



Fraser Murison Smith

A Planetary Economy

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Dedicated to the children of the world and all who come after.

*And to my wife, Pilar, whose beauty and love, strength and patience,
intelligence and insight, and inspiring motherhood are a constant joy, and
the foundations for this book.*

FOREWORD

I distinctly remember being obsessed about environmental systems when I participated at a recycling center for Earth Day 1970. My young awareness already realized that the natural systems were seriously out of balance, the air was toxic to people and rivers were on fire. People participating in that first Earth Day were not out to celebrate the planet but to protest the assault of the capitalist economic system on our ultimate life support, the primary context that connects us to every other thing. But we were also there to demonstrate that there was a much better way of doing ‘business’ on Earth.

That quest for a better way followed me throughout college and into the emerging service industry of ‘corporate environmental management’, featuring such organizational development fads as ‘total quality environmental management’ and ‘sustainable development’. My solution was to integrate existing regulatory, economic and civic systems into new ways to improve compliance on the part of businesses and provide critical environmental feedback to their customers. The result was the first comprehensive Green Business certification program in the nation.

But there was a persistent problem. Systems thinking was fairly rare in both the business and governmental sectors, which honored granularity and specialization. Most attempts at systems integration would be blocked by a cadre of mid-level managers. There seemed no real way to get everyone on the same page within a common context for change to gain traction. That is until I met Fraser Murison Smith.

Fraser was one of the first employees at a software start-up in 1997 by the name of Datafusion, working as a systems integrator. I signed on as the company's environmental consultant, working with Fraser to develop knowledge maps: galaxies of nodes and links within a recognizable, data-rich context, undergirded by a robust content catalogue. It was electrifying to be the first infocartographers on Earth!

Since then, I have had the privilege of sharing many visual contexts with Fraser. Better yet, I have found a person who can converse with anybody in a shared understanding of complex, integrated systems without the need for continual explanation. Think about that for a minute: maximum knowledge transmission with minimum conflict.

A Planetary Economy is about all these things: protecting the planet, our primary context; creating an economy that can deliver prosperity and a high quality of life for all beings; and developing a viable future without waiting for new technology or a major scientific advancement. Fraser elegantly shows it just requires a change of perspective wired with critical feedbacks to transform the current life-destroying economic context in which we participate to one that is life-respecting. We can have our planet and live on it too.

Viewcraft, Inc., Sebastopol, CA
March 2020

John Garn

CONTENTS

Part I	An Economy on a Crowded Planet	1
1	The Economy's Coevolution with Nature	3
2	Economic Worldviews: Modernity and Its Alternatives	35
Part II	Requirements for a Planetary Economy	73
3	Normative Requirements	75
4	Institutional Challenges and Legal Institutions	93
5	Political Institutions	111
6	Corporate and Financial Institutions	143
7	Policy Development	173
8	Requirements for Economic Policies	201
9	Requirements for Accounting Standards and Practices	239

10	Money and Finance in a Planetary Economy	283
11	Monetary and Financial Requirements	311
12	Economic Controls 1: Principles and Requirements	339
13	Economic Controls 2: Currency and Fees	353
14	Economic Controls 3: Taxation	369
15	Economic Controls 4: Subsidies, Incentives and Market Instruments	401
Part III How Will We Get There?		419
16	Pathway Toward a Planetary Economy	421
17	A Manifesto for Market Planetarianism	453
18	A Planetarian Society	469
Index		501

ABOUT THE AUTHOR

Fraser Murison Smith is an energy specialist in public utilities, formerly an information systems consultant and award-winning cleantech entrepreneur. After completing a PhD in Theoretical Ecology at Oxford University, he was a postdoctoral fellow at Stanford University in ecological economics. He has published papers on fisheries, biodiversity and economic development, as well as two books, *Environmental Sustainability: Practical Global Implications* (1997) and *Economics of a Crowded Planet* (2019). Murison Smith and his wife, a healthcare technology leader, share their home in Northern California with two wonderful children and a canoe and tent on standby for spontaneous forays into the surrounding mountains, rivers and lakes.

ABBREVIATIONS

GDP	Gross Domestic Product
GGP	Gross Global Product
GNP	Gross National Product
IMF	International Monetary Fund
LCOE	Levelized Cost of Electricity
NPP	Net Primary Production
OECD	Organization for Economic Co-operation and Development
SEEA	System of Environmental-Economic Accounting
SMC	Sovereign Money Creation
SNA	System of National Accounts
UN	United Nations

LIST OF FIGURES

Fig. 1.1	Estimates of human population, in millions, from deep history to 2000: Population every 1000 years from 10,000 BC. Source: Author's creation, using data from Klein Goldewijk and van Drecht (2007), History Database of the Global Environment	11
Fig. 1.2	Estimates of human population, in millions, from deep history to 2000: Population every 100 years from 1000 AD. Source: Author's creation, using data from Klein Goldewijk and van Drecht (2007), History Database of the Global Environment	12
Fig. 1.3	Historical and projected global human population under various demographic scenarios. Source: Author's creation, using data from United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision	13
Fig. 1.4	Human population (solid line) plotted against total primary energy consumption in billion tonnes of oil equivalent (dotted line). Source: Author's creation, using population data from the United Nations and energy data from British Petroleum, Statistical Review of World Energy, 2015	14
Fig. 1.5	Human population (solid line) plotted against total material extraction in gigatonnes (10^9 tonnes, dotted line). Source: Author's creation, using population data from the United Nations; 1950 material extraction value from Schaffartzik et al. (2013); and all other material extraction values from the Sustainable Europe Resource Institute (SERI), www.materialflows.net	15

- Fig. 1.6 Human population (solid line) plotted against the total material inputs to the economy in gigatonnes (dotted line), estimated as a sum of energy consumption and material extraction. Source: Author's creation 16
- Fig. 1.7 Human population (solid line) plotted against the total emissions and solid waste in gigatonnes (dotted line). Source: Author's creation, using emissions data from Emissions Database for Global Atmospheric Research (EDGAR), <http://edgar.jrc.ec.europa.eu>, and solid waste data from Hoornweg et al. (2013) 17
- Fig. 1.8 Human population (solid line) plotted against material efficiency (dotted line). Source: Note: Material efficiency is estimated as the percentage of material not wasted by the economy (inputs minus waste outputs, divided by inputs) 19
- Fig. 1.9 Human population (solid line) plotted against the total value of merchandise exports in trillions of 2014 US dollars. Source: Author's creation, using population data from the United Nations and global exports from the World Bank, World Development Indicators (<https://datacatalog.worldbank.org/dataset/world-development-indicators>) 20
- Fig. 1.10 Human population (solid line) plotted against total gross domestic product (or gross global product) in trillions of 2014 US dollars at market prices. Source: Author's creation, using population data from the United Nations and GDP data from the World Bank, World Development Indicators (<https://datacatalog.worldbank.org/dataset/world-development-indicators>). World Bank note: GDP at purchasers' prices is the sum of gross value added by all resident producers in the economy, plus any product taxes, minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources 21
- Fig. 1.11 Illustration of social auto-catalysis of economic growth. Source: Author's creation 24
- Fig. 1.12 Resource flows, gross planetary productivity per capita and a probability of avoiding economic collapse over 200 years in a nonparametric simulation model of an economy in coevolution with nature. Source: Murison Smith (2019). Note: Early reductions in economic demand and improvements in the economy's material efficiency pave the way for self-sustaining economic growth in the long term.

	The model tracks three principal resource flows: those into the economy from nature (R_x), out to nature from the economy (R_f) and regenerative circulation with the economy (R_g)	31
Fig. 3.1	Cycle of social norms to institutions, policies, controls and behavior, back to norms. Source: Author's creation	76
Fig. 5.1	Global governance as a nexus of social entities at various levels of organization. (Source: Author's creation)	120
Fig. 6.1	Self-similarity of corporate growth and economic growth over the maturation process of a materially constrained economy. (Source: Author's creation)	157
Fig. 8.1	Illustration of a policy of narrowing income distributions and establishing an income floor. (Source: Author's creation, based on income data from the US Census Bureau (Lofquist et al. 2012; Denavas-Walt and Proctor 2014). Note: Solid curve represents a typical current income distribution, scaled according to the median (m). Dotted curve is a hypothetical proposed income distribution in which a basic income scheme establishes an income floor close to the existing median and elective redistribution narrows the income distribution from the top end, such that the 90th percentile falls between two and three times the median)	228
Fig. 11.1	Illustration of a US national money system established through legislation to nationalize the dollar, separate commercial deposits from lending, and replace the Federal Reserve with a National Monetary Authority. Source: Author's creation	331
Fig. 11.2	Sequence of flows of money within a US sovereign money system. Source: Author's creation	332
Fig. 14.1	Schematic of the application of a material intensity tax, illustrating the distinction between extractive, regenerative and recirculated flows, as well as effluent, with respect to tax rates. Source: Author's creation	378
Fig. 14.2	Percentages of returns and income tax received from married couples filing jointly, organized by income bracket. Source: Author's creation, using income brackets from US Internal Revenue Service Data Table I.2: all returns: adjusted gross income, exemptions, deductions, and tax items, by size of adjusted gross income and by marital status. Data are from 2013. Note: The pattern for single filers is similar	382

Fig. 14.3	Existing (2013) effective tax rates for married couples filing jointly, by income bracket, and new effective tax rates under a proposed tax structure described in the text. Source: Author's creation, using data from IRS Data Table 1.2	384
Fig. 14.4	Percentages of returns and income tax received from corporations, organized by asset bracket. Source: Author's creation, using data from the IRS Income Tax Returns Complete Report, Fig. A, p. 2. Data from 2013	385
Fig. 14.5	Existing (2013) effective tax rates for corporations, by asset bracket, and new effective tax rates under a proposed tax structure described in the text. Source: Author's creation, using data from the IRS Income Tax Returns Complete Report, Fig. A, p. 2. and IRS Form 1120	386
Fig. 16.1	Projection of dividends for a basic living program consisting of basic income, free health and dependent care, and free education over 20 years. (Source: Author's creation, based on data and assumptions in the text and the Appendix)	428
Fig. 16.2	Projection of artificial capacity fee revenue and sovereign money creation to meet the basic living program funding requirements in Fig. 16.1. (Source: Author's creation, based on data and assumptions in the text and the Appendix)	429
Fig. 16.3	Projection of income tax revenues, material intensity tax revenues and total tax revenues, using 2013 tax data as a baseline. (Source: Author's creation, using 2013 tax data as a baseline. Data from US Internal Revenue Service and Congressional Budget Office. Note: Assumptions and method explained in text and the Appendix)	432
Fig. 16.4	Effect of tax-shifting on corporate effective income tax rates by year 20. (Source: Author's creation, baselined from 2013 IRS corporate income tax data for US corporations)	432
Fig. 16.5	Average (mean) net incomes in the baseline year and years 1, 5, 10, 15 and 20 in the scenario, showing the effects of the income tax reductions, basic income and elective redistribution: Married couples filing jointly. (Source: Author's creation, using 2013 IRS data. Note: Assumptions and method explained in text and the Appendix)	434
Fig. 16.6	Average (mean) net incomes in the baseline year and years 1, 5, 10, 15 and 20 in the scenario, showing the effects of the income tax reductions, basic income and elective redistribution: Single filers. (Source: Author's creation, using 2013 IRS data. Note: Assumptions and method explained in text and the Appendix)	434

Fig. 16.7	Distribution of average net income by IRS taxable income bracket in the baseline year and in years 1, 5, 10, 15 and 20: Married couples filing jointly. (Source: Author's creation, using 2013 IRS data. Note: Assumptions and method explained in text and the Appendix)	435
Fig. 16.8	Distribution of average net income by IRS taxable income bracket in the baseline year and in years 1, 5, 10, 15 and 20: Single filers. (Source: Author's creation, using 2013 IRS data. Note: Assumptions and method explained in text and the Appendix)	436
Fig. 16.9	Projected revenue from natural capacity fees on financial trades and corporate net income. (Source: Author's creation, based on assumptions and data described in the text)	438
Fig. 16.10	Illustrative projection for the US, in constant 2013 dollars, showing annual sovereign money creation, total government revenue and total budget, along with a paydown of the national debt and flows of new sovereign capital into the financial sector for commercial lending and investment. (Source: Author's creation, based on assumptions and data described in the text. Note: The projection incorporates a variety of measures, including tax-shifting from income onto material intensity, a basic income scheme, natural capacity fees levied on financial trades, and investments in material efficiency and natural capacity. Assumptions and method explained in text and in the Appendix)	440

LIST OF TABLES

Table 1.1	Comparison of the scale of Earth's biota against the scale of the economy	17
Table 3.1	Normative requirements for a planetary economy: attitudes toward nature	80
Table 4.1	Requirements for legal institutions for a planetary economy	108
Table 5.1	Numbers of representatives in selected local and regional legislative bodies by region	132
Table 5.2	Institutional and governance requirements for a planetary economy	139
Table 6.1	Ten largest public or state corporations in the world as of 2014 to 2015, showing type, ownership, exchanges where listed, headquarters, annual revenue and effective period	168
Table 6.2	Ten of the largest privately held companies reporting revenue, showing type of corporate structure	169
Table 6.3	World's largest five firms having a partnership structure (LLP or general partnership)	170
Table 6.4	World's largest non-profit organizations by value of assets held	171
Table 8.1	'High-income' countries for elective redistribution analysis	235
Table 9.1	Principal categories of the balance sheet for a corporate account	248
Table 9.2	Linkage of material flows (in tonnes, t) through Earth's natural systems and cash flows (\$) through a generic economic entity	251
Table 9.3	Illustrative example of parallel financial and material accounting using income statement structure	257
Table 9.4	Structure for a system of global material and financial accounting, side by side	270
Table 9.5	Approaches for valuing externalities in financial accounting	272

Table 9.6	Categories used in the balance sheet in the System of National Accounts	275
Table 9.7	Supply and use tables employed in the System of National Accounts (SNA) and the System of Environmental-Economic Accounting (SEEA)	279
Table 9.8	Connections between supply and use tables and asset accounts in the SEEA	280
Table 11.1	Similarities and differences between pure reserve banking, pure money and sovereign money creation	312
Table 12.1	Matrix of instruments described in this chapter and the three to follow, showing their applicability to government expenditure, direct natural capacity improvement (such as ecological restoration), and the four principles of controls for a planetary economy	349
Table 13.1	Approximate conformance of new currency creation to the four principles of economic controls for a planetary economy	354
Table 13.2	Approximate conformance of common capacity fees to the four principles of economic controls for a planetary economy	356
Table 13.3	Summary of annual income estimates from fees on co-owned wealth, for selected assets in the US	357
Table 13.4	Illustrative structure of a progressive financial infrastructure fee levied on trades of different intervals since the previous trade in the same asset by the same owner	358
Table 13.5	Estimate of annual income from common capacity fees on assets not reviewed by Barnes (2014)	359
Table 13.6	Summary of potential revenue from artificial capacity fees on common infrastructure assets	365
Table 13.7	Illustrative schedule of natural capacity fees using asset brackets for US businesses	367
Table 14.1	Approximate conformance of a progressive consumption tax to the four principles of economic controls for a planetary economy	371
Table 14.2	Selected existing or attempted taxes on material flows as of the early twenty-first century, organized into input and output categories	374
Table 14.3	Approximate conformance of a material intensity tax to the four principles of economic controls for a planetary economy	376
Table 14.4	Approximate conformance of tax-shifting away from income to the four principles of economic controls for a planetary economy	380
Table 14.5	Current (2013) and proposed US income tax rates for tax-shifting analysis	383

Table 14.6	Effects of changes on the income tax burden by bracket, in aggregate and per capita, for the two tax classes in the analysis	384
Table 14.7	Approximate conformance of a property tax structure supporting natural capacity to the four principles of economic controls for a planetary economy	393
Table 14.8	Summary of taxation policy for a future planetary economy, showing changes from current (early twenty-first century) policies prevalent within most market economies	396
Table 14.9	Selected Sections of the US Internal Revenue Code (26 USC) related to income and employment taxes showing how such taxes might be treated under a modified tax code for a materially stable US economy	397
Table 15.1	Approximate conformance of subsidies and incentives for material efficiency or natural capacity to the four principles of economic controls for a planetary economy	402
Table 15.2	Composition of electrical energy produced worldwide in 2012, showing also total production in terawatt-hours, and approximate, 2013 average levelized cost of electricity (LCOE) in dollars per megawatt-hour	403
Table 15.3	Subsidies to renewables and fossil fuels, worldwide, 2013	404
Table 15.4	Approximate conformance of tradable quotas to the four principles of economic controls for a planetary economy	410
Table 15.5	Approximate conformance of natural capacity share-ownership to the four principles of economic controls for a planetary economy	414
Table 16.1	Individual and corporate income tax rates and thresholds assumed for tax-shifting scenario	430
Table 16.2	Estimated growth rates and ceilings for forward projection of tax revenues in the economic projection scenario, by category	446
Table 16.3	Starting (year 0) and projected values for the government budget projection	449
Table 17.1	Proposals for a market-planetarian economy embodying capacitism as its guiding philosophy, expressed through a suite of market-planetarian institutions (I), governance structures (G), policies (P) and instruments (N)	464

INTRODUCTION

Nature keeps us safe.

—Orion Murison Smith, age 5

... a simple yet profound insight, summing up in four words what scientists have been trying to tell policymakers for years. Might his grandchildren, by the end of the twenty-first century, be enacting policies and developing technologies to maximize the longevity of the human economy? In the hope that they will, this book is for today's children, their children and the generations to come. The impetus for this book is generative.

Unlike many writings on the problems of the present day and how to solve them, this book describes a society—an economy, specifically—which does not yet exist. It asks the simple question, how would a future economy look if one started with a blank sheet of paper, requiring the economy to persist in stable alignment with natural systems, guaranteeing prosperity for all? How would it work? What kinds of norms and values would prevail? What kinds of institutions would be needed? What kinds of controls would be in place? In proposing answers to these questions, this book works backward from this imagined future to the present day to ask how we might get there.

The effort is not an exercise in speculation, nor in utopianism. Fred Polak, writing in 1961, identified the practical importance of having a concrete perception of the future: “there is a great deal of historical

evidence to suggest that a society which loses its identity with posterity and which loses its positive image of the future loses also its capacity to deal with present problems, and soon falls apart.”¹

As a graduate student studying species extinction rates² in the early 1990s, it was clear to me that the loss of biodiversity in today’s world is not really a biological problem but a social one. Years later, upon learning that snow leopards are hunted for their pelts, my daughter asked, “why? Money’s not important. Nature is important.” Ignorance of this simple fact is the essence of this social problem. Although the current spike in species extinctions could become a mass extinction comparable to those observed in the fossil record,³ the biosphere nonetheless will bounce back. If the geological past is any guide, then the recovery probably would take several million years; however, life on Earth is in no particular danger of being wiped out. It simply will continue to “create new versions of itself,” as Adam Frank describes.⁴

Species extinction is a symptom of a broader misalignment between social processes and natural ones. Why do the two have to be out of alignment in the first place? What is to stop the human social system from becoming realigned with nature? The philosopher Arne Naess, writing about the basis of environmental norms, wrote: “the mature human individual ... seeks a social order, or rather a biospheric order, that maximizes the potential for self-realization of all kinds of beings.”⁵ If a state of biospheric order is how the world *should* be, then the question becomes how to get there. Naess suggested that the environmental crisis could yet turn out to be of great value to “the expansion of human consciousness” or, more concretely, to a re-emergence of social norms and attitudes acknowledging the interconnectedness of the world. As this book goes to press, the world has become consumed with the coronavirus pandemic: a suggestion from nature to humanity to change its ways.

In this, an enormous opportunity lies ahead. By imagining a prosperous economy in alignment with nature, it becomes possible to articulate pathways toward it. Not only can the economy attain long-term economic stability but also it can generate significant wealth in the process—such as

¹ Polak (1961), quoted in Boulding (1966).

² Smith et al. (1993).

³ Kolbert (2014).

⁴ Frank (2018).

⁵ Naess (2008, p. 132).

through technological innovation—this wealth becoming the basis for widespread prosperity. The two go hand in hand; in fact, widespread prosperity is a prerequisite for economic alignment with nature. An economy that accomplishes both in the service of a large population is what I call a *planetary* economy.⁶

This book is the prescriptive companion to *Economics of a Crowded Planet*,⁷ which describes how the field of economics needs to change to support a planetary economy, and the ways its economics might differ from today's. Just as the economy and nature today are locked in coevolution, so a coevolution between the methodology of economics and the prescriptions it recommends also needs to occur. One cannot describe an economics of a crowded planet without having an economy to refer to.

The specific kind of planetary economy described here is a 'market-planetarian' one. In principle, a variety of systems could be imagined to enable an economy to persist in material balance with nature, offering a minimum living standard to all. One example is a command-and-control approach. Another is a community-based system. This book argues that the most likely, and most desirable, is a market-based system. Markets emerge naturally from civilization. They can be tremendously powerful engines of social change, when harnessed properly. The difference between a planetarian society and today's is that, in a planetarian one, markets will serve planetarian goals. They will constitute a means to an end rather than the end in itself, as they are considered under current market liberalism.

The book is divided into three parts. Part I examines how and why the economy became locked into material coevolution with nature. Part II of the book is prescriptive. It asks where the economy needs to be in order to arrive in stable alignment with natural processes. In this, it addresses norms, institutions, policies and economic instruments. Part III weaves the threads from the previous chapters into a pathway from the present growth economy toward a planetary economy a century or two hence. It imagines how life in this future planetarian society might look.

Both *Economics of a Crowded Planet* and this volume employ a number of terms and conventions, summarized below.

'Nature' is the collection of all natural systems on Earth, both living and non-living. 'Planet Earth', for the present discussion, consists of nature plus all human social systems, including the economy.

⁶The term derives from Peter Berg's 'planetarianism', discussed in Chap. 2.

⁷Murison Smith (2019).

A ‘crowded’ planet is a densely populated one. A crowded planet may or may not also be materially or energetically intense. ‘Material intensity’ is taken to mean the total resource loading of the economy, or of any enterprise within it, upon nature. This loading is the sum of inputs from nature and outputs to it.

An economy that is ‘large’ relative to planetary processes is one that produces measurable effects upon natural processes at the global level, and is in turn affected by them. If a change in natural processes is labeled ‘anthropogenic’, then this means that there exists a broad scientific consensus that the primary cause, with a high degree of probability, is human activity.

‘Natural capacity’ is the capacity of nature to support the human economy, both in terms of the resources it provides and in terms of its ability to absorb and process economic effluents. This term is distinct from the familiar ‘natural capital’, being dynamic in nature, explicitly encompassing both the provisioning of inputs and the absorption of outputs.

The term ‘alignment’ refers primarily to the state of the interface between human and natural systems, the human system being principally the economy. When inputs to and outputs from the two domains fall within the bounds of natural capacity, we have alignment. To fall within the bounds of natural capacity, a material flow must be small enough to be supported by nature’s regenerative capabilities, or to be absorbed and processed into naturally occurring substances, without any measurable anthropogenic change to natural processes. A policy of ‘material discipline’ is one that minimizes material intensity. Alignment of human processes with nature in this sense would be expected to result in long-term material stability of the economy.

‘Alignment’ at the individual level relates to norms, habits, attitudes and practices in the course of daily living. Ancient Eastern and indigenous worldviews speak of ‘harmony’ or ‘balance’ in one’s dealings with the natural world. One of the challenges for a modern economy on a crowded planet is to reclaim a semblance of this balance in daily life, as part of a broader economic alignment with nature.

The ‘prosperity’ of the economy is manifested by an absence of poverty, a minimum living standard for all, productive work rewarded in a variety of ways—not merely through wages—and ample time for family, community and creativity. It is the kind of world in which most of us probably would like to live. As Chap. 18 describes, it is a stable, co-operative, tranquil society, accommodating also innovation, competition and change.

The terms ‘environment’ and ‘sustainability’ are avoided wherever possible, as their meanings never were very precise, even among the specialists who coined them, and they have in any case been politically co-opted over the years. This text uses the terms ‘regeneration’ and ‘generative’ because they refer specifically to practices that improve system health, whether of natural systems or social ones. They are the antithesis of ‘exploitation’ or ‘exploitative’. As *Economics of a Crowded Planet* describes, the ability of nature to ‘sustain’ the human economy is inversely related to the economy’s probability of collapse over any defined period. This ability is a function of natural capacity. The ability of nature to sustain itself, on the other hand, is taken as given.

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An Economy on a Crowded Planet

Chapter 1 describes the economy's coevolution with nature as a form of structural coupling at multiple scales of organization, a concept covered in technical detail in *Economics of a Crowded Planet*. It provides an overview of the human enterprise, seen over ecological timescales of hundreds to thousands of years, placing the economy's exponential growth into its biophysical context. It examines the role played by the economy's internal flows of money in magnifying the exchanges of material between the economy and nature. The perspective is explicitly from outside the economy looking in, as distinct from the conventional economic one, inside the economy, occasionally looking out.

Chapter 2 addresses the origins of this growth, focusing particularly upon changes in people's attitudes toward nature over the centuries and, in turn, toward their roles as economic agents. Even though the present economy is a product of Western modernity, alternate worldviews have persisted within Western society, and alternate futures imagined. Chapter 2 evaluates some of these as templates for a future worldview in which individual action would be generative rather than exploitative, and the economy managed as a stable planetary subsystem.



CHAPTER 1

The Economy's Coevolution with Nature

Much has been written over the past 50 years about the growing effects of people upon natural systems. A consensus about these effects exists to a much greater degree early in the twenty-first century than in the 1960s when the debate about 'the environment' first permeated into the modern public consciousness. The measurable effects of the economy on the planet's natural systems feed back into influences of nature upon the economy, so that the two have become embroiled in a global coevolution. On the timescales of natural systems, the global economy appeared suddenly, as if out of nowhere, even though on human timescales its emergence was brought about by internal forces operating over many hundreds of years. Prior to this state-change in Earth's systems, the economy was materially small relative to natural processes. There was no 'global' economy in the sense we know it today, but rather a collection of local and regional economies, many of which had local or regional effects upon nature, and were affected by those changes in turn, all of which, however, being characterized by relatively low material intensity.

A wide range of laws, policies and, more recently, markets have been created to try to reduce the effects of economic activity upon nature. Yet the effects continue to accelerate. Few during the twentieth century asked whether the whole economic and financial system—indeed, the Western modernist paradigm that underpins them—should be re-examined and reconfigured for a new state of the world in which the human enterprise is large relative to its planetary container. Those who did were largely

marginalized by the economic mainstream.¹ Yet in the first years of the twenty-first century a small but increasing number of writers has begun to tackle this question head-on.²

Our historical reluctance to tackle the question might have as much to do with its daunting size as with its perceived relevance. One way to make a start is to construct a hypothetical future state, based on the current understanding of natural systems, in which an economy would be relatively stable, both in its exchanges with nature and internally. Then, if the assumptions underlying such a model were sufficiently robust, the question could be asked, how to go from here to there.

IT'S AN ECONOMY, JIM, BUT NOT AS WE KNOW IT

So might Mr. Spock say to Captain Kirk as the starship *Free Enterprise* glides into orbit around a planet crowded with inhabitants.

On this planet, the economy is stable, the inhabitants enjoying high living standards and a good quality of life. The reason for this state, in spite of the large population, is because the economy exists in a form of dynamic balance with the planet's natural systems. For these economic conditions to prevail, the economy's material efficiency must be very high.

Such a state, writes the captain in his log, suggests that this society, at some time in its past, confronted its growing material size and concluded that, in the interest of long-term stability, its economic activity had to be reconfigured to minimize its effects on nature. The society must also have been forced to accept the thermodynamic reality of their planet being a materially closed system. Its only external input was free energy from the star around which it orbited. There was only so much material to go around.

Such a conclusion may have represented a fundamental alteration in perspectives on economic activity. The society on this planet would have recognized, perhaps for the first time, the prime importance of a long-term view, a shift that came about because of a growing recognition that there was nowhere else to go. Consequently, the inhabitants of the planet re-examined the way they thought about their economic activity, how they measured it, studied it and managed it. Their economics evolved as a

¹ Soddy (1926), Boulding (1966), Daly (1991), Georgescu-Roegen (1971) and Odum (1971) are examples.

² For example, Douthwaite (2000), Boyle and Simms (2009), and Panayotakis (2011).

result, from a field concerned with individual ‘choices’ to one oriented toward alignment with nature.

On the planet in question, writes the captain, evolution in the society’s study of their economy stimulated a variety of fundamental changes in their management of it. A prime directive—to borrow another *Star Trek* phrase—became established to steer economic policy toward long-term stability. The economy underwent significant structural and dynamic changes away from a materially intense mode toward the materially efficient mode in which the *Free Enterprise* finds it. The inhabitants tell of certain difficult adjustments made along the way, even hardships; yet the society that the ship’s crew encounters is prosperous, vibrant and largely peaceful.

So much is written in this day and age—either of the gloomy future that awaits society here on Earth if it keeps ‘messing up the environment’ or, in equal measure, of the complete denial of an ‘environmental’ problem in the first place—that there has been missing a narrative of the *opportunity* in attaining a life like the one our fictional captain described in his log.

NATURE AND THE ECONOMY AS COMPLEX, HIERARCHICAL SYSTEMS

The human economy is a complex system of trade among people, representing themselves as individuals or the institutions to which they belong. It is also a complex system of trade with nature, the exchange of material with natural systems. Internally, the economy circulates two kinds of flow: material and currency. Money is a convenient proxy for valuing material goods against one another; also for services rendered by people to one another.

The economy exists within a biophysical context because it extracts material from nature and expels effluents back to it. On a crowded planet such as ours, the economy must work in concert with its natural support systems if it is to persist. This necessitates understanding those systems in depth and operating the global economy according to their requirements. Ever since human economies emerged, they have engaged in local coevolutions with nature. The difference today is that the coevolution is global and there is nowhere to escape to if it goes wrong.

The natural world does not lend itself to description using the mechanical tools of conventional economics. Mechanical analysis assumes reversibility: it is ahistorical. The concept of elapsed time does not exist. Natural systems are inherently nonlinear, evolutionary and unpredictable, lending themselves to historical descriptions incorporating elapsed time. Social systems are analogues of natural ones in this respect. One of the main reasons why economics adopted a mechanical analogue during the nineteenth century is because that was the dominant form of mathematics at the time. The mathematics of nonlinear systems did not emerge until the first half of the twentieth century, and computer technologies to run simulation models employing it did not mature until the 1980s. By that time, the mechanical analogue had become embedded into economic orthodoxy and the economy had grown exponentially. Only since the 1990s has the mechanical analogue's grip on economics begun to weaken.

Mechanics implies the management of a system as a form of control, much the same way as you might turn a thermostat up or down to heat or cool your house. Management as control in this way does not apply to complex, nonlinear systems. Our inability to control the weather the way we would control the temperature of our dwelling is matched by our inability to control the world's ecosystems or our own economy in the same way. Although complex systems defy management in the form of control, they respond, however, to management as selection. Management as selection is a form of trial-and-error. Nudge a system a little bit this way or that, see how it responds, and adjust accordingly. This mechanism is analogous to artificial selection—the breeding of animals—and to natural selection operating in the wild.

Luckily for our large economy, nature is autopoietic: it is self-generating, subject to free energy from the sun. Left to its own devices, it will regenerate toward some stable, mature state. Nature's takeover of the abandoned city of Chernobyl provides a living testament to what would happen to the edifices of the human economy were people suddenly to vanish. The challenge for economic policy, then, is quite simple: it is to nudge the economy this way or that so as to provide the best possible conditions for natural regeneration. Over time, this management will steer the economy's coevolution with nature toward some form of dynamic alignment. Because the economy runs internally on a distinct flow of money, which does not circulate through nature, the challenge then becomes representing the economy's material interface with nature through its flows of money.

The reality of this challenge is complex, insofar as the economy interacts with nature at multiple levels of organization. *Economics of a Crowded Planet* draws upon hierarchy theory to create a framework for the field of economics to address this challenge. That same framework applies to the practicalities of governance, policies and economic controls. It states essentially that phenomena at any particular scale of observation will result from interactions among factors at lower levels of observation, these being *emergent properties* of the system under study. The behavior of any system under observation also will be constrained by *boundary conditions* imposed from higher levels of organization.³ Think, for instance, of the interactions among the organs and tissues in your body giving rise to the emergent properties of you as a whole person. These properties—sentience, emotion, reason, homeostasis—are not properties possessed by any of your organs or tissues individually. Within the economy, entities at a variety of levels of organization can be identified, from individuals and households to private enterprises; also public entities at local, regional and national levels; and transnational entities, whether corporate, governmental or non-governmental. Any economic interaction, at any level, takes place within a context of both social and natural components. Economic entities at all levels interact with, and innervate with, natural processes.

By placing the economy within a context of natural processes, it becomes possible to construct a picture of economic activity as a hierarchy of complex systems. Hierarchy theory, as employed in systems science, is not the rigid, static hierarchy one might associate with a military institution but a dynamic hierarchy in which organization at one level emerges from dynamic interactions at another. It dovetails neatly with the evolutionary description of complex systems.

WHAT IS THE ECONOMY FOR?

Human economies have arisen as a result of an increasing division of labor. Hunter-gatherer societies were characterized by minimal division of labor. As civilization took root in tandem with the spread of agriculture, the division of labor increased. People specialized in certain tasks or skills, such as spear-making, pottery or construction. Early forms of money, which were used to measure agricultural production, also served as a means of exchange among these various other labors. With this, we had an economy.

³Eldredge and Salthe (1984); Vrba and Eldredge (1984).