

1. Introduction: what is ecological economics and why do we need it now more than ever

**Robert Costanza, Jon D. Erickson, Joshua Farley, and
Ida Kubiszewski**

INTRODUCTION

Ecological economics is a transdisciplinary effort to understand and manage the complex system of humans and the rest of nature towards the goal of mutually enhancing the wellbeing of all life. This book works to unpack this definition and propose an accompanying research, policy, and action agenda. A central challenge is that the focus of ecological economics tends to be on high-stakes, urgent, interdependent ecological, economic, and social problems in which facts are highly uncertain and values matter (Funtowicz and Ravetz, 1994).

The first challenge in problem-solving, and defining an accompanying research to action agenda, is to define the desired state, which requires input from a broad, representative swath of stakeholders. The scale and interdependence of many of today's problems requires a shared vision of the world we *all* want, rich and poor, North and South, East and West. Improved understanding of the existing state requires collaboration between numerous disciplines and traditional knowledge bases. Achieving solutions will require collaboration between academia, policy makers, the business sector, civil society, and nations. The creation of this book is just another point in this continuously evolving endeavour.

The urgency of the problems also questions the role of scientists as merely the source of objective, value-free knowledge. In the time it takes to research a given problem, publish a study in a peer reviewed journal, and disseminate the results widely in the hopes of capturing the attention of policy makers who may then choose to act on it, continuing system change may well have made that research obsolete. If ecological economics is to remain relevant, it must transcend the traditional boundaries of academia and co-produce research and action.

The transdisciplinary aspiration of ecological economics also recognizes that understanding or managing the complex, highly interdependent system we now inhabit requires the transcendence of both disciplinary and academic boundaries. It recognizes that humans are a part of nature, not apart from it. As a complex, interdependent and continually evolving whole system, the economy is fundamentally embedded within society, which is embedded within the rest of nature.

It also requires a better understanding of wellbeing and sustainability. What really contributes to wellbeing? What are the relative contributions of material standard

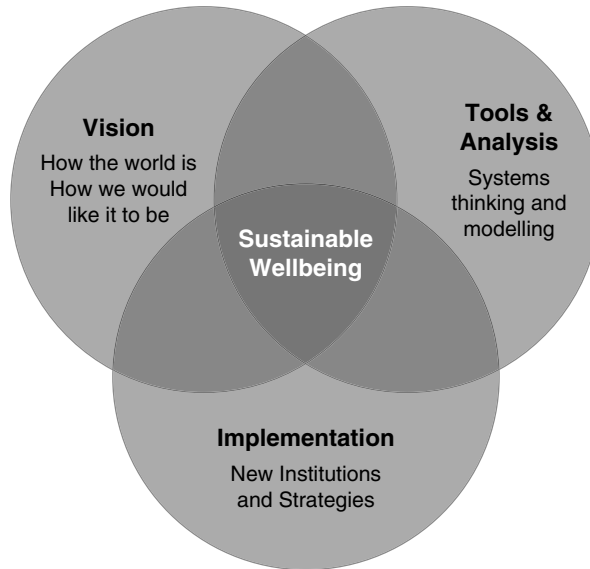


Figure 1.1 Elements of a shared vision of sustainable wellbeing

of living, social, cultural, and community interactions and institutions, and ecological life-support systems? How can we assess the wellbeing of the whole, interconnected system of humans and the rest of nature? How sustainable are various configurations of the system? How do we define, assess, and measure wellbeing and sustainability?

To answer these questions and solve urgent, transdisciplinary problems requires the integration of three basic elements (Figure 1.1):

1. **Vision:** developing an adequate understanding of how the world is and a shared vision of how *we all* would like the world to be;
2. **Tools for analysis and synthesis:** techniques capable of creating and deepening our understanding of individual elements of our complex ecological economic system and of the ways they interact in a continually evolving whole system, the presence of irreducible uncertainty; and
3. **Implementation:** developing new institutions, policies, and strategies that move us towards our shared vision.

Contributions to this volume explore all three of these elements and how to better integrate them. A big question is who “we all” are. It would be impossible to develop a detailed shared vision across the thousands of cultures and billions of people on the planet, though there may be more common ground than our current argument culture would lead us to believe. Developing a shared vision, tools for analysis and synthesis, and implementation is both a process, and a goal. Chapters in this book suggest directions and identify momentum to which others are welcome to contribute or challenge. These contributions to shared goals should be viewed as testable hypotheses. As elements are

implemented, we must ask whether they are as desirable as intended, how they can be improved upon, and even if they should be abandoned.

We summarize these contributions further on, but first this introductory chapter suggests some of the underlying premises of ecological economics, including how the world works and how to organize our intellectual effort to reach our goals. To achieve a transdisciplinary synthesis, ecological economics should challenge the tendency in our culture to cast every problem as a dichotomous choice between right and wrong, us and them. We first pose a challenge to move “beyond the argument culture” then briefly set the stage for ecological economics by reviewing its historical development and resulting worldview. We then return to a summary of the book project, process, and contributions.

BEYOND THE ARGUMENT CULTURE

The linguist Deborah Tannen has characterized American society (and much of the rest of the “developed” world) as an “argument culture” (Tannen, 1998). In this culture, even the most complex problems are cast as polar opposites. All discussions are cast as debates between two extremes in which one side is correct while the other is wrong. The media, law, politics, and especially academia are all caught in the argument culture and it is getting worse. While there is nothing inherently wrong with debate and direct confrontation on some topics, the problem is that this does not work for all topics. For example, the complex problems that ecological economics focuses on require a more multifaceted, complex approach – one that encourages real dialogue and does not cast every discussion as a zero-sum, win–lose, either/or dichotomy. This suggests that the endeavour of ecological economics should, in part, be led by modesty, recognizing the limits of our ability to fully understand a complex and evolving world.

In striving to be more transdisciplinary in our approach to problem-solving, it is important to recognize that the argument culture encourages creating and protecting disciplinary boundaries on the intellectual landscape. Sharp boundaries between disciplines, unique languages and cultures within disciplines, and lack of whole-system perspectives make problems that cross disciplinary boundaries very difficult, if not impossible, to solve. There are also large gaps in the landscapes that are not covered by any discipline. The argument culture also encourages continual sub-dividing into smaller and smaller fields, with a resulting decrease in their ability to achieve system-level changes.

Ecological economics, as an intelligently pluralistic transdiscipline, encourages moving beyond the argument culture. It tries to create an intellectual culture where the boundaries between disciplines disappear into the background and the problems and questions are seen as the defining landscape. This transdisciplinary perspective provides an overarching coherence that synthesizes disciplinary knowledge. It addresses the increasingly complex problems that cannot be addressed within the disciplinary structure. In this sense, ecological economics is not an alternative to any of the existing disciplines. Rather it is a different way of looking at a problem that adds value to the existing approaches and addresses some of their fundamental deficiencies. It is not a question of “conventional economics” versus “ecological economics” in the typical dichotomy of the argument culture. It is rather conventional economics as one input (among many) to a broader and richer transdisciplinary synthesis, which is ecological economics.

This is not to say that disagreements do not and should not exist; science would never progress if all scientists agreed about everything. Scientists are taught to be sceptical, and to rigorously test hypotheses and theories in an effort to prove them wrong. Ecological economics' transdisciplinary approach in fact helps identify shortcomings of different disciplines as well as fundamental inconsistencies within and between them. For example, conventional economists frequently claim that the single feedback loop of the price mechanism will drive our complex economy towards an optimal equilibrium. This contradicts basic insights from complexity theory and hence is incompatible with the synthesis that ecological economics is aiming for. Prices are simply one powerful feedback loop among many and can be applied to only some of the many variables that contribute to sustainable wellbeing. Nonetheless, within a transdisciplinary framework, conventional economics can still offer important insights into how prices function. Economics, especially the various schools of heterodox thought, can provide useful tools for the toolbox, but not an all-encompassing worldview. Another serious shortcoming of conventional disciplines that should be challenged is the belief that a narrow disciplinary approach is an acceptable approach for addressing complex problems at the interface of humans and the rest of nature. In a recent survey of various social scientists, 57.3 per cent of economists disagreed or strongly disagreed with the statement that "in general, interdisciplinary knowledge is better than knowledge obtained by a single discipline" (Fourcade et al., 2015, p. 95), while ecological economists would strongly agree with the statement.

Transdisciplinarity can also contribute to consilience (Wilson, 1998), meaning that core axioms of the sciences are mutually consistent, or where they are not, the shared goal is to make them so. The natural sciences have largely achieved consilience. Core axioms of the social sciences should also be consistent with the natural sciences and with each other (Wilson, 1998). At the same time, we must also recognize that social sciences are fundamentally different from natural sciences in that theories about social, economic, and political systems can affect human behaviour and hence the system they seek to explain (Wironen et al., 2019). Theories can be self-fulfilling. For example, studying economics can lead people to better conform to the rational, self-interested model of *Homo economicus* (Frank et al., 1993; Frank and Schulze, 2000). Theories can also be self-negating. For example, prior to the financial crisis that exploded in 2007, mainstream economists claimed we had achieved a "great moderation" and no longer had to fear financial crisis (Stock and Watson, 2002, Bernanke, 2004). This stimulated excessive risk-taking that precipitated and exacerbated the crisis.

Social science must be conciliant with natural science, but it also exhibits emergent properties like reflexivity that cannot be reduced to basic natural science principles. Likewise, biology cannot be reduced to chemistry which cannot be reduced to physics.

Thus disagreements play an essential role, but this role is undermined by the argument culture in an important way. Abundant studies have shown that many of our beliefs are more closely tied to group identity than to rational analysis of the relevant subject matter (Haidt, 2012). Humans engage in motivated reasoning, focusing on facts and arguments that support their convictions. Providing objective scientific evidence that someone's views are wrong can then reinforce their conviction that those views are correct. Certainty is often more an emotional response than the outcome of rational analysis (Burton, 2008). It would be unscientific for scientists to consider themselves immune to this behaviour. When two groups identify themselves in opposition to each other, argument will

only strengthen their group identities and convictions, reducing the likelihood of both scientific progress and mutual collaboration towards any shared goals. When individuals identify as members of the same group, they are more receptive to objectively weighing each other's views and modifying their own (Haidt, 2012). The argument culture can also lead to schisms within groups and the splintering-off of separate groups. Each of these groups is more homogenous, less likely to be exposed to alternative views, and less likely to consider flaws in its own. Again, both scientific progress and collaboration towards shared goals are likely to suffer.

Unfortunately, the argument culture has crept into ecological economics and related transdisciplines. The field of ecological economics has numerous close cousins, allies and offspring with quite similar worldviews and goals, including groups in the "camps" of Sustainability Science, Political Ecology, Degrowth, Environmental Justice, Green Political Economy, Resilience Alliance, Industrial Ecology, Life Cycle Analysis, and so on. Though many of these fields have remarkably similar worldviews and goals, their advocates too often focus on their differences. A far better approach is to address controversies as elements of a research agenda. In most cases, additional research can help determine which approaches will best help us achieve our shared goals. Ecological economics and its transdisciplinary kin offer a potentially powerful alternative to the business as usual of both disciplinary science and a growth-driven human system, but are only likely to make progress towards a sustainable wellbeing society if they overcome the argument culture and collaborate. What we need is a broad alliance of all the groups and interests that share the goal of sustainable wellbeing (cf. the Wellbeing Economy Alliance – Costanza et al., Chapter 24, this book).

BASIC WORLDVIEW AND GOALS

Ecology and economics share the same Greek root, *oikos*, meaning "house". Ecology literally means the "study of the house", while economics means the "management of the house", where the house is taken to be the world. Thus ecological economics implies studying and managing the world in an integrated way, taking full advantage of our accumulated knowledge and understanding of both the natural and the social parts of the system.

Ecological economics thus starts with the essential observation that the human economy is a subsystem of society, which in turn is a subsystem of the larger ecological life-support system. It recognizes that humans are a part of this larger ecological system and not apart from it. Humans have shaped and modified their supporting ecosystems since the time of their appearance as a species, sometimes sustainably, sometimes not (Costanza et al., 2007). In the past, this human presence (the economic subsystem) was relatively small in scale compared to the size of the rest of the supporting ecosystem. However, since the Industrial Revolution, due largely to the utilization of fossil fuels, the human subsystem has expanded so dramatically that it is now a major component of the overall system. In fact, much of the "great acceleration" of the human subsystem has occurred only since the second half of the twentieth century (Steffen et al., 2015). Unlike the majority of human history, we now live in a relatively "full", human-dominated, geologic epoch some have called the "Anthropocene" (Daly, 2005; Steffen et al., 2007).

This changes everything. In a full world context, the goal of the economic subsystem can no longer be simply expansion and growth with little regard to the rest of the system. We must now consider the whole system and the goal must shift from economic growth to long-term maintenance, resilience, and sustainable development. Growth implies increasing in quantity or size, while development implies improvement in quality without necessarily increasing in size (Daly, 2005). In a full world context, the goal must shift from creating “more” to creating “better” – to create a sustainable and desirable future.

This shift in primary goals and vision for the future has profound implications for analysis, policy, and action across the full range of academic disciplines, policies, and human activities. For example, if one’s goals include ecological sustainability then one cannot rely on the principle of “consumer sovereignty” on which most conventional economic solutions are based, but must allow for coevolving preferences, technology, and ecosystems (Norton et al., 1998; Beddoe et al., 2009). One of the basic organizing principles of ecological economics is thus a focus on the complex interrelationships between ecologically sustainable wellbeing (including system-carrying capacity and resilience), socially sustainable wellbeing (including the distribution of wealth and rights, social capital, and coevolving preferences), and economically sustainable wellbeing (including allocative efficiency via institutions matched to the specific goals and resources in question, which may or not include incomplete and imperfect markets).

The complexity of these many interacting systems that form the biosphere means a very high level of uncertainty. Indeed, uncertainty is a fundamental characteristic of all complex systems involving irreversible processes, a critical focus of ecological economics. More particularly, it is concerned with the problem of assuring sustainable wellbeing under uncertainty. Instead of locking ourselves into overly brittle development paths that may ultimately lead to ecological, social, and economic collapse, ecological economics seeks to improve wellbeing and maintain the resilience of the highly interconnected socio-ecological system. This may be done by conserving, maintaining, and investing in our irreplaceable ecological systems, as well as the systems of trust, governance, ingenuity, and exchange often described as human and built capital.¹

Ecological economics thus focuses on a broader set of questions and goals than the traditional disciplines (Daly, 1992). Here again, the differences are not so much the newness of the questions or goals, but how to find integrated solutions. They can be stated as both questions and goals since they represent complex problems requiring further research. At the broadest level, they have included:

1. **Sustainable Scale:** assessing and ensuring that the scale of human activities within the biosphere are ecologically sustainable;
2. **Fair Distribution:** distributing resources, power, and property rights fairly, both within the current generation of humans, between this and future generations, and also between humans and other species; and
3. **Efficient Allocation:** efficiently allocating resources towards sustainable wellbeing as constrained and defined by (1) and (2) above, including both marketed

¹ Some ecological economists do not like the term “capital” as applied to nature or society. We use it here in the sense of a stock that yields a flow of benefits into the future (Costanza and Daly, 1992), without implying substitutability between types of capital, property rights or commodification.

and non-marketed resources, especially social and natural capital and ecosystem services.

The historical roots of ecological economics are as long and deep as any field in the social or natural sciences, going back to at least the seventeenth century (Christensen, 1989). Nevertheless, its immediate roots lie in work done in the 1960s and 1970s. Kenneth Boulding's (1966) classic "The Economics of the Coming Spaceship Earth" set the stage for ecological economics with its description of the transition from the "frontier economics" of the past, where growth in human welfare implied growth in material consumption, to the "spaceship economics" of the future, where welfare can no longer be fuelled by growth in material consumption. Herman Daly (1968) elaborated further on this fundamental difference in vision and worldview, recasting economics as a life science, akin to biology and especially ecology, rather than a physical science like chemistry or physics.

The importance of this shift in "pre-analytic vision" cannot be overemphasized. It implies a fundamental change in the perception of resource allocation and how problems of mis-allocation (between people, present and future, and all life) should be addressed. More particularly, it implies that the focus of analysis should shift to balance marketed resources in the economic system with the biophysical basis and co-evolution of interdependent ecological and economic systems. However, rather than espousing and defending a single discipline or paradigm, it seeks to allow a broad, pluralistic range of viewpoints and models to be represented, compared, and synthesized into a richer understanding of inherently complex systems. As such, ecological economics is an "approach" that represents a commitment among academics and practitioners to learn from each other, to explore new patterns of thinking, and to facilitate the derivation and implementation of effective economic, social, and environmental policies (Gowdy and Erickson, 2005).

To stay clear of "one world" thinking or other ideological traps (Escobar, 2018), ecological economics has deliberately and consciously aspired to be pluralistic in its conceptual underpinnings (Norgaard, 1989). Within pluralism, traditional disciplinary perspectives are perfectly valid "as part of the mix". Ecological economics therefore includes some aspects of economics, ecology, environmental impact studies, and other methodological approaches as components, while at the same time challenging the singularity of their worldviews and the utility of some of their assumptions and methods. As such, ecological economics encourages completely new, more integrated ways to think about the linkages between ecological, social, and economic systems. It facilitates the integration and synthesis of new and emerging fields of study like behavioural economics, positive psychology, earth systems science, multi-level selection theory, and many more. It is based on pluralism, but recognizes that "all models are wrong – but some are useful" as George Box famously said. It thus aims for "intelligent pluralism" in a problem-solving context – recognizing the limits of all paradigms but also recognizing what ideas and perspectives are most useful for the task at hand.

This transdisciplinary, co-evolutionary, pluralistic orientation of ecological economics has helped to develop a solid institutional base. After numerous experiments with joint meetings between economists and ecologists, the International Society for Ecological Economics (ISEE) was formed in 1988. The journal of the society, *Ecological Economics*, published its first issue in February 1989 and currently publishes 12 issues per year, with an impact factor taking it to the top one-fifth of all economics *and* all environmental

journals. The first major international conference was held in 1990 at the World Bank in Washington, DC. Following that conference, a gathering was held that resulted in an edited book laying the groundwork for the field (Costanza, 1991). The first chapter synthesized the “Goals, agenda, and policy recommendations for ecological economics” (Costanza et al., 1991), a useful point of reflection for this current volume almost three decades on. Much has changed, but much is the same – in particular the basic transdisciplinary, co-evolutionary, intelligently pluralistic worldview of ecological economics. We need it now more than ever.

ORGANIZATION OF THE BOOK

The remainder of the book is organized into five parts that cover the major themes of ecological economics, along with a sixth part reporting on surveys of the ecological economics community about a research and action agenda. Preparation of the book was supported by the Rubenstein School of Environment and Natural Resources and the Economics for the Anthropocene graduate research and training partnership. Here we provide a brief summary of each part.

Part I: The Future We Want

The first part explores the broad goals of a research and action agenda for ecological economics. In the first chapter on “Creating Positive Futures for Humanity on Earth”, Robert Costanza and colleagues review theories of social change and propose the idea of “societal therapy” as a process towards defining and pursuing broadly shared goals of sustainable wellbeing. They propose the tools of scenario planning and allied projects such as the Great Transition Initiative and the Sustainable Development Goals as roadmaps for cultural evolution, supported by robust research in ecological economics.

Pathways to a broadly shared vision will include many entry points, including research on “Work, Labour, and Regenerative Production” outlined in the next chapter by Kaitlin Kish and Stephen Quilley. They explore the meaning, structure, and distribution of work in socially and environmentally embedded economies envisioned by ecological economics. Research themes include a focus on the “maker movement” and its implications on repurposing and rejuvenating work, education, and connection to place, with significant implications on the underlying political economy.

An interrelated exploration of the future we want relates to the role of technology. Stewart Wallis and colleagues evaluate both the risks and opportunities of technology in transitioning to a more sustainable and fair future. A number of questions will need to be addressed along the way, including the role of low versus high tech, contrasting visions of degrowth and ecomodernism, and the ultimate resource requirements of technological pathways. These questions necessarily involve research on the governance of technology, process of technological unemployment, distribution of gains from innovation, integration of technology into institutions, and evaluation of the socio-ecological impact of technology.

The evolution and role of ecological economics in designing a sustainable future is next explored through a valuable case study of China. Xi Ji investigates the history and status

of ecological economics in China and its synergies with traditional Chinese philosophy and a vision for an “ecological civilization”. Valuable lessons are drawn on “two-way tactics” through the interplay of top-down policy and bottom-up innovation.

The final chapter of this part then considers the implications of “Taking Evolution Seriously” in the further development of ecological economics. Peter G. Brown and John Gowdy call for a strong role of ecological economics in steering the global economy away from its current course of human domination of Earth systems, and towards a future of mutually enhancing relationships between humanity and all life. Echoing Daly’s (1968) call for economics as a life science, the authors envision an economics built from a co-evolutionary framework with “conceptions of human/Earth relationships based on mutualism, reciprocity, and respect”.

Part II: Measuring and Achieving Wellbeing

Aiming for the future we want will require new targets. In this part, we turn to questions of conceptualizing, measuring, and applying indicators of sustainable wellbeing. Elizabeth M. B. Doran and colleagues first explore “Frameworks and Systems Thinking for Measuring and Achieving Sustainable Wellbeing”. They provide an assessment of indicators that have risen to prominence within ecological economics and allied fields, including the culmination of efforts related to and reflected in the Sustainable Development Goals. A literature review reveals a comparatively narrow application of sustainability frameworks within ecological economics. Through the lens of systems thinking, they argue for a broader research agenda that combines various normative conceptions of wellbeing with positive science of metrics and measurement.

The next chapter directly addresses this narrowing of ecological economics due to the predominance of ecosystem services research. Rachele K. Gould and colleagues recommend a research agenda that leans into common criticism by measuring ecosystem services more broadly (beyond monetary valuation), focusing on the maintenance of stocks (not just the rate of flows), emphasizing the distributional impacts to ecosystem beneficiaries, incorporating non-Western perspectives on the benefits from ecosystems, and accounting for interrelated social dynamics including learning.

Part of this broadening (or perhaps re-broadening) of the scope and metrics of wellbeing research includes considering a “more-than-human world”, the focus of the next chapter by Kristian Brevik and colleagues. They argue for moving towards de-centred, non-anthropocentric understandings of wellbeing, embracing our interdependent evolutionary history with the full commonwealth of life. Broadening the “who” introduces rich research questions on how to achieve sustainable wellbeing because of (not despite) the planet being widely shared.

The last three chapters take up the application of metrics that mirror the three-tiered goals of ecological economics of sustainable scale, fair distribution, and efficient allocation. Kati Gallagher and colleagues provide a thorough review of wellbeing indicators and a familiar call of moving beyond gross domestic product (GDP) as a sole measure of an economy’s success. They also emphasize the process of indicator development, stressing the importance of fitness for use, stakeholder engagement, and communication, themes that are revisited in the next part on institutional design.

A chapter by Richard Wilkinson and Kate Pickett follows, reviewing the many linkages

between equality and sustainability, including well-researched relationships between greater equality and higher quality of life. More equal societies can have positive effects on social cohesion, public spiritedness, and concern for the environment, as well as reduce the status arms race of consumerism. They draw lessons from their books *The Spirit Level* and *The Inner Level* (Wilkinson and Pickett, 2010, 2018) to make the case for a social movement based on the inseparability of social and environmental problems.

These ties between wellbeing and socio-ecological condition are very clear in regard to human health, the subject of the final chapter of this part by Martin Hensher. Reviewing the links between demographic and epidemiological transitions, he finds a current synergy of epidemics (or “syndemics”) with shared root causes that can be addressed by ecological economics. There is also a synergistic health research agenda on quantifying the harms of overconsumption and uneconomic growth. Articulating and pursuing a vision of a sustainable health care system will require the transdisciplinary approach of ecological economics with a concomitant effort to translating planetary health research into policy action.

Part III: The Institutions We Require

To pursue sustainable wellbeing will not only require revised goals and gauges; we will also need to rethink the design and purpose of our institutions. From the evolutionary and moral foundations of socio-economic systems, to shared governance and engagement of our citizenry, this part develops a research agenda for ecological economics to help bridge ideas to action.

To begin, Joshua Farley and colleagues explore the intentional cultural changes needed to transform society towards a path of ecological sustainability and social justice. These include collective action strategies for solving socio-ecological crises, beginning with a deep understanding of our species’ ability to cooperate. A review of both theoretical and empirical studies suggests five key areas for further research, including: the power of reciprocity in social arrangements; the development and scaling of rewards and punishments to enable altruistic behaviour; the dynamics of group membership in both helping and hurting collective action; the impact of institutional design on human behaviour; and the application of conflict theory to studying inter-group conflict and collaboration.

Dan Spethmann and Valerie A. Luzadis then investigate the “Moral and Ethical Foundations for Ecological Economics”, making the case for deliberative, normative underpinnings with a focus on relational versus transactional interactions. They call for duty-based moral factors to reshape our economic lives and redirect our societies towards ecocentric values. Proposed research into diverse value systems would then open our understandings of moral authority, moral agency, and environmental and social wellbeing.

Our journey into institutional foundations and reforms continues with a chapter by Christopher Koliba and colleagues on governance and ecological economics. A literature review of environmental governance highlights the importance of networks of partnerships and collaboration between public, private, and nonprofit sectors, followed by considering the characteristics of governance in an ecological/post-growth economy. The Millennium Ecosystem Assessment and the Sustainable Development Goals provide two important illustrations of complex governance systems intended to guide socio-

ecological systems towards more sustainable and equitable outcomes. The authors conclude by assessing various governance mechanisms popular within ecological economics, including payments for ecosystem services and new forms of quasi-governmental institutions such as common asset trusts.

The fourth chapter in this part then addresses one of the most daunting institutions in need of research and reform in a post-growth economy: the institution of money. Romain Svartzman and colleagues unpack the complicated nature of money, and review debates over the so-called “growth imperative” of modern money. By investigating the underlying social constructs that have defined money, the authors reveal opportunities for reform that promote a more balanced relationship between creditors and debtors with the potential to reduce the growth bias of capitalism more generally.

Another key institution to highlight is private business. As Mairi-Jane V. Fox and colleagues note, business is often characterized as a “villain” in ecological economics, yet the private sector can be a powerful, fast-moving, near-term ally in addressing socio-ecological problems. They contrast an historical business mindset with potential leverage points to turn from destructive to regenerative impact, including informed consumer choice, socially responsible investing, and innovative corporate structures. Business motivations can then be harnessed as a means towards achieving sustainable wellbeing.

The last chapter further explores lessons from the private sector by reviewing its rich literature on stakeholder engagement. Madhavi Venkatesan and colleagues outline key principles relevant to the transdisciplinary and pluralist context of ecological economics guided by a commitment to empowerment, equity, trust, and learning. In contrast to top-down, monistic, expert-based processes often attributed to the style and influence of mainstream economics, the authors challenge ecological economics to commit to direct, broad, and diverse stakeholder engagement in developing the institutions and approaches needed to move towards sustainable wellbeing.

Part IV: Integrated, Dynamic Analysis and Modelling of Socio-ecological Systems

As a transdiscipline, ecological economics has emphasized the development and application of integrative methods that synthesize across temporal, spatial, disciplinary, and knowledge dimensions. Key elements of a research agenda include exploring the frontiers of integrated modelling, participatory decision support systems, and ecological macroeconomics.

Alexey Voinov and colleagues begin with a review of the art and practice of integrated modelling to research problems impossible to characterize by narrow disciplinary approaches. By assembling models in a modular fashion, the output of one approach becomes the input to the next, with opportunity for stakeholder participation, integrating both qualitative and quantitative data, and combinations of different conceptual approaches. The authors discuss numerous examples and summarize key research questions that grapple with complexity and uncertainty.

Asim Zia and Roel Boumans then pick up the theme of stakeholder participation in exploring the conditions for successful decision support systems. Generations of one-way communication of optimal solutions, from experts to decision-makers, have often failed to impact environment and development policies. The “wicked” problems addressed by ecological economics do not yield to unique, determinate solutions, but instead require a

broad range of disciplinary and experiential expertise to address. Meta-decision theory is proposed as a way to connect lessons from action with normative reflection, a dance between real-world and desirable outcomes. A continuous process of dialogue, modeling, experimentation, and learning can then elucidate valuable lessons about policy and planning alternatives in a given space and time.

This part closes with the development of “A Research Agenda for Ecological Macroeconomics”, one of the key foci of integrated, dynamic analysis and modeling. Peter A. Victor and Tim Jackson remind us of the importance of embedding the economy within planetary systems and recommend urgent research on the causes and effects of joint ecological and economic systems instability. Investigating the relationships between the real and financial economy are highlighted as a particular area of importance, particularly in pursuing post-growth economies that can deliver sustainable wellbeing for all.

Part V: Making the Transition

Many transition narratives have been proposed in the earlier chapters. Each have in common a move away from persistent social inequalities and unhealthy relations between humanity and the ecosystems on which we depend. The transition before us is towards mutually beneficial systems based on reciprocity, respect, and commitment to long-term wellbeing. The bad news is that, as a global species, there is much work to be done. The good news is that countless examples of the transition are already underway.

Many of the more hopeful transitions can be found at local and regional scales. Sabine O’Hara and Daniel Baker summarize a litany of examples of systematic change – from local food systems and ecological technology development to sharing economies and micro-living – each demonstrating the application of ecological economics principles. They highlight various civil society partnerships that have developed to catalogue and share such examples, providing the foundations to an ambitious research agenda to elicit lessons learned for scaling up and out.

The host of communities and sectors experimenting with new goals and economic configurations are pushing against significant headwinds in the predominant global capitalist system. Ultimately systemic problems will require systemic solutions, the central thesis of the next chapter by Gar Alperovitz and Joseph Ament. Following a review of the common features such as corporate power and extractive consumption that underlay persistent system crises, the authors investigate medium- and long-term change needed for both local and national socio-economic resilience. As with the previous chapters, examples abound of cooperative structures, democratic ownership, and socially useful production that challenge current political and economic arrangements.

In the final chapter of this part, Robert Costanza and colleagues describe the many players involved in transitioning economies away from a narrow focus on marketed goods and services and towards a broad focus on sustainable wellbeing. There is no shortage of ideas, research, and activism on economic transformation, but what is needed now more than ever are strong alliances to acknowledge, harmonize, and amplify the many initiatives. In this spirit, the authors describe the creation of the Wellbeing Economy Alliance (WEAll), a broad network of networks designed to bring together the many organizations already working on elements of a new economy. With a vision to serve as a

connector and facilitator, WEAll nurtures and amplifies the work of makers of change, including supporting the further development of ecological economics.

Part VI: Surveys of the Larger Community About the Research Agenda

The last part summarizes two complementary efforts to build a research and action agenda for ecological economics. The first emerged from a meeting of 28 doctoral students and postdoctoral researchers where they shared in-progress research and discussed the future of ecological economics. Unlike typical ecological economics meetings, over half of the emerging scholars were women and nearly two-fifths were from the Global South. Kaitlin Kish and Sam Bliss summarize key themes and research recommendations on biophysical and social systems, systems science and complexity, diverse economies of care, political and ethical relationships, allies and practitioner partnerships, and currency, markets, and value. They find a common desire to move the transdiscipline “forward with dialectical co-thinking from plural perspectives that builds on and interrogates the work that has come before us”.

The final chapter by Benjamin Dube provides a review of previous examinations of ecological economics, including the field’s social organization, influential publications, and surveys of conference attendees. He then reports on an online survey of active members of the International Society for Ecological Economics conducted as a lead up to the production of this book. Summaries of identified goals, major research themes, allied groups, identities of the field, assessment of the original Costanza et al. (1991) research agenda, and emergent tensions amongst scholars and practitioners provide a rich description of the challenges and opportunities ahead.

SUMMARY AND CONCLUSIONS

This book represents a sample of the range of transdisciplinary thinking that can be put under the heading of ecological economics. While it is difficult to categorize ecological economics in the same way one would a normal academic discipline, some general characteristics can be enumerated:

- The core problem is creating a future that is both sustainable and focused on the shared wellbeing of both humans and the rest of nature.
- An explicit attempt is made at “pluralistic dialogue” and integration across disciplines, rather than territorial disciplinary differentiation.
- An emphasis is placed on “integration” of three hierarchical goals of sustainable scale, fair distribution, and efficient allocation.
- There is a deep concern with the “biophysical underpinnings” of the functioning of jointly determined ecological and socio-economic systems.
- There is a deep concern with the relationship between the “scale” of economic activity and the nature of change in ecological systems.
- Since valuation based on stated willingness to pay reflects limitations in the valuer’s knowledge of ecosystems functions and unfairly favours the preferences of the rich, there is an emphasis on the development of valuation techniques that build

on an understanding of the role of ecosystem functions in economic production and wellbeing, gives adequate weight to uncertainty and ignorance about how these connections work, and more fairly weights the preferences of rich and poor, present and future.

- There is a broad focus on systems and “systems dynamics, scale, and hierarchy” and on “integrated modelling” of ecological economic systems.

These characteristics make ecological economics applicable to some of the major problems facing humanity today, which occur at the interfaces of human-dominated ecosystems and other natural systems, and especially to the problem of improving humanity’s wellbeing and assuring its survival within the biosphere into the indefinite future. It is not so much the individual core scientific questions that set ecological economics apart – since these questions are covered independently in other disciplines as well – but rather the treatment of these questions in an integrated, transdisciplinary way, which is essential to their understanding and effective use in policy. We hope that this book is a substantial step in that direction.

REFERENCES

- Beddoe, R., Costanza, R., Farley, J., Garza, E., Kent, J., Kubiszewski, I., Martinez, L., McCowen, T., Murphy, K., Myers, N., Ogden, Z., Stapleton, K. and Woodward, J. (2009). Overcoming Systemic Roadblocks to Sustainability: The Evolutionary Redesign of Worldviews, Institutions and Technologies. *Proceedings of the National Academy of Sciences*, 106, pp. 2483–2489.
- Bernanke, B. (2004). “The Great Moderation”. federalreserve.gov (accessed 20 February 2004).
- Boulding, K.E. (1966). The economics of the coming spaceship earth. In: H. Jarrett (ed.), *Environmental Quality in a Growing Economy*. Baltimore: Johns Hopkins University Press, pp. 3–14.
- Burton, R.A. (2008). *On Being Certain: Believing You are Right Even When You’re Not*. New York: St. Martin’s Press.
- Christensen, P.P. (1989). Historical Roots for Ecological Economics: Biophysical Versus Allocative Approaches. *Ecological Economics*, 1(1), pp. 17–36.
- Costanza, R. (ed.) (1991). *Ecological Economics: The Science and Management of Sustainability*. New York: Columbia University Press.
- Costanza, R. and Daly, H.E. (1992). Natural Capital and Sustainable Development. *Conservation Biology*, 6, pp. 37–46.
- Costanza, R., Daly, H.E. and Bartholomew, J.A. (1991). Goals, agenda, and policy recommendations for ecological economics. In: R. Costanza (ed.), *Ecological Economics: The Science and Management Of Sustainability*. New York: Columbia University Press, pp. 1–20.
- Costanza, R., Graumlich, L.J. and Steffen, W. (eds.) (2007). *Sustainability or Collapse? An Integrated History and Future of People on Earth*. Dahlem Workshop Report 96. Cambridge, MA: MIT Press.
- Daly, H.E. (1968). On Economics as a Life Science. *Journal of Political Economy*, 76, pp. 392–406.
- Daly, H.E. (1992). Allocation, Distribution, and Scale: Towards an Economics that is Efficient, Just, and Sustainable. *Ecological Economics*, 6, pp. 185–193.
- Daly, H.E. (2005). Economics in a Full World. *Scientific American*, 293, pp. 100–107.
- Escobar, A. (2018). *Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds*. Durham, NC: Duke University Press.
- Fourcade, M., Ollion, E. and Algan, Y. (2015). The Superiority of Economists. *Journal of Economic Perspectives*, 29(1), pp. 89–114.
- Frank, B. and Schulze, G.G. (2000). Does Economics make Citizens Corrupt? *Journal of Economic Behavior and Organization*, 43(1), pp. 101–113.

- Frank, R.H., Gilovich, T. and Regan, D.T. (1993). Does Studying Economics Inhibit Cooperation? *Journal of Economic Perspectives*, 7(2), pp. 159–171.
- Funtowicz, S.O. and Ravetz, J.R. (1994). The Worth of a Songbird: Ecological Economics as a Post-Normal Science. *Ecological Economics*, 10, pp. 197–207.
- Gowdy, J. and Erickson, J.D. (2005). The Approach of Ecological Economics. *Cambridge Journal of Economics*, 29(2), pp. 207–222.
- Haidt, J. (2012). *The Righteous Mind*. New York: Vintage Books.
- Norgaard, R.B. (1989). The Case for Methodological Pluralism. *Ecological Economics*, 1(1), pp. 37–57.
- Norton, B., Costanza, R. and Bishop, R. (1998). The Evolution of Preferences: Why “Sovereign” Preferences May Not Lead to Sustainable Policies and What to Do About It. *Ecological Economics*, 24, pp. 193–211.
- Steffen, W., Crutzen, P. and McNeill, J. (2007). The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature? *Ambio*, 36, pp. 614–621.
- Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O. and Ludwig, C. (2015). The Trajectory of the Anthropocene: The Great Acceleration. *The Anthropocene Review*, 2(1), pp. 81–98.
- Stock, J. and Watson, M. (2002). Has the Business Cycle Changed and Why? *NBER Macroeconomics Annual*, 17, pp. 159–218.
- Tannen, D. (1998). *The Argument Culture: Stopping America’s War of Words*. New York: Penguin Random House.
- Wilkinson, R. and Pickett, K. (2010). *The Spirit Level: Why Equality is Better for Everyone*. London: Penguin.
- Wilkinson, R. and Pickett, K. (2018). *The Inner Level: How More Equal Societies Reduce Stress, Restore Sanity and Improve Everyone’s Well-being*. London: Penguin.
- Wilson, E.O. (1998). *Consilience: The Unity of Knowledge*. New York: Knopf.
- Wironen, M.B., Bartlett, R.V. and Erickson, J.D. (2019). Deliberation and the Promise of a Deeply Democratic Sustainability Transition. *Sustainability*, 11, p. 1023.