Visualizing Stakeholder Perspectives for Reflection and Dialogue on Scale Dynamics in Social–Ecological Systems

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Abstract

An understanding among societal actors of how social–ecological systems interact across multiple levels and scales contributes to better governance of those systems. This paper introduces a tool, Scale Perspectives, developed to help societal actors share their perspectives on issues of social–ecological systems governance in a multilevel framework. A first version showed that participants in a local and European case study associated a diverse range of levels and time frames with the same issues, but the version was not able to capture cross-level dynamics. A second

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version of the tool did allow for the visualization of cross-level dynamics, and was tested in live workshops where more opportunities for individual and group reflection were offered. The tool proved useful for sharing perspectives and strategic dialogue among the participants. The results show the potential of such tools to help societal actors tackle challenges related to scale dynamics in social–ecological systems governance.

Keywords: governance, scale, social–ecological systems

Introduction

Interacting human and natural systems, or social–ecological systems (Folke, 2006), are neither predictable nor wholly chaotic, but rather evolve through an interplay of changing subsystems that interact across space and time. Therefore, spatial and temporal scales—as well as various social scales—play a key role in understanding this complexity (Cash et al., 2006). The role of scale dynamics has important implications for the governance of social–ecological systems (Ostrom, 2009).

In this paper, we use the following definitions from scale and governance research (Cash et al., 2006; Gibson et al., 2000; Vervoort, Rutting et al., 2012):

- We define a scale as a way to structure a certain dimension (such as time, space, power)—examples are the metric system as a scale for geographic space, a jurisdictional hierarchy for state governance, and the Julian calendar for time.
- We define the positions on a scale as levels, for example, individual level, community level, district level, national level.

There is evidence that sharing knowledge and coordination of action across multiple levels and scales contributes to better governance of social–ecological systems (Cash et al., 2006; Kinzig et al., 2006). According to Ostrom (2009), understanding cross-level and cross-scale dynamics in social–ecological systems from the perspectives of many actors is crucial to understanding why some systems are sustainable and why some collapse. This brings in the need to involve diverse societal actors operating at different levels and scales, as well as the need for methods to facilitate exchange between these societal actors that let them explicate multilevel and multiscale issues and identify possible solutions.

This paper introduces Scale Perspectives, a simple tool for linking societal perspectives and generating dialogue about the governance of social–ecological systems. The tool was developed because of a perceived value of making multilevel systems dynamics a direct topic to address with stakeholders (Cash et al., 2006). The first, online, version of this tool was created to elicit societal perspectives

on social–ecological systems in a space of multiple governance levels and time frames, with an initial model in mind of experts and decision-makers gathering information about societal perspectives. The application of this tool to two case studies yielded promising results but also demonstrated the limits of the first version. Based on this first analysis we extended Scale Perspectives and applied a pen and paper version in two workshops. These applications demonstrated that beyond its function to elicit societal perspectives, the tool could serve as an empowering aid for societal actors that could be used for the sharing of perspectives on scale dynamics to guide deliberation and decision-making.

The objective of this paper is to evaluate Scale Perspectives as an example of a simple tool to help the sharing of societal stakeholders' perspectives about scale dynamics in social–ecological systems. This example serves in turn to address general challenges and opportunities around such exchanges of perspectives and their potential to guide multi-stakeholder action.

We will first discuss research on scale dynamics in social–ecological systems and the role of stakeholders' framing of scale dynamics. Next, we will introduce the first and second versions of Scale Perspectives and the case studies to which these versions have been applied. We will then present the results from both versions. Finally, we will discuss Scale Perspectives as an example of a tool to facilitate multi-stakeholder dialogue around scale dynamics in social–ecological systems and how this type of tool may help tackle some of the challenges identified around governance of such systems across multiple levels.

Perspectives on scale dynamics in social–ecological systems governance

Scales and levels are human-constructed forms of classification. Different societal actors maintain different perspectives on spatial levels and time frames (Cumming et al., 2006; Scott, 1998; Wilbanks & Kates, 1999). Research and thought on human perspectives on space and time has a long history, initially in philosophers—for example, Heidegger (1962), Husserl (1964), and Kant (1965/1781). Later, psychologies of time (Zimbardo & Boyd, 1999) and space (Freundschuh & Egenhofer, 1997) were developed more extensively. In social science, social systems are seen as partly disembedded from traditional notions of space and time (Giddens, 1990; Westley et al., 2002) and moreover, according to human geographers, spatial and temporal dynamics are shaped by changing power relations (Dahl, 1989; Ostrom, 1991, 1997; Sayre, 2005).

In environmental change literature, scale dynamics in biophysical systems have been a topic of research for many years (Holland, 1998; Holling, 1986; Klir, 1969; Kok et al., 2001; Levin, 1992). However, ideas about the role of societal

perspectives on space and time have also long been part of environmental change research—the *Limits to Growth* report by Meadows et al. (1972) posited that humans have a limited interest in and capacity for action when considering a geographic extent beyond their local communities and over long time periods. Participants in research by Boniecki (1980), Hoogstra and Schanz (2009), and Simons et al. (2004) showed a lack of engagement with events on a temporal extent beyond 10–15 years. In contrast to this spatial and temporal “myopia,” a “hyperopia” has been found linked to both scales in terms of problem recognition (Gifford et al., 2009; Uzzell, 2000): the longer term future was seen as more problematic than the shorter term by participants in these studies, and global concerns were seen as more problematic than local issues. Other psychological research has dealt with personal views of temporal and geographic scale related to environmental change concerns (Gifford et al., 2009; Lima & Castro, 2005; Uzzell, 2000), but this research has not been operationalized to provide direct input for a participatory social–ecological systems governance context.

In the domain of social–ecological systems research, scale and level dynamics have played a key role (Holling et al., 2002; Levin, 1999). Cash et al. (2006) summarize the challenges of cross-level and cross-scale governance as (1) the challenge of ignorance among actors of how systems are linked to or behave at other levels and scales; (2) mismatches between levels of governance and levels where issues play out; and (3) different societal actors holding a plurality of perspectives on which scales and levels should be focused on (for instance, attempting to frame problems as either exclusively global or local), and diverse interests on what needs to happen. Kok and Veldkamp (2011) link these practical challenges to challenges of theory development by emphasizing the need to involve nonscientist actors in theory development around scale. Considering these challenges, there is a role for tools that can help societal actors and the scientists among them identify and overcome ignorance of system dynamics at other levels and scales, allow for dialogue between perspectives on scale dynamics, and help resolve mismatches and enable better governance of social–ecological systems.

Scale Perspectives

Scale Perspectives represents a simple, visual way of dealing with stakeholders’ perspectives on the relevant levels on scales of jurisdictional space and of time, for their most pressing social–ecological change issues. The tool was developed because of an assertion based on the scaling and governance literature that the challenges of ignorance, a plurality of stakeholder perspectives, and the resulting scale mismatches could be overcome through facilitating direct attention to scale aspects of social–ecological systems governance.

Scale Perspectives uses a direct visual mode of representation to capture an integrated view of the spatial and temporal levels where issues are relevant according to stakeholders. This direct use of a framing of stakeholder perspectives by time and space is distinct from participatory systems modeling approaches where these dimensions play a role but are not the main focus (Voinov & Bousquet, 2010).

Scale Perspectives pre-frames spatial and temporal scales for users. This means that the tool does not allow full freedom for users to outline some of the many different scales that are possible to make their perspectives on social–ecological systems governance explicit (Cash et al., 2006). As part of the same research project that resulted in this paper, an approach (Scale Repertoire) that does allow for the capturing of a diversity of scales has been applied and reported in Vervoort, Rutting et al. (2012). However, this approach depended on long, in-depth visually facilitated interviews that produced highly individual results, limited in direct comparability to each other. The Scale Perspectives tool, by contrast, limits users in their subjective framing of scales but thereby aims to produce results faster and in a format that allows for sharing, comparison, and dialogue between societal actors.

Scale Perspectives was developed and used in two versions, with version 2 expanding the flexibility of user inputs possible in version 1. We will describe each version and its case studies first, and then present and discuss results from both versions.

Scale Perspectives version 1

Figure 1 shows an example of Scale Perspectives version 1. This version was used online in two case studies, both further described below. The first version of this tool was developed from the notion that it would be valuable for experts guiding decision-makers to be able to elicit and analyze societal perspectives on scale dynamics.

Figure 1. Scale Perspectives with an input example from a single participant. Users drag their preselected issues to levels that reflect their perspectives within fixed scales of time and space.

In Scale Perspectives version 1, participants started out by providing the social–ecological systems governance issues they are most concerned about. We chose to limit the top issues to five to keep the test accessible in terms of cognitive load (Miller, 1956). A form was first presented (before a time–space field from Figure 1 was shown) with the following question: “Which issues around environmental change and sustainability do you consider to be the most important for society to engage with?” Participants listed these issues themselves in five boxes. In the next step, users were asked to place dots representing their issues on a field framed by fixed scales of time and of different governance levels (Figure 1). Each marker on the scales represented a new governance level or time frame (with the different time frames representing levels on a temporal scale). Instead of being guided by focusing questions on specific levels, the participants were free to determine relevant levels themselves, in a fully integrated field of spatial and temporal dimensions. They were given the following instruction: “Place each of your chosen issues on the field below, which is framed by different spatial levels of jurisdiction and decision-making on the y axis, and by different time frames on the x axis. Place each issue in the combination of space and time you

think is most relevant for this issue.” The issues were placed randomly in the field, and participants were able to drag each issue to the location they thought most appropriate.

An optional comment box was made available for participants to describe the reasoning behind their placement of chosen social–ecological systems governance issues. Additionally, participants were asked to provide demographic information about themselves.

Version 1 case studies

Scale Perspectives version 1 was applied with 63 participants in two case studies. These two case studies were selected to represent different contexts and different geographic scales. In each case, the choice of case study was made because of the role Scale Perspectives could play in a larger process for each case. One case study focused on local and regional sustainable development communities, such as local groups of volunteers, citizens involved in local government projects, social entrepreneurs and others—part of a network of active groups in Oxfordshire, United Kingdom, with a demographically diverse group of participants. This network of communities and groups was chosen because of its active engagement with environmental and sustainability governance, which we assumed would ensure active participation in the use of the tool as well as benefits of insights coming out of the analysis for the network. In Oxfordshire, the Scale Perspectives tool was used as a first scoping of perspectives on the key levels of governance and time frames for top issues of sustainable development and natural resource management in the county. The results of Scale Perspectives version 1 were shared with the network and with government projects, and presented to two of the groups after they used version 2 of the tool and a scenarios exercise to inform their planning, to compare their perspectives to wider perspectives captured by the tool in the Oxfordshire network.

The second case study where Scale Perspectives version 1 was used was a European-level study with PhD researchers working in environmental science—the METIER (methods for interdisciplinary environmental research) network. In the METIER case, the outcomes of Scale Perspectives were used as an educational tool, and presented in a subsequent meeting of the network to reflect on the group’s spectrum of perspectives on social–ecological change in terms of governance levels and time frames.

Scale Perspectives version 1 was applied in these two cases because of its expected usefulness to the participants. The cases were contrasting: a highly diverse group of participants bound to a single region (Oxfordshire), and a uniform group of highly educated participants, diverse in their geographic

and cultural locations (METIER). This contrast allowed us to test whether the tool was, itself, applicable with participants across multiple levels and from multiple backgrounds.²

The Oxfordshire case study had 39 participants. Of these, 34 gave all required input. The Oxfordshire group was fairly evenly balanced on all demographic characteristics, featuring participants from nongovernmental organizations (NGOs), the private sector, government, academia and education, as well as from different education levels and age groups, with an even gender balance. In all respects, the METIER group was much more uniform, being an international network of (mainly relatively young and 75 percent male) PhD researchers connected to a series of seven courses on environmental research, with an emphasis on remote sensing, spatio-temporal model construction and geovisualization.

Scale Perspectives version 2

Scale Perspectives was used in a second set of case studies, this time in a pen and paper format in participatory workshops. These workshops focused on offering different ways to share perspectives on the future: analytic (through Scale Perspectives and Myths of Nature (Holling, 1979)) and experiential (through scenario narratives). A paper focusing on the comparison of analytic and experiential methods of eliciting and sharing stakeholder perspectives based on these case studies is published elsewhere (Vervoort, Kok et al., 2012) but does not address the use of Scale Perspectives in depth.

Partly as a result of the greater flexibility allowed by this version of Scale Perspectives being in pen and paper format, and partly because of the limits of working with specific points only in the spatial–temporal field of the Scale Perspectives tool in version 1, in version 2 participants were encouraged not to limit themselves to a single governance level or time frame for social–ecological systems governance issues. Instead, participants could use connection arrows and area demarcations to describe cross-level effects between different scales of social–ecological systems governance issues (Figure 2). The underlying model of interaction had also changed from using Scale Perspectives as a tool for gathering stakeholder perspectives and indirect analysis of these perspectives to a direct tool for sharing and exchanging scale perspectives to guide planning among societal actors. Each participant received a form where they were first asked to outline their key issues and then apply these to the Scale Perspectives field as they saw fit. Participants were allowed to elaborate on each issue and on cross-level links.

² See scaleperspectives.org to learn about the future availability of an open, digital version of Scale Perspectives version 1.

Figure 2. A digital version of a participant's entry in Scale Perspectives version 2 from the Oxfordshire Rural Community Council workshop, done with pen and paper. In this version, participants are allowed to contribute multiple elements of an issue and potential actions related to it in the field, and draw connections between these elements.

In both workshops around 15 minutes were spent on participants' individual inputs into the Scale Perspectives tool. Another 45 minutes were spent sharing and discussing the Scale Perspectives inputs. This was done by participants showing and explaining their inputs into the Scale Perspectives forms, which formed the basis for a visually annotated dialogue. After the workshop, individual contributions were combined in the same Scale Perspectives field and digitized based on the visual notes of the dialogue and shared with the group for feedback.

In a questionnaire after the workshop, participants were asked to describe their experiences of using the Scale Perspectives tool. They were also asked to provide demographic information about themselves.

Based on the results of the first workshop with Scale Perspectives version 2, the time scale was adjusted to allow for more detail on the medium term in the second workshop (see Figure 2).³

Version 2 case studies

Following the scoping of regional perspectives through the use of Scale Perspectives version 1, two workshops were organized with two separate sustainability-oriented groups in Oxfordshire to further explore the potential

³ See scaleperspectives.org for the upcoming, free digital version of Scale Perspectives version 2.

of Scale Perspectives (among other tools) for capturing and sharing societal perspectives on social–ecological systems governance. The first workshop was run with Sustainable Woodstock, a community that facilitates sustainability projects focused on the town of Woodstock. The second workshop was run with the Oxfordshire Rural Community Council (ORCC), a charity that focuses on multiple issues of sustainability (housing, environments, food, energy, and more) across Oxfordshire County. These groups were chosen because each provided a case study of societal actors actively engaged with sustainability and social–ecological systems governance, who we expected might benefit from, and participate actively in, a dialogue about scale dynamics.

The 10 Sustainable Woodstock participants were highly educated and worked in business, government, education, and in NGOs. The 11 participants in a workshop with ORCC classified themselves as working in an NGO or in government. Both workshops had 1 hour allotted to Scale Perspectives.

Results

Results from Scale Perspectives version 1

User feedback

Users' reflections on Scale Perspectives version 1 were given relatively sparingly (20 percent of users) because the feedback form was voluntary. Comments were highly diverse, but several were made on the user experience ("bit confused, but good way to think!") and the relevance of the scales ("time scales are important"). The most common observation was that the submitted issues should ideally be linked across multiple levels ("some of these will operate across ranges of time and space," "all the issues are prevalent in global scale in the present time frame," "the issues are of core importance and therefore should start from now on and should be ongoing in the long term").

Results from participants' contributions

Table 1 gives an overview of the inputs in main combinations of broad categories of governance levels and time frames—chosen to give an overall impression of the distribution of inputs. For the Oxfordshire group input, the highest number of overall entries, 29 percent of the total, fell in the national–global/decades–centuries spectrum. District < national and national–global were also highly populated with entries on the months < decades time spectrum. The field < district spatial scale contains the lowest number of entries; another combination of levels with low entries is the district < national spatial spectrum on the hours < months time spectrum. For the METIER group, almost half (46.1 percent) of

the entries fell within the national–global and decades–centuries range. On the same spatial level, the months < decades levels also contain a large number of entries (25.2 percent). The lower levels in Scale Perspectives received low numbers of entries.

Table 1. Scale Perspectives for both case studies as percentages of the total entries, showing general trends in three temporal and spatial categories

Oxfordshire	hours < months	months < decades	decades–centuries
national–global	9.5	20.7	29.0
district < national	1.8	20.1	8.9
field < district	3.0	4.1	3.0
METIER			
national–global	4.3	25.2	46.1
district < national	5.2	5.2	12.2
field < district	0	0.9	0.9

Figures 3 and 4 give an indication of the diversity of time frames and spatial governance levels associated with the top five most contributed issues for each group of participants. Partly different and partly similar issues come up for the two groups and, as in the overall distribution, the METIER case results show a stronger focus on the national–global spatial governance levels and the decades–centuries time frame. However, in each of the cases, multiple perspectives on each issue result in multiple combinations of spatial levels and time frames being submitted as most important.

Figure 3. The top five most-mentioned issues in Scale Perspectives results for the Oxfordshire Scale Perspectives version 1 case: 1. Transport, 2. Energy, 3. Food, 4. Climate change, 5. Environmental degradation. Each of these issues is distributed across a diversity of spatial governance levels and time frames.

Figure 4. The top five most-mentioned issues in Scale Perspectives results for the METIER Scale Perspectives version 2 case: 1. Climate change, 2. Environmental degradation, 3. Food, 4. Economic change, 5. Public policies. Although the distribution of the top issues starts between the district/county level, this case also shows a diversity of spatial governance levels and time frames for each issue when participants' perspectives are compared.

Results from Scale Perspectives version 2

User feedback

The application of Scale Perspectives in a live setting in the Sustainable Woodstock and ORCC cases provided more in-depth information on the perception of the value of the toolbox by participants. Table 2 summarizes participants’ responses to an open question asked directly after using the tool.

Table 2. Participants’ responses to an open question about their experience of the Scale Perspectives tool—keywords numbered by appearance in responses

	Keywords in response to the question “What do you think of Scale Perspectives after using it?”
Positive: 14	(very) interesting (3), enlightening (1), well done (1), useful (1), thought provoking (2), encourages to think about own responses (1), realization (1), challenging (1), stimulating (1), encouraged holistic/system-wide considerations (1), clarifies individual thoughts (1)
Criticism: 4	difficult to choose only five (1), needs more time (3)

Responses from participants to this question were largely positive and referred to Scale Perspectives mainly as allowing them to re-examine and understand the patterns in their and others’ perspectives through the visual structure of the tool. Users’ main criticism of Scale Perspectives in the live setting was that they needed more time to explore and discuss their entries and one participant mentioned the limitation of the instruction to focus on only five issues.

Results from participants’ contributions

Individual contributions in Scale Perspectives, combined through discussions in each workshop, are shown in Figures 5 to 10. These combined Scale Perspectives inputs were produced from the workshops to function as guiding information for each organization.

Figures 5 to 7 show combined Scale Perspectives entries from the Sustainable Woodstock case. Figure 5 summarizes participants’ entries about biodiversity and ecosystem change along with water management and air pollution. It combines participants’ perspectives on the need to manage short-term risk at a regional level while linking to other governance levels, while some longer term issues around water and ecosystems management should be focused around national and European policies linked to higher and lower levels. Air pollution was seen as a problem to be solved in a top-down fashion from the European level. Figure 6 combines resource issues around energy, food, and waste and includes equality. Challenges around these issues are seen as needing governance across multiple levels but based in a bottom-up, short-term to long-term drive for

change. Figure 7 summarizes participants’ entries and subsequent discussions to combine them that focused on social–ecological systems governance and the role of Sustainable Woodstock, linking back to the issues presented in previous figures. This was subjected to the most elaborate discussion.

Figure 5. A thematic combination of participants’ contributions in the Sustainable Woodstock workshop using Scale Perspectives version 2. Solid arrows refer to water governance and broken arrows refer to ecosystem and biodiversity degradation. The lightest arrow refers to air pollution.

Figure 6. A thematic combination of participants’ contributions in the Sustainable Woodstock workshop using Scale Perspectives version 2, focusing on energy and resource use (solid arrows), food security (broken arrow) and global equality (dash-dot arrow)

Figure 7. A thematic combination of participants' contributions in the Sustainable Woodstock workshop using Scale Perspectives version 2, focusing on governance and actions by the group (solid arrows), higher governance levels (broken arrows) and individuals' choices (dash-dot arrows)

The discussion based on participants' entries focused on the perception that local initiatives are often led by dedicated individuals who have a long-term commitment to change. Also, these initiatives are often characterized by their concrete character: something tangible is achieved. These concrete projects can serve as icons and examples to motivate other communities to take similar actions. The difficulty with "upscaling" local initiatives to the regional level and above is that these governance levels require very different strategies and that the status quo regimes that dominate these larger scales are much more inert to change. The discussion then focused on the power and limits of top-down governance, as complementary to bottom-up action, both in terms of "hard" or enforcing governance and "soft" or facilitating governance.

Sustainable Woodstock activities were seen as making a positive contribution at the local community level: woodland planting, events, efforts to change local waste, and resource use. These activities also work on the individual level—aiming at informing and changing the behavior of individual community members. Beside individual behavior change, community members might be motivated to contribute at the community level by joining in the organization of events and projects. Sustainable Woodstock was seen as contributing to the profile of Oxfordshire as a county with many sustainable development communities working on concrete projects. Furthermore, from this basis of concrete action, Sustainable Woodstock was seen as having the potential for an active voice in policies at the regional level and above.

Figures 8 to 10 show combined Scale Perspectives entries from the ORCC case. Again, these entries were combined through a discussion about different overarching subjects. The time scale was adjusted after the Sustainable Woodstock workshop to allow for more detail in the medium time frames. This is reflected in the fact that combined entries from participants are less clustered to the right side of the figures and hve more space to outline relationships.

Figure 8 summarizes entries focused on resources: energy, food, water, and waste. For both food and energy, an emphasis was put on the relationship of local production and national/global use and trade. Awareness and the provision of options were seen as the most important regarding these topics. The contributions focused bottom-up action: scaling up from local success stories.

Figure 8. A summary of contributions by participants in the Oxfordshire Rural Community Council workshop using Scale Perspectives version 2, on the theme of resources: energy (broken arrows), food (arrows), water (dash-dot arrow), and waste (dotted arrow)

Contributions on demographic change, housing, and transport as elements of sustainable governance (Figure 9) focused on taking care of the growing share of elderly in the population, as well as ensuring affordable housing for the new generations. On higher governance levels, there were more questions than ideas: How will the world deal with migration and demographic change on the long run? In terms of local transport, planned travel and bus schemes were proposed. On higher levels, investment in alternatives like trains and water transport was suggested. Working from home was seen as a solution that should be stimulated as well.

Figure 9. A thematic summary of contributions by participants in the Oxfordshire Rural Community Council workshop using Scale Perspectives version 2, focusing on sustainable transport (broken arrows), sustainable building (solid arrows), and issues of demography and social dynamics (dash-dot arrows)

Similar to Sustainable Woodstock, general issues of governance were discussed at length, particularly around participants' entries about education, community empowerment, and awareness raising (Figure 10). Specific emphasis was given to cross-level interactions in the form of investment into lobbying and organizing local initiatives together. Also, a perceived lack of cross-level understanding of sustainability governance issues (the "not in my backyard" mentality) was highlighted as a challenge to be overcome. A historical perspective was brought into the discussion: a few decades ago, participants perceived that there was more direct influence from the local and regional levels of government on the national level, and therefore the action gap between these levels was smaller. In contrast, with a decreased emphasis on regional levels of organization, this gap appeared, to the participants in the workshop, to be increasing.

To take on the scale gap, a strategy was discussed that consisted of three elements. There should be a greater focus on higher-level political presence for the ORCC and its peer organizations in the United Kingdom. Aside from the larger involvement of rural community council networks in this local-to-national communication, individual members should also be made aware of the importance of this link across scales. A clear strategic vision should be communicated on each of the local, regional, and national organizational levels. Finally, in the context of the United Kingdom government's Big Society policy, it should be clearly communicated that the ORCC has always been doing what national politics were now trying to achieve.

Figure 10. A thematic summary of contributions by participants in the Oxfordshire Rural Community Council workshop using Scale Perspectives version 2, focusing on the council's engagement with other partners and higher governance levels (solid arrows), education (broken arrows), and awareness raising (dash-dot arrows)

Discussion

Scale Perspectives version 1

The goal of the first version of Scale Perspectives was to collect information about participants' perspectives within a target group and to come to general insights: to identify what governance levels and time frames participants were or were not engaged with, and to identify the diversity of scale perspectives around certain issues. In both case studies, the top five most-mentioned issues made up about half of the social-ecological change issues mentioned by the participants. This indicates that, overall, issues that were a concern to the majority of participants were identified and outlined in terms of governance levels and time frames, as well as a range of other issues.

The open character of the question used with Scale Perspectives version 1 was useful to discover the prevalence of top issues and the ways participants defined them. However, a problem of the results was that the issues identified by participants ranged from the specific to the general. We hypothesized that the more general the issue, the less embedded it would be in specific governance levels and time frames. This argued for a requirement of more specification and elaboration from the participants on their input, which contributed to the changes made in version 2.

Participating stakeholders in both cases entered diversely scaled perspectives, both in the temporal and spatial dimensions. The Oxfordshire group showed a focus on the highest spatial and temporal levels, but this preference was more extreme in the METIER group. We believe this difference reflects the difference between the case studies: the Oxfordshire group consisted of a demographically diverse group of participants, while the METIER group was made up of PhD students and researchers, mostly male and in the same age group. Also, the Oxfordshire group had a regional focus, while the METIER group was spread across Europe. Both cases indicated that several combinations of spatial and temporal levels are not considered relevant: the smallest spatial levels and shortest temporal levels are largely left empty. In Oxfordshire, the longest term for the intermediate spatial level (district < national) was also left largely empty. Temporal and spatial hyperopia may have affected the specificity of issues contributed by participants—the more global and long term the focus of the participants, the less specific their input will be.

In both cases, entries for each of the top five issues were widely spread across spatial and temporal levels. This indicates that while stakeholders agreed on many top issues, they had different perspectives on the spatial and temporal levels at which these issues were most relevant. This result can help to highlight to societal actors the prevalence of one of the three aforementioned challenges of governance across levels and scales, the “multiplicity of scale perspectives” (Cash et al., 2006). Gaps in the focus levels submitted by the participants offer clues as to what elements of the social–ecological systems are downplayed in the perspectives of stakeholders. Because of this, its outputs can help, to some degree, address another of Cash et al.’s (2006) identified scale challenges, that of “ignorance of other levels”. Scale Perspectives version 1 does not, however, offer a way in itself to use the mapping of this diversity to overcome differences between societal actors. Its inability to let participants frame environmental change issues as connected across governance levels and time frames ultimately turned out to be a significant limitation, evidenced both by the limited information provided by the participants’ contributions and their feedback on the tool. These insights contributed to the development of Scale Perspectives version 2.

Scale Perspectives version 2

The second version of Scale Perspectives was developed to overcome the limitations of the first version, specifically by lifting the limitation for participants to contribute only one marker per social–ecological systems governance issue in the scaled field provided by the tool, and instead allowing for multiple markers per issue, arrows, marked areas, and other visual indicators. After our experience with version 1, we also decided to use the new version of the tool in workshop

formats first, to get more information from users about their experience of it, and additionally to explore possibilities for sharing and dialogue based on use of the tool.

The potential of the Scale Perspectives tool as a format for sharing and combining societal perspectives on social–ecological systems governance went beyond the goal of the first version. This function, however, proved to be the main focus in the two workshops in which version 2 was used. Participants used the freedom provided by the scaled field to draw links across governance levels and time frames, connecting multiple elements of environmental change issues. Participants signified how challenges at one level (global) could begin to be tackled by bottom-up responses at the local level, supported by facilitating governments at regional, national, and European levels. Whereas some participants focused mainly on the agency of their own community or organization, others focused on the actions of higher-level actors, and these perspectives were combined. These differences in emphasis were made explicit and comparable using the Scale Perspectives tool.

In both cases, the conversation turned from an initial identification of issues and cross-level system links to what the role of the organization or community that these participants were engaging with was and could be in the greater multilevel perspective outlined by the group.

In both cases, participants used the dialogue-based Scale Perspectives contributions to strategize about engagements with new partners to ensure greater impact. Both groups thought that their focus so far had been too local and that they would benefit from leveraging higher-level institutions. These conclusions, drawn from the groups' use of Scale Perspectives, signified a different role for the tool than was initially intended—rather than being merely a tool for the collection and secondary analysis of societal perspectives on scale dynamics, the tool could function as a direct way to empower societal actors in their participation in governance across multiple levels and time frames (Dryzek, 2009; Ostrom, 2009).

Because the tool was used as a planning tool more than anticipated in the first of the two cases where Scale Perspectives version 2 was used (with Sustainable Woodstock), in the second case (with the ORCC) the time frame was adjusted, which allowed for more medium-term information to be captured.

Overall, Scale Perspectives version 2 retained the benefits of version 1 but increased the information captured, allowed participants to focus on the multifaceted nature of social–ecological systems governance issues, and provided the additional benefit of linking challenges with solutions at different levels and

time frames. This way, Scale Perspectives version 2 allowed for information to be visualized in a way that has benefits over Cash et al.'s (2006) visualization of scale challenges:

- It addresses the ignorance of scale dynamics by allowing participants to compare their scale perspectives with those of others and see complementarities in knowledge as well as recognizing common gaps and helping to identify key issues.
- It allows societal actors to make their perspectives explicit and thereby provides the basis for a multi-stakeholder dialogue that can help combine knowledge and action and overcome differences.

The challenge of scale mismatches was addressed only implicitly. However, it was the possibility for dialogue and a combination of participants' contributions in the workshop format that showed potential for this tool to help stakeholders act on such challenges by devising collaborative strategies.

Potential improvements

Scale Perspectives version 1 showed some potential to help address challenges in capturing societal perspectives around scale dynamics in social–ecological systems. Limitations identified by researchers and users informed Scale Perspectives version 2, which overcame some of these limitations. Given its potential to generate, share, and combine systems perspectives, the relative simplicity and flexibility of the tool is a benefit. However, this simplicity also comes with some drawbacks. Firstly, the scales used in the tool are prefamed, and it could be argued that this limits participants in eliciting their scale perspectives in a truly subjective fashion. An alternative to Scale Perspectives that does focus on the diversity of scales, rather than just levels, that stakeholders may use to frame environmental and other governance issues is the Scale Repertoire (Vervoort, Rutting et al., 2012). This tool, however, requires a much more in-depth analysis that is dependent on facilitation. A version of Scale Perspectives that could bank on the benefits of both tools could be one where a scoping of preferred scales and levels among stakeholders is done first and Scale Perspectives participants are then invited to frame the scaled field using their own identified, rather than predefined, scales.

Another drawback of the current simplicity of Scale Perspectives is that it does not, in its present form, allow for quantitative or even semiquantitative assessment of dynamics between system elements. Other tools for capturing stakeholder perspectives on systems, such as fuzzy cognitive maps (Kok, 2009; van Vliet et al., 2010) and other participatory modeling tools (Voinov & Bousquet, 2010), do allow for a systems description that includes semiquantification of relationships and feedbacks among system elements. These models, in turn,

have no specific focus on system levels and scales. A combination of Scale Perspectives with features of fuzzy cognitive maps (such as asking users to define the strengths of relationships and feedbacks across levels) would be feasible, however.

Finally, the advantage of Scale Perspectives version 2 over version 1 has partly come from its use in workshop settings where dialogue about Scale Perspectives inputs was easily shared, discussed, and combined. Version 1, by contrast, had the benefit of being scalable due to its online format. The introduction of options for exchange, comparison, and dialogue based on different Scale Perspectives inputs is, again, feasible, but would require an enabling architecture.⁴

Conclusion

Scale Perspectives provides an example of how simple interactive tools could be used to help address challenges for societal actors around social–ecological systems governance across multiple system levels. Allowing participants more flexibility to indicate system dynamics across governance levels and time frames, to include solutions, and then to offer a space for the sharing, discussing, and combining of those perspectives helps to address practical scale challenges. Challenges that Scale Perspectives can help address include the identification of areas of ignorance for societal actors about system dynamics and actors at other levels, and the elicitation and sharing of different actors' scale perspectives. The combination of scale perspectives stimulates multilevel dialogue about solutions for identified governance issues. This way, tools such as Scale Perspectives can empower societal actors to act collaboratively and strategically across system levels and scales to tackle the significant challenges of governing social–ecological systems.

4 See scaleperspectives.org for the upcoming, free digital version of Scale Perspectives version 2.

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This text taken from *Human Ecology Review*
Volume 20, Number 2, 2014, published 2014 by ANU Press,
The Australian National University, Canberra, Australia.