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RESEARCH ARTICLE



## Collective action by community groups: solutions for climate change or different players in the same game?

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### ABSTRACT

Community groups are taking initiatives to adapt to a changing climate. These organizations differ from businesses and governments by being non-profit, often informal, resource limited, and reliant on volunteer labor. How these organizations facilitate collective action is not well known, especially since they do not necessarily solve common pool resource governance, but rather improve common pool resources through collective action. In fact, at first glance, community groups seem to not have the means for solving collective action problems used routinely in industry and government, such as paying people for cooperation or punishing them for lack of it.

This article investigates how community groups solve collective action problems though data gathered across 25 organizations in three sites – Sitka, Alaska, USA; Toco, Trinidad; and a global site of distributed citizen science organizations. We found that community groups used positive reinforcement methods common to industry and used little punishment. Groups also engaged in mechanisms for collective action, such as relying on altruistic contributions by few individuals, that generally are not considered commonplace in businesses and governments. We conclude by discussing implications from this study for collective action theory and for how policymakers might learn from community groups to address climate change.

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## 1. Introduction

Climate change is an ongoing, creeping environmental influencer contributing to a wide variety of stressors for communities. Climate change drives ecosystem and social changes intersecting deep-rooted, chronic vulnerabilities, including how communities experience extreme weather, infectious disease, food systems, and many more (Romanello et al., 2021). In response, in diverse settings across the globe, grassroots organizations are taking initiatives that address climate change impacts and improve well-being. These community groups differ from other players like governments and businesses by being non-profit, with limited resources, and highly reliant on volunteer labor. However, they effectively utilize the resources at their disposal and instill collective action – i.e. engaging in cooperation when there is at least some incentive to not do so.

That climate change adaptation and mitigation is a collective action problem is well founded by researchers and policymakers (Aldy et al., 2001; Pendergraft, 1998; York et al., 2021). Climate change is a transboundary and large-scale (spatially and temporally) problem for which many suggest there is limited individual incentive to reduce risk but instead incentive to free ride. At the international level, climate change governance

and responses have been framed as collective action problems – and specifically ones mostly not being overcome (Barrett, 2016; Esty & Moffa, 2012; Glicksman, 2010). At the local level, climate change is also viewed from this perspective but with a broader mix of successes and failures (Aldy et al., 2001; Boda & Jerneck, 2019; Colding et al., 2021; Kreitmair & Bower-Bir, 2021; Pendergraft, 1998; Soubry et al., 2020). Indeed, the collective action concept is so well established in climate change contexts that it is referenced 57 times across the most recent Intergovernmental Panel on Climate Change Working Group report (Intergovernmental Panel on Climate Change, 2022).

How community groups overcome collective action problems within their organizations is much less well known, and at first glance these organizations do not seem to have the means for solving collective action problems used routinely in industry or government, such as paying people for cooperation or punishing them for lack of it. This gap in our knowledge of how community groups operate may reflect the trend of minimal engagement in ideas of “community”, especially for climate change related impacts (Barrios, 2014; Bulley, 2013; Faas & Marino, 2020; Titz et al., 2018) that is coincident with community engagement in risk reduction

becoming “mainstreamed to the point of orthodoxy” (Maskrey, 2011).

The function of these community groups has significance to theory and to public policy because of their major role in response to aspects of climate change adaptation that are not being addressed by governments or industry. Although community groups have and pursue their own material goals (Hilhorst, 2003; Prakash & Gugerty, 2012; Wallace et al., 2007), they fundamentally are oriented toward generating benefits for agents *outside of their group*. As will be seen in our results, the groups we interviewed are, *inter alia*, focused on creating benefits such as cleaner beaches, more sustainable fishing, or reduced landslide risk, that accrue primarily to individuals and organizations outside the group taking the action. The question for these groups is how to maintain collective action that “pays it forward” in this manner, not how to govern the totality of the system to render defection an unsustainable strategy. That is, to function, the groups must stop defection among its own members so as to generate benefits that accrue to those outside the group who do not contribute to it.

Thus, community groups operate in a very different ecology from the governance of all actors models typically applied to climate change collective action research (Benjamin Sovacool et al. 2015). In fact, not all collective action solutions end up solving common pool resource governance (Ostrom, 2010a, 2010b, 2010c) or even aiming for that – especially as recent work has continued to progress ideas and actions (Abbot, 2018). Instead, local collective action can contribute to improving those common pool resources, with these actions requiring more investigation given how much focus tends to be placed on older concepts of common pool resource governance.

Examining such groups therefore may have the potential to incite a fundamental re-think of collective action for climate change. Most prior literature assumes a governance approach by framing the problem as one of structuring rules and incentives to prevent all or most relevant actors from defection (Ostrom, 2010c; Sovacool, 2015). Although Ostrom (2010b, 2010c) identified that many sub-global actors were taking effective (if limited) action against climate change as part of her polycentric systems model, she still conceived of major countries as players in a global governance game.

We could alternatively recognize that these countries are unable to fully govern the system, leaving roles for community groups. They may seek to generate benefits, including for climate change adaptation and mitigation, despite the lack of any global governance that can prevent defection by other country-level actors. This fundamentally shifts the collective action problem from a mindset of governing common pool resources to accepting that such governance is limited, whereas local collective actions that can generate and pay forward benefits are possible. Nonetheless, between the national and local levels, there remains a wide range of actors from a variety of sectoral areas that continually shape and reshape collective action on climate change, especially beyond common pool resources (Scobie, 2019).

To contribute to expanding and deepening these topics, the purpose of this study is to understand how community groups overcome collective action problems and identify potential

ways that policymakers and researchers can support these efforts. We examined three distinct research sites where community groups are working to help their communities adapt to climate change: Sitka, Alaska; Toco, Trinidad; and a global set of citizen science organizations. These sites represent a broad mix of contexts where organizations are working collectively. They also engage in many different activities, from turtle conservation and farming, to counting of reef fish, improving access to affordable and fresh food, and running fitness centers, pharmacies, job training programs, and other community-based institutions. This diversity makes them a useful sample for the study.

We next review the relevant literature that was the basis for our inquiry before describing our interview methods that were designed to test how community group leaders and members perceived various collective action mechanisms. We then present our results and discuss the research and policy implications of our findings before concluding.

### 1.1 Collective action theory and community groups

A long-standing and still-evolving interdisciplinary literature defines collective action problems as occurring when there is some incentive for individuals to not perform or incur the cost of a cooperative behavior but still gain at least part of the collective benefit from others’ cooperation (Axelrod & Hamilton, 1981; Gavrillets & Fortunato, 2014; Hardin, 1968; Ostrom, 2010a). Cooperation is conceived in this same literature as any social interactions in which individuals coordinate their behavior to pursue a collective benefit.

In the collective action literature just cited, individuals who do not behave cooperatively are said to “defect”, and by simultaneously reaping collective benefits without contributing to their production they become “free riders.” Assuming the cooperative behavior entails some degree of cost of an individual’s time, money, or other resources, then free riders achieve greater net gains than would cooperators in systems that involve a collective action problem. When systems evolve over time, for example by allowing in new members, or when individuals copy or otherwise influence each other’s behaviors, free riders threaten to wholly undermine cooperation in response to a collective action problem. Left unchecked, this can result in the total collapse of cooperation, eliminating the collective benefit for everyone.

One system with this dynamic is the famous Prisoner’s Dilemma, named for the practice of interrogating prisoners separately from one another and offering them the greatest relief from prison terms in the condition that they confess while the other suspected confederate does not (Table 1). Cooperation in this case is not confessing to the police, while defection is the act of confession (Axelrod & Hamilton, 1981)

**Table 1.** Prisoner’s Dilemma Payoff Matrix. Note: payoffs in the cells are Player 1 / Player 2.

Player 2 Behavior	Player 1 Behavior	
	Cooperate	Defect
Cooperate	Medium/Medium	High/Very Low
Defect	Very Low/High	Low/Low

Not all collective action problems, however, conform to the Prisoner's Dilemma. Another recognized payoff structure that involves a collective action problem is termed the snowdrift game, which occurs when a stronger player is best able to achieve a benefit that incidentally benefits others (Kümmerli et al., 2007). The game is named for the hypothetical scenario of two drivers whose cars are trapped in a snowdrift in such a way that digging out one car will free the other. In such a scenario, the stronger of the drivers has an incentive to do all the work (the other is a freerider) because that gets the strongest driver going fastest, even though the other driver benefits without paying a cost (Table 2).

While in empirical studies it is frequently impossible to quantify precisely the game structures in which players participate, we will show that keeping them front of mind when analyzing even qualitative data can aid in gleaning policy insights from research. This is because the game structures help keep clear what might be utilitarian inducements versus other non-utility-maximizing factors that influence behavior. Some prior academic work, for example Olson (1965), has considered as equivalent the concept of asymmetric benefits as in a snowdrift with inferred 'benefits' in the form of subjective preferences (Dixit, 1999; Sandler, 2015). That is, starting from an economist's assumption that all human behavior is guided by benefit optimization, one can explain individuals who are high skew contributors to common pool resources, but who did not receive anything in return or even accepted net costs, by inferring they received wholly subjective benefits from mere performance of the altruistic behavior. Such explanations, however, are tautological, that is, they do nothing but restate the initial observation. Why did the altruist help? Because they experienced subjective benefits. How do we know they experienced these benefits? *Because they helped*. The fact that some members of a group contributed a great deal more should not be taken to mean the game being played is a snowdrift, nor taken, ipso facto, as evidence they received greater benefits in a non-tautological meaning of that. We best will find actionable policy recommendations only if we are open theoretically to the possibility of a variety of utilitarian and non-utilitarian promoters of cooperative behavior, rather than by assuming human behavior is always best explained by utility maximization of benefits either observable or unobservable.

For example, the structure of the snowdrift game has been applied to explain why chlorofluorocarbons (CFCs) were removed so successfully from use in contrast to much more limited progress on agreements to control greenhouse gas emissions (Zefferman, 2018). The greatest benefits from eliminating CFCs flowed to Northern latitude countries because these countries were more threatened by the depletion of the ozone layer near the poles. This made Northern latitude

countries willing to compensate countries near the equator to stop CFC use. Northern latitude countries were also the greatest users of CFCs and so able directly to enforce disproportionate change within their borders.

Collective action problems, however, should be regarded as a subset of all human cooperative behaviors. Many cooperative systems might lack the incentive to defect that is needed to create a collective action problem (Clutton-Brock, 2009b; Matthews, 2017, 2022). Cooperation still can be difficult to achieve in such systems due to requisite technical knowledge or detailed signaling among the cooperators, but there is no collective action problem that needs solving in a strict sense. "Risky coordination" has become the term of art for a common form of this type of mutualistic cooperation that does not involve collective action problems *sensu stricto* (Bulbulia, 2012). Risky coordination occurs when individuals reap a collective benefit by performing the same behavior without any incentive to defect, but multiple equally profitable behaviors are possible. An example would be driving on the left or right side of the road. Either option is equivalent in its outcome, but it is critical that all drivers coordinate their behavior to be the same (Table 3). The cooperation issue is how to successfully coordinate amongst behavioral variations that are intrinsically high risk, complex to perform, difficult to learn, or in some other way not obvious.

Some work on collective action in smaller organizations describes how organizations can effectively employ approaches to overcome collective action barriers (Lyon, 2006). Collective action solutions can include using various kinds of "payments" in money, goods, or services; these constitute immediate benefits for individuals that remove the incentive to defect. However, unlike large organizations, most community groups have limited or no material resources that they can use for such payments. Although punishment is often cited as a way to induce cooperation (Boyd et al. 2003; Henrich & Boyd, 2001), unlike governments and some local customary organizations – as well as the private sector and public opinion (Karlsson-Vinkhuyzen et al., 2022) – community groups lack inherited institutions for punishing noncompliance by their members.

Community groups might also rely on a variety of other cooperative modes such as group selection or finding particularly altruistic individuals. These means of cooperation might radically diverge from the theoretical literature just discussed (Clutton-Brock, 2009a; DeMarrais & Earle, 2017; Dubet & Thaler, 2004). In other words, some of these groups, or individuals within them, might be acting in altruistic ways not expected to be sustainable by collective action theoretical models.

**Table 2.** Snowdrift Game Payoff Matrix. Note: payoffs in the cells who Player 1 / Player 2

Player 2 Behavior (Weak)	Player 1 Behavior (Strong/Powerful)	
	Cooperate	Defect
Cooperate	High/High	Low/Low
Defect	High/Very High	Low/Low

**Table 3.** Risky Coordination Payoff Matrix. Note: The options in risky coordination do not include a true "defection" because there is no advantage to defect. Payoffs in the cells who Player 1 / Player 2

Player 2 Behavior	Player 1 Behavior	
	Variant A	Variant B
Variant A	High/High	Low/Low
Variant B	Low/Low	High/High



## 2. Methods

There are many different ways to research collective behaviors in small organizations, each of which has its own strengths and weaknesses. We took a qualitative approach and interviewed leaders from 25 community groups at three distinct study sites to ask them about how their groups resolved their collective action problems. We used a common interview collection protocol to assess respondent's own understandings of how their groups solved collective action problems. We chose interviews because they allow for detailed investigation, while a standardized protocol can help ensure consistency across results. In this way the work is both theory testing and generating.

### 2.1 Study sites

We investigated collective action concepts at three study sites where community groups have been acting to adapt to the effects of climate change. Often these groups organize in response to a perceived lack of action by governments, businesses, or large non-governmental organizations (Hilhorst, 2003) which generally-speaking are better funded and ostensibly more powerful than the groups we studied. We sampled 10 groups through 12 interviews in Sitka Alaska, USA, which is an island community of around 8,600 people. We also sampled 10 groups through 10 interviews in Toco, Trinidad, a coastal and rural area of the Republic of Trinidad and Tobago, comprising 13 communities of approximately 120–1800 persons each. These communities are largely dependent on the environment, and their main livelihoods are eco-tourism, agriculture, wildlife and ecosystem conservation, and fishing and hunting. The ethnically diverse inhabitants of the villages that make up Toco communities share a strong sense of community and belonging, and there are many self-organized community groups that are almost entirely based on volunteerism, ranging from sport to fishing, from attention to the needy and the aged to conservation, agriculture and disaster response teams. A third study site was virtual in character, and comprised 5 citizen science groups working at community levels and with volunteers on environmental issues (6 interviews) from Australia, continental Europe, and the United States.

Our sites represent a unique mix of contexts making them useful for understanding the broad ways that community groups are overcoming collective action problems. The similarities between Sitka and Toco are multiple, with the main differences mainly being geographic scale and latitude. Both sites face the disadvantages of being relatively remote, both spatially and institutionally, which limits the options for access to influence policy makers and resources and therefore makes them more vulnerable to the impacts of climate change (that are felt throughout their respective countries). They both depend on the environment for livelihoods, making them more vulnerable to changes in climate. Within this context, they are confronted with a variety of climate change influenced impacts – from temperature and precipitation changes, environmental degradation, and food insecurity (Sitka and Toco), to landslides (Sitka), and flooding, algae blooms

(sargassum), storm surges, and sea level rise (Toco). Sitka is home to Alaska Native peoples, mostly Tlingit, Haida, Aleut and Tsimpian, and governed by the Sitka Tribe of Alaska: a federally-recognized government. As well as this, the Tlingit-Haida Central Council and the Shee Atiká native corporations also play important roles in governance. Indigenous peoples, including those in Alaska, have a history of collective action and climate activism (Haley, 2004; Watt-Cloutier, 2018; Whyte, 2014). The virtual “site” of citizen science groups provides a complementary perspective on how groups that are not tied to a single place, but that operate in the same topical “space,” might differ in how they self-organize and incorporate volunteer labor into their activities.

### 2.2 Interview data collection

We developed the interview protocol through an iterative series of virtual team meetings that included the entire data collection team across the citizen science, Sitka, and Toco study sites. The final interview protocol is provided in the Supplemental Materials.

We identified individuals to interview using a snowball sampling approach that started from multiple seed individuals. The initial set of respondents for Sitka were obtained through consultation with the Sitka Sound Science Center (SSSC), a local museum and community science center with multiple linkages to organizations in Sitka and close collaborator of the research team during the research process. In Toco, we approached active community groups directly, drawing on our previous work and ongoing connections to the place. We identified the initial set of respondents for the citizen science virtual site based on the research reported in (Chari et al., 2019), which conducted a prior set of citizen science interviews.

Reflecting diverse impacts that climate change is having on communities, organizations' activities run the gambit on adapting to climate change. For instance, in Toco groups included involvement in social development, fishing, turtle conservation, agriculture, women's affairs etc. Our initially contacted individuals were in leadership roles within their organizations – the ones responsible for developing and enacting the strategies. The final number of interviews is shown in Table 4.

### 2.3 Analysis and development of results

We employed both deductive and inductive approaches to identifying the collective action strategies and approaches (Ryan & Bernard, 2003) to code themes for solutions to

**Table 4.** Data collection.

Study site	Number interviews	Number groups	Data collection time period and modality
Citizen science	6	5	Dec. 2020–Feb. 2021 (Virtual)
Sitka, AK	12	10	Nov. 2020–Jan. 2021 (Virtual), Apr. 2021–May 2021 (in Person)
Toco, Trinidad	10	10	Dec. 2020–Feb. 2021, May 2021–July 2021

collective action problems as described by the respondents. We deduced these collective action solutions from the theoretical articles on collective action that are reviewed in the Introduction, and we induced solutions that appeared repeatedly across several interviews but that had not been articulated in existing collective action theory literature. This process resulted in 10 collective action approaches deduced from the literature and 2 approaches induced from our reading of the interview data. These approaches were then categorized into four broader overarching strategies.

Two authors (LJM and ACG) independently coded interview transcripts to establish reliable coding. After coding two interviews and discussing the code discrepancies each time, LJM and ACG achieved 92% agreement in the application (or not) of each of the 12 collective action approaches to the third interview. LJM then proceeded to code the remainder of the interview data from all three study sites.

The codes were applied to marked excerpts from interview transcripts and notes in the NVivo (Release 1.5.1). After marking excerpts with codes, we exported the count of times each code was applied to each interview. We then constructed a matrix of binary data for whether a code was ever applied by a respondent of a specific community group. These binary data for the occurrence or absence of collective action approaches in each group became the primary data construct we used to assess the relative frequency of each collective action approaches across the groups and across the study sites.

### 3. Results

#### 3.1 The types of collective action strategies community groups employed

Table 5 presents an overview of the collective action activities that community groups used in their climate change adaptation work. As the table illustrates, community groups leveraged a diverse set of activities to overcome collective action problems corresponding to different strategies, some of which were found in the literature and others of which were not.

The four overarching strategies that community groups used to solve collective action problems associated with climate change adaptation that we identified are: A. market ‘payments’; B. avoid the prisoner’s dilemma; C. solve the prisoner’s dilemma; and D. leverage or learn from variation. These strategies are diverse. Market payments involves shifting over to market-based solutions like paying people or generating revenue instead of relying on collective action of volunteers. Both market payments (A in Table 5) and avoid the prisoner’s dilemma (B) are examples of *changing the game* to enable cooperation by avoiding collective action problems *sensu stricto* (i.e. removing incentives to defect). Solving the prisoner’s dilemma involves manipulating intra-group dynamics to incentivize within-group cooperation. Leveraging and learning from variation involves working with and building on heterogeneity both within community (e.g. to rely on strong contributors) and across groups (e.g. to learn and understand other approaches).

#### 3.2 Frequency of cooperation mechanisms

Table 6 shows the frequency of these cooperation strategies across the 25 groups of the study. The most commonly reported cooperation mechanisms included those that sustain cooperation by “changing the game” from one where there is an incentive to defect to one in which all parties immediately benefit (Zefferman, 2018). Such mechanisms include reducing the cooperation to a mutualism by providing some immediate good (like free food) that might make the volunteering task directly and immediately worthwhile to the volunteers, paying at least some personnel as employees, and generating revenues to support the incentives just mentioned. Groups reported generating revenue through small donations, large donations, government funds, and through selling products. These three mechanisms (mutualism, payment, and revenue) were reported by at least half the groups at each study site.

Two other mechanisms that were reported by over half of the groups were running group operations by utilizing volunteer hours of particular individuals who contributed vastly more time than did other individuals due to these individuals’ altruism and a sense of dedication to the community, and using social learning by modeling their group’s structure on previously existing similar groups that they observed.

#### 3.3 Factors shaping the use of these cooperation mechanisms

Respondents described reasons why they chose to employ certain cooperation mechanisms in their efforts to address the impacts of climate change. Market mechanisms, social learning, and contributors were widely used. Some used snowdrift dynamics and leveraging existing subcultural signals from place-identity, religion, or ethnicity. Few used group selection, reciprocity, and punishment.

##### 3.3.1 Widely used: market mechanisms, social learning, high skew contributors

**Market Mechanisms** Among of the common approaches to facilitating improved cooperation were market mechanisms. Many activities by the community groups involve limited opportunity for profit, and their activities may be too local to obtain government support, which explains why community groups have formed around them. Given this, it may seem surprising that so many groups (roughly half) reported using market-mechanisms like payments (of money, goods, or services) and revenue generation. However, even though groups used these mechanisms, they noted that their type of activity was difficult to support through market-based mechanisms. For example, a group in Toco stated:

What are the main challenges? Finance is the main challenge. Sometimes I get weary of begging for funds. That is a big challenge. But the goal is to help people and God had been good, so we don’t complain. We have gotten funds to hire people that need money to support their family. You can’t lose sight of your main goal.

Another Toco group stated it a bit more starkly:

**Table 5.** The four collective action strategies and 12 collective action approaches identified, with definitions and examples of those approaches.

Collective action strategy	Collective action approach	Definition	Example quotations
A. Market "payments"	1. Reduce to mutualism	Provide incentives to volunteers such that they receive immediate benefits from the act of volunteering that may make it worth their while. For example, free meal, opportunity to socialize.	<i>Our volunteers have similar motivations to birders, keep it accessible and fun. Don't over burden volunteers. Like don't keep asking them to do more. No requirements for lots of trainings etc.</i>
	2. Pay some employees	Provide salary or wages to get at least some of the needed work done.	<i>Most buying clubs collapse under their own weight and it fails – we knew this would happen and that we needed to build in profits to hire people and pay people a decent wage build capital so the club could continue to grow.</i>
	3. Generate revenue	Statements about ways the organization acquires money. This can involve a number of specific mentioned means including selling products, collecting small donations, grant support from foundations or government, wealthy individual donors, or modern financial banking instruments loans, interest, investments, etc.	<i>Get city on board to work with partner X with regional housing authority to get land. It wasn't 5 different organizations doing 5 different things – here's one project, here's another – X stepped up and took on debt to make this happen. X put in \$400k.</i>
B. Avoid the prisoner's dilemma	4. Shift to a technology solution	Reducing the need to use volunteer labor by finding a technology that can do the work without the need for as much collective action by humans.	<i>We no longer use volunteers to label a lot of things in images because we found we could do most of it with machine learning code</i>
	5. Leverage snowdrift dynamics of powerful people or institutions	Achieve the cooperation by relying on just a few entities that have vast capabilities through something other than just giving of their time.	<i>Partnership with X on the global Y project. We teamed up with Google to build the tech that is Y but we needed a big international conservational impact partner to make sure people found out about it and got it into play.</i>
C. Solve the prisoner's dilemma	6. Reciprocity	Use tit-for-tat (you scratch my back I scratch yours) to facilitate cooperation.	<i>It turned into a huge community. I mean it kind of caught on and we were coordinating now with the hospital, and doctors were coming in, and they were giving free talks on random things throughout the center</i>
	7. Recognition Signals	Only allow individuals to participate in the cooperation who are able to display the "signals" that they are enculturated member of the group. Classic signals of this sort would be religious creeds, secret handshake of the group, etc. This code is for something invented de novo, like the Boy Scout handshake.	no examples found in interviews
	8. Leverage subcultural identities like religion, ethnic group, etc.	The volunteers in the community group are mostly members of some prior existing religious or ethnic group that have a shared cultural affinity amongst them, and they participate in the community group as an explicit part of that religious or ethnic identity.	<i>X (ethnic group) stepped up and took on debt to make this happen. Small windows of unoccupied time. X (ethnic group) put in \$400k.</i>
	9. Group selection	Reliance on chance assortment of individuals into smaller groups within the whole organization to create at least some pockets of cooperators.	<i>We're more of helping to get the goals, and then we put it out there in the community and see who rallies around to make it happen, but we don't make them happen. We more do that beginning piece.</i>
D. Leverage or learn from variation	10. Punishment	Any means reportedly used to penalize a volunteer for not cooperating when they were supposed to do so i.e. punishment for not participating in the collective action.	<i>In order for us to stay licensed and able to continue to operate as an X and keep our status is we have to show that we are doing this [collecting hazardous materials]</i>
	11. Utilize high skew contributors "altruistic mutants" <sup>a</sup>	Achieve the needed collective action through unusually high contributors who give a lot of their time to the effort, without any incentives, and even though most people do not give much time.	<i>Every X project has a skew of a few super-users who contribute a lot of the data and then a big sample of people who contribute little. We think about both ends, take care off/support the super users but also be inclusive of the long tail.</i>
	12. Social learning <sup>a</sup>	Observing and copying other groups' successes or avoiding their errors.	<i>Most buying clubs collapse under their own weight and it fails – we knew this would happen and that we needed to build in profits to hire people ...</i>

a = These themes were derived inductively from the interviews. All other themes we derived deductively from the collective action literature.

The need is there but the funding is not. There are young people trained in the community, but we are not able to pay them. It is not easy to get people that are hungry [whose economic needs are not met] to come out to projects if there are not direct benefits to them.

Like Toco, Sitka is an island community experiencing many similar barriers and opportunities regarding service costs and benefits. These similarities may account for why Sitka community groups also made use of market mechanisms and qualitatively described their reasons:

Most buying clubs collapse under their own weight, and it fails – we knew this would happen and build in profits to hire people

and pay people a decent wage and build capital so we could continue to grow. This is especially a consideration when starting one of these clubs in a rural community. You can't just rely on volunteers.

These excerpts highlight the paradoxical relationship community groups in our study appeared to experience with market-based cooperation mechanisms like payments and revenue. These mechanisms straightforwardly solve some aspects of cooperation, but the nature of the groups' activities was oriented toward group benefits rather than providing services that would generate revenue. Reports of reducing a cooperation problem to mutualism essentially offered a non-

**Table 6.** Frequency of collective action approaches reported by community group leaders.

Collective action mechanism	Collective action approach	Study site			
		Total (N = 25)	Toco (N = 10)	Sitka (N = 10)	Citsci (N = 5)
A. Market "payments"	1. Reduce to mutualism	14	5	5	4
	2. Pay some employees	18	7	6	5
	3. Generate revenue	16	6	7	3
B. Avoid the prisoner's dilemma	4. Shift to technology solution	2	0	1	1
	5. Leverage snowdrift dynamics of powerful people or institutions	8	3	4	1
C. Solve the prisoner's dilemma	6. Reciprocity	1	0	1	0
	7. Recognition signals	0	0	0	0
	8. Leverage subcultural identities like religion, ethnic groups, etc.	5	0	3	2
	9. Group selection	2	0	2	0
	10. Punishment <sup>a</sup>	1	0	1	0
D. Leverage or learn from variation	11. Utilize high skew contributors "altruistic mutants"	14	5	5	4
	12. Social learning <sup>b</sup>	13	3	6	4

Sample sizes, N, count each group once. Any multiple interviews for a single group were counted as one group.

a. One group at Sitka reported intentionally not using punishments that are common at their sort of organization.

b. One group at Sitka reported specifically not using social learning by not examining or copying any other organizations.

monetary immediate benefit to volunteers, like free food, that rendered the volunteering activity more immediately beneficial to the individual.

**Social learning** Respondents also described efforts to implement social learning to identify ways to overcome climate change adaptation related collective action problems. Most groups reported learning how to structure their group by observing other similar groups. Several of the groups that mentioned social learning as a mechanism noted that they continue to try to learn better ways of operating through interactions with other groups. They did this mostly by attending or organizing together with other groups, workshops, and conferences to meet members of other similar community groups and exchange ideas. Only one group leader we interviewed reported that s/he intentionally did not model their group on others, because s/he sought to design the group around their specific goals and knowledge. In contrast to this design type thinking, most groups reported participating in more evolutionary modes of groups formation that tended to copy, a bit by default, many features of how prior groups operated (Lowitt et al., 2015). For example, a group focused on wilderness conservation stated their group formed by local concerned citizens initially partnering with an international conservation group and taking that group as a model. They stated:

At the time, wilderness designation was end all/be all to conservation. Of course, the problem with that, that is coming to light these days, is colonialistic mindset and using that wilderness area. We were ostracized and unpopular.

This respondent went on to state that their organization ultimately shifted away from the model for conservation action that they inherited from the larger group. In Toco many of the respondents reported on groups collaborating and learning from each other, particularly capacity building related to the legal requirements for registration of such groups. However, there were also respondents who lamented the unwillingness of some groups to work with others, due largely from their perspective, to an unspoken competition for funds or resources from donors. Two respondents also mentioned a generation divide, noting that the younger generation felt less the sense

of community and of working for the community benefit without pay and being concerned only about those community activities that could provide a clear source of income.

**High-skew contributors** were essential to the continued functioning of various group activities for over half the groups surveyed. Groups themselves appeared to recognize the problem with depending on rare high contributing individuals whose time was uncompensated. For example, a group leader in Sitka stated:

We worry about volunteer burnout a lot because it might not even be that they want to be there for that many hours. They do wanna be part of it, but I think they feel like it's kind of riding on them and we worry about that.

Two other respondents at different groups, one in Sitka and one a citizen science group, noted they had witnessed group activities succeed or fail based on whether they had one of these super-contributing members involved in that particular activity.

Two respondents in Toco mentioned the value of such individuals to either the establishment of the group (those individuals had the professional skills necessary to manage the legal registration of the group) or to the advising of the group. One of the groups, recognizing the need for this expert knowledge created a board of directors to advise the group. The respondent noted that the group reasoned that while they needed these experts, they knew that they could not count on them on an ongoing basis but that as members of a board that would meet only periodically the group could still benefit from their expertise.

These high-skew contributors are conceptually distinct from snowdrift dynamics (discussed shortly). As discussed below, snowdrifts were reported in our data when powerful entities like Google backed an NGO's activities that also benefited Google. High-skew contributors, in contrast, did not appear to our interviewees to reap any particularly greater benefits than did their other volunteers – other than the subjective and arguable tautological benefit of satisfaction that they contributed. They were not paid more than other volunteers, or thanked more, and nor were they typically more powerful, skilled, or wealthy than were other volunteers. For



these reasons, we did not anticipate high-skew contributors to be so frequently referenced.

### 3.4 Used by some: snowdrift and leveraging subcultural signals

#### 3.4.1 Snowdrift

The theoretical literature argues that the payoff structure of snowdrift cooperation games is inherently easier to solve than are games like the prisoner's dilemma. Thus, when a particularly wealthy or powerful benefactor can be secured it makes sense that community groups seize the snowdrift opportunity. One such example was a citizen science group who was able to enlist Google to provide technical and financial support one of their major efforts by building an artificial intelligence engine for their use-case. Google's support led that effort to being recognized and used by a global set of NGOs and governments. Although companies like Google may be compensated in a sense for such activities through benefits to their popular perception as well as harvesting and selling data without the locals knowing how or why their data will be used, from the standpoint of the community groups, these types of activities by big business or government are windfalls from a powerful outside actor (i.e. it conforms snowdrift game dynamics). In Toco, some groups reported partnering with international conservation groups and sometimes with the government to provide resources for conservation, that indirectly and for the length of the project, also provided income for some group members. One group member said that there was a lot of international money available for turtle conservation. The challenge was to tap into it and have it available on a sustainable basis.

#### 3.4.2 Leveraging existing subcultural identities

Ethnic and religious similarity has long been recognized to play a role at promoting cooperation, at least within the "in-group" (Hamilton, 1975). Ethnic or religious affiliation was used only occasionally by groups in our sample, but as with snowdrift dynamics, these external subcultural affiliations sometimes created windfalls of collective action that otherwise would not have occurred. For example, one group in Sitka stated:

Get city on board to work with X (ethnic group) and partner with regional housing authority to get land. It wasn't 5 different organizations doing 5 different things – here's one project, here's another – X (ethnic group) stepped up and took on debt to make this happen. Small windows of unoccupied time. X (ethnic group) put in \$400k.

This respondent indicated that the loan via an existing ethnic affiliation with their group's mission was substantially helpful for their activity. Because the ethnic group had resources substantial enough to provide a loan, this incident is an example of leveraging ethnic identities and also a case of snowdrift dynamics. While the same loan might have occurred through a more traditional lender like a bank, this case still illustrates how leveraging traditional cooperative structures like ethnicity or religion can boost the level of cooperation for community groups, perhaps resulting in snowdrift dynamics. In Toco,

while the communities include persons of multiple ethnicities and creeds, there is a strong sense of belonging to a shared geographical space distinct from urban or other areas. Respondents noted that group members shared a sense of responsibility for the weaker members (aged, unemployed, youth) in their community and that led them to volunteer to the group activities without compensation and even putting their own resources into achieving the goals of the group.

#### 3.4.3 Group selection

Some respondents did report clear examples of what seems to be group selection. For example, one citizen science group's leaders explained to us they used a chapter model for their organization, and they observed that some chapters would have the right initial mix of volunteers and succeed, while others would not have the right "mix of people" and fail to get off the ground. The larger organization's approach to handling this dynamic was simply to start more chapters. Thus, this would appear to be a classic group selection approach. Groups are started, and some succeed, and some fail due largely to factors outside the larger organization's control, but the whole system can be sustained so long as chapters are produced rapidly enough.

Most groups we interviewed, however, did not report any dynamics like this. Instead, they focused on retaining volunteer effort, including that of high-skew contributors, paying a few people to perform essential tasks that could not go undone, and when possible, seeking out revenue. Thus, while we did hear of two instances of group selection among our respondents, largely this was an infrequent mechanism.

### 3.5 Not used: punishment and custom signals

#### 3.5.1 Punishment

We observed no use of formal punishment by the community groups themselves being reported during the interviews. The only report of punishment was by a community group who had some of their activities linked with government regulations, and in this instance the government was the punisher. We also encountered a buying club that specifically did not punish individuals even though most buying clubs would deny benefits to individuals who did not volunteer enough hours to the group activity. They had intentionally made this decision, according to them, to maximize however little contribution they could get from the maximum number of individuals. This could apply to many other groups as well, i.e. that when a group relies heavily on volunteer labor, any potential disincentive to participation (like punishment) tends to reduce the aggregate contributions across all volunteers even if it might increase contributions from certain individuals.

#### 3.5.2 Custom signals

We did not find any examples of the groups creating their own custom signals for recognizing other groups members. We were told about instances in which some groups would leverage existing recognition signals based on ethnic or religious identities.

## 4. Discussion

Overall, the results indicate that community groups are commonly using solutions to climate change-related collective action previously characterized in the literature as “changing the game” (Zefferman, 2018). In essence this set of solutions takes a situation that would be a collective action problem like a prisoner’s dilemma, in which individuals have a strong incentive to collect benefits but not contribute, and changes that situation through payments (of money, goods, and/or services) such that there is an immediate benefit to the activity for the participants. We cannot quantify the costs and benefits of the various cooperative activities to determine with any precision whether they conform to the structures of the several classical cooperative games like the prisoner’s dilemma, the snowdrift, or risky coordination. We can note, however, that groups reported using payments of money, goods, and services, and it is possible for such payments to shift cooperation payoff structures from something like a Prisoner’s Dilemma to something like a risky coordination game. In turn, this can engender more support from community members towards community groups working to address the local impacts of climate change.

### 4.1 Group practices are socially learned

Reports of groups learning how to structure themselves by observing other groups suggest that groups experience cultural evolution in that they inherit from other groups ways of organizing, but then modify those based on their experience (Boyd & Richerson, 1988). Their modified activities become examples from which the next sets of new groups model themselves.

### 4.2 Reliance on high-skew contributors can be a sustainable solution for collective action

The theoretical literature on collective action has emphasized this strategy as being doomed to fail (Axelrod & Hamilton, 1981). Collective action theory has highlighted that if benefits are given to an entire group but the work of only a few people creates that benefit, then there should be a direct incentive to collect benefits but not contribute. Over time, individuals would be expected to flip from cooperating to “defecting” (in the technical sense), which eventually would undermine the cooperative activity itself. Groups themselves appeared to recognize the problem identified in the theoretical literature with using rare high contributing individuals whose time was uncompensated, as noted by discussion about burnout.

The reasons for reliance on unusually high contributing volunteers by the groups working to adapt to climate change that we sampled may arise from the time duration of most community groups relative to the population sizes of their potential volunteers. As already noted, groups follow an evolutionary dynamic. If we consider the dynamic nature of obtaining volunteers, each small group, which likely will exist only for years to decades, can over this time continuously pull new volunteers from the population. Just by chance, and because there is always variation in nature, some of the

individuals might be highly motivated about the group’s activity, at least for a time. This dynamic, although rightly considered in the theoretical literature on evolution of cooperation to be unsustainable over long durations and especially for cooperative actions to be performed by most individuals, might yet be sustainable from the standpoint of a group that exists only for a short duration relative to human generations and that requires cooperative effort from only a few altruistic individuals. In other words, community groups may have situated themselves such that relying on altruists, while unsustainable for the whole population’s cooperative activities, is sustainable for their particular group’s activities.

### 4.3 Some much-theorized mechanisms were rare

A few mechanisms that have received a great deal of theoretical treatment were rarely reported as being used among the community groups we studied. These mechanisms include group selection, reciprocity, and punishment. Although reciprocity has a long history in the theoretical literature as a collective action solution (Clutton-Brock, 2009a; Trivers, 1971), researchers also have suggested that cooperative dynamics at the scale of human social interactions simply become too complex to coordinate via reciprocity as a mechanism (see the discussion (Bowles & Gintis, 2004) for a critical review of this literature). Our empirical results for this study are consistent with that theoretical argument.

Punishment has received a great deal of attention in the collective action literature, because in theory it can amplify cooperation among the many so long as a relatively few punishers are sufficiently incentivized to punish (Boyd et al., 2003; Henrich & Boyd, 2001). In other words, sufficient punishment should make performing a cooperative behavior an immediate benefit for the individual (because otherwise they are punished), but this creates a second-order cooperation problem of who will do the punishing. This second-order cooperation problem may underly why we found very little evidence for punishment in our study.

We found few cases of group selection being used by community groups. This is consistent with the consensus of the group selection literature that, while theoretically possible, conditions to sustain group selection might be rare.

#### 4.3.1 Policy recommendations

These results may have implications for policymakers working to improve how communities adapt to climate change. One implication is that collaborations by governments with community groups may facilitate collective actions for benefits that are particularly unlikely to be achieved in other ways. Respondents described how they knew their communities and what facilitated action, going beyond easily observable measures related to economic ability to include broader (and much more difficult to measure or support externally) values, interests, and motivations. Community groups are well placed to navigate these situations effectively and to engage and use the tangible and intangible resources they have available. Thus, continued efforts to shift towards and support local actions – such as the localization agenda in the World Humanitarian Summit (Roepstorff, 2020) and localization in action

such as the transition towns movement (Connors & McDonald, 2011) – should be accelerated, with a focus on providing supports that can facilitate community collective action.

Policymakers and outside agencies can work to support these organizations in several ways, primarily through taking on supportive roles shaped through long-term and respectful partnerships, such as those associated with “resourcefulness” for community positive health (Peters et al., 2022). The first may be financial, providing material support that community groups can use to improve collective actions such as by facilitating market mechanisms, or when situations are complex, paying someone. This parallels a large body of work on disaster response and recovery on the efficacy of cash-based interventions for emergencies when the right economic conditions are in place (Doocy & Tappis, 2017; Harvey, 2007). A second important approach is facilitating learning: community groups learn from each other but also from other organizations in the form of conferences, discussions, and other processes. While many exhibit strong ability to seek, secure, and implement new forms of knowledge, they may lack the higher-level awareness of where all of that knowledge is available. Policymakers may be able to facilitate learning by connecting organizations together to develop common understanding of which collective action solutions work and under what conditions (Kudo et al., 2020) – and thus facilitate more robust and reliable networked forms of knowledge development (Tasker & Scoones, 2022).

#### 4.3.2 Strengths, limitations and global implications

One limitation is our results come wholly from groups’ own accounts of how they operate. We solicited groups for records of their actual operations (e.g. meeting minutes, records of volunteer hours) but understandably groups were disinclined to share such potentially sensitive information. One way future research could further test our findings would be to evaluate records of community group operations for evidence of the patterns we observed in the interview data. Participant-observer approaches might be particularly useful as well.

A second limitation is we were unable to sample groups that started, existed for some time, but then failed and ceased to exist by the time we collected our data. Although we heard occasional mention of failed groups in Sitka and in Toco, we likely sampled information about them at a much lower rate than we did existing groups. Groups with a recent history of failure (to the point of no longer being a group) could be informative about the relative riskiness of the collective action strategies we observed. For example, perhaps groups that failed made use of punishment, which really did turn off volunteers just as the surviving groups we interviewed thought it would. Alternatively, maybe failed groups made even greater use of high-skew contributors, which would indicate reliance on them is a high-risk proposition, even if it was successful for some of the groups we interviewed. We leave these hypotheses as promising avenues for further study by a project that might be able to sample recently failed community groups.

Thirdly, this study could not include all groups in the locations, with one prominent absence being Alaska Native organizations that were active in Sitka. Indigenous peoples have a long history of collective action, including around

climate change (Haley, 2004; Watt-Cloutier, 2018; Whyte, 2014). Understanding the perspectives of these groups could provide insight into how non-Indigenous groups can ensure that their actions are just and align with Indigenous people’s goals. This is important as some climate change action has infringed on Indigenous peoples priorities, including in Alaska (e.g. Shearer, 2012).

In fact, these three limitations to some extent converge on the standard challenge or representativeness with research involving necessarily small cohorts. The ability of any such study to draw inferences about the universe of organizations depends on the quality and representation of sampling. Further work ought to explore how sensitive the results here are to the sampling and how the results and the sensitivity might change in a different setting. Nonetheless, this still would not be achievable for groups no longer existing without any available ex-members or for confidential information that will not be made available.

The global implications for this study center on how much localized efforts could be translated upwards or sideways to other locations (i.e. scale up and/or scale out) to effect meaningful and constructive change, rather than survival and maintenance of the status quo. If a powerful country is examined as analogous to a community group, then the policy question shifts from asking how the country can enter into a global governance model that prevents defection to asking how the country can most effectively generate collective action from its own citizenry to produce benefits. An important next step is to develop user-inspired agendas on facilitating collective action, including pressuring for structural changes. Given the primacy of community groups coupled with the need to understand higher-level policy as well as ongoing research, this line of work should be a coproduction involving policy-makers, researchers, and community groups.

## 5. Conclusions

In this article, we set out to examine the strategies that community groups were undertaking to overcome collective action problems related to climate change adaptation. In our examination of three sites where community groups are acting to address the effects of climate change we identify several consistently used mechanisms for cooperation. Arguably, this indicates that classic collective action theory can be instrumental in un-black-boxing community, and that policy-makers can use their resources to facilitate collective action and ultimately reduce climate change’s impacts at local levels by providing monetary support to these groups in ways that helps overcome collective action problems, facilitating inter-community learning and exchange, and drawing on these groups over the policymaking process to shape more conducive policy. Doing so can further facilitate community collective action and leverage community resources for climate change adaptation.

### Human subjects statement

This research was reviewed and approved by the RAND Human Subjects Protection Committee (RAND HSPC),



which serves as RAND's Institutional Review Board (IRB) for all human subject research. HSPC ID 2020-N0657.

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