LETTER

High levels of participation in conservation projects enhance learning

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[Correction statement added after online publication 18 November, 2010: Mark S. Reed's affiliation has been updated.]

Keywords
Participation; learning; capacity building; community conservation; participatory research.

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Received
27 May 2010
Accepted
16 October 2010

Editor
Arun Agrawal

doi: 10.1111/j.1755-263X.2010.00152.x

Abstract

Participatory approaches are often suggested to increase sustainability and adaptability of conservation programs because they are assumed to build capacity of participants to learn and manage projects. This article compares participatory projects with different styles of management to determine whether increasing the extent or quality of engagement of participants affects the degree to which they learn. The results show that: (1) Participants in all projects learnt something, but the extent of learning was overall highest for projects with greatest engagement; (2) The length of time participants were involved in a project did not influence how much they learned; and (3) a range of factors relating to engagement influenced learning outcomes. The results suggest that if capacity building is a desired outcome of participation, then it pays to invest in high levels of engagement right from the outset. More research to help understand the processes involved in enhancing learning is required.

Introduction

Participation of stakeholders in developing policy and implementing environmental management is widely considered to be essential to encourage both ownership and responsibility for environmental problems (Shepherd & Bowler 1997; Song & M'Gonigle 2001; Stoll-Kleeman & O'Riordan 2002). Participatory processes have also been proposed as a means of enhancing the capacity of individuals and groups to respond adaptively to new information and circumstances (Armitage 2005), which in turn may enhance the effectiveness of conservation projects. The assumed benefits of engaging the public in conservation are based on the premise that participation provides opportunities for empowerment and helps people to learn new skills and develop understanding of conservation. However, the extent and quality of participant engagement varies across projects (Stringer *et al.* 2006; Reed 2008), which affects opportunities for participants to learn. This article therefore asks whether increasing the amount of volunteer input into management or the type of collaboration in project managers and volunteers (termed level and quality of engagement for the remainder of the article) increases the extent to which participants learn about conservation and project implementation.

Learning has been defined in many ways, but broadly can be thought of as a change in a person's understanding of, and relationship to, the world (Fazey & Marton 2002). It is a process that usually results in changes in

behavior and/or attitudes and in ways of thinking or feeling (Burns 1995). Learning can occur at different levels, with different impacts on understanding or on the behavior of an individual. This is reflected in, for example, models of loops of learning, including single-loop learning (learning about the consequences of specific actions), double-loop learning, (changes in the assumptions that underlie our actions) and triple-loop learning (learning that challenges the values and norms that underpin both our assumptions and our actions) (Argyris & Schon 1978; Fazey *et al.* 2005; Reed *et al.* 2010). Compared to single loop learning, when learning occurs through the second or third loops, this has much greater impact on how individuals understand a problem and how they behave. The extent or nature of what is learnt can be influenced by many factors, including whether motivations for learning are internally or externally driven, the style of learning favored by an individual, the personal beliefs of the learner, and the sociocultural context in which learning occurs (Bandura 1977; Ryan & Deci 2000). In general, however, learning is usually considered to be mediated through some form of social interaction (Buck *et al.* 2001; Fernandez-Gimenez *et al.* 2008).

Participation in environmental conservation and management provides opportunities for learning about a wide range of issues, including the development of skills, dispositions, and capacity for more effective conservation management (Dietz & Stern 2008). These can include changes in understanding of conservation (increased recognition of complexity, interconnection of social-ecological systems etc.), through to capabilities for implementing projects (managing habitats, sampling organisms, surveying etc.) and to wider transferable skills (e.g., ability to manage people, working in teams). Learning can be influenced directly through training or indirectly through social processes that expose participants to alternative perspectives and encourage reframing of concepts and behavior. For example, participants may learn through active deliberation of different management approaches that in turn alter other participants' perceptions (Habermas 1981). Learning outcomes are therefore considered to be dependent on how much people are encouraged to be involved, have control over what they engage in and how they do this, and levels of control imposed by others (Habermas 1981; Reed 2008).

Although others have suggested a link between learning, environmental behavior and participation (e.g., Agrawal 2005; Ostrom 2005; Dietz & Stern 2008), as yet there has been no direct evaluation of the extent to which differing levels of participation in conservation projects affects the learning outcomes of the participants. This article therefore aims to assist the design of future conservation projects that wish to take a long-term and participatory approach by determining whether projects with different levels and/or qualities of engagement affect the extent to which participants learn. Specifically, we ask: (1) How does learning by participants differ in projects with different levels and types of engagement? and (2) do some indicators of quality of engagement have a greater contribution to some learning outcomes than others?

Methods

The research involved interviews and surveys of managers and participants of eight conservation projects in different areas of the United Kingdom (Table 1). Projects involved either the conservation of native water voles (*Arvicola terrestris*) or red squirrels (*Sciurus vulgaris*) (Table 1). Since 1989, U.K. water vole populations have declined by 89%, largely due to the impact of nonnative American mink (*Neovison vison*), making the water vole the U.K.'s most rapidly declining mammal (Strachan *et al.* 2000). Like water voles, red squirrel populations have also declined due to the impact of a nonnative species. The red squirrel is the only squirrel species native to the United Kingdom; their population and range have declined over the last 50 years due to the squirrel poxvirus carried by the nonnative gray squirrel (*Sciurus carolinensis*) (Sainsbury *et al.* 2008). Volunteers are regularly used in projects to monitor and manage the populations of invasive species that are affecting both of the threatened native species.

Data collection included two stages. First, interviews with project coordinators were used to assess the type of participation and extent to which projects encouraged the engagement of participants. Interviews ensured project classifications could be determined independently from the perception of their participants. Typologies of participation vary, some focus on the degree to which participants are involved and have ownership and responsibility (e.g., Arnstein 1969; Pretty 1995). Others emphasise the nature of engagement (Davidson 1998; Rowe & Frewer 2000), the theoretical basis for participation (e.g., Habermas 1981; Beierle 2002, or the reason for participation (Michener 1998). This study used those of Pretty (1995) as these combine elements of engagement with a focus on management implementation. Projects were therefore categorized as *functional, interactive,* or *self-mobilizing* (Pretty 1995, Table 1 and 2). *Functional projects* used participants as a means of achieving project objectives and for providing the manpower required to deliver conservation outcomes. *Interactive projects* involved participants for a functional role, but provided greater opportunities for all participants to be involved in decision-making and enabled participants' greater autonomy. Finally, in *self-mobilization* projects participants made

Table 1 Participatory projects included water vole and red squirrel conservation projects and involved paid and nonpaid managers and volunteers. For all projects questionnaires were sent out by post ($N = 672$). Twelve were returned undeliverable giving an effective ample size of 660, of which 322 (49%) were returned. Participants of functional projects were more likely to have an environment-related occupation (54%). Interactive projects were the most demographically diverse in terms of occupations (44% classified as "nonenvironmental," 36% as "retired"). Self-mobilization projects had the highest proportion of retired participants (45%). For all projects, participants were likely to have lived in the area for 21 years or more

Type of project	Project name	Type of participation	No.(%) returned	Project information
Water Vole	Northeast water Vole Conservation (NEWV)	Functional	14 (82%)	The Northeast Water Vole project covers Aberdeenshire in Scotland (an area of approximately 1,500 km^2). This project works closely with the Cairngorms Water Vole project. Volunteers are largely in charge of monitoring nonnative mink. The area is largely rural, but encompasses the city of Aberdeen as well as other populated areas. Project participants include gamekeepers, fishing ghillies, rangers, farmers, as well as those with nonenvironmental occupations and retirees.
Water Vole	Cairngorms Water Vole Conservation (CWVC)	Functional	40 (53%)	The Cairngorms Water Vole project covers an area of approximately 6,000 km^2 of largely rural upland habitats. Volunteers of the project are dispersed over this area, and the occupational range and activities are similar to that of the Northeast Water Vole Project.
Water Vole	Whitchurch Water Vole Conservation (WCWV)	Self mobilization	15 (75%)	The Whitchurch water vole project covers an approximate area of 13 km^2, which encompasses the town of Whitchurch as well as some area beyond. Volunteers survey for water voles and create new habitats and run town meetings to educate the local populace. A majority of volunteers have nonenvironmental occupations or are retired.
Water Vole	British Association for Shooting for Conservation Water Vole Project (BASC)	Functional	16 (16%)	BASC members currently survey and control nonnative water voles over approx 1,262 km^2 of North Wales. The majority of the area is rural, and volunteers are spread across the area and the occupational range and activities are similar to that of the Northeast Water Vole Project.
Red Squirrel	Red Squirrels South Scotland (RSSS)	Functional	130 (49%)	The Red Squirrels South Scotland project covers an approximate area of 2,336 km^2. The area is mainly rural, and volunteers tend to have rural occupations, similar to those of the Northeast Water Vole Project. Participants are involved in the trapping and control of nonnative gray squirrel.
Red Squirrel	Northern England Red Squirrel Group (RSNE)	Self mobilization	67 (45%)	The Northern England Red Squirrel Group covers an approximate area of 31,000 km^2, with volunteer groups based within manageable village locations. Volunteers are involved in trapping and monitoring nonnative species, as well as supporting red squirrel populations, educational outreach, and lobbying of local councils to place road signs, etc. to warn of red squirrel presence. A majority of volunteers have non environmental occupations or are retired.
Red Squirrel	Dundee Red Squirrels (DRS)	Interactive	15 (83%)	The Dundee Red Squirrel project operates over approximately 145 km^2, which takes in Dundee city and the greater area. Volunteers are from an urban populace and mainly carry out survey and educational roles; a majority of volunteers have nonenvironment-related occupations.
Red Squirrel	Highland Red Squirrels (HRS)	Interactive	25 (89%)	The Highland Red Squirrel Project covers approximately 30,000 km^2 of the north of Scotland. Most volunteers are concentrated within the city of Inverness and surrounding areas. In the absence of gray squirrels or evidence of any decline in this species, volunteers mainly carry out survey work for the project to monitor Red Squirrel populations. A majority of volunteers have nonenvironmental occupations.

Table 2 Type of participatory approach adopted by projects involved in this study. Categories are based on Pretty (1995), interviews with project coordinators, and further validated by participant responses to questionnaires

Participation type	Description
Functional	Used participants as a means of achieving predetermined project objectives and for providing the manpower required to deliver conservation outcomes. In these projects, managers tended to make decisions separately from other participants. Participants tend to have very little interaction with other participants or with management. Functional projects tend not to emerge through grass root initiatives.
Interactive	Projects involved participants for a functional role, but provided greater opportunities for all participants to be involved in decision-making at selected management meetings. Participants had higher degrees of autonomy in their work, for example, designing and running their own events and choosing how and when to participate.
Self -mobilization	Participants are all able to make management decisions. Self-mobilization projects often emerge through community initiatives and remained relatively independent from government or other formal institutions. Participants valued each other as equal collaborators, were involved in making key decisions at regular open management meetings, and had high degrees of autonomy.

management decisions and valued each other more as collaborators each with something to contribute than in other projects. The different levels of engagement provided in different projects generate different motivational and social contexts that can hinder or encourage what or how much learning occurs.

The second aspect of data collection involved use of questionnaires. Questionnaires were sent to all project participants (Table 1). Respondents were asked questions derived from self-determination theory (theory that focuses on the extent to which motivations are internally or externally driven (Ryan & Deci 2000)), about their perceptions of the extent to which they were involved, valued, and able to influence project management. Respondents were asked about the extent to which they agreed with statements related to different levels of learning (e.g., to what extent did they agree with "do you feel you have learnt something new?" or "do you feel you have learnt about the viewpoints of others?") and statements about key variables and indicators of the extent of engagement (e.g., information sharing, project fairness, how valued they felt in the projects and the extent to which they could act autonomously). These indicators represent the average score for a number of different questions. For example, "information sharing" includes questions about whether participants have a good overview of the project, if the findings of the project are shared, and if information is regularly provided. Participants also indicated how long they had been involved with a project. Questions were structured as statements to which participants responded on a 1–7 scale (1 = very much disagree, 7 = very much agree).

Multinomial logistic regression analysis was used to assess if learning differed according to type of participation. In regression analyses, self-mobilization was used as the reference category. To select the best-fitting model, simple models were compared to those including all explanatory variables. Cluster analysis was used to categorize indicators of engagement as "high, medium, or low." Categories of "high" represent questionnaire scores of 6–7, on the 1–7 scale, "medium" had scores of 3–5, and "low" had scores of 1–2. All models assume consistent levels of participant retention. The statistical significance of explanatory variables in regression analysis was assessed using forward stepwise selection, the distributional fit of the variables was assessed graphically, and odds ratios report effect size. Both changes in Akaike Information Criteria (AIC) (Akaike 1974) and likelihood ratio tests helped guide model simplification. Models with the lowest AIC are reported. All analyses were conducted with the statistical software SPSS v16 (Chicago, IL, USA).

Results

How does learning of participants differ in projects with different levels and qualities of engagement?

Participants in all of the project types learnt something from their involvement (Figure 1). However, where levels of engagement were higher (i.e., self-mobilization and interactive projects), participants generally learnt significantly more than when engagement was lower ($\chi^2 = 160$, df = 10, $P < 0.001$, Figure 1). While trends for the learning outcomes in relation to different project types were consistent (Figure 1), not all of these differences made a statistically significant contribution to the regression model (Table 3). Those that did not differ significantly and were not included in the model tended to be related to how participants "understood" conservation (e.g., "learning something new" and "altered understanding of conservation"). Learning outcomes included in the model tended to involve implementing or managing conservation (e.g., learning about the viewpoints of other participants, being more able to work with others, and confidence about how to find solutions to complex conservation problems (Table 3; Figure 1)).

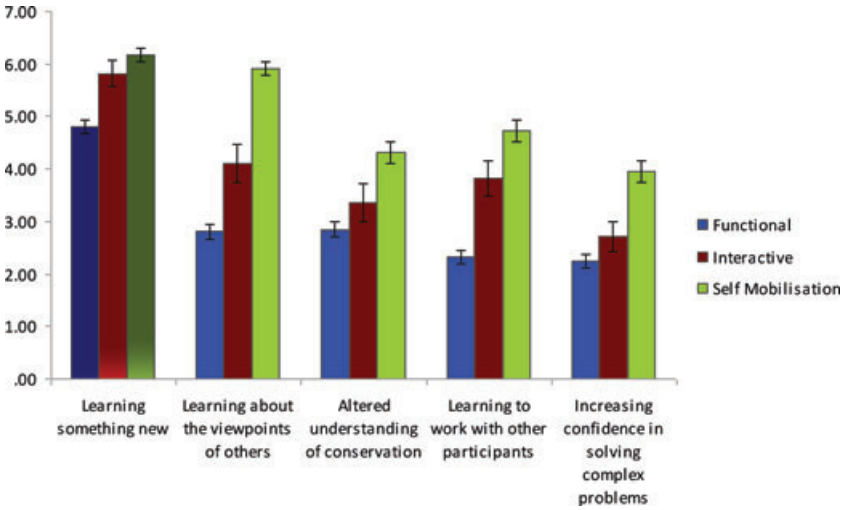

Figure 1 Average scores for the extent to which different learning outcomes were reported by participants in projects with different qualities and levels of participant engagement error bars represent standard error.

Table 3 Multinomial logistic regression evaluating differences in learning (in rows) for different project types (across the top). Note: * $P < 0.10$, ** $P < 0.05$, *** $P < 0.01$; the reference category is self-mobilization

	Functional		Interactive	
	B	SE	B	SE
Intercept	5.20***	0.62	2.27***	0.68
Learning about other participants' viewpoints * time participated	0.01**	0.01	0.01	0.01
Increasing confidence in solving complex problems * time participated	−0.01**	0.01	−0.01	0.01
Learning to work with others	−0.36***	0.13	0.23	0.16
Learning about other participants' viewpoints	−1.07***	0.16	−0.76***	0.19
Increasing confidence in solving complex problems	0.49**	0.18	0.04	0.22
No. observations	308			
Wald χ^2 (df)	160.32(10)			

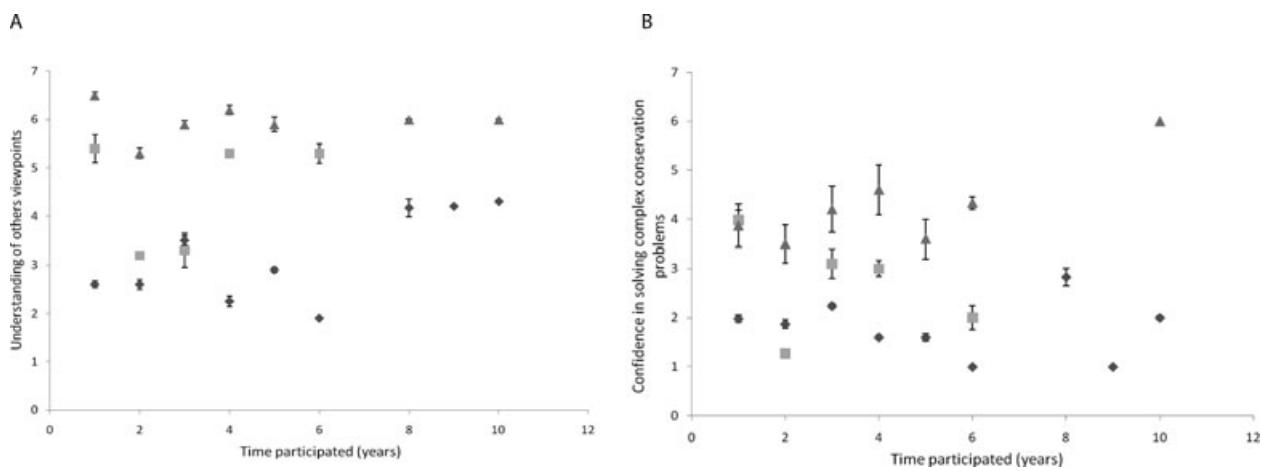

Figure 2 Effects of duration of participation in a conservation program on aspects of learning. (A) Relationship between time participated (years) and extent to which participants felt they understood others' viewpoints); (B) Relationship between time participated (years) and participants' "confidence in solving complex problems" Graphs show (m ± SE) in functional projects (triangle), interactive projects (square), and self-mobilization projects (diamond). Error bars represent standard error.

Generally, learning did not increase according to length of time involved. However, functional project participants took significantly longer to gain comparable levels of understanding of other participant viewpoints to participants in interactive and self-mobilization projects ($\chi^2 = 8.8$, df = 2, $P = 0.012$, Table 3; Figure 2A). A more complex pattern emerged for learning relating to building confidence, where self-mobilization participants grew in confidence over time and functional project participants lost confidence ($\chi^2 = 7.2$, df = 2, $P > 0.05$, Table 3; Figure 2B).

Do some indicators of engagement contribute more substantially to learning outcomes?

To better understand the association between participation type and extent of engagement and learning outcomes, additional analysis was conducted using specific indicators of engagement, rather than broader classifications of the project types. This enabled potential underlying processes to be identified and takes into account differences in the way that individuals may have experienced projects engagement. For example, in the Cairngorms water vole project, gamekeepers have high degrees of autonomy even though they are part of a project that is, overall, managed in a functional way.

Learning outcomes were generally higher when participants reported higher levels of engagement (Table 3; Figure 3). However, while trends for all indicators of engagement and learning outcomes were consistent (Figure 3), not all differences were statistically significant (Table 4 and 5). All statistical models for the indicators of engagement were explained by inclusion of at least three aspects of learning, but these aspects differed among the different models (Table 5). The results highlight that a range of underlying mechanisms of engagement influence learning, and that all mechanisms are required to achieve all learning outcomes.

Discussion

As environmental issues remain high on the public agenda and limits to funding from public sources are becoming more apparent, participatory projects are likely to be increasingly advocated as a cost-effective way to achieve conservation related outcomes (Ockenden 2007). Long-term effectiveness of conservation strategies, however, is dependent on adaptive approaches that respond to new information and circumstances and that are managed by engaged teams of motivated individuals (Allan & Stankey 2009). To achieve this adaptivity novel, collaborative approaches are therefore needed that enhance learning at a range of individual and institutional scales (Fazey *et al.* 2005; Armitage *et al.* 2008; Pahl-wostl 2009). Approaches that encourage learning and adaptive capacity in individuals are a key part of achieving broader conservation and environmental goals (Salafsky *et al.* 2002; Fazey *et al.* 2007; Allan & Stankey 2009). This study provides strong empirical evidence that participatory approaches enhance learning. Although the results are self-reported and based on observational rather than experimental methods, the high consistency of trends in the data, and comparison of learning across collaborative projects with different initial designs for public engagement suggests that the findings are robust.

All participatory approaches resulted in learning, but the extent to which some aspects of learning occurred increased with the quality or extent of engagement (Table 3; Figure 1). The types of learning most affected by improving quality of engagement tended to be those relating to abilities to deliver more effective practice and management of conservation (e.g., teamwork, ability to work with others, and problem solving capacity etc.), rather than relating to changes in understanding of the nature of conservation. This finding suggests that engagement has important implications for implementing conservation, especially given increasing recognition of the need for multiactor and multiinstitutional collaboration (Weber 2000; Ostrom 2005; Armitage *et al.* 2008), and calls for practitioners to be open to new ways of thinking and integrating knowledge (Salafsky *et al.* 2002; Bruner & Lynch 2010; Raymond *et al.* 2010).

The differences in the nature of what was learnt can be explained by the nature of the projects assessed. Participants of self-mobilization projects engaged more in management and worked in collaboration to address conservation problems providing them with greater opportunities to learn about implementing conservation. Increasing social interaction, however, does not always result in a greater reflection of underlying values and deeper personal conceptions of conservation. To achieve this type of transformative learning, more explicit reflective mechanisms built into a participatory approach are required. The projects evaluated in this study did not explicitly encourage reflection and deeper evaluation of underlying values and assumptions. That is, they lacked targeted attempts to promote double or triple loop learning, which are important for individual and organizational adaptation (Fazey *et al.* 2005; Pahl-Wostl 2009). As such, there is greater scope for enhancing learning if more explicit interventions are incorporated into the design of the participatory process.

Another key finding was that learning generally did not increase with the length of time of involvement. However, time participated was significantly associated

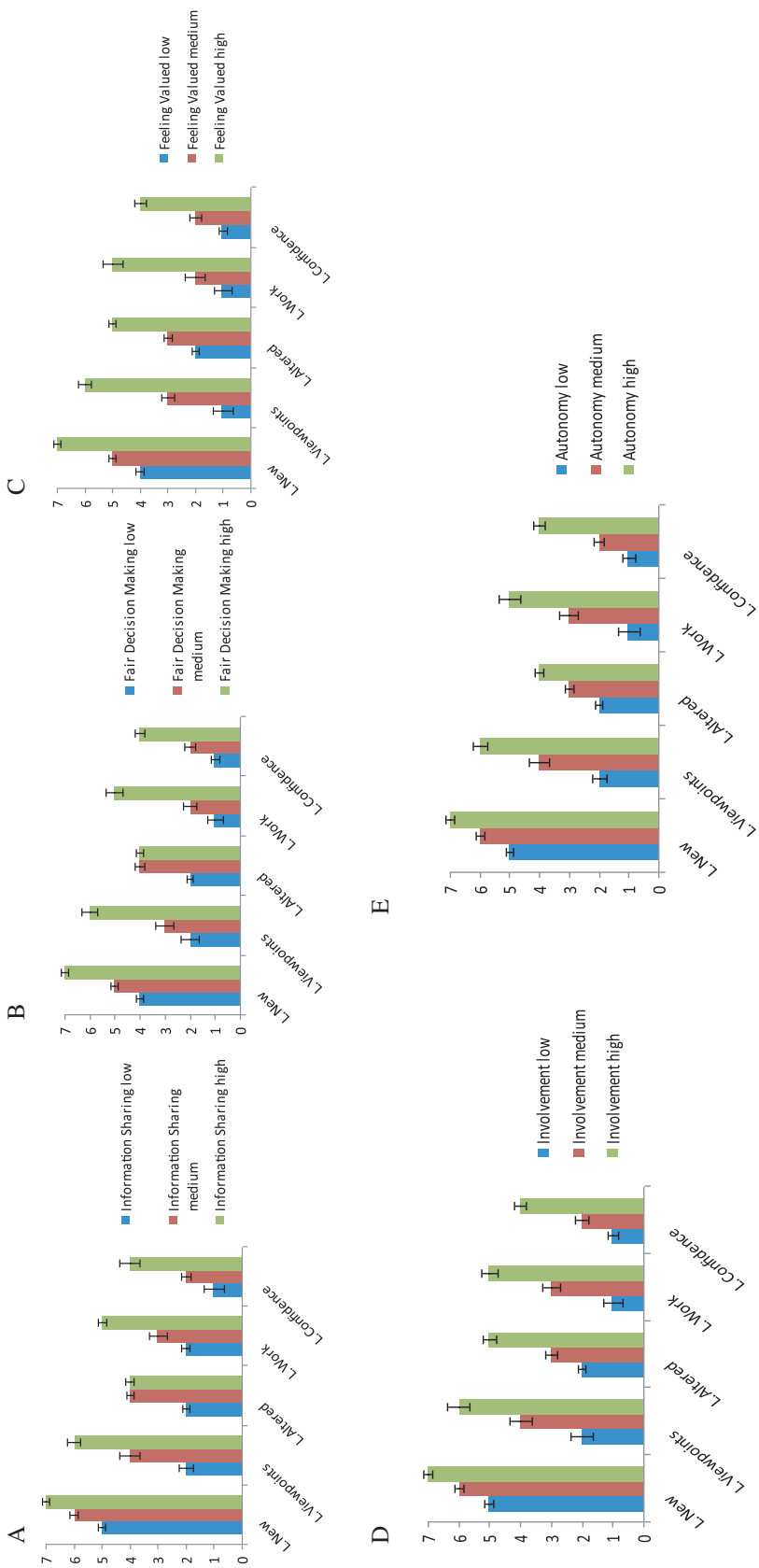

Figure 3 Average scores for the extent to which different learning outcomes were reported by participants in projects in relation to five indicators of engagement. (A) information sharing; (B) feeling that decision making within the project is fair; (C) feeling that valued by the project; (D) involvement in decision making; and (E) autonomy. Error bars represent standard error.

Table 4 Multinomial logistic regression to evaluate how different indicators of participation (across the top) are associated with different learning outcomes (listed in the rows). All regressions are compared to the category "low"

	Autonomy				Feeling valued				Information Sharing				Involvement in decision making				Feeling decision making is fair			
	Medium		High		Medium		High		Medium		High		Medium		High		Medium		High	
	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE
Learning something new	0.15*	0.10	0.53***	0.18	0.11	0.12	0.62***	0.16	0.14*	0.48	0.64***	0.17	0.08	0.10	0.34**	1.02	0.18*	0.48	0.47***	0.14
Learning about the viewpoints of others	0.40**	0.12	0.55***	0.19	0.81***	0.21	1.23***	0.22	0.40***	0.12	0.62***	0.15	0.39**	0.12	0.92***	0.17	0.28*	0.10	0.70***	0.18
Altered understanding of conservation	0.15*	0.10	0.51	0.13	0.28**	0.12	0.20*	0.14	0.51	0.15	−0.09	0.13	−0.55	0.11	−0.17	0.17	0.20*	0.17	0.13	0.13
Learning to work with other participants'	0.05	0.16	−0.01	0.20	−0.12	0.21	0.02	0.23	0.34	0.17	0.26*	0.18	−0.06	0.15	0.09	0.20	−0.12	0.20	−0.24	0.21
Increasing confidence in solving complex problems	0.14	0.16	0.31*	0.17	−0.02	0.17	0.01	0.20	0.08	0.16	0.13	0.15	0.24*	0.13	0.30**	0.18	−0.31	0.19	0.19	0.18
No. Observations	308				308				308				308				308			
Wald χ^2 (d.f.)	85.52 (10)				211.00(10)				146.86 (10)				168.89 (10)				122.42 (10)			

Table 5 Statistically significant associations between indicators of engagement and learning outcomes reported by participants, we signify a significant association of learning relating to each indicator of engagement with an "X"

	Indicators of engagement				
	Autonomy	Feeling valued	Information sharing	Involvement in decision making	Feeling decision making is fair
Learning outcomes					
Learning something new	X	X	X	X	X
Learning about the viewpoints of others	X	X	X	X	X
Altered understanding of conservation	X	X			X
Learning to work with other participants'			X		
Increasing confidence in solving complex problems	X			X	

with learning for two learning outcomes. The interaction is difficult to explain for the indicator "confidence in finding solutions to complex problems" and this may be due to an unusually high value in one of the self-mobilizing projects (Figure 2). However, after a period of eight years, a marked increase was noted in learning about the viewpoints of others in functional projects, with reported levels of learning coming close to those reported in interactive and self-mobilizing projects. Irrespective of anomalies, the implications remain the same. While some learning outcomes in projects with lower qualities of engagement may increase over time, higher levels of learning outcomes are achieved in the early stages of projects with high levels of engagement. Consequently, if learning is a desired outcome, it pays to invest in greater quality of engagement from the start.

Finally, results showed that a range of different factors were associated with different learning outcomes, with all factors related to increases in the whole range of learning outcomes (Tables 4 and 5, Figure 3). Both the factors and the learning outcomes were self reported, which raises questions about the direction of causality. Differences in the factors were, however, closely associated with the independent qualitative assessments of the projects, suggesting that engagement approach influences learning outcomes rather than the other way round. The results therefore suggest that attempts to improve opportunities for learning must consider multiple factors from the degree of autonomy to the kinds of factors that motivate learning, such as allowing participants be involved in decision making and promoting the feeling that their input is valued. The findings also highlight the need for further research to understand the processes of participation that affect learning and how this contributes to more effective conservation management. This will require integration of insights from a range of disciplines such as psychology, education, and social anthropology, in addition to biological and ecological disciplines.

Such research will encounter important challenges that were not investigated in this study. First, better understanding of the relationship between different aspects of learning and the adaptive capacity of individuals and organizations is required. Adaptive capacity (the ability to absorb shocks and cope with change) is not a trait held by everyone (Hatano & Inagaki 1986; Morel *et al.* 2008), but it is something that can be learnt and taught (Fazey *et al.* 2005; Martin *et al.* 2005). Adaptive capacity of individuals relates in many ways to adaptability of management and organizations (Morel *et al.* 2008; Pahl-Wostl 2009). However, it is not clear how these issues relate to the learning facilitated in participatory projects or how participation might enhance adaptive capacity. Second, while this article demonstrates a strong association between participation and learning, it did not assess whether increasing participation results in more effective conservation outcomes in ecological terms. Participatory approaches are generally advocated as being important for ensuring inclusive decision-making. Nevertheless, some of the functional projects in this study were making a very significant long-term contribution to conservation, and are likely to be paving the way for more inclusive participation in the future. Ultimately, whether participatory conservation projects are considered to be effective will depend on perceptions of the extent to which encouraging empowerment, learning, and social change are desired outcomes. Therefore, further research will be needed to determine what the longer-term ecological effects of participation might be, and whether there are trade-offs between resources used to encourage participation and those needed to achieve ecological outcomes.

Acknowledgments

We thank the British Association for Shooting for Conservation Water Vole Project, Cairngorms Water Vole Conservation Project, Dundee Red Squirrels Project, Highland Red Squirrels Project, North East Water Vole Conservation Project, Northern England Red Squirrel Group, Red Squirrels South Scotland Project, and Whitchurch Water Vole Conservation Project for their involvement in this research. Thanks to Xavier Lambin who commented on earlier drafts of this article. This work forms part of AE's PhD research and was funded by the College of Life Sciences and Medicine, University of Aberdeen.

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