LIU, T. (Eds.): *Sediments of Time. Environment and Society in Chinese History*; pp. 344–410. New York, NY: Cambridge University Press 1998
- GARNAUT, R., SONG, L., TENEV, S., and YAO, Y.: *China's Ownership Transformation. Process, Outcomes, Prospects*. Washington, DC: International Finance Corporation and The World Bank 2005
- HOSHI, A.: *The Ming Tribute Grain System*. Translated by ELVIN. M. Ann Arbor, MI: Center for Chinese Studies, University of Michigan 1969
- HUANG, Y.: *Capitalism with Chinese Characteristics. Entrepreneurship and the State*. New York, NY: Cambridge University Press 2008
- Les Missionnaires de Pékin: Mémoires concernant l'histoire, les arts, les moeurs, les usages &c des Chinois*. Paris: T. 11. Nyon 1786
- LIN, C.: *Changjiang Sanxia yu Geba-de nisha ji huanjing [Sediments and the environment at the Three Gorges and Geba dams]*. Nanjing: Nanjing University Press 1989
- LOVELOCK, J.: *The Vanishing Face of Gaia. A Final Warning*. London: Penguin Books 2009

Mark Elvin

- MOORE, R. I.: The Hamlyn Historical Atlas. London; New York; Hamlyn 1981 (p. 40)
WAGNER, W.: Die Chinesische Landwirtschaft. Berlin: Paul Parey 1926
YIM, S.: Famine Relief Statistics as a Guide to the Population of Sixteenth-Century China. A Case Study of Honan Province. *Ch'ing-shih Wen-t'i* 3/9 (1978)
ZHANG, Y., and ELVIN, M.: Environment and Tuberculosis in Modern China. In: LIU, T., and ELVIN, M. (Eds.): *Jijian suo zhi. Zhongguo jianjing-shi lunwenji*, 2 Vols., Taipei: Academia Sinica 1995. In: ELVIN, M., and LIU T. (Eds.): *Sediments of Time. Environment and Society in Chinese History*, 520–544. New York: Cambridge University Press 1998.
ZHU, K.: *Zhongguo jin wuqiannian-lai qihou bianqian-de chubu yanjiu* [Preliminary investigations into the changes in China's climate during the last 5000 years]. *Kaogu xuebao* 1 (1972)

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Coping with Abundance Revisited: American Energy Choices

Martin V. MELOSI (Houston, TX, USA)

With 3 Figures

Abstract

In his essay on the topic of energy in US American history, Martin MELOSI begins by pointing out that Americans have historically enjoyed an almost uninterrupted energy surplus, and that the USA—with the exception of the short energy crisis—has often wasted its resources, and rarely extracted more than a part of them. He shows that the transition from one source of energy to another—from wind and water to wood, to coal, and to oil—is something of a myth. In fact, a range of sources of energy co-existed. Thus, the demand for a new source of energy, one that would replace oil, does not really reflect the reality. Future transitions will neither be smooth nor radical.

Zusammenfassung

In seinem Aufsatz zum Thema Energie in der US-amerikanischen Geschichte geht Martin MELOSI zunächst darauf ein, dass die Amerikaner in ihrer Geschichte fast durchgängig von einem Überfluss an Energiequellen zehren konnten und dass die USA – von der kurzen Phase der Energiekrise abgesehen – ihre Ressourcen häufig verschwendet oder nur partiell extrahiert haben. Er zeigt, dass es den Übergang von einer Energiequelle in eine andere – von Wind und Wasser zu Holz, zu Kohle und Öl – in der Geschichte kaum gegeben hat. Vielmehr existierten verschiedene Energiequellen parallel nebeneinander. Die Forderung nach einer neuen Energiequelle, die etwa Öl ersetzt, gehe an der Realität vorbei. Auch in Zukunft werden Übergänge weder glatt noch radikal sein.

1. Introduction

In 1985, I wrote a book called *Coping with Abundance: Energy and Environment in Industrial America*, which was an energy history of the United States. While the latter chapters are quite dated by now, the title explains the central theme and argument stated in the opening paragraph:

“The United States was blessed with abundant energy sources throughout its history. Whether immediately exploitable or only potentially so, these sources were vital to the developing nation in the nineteenth century and the developed nation in the twentieth. Abundance affected the way Americans used energy, how businesses developed and marketed it, and how government established policies about it. While bestowing many benefits, the array of energy sources posed problems of choice. The *luxury of choice* was preferable to the *necessity to choose*, but it often proved a curse when policy makers tried to arrive at coherent and comprehensive energy policies or strategies. The energy history of the United States, therefore, has been an ongoing effort to cope with abundance.”¹

I came to a number of tentative conclusions (some self-evident) in the book in no particular order. These can be summarised as follows:

1 MELOSI 1985, pp. 3.

- *First*, the idea of energy abundance tells a great deal about the cultural impact of energy use and development in the United States. Endowed with copious quantities of domestic supplies and having access to foreign sources, Americans expected energy to be never ending and cheap. Energy was also a counterweight to traditional scarcities, especially through much of the nineteenth century—labour, capital, manufactured goods, land (in New England), water (in the West) and bullion for specie.
- *Second*, abundant energy turned labour-intensive jobs into capital-intensive jobs. Energy supplies provided sources of commercial wealth and aided in increasing agricultural and manufacturing efficiencies. Generally, abundance altered American material life, influenced the formation of energy policy, and distinguished the United States as a rising world power.
- *Third*, energy sources were squandered or inefficiently extracted. The energy crisis in the 1970s only temporarily brought to question the abundance and exploitation of precious resources, but the theme was echoed by critics of American capitalism over many years.

2. Energy Transitions: The “One Best Way”

For the United States, the concept of energy transitions has helped to periodise the development and use of energy sources over the years, and to explain economic and environmental changes, even cultural changes, taking place particularly since the Industrial Revolution in the nineteenth century. More recently, experts have used the concept in discussions about future energy exploitation, with an eye toward promoting sustainable development in a post-petroleum society (DUFFY 2007, KEDROSKY 2010, BRYCE 2010).

The concept of energy transitions (OOSTHOEK 2011) is based on the idea that a single energy source, or a group of sources, dominated the market during a particular period or era, eventually to be challenged and then replaced by another major source or sources. By tracing the rise and fall of dominant types of energy, scholars have focused more on a production-side perspective, than a consumption-side assessment (MELOSI 2006). One of the few exceptions is David NYE (1990, 1998), who has written substantially about consumption of several different types of energy sources. Few, however, have devoted much space to evaluating the inherent characteristics of rising and falling energy-source dependence and what that might mean for moving through a new period of transition.

A classic US periodisation model might be:

- Period I (pre–1820): A period before the mid-nineteenth century when human and animal power, wind, wood, and waterpower all contributed to American energy use. (Wind, wood, and waterpower often are identified as forms of “solar” power—deriving their energy from the sun.)
- Period II (1820–1914): An era roughly from 1820 to 1914 tracing the transition to an industrial society, where wood, waterpower, and eventually anthracite and bituminous coal were essential to the stimulation of the Industrial Revolution. Petroleum emerged as a major illuminant, and electrical power systems were in their early stages of development. The role of government to some degree began to shift from economic promoter to industrial regulator.
- Period III (1914–1945): Approximately between 1914 and 1945 (World War I and World War II), when the United States emerged as the world’s leading economic power. Oil

became the primary fuel, and the production and use of electrical power increased dramatically. Government played a major role in establishing an energy policy still built on economic promotion and some regulation.

- Period IV (1945–1970s): Beginning after World War II, with an uncertain end date and a very interesting break in the 1970s. The economy was becoming “postindustrial” with fewer primary industries and more service-oriented jobs. The role of government as economic promoter and regulator continued. A key change was that the demand for energy by Americans began to outstrip the nation’s capacity to produce it internally. The dominant fuel remained petroleum. The energy crisis of the 1970s created a brief “pause” in reflecting on our energy future, and the rise of the environmental movement raised several uncomfortable questions about the extraction, development, and use of many types of energy. Little or no change in consumption habits occurred, and increasing demand continued apace.
- Period V: (1970s–?): Living in the 1970s, some experts envisioned a major transition in the making, but it did not happen. The Ronald REAGAN administration’s enthusiasm for economic growth in the 1980s, a sustaining of that enthusiasm into the 1990s and beyond, and the country’s indifference to escalating energy problems—economic, strategic, and environmental—brought that into question. The current energy period is still wedded to fossil fuels—to carbon—without clear signs of a looming new transition. For some, a new transition is more hope than reality (MELOSI 1986).

The following are a few graphic representations of that classic model (Fig. 1–3).

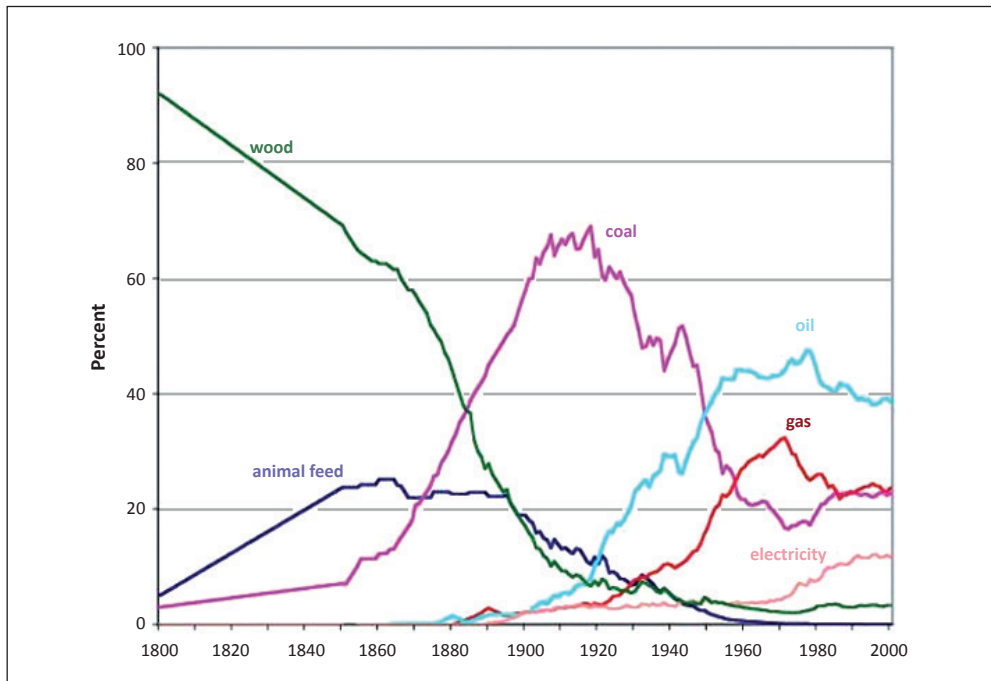


Fig. 1 Contributions to American energy use. Source: CLEVELAND and SAUNDY 2008, online, http://www.eoearth.org/article/Energy_transitions_past_and_future.

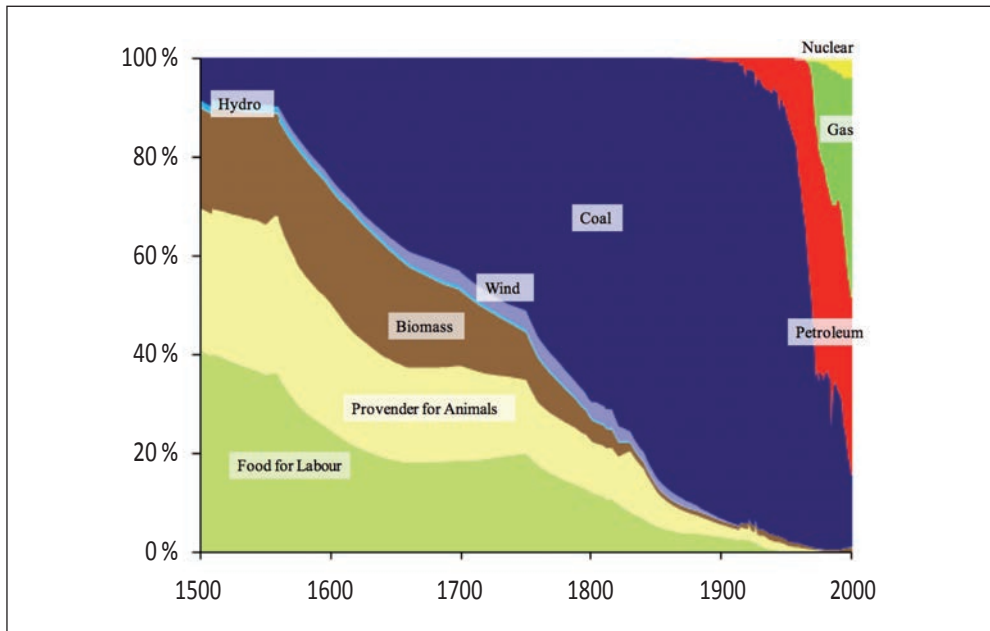


Fig. 2 Share of Primary Energy Consumption in the United Kingdom (1500–2000). Source: FOUQUET 2010

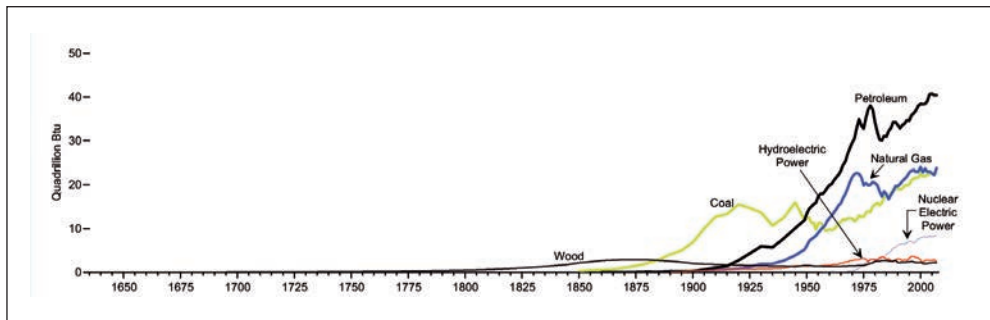


Fig. 3 Primary energy consumption by source, 1635–2008. Source: *Energy Information Administration* 2008, Fig. 5 [http://www.eia.doe.gov/emeu/aer/ep/ep_frame.html]

Looking beyond the chronological energy eras in American history, it is essential to recognise that not only did many Americans believe that energy supplies were abundant and inexhaustible, but that the change from one major source to another—a transition—was considered to be an *obvious improvement*: more energy, better energy, cheaper energy.

There was also a tendency to view American energy transitions as movement from one single source to another; that is, experts often viewed energy sources as competitive rather than potentially complementary. The “one best way,” therefore, remained in place until overthrown by a new “one best way.” The cycle has been understood in terms of transitions from wood, waterpower, and wind to coal; from coal to petroleum; and from petroleum to —?

No energy period actually relies on a single energy source. The basic question must be the degree of use and the particular end uses of fuels. In looking to the future—to a post-petroleum world—we cannot think in terms of leaving petroleum behind, but asking what role will it play in the future? In the nineteenth century, as softwood forests were being used for fuel at an alarming rate along the East Coast, it became clear that hardwood trees were not a good replacement. Hardwood had more value in constructing furniture or other products than as limbs and logs to be burned in fireplaces. So too, in the near future, petroleum may come to be regarded as too valuable as a feedstock for producing plastics and chemicals, for instance, than as a source for running automobiles or other conveyances (OLSON 1971).

Taking all of this into account (although this is a very elemental assessment) does help to explain why there has been resistance to a new transition that refuses to conform to the old patterns—especially in the current political debate. Extreme positions seem to dominate, and much is made of the polarity between focusing either on “peak oil”—or the end to petroleum—as driving a new and ultimately necessary transition, or on an apparent end to fossil fuels as “the best way” and the need for something to replace it, especially sustainable or alternative sources.

Obviously, not everyone—especially experts and specialists—thinks in such simplistic terms, but there is a great deal of historical momentum about energy transitions that is driving the public debate over our future energy needs and wants, which emphasises not only the “one best way” but also defends a lifestyle built on abundance and cheap sources of energy and underplays technical efficiencies and conservation. History offers some very useful lessons, but lessons that need to be deeply considered and re-evaluated.

3. Rethinking Energy Transitions

Let us examine a different way to think about energy transitions that might readjust the crude paradigm implicit in “America the Abundant.”

The use of conventional “energy transition” periodisation—wood to coal, coal to oil—has been a comfortable tool because it provides a rational structure and narrative. But it is not very useful as a predictive tool (are historians allowed to predict at all?) if its premises are flawed or too restrictive, as I think they are.

The following are some concerns that I have about a simplified “energy transitions” narrative, and what questions might be raised in evaluating its usefulness as a historical tool and as a future predictor.

The most beneficial way to utilise the conceptual tool of “energy transitions” perhaps would be to view this notion as a fluid process, rather than regarding it as a pretext for establishing rigid barriers between specific energy eras. Potentially, energy transitions can help to clarify how energy development and use influence, and are influenced by, the technical, economic, political, environmental, and social forces that shape society. As a historical tool, the energy transition has much to recommend it. In the broadest sense, the concept can help researchers understand the evolution of human material culture, economic growth and development, the utilisation of resources, and social organisation. Utilised too narrowly, however, it merely provides a convenient instrument for segmenting energy history within a one-dimensional chronology. Too often existing energy transition narratives depend on gross statistics about the amounts of energy sources utilised in a given time period. Such a

focus has little comparative value and does not easily translate into common measures with clear definitions.²

Simply stated, energy transitions can be used as the basis for historical arguments in two simple ways: quantitatively, by measuring changes in energy consumption; or qualitatively, by evaluating the impact of new sources of energy on various aspects of American life. The quantitative approach yields a simple periodisation of energy history based on peaks and troughs of wood, water power, coal, petroleum, natural gas, and so forth. The latter is more complex and, therefore, more flexible.

Before one develops any kind of “energy transitions” narrative, it must be contextualised to be placed within a time frame evaluating several variables aside from “scarcity” or “best use.”

Energy transitions are slippery when one tries to apply them nationally, except in the most quantitative sense. Transitions occur locally and regionally for a variety of reasons that transcend broad national trends. For example, take the exploitation of anthracite coal in Pennsylvania in the nineteenth century. In an abstract to a recent article, Christopher JONES argued:

“Between 1820 and 1860, the construction of a network of coal-carrying canals transformed the society, economy, and environment of the eastern mid-Atlantic. Artificial waterways created a new built environment for the region, an energy landscape in which anthracite coal could be transported cheaply, reliably, and in ever-increasing quantities. Flush with fossil fuel energy for the first time, mid-Atlantic residents experimented with new uses of coal in homes, iron forges, steam engines, and factories. Their efforts exceeded practically all expectations. Over the course of four decades, shipments of anthracite coal increased exponentially, helping turn a rural and commercial economy into an urban and industrial one.”³

JONES’s study points to the need for many more case studies that examine energy transitions on a local or regional basis. Broad generalisations about transitions fail in many cases because they do not take into account historic local and regional variations. Transitions occur locally and regionally for a variety of reasons that transcend broad national trends. A country as vast as the United States could not be expected to rely on a common single source of energy in any stage of its history. Examining regional or local uses obviously forces a restructuring of energy transition periodisation.⁴

Emphasis on single source transitions too often leads to the assumption that scarcity produces change. This may be true in some local circumstances, but most often, change in fuel choices takes into account the value of the source as a fuel (e.g., hard wood for furniture, not for burning); abundance and quality of the source (e.g., anthracite coal as opposed to wood); the end uses—can one fuel replace another for certain end uses?; access to sources of energy; and environmental costs.

I would argue that the most successful energy transitions embrace fuels with elastic uses—especially for both stationary and motive power. This has been true for wood, coal, and especially petroleum, more than hydropower or windpower, for example. That being said, no one source can accomplish all energy demands, but some are more flexible and adaptable than others. If one particular source demonstrates great value as a fuel for generating stationary power, thoughts must turn to complementary sources, not only competing ones. Therefore, future transitions must take into account a multi-source approach to energy development

2 See SCHURR and NETSCHERT 1960 for a very conventional approach to energy transitions.

3 JONES 2010, pp. 449.

4 See, for example, TARR and LAMPERES 1981.

and use. In the political arena, where fossil fuels are often pitted against “alternative energy sources,” such polarities are unworkable and terribly unwise.⁵

Also crucial is the question of the “process” of transitions. What inertia—technological, economic, social—have to be overcome to make the transition? Such issues as automation *versus* a manual workforce, vested economic interests, technical changes, environmental costs, the prevailing market system, and cultural and social preferences strongly influence transition—possibly much more than specific fuels.

In many respects, therefore, energy sources are strongly path-dependent; that is, initial decisions made about the choice of a fuel or energy source make it difficult to shift to another fuel or energy source, no matter what the newer source’s advantages might be (MELOSI 2005). Several years ago, historian Brooke HINDLE wrote about America’s “Wooden Age,” which faded by the mid-nineteenth century. The Wooden Age depended on wood for heat, for building, for transportation, and for commercial and manufacturing activity. At the time, grist mills and sawmills using waterpower utilised structures made of wood and leather to do work. With steam engines—and eventually the use of coal—such equipment could not withstand the faster speeds and greater power produced by steam power, and had to be replaced by new, sturdier machinery made out of metal and more rugged materials. Wood corders who had made a living selling fuel wood to residence later would lose their jobs to coal merchants. New stoves would eventually replace old wood-burning varieties to be able to handle higher intensity anthracite coal. All in all, new technologies, new economic institutions, new transportation systems, and so forth would have to be created to sustain an energy transition that could recast the Wooden Age into something different. Such changes eventually would happen, but not immediately and not without a multitude of actions and favourable circumstances. Transitions were rarely smooth nor absolute, and rarely revolutionary. They tend to be grounded in evolutionary change (HINDLE 1975, 1981).

4. Conclusion

In light of the statements above, here are a few forward-looking questions worth considering before relying so quickly on energy transitions:

- Can we really consider a near-term post-carbon transition? What forces suggest such a change?
- Given the complexity of a transition—something that cannot easily be forced—shouldn’t we be giving attention to bridge fuels/sources as well as long-term alternative sources?
- It might be useful to revive the idea of conservation as a source of energy as well as the complex problem of technical efficiencies as part of the intermediate solutions to energy needs.
- Based on what we know, how can we really predict what a post-carbon transition will look like and when? What forces suggest such a change?
- Shouldn’t we take into account a wider array of variables than we have in the past to construct predictive models?

⁵ For some useful context, see “Energy Transitions in History: A Short Bibliography,” Environmental History Resources, online, http://www.eh-resources.org/bibliography/biblio_energy.html (accessed February 4, 2011).

Understanding the energy present and energy future in the United States—and elsewhere—requires a clear appreciation of the role of “energy abundance” in framing perspectives on energy in its past, and ways in which such perspectives limit our thinking about present and future energy choices and alternatives. Such mindless chants as “Drill baby, drill!” are simply irresponsible and short-sighted (YERGIN 2006).

All things considered, it is time to revise our notion of energy transitions and develop more sophisticated ways to attempt to measure our future needs and expectations in the field of energy studies. It is not the time to necessarily reinvent the wheel, but to add some new wheels to our energy cart.

References

- BRYCE, R.: Wood to Coal to Oil to Natural Gas and Nuclear. The Slow Pace of Energy Transitions. Energy Tribune, 16 August 2010. [<http://www.energytribune.com>]
- CLEVELAND, C., and SAUNDRY, P.: Energy transitions past and future. In: CLEVELAND, C. (Ed.): *Encyclopedia of Earth*. Washington, DC: Environmental Information Coalition, National Council for Science and the Environment 2008.
[First published in the *Encyclopedia of Earth* September 23, 2008; Last revised Date February 13, 2011; Retrieved February 8, 2012. http://www.eoearth.org/article/Energy_transitions_past_and_future.]
- DUFFY, E.: The next energy transition. The Natural Patriot, accessed 13 April 2007
<http://naturalpatriot.org/2007/04/13/the-next-energy-transition/>
- Energy Information Administration: Annual Energy Review 2008*
http://www.eia.doe.gov/emeu/aer/ep/ep_frame.html
- FOUQUET, R.: The slow search for solutions. Lessons from historical energy transitions by sector and service. *Energy Policy* 38/10, 6586–6596 (2010)
- HINDLE, B. (Ed.): *America's Wooden Age. Aspects of its Early Technology*. Tarrytown, NY: Sleepy Hollow Restorations 1975
- HINDLE, B. (Ed.): *Material Culture of the Wooden Age*. Tarrytown, NY: Sleepy Hollow Restorations 1981
- JONES, C. F.: A landscape of energy abundance. Anthracite coal canals and the roots of American fossil fuel dependence, 1820–1860. *Environmental History* 15, 449–484 (2010)
- KEDROSKY, P.: Energy Transitions, Then and Now. Infectious Greed, 11 July 2010
http://paul.kedrosky.com/archives/2010/07/energy_transiti_1.html
- MELOSI, M. V.: *Coping with Abundance. Energy and Environment in Industrial America*. New York: Alfred Knopf 1985
- MELOSI, M. V.: The third energy transition. Origins and environmental implications. In: BREMNER, R. H., REICHARD, G. W., and HOPKINS, R. J. (Eds.): *American Choices. Social Dilemmas and Public Policy Since 1960*; pp. 187–218. Columbus: Ohio State University Press 1986
- MELOSI, M. V.: Path dependence and urban history. Is a marriage possible? In: SCHOTT, D., LUCKIN, B., and MAS-SARD-GUILBAUD, G. (Eds.): *Resources of the City. Contributions to an Environmental History of Modern Europe*; pp. 262–275. Hampshire: Ashgate 2005
- MELOSI, M. V.: Energy Transitions in Historical Perspective. In: DOOLEY, B. (Ed.): *Energy and Culture. Perspectives on the Power to Work*; pp. 3–18. Hampshire: Ashgate 2006
- NYE, D. E.: *Electrifying America: Social Meanings of a New Technology, 1880–1940*. Cambridge, MA: MIT Press 1990
- NYE, D. E.: *Consuming Power: A Cultural History of American Energies*. Cambridge, MA: MIT Press 1998
- OLSON, S. H.: *The Depletion Myth: A History of Railroad Use of Timber*. Cambridge, MA: Harvard University Press 1971
- OOSTHOEK, J.: *Energy Transitions in History. A Short Bibliography*. Environmental History Resources, accessed 4 February 2011 http://www.eh-resources.org/bibliography/biblio_energy.html

- SCHURR, S. H., and NETSCHERT, B. C.: *Energy in the American Economy, 1850–1975*. Baltimore: Johns Hopkins University Press 1960
- TARR, J. A., and LAMPERES, B.: Changing fuel use behavior and energy transitions. The Pittsburgh smoke control movement, 1940–1950. A case in historical analogy. *Journal of Social History* 14, 561–588 (1981)
- YERGIN, D.: The politics of energy conservation. *Annals of the New York Academy of Sciences* 324 doi/10.1111/j.1749-6632.1979.tb35154.x/ (1979)

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Environmental Studies: Research in Progress

Doctoral Dissertations from Georg-August-Universität, Göttingen

Less Bread—More Stones: Land-Use Change from the Late Eighteenth Century to the Beginning of the Twenty-First Century. A Regional Study of Göttingen

Ulrike ANDERS (Göttingen)

With 1 Figure

My dissertation project is a historical review of land use and land-use patterns within the city boundaries of today's Göttingen. I address questions relating to the change of landscape structure, ecological functions, and ecosystem services that can be understood as the result of changes in the utilisation of the landscape. I will examine GIS (Geographic Information System) and historical maps and documents to help answer questions concerning relevant changes. Furthermore, I will also address direct and indirect driving forces that may have brought about these changes.

1. Preservation of Ecosystems, Functions, and Services

Today, Europe's landscape is almost without exception a cultivated landscape. The area of southern Lower Saxony, where the city of Göttingen can be found, is no exception in this regard. Formerly a region that largely consisted of mixed beech woodland, today it consists of an open, mosaic-like landscape that is characterised by alternating woodland areas, hedges, meadows and arable land. In contemporary times, urban settlements and transportation routes are increasingly shaping the landscape. The landscape itself is very obviously the product of agricultural utilisation, a form of land use that has changed the landscape in this region like no other.

The history of land exploitation and the conversion of landscapes go far back into the past. The clearing of woodland, the cultivation of land for grazing, the division of land into fields and gardens, the introduction of cultivated plants and associated flora, the establishment of urban settlements and the construction of transportation routes profoundly changed the natural environment (VOS and MEEKS 1999). Centuries of pre-industrial land use have created Europe's diverse mosaic pattern of cultivated and natural landscapes, which may display great biodiversity (*European Environment Agency* 2010). There has not been any other period in the era of human settlement in which the landscape has undergone such serious and grave changes as in the past two hundred years.

At present, the preservation of both the functions and services provided by the ecosystem is an important concern for our society. This social concern is established in Article 1 of the Federal Nature Conservation Act (*Bundesnaturschutzgesetz*, BNatSchG as of March 2010). The preservation and generation of landscape functions and ecosystem services is largely dependent on the way the land is utilised (FRITSCH 2002).

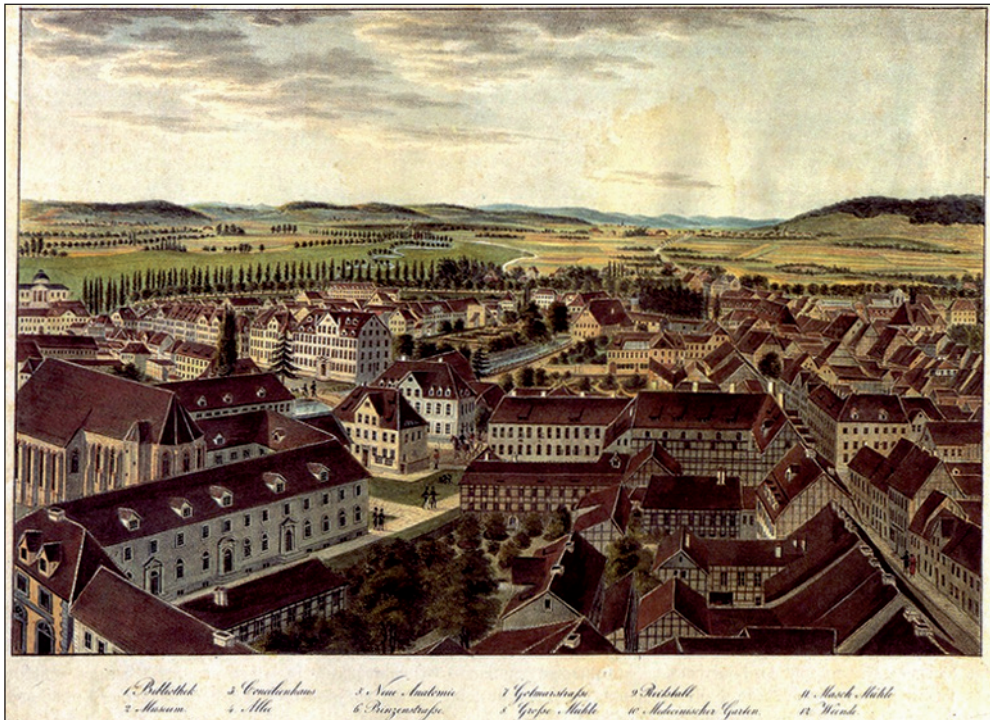


Fig. 1 View over Göttingen and its immediate environment, circa 1850. Source: Lithograph of Friedrich BESEMANN, Stadtarchiv Göttingen (2009)

Here, one must take into consideration the fact that ecosystem services are increasingly being considered in terms of their benefit to human society, both within scientific as well as a nature protection discourse (LENZ et al. 2010). Provisioning services, regulating services, supporting services, and cultural services are defined and combined with the factors of ecological integrity in order to determine the potential improvement of ecological structures and functions (cf. DE GROOT 1992, COSTANZA et al. 1997, BASTIAN and SCHREIBER 1999, LENZ et al. 2010). Supporting services include nutrient cycles, ground formation, and the primary production of materials. Provisioning services include food, water, wood and fibrous materials. Regulating services include the positive influence of the ecosystem on the local climate, protection against flooding or disease, and the removal of harmful substances. Cultural services include the recreational effect of the landscape as well as aesthetic and spiritual benefits (DAILY 1997, *Millennium Ecosystem Assessment* 2005).

2. Research

The aim of this investigation is to assess changes in landscape functions and services in the present communal district of Göttingen over the past two hundred years. Furthermore, the direction these changes are inclined to take is also of interest. I have used an area of around twelve thousand hectares in today's city of Göttingen for an area analysis.

To develop this subject matter, I have used historical and current maps as the basis for the production of a geographical information system (GIS) for various land utilisation analyses. The first stage of my project involves recording change in land use from the late eighteenth century to the beginning of the twenty-first century, using maps and transferring them to standard classes of utilisation in order to make a comparison possible. This will be followed by the creation of a model of selected ecosystem services and landscape functions. In order to assess these functions, I will identify examples of landscape functions that correspond to the land surface coverage in a particular way. The procedure for determining structural measure masses has turned out to be a suitable means for determining the structural diversity. In addition to analysing maps and remote sensing data, planning-related documents as well as written and image sources from various eras must be evaluated and checked in an analysis that considers existing, utilised, or lost functions, services and structures.

Verifying whether there has been a loss of services and functions in the past two hundred years, whether there was a shift in potential benefits that demonstrate overlapping/converging and claimed functions and services appears important in this respect.

References

- BASTIAN, O., and SCHREIBER, K. F. (Eds.): *Analyse und ökologische Bewertung der Landschaft*. 2nd ed. Heidelberg: Spektrum Akademie Verlag 1999
- Bundesnaturschutzgesetz* (BNatSchG) (2010): http://www.bundesrechtjuris.de/bnatschg_2009/ accessed 19 January 2011
- COSTANZA, R. (Ed.): *The value of world's ecosystem services and natural capital*. *Nature* 387, 253–260 (1997)
- DAILY, G. C.: *Nature's Services Societal Dependence on Natural Ecosystems*. Washington DC: Island Press 1997
- GROOT, R. S. DE: *Functions of Nature: Evaluation of Nature in Environmental Planning, Management and Decision Making*. Groningen: Wolters-Noordhoff 1992
- European Environment Agency (EEA): 10 Messages for 2010 Cultural Landscape and Biodiversity Heritage*. Copenhagen: EEA 2010
- FRITSCH, U.: *Entwicklung von Landnutzungszenarien für landschaftsökologische Fragestellungen*. Potsdam: PIK 2002
- LENZ, R., BREUSTE, J., LÖFFLER, J., MÜLLER, F., STEINHARDT, U., and WALZ, U. (Eds.): *Was macht Landschaft wertvoll? Ökologie, Kunst und Wirtschaft zwischen Bewertung und Inwertsetzung*. Nürtingen: Hausdruckerei der Hochschule für Wirtschaft und Umwelt 2010
- Millennium Ecosystem Assessment*: <http://www.millenniumassessment.org/en/About.aspx>, accessed 10 May 2010
- VOS, W., and MEEKES, H.: *Trends in European cultural landscape development. Perspectives for Sustainable Future. Landscape and Urban Planning* 46/1–3, 3–14 (1999)

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Continents under Climate Change

Konferenz aus Anlass des 200. Gründungsjubiläums der Humboldt-Universität zu Berlin in Zusammenarbeit mit dem Potsdam-Institut für Klimafolgenforschung (PIK) und der Deutschen Akademie der Naturforscher Leopoldina

Unter der Schirmherrschaft des Auswärtigen Amtes der Bundesrepublik Deutschland

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Der Klimawandel gehört zu den drängendsten globalen Problemen unserer Zeit. Die Menschheit steht vor besonderen Herausforderungen, um insbesondere den CO₂-Ausstoß zu senken. Führende Wissenschaftler aus der Klimaforschung betrachten die Auswirkungen des Klimawandels auf die Kontinente Europa, Asien, Afrika, Amerika und Australien sowie die Polarregionen. Dabei werden neueste Klimadaten unter globalen und regionalen Gesichtspunkten ausgewertet und Simulationsmodelle für zukünftige Entwicklungen diskutiert. Die Ausführungen bieten ein gut fundiertes Bild der Klimaänderungen, die sich weltweit bereits vollziehen bzw. in Zukunft ereignen werden, und untersuchen kritisch die Folgen für Natur, Gesellschaft und Wirtschaft. Der Kongress „Continents under Climate Change“ wurde im Rahmen der 200. Jahrfeier der Humboldt-Universität zu Berlin vom Potsdam-Institut für Klimaforschung und der Deutschen Akademie der Naturforscher Leopoldina – Nationale Akademie der Wissenschaften veranstaltet. Alle Beiträge sind in englischer Sprache verfasst.

Analyses of the Utilisation and Protection of Waterways in Lower Saxony during the Late Middle Ages and the Early Modern Period (1350–1650)

Ronny CAMMIN (Göttingen)

In general, the focus of my investigation is the confrontation with and about waterways and the handling of the natural infrastructure of rivers. In my study, I will concentrate on eastern Lower Saxony, and especially on the river Aller and its inflows, the Leine and Oker Rivers. Important cities, which were very interested in trade as well as in the navigability of the rivers, were situated next to these rivers. Because of strong regional competition between these cities, they disputed both the right to transport goods down- and upstream to other cities and territorial lordship.

Thus, different interests and concepts of the economical utilisation of rivers among cities and territorial lordships form one of the focal points of this investigation. In this area in the late Middle Ages, the most important problem in the utilisation of waterways was the decision whether or not to allow or tolerate the construction or existence of a waterway for other cities' ships, their skippers and traders. On the one hand it was possible to participate on these as a territorial lordship with protection- and customs duty. Cities held the additional right to force external traders to offer their goods in their market places. In German, this concept is referred to as *Stapelzwang*. On the other hand, there was strong regional economic competition, and so it was often more desirable for a city or territorial lordship to prevent the construction of a waterway to other cities or to cut off existing ones. In this way, goods had to be transported directly by land and had the advantage of a reloading point. If the dispute was about exclusive rights to the use of a waterway, it was possible to secure these rights and still allow the waterway be used for the city's own shipping.

In most cases, a political solution to conflicts concerning waterways was to barge the customs duty for ships. Seldom, disputes led to military confrontation. It is important to look at these economic and political reasons before directly investigating environmental influences such as the engineering and maintenance of waterways, for example water gates, landing stages or tow paths, and changes in utilisation *via* technical progress that originated, for example, in the development of larger ships, which made it more difficult to move further upstream.

At this point in my investigation, other utilisations of rivers, including the construction of water mills or fish traps, is only one point in my argument concerning the constitution of a waterway. It is also possible that these local utilisations were used to prevent regional or supra-regional utilisation—in other words shipping. Compromises were possible, but because of the economic importance of these utilisations, cities preferred to focus on navigability.

When working with my sources, the first step will be to gain an overview of the documents, for example edited document collections of cities and regions. In addition, I must also evaluate the sources in city and state archives. In order to consolidate my research, I will also have to research special economic and legal sources: for example, customs duty registers of ships, bill books of cities that document costs and budget allocations for the construction, maintenance, or extension of waterways.

In the early modern period, not the cities, but rather the territorial lordships attempted to force the extension of waterways in order to ensure economic development in the region.

The chosen time periods are suitable points in history of the Aller, Leine, and Oker Rivers. Around 1350, these rivers lost their importance as waterways, but eventually regained their status by the middle of the seventeenth century, at which point they were once again neglected.

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Natural Environment and Societal Actions in the West Slavic Territory: Conditions and Effects of Hillfort Building in the Natural Environment, Eighth to Twelfth Centuries

Andreas KIESELER (Göttingen)

1. Basis and Question

From the settlement area of the West Slavs, whose territory can roughly be defined by the rivers Elbe and Saale in the west, the Vistula and Bug in the east, the Baltic Sea coast in the north, and Bohemia and Moravia in the south, about three thousand Slavic fortifications are known (BRATHER 2001, p. 119). These ramparts were—with regional differences—built starting in the eighth century and formed several hillfort regions of exceptionally high density. In particular, the fortifications fulfilled different functions: they were possibly the seats of the tribal elite, fortifications for cultic sites, hideaways, or the core of central economic areas—like the late Slavic castle towns (BRACHMANN 1995, BIERMANN 2009). Moreover, their establishment bears witness to the development of social and political relations that correlated with economical development. In this respect, the hillforts are the most important basis for our knowledge of manorial-political and economical development in the different branches of the West Slavic territory. Thus, if one wants to examine the connection between societal actions and the natural environment in the early and high medieval West Slavic territory, the investigation of hillforts holds a key position.

While simple, open settlements could be laid out without special expenditure, the establishment of a fortification meant a drastic intervention both in the natural environment and the environment already anthropogenically modified: at the same time, the construction of fortification claimed a considerable amount of natural resources, including immense amounts of timber, earth, water, raw base material, and livestock and food for the huge group of people who could not supply themselves by agriculture during construction, and later on, while servicing the fortifications. The existing form of settlement changed with the establishment of these new, centralised fortifications: communication networks transformed accordingly and the previously “roaming settlements” became stationary ones. Wood was cleared; clearings, in turn, affected the use of water in the surrounding areas. These were anything but local processes. For instance, in the decades around the year 900, in Lower Lusatia, about forty ringforts were erected in an area of about 1200 km², which dramatically impinged upon both the settlement and the natural environment (HENNING 1998, BIERMANN 2000).

After the construction of the hillforts, their influence on the environment remained strong. This included the effects on the drinking water supply, which was largely assured by courtyard wells, the laying out of fields, the rearing of domestic animals, hunting, and the exploi-

tation of raw materials. All in all, both man-made and natural landscapes were subjected to numerous changes caused by the fortifications. With the onset of hillforts building, the intervention of man in his natural environment was intensified to an extent previously unknown.

Thus, an analysis of hillforts encompasses many aspects concerning the relationship between man and nature. These are beyond the scope of the actual erection of fortifications, because the whole relationship between men and their environment in the early and high medieval West-Slavic area is reflected in hillfort building, and cannot be better characterised archaeologically. Specifically, my research focuses on answering three main questions:

- Which natural requirements formed the basis for the erection of fortifications?
- In what way, and to what extent, were natural resources used?
- How many natural resources were consumed in the building and maintenance of a hillfort?

While, a large number of fortifications in the West Slavic territory have already been investigated in an interdisciplinary way and can, moreover, be dated exactly by dendrochronological analyses (HEUSSNER and WESTPHAL 1998, KARA and KRAPIEC 2000), the basis for an investigation of problems is given. It can be only examined with reference to several aspects of the relation between man and nature, since it is not just a matter of linear relations. An erected fortification, rather, intervened into a complex natural system, and so referred to a network of natural factors, so that a wide range of different sources, and therefore research, had to be used. The study makes use of results from the following scientific disciplines: first and foremost archeological sources, which provide basic information about the fortresses, their character, dating and duration, size, architecture and courtyard development (cf. SCHULDT 1965, J. HERRMANN 1966, DONAT 1984, HENNING 1998, BIERMANN 2000); archeological features related to the utilisation of natural resources (iron production [cf. SCHNEEWEISS 1996], tar distillery [cf. BIERMANN 1998], charcoal burning); archeological features connected with hunting, the cultivation of land, and the rearing of domestic animals (BENECKE 1994). Secondly, dendrological analyses have to be included in view of the kinds and quantity of wood used for different types of hillforts during different time periods. Thirdly, analyses of pollen and macro-botanical material have to be factored in, in order to reconstruct the former natural environment and its changes over the course of the settlement development. Last but not least, archaeozoological aspects may provide indications of the importance of hunting and gathering, draught, and animal husbandry (BENECKE 1994).

With reference to these questions and methods, single fortifications and fortification groups are to be compared with other ringforts from other sub-regions of the West Slavic territory. In doing so, local and regional specifics can be grasped in an innovative and refined form. At the same time, the features have to be analysed in different periods (the Carolingian era with large-scale hillforts from the eighth and ninth centuries, the small, circular ringforts of the tribal era of the later ninth and tenth centuries, and the Late Slavic fortifications [princely residences, residences of castellans, temple fortifications, and castle towns]) to grasp chronological changes and specific functional features of the relationship between man and nature in different fortifications. To realise this, appropriate research on open settlements of the West-Slavic territory must also be integrated, even if only to a certain degree. Besides, the relations in neighbouring wider areas — such as the Frankish-Saxon and German settlement territories — must be considered as well.

2. Methodical Procedure

The area of operation is the territory of Poland and Eastern Germany (to the east of the rivers Elbe and Saale), the Czech Republic, and Slovakia, because this area offers a good research base and encloses different physical-spatial and historical conditions: the earlier economically and politically developed areas on the Baltic Sea coast; the backward Polabian and Polish inner land; the area between the rivers Elbe and Saale, with early influences from the Frankish and German Empires; Silesia and the mountain region of the Sudetes and the Erzgebirge, with strong influences from the Danube region, as well as from the Great Moravian sphere of influence; the territory of the Piasts, with its centre in Greater Poland; the eastern regions of Lesser Poland, Mazovia, and Podlasia, with strong impulses from Kievan Rus; the Bohemian Basin with the early Czech Empire; and the territories of Moravia and Slovakia with the Great Moravian Empire.

The foundation of the study is based on complex investigations of fortifications, on the basis of which the relation between man and nature can be analysed. In Germany and Poland, the Czech Republic, and Slovakia there is meanwhile a huge number of suitable research sites which have been investigated not only archaeologically, but also intensively scientifically, among them the ringfort of Tornow in Lower Lusatia (J. HERRMANN 1966, 1973); the “Pennigsberg” in Brandenburg (BIERMANN 2001); Behren-Lübchin and Groß Raden in Mecklenburg (SCHULDT 1965, 1985); Oldenburg in Holstein (MÜLLER-WILLE 1991); Santok and Bruszczewo in Greater Poland (DYMACZEWSKI 1975, BRZOSTOWICZ 2002); Sypniewo in Mazovia (BIERMANN 2006); Klučov in Czech Republic (KUDRNÁČ 1970); Mikulčice and Pohansko in Moravia (POLÁČEK et al. 1995–2008, MACHÁČEK 2007).

Up to now there have been middle-scale and small-scale studies about the relations of man and environment in single parts of the West Slavic territory (cf. GRINGMUTH-DALLMER and LECIEJEWICZ 2002), single aspects of landscape and agrarian history (e.g. BENECKE et al. 2003, B. HERRMANN 1987), and the history of flora and fauna (BENECKE 1994) as well as the economic exploitation of natural resources (e.g. BIERMANN 1998, 2008).

However, a general and comparative study that examines the characteristics of interrelations between the environment and humans acting within a huge territory, referring to exact dating and different functions of the hillforts, and including a cultural-historical reflection, does not yet exist. This project is meant to fill this gap.

The comparative study will bring together all suitable results from extensively investigated hillforts in the West Slavic settlement area to thus answer the questions outlined above, referring to the relation between man and environment. First, a catalogue has to be prepared that encloses all aspects of hillfort construction, life, and management, and all facts concerning its environmental relations. This catalogue, which will be based on literature and archival studies, forms, for its part, the base on which to examine the aforementioned questions within the scope of a comprehensive and interdisciplinary study, and to analyse and compare them with other regions. Finally, the aim is to work out Slavic hillfort building in its correlation with the progress of the natural environment and, at the same time, to explain the social development of the Slavs against the background of their strategies of utilising land and natural resources.

References

- BENECKE, N.: Archäozoologische Studien zur Entwicklung der Haustierhaltung in Mitteleuropa und Südkandinavien von den Anfängen bis zum ausgehenden Mittelalter. Berlin: Oldenbourg Akademieverlag 1994
- BENECKE, N., DONAT, P., GRINGMUTH-DALLMER, E., und WILLERDING, U. (Eds.): Frühgeschichte der Landwirtschaft in Deutschland. Langenweißbach: Beier & Beran 2003
- BIERMANN, F.: Teererzeugungsgruben als Quelle zur mittelalterlichen Technik- und Wirtschaftsgeschichte des westslawischen Siedlungsraums. *Ethnogr. Arch. Zeitschr.* 39, 161–187 (1998)
- BIERMANN, F.: Slawische Besiedlung zwischen Elbe, Neiße und Lubsza. Archäologische Studien zum Siedlungsweisen und zur Sachkultur des frühen und hohen Mittelalters. Bonn: R. Habelt 2000
- BIERMANN, F. (Ed.): Pennigsberg. Untersuchungen zu der slawischen Burg bei Mittenwalde und zum Siedlungsweisen des 7./8. bis 12. Jahrhunderts am Teltow und im Berliner Raum. Weissbach: Beier & Beran 2001
- BIERMANN, F.: Sypniewo. Ein frühmittelalterlicher Burg-Siedlungskomplex in Nordmasowien/Wczesnośredniowieczny kompleks osadniczy na północnym Mazowszu 1. *Arch. Mazowsza i Podlasia. Studia i Materiały IV.* Warszawa: 2006
- BIERMANN, F.: Die Knochen- und Geweihbearbeitung im nordwestslawischen Siedlungsgebiet vom 7./8. bis 12. Jahrhundert n. Chr. In: MELZER, W. (Ed.): Archäologie und mittelalterliches Handwerk – eine Standortbestimmung. Beiträge des 10. Kolloquiums des Arbeitskreises zur archäologischen Erforschung des mittelalterlichen Handwerks. *Soester Beiträge zur Archäologie* 9, 239–266 (2008)
- BIERMANN, F.: Burgstädtische Zentren der Slawenzeit in Brandenburg. In: MÜLLER, J., NEITMANN, K. K., und SCHOPPER, F. (Eds.): Wie die Mark entstand. 850 Jahre Brandenburg. S. 101–121. Wünsdorf: Brandenburgisches Landesamt für Denkmalpflege und Archäologisches Landesmuseum 2009
- BRACHMANN, H. (Ed.): Burg – Burgstadt – Stadt. Zur Genese mittelalterlicher nichtagrarischer Zentren in Ostmitteleuropa. Berlin: Akademie Verlag 1995
- BATHER, S.: Archäologie der westlichen Slawen. Siedlung, Wirtschaft und Gesellschaft im früh- und hochmittelalterlichen Ostmitteleuropa. Berlin, New York: de Gruyter 2001
- BRZOSTOWICZ, M.: Bruszczewski zespół osadniczy we wczesnym średniowieczu. Poznań: Wydawn. Poznańskiego Towarzystwa Przyjaciół Nauk 2002
- DONAT, P.: Die Mecklenburg – eine Hauptburg der Obodriten. *Schriften zur Ur- und Frühgeschichte* 37. Berlin: Akademie Verlag 1984
- DYMACZEWSKI, A.: Die Ausgrabungen in Santok – Ergebnisse und Fragen der Weiterführung der Forschungen. *Arch. Polona* 16, 231–238 (1975)
- GRINGMUTH-DALLMER, E., und LECIEJEWICZ, L. (Eds.): Forschung zu Mensch und Umwelt im Odergebiet in Ur- und frühgeschichtliche Zeit. *Römisch-Germanische Forschungen* 60. Mainz: P. von Zabern 2002
- HENNING, J.: Archäologische Forschungen an Ringwällen in Niederungslage. Die Niederlausitz als Burgenlandschaft des östlichen Mitteleuropas im frühen Mittelalter. In: HENNING, J., und RUTTKAY, A. T. (Eds.): Frühmittelalterlicher Burgenbau in Mittel- und Osteuropa. Tagung Nitra vom 7. bis 10. Oktober 1996. S. 9–29. Bonn: Habelt 1998
- HERRMANN, B. (Ed.): Mensch und Umwelt im Mittelalter. Stuttgart: Deutsche Verlags-Anstalt 1986
- HERRMANN, J.: Tornow und Vorberg. Ein Beitrag zur Frühgeschichte der Lausitz. Berlin: Akademie Verlag 1966
- HERRMANN, J.: Die germanischen und slawischen Siedlungen und das mittelalterliche Dorf von Tornow, Kr. Calau. Berlin: Akademie Verlag 1973
- HEUSSNER, K. U., und WESTPHAL, T.: Dendrochronologische Untersuchungen an Holzfunden aus frühmittelalterlichen Burgwällen zwischen Elbe und Oder. In: HENNING, J., und RUTTKAY, A. T. (Eds.): Frühmittelalterlicher Burgenbau in Mittel- und Osteuropa. Tagung Nitra vom 7. bis 10. Oktober 1996. S. 223–234. Bonn: Habelt 1998
- KARA, M., and KRAPIEC, M.: Możliwości datowania metodą dendrochronologiczną oraz stan badań dendrochronologicznych wczesnośredniowiecznych grodzisk z terenu Wielkopolski, Dolnego Śląska i Małopolski. In: SAMSONOWICZ, H. (Ed.): *Ziemia polskie w X wieku i ich znaczenie w kształtowaniu się nowej Europy*; pp. 303–327. Kraków: Universitas 2000
- KUDRNÁČ, J.: Klučov. Staroslovanské hradiště ve středních Čechách. Praha: Academia 1970
- MACHÁČEK, J.: Pohansko bei Břeclav. Ein Frühmittelalterliches Zentrum als sozialwirtschaftliches System. Bonn: Habelt 2007
- MÜLLER-WILLE, M. (Ed.): Starigard/Oldenburg. Ein slawischer Herrschersitz des frühen Mittelalters in Ostholstein. Neumünster: K. Wachholtz 1991
- POLÁČEK, L., DAIM, F., und VELEMÍNSKÝ, P. (Eds.): Studien zum Burgwall von Mikulčice. Archäologisches Institut der Akademie der Wissenschaften der Tschechischen Republik. Bd. 1–8. Brno: 1995–2008

- SCHNEEWEISS, J.: Die ur- und frühgeschichtliche Eisenverhüttung und -verarbeitung im westlichen Odergebiet. Ethnogr. Arch. Zeitschr. 37, 335–363 (1996)
SCHULDT, E.: Behren-Lübchin. Eine spätslawische Burganlage in Mecklenburg. Berlin: Akademie Verlag 1965
SCHULDT, E.: Groß Raden. Ein slawischer Tempelort des 9./10. Jh. in Mecklenburg. Berlin: Akademie Verlag 1985

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SALUTEM ET FELICITATEM!

Gründung und internationale Ausstrahlung der Leopoldina

Ausstellung zum 325. Jahrestag ihrer Privilegierung 1687 durch Kaiser Leopold I. und Edition aller kaiserlichen Urkunden von 1677 bis 1742

Halle (Saale) vom 28. Oktober bis 21. Dezember 2012, Hauptgebäude der Leopoldina, Schweinfurt vom 29. September bis 24. November 2013, Museum Otto Schäfer

Acta Historica Leopoldina Nr. 61

Herausgegeben von Uwe MÜLLER (Schweinfurt) und Danny WEBER (Halle/Saale)
(2012, 204 Seiten, 118 Abbildungen, 24,95 Euro, ISBN: 978-3-8047-3115-8)

2012 jährt sich zum 360. Mal die Gründung der heutigen Deutschen Akademie der Naturforscher Leopoldina – Nationale Akademie der Wissenschaften im Jahr 1652 in Schweinfurt, und am 7. August 1687, vor 325 Jahren, gewährte Kaiser LEOPOLD I. der Gelehrten-gesellschaft besondere Privilegien. Diesen Anlässen widmet sich eine Ausstellung, die eine große Anzahl von authentischen und einzigartigen Quellen zur Geschichte der Akademie aus den Archiven der Stadt Schweinfurt und der Leopoldina als Kooperationsprojekt zunächst in Halle (Saale) und später in Schweinfurt zeigt. Der Schwerpunkt liegt auf der frühen Internationalisierung der Akademie. Die Publikation beschreibt die vorgestellten Objekte und enthält darüber hinaus eine Edition aller kaiserlichen Urkunden von 1677 bis 1742.

Disaster Responses to Floods: A Comparison of Vietnam and Germany in the Twentieth Century

Nicole KRONENBERG (Göttingen)

The fear of natural disasters leads to a united programme of sciences and politics in order to apply technologies on a global scale. In the context of central Europe, I plan to study how the change in awareness and treatment of floods impacts societies directly threatened by greater and more frequent events. Vietnam has experienced the most severe cases of floods world-wide.

Human beings are always oriented towards solving problems. However, limited resources force decision makers to assess which problems can be solved and which cannot. In this context it may be reasonable for a society in a disaster situation not to respond with a preventive measure, because the associated opportunity costs would be too high. The historical environmental sciences have asked how the way societies learn from natural disasters can be studied. I aim to contribute to the question: Was their treatment of flood events rational?

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Vorträge und Abhandlungen zur Wissenschaftsgeschichte 2011/2012

Acta Historica Leopoldina Nr. 59

Herausgegeben von Sybille GERSTENGARBE, Joachim KAASCH, Michael KAASCH,
Andreas KLEINERT und Benno PARTHIER (HALLE/Saale)

(2012, 512 Seiten, 129 Abbildungen, 5 Tabellen, 26,95 Euro,
ISBN: 978-3-8047-3078-6)

Der Band versammelt Vorträge aus den wissenschaftshistorischen Seminaren der Leopoldina einerseits und Abhandlungen zur Wissenschafts- und Akademiegeschichte andererseits. So werden GOETHES Leiden und Krankheiten, ROUSSEAUS Verhältnis zu den Wissenschaften und die Asklepiosmedizin in der römischen Kaiserzeit behandelt. Die Beiträge zu Institutionen untersuchen die Entwicklung der Max-Planck-Gesellschaft seit ihrer Gründung bis zur Gegenwart im Überblick, zeigen die Leopoldina in den DDR-Jahren im Netz der Staatssicherheit und folgen dieser Naturforscherakademie auf den Spuren DARWINS. Außerdem werden die Anfänge der Leopoldina-Ausgabe von GOETHES naturwissenschaftlichen Schriften dargestellt. Einen Schwerpunkt des Bandes bilden die Biographien hervorragender Forscher: des Botanikers Otto RENNER (1883–1960), der als Genetiker und Leopoldiner gewürdigt wird, und des Biochemikers Otto MEYERHOF (1884–1951), dessen Wirken als vielseitiger Gelehrter, Verfolger des NS-Regimes und Emigrant analysiert wird.

Famines in Early Modern History: An Environmental Analysis of the Landscapes in Lower Saxony, 1690–1750

Thore LASSEN (Göttingen)

Hunger crises of varying degrees of severity and times of dearth were frequent in early modern Europe. My research project focuses on the time span between 1690 and 1750. Due to their diverse forms of landscape, the territories of today's German state of Lower Saxony form the area under inspection. While the *Börde* area is characterised by very fertile grounds containing a high loess proportion, the region of the Harz Mountains always had to rely on corn imports. Furthermore, both territories were divided into a set of individual sovereign territories throughout the time in question.

A first goal of my project is to determine the dearth crises and their severity. On the basis of this, I will compare various forms of landscapes in order to detect and assess relevant factors and their interaction during times of hunger crisis. Among these factors are not only natural conditions, like weather and climate, but also political and social circumstances that regulated access to food. In addition, I will investigate short-, medium-, and long-term effects of hunger crisis and times of dearth, and eventually address the question of whether learning processes in order to prevent future dearth were possible.

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Ergebnisse des Leopoldina-Förderprogramms VII

Nova Acta Leopoldina N. F., Supplementum 26

Herausgegeben von Gunnar BERG (Halle/Saale), Andreas CLAUSING (Halle/Saale)
und Jörg HACKER (Halle/Saale – Berlin)

(2012, 184 Seiten, 95 Abbildungen, 21,80 Euro, ISBN: 978-3-8047-3061-8)

Die Deutsche Akademie der Naturforscher Leopoldina – Nationale Akademie der Wissenschaften bemüht sich mit ihrem Leopoldina-Förderprogramm um die Unterstützung von jungen herausragenden Wissenschaftlerinnen und Wissenschaftlern in ihrer beruflichen Weiterentwicklung durch einen Auslandsaufenthalt an einer weltweit führenden Forschungseinrichtung. Im Jahre 1996 als Projekt durch das Bundesministerium für Bildung und Forschung (BMBF) in Trägerschaft der Leopoldina eingerichtet und jährlich fortgeschrieben, wurde es 2009 Bestandteil des vom BMBF und vom Land Sachsen-Anhalt getragenen Haushalts der Akademie. Der vorliegende Band gibt einen Einblick in die Vielfalt und liefert Beispiele für die Projekte und erreichten Ergebnisse in den Jahren 2009 bis 2011. Damit werden Chancen und Ansprüche des Förderprogramms für künftige Bewerber deutlich.

High and Low Water Events on North German Rivers: Coping with Hydrological Extremes on the River Weser, 1800–1950. A Case Study

Philipp RIESMEYER (Göttingen)

High and low water events are intermittent natural phenomena that traditionally influence and shape the life of riverside and coastal communities. However, up until now it has primarily been floods that have been at the centre of attention. Only in recent years, following the heat wave of 2003 and the reinforced prospect of climate change, have low water events become a matter for public interest.

My research considers the period from the beginning of the nineteenth century to the second half of the twentieth century. I chose the area around the mouth of the River Weser, at Hann. Münden in modern Lower Saxony, as the focus of my research.

The main objective of my research is to examine selected hydrological extremes in the reporting period, including their effects and the consequences for inhabitants, and local responsiveness to the events. I will mainly focus here on aspects such as harvest failures, starvation, and flood damage. Another aspect of my research considers the actions of the government and local authorities in the wake of water extremes, and the extent to which water regulation influenced the frequency and severity of water extremes. I am interested to see whether and to what extent a learning process can be said to have ceased during this period.

Additionally, I will use the course and hydrograph Geographic Information Systems and hydrological modelling software in an attempt to reconstruct and create visualisations of selected water extremes. These visualisations might show, in particular, the timing and monitoring of the events and their impacts on the population.

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Durch Lebensereignisse verbunden

Festgabe für Dorothea Kuhn zum 90. Geburtstag am 11. März 2013

Acta Historica Leopoldina Nr. 62

Herausgegeben von Jutta ECKLE (Weimar) und Dietrich VON ENGELHARDT (Karlsruhe)
(2013, 440 Seiten, 84 Abbildungen, 4 Tabellen, 26,95 Euro,
ISBN: 978-3-8047-3159-2)

Zum 90. Geburtstag von Dorothea KUHN, der langjährigen Herausgeberin der Leopoldina-Ausgabe von GOETHES Schriften zur Naturwissenschaft, legt die Leopoldina eine wissenschaftshistorische Festschrift vor. Neben dem Leben und Wirken der Jubilarin, das u. a. mit einer vollständigen Bibliographie gewürdigt wird, sind Beiträge namhafter Wissenschaftshistoriker und Germanisten aus den verschiedenen Interessengebieten der Geehrten versammelt: zu Naturwissenschaft und Medizin, Kunst und Philosophie um 1800, zu GOETHES naturwissenschaftlichen Forschungen, zu Italienerlebnissen reisender Naturforscher, zur Verlagsgeschichte, vor allem des Cotta-Verlages, zur Editions- und Buchgeschichte sowie zur Akademiegeschichte.

Animal Pests in Agriculture and Forestry: Perception, Damage, and Control in Prussian Brandenburg, 1700–1850

Jana SPRENGER (Göttingen)

With 1 Figure

Since the early days of agriculture and livestock breeding, human societies have been competing with other organisms for resources. Profit cuts in agronomics and forestry from frequent pest infestations and the loss of domestic livestock to predators rendered the search for control measures a necessity. Until today, harmful animals can be found in various areas of life, and can affect health, food, and our well-being. Past discourses that analyse pest infestations reflect contemporary knowledge about special aspects of the natural world as well as societal changes in the valuation and appreciation of nature. During the early modern period, for example, locusts, sparrows, wolves, and various caterpillars were often mentioned as pests in agriculture and forestry (cf. HERRMANN 2007).

This study focuses on the federal state of Brandenburg in northeast Germany. Brandenburg, the former core of the Prussian state, is known for its dry and sandy grounds, which were mainly formed by the last two glacial periods and the following anthropogenic utilisation of natural resources.¹ Due to the condition of the soil, the most common tree was the undemanding Scots pine, and the crop yield in many agricultural areas was quite low. This study compares different ways of coping with infestations in two economic sectors: agriculture and forestry. Firstly, I am interested in perceptions and descriptions of animals considered pests in administrative documents and historical literature and what information this can reveal about geographic distribution. Furthermore, I intend to explain what practical measures were taken by the administration in reaction to such infestations, and to what extent people were actually affected by the damage.

In the early eighteenth century, mammals and birds still had a strong significance in contemporary perceptions of harmful animals. Aside from this, the definition of animal pests could include mythical creatures like basilisks as well. During the following century, the focus increasingly shifted towards insect pests.² Due to the content of the archival documents, I focus mainly on migratory locusts in agriculture and pine-caterpillars in forestry — two typical examples of animal pests in early modern Prussia. In this summary, I highlight particular examples related to locust infestations (below).

According to contemporary reports, the damage caused by insect calamities often reached a disastrous level. In 1753, a regional landholder and minister of state wrote about people who had not yet had any previous experiences with locust plagues:

1 Formation of soil conditions in DALCHOW et al. 1998 and BORK et al. 1998.

2 HERRMANN 2007, p. 178.

“How would the enormous distress have affected them, if but an hour ago they had seen their own fields of wheat standing thick as reed [...] yet an hour later they glimpse nothing but mere stubbles [...] If they had seen fields of oat and barley wiped clean like fallow grounds.”³

In general, a harmful insect was perceived to be an “evil enemy” or “calamitous menace.” Reports about the devastating damage designated the issue a “sad story.” While at the beginning of the eighteenth century, the causes for such tremendous pest infestations were often still believed to be of religious origin, the analysis of natural phenomena gained increasing importance over the course of time.⁴

A flock of locusts could ruin an entire harvest, consequently destroying a year’s work and creating hunger and economic losses. A caterpillar infestation could destroy several square miles of coniferous forest and facilitate significant economic losses for both the Prussian State and private forest owners. The threat of destructive animals prompted the Prussian authorities to take action. Particularly in the eighteenth century, numerous edicts for pest control were passed. Edicts against locusts were issued in 1731, 1752, and 1753; edicts against caterpillars roughly fifty years later at the end of the century.⁵ The long time period between edicts can be explained by the occurrence of insect plagues at different times. Due to changes in landscape and climatic factors, locusts had already become common in northern Germany at the beginning of the eighteenth century.⁶ In comparison, caterpillars most likely did not occur in any greater frequency until the final decades of the century—presumably due to an increase in pine monoculture.⁷

In all the edicts mentioned, basic mechanical procedures were recommended for pest control. The most important methods described were the following: first, the collecting of individual animals of different growth stages. Secondly, the digging of long trenches around affected field and forest areas to catch the migrating insects (Fig. 1). The methods employed in fighting caterpillars at the end of the century often followed the basic structure of well-established locust control methods, with appropriate modifications. However, in both cases, improvements can be seen over the course of time. The decrees were renewed at intervals of several years and were extended to include the knowledge acquired in the meantime. Later locust edicts considered functional and ecological aspects by eliminating some ineffective measures and concentrating on the collection of egg clutches. Furthermore, later decrees additionally contained methods of early biological pest control. Useful animals were deployed against vermin. Domestic pigs were to be herded into the fields and forests to feed on young locusts and their egg clutches or on overwintering caterpillars. At the end of the eighteenth century, shooting birds such as crows and jackdaws was prohibited, as they were considered to be effective tools in the fight against caterpillars.

3 Secret State Archives Prussian Cultural Heritage (GStAPK): II. HA, Abt. 14, Tit. 268, No. 2, Vol. 2. Translation by author.

4 WINDELEN 2010, p. 92.

5 MYLIUS 1737–1755, 1753–1822; Brandenburg Main State Archive (BLHA): Rep. 2, No. F 7400.

6 Cf. HERRMANN and SPRENGER 2010, p. 82.

7 Information about the beginning increase of pine monoculture in the eighteenth century can be found in PFEIL 1839, pp. 21 and KRAUSCH 2008, p. 106.

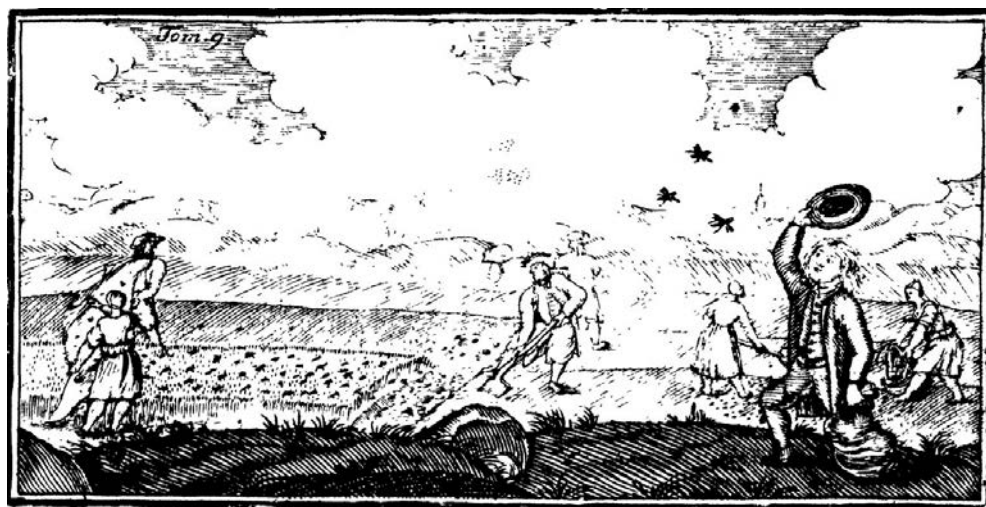


Fig. 1 Methods for locust control: digging trenches to catch migrating locusts (*left side*), collecting individuals (*right side*). Source: FRISCH 1730

Neither the mechanical system nor some biological methods of pest control were inventions of the eighteenth century. Some methods, such as collecting individual animals, are mentioned in locust control documents of the Austrian Alps as early as the fourteenth century.⁸ Whether the Prussian administration knew about these happenings or not, many early modern authors from northern Germany referred to much older evidence:⁹ even in antiquity, official locust collecting was common in some regions, and cases of bird protection for locust control can be found.¹⁰

I assume that locust infestations, followed by real threats to existence, were relatively uncommon in Brandenburg. Probably, most landholders could compensate the loss caused by locust plagues by falling back on unaffected crops from other fields. Only peasants with very small estates were in danger of losing all their subsistence and threatened by starvation due to locust swarms. In 1786, three inhabitants of a small village near Berlin suffered a significant loss. About 60 to 97 % of their harvest was destroyed by indigenous locusts, so that even their supply of seeds for next year's crop was gone.¹¹ In such cases, it was possible to receive compensation from the government. The damage could not be eliminated entirely by such measures, but famines could be avoided.

8 ROHR 2007, p. 483.

9 For example RATHLEFF 1748.

10 Cf. GRASSL 1998, p. 444.

11 Brandenburg Main State Archive (BLHA): Rep. 2, No. D 16171; cf. HERRMANN and SPRENGER 2010 p. 103.

References

- BORK, H. R., DALCHOW, C., DOTTERWEICH, M., SCHATZ, T., und SCHMIDTCHEN, G.: Die Entwicklung der Landschaften Brandenburgs in den vergangenen Jahrtausenden. In: KLEMM, V., DARKOW, G., und BORK, H. R. (Eds.): Geschichte der Landwirtschaft in Brandenburg. S. 237–258. Budapest: Mezogazda 1998
- DALCHOW, C., BORK, H. R., und NEUMANN, K.: Genese, Struktur und Regionalgeschichte der Landschaften Brandenburgs. In: KLEMM, V., DARKOW, G., und BORK, H. R. (Eds.): Geschichte der Landwirtschaft in Brandenburg. S. 1–7. Budapest: Mezogazda 1998
- FRISCH, J. L.: Beschreibung Von allerley Insecten in Teutsch=Land, Part 9. Berlin: 1730
- GRASSL, H.: Heuschreckenplagen in der Antike. In: OLSHAUSEN, E., und SONNABEND, H. (Eds.): Naturkatastrophen in der antiken Welt. Stuttgarter Kolloquium zur historischen Geographie des Altertums 6, 1996. S. 439–447. Stuttgart: Steiner 1998
- HERRMANN, B.: Ein Beitrag zur Kenntnis von Schädlingsbekämpfungen und ihren Konzepten im 18. und frühen 19. Jahrhundert an Beispielen aus Brandenburg-Preußen. In: ENGELKEN, K., WINDELEN, S., und HÜNNIGER, D. (Eds.): Beten, Impfen, Sammeln. Zur Viehseuchen- und Schädlingsbekämpfung in der Frühen Neuzeit. S. 135–189. Göttingen: Universitätsverlag 2007
- HERRMANN, B., und SPRENGER, J.: Das landesverderbliche Übel der Sprengsel in den brandenburgischen Gemarkungen – Heuschreckenkalamitäten im 18. Jahrhundert. In: MASIUS, P., SPRENGER, J., und MACKOWIAK, E. (Eds.): Katastrophen machen Geschichte. Umweltgeschichtliche Prozesse im Spannungsfeld von Ressourcennutzung und Extremereignis. S. 79–118. Göttingen: Universitätsverlag 2010
- KRAUSCH, H. D.: Die Menzer Heide. In: Beiträge zur Wald-, Forst- und Landschaftsgeschichte Brandenburgs. S. 95–119. Remagen-Oberwinter: Kessel 2008
- MYLIUS, C. O.: Corpus Constitutionum Marchicarum. Berlin: Waysenhaus 1737–1755
- MYLIUS, C. O.: Novum Corpus Constitutionum. Berlin: Königl. Preußische Akademie der Wissenschaften 1753–1822
- PFEIL, W.: Die Forstgeschichte Preußens bis zum Jahr 1806. Leipzig: Baumgärtner 1839
- RATHLEFF, E. L.: Akridotheologie oder Historische und Theologische Betrachtungen über die Heuschrecken, bei Gelegenheit der jetzigen Heuschrecken in Siebenbürgen, Ungern, Polen, Schlesien und Engelland. Hannover: Johann Christopf Richter 1748
- ROHR, C.: Extreme Naturereignisse im Ostalpenraum. Naturerfahrung im Spätmittelalter und am Beginn der Neuzeit. Köln, Weimar, Wien: Böhlau 2007
- SPRENGER, J.: „Die Landplage des Raupenfraßes“. Wahrnehmung, Schaden und Bekämpfung von Insekten in der Forst- und Agrarwirtschaft des preußischen Brandenburgs (1700–1850). Schriftenreihe des Julius-Kühn-Instituts, Bundesforschungsinstitut für Kulturpflanzen, Dissertation. Göttingen: Georg-August-University of Göttingen 2011
- WINDELEN, S.: Mäuse, Maden, Maulwürfe. Zur Thematisierung von Ungeziefer im 18. Jahrhundert, Dissertation. (published online) Göttingen: Georg-August-University of Göttingen 2010

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Changes of the Landscape since the End of the Eighteenth Century in the District of Göttingen

Linda Szücs (Göttingen)

With 1 Figure

In the last two hundred years, the landscape within the district of Göttingen has changed dramatically. This landscape change was accompanied by changes in biodiversity, human usage potential, and perceivable forms of appearance, such as landscape design. This last subject area is dealt with in Project C I.3 of the doctoral programme of Interdisciplinary Environmental History at the University of Göttingen. This project examines visual imaging (reconstruction) of landscape change since the end of the eighteenth century, and its aesthetic perception (reception) and evaluation from a contemporary perspective. The research area is situated in today's district of Göttingen. The relevance of my dissertation in environmental history is based on the connection between the reconstruction and reception of previous landscape conditions—a fundamental aspect of our overall concept of landscapes.

1. Introduction

The roots of nature conservation in Germany lie in the protection and preservation of natural and cultural values of historical landscapes, which are similar to the pre-industrial ones largely defined by natural elements. This kind of landscape scene is often used as guide principle (in German called “Leitbild”) in the planning process. In Article 1 of the German Federal Nature Conservation Act, the establishment of a “sustainable protection of the diversity, uniqueness, and beauty of nature and the landscape” (*Bundesnaturschutzgesetz* 2010) is named as the primary objective of the Act. Although three aspects relevant to landscape aesthetics are mentioned in the above statement, for many decades, conservation has focused almost exclusively on ecology. The idea of preserving and designing the beauty of nature and the landscape for mankind has now faded into the background. This reflects the fact that, up until now, there has been no consistent, generally recognised concept of landscape aesthetics, providing a practical framework for landscape assessment studies, which are essential to landscape planning processes.

For this reason, my project aims to contribute both to the investigation of landscape change and its perception and evaluation, and the conception of a conservation-based practical theory of landscape aesthetics.

2. Research Aims

My proposal builds upon previous studies on the land-use change, biodiversity, and landscape functions in the district of Göttingen, for which an extensive Geographic Information System

(GIS) was established for the years 1784, 1878, 1910, 1965, and 2002. Taking into account three interdisciplinary subject areas of landscape visualisation, landscape assessment, and landscape aesthetics, I attempt to answer the following questions:

- Which landscapes existed in the research area and time period? What is the relevance of three-dimensional landscape visualisations for landscape planning issues?
- What is the relevance of 3D landscape visualisations by interpreting functional changes in the landscape?
- What landscape elements, structures, and dimensions have changed, and does this change affect evaluations of landscape conditions today? Is today's landscape an "ugly" landscape in comparison to the historical landscapes, and if so, why?
- What connections can be drawn between land use (type, intensity, diversity, dimensioning, etc.), landscape function (especially cultural values), and landscape appearance (naturalness, diversity, uniqueness, etc.)?

3. Methods

3.1 Landscape Visualisation

Based on monographic, cartographic, and photographic analysis, I strive to achieve an accurate visualisation of the Göttingen landscape at five separate time intervals (1784, 1878, 1910, 1965, and 2002). This visualisation will be created with the softwares called *Visual Nature Studio 3* and *Biospere 3D*. Land-use data processed by an earlier project (PREUTENBORBECK 2009) will be used as a database for the visualisation of landscape changes. Digital terrain models, aerial photographs, orthophotos, historical maps (structural agricultural maps of deposits) and historical photographs (Fig. 1) are essential sources in my research. Land-use changes such as afforestation processes will be shown on approximately 2 km² in various open spaces, forested areas, and suburban areas of Göttingen.

3.2 Landscape Assessment

On the basis of the realistic reconstructions and photographs of these case study areas, taken at different times over the years, various groups of actors will be targeted (residents, tourists, experts, planners), and their preferences and evaluations will be analysed based on interviews. Blending these evaluations with existing space-oriented information related to terrain morphology, types of land use, and landscape functions will offer a wide field for continuing analysis and interpretation.

3.3 Analysis of Landscape Aesthetics

The requested verbalised and visual impressions will be investigated in terms of their different recognisable aesthetic dimensions (BÜRGER-ARNDT et. al. 2006, WÖBSE 2002) in order to clarify whether and how strongly they influence people's perception of landscapes, and what role landscape design plays in this process. Based on the analysis of theories and empirical studies of landscape preferences, it is possible to add new ideas to the theoretical background



Fig. 1 Land use in the suburban area of Göttingen in the early twentieth century—panoramic view of Hainberg.
Source: City Archive of Göttingen (2010)

of the research project (BÜRGER-ARNDT et. al. 2006) with the goal of defining the aforementioned aesthetic concept.

References

- Bundesnaturschutzgesetz*: www.bundesrechtjuris.de/bnatschg_2009/ (2010) accessed on 21 January 2011
- BÜRGER-ARNDT, R., and REEH, T.: Landschaftsästhetik. Theoretische Grundlagen. In: KONOLD, W., BÖCKER, R., und HAMPICKE, U. (Eds.): *Handbuch Naturschutz und Landschaftspflege 19, Supplement 7/06, VI-3*; S. 1–19. Ecomed: Landsberg 2006
- PREUTENBORBECK, J.: *Zur Wirkung historischer Landnutzungsmuster auf Artenvielfalt und Lebensgemeinschaften. Eine Exemplarische GIS-Gestützte Analyse von Landnutzungswandel und Biodiversität der Kulturlandschaft im Naturraum Göttinger Wald*. Göttingen: Georg-August Universität Göttingen 2009
- WÖBSE, H.: *Landschaftsästhetik. Über das Wesen, die Bedeutung und den Umgang mit landschaftlicher Schönheit*. Stuttgart: Ulmer 2002

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Doctoral Dissertations from Ludwig-Maximilians-Universität, Munich

A Case Study on the History of the Atmospheric Sciences

Dania ACHERMANN (Munich)

For several decades, discussions surrounding air pollution, the formation of the ozone layer, and climate change have strongly influenced the atmospheric and climate sciences. These new issues, combined with newly invented technologies in the form of measuring instruments, aircrafts, satellites, and computer programmes have fundamentally changed both research goals and the way in which this research is conducted. Such technological developments, together with the political, economic, and societal changes that have occurred since the end of the Second World War, have facilitated the enormous expansion of research conducted in the atmospheric sciences, and have led to a shift in methodology, goals, and self-perception in the field.

In the 1950s and 1960s, various institutions dedicated to the exploration of the atmosphere were founded in the German-speaking world, both within and outside universities.¹ Among these was the *Institut für Physik der Atmosphäre* (IPA), which today is a part of the *Deutsches Zentrum für Luft- und Raumfahrt*, founded in 1962. At the institute, which has been based in Oberpfaffenhofen since 1967, scientists explore, among other things, how airplanes, ships and ground traffic are changing our climate,² how, conversely, weather influences air traffic, how air traffic influences air quality and noise pollution, how weather affects air traffic, and how solar radiation can be used for solar energy.

The goal of my dissertation is to examine the *Institut für Physik der Atmosphäre* and its predecessors since the 1950s. It is intended as a case study on the history of the atmospheric sciences after the Second World War, in the period of upheaval and restructuring during the Cold War. I will especially focus on how such non-university scientific institutes have changed based on their relationships to politics, the economy, the development of new technologies, and public discussions, and how research focus shifts and traditions are adapted to fit these new factors.

It is important for me not to explicitly follow either an internal or external approach. Instead, I hope to combine both in order to achieve a comprehensive insight into the development of the discipline.³ Thus, I will incorporate the tendencies, developments, and innova-

1 For example the Karlsruhe Institute for Technology (KIT), *Institut für Chemie und Dynamik der Geosphäre des Forschungszentrums Jülich* (Institute for Chemistry and Dynamics of the Geosphere at the Research Center Jülich), and the Institute for Atmospheric and Climate Science at the ETH Zurich.

2 In form of the EU FP6 Integrated Project QUANTIFY. For more information, see <http://www.pa.op.dlr.de/quantify/>.

3 Cf. LATOUR 2006.

tions within sciences as well the interdependent factors in the realm of the economy, politics, technology and society.

My research can be organised into three categories:

- *Identity and research politics*: How has the institute established itself outside the university sphere in the political and research landscape of postwar Germany? How strongly does the IPA's research orientate its focus according to science politics?⁴
- *Local and global dimension*: How is local research at an institute like the IPA connected to global research, and what role do private or professional networks play therein?
- *Research Technologies*:⁵ Measuring instruments and technologies like lidar, radar, and computer models are highly sensitive and require specialised personnel and procedures. What implications do such research technologies have for the daily routine at the institute and the structure of the discipline?

Since James Rodger FLEMING (1989) complained that history of the atmospheric sciences was underdeveloped in 1967, a lot has changed.⁶ Until now, however, research has concentrated primarily on the English-speaking realm. My project therefore attempts to contribute to a history of the atmospheric sciences in the German-speaking world.

References

- ASH, M.: Wissenschaftswandel in Zeiten politischer Umwälzungen. Entwicklungen, Verwicklungen, Abwicklungen. Internationale Zeitschrift für Geschichte und Ethik der Naturwissenschaften, Technik und Medizin 3/1, 1–21 (1995)
- EDWARDS, P. N.: A Vast Machine. Computer Models, Climate Data, and the Politics of Global Warming. Cambridge, MA: MIT Press 2010
- FLEMING, J. R.: Guide to the History of the Atmospheric Sciences. Archives, Manuscripts, and Special Collections in the Washington, D. C. Area. Boulder: National Center for Atmospheric Research 1989
- FLEMING, J. R.: Meteorology in America 1800–1870. Baltimore: James Hopkins University Press 1990
- GRAMELSBERGER, G.: Computereperimente. Zum Wandel der Wissenschaft im Zeitalter des Computers. Bielefeld: Transcript 2010
- HARPER, K.: Weather by the Numbers. The Genesis of Modern Meteorology. Cambridge, MA: MIT Press 2008
- HEYMANN, M.: Klimakonstruktionen. Von der klassischen Klimatologie zur Klimaforschung. N.T.M. International Journal of History and Ethics of Natural Sciences, Technology and Medicine 17/2, 171–197 (2009)
- JANKOVIC, V.: Reading the Skies. A Cultural History of English Weather, 1650–1820. Manchester: Manchester University Press 2000
- JOERGES, B., and SHINN, T. (Eds.): Instrumentation between Science, State, and Industry. Dordrecht: Kluwer Academic Publishers 2001
- LATOUR, B.: Gebt mir ein Laboratorium und ich werde die Welt aus den Angeln heben. In: BELLINGER, A., and KRIEGER, D. (Eds.): ANThology. Ein einführendes Handbuch zur Akteur-Netzwerk-Theorie. S. 103–134. Bielefeld: Transcript 2006
- LÜDECKE, C.: Hundert Jahre meteorologische Hochstation auf der Zugspitze. Der Deutsch-Österreichische Alpenverein als Förderer der alpinen Meteorologie. Meteorologische Zeitschrift 9/6, 381–391 (2000)

4 Cf. ASH 1995.

5 Cf. JOERGES and SHINN 2001.

6 To name just a few works in the past few decades: FLEMING 1990, NEBEKER 1995, JANKOVIC 2000, LÜDECKE 2000, WEGE 2002, HARPER 2008, HEYMANN 2009, GRAMELSBERGER 2010, and EDWARDS 2010.

NEBEKER, F.: Calculating the Weather. Meteorology in the 20th Century. San Diego: Academic Press 1995

WEGE, K.: Die Entwicklung der meteorologischen Dienste in Deutschland. Geschichte der Meteorologie in Deutschland 5, S. 277–286. Offenbach am Main: DWD 2002

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Altern in Deutschland

Die Deutsche Akademie der Naturforscher Leopoldina und die Deutsche Akademie für Technikwissenschaften acatech gründeten im Mai 2005 eine gemeinsame interdisziplinäre Akademiengruppe „Altern in Deutschland“, die auf der Grundlage der besten verfügbaren wissenschaftlichen Evidenz öffentliche Empfehlungen erarbeitete, um die Chancen der im letzten Jahrhundert erheblich gestiegenen Lebenserwartung – die „gewonnenen Jahre“ – vernünftig zu nutzen und mit den Herausforderungen des demographischen Alterns klug umzugehen.

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(1. Aufl. 2009, 2. Aufl. 2010, 102 Seiten, 1 Abbildung, 12,00 Euro, ISBN: 978-3-8047-2550-8)

Wissenschaftliche Verlagsgesellschaft Stuttgart

How Green is the Church? An Analysis of Subsidiarity in the Catholic Church in Environmental Policy Debate: A Case Study of Selected European Countries

Julia BLANC (Munich)

Given that Europe—even if it is still predominantly Christian—is characterised by its diverse and divergent ideologies, and is, moreover, still the driving force behind the development of political environmental standards, one might consider Europe something of a role model in global terms. How and under what circumstances and conditions the Catholic Church contributes to Europe’s political image, and can continue to contribute in the future, are the questions that I hope to address in this project. From a theological and ethical perspective, it is not merely a question of ecological issues, but more generally a question of contingency management. Ecological questions cannot be understood as isolated issues, which is why most people see them as “social” problems, e.g. the loss or damage to habitats, existential danger caused by pollution and lack of resources, and an unfair distribution of benefits and risks, i.e. wealth and poverty.

Modern transitional society is travelling towards a yet uncertain future. The erosion of traditional moral authorities has led to a vacuum, with society disorientated and facing an entirely new set of challenges. The current situation increasingly suggests that society is in need of a new system of values that can be applied not only to direct human interactions, but also—given the prevalence of ecological disasters and the knowledge that the potentially damaging consequences of today’s decisions will reach their full intensity only decades or even centuries from now—to also uphold inter- and intra-generational justice.

The Catholic Church, in its capacity as one of the earliest “global players,” has the potential to play a fundamental role in this transformation. Sustainability, in the sense of maintaining a constant quality of life for current and future generations, is a demand allied with the most basic Christian idea of justice, even if this has not yet been explicitly formulated as such by the institution of the church. At the same time, the task of looking after Creation is a re-discovered demand that society, unfortunately, is far from understanding, let alone fulfilling.

Against this background, environmental politics—driven by the immediacy of the topic and the completeness with which whole communities are affected—is the greatest challenge facing governments and other responsible bodies, including the Catholic Church, worldwide.

Europe consists of very different nation states with highly diverse historical developments. Despite all these differences and divergences in their common history, there have been recurring events of historical significance, which, if not necessarily unifying, have contributed to the sense of a shared background. The most recent event of this magnitude was the fall of the Berlin Wall, the opening of the Iron Curtain, and the end of divided Europe, all of which took

place in the years 1989–1990. For this reason, my investigation will take this watershed date as its starting point.

I will use a selection of European countries to attempt to answer the question of how the Catholic Church influences environmental policy. This task will be completed not by comparing the whole country with all different parts of Catholic Church therein, but by referring to the basic assumption that Catholicism is different in almost every country. Therefore, I also presuppose that the relationship between the state and the church is different in almost every country, that financial and religious support varies, and that people in different circumstances have a different relationship to the church. In short, being Catholic is different in each country, and the Catholic Church acts differently in each country. Within this context of varying conditions, I will examine the church's subsidiarity with the help of case studies that represent the typical role of the Catholic Church in environmental policies.

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Constructing Modern Egypt: Experts, Dams, and the Transformation of the Nile, 1882–1970

Ewald BLOCHER (Munich)

My dissertation project examines water engineering in Egypt between 1882 and 1970. I concentrate on the Aswan Dam, which has, in the past, been Egypt's most important hydrological project. From the British occupation of Egypt until its completion during the Nasser regime, the Aswan Dam has always been a part of the country's ambitions for modernisation and progress. Since the Nile has always been Egypt's most valuable natural resource, water engineering has historically been accorded central importance. Thus, my dissertation intends to outline the far-reaching dimensions of this engineering technology, going beyond technical and engineering aspects. The history of knowledge and the environment form the backbone of my research.

Taking the ideology of modernisation as a starting point, my research is divided into three rather abstract topics: knowledge/perception, space, and nature. Firstly, I would like to discuss the British water experts' networks in Egypt, exploring their mindsets, ideologies and discourses as well as the resulting consequences. This will help determine the effect of colonial domination discourse on Egyptian elites' and experts' knowledge order and perceptions of nature, thereby examining to what extent these experts were "created" or "invented" by these processes. The aim of this section is to reconstruct their knowledge order in the framework of modernisation and progress paradigms that were created by the expert networks and that, in turn, determined, to a great extent, the future Egyptian discourse on infrastructure planning.

The second section of my dissertation deals with the spatial dimension of the changing perception of nature and its impact on social structure and the construction of a national identity in Egypt. Furthermore, I will discuss how water engineering knowledge and the subsequent creation of a mentally constructed territory can be imagined as a "knowledge space."

Finally, I would like to combine the results of the first two sections and discuss which conclusions can be drawn from nature itself and whether, and in what way, the handling of water resources has changed during the course of the processes described above. I will argue that the scientific-technological belief in universal feasibility has led to both an increasing ignorance about the ecosystem of the Nile and to inappropriate handling of water resource as a resource.

Aside from historical sources from the national archives of Egypt, Great Britain, and the United States, which contain material on the Aswan Dam and its technical, energetic, water management, electrical aspects, etc., other sources, such as contemporary literature on the Nile and professional articles and travel reports by engineers and officials, are of great im-

portance to my project. These sources can provide insight into the perception of water as a natural resource and the contemporary understanding of nature in general.

The goal of my dissertation is to demonstrate how Egypt was “constructed” by engineers and experts through the technology of water engineering, an aspect which has always been extremely important to the country. This “construction” is true in two senses of the word. *Firstly*, in a literal sense, as seen from a technological and scientific perspective: the economic backbone of the modern Egyptian state was facilitated by the building of dams and irrigation systems. *Secondly*, one can consider Egypt’s construction by water engineering and the ideology of modernisation on an intellectual level, providing a frame of reference for Egyptian elites and their endeavour to construct a modern and progressive Egypt. Thus, in a drastic way, modernisation and planning ideology were inherently connected to the natural environment, or to put it in the words of Timothy MITCHELL (2002), “nature was not the cause of the changes taking place [in the Nile Valley]. It was the outcome.”

References

MITCHELL, T.: Rule of Experts. Egypt, Techno-Politics, Modernity. Berkeley: University of California Press 2002

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Local Perceptions of Climate Change: An Assessment of Climate Impacts and Adaptation Strategies in the Area near Gangotri Glacier

Shrabana DATTA (Munich)

We live in a time of significant climate change, with almost all regions of the world experiencing continuous and accelerating environmental warming. One of the prominent indicators of climate change is the melting of ice masses and glaciers worldwide, visible in the advancement or retreat of glacial snouts in the last few decades. Glaciers are the most important component of our ecosystem, and the currently accelerating rate of melting and retreating of glaciers has severe impacts on the environment and the well being of humans, including impacts on vegetation patterns, economic livelihoods, natural disasters, water, and energy supplies.¹ In Southeast Asia, changes have been recorded in glaciers in the Garhwal and Kumaon Himalayas in northern India as well as in other parts of this Himalayan range. With significant snout fluctuations, most glaciers in the Himalayan mountain ranges have been retreating at accelerated rates in the last three decades² and their rate of retreat is much faster than that of glaciers in other parts of the world.³

The Gangotri glacier, one of the largest ice bodies in the Garhwal Himalayas, is located in the Uttarkashi district of the state of Uttarakhand in India. The glacier's discharge, a vital source of freshwater storage and supply during the summer season for a large population living downstream, initially flows along the Bhagirathi River before meeting the Alaknanda River at Devprayag to form the mighty Ganga River. Snow and glaciers account for about 29% of the Ganga's annual flow (up to Devprayag) and, therefore, these glaciers are likely to affect this large river system.⁴

It is entirely clear that climate change directly influences the retreat of the glaciers in the Himalayas, and that it will eventually affect the biodiversity, water storage, ecosystems, and human habitats of the region. It should also be noted that spreading doubt about the rate of retreat has placed other environmental and social impacts on the wayside. Although the ecosystem near to Gangotri glacier and its inhabitants are apparently being strongly affected by the forces of climate change, it is surprising that almost no studies have been conducted to verify this conclusion. The fact that this local community is in a particularly vulnerable position, both geographically and culturally, points towards the necessity of taking proactive, action-based measures to secure their long-term survival in the area. With the glacier and ice

1 ZEMP 2008, p. 7.

2 WWF *Nepal Program* 2005, p. 68.

3 CRUZ et al. 2007, p. 472.

4 SINGH et al. 2009, pp. 366–371.

melting in the Bhagirathi catchment, local communities are dependent on the resulting ice water for their agriculture, livelihood, and survival. The increased cash flow facilitated by the emergence of religious tourism in the region has often made policy makers forget that these people are living in a danger zone, and that if proper measurements are not taken, the future of these people will be bleak.

Because the human ability to adapt depends on a variety of motivations and information about the changing state of their environment, and the links between human decisions and the environment, local knowledge can promote an understanding of the fact that climate change and its impacts, and therefore the population's future, depends on making the right decision at the right time. The local population's observations are embedded in a local cultural and social context, and are important in shaping their conception of the outcome of climate change. Since such observations take place on a local scale, local knowledge can make valuable contributions to information about local conditions, and can redirect the foci of empirical investigations.

With this objective in mind, my research will investigate the following questions:

- How do local people perceive climate change in their area?
- In the local community, who are the actors involved in creation of “climate change” perception?
- What methods are practiced by locals to deal with this climate-induced crisis?
- Are these methods efficient enough to create local awareness and a way of dealing with climate change?

By documenting local perceptions of climate change, I intend to establish a correlation between local people's perceptions of this global phenomenon and their ability to make decisions based on the adaptive methods on both a short- and long-term scale.

References

- CRUZ, R. V., HARASAWA, H., LAL, M., WU, S., ANOKHIN, Y., PUNSALMAA, B., HONDA, Y., JAFARI, M., LI, C., and NINH HUU, N.: Asia. In: PERRY, M. L., CANZIANI, O. F., PALUTIKOF, J. P., VAN DER LINDEN, P. J., and HANSON, C. E. (Eds.): *Climate Change 2007. Impacts, Adaptation and Vulnerabilities, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*; pp. 469–506. Cambridge: Cambridge University Press 2007
- SINGH, P., POLGLASE, L., and WILSON, D.: Role of snow and glacier melt runoff modeling in hydropower projects in the Himalayan region. In: *International Conference on Water, Environment, Energy and Society, New Delhi, 12–16 January 2009. Hydrologic and Hydraulic Modeling I (WEES) (2009)*
- WWF Nepal Program: An Overview of Glaciers, Glacier Retreat and Its Subsequent Impacts in Nepal, India and China. 2005*
- ZEMP, M., VAN WOERDEN, J., and ROER, I.: *Global Glacier Changes. Facts and Figures. United Nations Environmental Programme. Zurich: World Glacier Monitoring Service 2008*

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Perception and Reception of Climate Change in Micronesia

Rebecca HOFMANN (Munich)

Climate change acts as both the catalyst and amplifier of global and local weather extremes and their consequences, such as droughts and floods. People exposed to extreme weather conditions are in many cases indigenous or otherwise vulnerable people who are poorly equipped to deal with the situation. One group that is especially prone to environmental change are the Pacific Islanders. Due to their limited space, islands are very sensitive to the effects of human interaction with the environment and offer hardly any sufficient adaptation possibilities. Thus, with the prospect of a higher frequency and intensity of hydrometeorological disasters such as tropical storms as well as one of the first recorded modern-day climate-related migrations from the low Carteret Islands to the main island of Bougainville (Papua New Guinea) in 2005, the Pacific Islands have become a symbol for the pending humanitarian crisis.

Island populations will have to adjust both their economic activities and settlement structures in order to face the challenges of land loss, the salinisation of fresh water and arable land, the increasing threat of extreme weather conditions as well as numerous other natural, economic, and socio-cultural implications. Thus, in my current project, I concentrate on the indigenous perception of environmental or “climate change” and its impact. I aim to understand the population’s disposition and capability to adapt, not least through the integration of cultural experiences with natural disasters in the past. Hereby, I also attempt to identify critical thresholds of collapse of the socio-ecological island systems to the point where the abandonment of traditional settlement sites becomes a plausible option.

At the same time, it is important to keep in mind that places of religious and cultural significance, or land in general, represent a large part of a community’s identity, and that migration could therefore mean the loss of spatial connection to a person’s self-conception. On the other hand, however, mobility has always been an essential part of social reality in the Pacific, be it in the form of short-term adaptation strategies after natural disasters, or in the form of increasing aspirations, triggered by the allure of the globalised “outside” world.

To further explore these deliberations, I will use the island group of Chuuk, in the Federated States of Micronesia, as an example. Here, low atolls and high volcanic islands offer divergent conditions for the scope of human resilience, dictated by local perceptions, evaluations, and possible adaptation strategies. A second dichotomy can be found in the relative significance of land and mobility. In Chuukese society, the loss of traditional settlement sites is especially tragic because land is profoundly connected to prestige and political rights. In addition, breadfruit and taro, both important staple foods as well as the focus of local identity,

significantly increase the relative value of the land. This way, access to land is equated with socio-political status, which can therefore impact the resilience of local people, depending on whether or not they have access to land on the high volcanic islands. In the end, ownership of land plays into questions of mobility and is therefore an important aspect of risk management, while, at the same time, natural disasters such as cyclones or tsunamis are known to have induced temporary evacuations of islands in the past. Today, however, motives for migration are manifold, and many young people seek more than what their traditional villages usually have to offer.

Hence, as indicated above, the following fields of investigation have presented themselves:

- Are occurrences of natural disasters part of a culture’s collective memory? If yes, what are the channels through which such knowledge is passed on (oral history, rituals, etc.) and what are the consequences of present-day perception of and strategies for coping with short- and long-term disasters (storms, sea-level rise)?
- What are the incentives for human movement? Which motivations, structures, and processes (push and pull factors) govern the decision of where to go, be it within the realm of Chuuk or across international borders?

In sum, this project aims to identify and understand local perceptions and a culture’s strategy of dealing with natural disasters, including sea-level rise, from the past until today. By combining the concepts of “cultural memory” and today’s “cultural response,” I hope to gain better insight into present-day risk management and decision-making processes of people affected by climate change. Moreover, the emic approach towards climate change risks and climate migration will allow me to detect potential differences between Western European perspectives and those of other world regions. Identifying and assessing these differences could help further the integration of local perceptions in future legislation concerning climate change mitigation.

In terms of future migration scenarios, the question of whether the abandonment of settlements is defined as voluntary or involuntary, or, in other words, whether it is considered a reasonable form of adaption or a sheer necessity, represents a crucial dividing line between “migrants” and “refugees”—a difference that may have far-reaching consequences for them in their new homes. This question is especially important due to the fact that to this day, climate refugees are not legally defined as such, and are therefore not guaranteed economic and political security, making this a pressing issue. Furthermore, the question of social acceptance in climate refugees’ new surroundings has not yet been addressed in relevant literature, although global climate change is considered to be one of the main reasons for future migrations.

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The Geography of Civil Conflict on the Oil Frontiers of the Niger Delta Region of Nigeria: Modelling the Ecological Correlates and Risk of Micro-Level Violent Conflict, 1980s–2010

Lawrence IBEH (Munich)

My dissertation examines, in both a qualitative and a quantitative manner, the relationship between ecological and geographical factors and the risk of violent conflicts on a micro level. My research will address questions such as: To what extent do geographic factors, e.g. ecological degradation indicators, land use/land cover change, and oil infrastructure expansion, affect the propensity of the occurrence of micro-level violent conflicts? And how can this relationship help develop an innovative method for predicting likely locations of violent conflicts using data sets from remote sensing, surveys and other official sources? Special emphasis will be given to the violent conflicts at a community level, which is today the dominant form of conflicts throughout the world. My research touches on two main fields of study: geography/remote sensing, political/peace science, and conflict resolution. I situate this study under natural resources conflicts.

Consensus is increasingly being reached that sustainable development and poverty reduction efforts cannot be dissociated from the constraints imposed by violent conflicts. In most cases, these arise over the impact of natural resources extraction, such as oil, which mostly occurs in in the global south. The 2011 World Development Report confirmed that no fragile or conflict-affected state has, to date, achieved a single Millennium Development Goal (MDG). Nigeria is a case in point. My case study focuses on the Niger Delta coastal region, located in the southeastern part of the country. This region exemplifies both the importance of local conflict and the relative lack of theory and empirical evidence to help understand it. Within relevant literature, there is a major lack of research that explicitly looks at the relationship between ecological correlates and risk of local violence. The region is known as a hot spot for contending issues of environmental degradation and the scarcity of renewable natural resources such as farmland, mangroves, fresh water, etc. This has been the case particularly since the early 1990s. Thousands of people within different communities have lost their lives due to violent conflicts over land resources. Community protests are resisted by security agents, which worsen the situation, leading to further killings and destruction of property. Local communities claim that the activities of oil companies, far from improving their lives, have impoverished their marine and agricultural resources and have led to a drastic decline in ecological resources and biodiversity including land, water, and fishing sites. These, with social and political factors, have been attributed to the violent conflicts.

This study departs from the current empirical literature on natural resource and violent conflicts. Many analysts have often reduced everything to political, economic, and social forces in

order to explain conflict likelihood, especially using a large-N macro-level country or cross-country scale datasets. Previous studies, however, have been successful in identifying a handful of factors for distinguishing among peaceful and unstable societies. But these are not well suited to evaluate micro-level explanations for social unrest, as the cause, dynamics, and outcomes of violent conflicts are usually studied from aggregated country-level perspectives. Researchers have now recognised the limitation of this by increasingly adopting disaggregated approaches to the study of conflicts. This helps uncover the key actors and driving forces crucial towards furthering knowledge about the micro foundations of violence. I therefore argue that incorporating a spatial dimension of micro-level violent conflicts and relationships to ecological factors will help build a model that can support post-conflict policies.

Overall, studies on natural resource conflicts with specific focus on environmental change and conflicts have examined the absolute and relative scarcity driving deprived groups toward violence, greed, grievance, and governance, climate change, and other related topics. Recently, the connection between geography and violent conflicts has been recognised. Geography exerts a major influence on violent conflicts because they are usually spatially limited and leave large parts of the population unaffected.

Despite growing attention to geography, little effort has been made towards addressing environmental factors and violent conflicts on a micro scale. A micro-level approach advances our understanding of conflict through its ability to account for individual and group heterogeneity, and, for instance, to explain how different factors such as poverty, access to resources, environmental degradation, and demographic structure lead to intra-country variation. The shift will also help improve the specification of causal mechanisms underlying statistical correlations, and address problems of measurement and interpretation that cannot be easily resolved at the cross-national level.

My doctoral dissertation therefore seeks to contribute to the emerging field of micro-quantitative studies by looking at the patterns of local conflict in Niger Delta and the factors that are associated with varying levels. The research will establish the extent to which geographic and ecological factors, with the latter measured in terms of depletion of mangroves, fresh water, and oil spill hazards, explain the variation in the intensity of violent uprisings. It also intends to fill a current information gap on spatial aspects of violence in the Niger Delta. The new method that will emerge in this study can help predict the occurrence of conflicts by combining several data sources coupled with a computer based model with Geographic Information Systems (GIS). Lastly, my research will support policies on both post-conflict reconciliation and early warning systems in regions that suffer from environmentally induced violent conflicts.

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How Much Equality Is Fair? Social-Ethical Studies on Sustainable and Fair Climate Protection

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More and more, people from all over the world are realising that our climate is changing. The International Panel on Climate Change 2007 report and other, newer studies predict devastating anthropogenous climate and environmental changes that will dramatically aggravate living conditions around the world. The unsuccessful UN Climate Change Conference in Copenhagen in December 2009 and the insufficient results of the follow-up conference in Cancun in December 2010 show clearly that it is extremely difficult to find accords that are binding under international law. In light of these political difficulties and the present economic trends, the 2 °C goal, and therefore the prevention of a dangerous climate change seem, for many climate experts, nearly unreachable. We would need to drastically reduce our carbon emissions in order to enforce any form of climate protection. But how should carbon dioxide rights be distributed?

Is it really fair that everyone has the right to an equal amount of carbon emissions? A per capita distribution of emission rights would have enormous moral, political, and economic effects, and would establish a form of global and intergenerational egalitarianism unrivalled in the history of humanity. Therefore, it is important to ask whether the concept of human equality should be taken to mean that we all have the same right to carbon emissions.

On a theoretical level, there is a lively philosophical controversy between egalitarians, mainly in the tradition of John RAWLS, and so-called non-egalitarians. In the opinion of John RAWLS (1971), who reinitiated the discourse on justice in modern times with his book *A Theory of Justice*, social and economic inequalities are only acceptable if they are beneficial to even the worst situated person in a society and if they are linked to social positions that are accessible to all members of a society. Non-egalitarians, like Wolfgang KERSTING, a philosophy professor at the University of Kiel and expert on John RAWLS, criticise this concept of egalitarianism. In his book *Kritik der Gleichheit*, KERSTING (2002) argues that if such a model of justice is consistently used, it will lead to a deconstruction of human differences, which are fundamentally important for human dignity.

In the field of climate justice, this problem is intensifying because questions of mitigation of future climate change and adaptation to the current climate problems, which are globally spread very unevenly, have to be taken into account. Thus, borrowing ARISTOTLE'S systemisation, a differentiated view of distributive justice is necessary. In *Nicomachian Ethics*, ARISTOTLE defines the measure of distributive justice in relation to a *tertium comparationis*. Because of the close interconnection between climate change and development opportunities,

these two complementary and sometimes rival elements of distributive justice—demand-based justice and burden-based justice—must be considered. Demand-based justice can be linked as *tertium comparationis* to the varying vulnerabilities of different population groups, and burden-based justice to mitigation demands.

My doctoral project explores a range of decisions for or against egalitarian patterns of distribution, analyses the resulting ethical, political, and economic conflicts, and examines popular instruments and strategies used in climate treaties and the justice theories that influence them. Based on the concept of equal human dignity in Christian, but also non-Christian belief, the main question of all such investigations is the following: How much equality is fair?

References

Intergovernmental Panel on Climate Change: IPCC Fourth Assessment Report. Climate Change 2007. Geneva: Intergovernmental Panel on Climate Change 2007

KERSTING, W.: *Kritik der Gleichheit*. Weilerswist: Velbrück 2002

RAWLES, J.: *A Theory of Justice*. Cambridge, MA: Belknap Press of Harvard University Press 1971

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Econovels: The Concept of Environmental Justice in the Nineteenth Century Social Novel

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To date, historians and scholars of literature have concentrated primarily on the social significance of industrialisation. The fact that many authors from the middle of the nineteenth century onwards have treated questions of what today would be known as “environmental justice” in their works has been largely overlooked. The socially just distribution of environmental risks, hazards, and resources was an important element of realist and naturalist novels long before environmental groups — as we know them nowadays — emerged. Not just in Europe, but in the whole of the Europeanised world.

My doctoral thesis, rooted in historical research open to literary sources and interpretations, is conceived as a contribution to cultural studies; it will examine the links between environmental justice and the first stirrings of environmental consciousness.

Environmental justice in the nineteenth century was not recognised as a freestanding phenomenon, nor was it analysed and discussed as such; the examination of literary sources does, however, reveal that a socially sensitive and committed group of litterateurs, in particular in Western Europe and the US, did see the unfair distribution of environmental resources and damage during the age of industrialisation as contentious. In my research project, I will draw on a selection of novels from Great Britain, Germany, France, and the United States that all present a critical stance with regard to the social consequences of pollution in the industrial or urban environment.

In *Our Mutual Friend*, Charles DICKENS (1864/65) deals with the interdependence between social decline and the pollution of the river Thames. Wilhelm RAABE’s *Pfisters Mühle* (1883/84) symbolises the price the Germans played in order to transform from an agrarian into an industrial state. In *Germinal*, Emile ZOLA (1885) considers the “social question” concerning miners to be a societal problem as well as a question of environmental pollution and its subsequent costs. Using an environmental metaphor, Upton SINCLAIR (1906) criticises the slaughterhouses of Chicago as a “modern” jungle, threatening the workers in his novel, *The Jungle*.

Within the scope of my project, these selected novels will function as sources on two levels: *firstly*, as documents that bear witness to the author’s perception of the environment, and *secondly*, as sources that, despite their status as works of fiction, relate to historical problems. In order to gain a more comprehensive picture, I will present and discuss each novel separately and examine them not only in relation to other personal writings of the authors, such as correspondence or diaries, but also in relation to other cultural products contemporaneous to their origin.

A history of ideas approach will also allow a comparative and transferable analysis between authors, themes and discourses. The starting point for this undertaking is the hypothesis that each of the authors accessed environmental topics from an individual, specific situation, and that transnational references, transfers of ideas, and networks existed.

Current interpretations of these works as social novels need to be re-examined. The social novels of the nineteenth and early twentieth centuries can also be read as “eco-novels” and thus need to be appreciated in a new and different way. I therefore suggest that it is possible to re-evaluate the social question as an environmental question, and to (re)think social (in) justice as an inherent problem of environmental justice.

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Erinnerungsfluten: The Storm Flood of 1962 in Hamburg's Civic Memory

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On 20 February 1962, some 150,000 people assembled in the Hamburger *Rathausmarkt* for a commemoration of the victims of the storm flood that had inundated vast parts of the city from 16 to 17 February. In his speech, Mayor Paul NEVERMANN unveiled the first symbolic monument of the flood: “Only in the night-time bombings in the year 1943 and the conflagration in the year 1842 was our city affected by afflictions that were as grave as this last blow. This experience of suffering will stand as both a warning and appeal.” This appeal did not go unheard. To this day, public remembrance events and medial or material commemorations of the storm flood of 1962 have been an enduring part of local and national memory culture.

My doctoral research project examines the history of public memory of the storm flood of 1962 from a cultural and environmental perspective, and its formative significance for Hamburg's civic culture of disaster. The general aim is to establish a second-order observation plane in which attention is focused on subsequent acts of memory and narrative interpretations rather than on the flood itself. Another aspect of the project will look at Hamburg's disaster memory as a joint story of nature and society. It will aim to reveal the extent to which concepts of nature and disaster were shaped by memory and memorial, aiding the development of a new and deeper understanding of extreme flood events—and, conversely, how the urban culture of memory gained a new dimension through its altered perceptions of human interaction with the hazardous forces of nature.

This leads to a research concept that brings together environment and history. Taking into account the iterative structure of both natural disasters and processes of memory, my approach combines experiences and methods of coping with past extreme events, as well as the significance accorded to them in the present and the anticipation of future flood disasters. Nature is taken as a fundamental historical factor for cultural acts of memory and memorial practices. By means of this methodology, my research links the appearance of nature in historical analysis with the actual culture and politics of memory (actors), and its medial applications (including, among others, commemorative monuments, memorials, and exhibitions).

In respect to the flood events, the culture of memory in Hamburg is understood to be the result of interpretive processes, in which memory is formulated and constructed, and given spatial, material, and symbolic frames of reference. This urban disaster memory represents the current and contemporary spectrum of interpretation of storm floods, which is publicly communicated and in constant flux. Since the flood did not only cement itself in local memory culture, but also the collective national consciousness, I will consider the interaction between these intertwined levels of memory.

The Great Flood of 1962 functions as a focal point of my dissertation project: it is the juncture at which the culture and memory of storm floods comes up against dynamic processes of memory displacement and obliteration. This complex interrelationship, between the natural causes of a disaster, its social consequences, and its cultural interpretation, can be understood to be a socio-natural site of memory, born of the cultural challenges that arise from natural hazards and, as such, has a heuristic value. The Hamburg storm flood can therefore be seen, in hindsight, as a key event in which a multitude of narrative threads concerned with the landscape of local and national memory come together. This examination of urban memory and disaster culture in Hamburg is thus more than a mere history of remembering; its scope includes an analysis of the relationship between humanity and nature, and its significance in and for historical change. In keeping with the diversity within environmental history, it also contributes to our knowledge of the social, political, and cultural history of Hamburg and the FRG in the twentieth century.

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“With Recreation for All:” Cemeteries as City Parks in New York City, 1811–1898

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In 1858, landscape architect Frederick Law OLMSTED addressed the Board of Commissioners of Central Park in a letter:

“The time will come when New York will be built up, when all the grading and the filling will be done, and when the picturesquely-varied rocky formations of the Island will have been converted into foundations for rows of monotonous straight streets, and piles of erect, angular buildings. There will be no suggestion left of its present varied surface, with the single exception of the few acres contained in the Park. Then the priceless value of the present picturesque outlines of the ground will be more distinctively perceived, and its adaptability for its purpose more fully recognized.”¹

The words of the “father of American landscape architecture” incorporate a vision of a future New York City—a place without much urban greenery and pastoral ambience. OLMSTED and his collaborator, the British-born architect Calvert VAUX, tried to counter the effects of industrialisation and urbanisation on the cityscape by proposing and finally building Central Park as a democratic bastion of recreation. At first, in opposition to OLMSTED’s idealistic plans, the park became a promenade for the affluent. Those who lived close by or could afford to go there by carriage or —starting in 1864—by streetcar, did.²

No other city in the United States is associated quite as strongly with change as New York City. Both celebrated and cursed as the powerhouse of American modernism, the metropolis is a symbol of America like no other. Since its inception as the Dutch colony of New Amsterdam, the city has been in permanent transition. The growth of the city was inextricably connected to its port. Commerce, industrialisation, immigration, and migration all fed into the development of the metropolis. A rising population and the realisation that tourism had become an increasingly important source of income for the local economy led to the development of public, semi-public, and private institutions of leisure and recreation.

In *The Politics of Park Design: A History of Urban Parks*, CRANZ (1989) points out that nineteenth-century public policy relating to recreation within cities was mainly concerned with the acquisition and development of parks. Parks brought the aesthetic qualities of pastoral landscapes to the heart of the American city. Green spaces were conceptualised as places of regeneration.

1 Quoted in BEVERIDGE and SCHUYLER 1983.

2 HOOD 1993, pp. 79–40.

New York City's Central Park served as a model for many other naturalistic retreats that sprang up in the United States later on. Even though the park was much praised for its design, it failed to serve its primary function as a social centre for the city's inhabitants. Built too far north on Manhattan Island, Central Park was not a convenient neighbourhood retreat, but rather a place of excursions. Frederick Law OLMSTED's idea of a democratic commons for recreation purposes was realised on a smaller scale within New York's various neighbourhoods.

In my project, I will argue that comparatively small parks and open spaces, such as cemeteries and public squares, served the city's diverse population to a greater extent than OLMSTED's centralised park structure. I presuppose that these places possessed a momentum that helped shape their neighbouring communities. Furthermore, it is assumed that as New York inscribed itself into the landscape by building massive high-rise structures, the city did not only become a landmark of architectural grandeur, but also niche urban development, which was just as important for its maintenance as financial investments. Cemeteries are seen as one of the most meaningful niches akin to nature besides parks. A close examination of these places and their transformation offers an opportunity to extend our knowledge about urbanites and their way to deal with any given environment. Therefore, I will especially investigate the importance of the rising immigrant population to the appropriation of cemeteries and their transformation into parks.

My research rests on the assumption that the transformation of cemeteries into city parks took place at precisely the moment when New York's cityscape was in the process of radical change; and that reform movements were just as significant to this development as were landowner concerns, city planning, property speculation, and urban elites.

References

- BEVERIDGE, C., and SCHUYLER, D. (Eds.): *The Papers of Frederick Law Olmstead, Volume III. Creating Central Park*. Baltimore: Johns Hopkins University Press 1983/1996
- CRANZ, G.: *The Politics of Park Design. A History of Urban Parks*. Cambridge, MA: MIT Press, 1989
- HOOD, C.: *722 Miles. The Building of The Subways and How They Transformed New York*. Baltimore: Johns Hopkins University Press 1993

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Possibilities and Capacities of Islamic Societies to Construct Environmental Ethics with a Focus on Iranian Society and its Media

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Today, the environment has become one of the most significant problems in almost all theoretical fields, especially in ethics. Within the realm of ethics, debates have formed in two major sub-fields: ecocentric and anthropocentric ethics. These two branches of ethics explore the relationship between the environment and religion. Recently, the debate was enflamed by the publication of Lynn WHITE's (1967) article "The Historical Roots of our Ecological Crisis."

In his article, WHITE contemplates the causal link between the destruction of the environment and theological views, asserting that our current environmental crisis was essentially caused by a Judeo-Christian view of the environment. This argument provoked criticism that can be divided into three main groups: (1) those coming from the Judeo-Christian tradition who believe that WHITE's understanding of the topic is prejudiced and that he neglects exhortations and commands in Christianity and Judaism that demand the protection of nature; (2) opponents who try to depict Islam as an exception among the religions; these critics have attempted to provide an alternative to WHITE's theory by emphasising and highlighting the environmentally friendly commands of Islam; and, finally, (3) those traditionalists who believe in perennial wisdom and assert that the solution to this modern crisis is to copy the spiritual core of religion in general.

Of course, all three groups of opponents agree that the proper human interaction with nature and the solution to the crisis is to return to religious and spiritual foundations. However, due to the danger of climate change, with its deteriorating progress, we are faced with the fear of environmental annihilation: There is no room for trial and error, and every solution must prove its efficiency before being applied. In this order, specialists have to critique, interpret and, of course, investigate these claims through different methods to understand the possibilities and capacities of such ethical attitudes toward the environmental crisis.

Therefore, I intend to study the social debates in religious beliefs through an objective approach: that is, since environmental ethics are "a solution to the environmental crisis," and are considered to be one of the divisions within applied ethics, I will attempt to study feedback of one of these moral systems, Islamic ethics, which has been put forward as a solution. I will study the media's perspective to understand the similarities, differences, and, of course, possibilities that religious cultures offer nature. In other words, the question of this research is how and to what extent they are effective in extending this nature-friendly culture, consistent with general and determined policies in the faith-based culture and society of Iran.

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References

WHITE, L.: The historical roots of our ecological crisis. *Science* 10, 1203–1207 (1967)

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Struggle for Oil: An Environmental History of West Siberia, 1970s–2008

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Russia's substantial oil reserves have played a central role in its geopolitical and economic rebirth. West Siberia is Russia's most highly developed and oldest oil province, producing 78% of all Russian oil. Though the province enjoys the highest gross regional product in the country, ever since the discovery of oil in the 1960s, West Siberia has been notorious for its pollution. West Siberian oil resources have been exploited on a massive scale, and have been a major source of both revenue and an entire spectrum of petroleum-related ecological problems for over forty years. Russian historiography, however, clearly lacks works on late- and post-Soviet regional environmental history. Although there is no shortage of literature on Soviet environmental damage, work on modern Russian environmental history and on the history of oil in particular is still just beginning to accumulate. Material histories concerned with the late Soviet Union and the newly created Russian Federation are extremely rare. By focusing particularly on Western Siberia, this project also offers a perspective on the provinces, a much neglected area in terms of research.

In my dissertation project, I interpret West Siberia's environmental problems as the product of ever-growing conflicts between federal and regional politics on the one hand, and between the state, businesses, and society on the other. These problems have deep historical roots in Soviet resource policy, the planned economy, and in the challenges of the Cold War. At the same time, the full-scale socio-economic and political transition following the collapse of the Soviet Union has brought new trends to Russia's energy policy and created new challenges for the environment. This study focuses on the following questions: When and in what context were the environmental aspects of oil production first brought up? What effect has oil production had on the indigenous communities of the region, and what has been the societal response thereto? How has the regional environmental movement developed, and what relationship does it have to the state and businesses? How have conflicts between federal and regional oil policies affected the environment of West Siberia? To what extent have the environmental challenges of the modern Russian oil industry been inherited from Soviet energy and natural resource policy?

The choice of the time frame examined in this study is based on the following logic: On the one hand, the 1970s heralded a period of environmental concessions evident in Soviet legislation of the time. This date coincides with the UN Conference on Human Environment held in Stockholm in 1972, which marked a watershed in the development of a global environmental consciousness. Soviet environmental policy and associated thinking were affected

by this major international event. The beginning of the 1970s also marked the emergence of a coherent system of environmental data collection in the Soviet Union, which increases the number of primary sources under investigation.

On the other hand, the 1973 oil shock pushed the Soviet government even more into merely calculating the amount of newly discovered West Siberian oil to be sold to pay for imported grain and equipment, and, most importantly, to keep military spending at its traditionally high level. Thus, the launching of the West Siberian oil industry in the 1970s averted the collapse of the Soviet Union. The excessive pumping of oil did not correspond with geological and environmental norms, leading to premature field depreciation and long-term ecological problems. The modern Russian energy sector and the West Siberian economy, in particular, are still showing signs of Dutch disease, an economic condition that occurred in the Soviet Union in the 1970s as a result of the oil shock and the simultaneous irrational development of oil fields.

I have limited the period under investigation from the 1970s until 2008, which therefore includes both presidential terms of Vladimir PUTIN, whose regime introduced significant changes to both environmental protection and natural resources management.

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