

11. Practicing Polycentric Governance

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Abstract. How can communities, associations, governments, and other organizations work better together? Principles for practicing polycentric governance include organizing at multiple scales, embracing self-governance, customizing solutions, and learning together. Communities working together to govern surface and groundwater commons in Rajasthan, India offer an example of challenges and opportunities for developing polycentric governance, as do various strategies to improve basin governance. Putting polycentric governance into practice can start with assessing how stakeholders are already interconnected and appreciative exploration of how they might improve their interactions. Institutional artisans can apply principles and mechanisms to craft overarching rules and other specific arrangements for polycentric governance. Polycentric governance can be facilitated by convening discussions among stakeholders, sharing knowledge, and empowering self-organized mutual adjustment.

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11.1 Introduction

As discussed in earlier chapters of this book, polycentric governance offers a perspective that emphasizes the potential for effective cooperation, conflict resolution, fruitful competition, and shared learning among multiple autonomous decision centres interacting with each other, such as:

- federal governments with autonomous state governments and overarching institutions;
- local public economies composed of government agencies and specialized service providers in a metropolitan area;
- nested natural resource management, as with multiple layers of water management organizations within irrigation systems and river basins; and
- co-management between communities and agencies managing natural resources such as forests or fisheries.

The literature on polycentric governance and related ideas has emphasised practical principles including the potential value of multiple centres and linkages across scales, empowering people to govern themselves, crafting institutions to fit specific situations, and sharing learning from diverse experiences and experiments. Table 1 summarizes these in a set of principles for practicing polycentric governance.

The chapter begins with an example of polycentric practice in the development of land and water commons by communities in rural India, including strengthening of community-level governance and wider federations through processes that connect multiple communities, agencies, and programs. Putting a polycentric perspective into practice can start with assessment of existing polycentricity and participatory exploration of options for change, such as in the number of decision centres involved, their autonomy, and how they are linked. In crafting polycentric governance, institutional artisans can draw on a variety of mechanisms and design principles. Efforts to improve water governance in river and groundwater basins illustrate some of the opportunities and challenges for developing polycentric governance. The development of polycentric governance can be facilitated by institutional changes, including improving networks, sharing knowledge, and cultivating “power with.”

Table 11.1 Principles for Practicing Polycentric Governance
Organize at multiple scales. Don't assume that bigger is better, or that small is always beautiful. There are many alternatives to top-down hierarchies and institutional monocultures. Consider linking horizontally and across scales through federations, compacts, co-management agreements, and other overarching institutions for cooperation, regulation, conflict resolution, and competitive service provision. In exploring the scale and scope of how organizations could constitute institutions for cooperation and other fruitful interaction, consider not just government jurisdictions but also resource boundaries, the stakeholders involved, and "problemsheds" around a particular issue.
Embrace self-governance. Accept and work with the necessary messiness, time-consuming processes, contestation, compromises, and trial-and-error of how self-governance with meaningful autonomy happens in practical politics among public and private actors. Acknowledge the importance of the consent of the governed, the distribution of power through checks-and-balances, and the challenges and opportunities these bring. Empower organizations to work together in solving problems. Enable institutional artisans to make agreements and put them into operation, for example through customary local governance practices, special districts, devolution of authority, contracts with service providers, court backing for binding agreements, and other mechanisms.
Customize solutions. Go beyond panaceas. Don't pursue or impose oversimplified standard solutions. There is no "one best way" or unique set of "best practices" that is ideal everywhere. Appreciate the benefits and complexity of institutional diversity and adaptation. Consider ways to increase flexibility, choice, and competition among alternative service providers. Analyse specific action situations to diagnose problems and identify opportunities. Encourage pragmatic innovation in crafting customized solutions.
Learn together. A core advantage that polycentric governance can offer is the opportunity to learn from multiple experiences, for example different communities, states, or other organizations trying different things to discover what may work and learning from each other as they proceed. Convene meetings, workshops, and other forums, as well as facilitating networks of communication, formal and informal, that promote social learning.

11.2 Commoning Water: Polycentric Governance in Rajasthan

Rural communities in Rajasthan State in India face the challenges of governing shared surface and ground water resources in the face of fluctuating monsoon rainfall. Technologies such as tube wells and pumps may help improve livelihoods, but risk leading to depletion of aquifers and degradation of land and water resources. The Foundation for Ecological Security (FES) works with communities to pursue a "triple bottom line" of more inclusive and equitable governance, improved livelihoods, and environmental sustainability. Project activities help villagers organize inclusive democratic institutions for managing land and water resources, understand the flows of surface and groundwater, claim or reclaim shared resources such as ponds and

grazing land (“commoning”), increase surface and groundwater storage, and balance productive water use with renewable supplies (FES 2010, 2014).

A participatory planning process, including Participatory Rapid Appraisal (PRA) techniques, helps communities assess their own resources and priorities, enhancing their capacity to cooperate with government programs pro-actively as partners. This means engaging with programs supported from outside as a way to pursue local goals, with deliberate selection and negotiation about when and how to cooperate with other organizations and programs.

In this case, a key element of a polycentric strategy for change has been establishing inclusive governance institutions with universal membership at the “habitation” level of small settlements. This strengthens organized, autonomous decisionmaking centres, in a way that is linked with a variety of other social actors and organizations. This is a key aspect of polycentricity, because habitations are the social villages of people who live close to each other and interact frequently, whereas the official “revenue villages” are usually much larger and less tightly connected. Earlier FES work showed the limitations of focusing too narrowly on groups of resource users, such as forest user groups, particularly the risk of excluding poorer and more vulnerable people who may own little or no land, but who rely on common lands for fuel, food, fodder, and other resources. Organizing at the habitation level strengthens a centre of inclusive, democratic decisionmaking, which can then engage more effectively with other resource users, communities, agencies, and programs.

This context contains multiple forms of polycentricity, with organizations ranging from households to settlements of various sizes on through panchayats (sub-district level assemblies), districts and states, and multiple government units, including forest and water agencies. Activities go beyond individual communities to consider interaction with neighbouring communities that share land and water resources, such as ponds, aquifers, forests, and grazing land, as well as engaging with multiple levels of government jurisdictions and agencies involved in regulating land and water resources. Federations and other forums facilitate information sharing, conflict resolution, and cooperation at multiple scales for forests and river basins.

11.3 Assessing Polycentricity in Governance

Stakeholder analysis and other techniques can explore the extent to which there are multiple actors involved in a situation, how they are connected, their converging or conflicting interests, and whether they already have a history of interacting with each other and are bound within larger sets of overarching rules. Stakeholder analysis may be relatively informal or more systematic, identifying those who are involved, their concerns, relationships, and how they might be engaged in making changes (Grimble and Wellard 1997; Brugha and Varvasovszky 2000; Varvasovszky and Brugha 2000; Reed et al. 2009; Sabatier et al. 2005; Prell, Hubacek, and Reed 2009). Netmapping offers a practical and interesting way for stakeholder groups to visualize their connections (Schiffer and Hauck 2010; Hauck et al. 2015).

Conceptually, polycentricity may be analysed in terms of the number of centres, and how they are linked within social networks, including the extent of autonomy, mutual adjustment, cooperation, competition, conflict, and other interactions (Aligica and Tarko 2012; Lubell, Henry, and McCoy 2010). Systems may be tightly or loosely linked

in networks and have power centralized or distributed, with polycentric systems typically having both strong linkages and distributed control (Cumming 2016). Polycentricity can be seen as a particularly interesting form of network governance (Jones, Hesterly, and Borgatti 1997; Carlsson and Sandström 2008) where many centres have substantial autonomy while being linked through overarching institutions.

Social network analysis (Borgatti, Everett, and Johnson 2013; Chaffin et al. 2016) offers tools for mapping and thinking about various patterns of linkage between individuals and organizations, and so holds considerable potential for a systematic understanding of the options for designing and modifying polycentric governance. From a social network perspective, diagnostic questions for assessing the extent of existing polycentricity and potential changes include asking:

- How are organizations and individuals connected, in terms of communication, influence, flows of funding and other resources, authority, and other links?
- What patterns do these linkages form, particularly in terms of the number of centres (nodes, clusters, etc.) and how these are connected?
- What do these patterns of linkages mean for awareness, voice, and ability to influence outcomes?
- What are the key linkages in terms of mutual adjustment (learning, cooperation, competition, conflict resolution, and so forth), and to what extent do these linkages allow or constrain autonomy? Are different centres tightly, moderately, or loosely connected?
- Are there major gaps or problems in the ways in which organizations are linked, particularly in terms of lack of overarching institutions, or in terms of lack of autonomy that could facilitate local adaptation, choice among service providers, learning, and performance improvements?

A polycentric perspective emphasizes the potential for self-governance, problem-solving arising from the initiative of people organizing themselves. An emphasis on self-governance involving multiple centres makes it particularly important to appreciate how those concerned with a problem or opportunity view their situation, their aspirations, and priorities for change, and for them to take part in considering options and making decisions. Some particularly relevant approaches are part of what could be considered an “appreciative turn” in applied social science, sharing a common concern with using participatory processes to understand what is good about the current situation, as a basis for those involved to consider potential improvements:

- Participatory Rapid Appraisal (PRA) offers a philosophy and a variety of techniques through which people can use their own local knowledge to assess their situation and the available options for change, in ways that have been developed to be interesting, enjoyable, and empowering for those involved. PRA has been extensively applied in rural development including situations where resources are shared between overlapping communities of users and as part of attempts to increase the involvement of communities in natural resources management, on their own or in co-management with government agencies (Chambers 1994). In the example discussed in the previous section, communities used PRA methods to map resources, assess trends, and consider options for change.

- SWOT analysis assesses strengths and opportunities, as well as weaknesses (problems) and threats (risks), providing a framework that tries to go beyond the tendency to only frame issues reactively in terms of problems, dangers, and deficiencies and instead to pay attention to capabilities and promising potentials.
- Appreciative inquiry (AI) asks people what they think is working well and how it could be made even better, emphasizing what they value and want more of. In contrast to a pre-occupation with problems, it concentrates on identifying positive options that are feasible and interesting for key stakeholders, including potential cooperation with other organizations (Cooperrider 2005; Mac Odell n.d.).
- Asset-based community development (Cunningham and Mathie 2002), and similar approaches also emphasize identifying the capacities that exist, and building on such strengths, often in the context of opportunities for partnering with external institutions.
- Positive deviance approaches emphasize looking at situations where things are “going right” and exploring what might be learned to make things better elsewhere (Pascale, Sternin, and Sternin 2010).
- Albert Hirschman argued for the advantages of “possibilism,” building on what is already occurring and has been shown to be feasible in some cases, in ways that can harness the “social energy” of citizen groups trying to better their lives, often in the context of working with other organizations (Hirschman 1971, 1986; Ellerman and Hirschman 2006; Lepenies 2008).
- While critical social science often emphasizes how social structures tend to serve existing interests and make change difficult, it also includes approaches, that pay attention to the degree of autonomy, “agency,” or “room for manoeuvre,” that various actors have. This may allow people to engage in initiatives and self-organize polycentrically. Meaningful and effective innovation may occur through using the opportunities that can be developed within existing structures of power (Gibson-Graham 2006).
- Citizens can be seen as “co-creators” of their worlds, in how they implicitly and explicitly create, re-create, and transform ideas and institutions. (Boyte et al. 2014). Many approaches to improving people’s capacity to act as citizens emphasize developing dialogue and deliberation among individuals and groups (NCDD 2017).

Assessment of existing polycentricity should include recognition of the extent to which various government agencies, and different units and levels within governments and their agencies, may have different interests and degrees of autonomy that would enable them to support or obstruct change. In practice, even situations that may appear hierarchical, such as within government or corporate bureaucracies, may contain many actors who have considerable discretion to help or hinder change. Rather than “the state” as a unitary entity, governments at various levels are composed of a multiplicity of different agencies and interests. Courts and legislatures may offer a variety of forums and opportunities for action. Institutional diversity within governments enhances the possibility for constructing coalitions and finding venues to pursue particular goals.

The assessment of current polycentricity and the capabilities that may already exist provides a framework for thinking about what might be changed, and what changes may be most attractive and worthwhile for those involved.

- The number of centres could be expanded by establishing new centres, existing centres might be split up, or, alternatively, centres might be consolidated.
- The scale and scope of collective action could be changed to involve more centres, or fewer, bringing in more stakeholders, or focusing on a smaller coalition who may be ready to act.
- Inclusion of those who are left out or only weakly connected could help to promote better processes and outcomes.
- Interactions could be changed by activities to share information, or encourage cooperation, for example by convening meetings or providing funding for joint activities, as well as by constituting agreements about new overarching institutions that create rules, resolve conflicts, encourage competition, or organize collective efforts.
- There may be ways in which contestability among institutional alternatives can promote innovation and efficiency, for example competitive contracting in local public economies, or facilitating easier transfers of resources, movement of members between centres, or choices between service providers (exit options).
- Autonomy might be increased by devolving authority and money; or by reducing regulations, requirements for approval, or other restrictions. Conversely, coordination, enforceable agreements, and conflict resolution institutions may reduce autonomy, while helping to solve problems and achieve shared objectives.

11.4 *Crafting Polycentric Governance*

Citizens, including community leaders and government officials, act as public entrepreneurs and institutional artisans when they decide on ways to work together (V. Ostrom 1980). Institutional artisans may draw on a range of principles and mechanisms, from many sources including their own experience, public policy discussions, and research. The design of polycentric governance may benefit from frameworks such as institutional analysis and development (IAD) and socio-ecological systems (SES) (E. Ostrom 2005, 2009; Goodin 1998). However, while useful for analysts, such frameworks and associated methods often require more time to understand and apply than most participants have available. Those crafting new institutions usually take a more informal, improvisational, “vernacular” approach to institutional artisanship, applying and modifying available patterns of organization. Rather than creating totally new institutions, the tendency is often to adapt existing institutions and organizations to new tasks, in a process of institutional bricolage, recombining familiar ideas and institutions in new ways (Cleaver 2012).

As an example of a trajectory for the development of polycentric governance, communication links for information sharing could lead to informal collaboration, partnerships, cooperation in joint projects, and conflict resolution (Galaz et al. 2011). Existing institutional arrangements shape the potential for change, including restricting or expanding potential changes in polycentricity (DeCaro et al. 2017). A key question

concerns the transaction costs of change, and whether the value of benefits and costs, and how they are distributed across stakeholders, make change attractive to those involved (Coase 1990; Challen 2000). Starting from the current situation, one can think about the “adjacent possible” of feasible reforms (Kauffman 1995). Kauffman’s idea of the adjacent possible draws on the analogy with chemical transformations in molecules: depending on the atomic properties and existing configurations some changes require less energy and are easier to achieve. Other transformations may be much more difficult or dependent on special conditions.

On the one hand, a polycentric perspective can help expand the “design space” of institutional options that are considered. Rather than assuming there is “one best way,” an ideal to be achieved, a single standardized solution or panacea, only one form of modernity, or just one form of polycentric governance, an open polycentric perspective can instead look at the space for institutional diversity, with multiple possible solutions, customized to match particular circumstances and needs (E. Ostrom, Janssen, and Anderies 2007). On the other hand, thinking about the adjacent possible may focus attention on more feasible nearby options that offer enough benefits, compared to the transaction costs of change, to attract initiative and support from stakeholders who can overcome obstacles to collective action.

There is sometimes a tendency to talk as if institutional changes can easily be deliberately designed, as if starting from scratch with a blank slate, or at least with great scope for making major changes. Closer study of institutional change suggests that most changes are highly constrained by history (path dependence), politics (contesting interests), and by the language (discourse) people use to think about and discuss their situation and the potential for change (North 1990; Pierson 2000; V. Ostrom 1997; Foucault 1984). Those crafting institutions make decisions, explicit and implicit, about what objectives to consider, including implications for equity, efficiency, sustainability and other characteristics of processes and outcomes. Efforts to institute polycentric reforms should be informed by an understanding of how differences in knowledge, power, wealth, and other characteristics may enhance or limit capabilities and the options for exploring and expanding the potential for improvement within or despite such conditions (Morrison et al. 2017). As discussed in earlier chapters, concepts of citizenship and institutional artisanship are embedded in ideas and attitudes about who is entitled to have a voice in decisions, how people may be able to govern themselves and shape their shared lives, and how changes in ideas and attitudes sometimes have the potential to open up new possibilities.

Even when community leaders, government officials, legislators, corporate managers, and other institutional artisans consider proposals from academic analysts, recommendations are likely to require translation into simple, easily-communicated messages that can survive the rough and tumble of political debate, and ideas often become transformed in the process. In translating changes in policy into practice, there are many opportunities for reinterpretation, contestation, and unintended consequences (Pressman and Wildavsky 1984). These provide additional illustrations of why policy changes, including efforts to improve polycentric governance, may be unlikely to go far if simply pushed from the top down. Instead change may be more successful if advanced by supportive policy coalitions, with negotiation and adjustment to respond to diverse interests, and continuing efforts by proponents that go well

beyond just enacting legislation or having a new policy promulgated (Sabatier and Weible 2016; Andrews 2013).

Elinor Ostrom synthesized a set of design principles for robust governance of local commons (E. Ostrom 1990; Cox, Arnold, and Tomás 2010; Tarko 2017) including the use of nested organizational structures. A crucial insight leading to the design principles was that while local rules for resource governance were incredibly diverse, and had been customized to fit particular circumstances, there were nevertheless more general principles associated with long-enduring commons. The design principles do not offer a simple formula or checklist sufficient for success. However, they can be used to identify key questions to consider for institutional design of polycentric governance (E. Ostrom 2005, 270–71). For practicing polycentric governance at larger scales, some relevant questions and considerations for institutional design concern:

- *Boundaries.* Identifying how users from multiple communities could share or restrict access to resources, including situations where boundaries may be overlapping, ambiguous, or fuzzy
- *Local fit.* Configuring rules to fit with conditions, including the movement of water, livestock, fish, air, or other mobile resources across wider areas that encompass multiple communities and governmental units
- *Fairness of benefits and costs.* Understanding the potential gains and costs of changes in interaction across wider scales and multiple organizations; how costs and benefits are or could be distributed among different organizations and others affected, and whether potential gains are sufficient to offset higher transaction costs
- *Representation.* How to choose representatives and keep them accountable within federations or other complex networks of relationships; how to ensure that large numbers of users are informed and able to participate
- *Accountability.* Monitoring resource use at wider scales, including impacts (externalities) affecting distant users, especially when impacts are not easily visible as part of self-monitoring by users during their everyday life
- *Conflict resolution.* Finding low-cost and effective ways to resolve conflicts between communities, agencies, and other stakeholders
- *Graduated sanctions.* How to efficiently get “strangers” to comply with rules, particularly those less affected by local norms and social pressures
- *Autonomy.* Whether and how government agencies and other powerful interests may respect and empower local autonomy, or be open to sharing authority as part of co-management arrangements
- *Nested enterprises.* Arranging nested or overlapping institutions, in terms of scale, types of linkages, conflict resolution mechanisms, and other considerations.

In institutional design, the concept of checks-and-balances involves distributing authority, “using ambition against ambition” so that those who are dissatisfied have recourse to voice their objections and contest actions that might harm their interests. While sometimes taken for granted, conventional institutional mechanisms such as specialized roles for an organization president, secretary, and treasurer; separation of executive, legislative, and judicial power; disclosure of information; and procedures for public deliberation are part of an institutional heritage of ways to spread decision

making authority among multiple centres. Such mechanisms may be particularly important for federations and other overarching institutions that link multiple decision centres. Such mechanisms offer ways of arranging autonomy, mutual adjustment, and conflict resolution within a larger institutional framework. Similarly, good governance principles such as transparency and accountability increase the ability of those who are involved to monitor and engage. The sharing of information and decisionmaking processes may be able to take advantage of newer technologies such as mobile phones, the internet, and remote sensing that affect monitoring, transparency and other principles. These may be particularly useful in polycentric contexts involving wide areas, multiple resources, complex interactions, and diverse networks of participants. Decision support systems can be designed to support a range of participants in polycentric systems (Zulkafli et al. 2017).

The composition of the board of a federation or other higher-level organizations often involves decisions about how various groups will be represented. It may incorporate decision rules designed to maintain the influence and autonomy of participating organizations, such as emphasizing consensus or requiring supermajorities for some decisions. Conventional organizational design concerns, such as span of control, the optimal number of participants for effective meetings, and the use of committees and subcommittees, may be important considerations in designing effective and efficient polycentric governance structures.

The discussion of the design of the United States constitution contained in the Federalist Papers offers a series of essays, by institutional artisans, about ways of arranging authority, including checks-and-balances, ways of distributing authority between national and state governments, and choices and trade-offs between faster versus more thorough processes for making decisions (Hamilton, Jay, and Madison 2009; V. Ostrom 2008). There is sometimes a tendency to assume a simple choice between unitary central rule or independent local control. For thinking about polycentric governance, an example of an important but possibly non-intuitive concept is that of concurrent jurisdiction between federal and state governments, in which the federal government has direct jurisdiction over citizens for some matters, while other matters are left for individual states (V. Ostrom 2008). Concurrent jurisdiction offers an illustrative example of how overarching rules may be creatively arranged, including their associated tensions, debates, and changes over time.

The questions and mechanisms for crafting polycentricity discussed in this section illustrate some of the principles for polycentric practice outlined in the introduction. Polycentricity offers ideas about how to organize at multiple scales, linking different decision centres such as multiple communities and government agencies. Institutional artisans can work together to craft agreements, drawing on their knowledge and a shared heritage of examples and ideas. Principles for institutional design can identify important questions to ask, while institutional arrangements can be customized to fit specific conditions. Institutional artisans can engage in bricolage, recombining and adapting existing institutions in new ways, learning from the past and from experience in other decision centres within polycentric systems.

11.5 Vignette: Watersheds and Problemsheds

Governance of river basins typically involves multiple communities, agencies, and uses of water, a multiplicity of organizations and issues, with shared and conflicting interests at multiple scales, and so is a promising area for application of polycentricity. In river basins, it has often proven possible to convene multi-stakeholder platforms to discuss issues, explore problems, and pursue improvements (Sabatier et al. 2005; Boelens et al. 1998; Steins and Edwards 1998; Lubell, Robins, and Wang 2014). There is a risk that such efforts may be ineffective, especially if driven more by outside interests than local initiative and may lead to time wasted on “talk shops,” agreements without substance, or plans that never get put into practice. There are important questions about who is included, and how to promote inclusion and equity. Nevertheless, even where there are strong conflicts, a process of continuing dialogue, including relevant fact-finding and exploration of options, has often turned out to be surprisingly effective in building shared understanding, consensus on ways to move forward, and practical efforts and results.

Efforts focused on addressing specific problems and conflicts may offer fertile opportunities for bringing together effective coalitions. Despite contentious debates about large dams there are a variety of interesting results that have been achieved through working to adjust releases from large reservoirs to better serve the needs of downstream habitats and water users. Such “reservoir reoperation” often requires only minor costs in terms of energy income in comparison to the broader benefits downstream (Richter and Thomas 2007).

Groundwater basins in southern California face challenges including depletion and seawater intrusion. They offer an instructive example of polycentric governance where irrigation districts, urban water utilities and other specialized government agencies have cooperated, sometimes (but not always) successfully, to replenish aquifers and reverse seawater intrusion (Blomquist 1992). California’s state government has not tried to take full control over local governance of surface or groundwater. Instead the state provided a legal framework that enabled water user organizations to be established and to work together, and supported research to better understand local conditions.

In California, groundwater disputes could be taken to court, for example to assert or protect rights to water (Blomquist 2009). Rather than a judge making a final decision, the judge instead could encourage and provide legal backing for a negotiated settlement agreement. An agreement to settle a dispute could thus constitute a new institution with the legal authority to carry out tasks such as monitoring groundwater use; contracting for technical analysis and engineering design, pursuing funding, and carrying out works such as recharging aquifers, and monitoring and taking action against those who violate the agreement. Equity courts that could approve settlement agreements are an example of an enabling mechanism that facilitated the emergence of polycentric self-governance in some areas. More recently, California’s 2014 Sustainable Groundwater Management Act provides a more specific legal framework, which still emphasizes local level groundwater governance within an overarching context of state-level rules (Kiparsky et al. 2017; Conrad et al. 2018).

Concepts concerning integrated water resources management (IWRM) (Global Water Partnership 2008) offer ideas seemingly quite compatible with polycentricity including ways of incorporating the hydrological linkages of water within basins, competing uses, multiple government agencies and user organizations, and academic disciplines. The principles of IWRM explicitly include participation of stakeholders, and subsidiarity, putting decision-making at the lowest appropriate level. In theory IWRM is quite compatible with subsidiarity, participation, federated structures, and polycentric organization at multiple scales in river basins.

However, attempts to implement IWRM have often had limited impact (Biswas 2004; Schlager and Blomquist 2008). The ways in which water is linked within larger basins can become a justification for approaches that try to establish large scale formal organization at the river basin level, pushed by national-level agencies, hierarchically arranged in terms of basins and levels of government jurisdiction. The principle of organization along the lines of basin hydraulic boundaries may also become an excuse to neglect or bypass key stakeholders, such as cities and their mayors, or provincial governors. A too rigid emphasis on organizing water users solely along hydraulic lines of canals and catchments can fail to take advantage of the social capital of how people are already organized in villages, districts, cities, and associated patterns of settlement and political jurisdiction. Hydrologically-based approaches to organization may also be used or abused to try to expand the authority of water agencies, while failing to build effective coalitions needed to enact and implement policy changes. In practice IWRM efforts can end up emphasizing comprehensive formal planning mechanisms, reliant on expert analysis, and may miss opportunities for more modest self-organized problem-solving initiated by ad hoc coalitions of organizations, which would depend on lots of messy trial-and-error.

A polycentric perspective does not necessarily require rejecting the potential for management in accordance with resource boundaries, use of formal planning mechanisms, or forms of centralized control. It does raise questions about how to encourage problem-solving initiatives at appropriate scales, facilitating efforts by those involved, which may offer more feasible and appropriate pathways for change. This may involve looking at *problemsheds* (Kneese 1968) formed by those concerned with a particular issue, rather than only watersheds, and a more modest, pragmatic or expedient approach to addressing priority opportunities (Moriarty et al. 2010; World Bank 2003; Lankford et al. 2007; Woodhouse and Muller 2017).

Comparative research on river basin governance in many countries indicates that polycentricity can contribute to better performance and better institutional adaptation, such as to climate change (Pahl-Wostl et al. 2012; Pahl-Wostl and Knieper 2014). Polycentricity makes a difference where there is both horizontal coordination and vertical distribution of power, in which lower level units have genuine autonomy, as well as overarching institutions in the form of coordination structures such as overall accepted rules. In practical terms, a pathway to polycentric governance requires paying attention to horizontal coordination, vertical distribution of power, and the development of overarching institutions.

11.6 Facilitating Polycentric Governance

A polycentric perspective tends to be particularly interested in ways in which people and organizations can act on their own initiative, self-organizing to cope with shared problems. As discussed above, bringing together representatives of different water users and areas in a river basin has sometimes been an effective way to create agreement, even in the presence of many conflicting interests. For local natural resources management, a key intervention has often been to provide community organizers of some kind to facilitate collective action at the local level, and in some cases to also assist in the formation of higher-level federations. Examples include formation of water user federations at the secondary or scheme level, and forest user federations encompassing multiple villages, as well as wider forums at river basin, state/provincial, and national levels.

In his work as a consultant on the drafting of the natural resources article for the constitution of the State of Alaska, Vincent Ostrom declined to simply draft wording on his own as an expert. Instead, he chose to facilitate a process of common inquiry involving a series of discussions about draft language: within a subcommittee on natural resources; in the larger constitutional committee; through responses to drafts published in newspapers and sent to households; and at local meetings during a recess in the state's constitutional convention, (V. Ostrom 2008; Allen and Lutz 2009; Allen 2014). This process of constitutional choice provided a way to explore a range of issues and seek language that would reflect the values and experience of Alaskans and fit with the complex characteristics of common and concurrent use of resources they sought to govern together. Those involved in writing the constitution acted as public entrepreneurs, drafting and redrafting institutional arrangements to serve the common good, with an outside expert acting only as one source of ideas, questions, and synthesis within the larger process of common inquiry.

A variety of techniques are available for helping people get to know each other and learn to work together, including those developed in terms of facilitation, public participation, community engagement, dialogue and deliberation, and alternative dispute resolution. More specialized processes such as multi-stakeholder dialogue (Boelens et al. 1998; Edmunds and Wollenberg 2001; Focht and Trachtenberg 2005; Ratner and Smith 2014), may be particularly suitable for facilitating cooperation among diverse interests and organizations, but need due attention to differences among participants. Where adequate funding is available, it can be useful to hire specialized facilitators, especially in cases where there are severe and long-standing conflicts, or major differences in knowledge and power among participants. However, this does not mean that complicated methods are always essential or effective. Even in cases such as international negotiations, among highly skilled professionals with abundant resources, simple activities such as an informal “walk in the woods” can play a crucial role in opening up solutions. Where participants are already familiar with workshop processes such as breakout groups and plenary reporting and discussions, a minimalist approach to facilitation may be sufficient (Weisbord and Janoff 2007).

Availability of information, and additional research may help to understand resource characteristics, especially where resource availability and dynamics are not easy to see and understand, such as for fisheries, groundwater, or water quality (Schlager, Blomquist, and Tang 1994; Schlager 2005). Understanding resource characteristics

may be crucial in figuring out whether and how polycentric governance might be organized, such as whether the resource is highly localized or widely dispersed, fixed or mobile, rapidly renewable or vulnerable to degradation, easily observed or hard to understand without systematic analysis, very important (salient) for user livelihoods or not, and so forth. In multi-stakeholder processes, joint fact-finding can be important as a process not only for forging personal connections but also to build common knowledge and mutual understanding among those involved in trying to resolve disputes and craft cooperation for a river basin, forest, or other shared resources.

Academic disciplines, professional societies, and publications contribute to the exchange of ideas and creation of consensus within epistemic communities, such as among academics and experts, that help define how problems are framed and what kind of solutions are considered (Haas 1993). Professional organizations and coalitions may also engage in deliberate setting of standards. Advocacy of new ideas, and relevant research, can help to shift understanding and agendas for action within epistemic communities and broader publics. Changes in professional networks and knowledge are themselves a polycentric process and may play a crucial role in changing ideas about polycentric governance, including for management of water and other natural resources.

A key argument for polycentricity is that it offers more opportunity for experimentation and learning, discovering useful new knowledge. Approaches that ostensibly decentralize, but impose standardized approaches, panaceas (E. Ostrom, Janssen, and Andries 2007), and emphasize one-way top-down implementation, with extensive regulation and guidance (tutelage) thereby miss a major opportunity for learning and potential avenue to success. As an example of social learning, the fifty US states are sometimes referred to as “laboratories for democracy.” Different states try out different approaches, see what happens, and then can learn from each other’s experience. Similar opportunities for shared learning can be cultivated as an essential part of polycentricity.

Laws and policy may facilitate or impede the creation of polycentric governance. In many cases, an important way to “develop” polycentric governance may well be to reduce regulation and top-down control, to leave more space for self-organization by citizens and their organizations. Beyond that are questions of what may be done, particularly by governments, to strengthen autonomy, promote fruitful interactions, and encourage development of overarching rules that make things better. There are multiple mechanisms through which governments can encourage self-organization (E. Ostrom 1990; Sarker 2013). Legislation can help empower polycentric governance if it enables associations and other organizations at different scales to obtain legal status, enter into binding contracts, protect their interests in court, and mobilize money and other resources, and to work together to create overarching institutions for cooperation, competition, and conflict resolution.

For natural resources governance, a key recommendation has often been to enable the creation of “special districts,” bodies with a degree of governmental authority, focused on a particular task. Special districts, such as irrigation districts, drainage districts, and so forth are essentially a form of local government authority concerned with a particular topic and organized along resource boundaries, rather than administrative jurisdictions such as districts and provinces. After being properly established, such an

authority can have power to make and enforce rules concerning resource use, including requiring compulsory payment of fees and enforcing sanctions against those who violate rules. This contrasts with the risks of assuming that user groups for those sharing a natural resource can simply be organized using existing legislation for cooperatives or other voluntary associations, where people are free to join or leave as they wish. Instead, the ways in which each person's actions affect others mean that effective cooperation may depend on the ability to make enforceable rules about resource use, for example to exclude those who do not cooperate or contribute, and to credibly threaten to punish those whose actions harm others or damage the shared resource. Sometimes local social solidarity may suffice to overcome the lack of explicit legal authority, especially within small face-to-face communities. However, norms and informal sanctions become less effective as the scale and scope of governance become larger, and as people are less embedded in a web of overlapping social relationships. Special districts with legal authority can thus act as a crucial component of polycentric governance, able to cooperate among themselves and engage in co-management agreements with resource agencies.

As should be clear, polycentric governance goes beyond a one-dimensional concern with centralizing or decentralizing to look at a variety of options for horizontal (peer-to-peer), vertical (hierarchical), and cross-scale (diagonal) linkages and ways of arranging authority, including conflict resolution mechanisms and other specialized services. There may be many different opportunities for organizing at intermediate, “meso” scales, and many ways in which such arrangements may be modified. In many cases, what is discussed in relation to the subsidiarity principle of organizing at the “lowest possible level” may only be practicable if embedded within arrangements for wider scale linkages, including conflict resolution, recourse against local injustice, technical support, and regulation to protect broader interests, in other words, a polycentric network of institutional arrangements.

Power is often oversimplified into a merely a matter of control and coercion, “power over,” while a polycentric perspective is very concerned with enabling the capacity for self-governance of communities and other organizations, “power to” (power as freedom, capacity to act) (Sen 2000), and with the opportunities for making things better through cooperation, “power with” (V. Ostrom 1997). A polycentric perspective can aid in identifying the multiple opportunities that may exist for power-sharing, creating “power with,” capacity for constituting cooperation between organizations that can retain autonomy while becoming better able to coordinate their actions and resolve conflicts. On a more basic level, citizens can be considered, treated, and expected to act not simply as occasional voters and passive beneficiaries, but instead as people empowered to engage in improving their lives, co-producers and co-managers, active in constituting new arrangements for beneficial interaction between autonomous organizations.

11.7 Conclusions: Practicing Polycentric Governance

As discussed in this book, polycentricity concerns not just a type of governance but also a perspective on how organizations can interact. Polycentric governance offers a variety of alternatives to vertical hierarchies or flat decentralization. Practicing polycentric governance focuses on the opportunities to organize governance arrangements that match the scale of particular problems and highlights the potential for action by those

who are ready to work together in improving a situation. Polycentricity is made more effective by ideas and attitudes of citizens who feel able to associate and act together to constitute new or improved organizations and inter-organizational arrangements.

For a particular situation, it is important to assess ways in which various aspects of polycentricity already exist, and how polycentricity may be created or modified. That involves looking at the stakeholders, the extent to which there are multiple centres for decision making, what kinds of interaction exist between them, including how much (or how little) autonomy each has, and how these dimensions of governance might be changed to better fit a social situation and pursue the objectives of institutional artisans.

Research such as that reported in Section 3 of this book offers insights into different polycentric ways in which people organize themselves to govern water and other natural resources, and how such institutional arrangements perform. Such research can contribute to a better understanding of the options available for designing or improving polycentric governance structures, such as nested federations of user groups, co-management between resource users and government agencies, and contracting to provide specialized services in local public economies. There is much scope for better understanding the diversity of potential polycentric arrangements, how different institutional configurations may be related to resource characteristics and to performance outcomes, and how transformations in polycentric governance occur (Heikkila, Villamayor-Tomas, and Garrick 2018; Jordan et al. 2018).

Organization leaders, government officials, applied researchers, and others act as public entrepreneurs and institutional artisans as they engage in discussion and decisions at the constitutional level to establish or modify institutions for polycentric governance, and at the collective choice level in making specific rules, and then act operationally to put those rules into use. Artisanship often takes the form of institutional bricolage, creatively adapting and recombining existing institutions, including mechanisms that facilitate sharing power among multiple centres. The design of polycentric institutional arrangements is not a neutral technical exercise, but instead is inescapably political, part of larger processes of societal contestation over how power and benefits are created and distributed. In assessing institutional options, political feasibility is thus as important a constraint as technical feasibility. In contrast to the tendency to assume that solutions must be imposed through top-down control, a polycentric perspective highlights the potential for creating “power with” through contestation, negotiation, and cooperation.

Polycentric governance may be promoted by providing information about polycentric possibilities, as this book does, and through policies and legislation that facilitate mutual adjustment and self-organization of overarching institutions for cooperation, shared learning, competitive improvement, and conflict resolution. More specific efforts may also be initiated to bring people together, to share information and experience and explore opportunities for fruitful interaction at wider scales, putting polycentric governance into practice.

References

- Aligica, Paul D., and Vlad Tarko. 2012. 'Polycentricity: From Polanyi to Ostrom, and Beyond'. *Governance* 25 (2): 237–262.
- Allen, Barbara. 2014. *Vincent Ostrom and the Alaska Constitution in Ostrom's the Movie*. <https://vimeo.com/channels/ostromsthemovie/84354523>.
- Allen, Barbara, and Donald Lutz. 2009. 'Experience Guides Theory: "Discovering" the Political Theory of a Compound Republic'. *The Practice of Constitutional Development: Vincent Ostrom's Quest to Understand Human Affairs*, 73.
- Andrews, Matt. 2013. *The Limits of Institutional Reform in Development: Changing Rules for Realistic Solutions*. Cambridge: Cambridge University Press.
- Biswas, A. K. 2004. 'Integrated Water Resources Management: A Reassessment.' *Water International* 29 (2): 248–56.
- Blomquist, William. 1992. *Dividing the Waters: Governing Groundwater in Southern California*. San Francisco: Institute for Contemporary Studies.
- . 2009. 'Crafting Water Constitutions in California'. *The Practice of Constitutional Development: Vincent Ostrom's Quest to Understand Human Affairs*, 105.
- Boelens, Rutgerd, Axel Dourojeanni, Alfredo Duran, and Paul Hoogendam. 1998. 'Water Rights and Watersheds: Managing Multiple Water Uses and Strengthening Stakeholder Platforms'. In *Searching for Equity: Conceptions of Justice and Equity in Peasant Irrigation*, edited by Rutgerd Boelens and Gloria Davila. Assen, Netherlands: Van Gorcum.
- Borgatti, Stephen P., Martin G. Everett, and Jeffrey C. Johnson. 2013. *Analyzing Social Networks*. SAGE Publications Limited.
- Boyte, Harry, Stephen Elkin, Peter Levine, Jane Mansbridge, Elinor Ostrom, Karol Soltan, and Rogers Smith. 2014. 'The New Civic Politics: Civic Theory and Practice for the Future'. *The Good Society* 23 (2): 206–211.
- Brugha, Ruairi, and Zsuzsa Varvasovszky. 2000. 'Stakeholder Analysis: A Review'. *Health Policy and Planning* 15 (3): 239–246.
- Carlsson, L., and A. Sandström. 2008. 'Network Governance of the Commons'. *International Journal of the Commons* 2 (1): 33–54.
- Chaffin, B. C., A. S. Garmestani, Hannah Gosnell, and R. K. Craig. 2016. 'Institutional Networks and Adaptive Water Governance in the Klamath River Basin, USA'. *Environmental Science & Policy* 57: 112–121.
- Challen, Ray. 2000. *Institutions, Transaction Cost and Environmental Policy: Institutional Reform for Water Resources*. Edward Elgar Pub.
- Chambers, R. 1994. 'Participatory Rural Appraisal (PRA): Analysis of Experience'. *World Development* 22 (9): 1253–1268.
- Cleaver, Frances. 2012. *Development Through Bricolage: Rethinking Institutions for Natural Resource Management*. 1st ed. Routledge.
- Coase, R. H. 1990. *The Firm, the Market and the Law*. Chicago: University of Chicago Press.
- Conrad, E., T. Moran, M. DuPraw, D. Ceppos, J. Martinez, and W. Blomquist. 2018. 'Diverse Stakeholders Create Collaborative, Multilevel Basin Governance for Groundwater Sustainability'. *California Agriculture* 72 (1): 44–53.
- Cooperrider, David L. 2005. *Appreciative Inquiry: A Positive Revolution in Change*. 1st ed. Berrett-Koehler.

- Cox, Michael, Gwen Arnold, and Sergio Villamayor Tomás. 2010. 'A Review of Design Principles for Community-Based Natural Resource Management.' *Ecology & Society* 15 (4).
- Cumming, Graeme S. 2016. 'Heterarchies: Reconciling Networks and Hierarchies'. *Trends in Ecology & Evolution* 31 (8): 622–632.
- Cunningham, Gord, and Alison Mathie. 2002. 'Asset-Based Community Development: An Overview'. *Coady International Institute*. Retrieved February 4: 2009.
- DeCaro, Daniel, Brian Chaffin, Edella Schlager, Ahjond Garmestani, and J. B. Ruhl. 2017. 'Legal and Institutional Foundations of Adaptive Environmental Governance'. *Ecology and Society* 22 (1).
- Edmunds, David, and Eva Wollenberg. 2001. 'A Strategic Approach to Multi-Stakeholder Negotiations'. *Development and Change* 32 (231–253).
- Ellerman, D., and A. O Hirschman. 2006. *Helping People Help Themselves: From the World Bank to an Alternative Philosophy of Development Assistance*. Univ of Michigan Pr.
- FES, (Foundation for Ecological Security). 2010. *Social and Institutional Aspects: FES Source Book*. Anand, Gujarat: FES.
- . 2014. 'Evolving Concepts for Assisting Villages in Governing Landscapes'. Foundation for Ecological Security.
- Focht, Will, and Zev Trachtenberg. 2005. 'A Trust-Based Guide to Stakeholder Participation'. In *Swimming Upstream: Collaborative Approaches to Watershed Management*, edited by Paul A Sabatier, Will Focht, Mark Lubell, Zev Trachtenberg, Arnold Vedlitz, and Marty Matlock, 85–135. Cambridge, MA: MIT Press.
- Foucault, M. 1984. *The Foucault Reader*. Pantheon Books.
- Galaz, Victor, Beatrice Crona, Henrik Österblom, Per Olsson, and Carl Folke. 2011. 'Polycentric Systems and Interacting Planetary Boundaries—Emerging Governance of Climate Change–Ocean Acidification–Marine Biodiversity'.
- Gibson-Graham, Julie Katherine. 2006. *A Postcapitalist Politics*. U of Minnesota Press.
- Global Water Partnership. 2008. 'Integrated Water Resources Management'. 2008. http://www.gwptoolbox.org/index.php?option=com_content&view=article&id=8&Itemid=3.
- Goodin, Robert E. 1998. *The Theory of Institutional Design*. Cambridge University Press.
- Grimble, Robin, and Kate Wellard. 1997. 'Stakeholder Methodologies in Natural Resource Management: A Review of Principles, Contexts, Experiences and Opportunities'. *Agricultural Systems, Socio-economic Methods in Renewable Natural Resources Research*, 55 (2): 173–93.
- Haas, Peter M. 1993. 'Epistemic Communities and the Dynamics of International Environmental Co-Operations'. In *Regime Theory and International Relations*, edited by Volker Rittberger with Peter Mayer, 168–201. Oxford: Clarendon Press.
- Hamilton, Alexander, John Jay, and James Madison. 2009. 'The Federalist Papers'. 2009. <https://www.gutenberg.org/files/1404/1404-h/1404-h.htm>.
- Hauck, Jennifer, Christian Stein, Eva Schiffer, and Marie Vandewalle. 2015. 'Seeing the Forest and the Trees: Facilitating Participatory Network Planning in Environmental Governance'. *Global Environmental Change* 35: 400–410.

- Heikkila, Tanya, Sergio Villamayor-Tomas, and Dustin Garrick. 2018. 'Bringing Polycentric Systems into Focus for Environmental Governance.' *Environmental Policy and Governance* 28 (4): 207–318.
- Hirschman, Albert O. 1971. 'Introduction: Political Economics and Possibilism'. *A Bias for Hope: Essays on Development in Latin America*.
- . 1986. 'In Defense of Possibilism'. *Albert O. Hirschman, Rival Views of Market Society and Other Recent Essays*, 171–75.
- Jones, Candace, William S. Hesterly, and Stephen P. Borgatti. 1997. 'A General Theory of Network Governance: Exchange Conditions and Social Mechanisms'. *Academy of Management Review* 22 (4): 911–945.
- Jordan, Andrew, Dave Huitema, Harro van Asselt, and Johanna Forster. 2018. *Governing Climate Change: Polycentricity in Action?* Cambridge University Press.
- Kauffman, Stuart. 1995. *At Home in the Universe: The Search for Laws of Self-Organization and Complexity*. New York: Oxford University Press.
- Kiparsky, Michael, Anita Milman, Dave Owen, and Andrew T. Fisher. 2017. 'The Importance of Institutional Design for Distributed Local-Level Governance of Groundwater: The Case of California's Sustainable Groundwater Management Act'. *Water* 9 (10): 755.
- Kneese, Allen V. 1968. 'The "Problem Shed" as a Unit for Environmental Control'. *Archives of Environmental Health: An International Journal* 16 (1): 124–127.
- Lankford, Bruce A., Douglas J. Merrey, Julien Cour, and Nick Hepworth. 2007. *From Integrated to Expedient: An Adaptive Framework for River Basin Management in Developing Countries*. International Water Management Institute.
- Lepenies, Philipp H. 2008. 'Possibilism: An Approach to Problem-Solving Derived from the Life and Work of Albert O. Hirschman'. *Development and Change* 39 (3): 437–459.
- Lubell, Mark, Adam Douglas Henry, and Mike McCoy. 2010. 'Collaborative Institutions in an Ecology of Games'. *American Journal of Political Science* 54 (2): 287–300.
- Lubell, Mark, Garry Robins, and Peng Wang. 2014. 'Network Structure and Institutional Complexity in an Ecology of Water Management Games'. *Ecology and Society* 19 (4).
- Mac Odell. n.d. 'Appreciative Planning and Action: Mission Statement'. Accessed 2 September 2012. <http://www.macodell.com/page-Appreciative-Planning>.
- Moriarty, Patrick, Charles Batchelor, Peter Laban, and Hazem Fahmy. 2010. 'Developing a Practical Approach to "light IWRM" in the Middle East'. *Water Alternatives* 3 (1): 122–136.
- Morrison, Tiffany H., W. Neil Adger, Katrina Brown, Maria Carmen Lemos, Dave Huitema, and Terry P. Hughes. 2017. 'Mitigation and Adaptation in Polycentric Systems: Sources of Power in the Pursuit of Collective Goals'. *Wiley Interdisciplinary Reviews: Climate Change* 8 (5): n/a-n/a.
- NCDD. 2017. 'NCDD Resource Center'. National Conference on Dialogue and Deliberation. 2017. <http://ncdd.org/rc/>.
- North, Douglass C. 1990. *Institutions, Institutional Change and Economic Performance*. New York: Cambridge University Press.

- Ostrom, Elinor. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.
- . 2005. *Understanding Institutional Diversity*. Princeton, NJ: Princeton University Press.
- . 2009. ‘A General Framework for Analyzing Sustainability of Social-Ecological Systems’. *Science* 325: 419.
- Ostrom, Elinor, Marco A. Janssen, and John M. Andries. 2007. ‘Introduction: Going Beyond Panaceas’. *Proceedings of the National Academy of Sciences* 104 (39): 15176–78.
- Ostrom, Vincent. 1980. ‘Artisanship and Artifact’. *Public Administration Review*, 309–17.
- . 1997. *The Meaning of Democracy and the Vulnerability of Democracies*. Ann Arbor: University of Michigan Press.
- . 2008. *The Political Theory of a Compound Republic: Designing the American Experiment*. Lexington Books.
- Pahl-Wostl, Claudia, and Christian Knieper. 2014. ‘The Capacity of Water Governance to Deal with the Climate Change Adaptation Challenge: Using Fuzzy Set Qualitative Comparative Analysis to Distinguish between Polycentric, Fragmented and Centralized Regimes’. *Global Environmental Change* 29: 139–154.
- Pahl-Wostl, Claudia, Louis Lebel, Christian Knieper, and Elena Nikitina. 2012. ‘From Applying Panaceas to Mastering Complexity: Toward Adaptive Water Governance in River Basins’. *Environmental Science & Policy* 23: 24–34.
- Pierson, Paul. 2000. ‘The Limits of Design: Explaining Institutional Origins and Change’. *Governance* 13 (4): 475–499.
- Prell, Christina, Klaus Hubacek, and Mark Reed. 2009. ‘Stakeholder Analysis and Social Network Analysis in Natural Resource Management’. *Society and Natural Resources* 22 (6): 501–518.
- Pressman, Jeffrey L., and Aaron B. Wildavsky. 1984. *Implementation: How Great Expectations in Washington Are Dashed in Oakland: Or, Why It’s Amazing That Federal Programs Work at All, This Being a Saga of the Economic Development Administration as Told by Two Sympathetic Observers Who Seek to Build Morals on a Foundation of Ruined Hopes*. Univ of California Press.
- Ratner, Blake D., and William E. Smith. 2014. ‘Collaborating for Resilience: A Practitioner’s Guide’. Collaborating for Resilience.
- Reed, Mark S., Anil Graves, Norman Dandy, Helena Posthumus, Klaus Hubacek, Joe Morris, Christina Prell, Claire H. Quinn, and Lindsay C. Stringer. 2009. ‘Who’s in and Why? A Typology of Stakeholder Analysis Methods for Natural Resource Management’. *Journal of Environmental Management* 90 (5): 1933–1949.
- Richter, Brian D., and Gregory A. Thomas. 2007. ‘Restoring Environmental Flows by Modifying Dam Operations’. *Ecology and Society* 12 (1): 12.
- Sabatier, Paul A., Will Focht, Mark Lubell, Zev Trachtenberg, Arnold Vedlitz, and Marty Matlock. 2005. *Swimming Upstream: Collaborative Approaches to Watershed Management*. MIT press.

- Sabatier, Paul A., and Christopher M. Weible. 2016. 'The Advocacy Coalition Framework: Innovations and Clarifications'. In: *Sabatier, PA (Ed.). Theories of the Policy Process, Second Edition*, 189–217.
- Sarker, Ashutosh. 2013. 'The Role of State-Reinforced Self-Governance in Averting the Tragedy of the Irrigation Commons in Japan'. *Public Administration*.
- Schiffer, Eva, and Jennifer Hauck. 2010. 'Net-Map: Collecting Social Network Data and Facilitating Network Learning through Participatory Influence Network Mapping'. *Field Methods* 22 (3): 231–249.
- Schlager, Edella. 2005. 'Getting the Relationships Right in Water Property Rights'. In *Water Rights Reform: Lessons for Institutional Design*, edited by Bryan Bruns, Claudia Ringler, and Ruth Meinzen-Dick. Washington, D.C.: IFPRI.
- Schlager, Edella, and William Blomquist. 2008. *Embracing Watershed Politics*. University Press of Colorado.
- Schlager, Edella, William Blomquist, and Shui Yan Tang. 1994. 'Mobile Flows, Storage and Self-Organized Institutions for Governing Common-Pool Resources'. *Land Economics* 70 (3): 294–317.
- Sen, Amartya. 2000. *Development as Freedom*. New York: Anchor Books.
- Steins, Nathalie A., and Victoria M Edwards. 1998. 'Platforms for Collective Action in Multiple-Use CPRs'. Presented at *Crossing Boundaries, the Seventh Annual Conference of the International Association for the Study of Common Property*.
- Tarko, Vlad. 2017. *Elinor Ostrom: An Intellectual Biography*. Oxford University Press.
- Varvasovszky, Zsuzsa, and Ruairí Brugha. 2000. 'How to Do (or Not to Do) ... A Stakeholder Analysis'. *Health Policy and Planning* 15 (3): 338–345.
- Weisbord, M. R., and S Janoff. 2007. *Don't Just Do Something, Stand There! Ten Principles for Leading Meetings That Matter*. Berrett-Koehler Publishers.
- Woodhouse, P., and M. Muller. 2017. 'Water Governance—An Historical Perspective on Current Debates'. *World Development* 92: 225–241.
- World Bank. 2003. 'World Bank Water Resources Sector Strategy: Strategic Directions for World Bank Engagement'. *World Bank, Washington, DC*.
- Zulkafli, Zed, Katya Perez, Claudia Vitolo, Wouter Buytaert, Timothy Karpouzoglou, Art Dewulf, Bert De Bievre, Julian Clark, David M. Hannah, and Simrita Shaheed. 2017. 'User-Driven Design of Decision Support Systems for Polycentric Environmental Resources Management'. *Environmental Modelling & Software* 88: 58–73.