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POLICY PERSPECTIVE

Conservation Organizations Need to Consider Adaptive Capacity: Why Local Input Matters

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Abstract

Conservation organizations are increasingly applying adaptive capacity assessments in response to escalating climate change impacts. These assessments are essential to identify climate risks to ecosystems, prioritize management interventions, maximize the effectiveness of conservation actions, and ensure conservation resources are allocated appropriately. Despite an extensive literature on the topic, there is little agreement on the most relevant factors needed to support local scale initiatives, and additional guidance is needed to clarify how adaptive capacity should be assessed. This article discusses why adaptive capacity assessment represents a critical tool supporting conservation planning and management. It also evaluates key factors guiding conservation NGOs conducting these assessments in tropical island communities, and explores alternative priorities based on input from academic experts and key local stakeholders. Our results demonstrate that important differences exist between local stakeholders and nonlocal academic experts on key factors affecting adaptation and coping mechanisms. The exclusion of local community input affects the validity of adaptive capacity assessment findings, and has significant implications for the prioritization and effectiveness of conservation strategies and funding allocation.

Introduction

Adaptive capacity provides a valuable construct for managers, scientists, resource users, and policy makers to address the challenges of climate change for conservation (Armitage & Plummer 2010). Adaptive capacity is the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (IPCC 2014). Folke *et al.* (2003) identified four dimensions of

Table 1 Barriers to assessing adaptive capacity (AC)

Barriers	Source
AC is context-specific and shaped by dynamic factors not easily generalizable	Engle (2011); Juhola & Kruse (2013)
AC factors do not carry equal weight between contexts	Engle (2011)
AC factors are affected by climate change–related stress under consideration	Yohe & Tol (2002)
Lack of clarity on the relative importance of each factor	Preston *et al.* (2011)
Lack of agreement on efficacy of assessment techniques	Engle (2011)
AC assessments are criticized for relying preferentially upon specialized, academic knowledge and insufficient consideration of key stakeholders, but have evolved to incorporate greater stakeholder input and participation	Füssel & Klein (2006); Hinkel (2011); Preston *et al.* (2011)
Conservation organizations often lack social science expertise required to conduct AC assessments and often have limited resources to implement them	Bennett & Roth (2015)

adaptive capacity: (1) learning to live with change and uncertainty; (2) nurturing diversity for resilience; (3) combining different types of knowledge for learning; and (4) maintaining opportunity for self-organization toward socioecological sustainability. Recently, there has been an increasing awareness of the importance of social capital, social networks, institutions, and governance in determining a social system's ability to adapt to climate change (Engle 2011; Cinner *et al.* 2013; Lockwood *et al.* 2015).

Despite the well-developed literature on adaptive capacity, key challenges facing conservation organizations include understanding why it is important to assess and which factors should be assessed (Table 1). This article has three aims to address these challenges: (1) highlight the importance of assessing adaptive capacity to inform conservation planning and management; (2) generate a list of prioritized factors for evaluating adaptive capacity to guide conservation NGOs in conducting assessments in tropical island communities; and (3) explore potential differences in prioritization between academic experts located in developed countries and local stakeholders from a developing nation in the Pacific.

Why conservation organizations need to assess adaptive capacity

Conservation organizations are increasingly assessing the adaptive capacity of ecosystems and the human communities that depend upon them to identify risks and prioritize management interventions. This has been fueled by two important shifts in conservation: (1) an increasing emphasis on human well-being; and (2) the recognition that communities with reduced adaptive capacity have greater potential for environmental degradation (Marshall 2010). The more adaptive capacity a system has, the more likely it will be resilient to climate change (Engle 2011). Understanding how systems are positioned to cope with climate impacts is essential for understanding and reinforcing the potential effectiveness of conservation actions, identifying strategies to adapt to climate change, and knowing where to prioritize conservation investments.

The adaptive capacity of ecosystems including human communities affects the success of conservation actions and policies (McClanahan *et al.* 2008; Cinner *et al.* 2013). For example, communities with low adaptive capacity may be less likely to cope with restrictions on resource-use and therefore, less willing to comply with conservation measures (McClanahan *et al.* 2008). Ignoring adaptive capacity means that key considerations (e.g., political will, institutional capacity, and cultural support) that influence the ability to manage risk and the effectiveness of conservation actions are not incorporated into conservation planning and management. The exclusion of such considerations also leads to different conservation decisions (Sexton *et al.* 2010). Finally, assessing adaptive capacity allows conservation resources to be directed to most effectively achieve desired social and ecological outcomes, and informs the allocation of adaptation funding, which provides a significant source of income for island conservation. The degree of adaptive capacity may be used to prioritize conservation areas for investment (e.g., local communities may be more likely to adapt to restrictions and take advantage of new opportunities in places with high adaptive capacity; McClanahan *et al.* 2008).

Methods

Two methods were utilized to evaluate adaptive capacity factors in this study: the Delphi method and a focus group comprised of local stakeholders in Pohnpei, Micronesia.

Delphi method

The Delphi method was selected to develop a prioritized list of adaptive capacity factors because it provides a

Table 2 Delphi experts

Experts	Discipline	Location of institution	Regional expertise	Number of climate vulnerability adaptation and resource management papers	Number of years working in the field
1	Climate, disaster, risk reduction, gender	USA	Asia, Pacific	>10	>10
2	Climate vulnerability, livelihoods, and adaptation, decision support	UK	Africa, Asia	>20	>10
3	Societal responses to climate change, comanagement, how socioeconomic conditions influence natural resource use	Australia	Africa, Asia, Pacific	>90	>10
4	Climate change, adaptation, vulnerability, disaster risk reduction	United Kingdom	Africa, Europe	>200	>30
5	Climate change, adaptation, vulnerability, disaster risk reduction	Denmark	Africa, Asia	>20	>30
6	Climate change, adaptation, vulnerability, natural resource management	USA	Asia, Central America, Pacific, U.S.	>20	>15
7	Climate change, adaptation, vulnerability, social change, environmental management	Australia	Africa, Australia	>40	>20
8	Climate change, adaptation, vulnerability, mitigation	USA	Asia	>40	>20
9	Climate change, adaptation, vulnerability, marine policy, natural resource management	USA	Latin America, Pacific, Southeast Asia, U.S.	>10	>20
10	Climate change, adaptation, vulnerability, environment, and resource use	Canada	Africa, Asia, Canada, Pacific, U.S.	>100	>30
11	Climate change, adaptation, vulnerability, hazards, small island states, environmental management	United Kingdom	Africa, Asia, Caribbean, Europe	>50	>15
12	Climate change, adaptation, vulnerability, natural resource management, small island states, traditional ecological knowledge	USA	Asia, Central America, Pacific	>10	>20

structured approach to collect and analyze data to achieve convergence of expert opinion (Linstone & Turoff 1975), and it has been applied in climate change and vulnerability analysis (e.g., Brooks *et al.* 2005). Twelve vulnerability and adaptation experts were selected. Research suggests that between 10 and 15 experts are recommended (Garrod & Fyall 2000). Criteria for selection included: (1) climate vulnerability and adaptation knowledge based on climate vulnerability or adaptation publications in peer-reviewed journals; (2) research conducted on climate change and adaptation; (3) development or application of tools to assess the impacts of climate change and the development of adaptation strategies; and (4) expertise in tropical island environments and developing countries (Table 2). Experts participated in three rounds of the Delphi exercise. Prior to the first round, panelists were given a list of definitions of key terms including vulnerability, adaptation, adaptive capacity, and climate change based on IPCC (2007). They were asked to address gaps in the list of adaptive capacity factors from the literature review, and were asked to refine and prioritize the factors in the context of tropical island communities. They rated the importance of adaptive capacity factors using a 5-point Likert scale.

Focus group

The prioritized list obtained through the Delphi exercise was tested through focus groups in Pohnpei, Micronesia. Pohnpei is the largest and most populated island in the Federated States of Micronesia, and climate change is a significant threat. Historically, Pohnpeian society was structured into tribes and clans, headed by chiefs. Today, natural resources are managed through a complex combination of traditional leadership and government (Raynor & Kostka 2003). Focus groups were convened to explore the degree of consensus of participants in greater depth than would be permitted through a Delphi (Morgan 1993). Focus groups were conducted because they can be sensitive to cultural variables, encourage participation from those who may be reluctant to complete surveys, and are more culturally appropriate in communities who rely on group discussions for decision-making, such as those in Pohnpei (Englberger 2003).

Focus groups were conducted with 17 community members from the following villages: Dehpehk/Takaiou, Metipw, and Nanpil/Nett, and included key stakeholders (local chiefs, government officials, and conservation workers). The focus groups were asked to brainstorm factors likely to affect the capacity of a community to adapt to climate change, discussed definitions of climate change, and were given the same IPCC (2007) definitions provided to the Delphi group. Key terms were translated into the local language through facilitated group discussion. Each focus group was given the list of factors from the Delphi (Table 3), and was asked to include any missing factors based on the brainstorming exercise. Focus group members were asked to rank factors, and consensus was achieved through group discussions on the first, second, third most important, and least important factor affecting adaptive capacity.

Results

Delphi results

Nineteen adaptive capacity factors were identified through three rounds of Delphi (Table 3). Consensus of strong support ranged from none to high. Over half (68%) of the factors had high or medium support for strong consensus. The majority that received low or no consensus of strong support related to climate impacts on ecosystems and ecosystem responses. Ecosystem-specific factors were added in the second round due to an expert's comment that the list did not adequately address ecological resilience.

One expert noted the importance of adaptive management and the need for learning mechanisms to ensure lasting benefits of adaptation actions. In response, two factors were added: presence/effectiveness of learning processes that support adaptation and conditions that support adaptation leaders (Tables 3 and 4). Both received a high consensus of strong support in subsequent rounds. In the final round, experts were asked to identify the top three most important factors and the least important. The top three were: (1) capacity to plan, learn, and reorganize in response to hazards/climate events; (2) effectiveness of and access to institutions supporting adaptation; and (3) local knowledge, practices, and mechanisms to cope with climate events and impacts, and the least important was perception of equity in accessing resources.

Focus group results

The Focus group in Pohnpei identified the following adaptive capacity factors: strong leadership, collective responsibility, organized communities/social groups, and healthy natural resources as important for supporting adaptive capacity. The group identified lack of knowledge and skills, insufficient resources, lack of organization, and breakdown of traditional practices as limitations. Focus group members ranked the most important factors of adaptive capacity as: (1) climate change awareness; (2) leadership effectiveness; and (3) local knowledge, practices, and mechanisms to cope with climate events and impacts; and the least important was perception of equity in accessing resources.

When the focus groups' results were compared with the Delphi results (Figure 1), a number of similarities emerged, but there were also differences. Some factors that were identified as very important to both groups were capacity to plan, learn, and reorganize; presence and effectiveness of formal and informal learning processes supporting adaptation; local knowledge, practices, and mechanisms to cope with climate impacts; and effectiveness of adaptation leaders. As mentioned, both groups identified perception of equity in accessing resources as one of the least important.

However, there were some key differences between the two groups. For example, with regard to ecosystem-specific adaptive capacity factors, 18% of Delphi panelists identified the level of biodiversity as least important, compared to 36% of the Focus group community members who identified it as very important. Major divergence also existed between how the Delphi group and the Focus group ranked effectiveness of and access to institutions supporting adaptation. The Delphi group ranked it as one of the most important, while the local stakeholders ranked it as one of the least important. The Delphi group also ranked how well natural resources are currently managed, and access to financial, material, and

Table 3 Prioritization of adaptive capacity factors identified by Delphi experts and stakeholders (mean and standard deviation, degree of strong consensus and rankings)

Factors	Definition	Delphi mean (SD)	Delphi degree of consensus	Delphi expert rank	Focus group stakeholder rank
Planning and learning	Capacity to plan, learn, and reorganize in response to hazards/climate events	4.91 (0.30)	High	1	5
Resource management effectiveness	How well natural resources are currently managed (informally/formally)	4.09 (0.30)	High	7	15
Presence of local coping strategies	Local knowledge, practices, and mechanisms to cope with climate events and impacts	4.55 (0.52)	High	3	3
Leadership effectiveness	Effectiveness of leaders	4.00 (0.45)	High	4	2
Social networks	Effectiveness of and access to social networks	4.00 (0.63)	High	11	13
Resource access	Access to financial and material resources	4.18 (0.75)	High	6	14
Institutions supporting adaptation	Effectiveness of and access to institutions supporting adaptation	4.45 (0.82)	High	2	10
Effective learning processes	Presence and effectiveness of learning processes that support adaptation (e.g., extent to which community has processes/culture to stimulate learning through experimentation, to assess outcomes, and to use results to improve adaptation)	4.27 (0.79)	High	5	6
Mechanisms to support leaders	Presence/effectiveness of conditions that support adaptation leaders (e.g., processes to pass learning from one person/project to another, mentoring)	4.00 (0.63)	High	13	17
Information access	Access to information and knowledge to cope with risk	4.27 (0.79)	High	9	11
Ecosystem resilience	Resilience of key natural resources and ecosystems	4.18 (0.87)	Medium	14	18
Equity	Perceptions of equity in accessing resources	3.82 (0.60)	Medium	19	19
Warning mechanisms	Effectiveness of and access to warning mechanisms	3.91 (0.70)	Medium	12	16
Climate refugia	Presence of climate refugia	4.00 (0.89)	Low	18	9
Alternative livelihood opportunities	Alternative livelihood opportunities (including subsistence and income-generating activities)	3.82 (0.87)	None	10	12
Livelihood diversification	Level of current livelihood diversification	3.82 (0.87)	None	8	7
Climate change awareness	Community awareness of climate change	3.45 (0.93)	None	15	1
Ecosystem adaptation	Adaptation potential of ecosystems	3.73 (0.79)	None	17	8
Biodiversity	Level of biodiversity	3.18 (0.98)	None	16	4

Table 4 Key adaptive capacity factors with examples of indicators[a]

Factor	Definition	Example indicator
Awareness of climate change	Community awareness of the causes and impacts of climate change	Definition of climate change; observed/expected changes in climate; perceived causes and expected impacts; # adaptation actions implemented; access to climate information.
Effectiveness of leaders	Effectiveness of leaders in community who can mobilize awareness and resources to better cope with climate change	Scaled rating of respondents trust in local leadership's knowledge and preparedness for climate change. Perceptions of corruption and efficacy of local leadership. At the policy level, the number of adaptation and mitigation programs that are planned; government spending toward climate adaptation and mitigation programs.
Capacity to plan, learn, and reorganize	Capacity to plan, learn, and reorganize in response to hazards/climate events reflects capacity to anticipate the future; without it, any response to climate changes will be reactive	Number of organizations/public private collaborations emerging annually in response to climate change threats; number of amendments to local development or conservation management plans or new plans that address climate adaptation. Responses to open-ended questions relating to a hypothetical 50% decline in key natural resources; responses to statements such as, I am interested in learning new skills outside of my profession; I plan for my financial security; Every time there is a change, I plan a way to make it work for me.
Learning processes	Presence and effectiveness of learning processes that support adaptation (e.g., extent to which community has processes/culture to stimulate learning through experimentation, to assess outcomes, and to use results to improve adaptation)	Adoption of new technologies that reduce risk to climate change. Responses to statements such as: If my garden was destroyed, would I (move garden; plant different type of crop; switch to different subsistence activity; move household to another village; other?) If the reefs where I fish were destroyed (fish on different reef; change gear; switch to alternate activity; move); If my house was destroyed by natural hazards (rebuild in same location/same materials; rebuild in same location with stronger materials; rebuild somewhere less vulnerable; relocate to different community).
Conditions supporting adaptation leaders	Presence/effectiveness of conditions that support adaptation leaders (e.g., processes to pass learning from one person/project to another, mentoring)	The number of training opportunities such as workshops, courses, capacity building (e.g., conflict resolution, management, development needs, environmental education, policy development), as well as participation relative to recruitment.
Local knowledge	Local knowledge, practices, and mechanisms to cope with climate events and impacts	Knowledge of natural hazards and responses in village, local impacts of climate change; threats to natural resources; quantity and quality of primary sources for environmental information.
Social networks	Effectiveness of and access to formal/informal social networks (e.g., women's groups, church groups, youth groups, Council of Chiefs), which may help people prepare for and respond to climate events in community; social networks may either reinforce or limit adaptive capacity	Total number of community groups that respondent belongs to; network size; network structure for risk and adaptation management.
Access to financial and material resources	Access to financial (e.g., credit, loans, money) and material resources in community to support adaptation	Income; debt; access to credit; consumption and expenditure data; responses to statements such as: "we always have an amount of money available for emergencies"; measure of whether respondents have material possessions such as vehicle, electricity, and the type of walls, roof, and floor.

[a]Objective and subjective qualitative and quantitative indicators are presented to provide a range of possibilities (Marshall *et al.* 2010; Cinner *et al.* 2013; Matsuda *pers. comm*.).

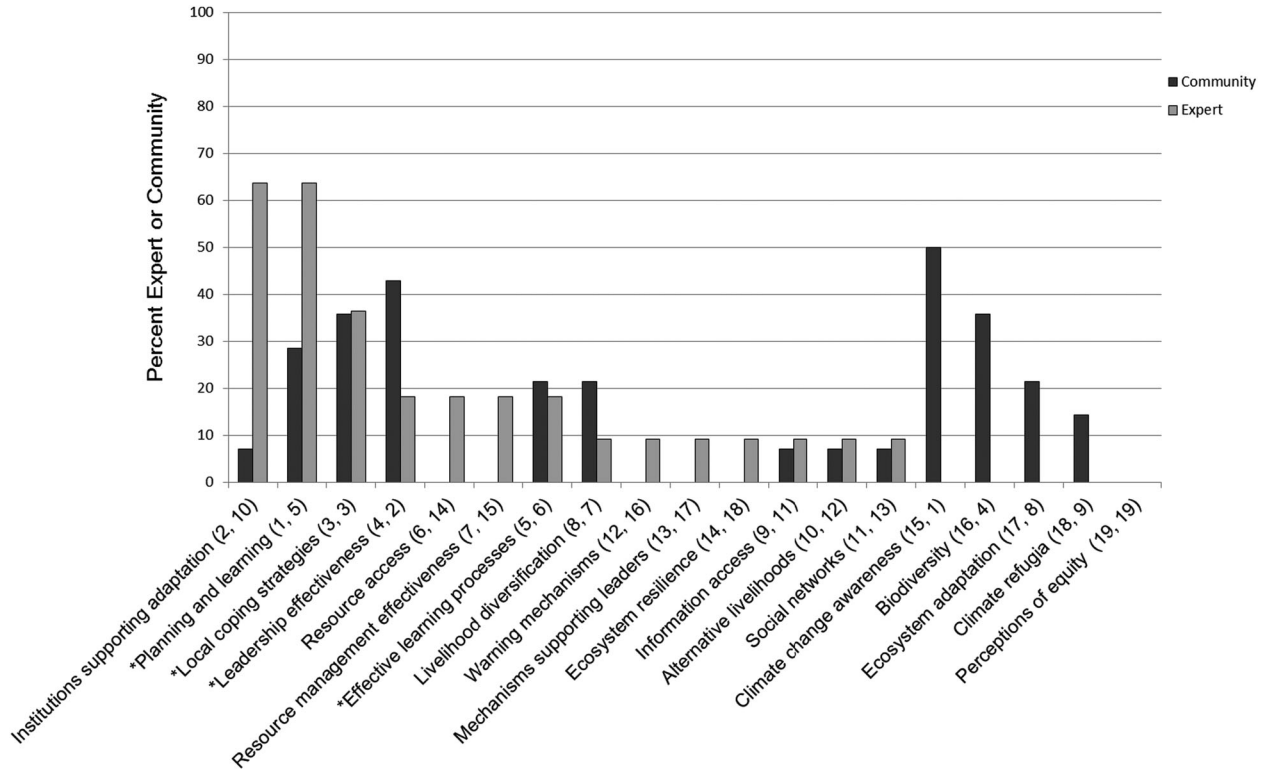

Figure 1 Community and global expert views on importance of adaptive capacity factors. The *x*-axis includes the list of factors affecting adaptive capacity, and the *y*-axis indicates the percentage of experts or community members who identified factors as one of the top three most important. The parentheses include the rank of a given factor by expert and then community, and asterisks demonstrate high rankings for both groups.

technological resources to help cope with disaster as more important than the community. One of the most critical distinctions between the groups was the ranking of community awareness of climate change, e.g., the Delphi group ranked this near the bottom of the list (15th), whereas the local stakeholders ranked it at the top (1st).

While important differences were found between global climate vulnerability experts and local stakeholders in Pohnpei, it is problematic to attribute these solely to differences in backgrounds and locations. Methodological challenges such as power dynamics in the focus groups may have affected the rankings. Further, both the academic experts and local stakeholders (decision-makers, chiefs, conservation, and development planners) are likely to come from a respective position of power or privilege, which may not provide an adequate diversity of perspectives, especially at the local level.

Discussion

The severity and scale of climate change impacts requires conservation organizations to assess adaptive capacity to inform conservation planning, management, and investment decisions. Doing so will help to clarify and reinforce the effectiveness of conservation actions, identify and prioritize adaptation strategies, and where to prioritize conservation investments. However, assessing adaptive capacity requires changes in current capacity and investment of limited resources, specifically, the need to build social science research capacity to conduct the assessments, which is a typically underfunded and underrepresented research skillset in many large conservation organizations (Bennett & Roth 2015). It also requires partnerships with universities, development organizations, or other groups with the necessary social science expertise. The results of this study (and widely accepted as best practice in conservation management and to address climate change; Huntington 2000; Pullin & Stewart 2006; Tompkins *et al.* 2008) reinforce the importance of incorporating local knowledge and input into the assessment process. Adaptation projects need to consider the capacity and time to integrate local input and build the necessary expertise, facilitation skills, and capacity development of community facilitators into long-term plans and funding (Wongbusarakum *et al.* 2015).

To encourage greater incorporation of adaptive capacity into conservation decision-making, conservation organizations need guidance on how to select methods for

implementing assessments and which factors are most critical to assess. Research comparing and evaluating strengths and weaknesses of different methods for assessing adaptive capacity is needed to help resolve the challenges of method selection. Conservation organizations have traditionally prioritized measuring changes in ecological condition, as opposed to changes in social condition and capacity, thus guidance is needed on appropriate indicators (e.g., Spearman & McGray 2011) to assess changes in adaptive capacity over time (Table 4). Additionally, research exploring the challenges and benefits of implementing adaptive capacity assessments also would be valuable to the conservation community, highlighting examples of indicators used and best practices.

Many of the factors affecting adaptive capacity identified in the literature and through this research include subjective and vague terms (e.g., learning processes, institutions, and equity). If local stakeholders are asked to rank a list of adaptive capacity factors, lack of clarity on the factors may make it difficult to incorporate local input. Ensuring that terminology is clearly explained and translated into the local language is essential in community consultations, as is soliciting input on adaptive capacity factors from communities in their own words. As mentioned, academic experts and local stakeholders consulted in this study are likely from positions of power, which may have influenced the low ranking of perception of equity accessing resources. However, if conservation organizations ignored this factor, it may lead to greater power inequalities, marginalization of certain groups, or undermining conservation goals. Therefore, it is important to ensure that local input represents a diversity of perspectives and values including participation from vulnerable and marginalized individuals and groups (Hicks *et al.* 2009).

While more research is needed across different geographies and ecosystems to prioritize adaptive capacity factors, the Delphi results provide a useful starting point for conservation teams to consider for adaptive capacity assessments in tropical island ecosystems. They are based on decades of collective experience developing and analyzing climate vulnerability assessments globally. Importantly, however, they do not incorporate local climate knowledge and adaptation priorities in Pohnpei, as demonstrated by the focus group results, thus reinforcing the need to include local input. Our analysis suggests that in Pohnpei, critical factors to consider in adaptive capacity assessments include: awareness of climate change, capacity to plan, learn, and reorganize; presence and effectiveness of learning processes; local knowledge to cope with climate impacts; and effectiveness of adaptation leaders (Table 4).

Historically, assessments developed by conservation organizations have been criticized for dealing insufficiently with social aspects of social–ecological systems, and those developed by development organizations have been criticized for missing key ecological aspects (Adger 2006). When conservation organizations do consider adaptive capacity, they often prioritize ecosystem-specific factors based on their organizational focus on ecosystem protection and the often high degree of community dependence on their natural resources. Our results reinforce the necessity of including both social and ecological components. Additionally, local stakeholders in Pohnpei ranked ecosystem-specific factors as more important than the Delphi group, demonstrating how a disconnect between social and ecological factors may be reinforced when local input is excluded. While the recognition that human actions and social structures profoundly influence ecological dynamics and vice versa is not new (Folke 2006), conservation assessments are only recently combining both social and ecological components (e.g., Cinner *et al.* 2013; Gombos *et al.* 2013).

Differences in prioritization of adaptive capacity factors between global experts and local communities demonstrate the importance of conservation groups seeking input from both groups. The most surprising result was the ranking of community awareness of climate change (Delphi group ranked it 15th, local stakeholders ranked it first). The Delphi group may have ranked awareness low because they assumed communities are already aware of climate change and hence, it does not constrain adaptation. However, local stakeholders appear to know that climate change awareness needs improvement in Pohnpei and directly impacts local responses. Such differences in ranking show that assessments excluding local stakeholders may miss key factors directly impacting the success of adaptation strategies, and conservation strategies, more broadly.

Despite the overwhelming number of community-based tools to support climate vulnerability assessments used by conservation organizations, such tools often neglect adaptive capacity due to the challenges mentioned (Table 1). Without the necessary guidance, conservation organizations may ignore adaptive capacity altogether (e.g., NatureServe's Climate Change Vulnerability Index) or miss key components resulting in conservation strategies that do not achieve the desired conservation objectives or adequately consider the role of human decision-making (Grothmann & Patt 2005). Further, conservation groups need guidance on how best to support adaptive capacity and how much they should invest in these improvements (Sexton *et al.* 2010), which requires effective partnerships with government agencies and development organizations with the mandate and

expertise to support social adaptive capacity. Research is also needed to explore if/how adaptive capacity influences a community, group, or nation's motivation and ability to conserve species, habitats, and ecosystems. Without such data, it is challenging for conservation organizations to make the case for sustained investment in supporting adaptive capacity.

Conclusion

Ultimately, the effectiveness of conservation actions in an era of climate change depends on the ability of communities and local organizations to be innovative, learn through uncertainty or crisis, develop and maintain a collective memory of resource management approaches, link different knowledge systems to support learning and adaptation, and collaborate to maintain organizational and institutional diversity (Armitage & Plummer 2010). Conservation organizations need to understand the highly contextual variables that influence adaptive capacity, and reinforce the most important factors that empower effective community responses that enhance social and ecological resilience. Adaptive capacity assessments are necessary to ensure conservation strategies are locally relevant and incorporate local knowledge critical to conservation planning (Huntington 2000). These assessments can also inform adaptation funding decisions and build local support for conservation actions and policies.

Adaptive capacity assessments also have an important global role in prioritizing conservation investments. Approximately 25 billion USD is allocated to climate adaptation each year, with a majority flowing from developed to developing countries (UNFCCC 2011). The allocation of adaptation funds is often based on the results of assessments developed by experts from developed countries. Conservation organizations, development agencies, and adaptation funders need to recognize that local input is a critical factor in adaptive capacity assessment; and enhancing local input in these assessments has the potential to both change and improve the way that adaptation projects are prioritized, funded, and completed. Such groups also have an important role to play in pushing for greater transparency and accountability in the development and application of adaptive capacity assessments at local, national, and international levels.

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