

Chapter 1

Introduction

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Abstract Three hundred years after defining sustainable development in forestry and 25 years after conceptualizing sustainability as a societal guiding vision and regulative idea, the necessity for further operationalizing and realizing sustainability is greater than ever. The textbook at hand provides a state-of-the-art overview of key areas of sustainable development. Like a mosaic, the chapters compose building blocks, which assemble an encompassing perspective on sustainability science. We hope to contribute with this textbook to the further establishment of sustainability science and to enable the next generation of sustainability experts to get a “grip” on the challenging and exciting “centenary topic” of sustainable development.

Keywords Sustainable development • Sustainability science • Transformation • Inter- and transdisciplinarity

The necessity for sustainable development was first documented in 1713, in the book *Sylvicultura Oeconomica* by German chief miner Hans Carl von Carlowitz (2013). He asserted that “sustainable forestry” is key for long-term success in mining and related livelihoods. He argued that the demand for trees for heating, building, brewing, mining, and smelting activities could only be met if a balance between harvesting and growing/restoring trees would be reached. Nowadays, 300

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years later, concepts of sustainable development and sustainability have reached far beyond the realm of forestry or natural resource management and have entered discourses and practices in urban development, chemical industry, tourism, policy making, and education, to name a few. Sustainability has become an important reference point for safeguarding the future across societies worldwide. The broad dissemination of sustainability as a societal guiding principle can be ascribed to the Brundtland Commission Report (WCED 1987) and the succeeding United Nations Conference on Environment and Development in Rio de Janeiro in 1992 (United Nations 1993).

In 2012, 25 years after the Brundtland report and 20 years after the Rio conference, representatives from governments, business leaders, NGO activists, and engaged researchers met again in Rio de Janeiro to take stock and discuss the future of sustainable development. The outcome of this latest sustainability summit was mixed – at best. Despite some progress on sustainability issues in government, business, and civil society, the world continues on unsustainable pathways (e.g., United Nations 2011; UNEP 2012; WWF 2012). The global community is still far away from realizing inter- and intra-generationally just development that balances ecological, social, and economic needs. For example, CO₂, the key driver of anthropogenic climate change, continues to increase despite international climate policy instituted in 1990; biodiversity loss is accelerating; global poverty reduction is lagging behind its goals; and social inequality has intensified over the past 30 years through economic globalization – in some cases passing critical tipping points (Rockström et al. 2009). Thus, it was of utmost importance that the Rio+20 conference agreed on next steps – such as developing global sustainability goals by 2015 or establishing a global sustainability council – to accelerate progress toward sustainable development.

Despite the ongoing debate about the form and shape of the “Great Transformation” toward sustainability (Raskin et al. 2002; WBGU 2011), it is obvious that sharply altered and improved decision-making and action are necessary to secure a better future for humankind and the planet. Next to decision-makers in politics, business, media, and civil society, as well as citizens and consumers, academia has to play an important role in this endeavor. Through research and teaching, higher education institutions are prime places for exploring and shaping the future. However, the traditional academic disciplines, which operate as if “society has its problems – universities have their disciplines,” are not adequately equipped for the enormous challenges ahead (Van der Leeuw et al. 2012). The disciplines that aim at contributing effectively to sustainable development need to switch their *modi operandi* toward transformational and solution-oriented research and education (Wiek et al. 2012; Miller et al. 2014; Wiek and Kay 2015). Beyond interdisciplinary collaboration (working across disciplinary boundaries), transdisciplinary research projects are needed in which researchers and practitioners collaborate in problem-solving efforts (Lang et al. 2012). Over the past two decades, many inspiring approaches and projects have advanced sustainability science (Kates et al. 2001; Clark and Dickson 2003; Komiyama and Takeuchi 2006; Jernecke et al. 2011; Wiek et al. 2012, 2015; Clark et al. *in press*). There are now numerous academic journals, conferences,

study programs, professorial positions, and so forth devoted to sustainability science. Despite these initiatives, there is still a lack of textbooks providing a broad overview of sustainability science efforts to students specifically. The textbook at hand aims at helping to fill this gap.

The 28 chapters compiled in this textbook address a wide spectrum of topics relevant to sustainable development and sustainability, ranging from justice, science policy, art, and business to mobility, oceans, international development, health, energy systems, and education. We have deliberately abstained from imposing a meta-structure to the book, in order to overcome the limits of disciplinary perspectives on sustainability. Like a mosaic, the individual chapters represent building blocks, which assemble an encompassing perspective on sustainability science. All chapters are written for students and early-career professionals entering the field of sustainability with different interests and backgrounds. All chapters provide introductory level information and indicate further readings. To support a solution-oriented approach to sustainability science, we have asked the authors to cover the specific sustainability challenge (why is this relevant to sustainability science), currently offered solution options to this challenge (what has been achieved), and open issues (what is still needed) of the respective topic.

We hope to contribute with this textbook to the further establishment of sustainability science and to enable the next generation of sustainability experts to get a grip on the challenging and exciting “centenary topic” of sustainable development.

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