Chapter 28
The Need for a Value-Reflexive Governance of Water in the Anthropocene

Simon Meisch

Abstract The paper reflects on the conditions for a value-reflexive governance of water as a tool to contribute to Sustainable Development within the Anthropocene and to deal with the social and political challenges along the way. Its contribution consists in integrating value discourses in sustainable water governance. These value discourses are necessary and unavoidable. While integrating more stakeholders in problem solving and knowledge production leads to more value disputes, it will at the same time strengthen the legitimacy of water governance. A value-reflexive governance aims to make visible the values underlying scientific and political concepts, and to treat value conflicts in an ethically informed and structured way. The paper discusses conceptual considerations and critically assesses the Anthropocene concept and deals with challenges to sustainable water governance. It then argues that the approach of value-reflexive governance might be useful for water governance and shows what questions need to be considered conceptually: What are values? What is the contribution of ethics to a value-reflexive governance of water? What is the relationship between good and value-reflexive governance? As a result a pragmatically concept of values and a more value-reflexive stance to values in governance is suggested.

The Anthropocene Concept

The term 'Anthropocene' is meant to describe the geological time period that has been dominantly shaped by humans since the beginning of the Industrial Revolution in the late 18th century (Crutzen 2002; Zalasiewicz et al. 2011). There

S. Meisch (✉)
Junior Research Group "Ethics of Science in the Research for Sustainable Development", International Centre for Ethics in the Sciences and Humanities, University of Tuebingen, Wilhelmstr. 19, 72074 Tuebingen, Germany
e-mail: simon.meisch@uni-tuebingen.de

A. Bhaduri et al. (eds.), *The Global Water System in the Anthropocene*, Springer Water, DOI: 10.1007/978-3-319-07548-8_28,

is an ongoing discussion of the scientifically detected manifestations that led to the classification of the Anthropocene as a new geological epoch (ICS 2013). Yet, regardless of contested issues, global changes such as rapid expansion of mankind, climate change, release of greenhouse gases and toxic substances, transformation of landscape by humans, loss of biodiversity etc. are evident (Rockström et al. 2009; Zalasiewicz et al. 2010).

Conceptually, 'Anthropocene' encompasses more than empirical knowledge about characteristics of geological eras. In addition to its scientific content, the concept also encompasses a normative component calling for social and political action in order to counteract global environmental changes and their detrimental effects on humans and nature. The concept describes and evaluates states of the world and fields of action and makes normative statements. It "[stresses] the enormity of humanity's responsibility as stewards of the Earth" (Crutzen and Schwägerl 2013). A business-as-usual strategy is no longer possible, because continuing with the status-quo would be "detrimental or even catastrophic for large parts of the world" (Rockström 2009, p. 472).

'Anthropocene' can therefore be described as a 'thick moral concept' or 'epistemic-moral hybrid'. Thick moral concepts comprise descriptive as well as normative and evaluative elements, i.e. facts and value judgements, which are closely intertwined in common language usage ('thick') but which nevertheless can be separated analytically (Dietrich 2004, p. 21; cf. also Ricken 2003, pp. 62–65). This hybrid raises meta-ethical as well as epistemological objections. Meta-ethical objections refer to the 'is-ought problem' (or 'naturalistic fallacy') according to which it is impossible to deduce normative statements about what *ought* to be from descriptive statements about what *is*. The mere fact of global environmental changes does not itself create obligations for action unless there is a normative concept such as justice claiming that detrimental effects on human life and nature are to be prevented. The epistemological objection is related to the meta-ethical one. In conventional understanding, science is about objective facts. As the Anthropocene concept is intertwined with normative statements, its scientific soundness might be questioned (Autin and Holbrook 2011). The argument made here is that there are scientific concepts (such as Biodiversity or Anthropocene) that evolve and can be understood against the background of a certain normative theory. Yet, they are neither naturalistic fallacy nor political ideology. In epistemological terms, they can be described as 'epistemic-moral hybrids' (Potthast 2000, 2010). Regarding scientific concepts in such a way initiates an interdisciplinary discourse on concepts themselves, their meanings and implications. More precisely, it enables reflection on underlying norms and values of the Anthropocene.

Though the Anthropocene concept increasingly resonates within political and public debates, it is still very much science-driven. Therefore, it is no surprise that scientists are ascribed a prominent task in problem solving and guiding society towards environmentally sustainable management during the era of the Anthropocene (Crutzen 2002). According to Crutzen (2002), this involves scientific and engineering measures on all scales up to internationally accepted, large-scale

geo-engineering projects (for a critical view, cf. Ott and Baatz 2012). What could be understood as self-authorisation of science (cf. Lövbrand et al. 2009) is not a subject to be further discussed here. While acknowledging that science has an important role to play in solving the major future challenges, other social actors and their values also contribute to the solution. The paper turns next to issues that must be considered in order to address value pluralism in dealing with water problems within the Anthropocene.

Challenges to Sustainable Water Governance in the Anthropocene

It has been mentioned above that the Anthropocene concept has to be understood against a normative background. Since the Brundtland report in 1987, the concept of Sustainable Development (SD) has become the political strategy to balance the needs of humans and nature. The concept's normative core is the idea of inter- and intra-generational justice in the face of decreasing natural resources, the ecosystems' limited capacity to absorb human emissions, and the ongoing environmental destruction. Briefly stated, SD dictates that humans are obligated to ensure that everyone has the opportunity to live a self-determined and good life. In this endeavour, we proceed in such a way that the natural basis necessary to live such a life is at least retained (and in the best case extended) for all contemporary and future humans (Meisch 2013; Voget-Kleschin 2013). On a normative level, action in the Anthropocene refers to SD.

In many ways, water plays a crucial role in the transformation process to SD. Even without the global environmental changes associated with the Anthropocene, constituting and enforcing a human right to water constitutes a major task in itself. Access to and allocation of water is unequal and often unfair due to regional scarcities, changing consumption patterns and political entitlement (Kowarsch 2011). In the Anthropocene, human action has affected water and water systems in many ways—ranging from ocean circulation, to river hydrology, to coastal zones, and to local and regional projects (dams, channels) (Crutzen 2002; Rockström 2009). Besides social and political factors, anthropogenic change puts additional stress on water resources and supply and thereby further complicates enforcing a human right to water (Parry et al. 2007; Bals et al. 2008; Rockström et al. 2009). However, as water is essentially connected to many other SD issues (e.g. food, health and sanitation, social development etc.), it can also be seen as an ideal starting point to address many sustainability issues and to cope with global change in the Anthropocene (Steduto and Kuylenstierna 2009). Research platforms such as the Integrated Water Resources Management (IWRM) or the Water, Energy and Food Security Nexus explicitly point in this direction.

In recent years, many approaches in the water sciences and management have emerged. Yet, while scientific debates develop steadily and substantially, progress

in solving real world problems is lagging behind expectations: Non-SD endures, water problems escalate and decisions remain urgent (Ingram 2011; Ostrom 2008). Politics must be brought back into water governance by directly considering value conflicts. This claim implies changing present practices e.g. by paying more attention to policy implementation and power relations. An essential component of this politicised water governance is water ethics. Water ethics deal with human actions and social institutions that affect water. In particular, water ethics aims to reflect normative and evaluative claims with regard to existing water practices and institutions and tries to assess whether they contribute to solutions that conform to the normative right or the evaluative good (cf. Düwell et al. 2011).

Coping with value conflicts that with regard to water are likely to happen (Ingram 2011; Schmidt 2010) faces ethical challenges that will be considered here. As many different values are ascribed to water, more politicised water governance is most likely to be in need for a value-reflexive governance in order to deal with competing values (Ingram 2006; Groenfeldt and Schmidt 2013; Groenfeldt 2013). Paying more attention to the value dimension of politics opens up new opportunities. For instance, there is an agreement within the political and scientific community that contextual solutions to water problems are necessary (Ostrom 2007; Pahl-Wostl and Toonen 2009a). One consequence can be seen in a greater participation of communities in developing water research issues and in implementing possible findings (Ziegler and Ott 2011; Ingram 2011). Explicit debate on values allows for a low-threshold entrance into ethical debates on sustainable water governance. Therefore, facing the ethical dimension, in which the value-dimension plays a central part, is not only vital for successful water governance but also an opportunity for involving people into ethical debates on water governance and water science. The discussion turns to the premises and conditions for value dialogue. It argues for politicising water governance and reflects about conceptual preconditions of a value-reflexive governance of water: it deals with the concept of value and its relationship to ethics and compares good and value-reflexive governance.

Value-Reflexive Governance of Water

Water Governance: Bringing Politics Back In

Though numerous scientific, technological and policy approaches to cope with water issues have been pursued, actual results seem to be disappointing. Reasons for failure are diverse and cannot be discussed in detail here (for an excellent overview, cf. Ingram 2011). The paper focuses instead on water governance and water ethics as essential parts of a solution. After being neglected by water scholars and practitioners, the political dimension must be seen as an indispensable component for sustainable innovations in water science and governance (Ingram 2011; Pahl-Wostl and Toonen 2009a; Hoppe and Wesselink 2011). Ignoring the

political aspect of water and leaving it unmanaged also raises serious socio-ethical questions. For instance, unmanaged water might leave the world's poorest worst off because it is likely more vulnerable to natural disasters or subject to informal elite rule and corruption ('iron law of oligarchy') (cf. Meisch et al. 2012, p. 414).

It is reasonable to distinguish management and governance as many of the previous shortcomings and failures can be traced back to the confusion of the two. While management strives for effectiveness and efficiency, governance intends to create legitimacy (Pahl-Wostl and Toonen 2009b). Making water policies more efficient and effective does not make them more legitimate and socially accepted when distributional effects or cultural factors are ignored (Ingram 2011; Ostrom 2008). Sustainable water governance needs to fulfil several tasks: unfolding and settling value differences; finding legitimate policy solutions; dealing with uncertainty and surprise due to climate change; and finally finding ways and means for policy implementation. With regard to reforms of water policies, it seems to be undisputed that panaceas or universal solutions that are supposed to fit all situations independently of time and space are destined to fail. Contextualised solutions are needed (Ingram 2011; Ostrom 2007, 2008). Central factors in contextualized solutions are: attracting public attention in an area with values at stake; generating engagement and support; engaging social movements; making water governance an issue of politics and not only of expert circles; overcoming (formal and informal) bureaucratic path dependency; and finding means for policy implementation contexts (Hoppe and Wesselink 2011; Huitema and Mejerink 2007; Ingram 2011). Transformation to SD is an eminently knowledge-driven process. However, it has been argued that it needs to be a different science and knowledge from what we know now, namely one that is more credible, trusted and legitimate (Ingram 2011; Funtowicz and Ravetz 1993). Inter- and intra-disciplinarity as well as participation should feature more prominently (Ziegler and Ott 2011). The claim for contextual problem solving encompasses other scientific methods or models, more robust and reliable technologies (Ingram 2011; Hoppe and Wesselink 2011) and value-reflexive governance of water.

The Concept of Value

Conceptualising 'value' is notoriously difficult (Schnädelbach 1983). However, addressing the value dimension of governance requires a basic conceptual understanding. Values have to be distinguished from preferences and attitudes, as they are not on the same analytical level (Meisch and Potthast 2011, pp. 8–14) even though all three terms refer to evaluations in one way or another. In conceptualising values, it is reasonable to take a pragmatic approach and to avoid the philosophical difficulties of value-philosophical traditions with strong metaphysical claims (Joas 2001, 2008). In short, values originate in contexts of action and are connected to specific experiences in which people evaluate actions, institutions, contexts etc. with regard to their moral desirability. One can also state that

practical contexts (such as science) are always value-laden. In the course of time, these evaluations become detached from specific situations. Values as nouns (such as transparency, participation etc.) then become the reference points for evaluations. As values originate in experiences, their meaning might to some degree vary in different contexts. Attitudes and preferences are related to values in different ways. Attitudes are the tendency to evaluate, not the evaluation itself. As mental sets, attitudes determine the way people evaluate a stimulus object. Preferences are part of a comparative value concept that compares objects according to some value. Therefore, they need one or more values as criteria to build preference lists. Both attitudes and preferences can be evaluated on the basis of values. While attitudes and preferences influence and structure actions, the terms themselves are normatively undetermined. Reference to values allows for ethical considerations such as argumentation, reflectivity and justification (Meisch and Potthast 2011; Joas 2008).

Thus, values must be regarded as reference points for evaluations, and, as such they work as ideals or criteria for evaluating actions, persons, institutions, things, attitudes, preferences, norms, etc. as good or bad. Values are emotionally and rationally binding, and give long-term orientation and motivate for action. They also encompass an active and passive as well as rational and emotional element (Beck et al. 2012; Meisch et al. 2012). This approach to values has several advantages. First, it takes into account that actors already have concrete and strong beliefs about their values. It is applicable by persons with different moral backgrounds in different contexts. Second, it acknowledges the situation of several and heterogeneous accepted values within a value community (i.e. freedom, wealth, etc.). Descriptions of a pluralistic society with a plurality of values are empirically undeniable and broadly accepted. Third, it offers a value theory neither claiming the eternal existence of fixed values independent of time and space nor paving the way for value relativist or value subjectivist positions. Instead, historically contingent values can be employed as valid and binding for a certain given time or at least for certain societies. Even if in pluralistic backgrounds, the acceptance of certain justification models is difficult, one must not underestimate the consensual acceptance of basic values, which gain a quasi-objective status. But, as values are generated in dynamical interactions between individuals and society, the question arises how it is possible to identify a substantial value system of a social group. This would be necessary if we wanted to solve the problem of competing values in a certain context (Beck et al. 2012).

Values and Ethics

Ethics that is aware of a plurality of values within and between societies can develop mechanisms that allow citizens to bring their values into ethical debates and thereby to participate in the finding of socially robust innovations (Funtowicz and Ravetz 1993). It is necessary to pay attention on two value-ethical claims:

First, values can be regarded as low-threshold entry to ethical debates. Including the value dimension in coping with situations of high uncertainties allows to better address citizens and stake-holders, who want to understand, support and participate consciously and deliberately in water governance. It can be expected that value dialogue contributes to politicised water governance as water issues get more easily on the political agenda, stakeholders can be better mobilised and more intensively included in policy making (Ingram 2011; Huitema and Mejerink 2007). Second, ethical debates cannot be restricted to mere value talk. Value debates need an ethical framing that enables participation as well as a philosophically sound reflection on (conflicting) values. The approach of value-reflexive governance has three aims. It wants first to contribute to a democratisation of sciences, second to make implicit value commitments explicit and third to allow for rational discourses on values. The last point is important because there are strands in moral philosophy that regard values as purely subjective and non-argumentative. The value-ethical core of a value-reflexive governance therefore does not only take stock of the values involved but also develops philosophical tools to deal with value conflicts and participatory mechanisms to deal with value conflicts in social contexts.

Ethics has different tasks in solving value conflicts. First, it contributes to the understanding of what is actually meant by a given value. Depending on a value's genesis, there are very likely different and conflicting interpretations of the same value. These have to be made transparent and open for dialogue. Ethics might as well examine different value interpretations with regard to their moral rightness or goodness. Second, ethics helps to handle conflict between different values. As mentioned earlier, water is an issue where many different values are at stake and value conflict seems likely. An ethics of values offers philosophical frames (e.g. the concept of inter- and intra-generational justice) to deal with conflicting values and it also addresses the need to set up norms and regulations in water governance (Meisch et al. 2012; Immergut 2011).

Toward a Value-Reflexive Governance: More than Good Governance

When suggesting the concept of value-reflexive governance, one needs to clarify its relationship to the concept of good governance as on the surface both concepts might appear identical. The idea of good governance first evolved within the value context of the World Bank, which developed principles that could determine the allocation of loans to developing countries and that had a strong anti-corruption bias. The genesis of good governance conceptions within the context of an international economic institution does not delegitimize the concept as such. However, as explained before, concepts have a factual and a value side that are intertwined. Therefore, one has to be aware of implicit normative and evaluative

statements, make them transparent and open for rational public discourse. While the concept of good governance is mainly concerned with norms that are meant to guide governance processes, which values are at play often remains implicit. This observation leads to two main further questions to be addressed in the processes of water governance: which values form the basis of normative statements about how good water governance should be? Whose values are meant to guide governance (Meisch et al. 2012; Immergut 2011)?

An interesting example is the concept of Integrated Water Resources Management (IWRM) that has become a major point of reference for discourses in water management. It is understood to be "a process which promotes the coordinated development and management of water, land and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment" and which also comprises notions of good governance (GWP 2010). Although it was meant to be a science-based and impartial conception of water management, it nevertheless makes explicit and implicit moral judgements on the world water situation and social relationships with regard to water (Scmidt 2010, pp. 7–8; Biswas 2008) by explicitly referring to ethical concepts such as welfare or sustainability and by implicitly promoting a Utilitarian framework (Kowarsch 2011, pp. 47–48). It has been mentioned above that scientific practise is value-based and that scientific conceptions in the form of epistemic-moral hybrids make factual as well as normative and evaluative judgements. Both have to be made transparent for discourse and need ethical justification.

In this situation, a value-reflexive governance aims for two objectives. First, it makes explicit underlying values of good governance concepts and the processes by which they became guiding imperatives. With this, one can avoid imposing specific value systems on social contexts. Secondly, it offers solutions which ensure that open, transparent and more inclusive governance not only allows more social actors to express their values but also that those values can be translated into policy programmes. In contrast to the broader concept of good governance, the concept of value-reflexive governance stresses the point of sensitivity in regard to participants' values in governance processes. Ensuring that all stakeholders' values will be voiced and heard within governance processes does not say anything about how to deal with values, let alone value conflicts that are most likely going to arise (Meisch et al. 2012).

What does this mean for water governance and the water sciences? The scientific system considers itself a self-regulating social system. However, politics and business play an important role in shaping it. Both spheres interact. A value-reflexive governance of water opens up dialogue on underlying values. At the same time, water sciences take part in solving social problems and are therefore actors in governance processes. While traditionally the sciences have been assigned with the role of contributing a standing knowledge to deal with concrete problems, this (self) perception changed. Fixed, cure-all solutions failed in concrete social contexts because governance processes overlooked value dimensions of people affected by political and technical solutions. In value-reflexive governance, water sciences and practitioners do not contribute to societal requests by providing fixed knowledge but by

developing context-specific solutions to problems with a specific time-space dimension. This requires an understanding of values involved and suggestions how to deal with value conflicts. In that sense, value-based governance needs, among others, conceptual clarification as well as extensive deliberation on the ethical norms and decisions to be made in water governance.

Conclusion and Outlook

In the era of Anthropocene, humanity is faced with massive challenges. Water is one of the key elements for sustainable development claiming an autonomous and good life for contemporary and future generations. While human activity has put stress on water, addressing the water issue can help to bring about SD on many scales and policies. So far, the record of water management is mixed, which can, among others, be traced back to the neglect of the political dimension of water. Finding solutions to water problems is not only about technology to be applied by experts, it is also a highly normative undertaking with values at stake. The paper suggested conceptual considerations for a value-reflexive governance as a response to the present shortcomings in water governance. The proposed approach intends to make values visible and accessible for rational discourse and at the same time suggests value discourses as a low-threshold entry for stakeholders to ethical debates of water governance.

Next research steps need to assess existing ethical tools such as, among others, the "Ethical Matrix" (Kaiser et al. 2007) and apply it to the context of water governance. In this endeavour, there are many tasks ahead which cannot all be discussed here. What is clearly needed is developing appropriate tools for different scales that also consider how they can be placed within respective processes of policy formation and implementation. Their main task would be bringing together different forms of knowledge with an ethically sound process of reflection and decision making.

Acknowledgements The paper builds on previous work and results of the EU project "Value Isobars—The Landscape and Isobars of European Values in Relation to Science and New Technology" (FP7 31004480; http://www.value-isobars.eu/). I acknowledge the provision of important discussion points from project partners and especially thank Thomas Potthast, Matthias Kaiser and Helen Ingram. The full responsibility for the content, style, errors and inaccuracies is mine.

References

Autin W, Holbrook J (2011) Is the Anthropocene an issue of stratigraphy or pop culture? GSA Today 22:60–61. doi:10.1130/G153GW.1

Bals C, Hameling S, Windfuhr M (2008) Climate change, food security and the right to adequate food. Study Published by Bread for the World and Germanwatch. Stuttgart

Beck R, Meisch S, Potthast T (2012) The value(s) of sustainability within a pragmatically justified theory of values: considerations in the context of climate change. In: Potthast T, Meisch S (eds) Climate change and sustainable development. Ethical perspectives on land use and food production. Wageningen Academic Publishers, Wageningen, pp 49–54

Biswas A (2008) Integrated water resources management: is it working? Water Resour Dev 24:5–22

Crutzen P (2002) The geology of mankind. Nature 415:23

Crutzen P, Schwägerl C (2013) Living in the anthropocene: towards a new global ethos. environment 360. http://e360.yale.edu/feature/living_in_the_anthropocene_toward_a_new_global_ethos/2363/. Accessed 17 Aug 2013

Dietrich J (2004) Ethisch-Philosophische Grundlagenkompetenzen: ein Modell für Studierende und Lehrende. In: Maring M (ed) Ethisch-Philosophisches Grundlagenstudium. Ein Studienbuch. LIT, Münster, pp 15–33

Düwell M, Hübenthal C, Werner MH (2011) Einleitung. In: Düwell M, Hübenthal C, Werner MH (eds) Handbuch ethik. Metzler, Stuttgart, pp 1–23

Funtowicz S, Ravetz J (1993) Science for the post-normal age. Futures 26:568–582

Groenfeldt D (2013) Water ethics. A values approach to solving the water crisis. Routledge, London

Groenfeldt D, Schmidt J (2013) Ethics and water governance. Ecol Soc 18. doi:10.5751/ES-04629-180114

GWP [= Global Water Partnership] (2010) What is IWRM? http://www.gwp.org/en/The-Challenge/What-is-IWRM/. Accessed 29 Dec 2013

Hoppe R, Wesselink A (2011) If post-normal science is the solution, what is the problem? Sci Technol Human Values 36:389–412

Huitema D, Mejerink S (2007) Understanding and managing water transitions: a policy science perspective. Paper presented to the First International Conference on Adaptive and Integrated Water Management, Basel, Switzerland, 12–15 Nov 2007. http://www.newater.uni-osnabrueck.de/caiwa/data/papers%20session/G1/springer01-Meijerink.pdf. Accessed 8 Sep 2012

ICS [= International Commission on Stratigraphy] (2013) Subcommission on Quaternary Stratigraphy, Working Group on the 'Anthropocene'. http://quaternary.stratigraphy.org/workinggroups/anthropocene/. Accessed 29 Dec 2013

Immergut E (2011) Democratic theory and policy analysis: four models of "Policy, Politics and Choice". der moderne staat 1: 69–86

Ingram H (2006) Water as a multi-dimensional value: implications for participation and transparency. Int Environ Agreements 6:429–433

Ingram H (2011) Beyond universal remedies for good water governance: a political and contextual approach. In: Garrido A, Ingram H (eds) Water for food in a changing world. Routledge, London, pp 241–261

Joas H (2001) The genesis of values. University of Chicago Press, Chicago

Joas H (2008) Value generalization. Limitations and possibilities of a communication about values. J Bus Econ Ethics 9:88–96

Kaiser M, Millar K, Thorstensen E et al (2007) Developing the ethical matrix as a decision support framework: GM fish as a case study. J Agric Environ Ethics 20:65–80

Kowarsch M (2011) Ethical targets and questions of water management. In: Kowarsch M (ed) Water management options in a globalised world. Proceedings of an international scientific workshop (20–23 June 2011, Bad Schönbrunn), p 38–49. http://www.hfph.de/igp/proceedings2011. Accessed 29 Dec 2013

Lövbrand E, Stripple J, Wiman B (2009) Earth system governmentality. Reflections on science in the anthropocene. Glob Environ Change 19:7–13

Meisch S (2013) Green food consumption: whose responsibility? In: Röcklinsberg H, Sandin P (eds) The ethics of consumption. The citizen, the market and the law. Wageningen Academic Publishers, Wageningen, pp 160–165

Meisch S, Potthast T (2011) Towards a pragmatically justified theory of values for governance. Conceptual analysis of values, norms, preferences and attitudes. EU-Project Value Isobars.

Work package 1 Deliverable 2 (Mar 2011). http://www.value-isobars.no/filestore/WP1_2_Conceptualanalysisofvaluesnormspreferencesandattitudes.pdf. Accessed 29 Dec 2013
Meisch S, Beck R, Potthast T (2012) Towards a value-reflexive governance of water. In: Potthast T, Meisch S (eds) Climate change and sustainable development. Ethical perspectives on land use and food production. Wageningen Academic Publishers, Wageningen, pp 413–418
Ostrom E (2007) A diagnostic approach for going beyond panaceas. Proc Natl Acad Sci 104:15181–15187
Ostrom E (2008) Sustainable development of common-pool resources. http://www.indiana.edu/~workshop/colloquia/materials/papers/ostrom_paper1.pdf. Accessed 9 Sep 2012
Ostrom E (2010) A multi-scale approach to coping with climate change and other collective action problems. Solutions 1:27–36
Ott K, Baatz C (2012) Domains of climate ethics: an overview. In: Potthast T, Meisch S (eds) Climate change and sustainable development. Ethical perspectives on land use and food production. Wageningen Academic Publishers, Wageningen, pp 23–28
Pahl-Wostl C, Toonen T (2009a) Sustainable water governance in times of global change. A major challenge for the scientific and policy communities. IHDP Update Issue 3:26–30
Pahl-Wostl C, Toonen T (2009b) Global water governance: Quo Vadis? Global Water News 8:8–10
Parry M, Canziani O, Palutikof J et al (2007) Climate change 2007: Impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the IPCC. Cambridge University Press, Cambridge, pp 23–78
Potthast T (2000) Bioethics and epistemic-moral hybrids: Perspectives from the history of science. Biomedical Ethics 5:20–23
Potthast T (2010) Epistemisch-moralische Hybride und das Problem interdisziplinärer Urteilsbildung. In: Jungert M, Romfeld E, Sukopp T et al (eds) Interdisziplinarität. Theorie, Praxis, Probleme. WBG, Darmstadt, pp 173–191
Ricken F (2003) Allgemeine ethik. Kohlhammer, Stuttgart
Röckström J, Steffen W, Noone K et al (2009) A safe operating space for humanity. Nature 46:472–475
Schnädelbach H (1983) Philosophie in Deutschland 1831–1933. Suhrkamp, Frankfurt/Main
Schmidt J (2010) Water ethics and water management. In: Brown P, Schmidt J (eds) Water ethics. Foundational readings for students and professionals. Island Press, Washington, pp 3–15
Steduto P, Kuylenstierna J (2009) Climate change, energy and food security, economic development—in the end, it all trickles down to water. Climate change policy and practice. http://climate-l.iisd.org/guest-articles/climate-change-energy-and-food-security-economic-development-in-the-end-it-all-trickles-down-to-water/. Accessed 9 Sep 2012
Voget-Kleschin L (2013) Employing the capability approach in conceptualizing sustainable development. J Hum Dev Capabilities 14:483–502
Zalasiewicz J, Williams M, Steffen W et al (2010) The new world of the anthropocene. Environ Sci Technol 44:2228–2231
Zalasiewicz J, Williams M, Haywood A et al (2011) The anthropocene: a new epoch of geological time? Phil Trans R Soc 369:835–841
Ziegler R, Ott K (2011) The quality of sustainability science: a philosophical perspective. Sustain Sci Practice Policy 7:31–44