Participatory Governance Mechanisms for the Nexus: A California Case-study

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Expands on a case-study in the *Water-Energy-Food Nexus Knowledge-Action-Network Research and Engagement Plan,* available at http://futureearth.org/future-earth-water-energy-food-nexus

Introduction

Our "planetary boundaries", including freshwater use and land system change, are increasingly tested, and in some instances exceeded, as limited resources are overexploited to meet growing global demand for water, energy and food (WEF) resources (Rockström et al., 2009; Hoff, 2011). WEF resources, which are vital for human development, depend on market fluctuations, regulations and the environment, and their sustainable use represents one of the most pressing societal challenges of today (Bazilian et al., 2011; Rasul and Sharma, 2016). The need for more integrated research, planning and management of WEF resources has been increasingly put forward within international research and policy circles since the early 2010s, driven by the "critical, interconnected risks" presented by WEF security (Bizikova et al., 2013; Mohtar and Daher, 2016).

A nexus approach therefore aims to identify trade-offs and enhance synergies between water, energy and food systems, going beyond sector-specific thinking while recognising that one resource's security can impact another's (Ringler, Bhaduri and Lawford, 2013). "Critical connections" exist between WEF resources, such as energy for water extraction and the transportation and distribution for urban and agricultural purposes, and food production, which is usually energy intensive, and can subsequently affect water resource ecosystems through agricultural runoff, requiring in turn more energy for treatment (Liu, 2016). The nexus concept may extend to other variables such as climate change, ecosystems and land, as illustrated in this paper (Liu, 2016; Rasul and Sharma, 2016; United Nations Economic Commission for Europe, 2016).

From these interconnections emerge nexus challenges, defined by the Future Earth Water-Energy-Food Nexus Knowledge-Action Network (Nexus KAN) as "*current or anticipated threats to equitable and sustainable access to energy, water and food whose causes and/or consequences are embedded in the interactions between these components*" (Future Earth, 2018). The Nexus KAN identified four types of nexus challenges that impact equitable and sustainable access to food, water, and energy (see Figure 1):

1. Impacts of the modes of production and consumption of food, water and energy;
2. Impacts of poverty and resource scarcity;
3. Impacts of competing claims over natural resources;
4. Vulnerability to extreme events (e.g. climate hazards, natural disasters, conflicts).

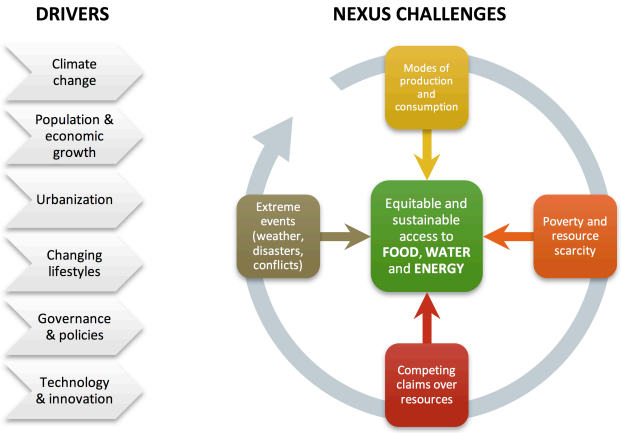

Figure 1 - Water-Energy-Food Nexus KAN Typology of Nexus Challenges

Understanding these challenges requires the collaboration of people and organisations to build the knowledge and tools needed to implement WEF nexus solutions. Initiatives such as the Nexus KAN aim to address this gap by, amongst others, improving our understanding of effective governance mechanisms. Although existing literature on the WEF nexus predominately takes a technical and/or engineering approach due to the inherent nature of WEF systems (see for instance Bazilian et al., 2011), there is a growing body of literature on WEF resource governance, or the way decisions and policies are made concerning the use of WEF resources. The Nexus KAN

recognises the importance and complementarity of both approaches to analysing and solving Nexus challenges.

A brief review of "nexus governance"

Governance is the step from theoretical concepts to practical solutions, or, in other words, how frameworks and models can be used and be of assistance to take decisions and design policies. "Nexus governance" would thus mean "*the different patterns of governing by which political actors seek to achieve nexus objectives for sectoral integration, thereby enhancing synergies between water, energy, and food production, and reducing conflicts*" (Benson et al., 2017). Since governance itself is a driver of nexus challenges, as evidenced for instance by the impact of subsidies on consumption patterns of water-intensive foods, governance has a crucial role to play in effectively addressing WEF challenges.

Yet, our understanding of governance for the nexus is limited, in particular concerning:

Governance modes and their coordination for the nexus

Knowledge gaps exist in regards to which modes should be developed (e.g. markets, regulatory mechanisms, bureaucratic hierarchies, learning networks etc.) and how should they be combined to best achieve nexus outcomes (Halbe and Knüppe, 2015; Pahl-Wostl, 2017). Nexus outcomes refer to the degree of integration and synergies achieved after implementing a nexus-related policy, and are considered positive when policies are well integrated across the sectors. More specifically, research should draw on and learn from numerous context-specific empirical cases and identify scalable solutions for coordination. Furthermore, the relevance of the WEF nexus to the implementation of the SDGs and the complementarity of the two approaches is yet to be defined (Halbe and Knüppe, 2015; Pahl-Wostl, 2017).

Nexus stakeholder networks and their individual interests, values and power relations

Decisions and policies surrounding the WEF nexus are not strictly based on technical considerations, but often rely on stakeholders' diverse values, thereby reflecting the power relations which exist between them (Weitz et al., 2017). Identifying the political, social and economic basis for certain policy choices, as well as encouraging learning processes for decision-makers (i.e. disseminating new underpinnings), are key to addressing collaboration failures between sectors (Weitz et al., 2017). For example, institutional limitations and financial constraints can lead public officials to favour one sector over another (Wichelns, 2017). Furthermore, gaps in the framing of the connections between water, energy and food actors still exist. Network analysis for the nexus is a new field of research which aims to address this gap, by seeking to map cross-sectoral connections between stakeholders, target nodes where change can be achieved most effectively, and identify sectors where coordination is lacking (Stein, Barron and Moss, 2014; Portney et al., 2017).

The value of integrated governance approaches in terms of nexus outcomes

Despite positive results in terms of stakeholder inclusion and legitimacy in the face of complex issues, gaps remain in the evaluation of integrated governance approaches in terms of nexus outcomes. In other words, is nexus governance able to represent a fair and optimal balance of water-energy-food trade-offs and synergies? (Benson et al., 2017; Weitz et al., 2017). Moreover, there is some debate concerning the relevance of such complex integrated schemes, and the time and resources involved, especially for pressing issues (Wichelns, 2017).

Case study: Desalination in Santa Cruz, CA

Desalination & politics of the nexus: from diverging values to shifting power relations

To adequately address these questions, it is necessary to look at concrete examples of governance mechanisms targeted at nexus-related challenges. This paper considers a case study built on the knowledge and insight of semi-directive interviews with members of the Santa Cruz Water Supply Advisory Committee, a local participatory mechanism established to solve a resource-planning controversy. Santa Cruz provides a good example of local resource governance due to its decentralised water system. Interviewees were chosen to represent a diversity of opinions.

The case study aims to investigate how local communities understand and deal with potential nexus challenges, which falls under Type 1 of the Nexus KAN typology (see Figure 1), and how the technical complexity of resource planning interacts with society, by looking at a desalination project through the lens of the "politics of the nexus". The "politics of the nexus" refers to the various power forces at work when weighing up different resource allocation strategies, and the possible trade-offs and synergies which emerge from them.

Santa Cruz is a coastal Californian city, located 120 kilometres south of San Francisco, on the northern edge of the Monterey Bay, with a water service area of nearly

90,000 people. Historically affected by multi-year droughts, Santa Cruz has long been searching for a supplemental water supply. City planners had been studying possible solutions since the 1960-70s, including the construction of another reservoir. In the late 2000s, they finally decided to pursue desalination, in collaboration with Soquel Creek Water District, a neighbouring water district. A desalination plant with a capacity of 2.5 million gallons per day, which would "limit peak season shortages to 15% of normal water needs", was seen as a viable and permanent solution to droughts and expected climate change (City of Santa Cruz and Soquel Creek Water District, 2013).

In 2010, a representative group of local stakeholders, including business groups and environmental NGOs, were included in a consultation phase, with the idea to allay the community's fears regarding desalination, which included marine wildlife destruction and the CO_2 emissions associated with large energy inputs. However, some of the involved stakeholders, including Surfrider, an environmental NGO, found the city's efforts to address community concerns lacking. For example, when the City's promise to have a 100% renewable energy-powered facility proved to be difficult, many stakeholders were unhappy with the City's proposal to use carbon offsets instead.

Public forums, debates and letters in the local newspaper proliferated as the community looked further into the potential impacts, both positive and negative, of desalination. An opposition organization, "Desalination Alternatives," emerged from various local groups, to highlight the potential adverse impacts of desalination and educate the community about possible alternatives.

The group pointed to a decline in water demand, and the pursuit of a water transfer strategy, which had so far been rejected by the City. Moreover, many of the wider Santa Cruz community were still "*uncomfortable*" with desalination, despite the City's efforts to present it as a necessary project. Some interviewees added that opposition also came from NIMBY-like fears, such as pump stations being located near homes.

Interviewees all highlighted Santa Cruz's uniqueness in terms its citizens' high ability for collective political action, which made this case particularly interesting for studying inclusive governance on complex and controversial issues; as one of the interviewees, from the Santa Cruz City Council, put it:

> "If it were not Santa Cruz where this all took place, (...) we would have had a desalination plant, we would not have had this level of public opposition because we were very close to making it happen. All the work was ready, all the regulatory authorities had approved the project and we had the funding."

Assessing conflicting values among stakeholders

Beyond design flaws identified by Surfrider, such as the absence of a slow-sand filtration system, or possible climate change implications pointed out by Desalination Alternatives[1], the early stages of the controversy can also be looked at through the lens of opposing values and expressed attitudes.

Two prevailing values dominated the public debate: (i) value for conservation (e.g. biodiversity, water and energy) and to a lesser extent (ii) value for what is "natural".

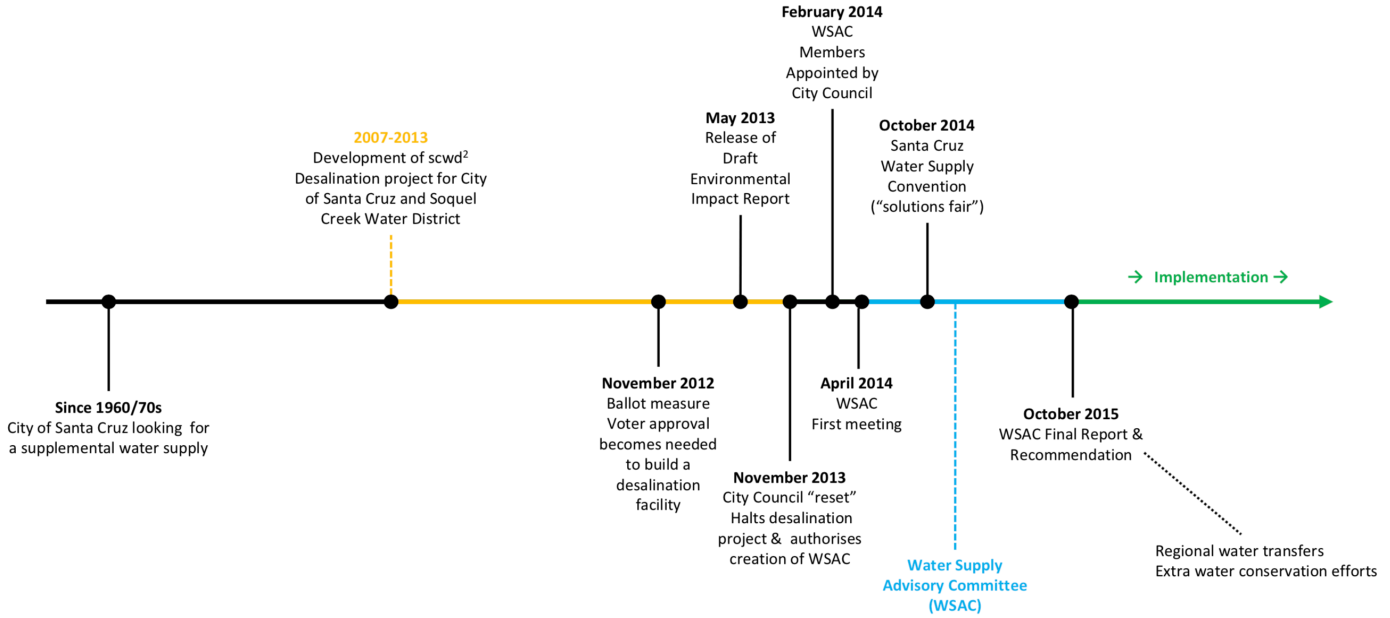

Figure 2: Timeline of the Santa Cruz "Desalination Controversy"

[1] WSAC 8/6/15 - Agenda Item 4, Document #21b « Thinking about energy impacts » by Rick Longinotti

Conservation values were the most conflictual. Energy conservation values, in particular, partly fuelled the opposition to desalination, as illustrated by Desalination Alternatives:

> "For our group, it was really the energy cost of the plant (that was problematic), and we were saying 'Look, even if you built seven acres of solar panels, wouldn't it be better to use the solar energy from those panels to power people's lights in their homes?'"

The attitudes towards energy consumption by desalination by its opponents can be understood through past experiences. For example, Rick Longinotti, from Desalination Alternatives, insisted that his work as an electrical contractor made him even more aware of the need for energy conservation. The importance of past experiences was also expressed by a representative of the Surfrider Foundation:

> "Energy has always been a concern, desalination is the most expensive, energy wise, water to produce. I used to work at the (…) Aquarium, and they had a small desalination plant there (…) So I'm familiar with desalination and helped maintain it. We already knew how energy intensive it was (…) it was really our most costly water, it was quite ridiculous."

Interestingly, although many people share the same values, they are often expressed differently – especially in relation to desalination. For instance, biodiversity conservation values led to different attitudes towards desalination. While Surfrider invoked the need to protect marine ecosystems to oppose to desalination, representatives of the business community believed a desalination plant would be beneficial for freshwater ecosystems by lessening the pressure on the San Lorenzo river:

> "It mattered to me because having a reliable water supply is "life", it is crucial for economic activity and quality of life (…) our situation here is complicated, by the fact that we have two endangered fish species that rely on the water in our river, our water supply is largely dependent on the river (…). When we take water out of the river the fish are hurting because there is not enough water, and that's not OK either. In my opinion we're not allowed to let species go extinct, we're to do everything in our power to provide them with what they need to survive."

Moreover, values for what is "natural" shaped the public debate on desalination, with the desalination proponents claiming that opposition was fed by the idea that desalinated water was "unnatural":

> "I would say one of the main opposition was that they didn't want to have 'manufactured water'. You would hear that term all the time, that they felt like one source of water was more natural than the other."

In the end, understanding stakeholders' values is key to successfully addressing nexus challenges as it allows for (i) better understanding between stakeholders, which, in turn facilitates (ii) the identification of a politically acceptable solution.

Eventually, Desalination Alternatives secured enough signatures to submit a measure to the November 2012 ballot[2], that would require voter approval before a desalination project could be built (see Figure 2). When "yes" received 72.13% of the popular vote, the city understood that it wouldn't be able to pursue desalination without the consent of its voters. More public opposition surfaced when the Draft Environmental Impact Report was released for public comment, with over 400 comments submitted. This step was described as crucial by all interviewees as power shifted from the City to those opposing desalination:

> "I think the success had to do with the power that our group had achieved by virtue of the charter amendment."

Mashing the potatoes in search for alternatives: The Water Supply Advisory Committee

Facing a political gridlock, the City of Santa Cruz decided to re-evaluate the project through more in-depth local community involvement. The Water Supply Advisory Committee (WSAC) was thus created to "*explore, through an iterative, fact-based process, the City's water profile, including supply, demand and future risks; analyse potential solutions to deliver a safe, adequate, reliable, affordable and environmentally sustainable water supply and develop recommendations for City Council consideration*" through an 18-month process, with special attention given to drought, fish habitat protection and climate change (City of Santa Cruz Water Supply Advisory Committee, 2015).

> "(The creation of WSAC) was a political thing, recognising that there was political opposition to the project, and we wanted to have a project that would have broader community acceptance (…) since the Desalination Alternatives (group) was a reflection of how we didn't have enough community buy-in."

The WSAC's membership was widely representative. The 14 members, selected from the responses to a community-wide Call for Applications, represented both the business

[2] A ballot initiative is a way through which a petition signed by a minimum of registered voters in a jurisdiction can force a public vote.

and environmental communities, as well as "regular" city residents, and citizen-members of the City's Water Commission. Over the following 18 months, WSAC held large public meetings, as well as smaller thematic breakout sessions, and members were given substantial reading materials, met with experts and went on field trips. WSAC also launched a community-wide consultation and call for solutions, with more than 80 proposed solutions by Santa Cruz citizens, out of which were 50 presented during a "solutions fair" (Santa Cruz Water Supply Convention), for further evaluation by WSAC. The alternatives were evaluated on the basis of their technical, institutional and political feasibility, supply reliability, energy and environmental profiles and costs. During the interviews, WSAC members often insisted that the energy input was one important criteria for the acceptability of a solution.

Somewhat surprisingly to interviewees, the WSAC was able to reach a consensus by the end of its term:

> "We ended up solving the problem with general public support. Impressive that we reached consensus with people who had such different views, especially in Santa Cruz with a very politically active community."

> "It is mind boggling that they pulled together such a broad perspective, in terms of opinions and personalities, and the fact that people were there to work together."

The final recommendation, which has been adopted and incorporated into the Urban Water Management Plan by the City Council, favours (i) extra water conservation efforts and (ii) regional water transfers (in lieu transfers), which would send water to neighbouring water districts during periods of high river flow. The neighbouring districts would use river water instead of pumping from the aquifers, allowing the depleted aquifers to recover. Additionally, a process known as Aquifer Storage and Recovery (ASR), would inject treated river water directly into the aquifers, making aquifer water available for Santa Cruz in dry years. As of 2018, the city is actively looking into in lieu transfers and ASR, including the required technology, and negotiating with neighbouring districts. If in lieu transfers and ASR prove technically and/or financially infeasible, a second option is to use recycled water. If neither of these options prove feasible for creating a sufficient supplemental water supply for Santa Cruz, then desalination may be pursued. As the WSAC recommendations are implemented, further studies are being done to determine which of the alternatives identified by WSAC are feasible and best meet the City's needs. In that sense, WSAC successfully managed to explore alternatives to desalination with regards to the cross-cutting concerns of energy consumption, climate change impacts and ecosystem protection.

Discussion: WSAC and public involvement on complex, technical issues

Selected stakeholder involvement had already been a strategy since the earlier stages of the project, well before it became a "*political hot potato*" as one of the members phrased it. As the issue gained more coverage, it became difficult to articulate and discuss concerns and disagreements with key stakeholders. Several members of WSAC described the period preceding WSAC as relatively tense and confrontational, with each party seeking to stand their ground and prove the other wrong.

With the political leverage gained through the ballot initiative, Desalination Alternatives pushed the city into creating a space that would allow for better public involvement on the complex issue of water supply. Indeed, failing to involve the community in difficult technical questions was one of the reasons the City's earlier attempt at implementing desalination had failed. City officials were frustrated by the public's reaction, given the many decades that had already spent on desalination research and groundwork. Those opposing desalination had similar sentiments, leaving them feeling unincluded and generating an atmosphere of mutual misunderstanding and distrust.

Interviews revealed how WSAC was able to reverse that trend and create community-wide consensus on Santa Cruz's complex water supply issue. The process was key to resolving conflict:

> "I do sort of think it healed the political rift in our community, that there was this distrust by the business community of the environmentalist -I'm oversimplifying this-, and a similar distrust on the other side."

Most importantly, WSAC created a space for dialogue, rather than a place for debate. Rather than winning through one "right" answer, WSAC focused on learning and collaboratively building a "new" solution. In this way, while not changing its members' original opinions on desalination, it created a new, flexible and consensual solution:

> "I'm not sure it changed my mind on desalination as a possible technology or a solution to our water problem, I think what it did, is that it opened my mind to the wide variety of potential solutions to creating a reliable water supply that would serve our community."

> "The committee enabled me to broaden my consideration of what might be options to give us a supplemental water supply."

> "My concerns with desalination are the same (…) what we really wanted to work on was to broaden our perspectives on alternatives and it worked."

Three key elements constituted WSAC's success: (i) solution-oriented personalities, (ii) the inclusion of various forms of knowledge to address complexity and uncertainty, and (iii) the design of a flexible solution.

Solution-oriented personalities

All interviewees said that the solution-oriented nature of WSAC and its members was central to its success. Indeed, the drought coupled with the political gridlock meant that members were convinced that "*having a solution at the end was more important than 'the individual' being right*". Furthermore, the WSAC members had been selected based, in part, on their ability to collaborate and listen, which was integral to reaching a consensus. For instance, two members would help each other to explain themselves to WSAC. In one example, despite holding opposing views (one was an "*opponent to desalination*"), a member of WSAC was able to "*translate*" his colleague's words into less political concerns, to which the others were more likely to listen.

The WSAC members' "people-skills" were therefore the key to its success. As one member illustrates:

> "Also it is my profession to help people communicate, resolve conflict, I was looking for ways to practice that on the committee."

Roleplaying was also an effective tool, which was used to encourage empathy and a better understanding of each other's perspectives and motivations. In one example, environmental and business community members were asked to exchange roles, thereby fostering mutual understanding and facilitating communication. Nevertheless, there were limits to the WSAC process in that regard:

> "I'm not sure how far WSAC got in deeply understanding each other's basic motivations—even though that's the goal of interest-based negotiation. For example, one member responded to my opposition to desalination due to its high-energy intensity with the claim that the desalination plant would be operated on 100% renewable energy. That claim wasn't accurate, but I think it cast doubt on my motivations."

Various forms of knowledge to face complexity and uncertainty

While facilitators and experts were key in the WSAC process, individual members played an important role in translating the knowledge necessary for members to make decisions on complicated technical issues. Indeed, many members were "bridgers," capable of facilitating communication and understanding between experts and other members. For example, one member with a strong engineering background, was able to "decode" technical knowledge into more simple terms. Similarly, another member brought important knowledge on marine biology as well as practical know-how on desalination.

> "These different skillsets and background information allowed us to analyse what was in front of us, they could bring a voice that we trusted, instead of us taking in information from the experts."

Stakeholder and citizen involvement on complex nexus issues should occur in a space where people's skillsets can be used and their input integrated into the final decision.

> "I think there was a certain flexibility on the part of the experts to sort of hear the feedbacks and to try to accommodate the feedback."

Experts and facilitators used tools to help the WSAC members understand the new and complex issues on which they had to decide, such as the relationship between technology choice, water supply and energy use.

> "They brought us experts, people from all over the state (…) to answer questions like 'how much energy does an injection well use?' 'what are the pumping costs?'. Very technical questions. Since we're not all experts, when they would tell us numbers, they would put them in very accessible bar charts, to show us 'this is the amount of energy needed'."

> "We explored the relative energy cost of different water technologies, and we had a good understanding of the ranking of those things (…) things were ranked by points; numerical numbers that we used which included everything from pumping to circulating water across the system, so for instance let's say desalination was 15, recycled 10 and in lieu 6 (not the actual numbers)."

To further differentiate "*between 10 and 6*", analogies were used:

> "(With a) desalination plant to provide all this water (…) all 90,000 water consumers would be operating a 25-watt lightbulb, twenty-four hours a day, seven days a week. If we did recycled-water it would be a 15-watt lightbulb etc. I don't remember the exact numbers. It was an attempt to create an energy use analogy that made some sense. Then you get an idea: 'a 15-watt lightbulb, it's just not a lot' (…). It contextualized the energy use."

Field trips provided insights and a sense of reality, beyond what was available through academic literature or expert presentations. A field trip to the local water treatment plant, for example, showed many members how energy intensive such water systems are, while a trip to a quarry,

which many considered ideal place for storing water, served to highlight its shortcomings.

> "A tour of our current water system, we went to source water, we have four streams north of us, going and see at the various places where we get the water from, looking at the water treatment plant, storage tanks: understanding how complex the system is, and thinking of ways to 'to change this' without having an impact all over the place, (it was about) really understanding our drinking water supply system.'"

In sum, WSAC was successful in creating a space where experts could communicate and interact with non-experts, integrating the community's own knowledge and input and generating trust so as to reach consensus.

A flexible solution

The WSAC's success was also due to the flexibility of the solution, which is key to answering uncertainty. Future water supply and demand are dependent on political and climatic changes, amongst others, while available technologies are constantly evolving and therefore similarly uncertain. Designing an adaptive solution which provides city planners with the necessary guidelines for implementation is thus integral to success, as shown in the various policy options in the WSAC's final recommendation discussed above. One of the WSAC members, an expert in project management, was key in that process:

> "(He) was able to fashion a timeline, with decision points (for each strategy, i.e. main one and two back up strategies), (showing) where in time it would be a full commitment to that strategy etc. It was really helpful to our group, and especially important for consensus, it made everybody feel comfortable that if the main strategy wasn't working, a backup existed."

Conclusion

Despite a narrow "nexus approach", given the limited relevance of food systems in the Santa Cruz water service area, variables such as climate change and ecosystems were crucial for stakeholders and city planners. Addressing the "water-energy-ecosystems" nexus, the case study offers a practical example of a solution-based, participatory mechanism for managing resource use under the pressure of drought and expected climate change.

The process tackled both complexity, including resource and system interactions, and uncertainty. It resolved local conflict to a certain extent, allowing stakeholders to understand each other's values and motivations and build a new, cross-scale cooperation-based solution. Indeed, WSAC's final recommendation integrated various inputs, through wide external citizen consultation to the tighter and long-term participation of the 12 committee members, as well as outside experts.

Overall, WSAC was an in-depth learning process through which members broadened their diverging perspectives on alternatives to desalination. The desire to consider alternatives was driven by City officials and the power acquired by Desalination Alternatives, both of whom were looking to address both the political gridlock and the looming impacts of the drought. Interviewees hope that the WSAC process will create long-term community buy-in and renew the community's trust and understanding in the ability of the City's Water Department to handle water supply issues. Whether or not the outcome of this collaborative process is a success in light of its original objectives can only be evaluated once the solutions are implemented (i.e. evaluating nexus outcomes).

Identifying links and power relations between actors of the "politics of the nexus" prior to the establishment of formalised nexus-related mechanisms is essential (see Figure 3). Furthermore, nexus approaches need to remain flexible: the chosen variables (e.g. water, energy, food, ecosystems, climate change) should reflect the community's context and values, while questioning the added-value of a nexus approach as compared to previously-existing integrated resource management approaches. Moreover, understanding and replicating processes like WSAC will be crucial as nexus-related infrastructure projects (e.g. desalination plants, dams or large solar power plants), which will likely become more frequent in a resource-constrained future, often clash with communities' interests and values. Actions and decisions concerning nexus challenges must thus be co-designed from the beginning to avoid conflict and create long-term community buy-in.

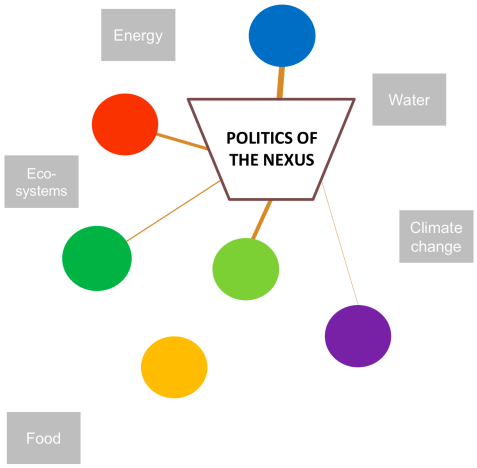

Figure 3: The "politics of the nexus", i.e. the different actors involved in a nexus issue. Circles represent actors and line thickness their involvement on a given issue, ranging from strong (thick line) to non-existent. Boxes represent the gravitating themes or nexus variables and their proximity to the issue at hand.

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