

Connecting with Nature:  
the role of motivation, fulfilment and  
perceived benefits in citizen science

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## **Project declaration**

I declare that this thesis, “Connecting with Nature: the role of motivation, fulfilment and perceived benefits in citizen science” is entirely my own work, and that where material could be construed as the work of others, it is fully cited and referenced, and/or with appropriate acknowledgement given.

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## **Abstract**

Citizen science presents a significant opportunity for conservation of global biodiversity. There is a need to further understand volunteer decision-making, motivations and satisfaction in order to improve programme outreach, volunteer retention, and productivity. Using methods developed in social and psychological sciences, this study looks to further understand the human dimensions of conservation volunteerism. A web-based survey involving several citizen science programmes in the UK and qualitative methods were used to refine and adapt a psychometric framework for assessing motivations, satisfaction and level of advocacy of volunteers. The reliability of the test was estimated by measuring internal consistency with the McDonald omega hierarchical coefficient. Exploratory factor analyses resulted in five factors for motivation, two for satisfaction and two for the level of advocacy. ‘Connection with Nature’ was found to be the most important motivation for volunteering and high satisfaction was indicated with the factor ‘Individual Fulfilment’. A high ability of acting as a conservation advocate was also reported. ‘Connection with Nature’, ‘Personal Development’, ‘Individual Fulfilment’ and ‘Perceived Benefits’ were significant predictors of volunteers productivity. This study corroborates the existing literature on conservation volunteerism and highlights the importance of recognising motivational factors and other human dimensions of the volunteer experience in evaluating citizen science programmes. The framework proposed can further our understanding of what psychological factors influence volunteer wellbeing and productivity of citizen science.

# 1. Introduction

## *1.1. Science connecting citizens to nature*

The method of scientific research whereby citizens are involved in management of natural resources and data collection is known as ‘citizen science’ (Conrad & Hilchey 2011; Couvet et al. 2008; Devictor et al. 2010). For centuries nature enthusiasts have contributed to science by observing, studying and monitoring the natural world. The phenomenon of volunteerism has been defined as a long-term, planned and pro-social behaviour whereby time is given for benefiting a specific cause without recourse of payment (Penner 2002). Citizen science programmes have main aims and objectives ranging from monitoring of biodiversity, land management and clearing invasive species (Silvertown 2009). Engaging large numbers of people, across often wide spatial and temporal scales, citizen science has the capability of producing valuable datasets, which can contribute towards our scientific understanding of the effects of global changes on the environment (Sullivan et al. 2009). By collaborating with citizens in research, scientists and environmental practitioners can help to develop a wider scientific community network, which, in turn, can become a powerful tool for conservation for scientific research and public awareness towards conservation issues (Tulloch et al. 2013).

Over the past decades, citizens’ engagement in natural resources monitoring and management has expanded and there has been a significant increase in conservation volunteering programmes, which are geared to promote cooperation between institutions, researchers and citizens. Since the early 1990s up to 500,00 community-led groups involved in forest, wildlife, and watershed management have emerged across the globe (Pretty 2003). Possessing a strong sense of ownership over their local environment, citizens are often well positioned to act on environmental issues (Carr 2004; Sheppard & Terveen 2011; Smith et al. 2009). Participation in monitoring activities can empower citizens to actively engage in policy making decision and contribute meaningfully to conservation interventions (Danielsen et al. 2005; Danielsen et al. 2009; Sutherland et al. 2004), whilst public engagement in scientific research plays a key role in raising awareness on conservation issues and reconnecting people with nature (Bell et al. 2008; Bonney et al. 2009; Devictor et al. 2010; Koss & Kingsley 2010).

## *1.2. Opportunity costs of volunteering*

Given the high economic costs and inadequate funding available for conservation, engaging volunteers in conservation activities is often regarded as cost-effective strategy to best allocate limited resources (Tulloch et al. 2013). By harnessing volunteer power, conservation managers can significantly reduce costs of natural resource monitoring and management (Weston et al. 2003; Danielsen et al. 2005). However, through donating time and effort to a programme, volunteers can incur costs – sometimes high costs. Bell et al. (2008) supported this statement by revealing that people who volunteer in conservation programmes often sustain high opportunity costs from engagement in activities, which inevitably, represent a potential constraint upon the willingness and opportunity for citizens to participate. However, what is less recognised is the multitude of personal benefits people can gain through the volunteer experience (Guiney & Oberhauser 2009; Pillemer et al. 2010). Indeed, conservation programmes that rely on the contribution of volunteers should have an obligation to ensure that the full range of benefits people derive from participation exceed the costs (Caissie & Halpenny 2011).

## *1.3. A shift away from data quality research to understand trade-offs of volunteering*

Programme evaluation is an essential component of conservation initiatives to ensure effectiveness and make recommendation to practitioners (Howe & Milner-Gulland 2012; Sutherland et al. 2004). Traditionally, when evaluating volunteer programmes, the focus has been on scientific outcomes, for example, a common concern when involving citizens in data collection is a presumed lower quality of data submitted by volunteers compared with professionals (Crall et al. 2011; Finn et al. 2010; Sheppard & Terveen 2011; Tregidgo et al. 2013). However, in a study comparing data collected by volunteer and professionals on coral reef ecology, Gillet et al. (2012) have demonstrated that well-trained and supervised volunteers can produce a similar quality of data to professionals. Despite this evidence, there is still a tendency for managers to focus programme evaluation efforts on data gathered and project outcomes (Galloway et al. 2006; Delaney et al. 2007; Hochachka et al. 2012; Hunter et al. 2013; Butt et al. 2013; Nerbonne & Nelson 2008), rather than understanding costs incurred to volunteers and the opportunities to maximise benefits which, in turn, can raise productivity and programme achievement.

Members of conservation groups derive a wide variety of benefits from participation in citizen science programmes. For example, Moore et al. (2006) found health and wellbeing higher in

volunteers engaged in land management compared to people not involved in such activity. A correlation between participation in environmental work and benefits relating to physical, spiritual and social health was found in a study involving people suffering depression (Townsend 2006). Wellbeing and life satisfaction have also been found to be associated with a strong sense of connectedness to nature. Mayer & Frantz (2004) found that ‘connection with nature’ was a strong predictor of wellbeing, such that “if people derive a sense of well-being from feeling connected to nature, those who are more connected should experience more satisfaction”. As understanding human behaviour lies at the core of conservation, conservation psychology – which adopts frameworks developed in psychology to understand human decision-making – has emerged as a priority area for conservation research and practice (Asah & Blahna 2013; Clayton & Mayers 2009; Davis et al. 2011; Schultz 2011).

#### *1.4. Introducing a psychological framework to understand volunteerism*

Methods for researching volunteerism have been used in the social service sector over the past two decades (Clary et al. 1998; Finkelstein 2008) but have only recently been applied to conservation volunteerism (Ryan et al. 2001). These methods explain pro-social behaviours by understanding the underlying motivations that drive such behaviours (Omoto & Snyder, 1995; 2002). Previous research conducted on the social and psychological aspects of conservation volunteers have as its starting point the importance of assessing motivations for volunteering, because, by understanding motivations, volunteers expectations can be met (Bruyere & Rappe 2007; Liarakou et al. 2011; Measham & Barnett 2008; Weston et al. 2003). Furthering our understanding regarding volunteer motivation and values is therefore essential for conservation programmes to better target recruitment and increase retention.

Motivations for volunteering can differ between individual and the wider social context. The classic psychological theory of functionalism (Katz 1960) purports that people can present similar attitudes in response of psychological functions that serve individual’s needs. This theory has laid the foundations for a functional analytical framework for understanding the psychological and social processes that initiate and sustain volunteerism (Clary et al. 1998). Clary et al. (1998) proposed the Volunteer Function Index (VFI), a measure of six motivational functions served by volunteering (Table 1). Through better understanding of why people decide to volunteer, citizens can be matched

to appropriate volunteer programmes, which can help sustain longer-term commitment (Clary & Snyder, 1999).

**Table 1**

Motives identified by the Volunteer Function Inventory (Clary et al. 1998).

<b>Motivation</b>	<b>Description</b>
<i>Values</i>	Expressing values related to altruistic and humanitarian concerns.
<i>Understanding</i>	Learning new experiences and exercising skills and knowledge.
<i>Social</i>	Strengthening social relationships.
<i>Career</i>	Gaining career-related experience.
<i>Ego protection</i>	Reducing negative feelings or address personal problems.
<i>Ego Enhancement</i>	Developing psychologically.

### *1.5. Recruitment vs retention*

There is a distinction between motivations leading people to start volunteering (e.g. recruitment) and the reasons that sustain their involvement (e.g. retention) (Galindo-Kuhn & Guzley 2001). The identification of the factors that contribute to volunteers' satisfaction plays a crucial role in programme evaluation. Through the evaluation, programmes managers can improve volunteer experience, therefore sustaining engagement. Galindo-Kuhn & Guzley (2001) investigated the satisfaction of social service volunteers and proposed the Volunteer Satisfaction Index (VSI). This tool tests four dimensions of volunteer satisfaction, which are linked to organisational and personal variables (Table 2).

**Table 2**

Factor of volunteer satisfaction identified by the Volunteer Satisfaction Index (Galindo-Kuhn & Guzley 2001).

<b>Satisfaction</b>	<b>Description</b>
<i>Empowerment</i>	Developing relationship with the organisation.
<i>Group Integration</i>	Developing relationships with other volunteers and paid staff.
<i>Organisational Support</i>	Providing supportive resources for volunteers.
<i>Personal efficacy</i>	Expecting that participation in volunteering will benefit someone.

The few studies that have assessed satisfaction of conservation volunteers indicate satisfaction plays a crucial role in evaluation of volunteers' wellbeing, retention and programmes effectiveness (Davis et al. 2011; Wright et al. unpublished results). The variability of volunteers' performance can be moderated by individuals' motivations and satisfaction. Miles (1998) found that the frequency of volunteering was related to the benefits perceived from participation. This means that highly satisfied volunteers, volunteered more frequently, potentially have higher productivity, and thereby can contribute significantly to the effectiveness of conservation initiatives (Bruyere & Rappe 2007; Newman 2003).

Further research focused on understanding the processes behind conservation volunteerism is needed. Evaluation of citizen science programmes must consider the social-psychological aspects of volunteer experience, since this has been shown to determine a volunteer's level of productivity, therefore outcomes of conservation programmes. This research aims to achieve understanding of what motivates volunteers to engage in citizen science programmes in order to ensure that expectations are met and to facilitate recruitment. The identification of factors influencing volunteers' satisfaction will elucidate what increases volunteers' wellbeing and sustains their involvement, therefore providing indications for the development of retention strategies. The final aim will be to identify factors predicting volunteers' productivity and behaviour, so that a more advantageous management of human resources will increase the effectiveness of citizen science programmes.

## **2. Method**

### *2.1. Selecting participants*

Study participants comprised volunteers engaged in citizen science programmes in the UK (Appendix 1; Fig. 1). These volunteers were involved in a range of different activities such as monitoring wildlife, habitat management and restoration, and administration work. Liaison with stakeholders was an essential component and resulted in several organisations that provided a broad spectrum of volunteer profiles. The programmes to be evaluated were selected with Surrey Wildlife Trust (SWT). Programme managers and representatives of NGOs were contacted via email,



presented with a brief introduction to the research project and invited to take part in focus groups and workshop (Workshop report in Appendix 2).

## *2.2. Qualitative methods and questionnaire design*

Field observations, face-to-face interviews, focus groups and workshops were implemented, with volunteers and coordinators from several organisations (Appendix 3). These methods were necessary to develop an in-depth understanding of stakeholder's views and perspectives, and provided background information on citizen science programmes in the UK. These insights also informed the development of an online survey and the psychometric scales employed to assess volunteer motivation, satisfaction and advocacy ability (Appendix 4). The online survey was designed to collect information on respondents' motivations for volunteering and different aspects of the volunteer experience such as expectations, constraints on participation, benefits and satisfaction. Demographic attributes were asked in the last section, as per common practice in social research (Babbie 2010).

The survey was piloted with 9 volunteers, two of which were previously interviewed. Pilot respondents completed the online survey and provided feedback on the length and adequacy of questions. As a result, the questionnaire was edited for better clarity and reduced in length. The final self-administered questionnaire, hosted by the software Qualtrics (Qualtrics, Provo, UT), took about 15 minutes to be completed and contained 83 items in the form of open-ended questions, close-ended questions and Likert statements. The link to the online survey was delivered to volunteers with an introductory email sent out by managers of volunteer programmes. In addition, the online survey was published on the SWT website, disseminated in SWT and British Trust for Ornithology (BTO) newsletters and posted on the People's Trust for Endangered Species (PTES) forum.

## *2.3. Psychometrics instruments*

Psychological aspects of volunteers were assessed using psychometrics methods. Since latent variables such as motivation and satisfaction cannot be directly measured, reflective indicators were used. The framework used for this research, the Environmental Volunteer Functions Inventory (EVFI), was developed by Wright et al. in 2011 (unpublished results) and included tools to

investigate motivations, satisfaction and advocacy ability of South African atlasers of the South African Bird Atlaser Programme 2 (SABAP2). For the purpose of this study, the pre-existing psychometric instruments were refined and adapted to the English population of conservation volunteers. Minor modifications followed key informants interviews and pilot respondents feedback. Statements such as *'I volunteer because it helps my physical fitness'*, *'volunteering is an important activity for people I know best'* and *'my volunteer experience may help me in changing career'* were added to the scale.

The adapted version of the EVFI consisted of thirty-seven items designed to describe motivations and satisfaction. The items describing motivations were based on those identified by the VFI (Clary et al. 1998) and from previous research on the motivation of citizen scientists (Appendix 5). These represented the major motives for volunteering: values/helping the environment, learning, skills development, project organisation/career, social interaction and nature/recreation (Wright et al., 2011, unpublished). The VSI developed by Galindo-Kuhn & Guzley (2001) was modified to apply to factors of satisfaction for conservation volunteers. This inventory included items designed to investigate motives fulfilment, the overall satisfaction with the experience and with particular aspects of the programme organisation. Following the functional approach, according to which the fulfilment of certain motives lead to satisfaction, eight of the thirty-seven items, were specifically designed to investigate the extent to which motivations were fulfilled and therefore become a measure of satisfaction. These eight items were subsequently used in the analysis of both motivation and satisfaction. Lastly, a psychometric scale of eight items assessed volunteers' ability to act as an advocate for both respective programmes and conservation in general. Respondents indicated their level of agreement with an item on a scale ranging from 1 ('strongly agree') to 5 ('strongly disagree') and a sixth category 'unsure' was included as per social science research recommendation (Babbie 2010).

#### *2.4. Assessing volunteer productivity*

To further investigate the outcomes of volunteer experience, the survey included specific questions to collect data on a set of variables measuring the productivity of volunteers. Indicator measures of the level of productivity were operationalised as the duration of service; regularity of participation; average number of hours spent volunteering in a day and over a month, and number of volunteering sites. Respondents were asked to indicate their effort based on categories. In addition, volunteers

indicated their level of productivity by checking the activities in which they were involved in the organisation. In this case, the measure of productivity was calculated by adding up the total number of volunteers' activities.

## *2.5. Statistical analyses*

Exploratory principal-axis factor analysis with varimax rotation was performed to reduce the size of the data and build the theoretical model of motivation, satisfaction and advocacy ability. This method is commonly used in the literature to generate a factor structure from Likert scales data (Asah & Blahna 2013; Galindo-Kuhn & Guzley 2001; Ryan 2001; Miles 1998). Items are grouped together in one factor when they describe the same latent variable and relative factor loading measures how well the item is describing that specific variable. Factor-retention strategies such as scree plot and parallel analysis were used to identify the number of factors that explained the higher proportion of variance (Clary et al. 1998; Davis et al. 2011; Helitzer et al. 2010; Mayer & Frantz 2004). Reliability of the test was estimated by measuring internal consistency. Although Cronbach's alpha coefficient is the most common used in the literature, McDonald Omega hierarchical ( $\omega_h$ ) has been suggested as the most accurate coefficient reflecting the structure of a scale in case of a multidimensional test (Difford 2013; Revelle & Zinbarg 2009; Zinbarg et al. 2005). Factors with  $\omega_h \geq 0.60$  were considered reliable (Knight et al. 2010). Items with factor loading  $\geq 0.32$  were retained in the factors and used for successive analyses. Twenty-six items were used for the identification of factors of motivation, whilst nineteen items were used for assessing satisfaction. Eight additional items were used to reflect both satisfaction and motivation.

The mean of each motivation factor obtained was calculated with respect to the different programmes in order to identify the scale of importance of the different motivational factor dependent on organisation. Lastly, factor scores for each of the motivation and satisfaction factor were extracted and used as a predictor of volunteers' productivity in regression analyses (Distefano & Míndril 2009). The results of the regression were used to verify whether motivation and satisfaction reflected an actual behaviour. GLM's were fitted (with Poisson errors) to all the factors to predict the total number of activities carried out by volunteers within an organisation. Cumulative links models (CLM) are reported as most suitable class of regression models for ordinal data analysis (Agresti, 2010) and so were used to test relationships between response variables

measuring productivity of volunteers and factors of motivation and satisfaction. Statistical analysis was conducted in R (R Development Core Team, 2014) using the Psych Package (Revelle, 2013) and Ordinal (Christensen, 2014).

### 3. Results

#### 3.1. Participants' demographics

A total of 174 responses were collected from the online survey. However, observations with missing data were not included for the analysis, reducing the sample size to 138. 57.25% of the survey population were males and 42.03% females. Most respondents (53.63%) were aged over 60 years old. Only 0.72% were in full-time education and 39.13% were permanently retired. 8.70% a high school diploma, 47.83% of the respondents hold an undergraduate university degree and 22.46% a Masters level degree. The 81.16% of the volunteer sample population were recorder volunteers.

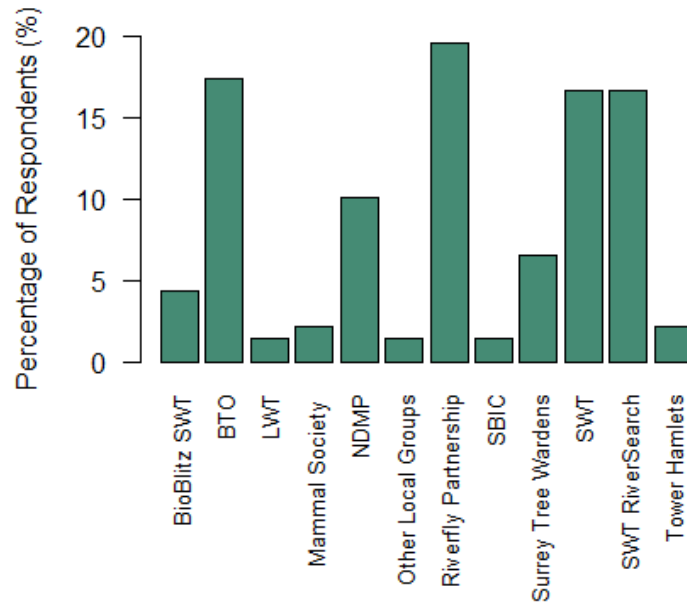


Figure. Percentage of respondents for each programme involved in the survey.

### 3.2. Participants' motivations

Factor analysis was used to assess volunteer motivations. Scree plot and parallel analysis proposed a 6-factor solution but one factor was not retained because of the lack of theoretical fit, as it included items not closely related (Matsunaga 2011). The factors retained were: 1) Connection with Nature, 2) Social Interaction, 3) Project Organisation, 4) Community Building and 5) Personal Development (Table 3). These five factors represented 47% of the variance in the data. With the exception of Project Organisation, the other 4 factors had adequate internal consistency ( $\omega_h \geq 0.60$ ). Three items with factor loading below the 0.32 cut-off were dropped.

Connection with Nature was the most important motivation, with the highest number of 'strongly agree' responses ( $1.57 \pm 0.76$ , 1SD). This factor included five statements of which '*I feel a strong connection with nature*' had the greatest factor loading. Higher factor loadings indicate statements that best describe a factor. The statement related to the theme of '*learning about nature*' received the highest number of 'strongly agree'.

The second most important factor was Social Interaction ( $2.06 \pm 1.02$ ). Four items pertaining to social motives loaded in this factor. The statement '*I enjoy volunteering because of the social time it provides*' had the highest factor loading and '*volunteering provides me with an opportunity for meeting people with similar interests*' was rated the highest. The factor Project Organisation had the third lowest mean ( $2.11 \pm 0.92$ ). Although this factor exhibited poor internal consistency ( $\omega_h = 0.56$ ), the coefficient value was near the threshold of reliability ( $\omega_h \geq 0.60$ ). Therefore, because of its theoretical fit and coherence with the literature, this factor was retained.

The factor labelled Community Building was the fourth factor of motivation rated by respondents ( $2.51 \pm 1.04$ ). Items related to social, values and project organisation motives loaded in this factor. Together, the four constitutive statements captured the motive of contributing to enhancing the community. The item '*I enjoy sharing new knowledge with others in the volunteering community*' best described this factor and was also rated the highest by respondents. Finally, the subscale with highest mean, and therefore most 'strongly disagree' responses, was Personal Development ( $2.62 \pm 1.1$ ). The five items included in this factor were related to ego enhancement, escape and physical health motives. Overall, this factor captured the motives of developing psychologically and increasing physical and spiritual health. The statement '*volunteering provides an opportunity to explore new places*' had the highest factor loading and rating.

**Table 3**

Five factors of motivation with corresponding McDonalds  $\hat{\omega}_h$ , mean and standard deviation and the constitutive items with respective factor loadings.

<i>Factors of motivation and constitutive items</i>	<i>Factor loading</i>					<i>Internal consistency (<math>\hat{\omega}_h</math>)</i>	<i>Mean</i>	<i>Standard Deviation</i>
	1	2	3	4	5			
<b>Connection with Nature</b>						<b>0.65</b>	1.57	0.76
Connection	0.83							
Fascination	0.76							
Learning about nature	0.51							
Worthy cause	0.41							
Environmental concern	0.33							
Passion	0.34							
<b>Social Interaction</b>						<b>0.61</b>	2.06	1.02
Social time		0.88						
Being part of a group		0.54						
Sharing interests		0.48						
Social activity		0.32						
<b>Project Organisation</b>						<b>0.56<sup>a</sup></b>	2.11	0.92
Overcoming challenges			0.64					
Well organized project			0.54					
Contributing to society			0.46					
Staff supervision			0.49					
<b>Community Building</b>						<b>0.64</b>	2.51	1.04
Community sharing				0.68				
Educating				0.51				
Programme development				0.63				
Seeing impact				0.40				
<b>Personal Development</b>						<b>0.63</b>	2.62	1.1
Explore new places					0.67			
Break routine					0.60			
Change career					0.53			
Self esteem					0.53			
Physical health					0.44			

*Note:* items with loading below 0.32 were dropped.

<sup>a</sup> Project Organisation was retained for its theoretical fit despite poor internal consistency.

The relative importance of each of the five motivation factors was then compared between programmes (Table 4). Connection with Nature was consistently the most important factor for volunteers across all the programmes. However, the second most important motivation varied from programme to programme. Project Organisation was of secondary importance for BTO, BioBlitz, Riverfly Partnership, RiverSearch, SWT and Tower Hamlets; Community Building for Mammal Society and NDMP; Social Interaction for Surrey Tree Wardens.

**Table 4**

Factors of motivations in order of importance (mean from raw data with 1SD) for each programme.

<i>Programme</i>	<i>1st</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>	<i>5th</i>
<b>BTO</b> (n=24)	Connection with Nature (1.64±0.82)	Project Organisation (2.05±0.95)	Community Building (2.81±1.11)	Personal Development (2.81±1.17)	Social Interaction (3.09±1.04)
<b>BioBlitz</b> (n=6)	Connection with Nature (1.52±0.69)	Project Organisation (2.12±0.85)	Social Interaction (2.29±1.08)	Personal Development (2.5±1.16)	Community Building (2.5±1.02)
<b>Mammal Society</b> (n=3)	Connection with Nature (1.16±0.38)	Community Building (2±0.85)	Project Organisation (2.16±1.02)	Social Interaction (2.5±1.24)	Personal Development (3.4±1.05)
<b>NDMP</b> (n=14)	Connection with Nature (1.3±0.55)	Community Building (2.23±1.15)	Project Organisation (2.23±1.04)	Social Interaction (2.46±1.32)	Personal Development (2.67±1.27)
<b>Riverfly Partnership</b> (n=27)	Connection with Nature (1.65±0.78)	Project Organisation (2.09±0.85)	Personal Development (2.27±0.87)	Community Building (2.67±0.85)	Social Interaction (2.7±0.88)
<b>RiverSearch</b> (n=23)	Connection with Nature (1.43±0.60)	Project Organisation (1.89±0.74)	Personal Development (2.26±1)	Community Building (2.39±0.94)	Social Interaction (2.55±0.82)
<b>Surrey Tree Wardens</b> (n=9)	Connection with Nature (1.7±0.88)	Social Interaction (2.44±0.8)	Community Building (2.61±0.83)	Project Organisation (2.63±0.86)	Personal Development (2.86±0.96)
<b>SWT</b> (recorders) (n=15)	Connection with Nature (1.71±0.83)	Project Organisation (2.43±1.03)	Personal Development (2.53±1.15)	Social Interaction (M.53±1.01)	Community Building (2.6±1.25)
<b>SWT</b> (administration) (n=10)	Connection with Nature (1.71±0.86)	Project Organisation (1.75±0.74)	Social Interaction (1.75±1.08)	Personal Development (2.56±1.28)	Community Building (2.7±0.99)
<b>Tower Hamlets</b> (n=3)	Connection with Nature (1.94±0.87)	Project Organisation (2.66±0.98)	Community Building (2.83±0.93)	Social Interaction (3.08±0.79)	Personal Development (3.2±1.2)
<b>LWT</b> (n=4)	Connection with Nature (1.37±0.57)	Project Organisation (1.68±0.7)	Community Building (1.75±0.93)	Personal Development (2.1±0.91)	Social Interaction (2.37±1.02)

### 3.3. *Participants' satisfaction*

Scree plot and parallel analysis suggested a 3-factor solution. However, the factor Organisational Support did not meet adequate levels of internal consistency and so was removed. Thus, the satisfaction inventory provided two reliable factors: Individual Fulfilment and Perceived Benefits (Table 5). These two factors represented 47% of the variance in the data. The average volunteer satisfaction mean was  $2.08 \pm 0.96$ . Individual Fulfilment was the most important factor of satisfaction ( $1.73 \pm 0.75$ ). Within this factor, the statements '*my overall experience has been personally fulfilling*' and '*my volunteer experience has been positive*' loaded together with those reflecting a sense of personal '*contribution to conservation and science*'. The item reflecting a sense of '*fulfilment derived from holding volunteer roles and responsibility that meet individual motives*' further clarified this factor of satisfaction. The second factor Perceived Benefits ( $2.30 \pm 1$ ) included items related to typical benefits derived from volunteering. Overall satisfaction ( $2.17 \pm 1.06$ ) is the combination of these two factors.



**Table 5**

Two factors of satisfaction with corresponding McDonalds  $\omega_h$ , mean and standard deviation and the constitutive items with respective factor loadings.

<i>Factors of satisfaction and constitutive items</i>	<i>Factor loading</i>			<i>Internal consistency (<math>\omega_h</math>)</i>	<i>Mean</i>	<i>Standard Deviation</i>
	1	2	3			
<b>Individual Fulfilment</b>				<b>0.75</b>	1.73	0.75
Fulfilling experience	0.67					
Positive experience	0.64					
Contribute to science	0.53					
Work fit	0.50					
Contribute to conservation	0.57					
<b>Benefits perceived</b>				<b>0.71</b>	2.30	1.00
Physical health		0.70				
Recreation		0.63				
Personal development		0.55				
Self esteem		0.58				
Learned skills		0.48				
Volunteer network		0.53				
Professional network		0.56				
Break routine		0.46				

*Note:* items with loading below 0.32 were dropped.

### 3.4. Participants' productivity

Two factors of motivation from factor analysis could predict the average time spent volunteering in a day (Table 6). Individuals who spent more time volunteering in a day were more likely motivated by Connection with nature (CLM:  $p=0.08$ ,  $z=-1.942$ ) and Personal Development (CLM:  $p=0.05$ ,  $z=-1.710$ ). However, motivation factors were not significant predictors of other variables used to measure productivity of volunteers. The total activity number in which volunteers engaged was significantly predicted by both factors of satisfaction Perceived Benefits (GLM:  $p=0.001$ ,  $df=135$ ,  $z=-0.2685$ ) and Individual Fulfilment (GLM:  $p=0.023$ ,  $df=135$ ,  $z=-0.2464$ ). Furthermore, Perceived Benefits predicted the number of volunteering sites (CLM:  $p=0.004$ ; estimate=0.5341;  $z=-2.582$ ), whereas Individual Fulfilment significantly affected the average time spent volunteering in a month (CLM:  $p=0.026$ , estimate=0.4013,  $z=-2.322$ ). None of the factors of motivation and satisfaction

were predictors of length of service and regularity of participation, and so not included in Table 4. An inverse relationship is seen due to the fact that lower values corresponded to stronger agreement to the statement in the questionnaire, whereas higher values corresponded to more disagreement.

**Table 6**

Parameter estimates for volunteer behaviour models with factors of motivation and satisfaction as predictors with standard error.

	<i>Dependent variable:</i>			
	Time spent in a day <i>Cumulative link</i> (1)	Number activities <i>Poisson</i> (2)	Time spent in a month <i>Cumulative link</i> (3)	Number sites <i>Cumulative link</i> (4)
Intercept		0.779*** ±0.058		
Personal Development <sup>a</sup> ( <i>Motivation factor</i> )	-0.327* ±0.191			
Connection with Nature ( <i>Motivation factor</i> )	-0.338* ±0.174			
Individual Fulfilment ( <i>Satisfaction factor</i> )		-0.167** ±0.068	-0.423** ±0.182	
Benefits Perceived ( <i>Satisfaction factor</i> )		-0.181*** ±0.068		-0.494*** ±0.191
Observations	138			

Note: Significance levels \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

<sup>a</sup> Factor scores are used as predictors.

### 3.5. Participants' level of advocacy

Factor analysis yielded two factors of volunteer advocacy, dividing advocacy for the programme and for conservation in a broader sense (Table 7). Scree plot and parallel analysis supported the 2-factor solution. In these two factors all items loaded with factor loading greater than 0.32. The factor Conservation Advocacy had the lowest mean (2.00±0.90), and so was regarded as the most

representative of volunteer behaviour. All the items reflecting a pro-environmental behaviour loaded together and the statement ‘*it is important for me to explain the impacts of human actions on the environment to friends and acquaintances*’ was the best descriptor. The second factor, labelled Programme Advocacy had higher mean (2.74±1.12). The item ‘*I encourage friends and family to join the programme*’ had the highest factor loading.

**Table 7**

Two factors of advocacy ability with corresponding McDonalds  $\omega_h$ , mean and standard deviation and the constitutive items with respective factor loadings.

<i>Factors of advocacy and constitutive items</i>	<i>Factor loading</i>		<i>Internal consistency (<math>\omega_h</math>)</i>	Mean <sup>a</sup>	<i>Standard deviation</i>
	1	2			
<b>Conservation Advocacy</b>			<b>0.63</b>	2.00	0.90
Explaining human impact	0.77				
Discussing conservation issues	0.64				
Reducing impact	0.61				
Contributing to other NGOs	0.35				
<b>Programme Advocacy</b>			<b>0.7</b>	2.74	1.12
Encouraging to join programmes		0.79			
Sharing through media		0.62			
Sharing volunteer experiences		0.59			
Facilitating logistics		0.54			

*Note:* items with loading below 0.32 were dropped.

## 4. Discussion

In accordance to Finkelstein’s modus operandi (2008), three crucial stages of the volunteer experience were investigated: antecedents of volunteering, aspects of the experience such as volunteer’s satisfaction and the overall outcomes of productivity and advocacy ability. This study provides evidence of the importance of integrating social-psychological perspectives into the evaluation of citizen science programmes. Increasing investment in citizen scientists’ wellbeing can encourage increasing benefits for both volunteers and programmes. Such strategies should be adopted in order to ensure longer-term effectiveness of volunteer-based conservation programmes.

#### *4.1. Understanding volunteers' motivations to target recruitment*

The theoretical model presented identified five motivations for volunteering similar to those described in the conservation volunteer's literature. Motivation to volunteer due to a Connection with Nature was previously identified (e.g., Miles 1998; Ryan 2001) and Community motivations have emerged (e.g., Raddick et al. 2010; Asah & Blahna 2012). Personal Development and enhancement related motives are commonly ranked as important in previous studies (e.g., Miles et al. 1998; Weston et al. 2003; Asah & Blahna 2012). Reporting of motivations relating to Project Organisation are also not uncommon (Ryan et al. 2001; Bruyere & Rappe 2007). A Social motivation is the most recurrent theme described generally in this literature.

A motivation to form a Connection with Nature is the most important reason people to decide to volunteer for citizen science in the study area, regardless of the programme they belong to. This finding supports Weston et al. (2003) who found that the main reason for volunteering was a keen interest in nature conservation. When volunteers are '*passionate*' and '*fascinated by nature*' they are likely to be more '*concerned about the ongoing degradation of the ecosystems*' and possibly as a result decide to '*dedicate their time to a worthy cause*'. Another notable relationship that emerged within the Connection with Nature factor is with the 'learning' theme. Through engaging in citizen science work, people are given an opportunity to learn about nature, increasing knowledge, and understanding how the natural environment can be enhanced and protected.

##### *4.1.1. Motivations of different citizen scientists*

Comparison of motivation strength dependent on programme provided further insight for developing strategies to improve recruitment and increase retention. Although a small sample size was analysed, differences were detected in relative strength of motivations between respondents from different conservation programmes. Motivations from respondents belonging to the same programme formed similar groups. The identification of general profiles of citizen scientists is extremely informative for understanding how expectation can be met, so as to increase satisfaction and therefore productivity. As a matter of fact, one of the major challenges for programme managers that emerged during the workshop was complying with the different needs and expectations of participants.

With the exception of the Connection with Nature factor, which was consistently of primary importance, the four other motivations were valued differently across all programmes. For example, volunteers engaged in programmes focused on species monitoring (i.e., BTO, Mammal Society, Tower Hamlets and NDMP) were less motivated by Social Interaction. Conversely, people who volunteered for the BioBlitz, an annual recording event organised by SWT, rated Project Organisation and Social Interaction as motivations of secondary and tertiary importance. BioBlitz is seemingly focused towards creating a social experience; volunteers typically come together for short spells to record species inventories and abundances (Lundmark 2003). Social events play an important role in sustaining the enthusiasm of socially-oriented volunteers and may provide an effective strategy to engage the public and recruit new volunteers.

Interestingly, volunteers dedicated to the monitoring and management of rivers (RiverSearch and Riverfly Partnership) reported the same motivations. Project Organisation was followed by Personal Development, Community Building and Social Interaction. The *'supervision provided by the staff'* of a *'well organised'* and reputable programme is crucial for volunteers learning to conduct surveys and improving technical skills. When people choose to dedicate their time and resources to a specific cause, they expect that organisations are making the most of their effort and that their *'contribution'* can effectively make a difference. Furthermore, a regular commitment in river monitoring allows for Personal Development of citizens as it promotes the *'exploration of new places'*, a *'break out from routine'*, the opportunity to exercise, which in turn provides benefits for self-esteem and physical health (Mannell 2011; Miles et al. 1998; Moore et al. 2006).

NDMP volunteers have same rank of motivations, with Community Building of second importance. Community-led groups allow for social learning. Learning processes are facilitated when volunteer *'enjoy sharing new knowledge with others in the volunteering community'* and dedicated volunteers take on an educational role raising awareness to enhance the local environment and *'introducing other to science'*. The NDMP, led by People's Trust for Endangered Species (PTES), has established a community of skilled and dedicated citizens, who collect data on the dormouse (*Muscardinus avellanarius*) across the UK for entry into a national database. Wide networks of volunteers contribute to this database and as a result this endangered species is monitored on a national scale.

## 4.2. Factors sustaining volunteerism

Volunteers indicated greatest agreement with Individual Fulfilment and then Perceived Benefits, which drove the high mean satisfaction score. The items that loaded into this factor related to a sense of personal efficacy, aligned with conservation values, such as ‘*contributing to science*’ and ‘*nature conservation*’. Fulfilment was also generated by ‘*roles and responsibilities that meet motivations for volunteering*’ and an overall ‘*positive experience*’. Satisfaction arises when volunteers feel that they have successfully contributed to conservation and the volunteer is further rewarded by a sense of accomplishment. This supports the central finding that volunteers were primarily motivated by Connection with Nature.

Items contributing to Perceived Benefits, the second-ranked factor, described fulfilment for other common motives but not Connection with Nature. ‘*Learning new skills*’, ‘*expand social network*’, ‘*increase self-esteem*’ are recurring theme in the literature and qualitative research methods further supported these result (Bruyere & Rappe 2007; Measham & Barnett 2008). Although individuals may have different motivations for getting involved, there are some common benefits associated to spiritual and physical health that are perceived, some of which are intangible (Pillemer et al. 2010). Understanding the societal benefits gained by being connected with nature is extremely important if managers want to improve wellbeing and efficiency of volunteers (Miles et al. 1998; Moore et al. 2006). As one volunteer conveyed:

*“The benefits derived from the natural environment are not quantifiable”* (SWT RiverSearch volunteer).

However, respondents reported a slightly lower agreement regarding the Perceived Benefits. One explanation is that benefits derived from participation are developed over time, as opposed to the initial motivations for joining a programme - which are felt at a single point in time. When volunteering for nature, no matter the level of participation and commitment, people may perceive immediate satisfaction from being connected with nature (Guiney & Oberhauser 2009). However, other benefits may be perceived to have accrued as immediately, and may be perceived as a function of the duration of volunteers’ involvement; awareness of the benefits derived from participation happens gradually (Pillemer et al. 2010). This process of incremental fulfilment was summarised well by one participant during a focus group discussion:

*“Frequently people might be not aware of their achievement; volunteers do not understand at once the benefits they are gaining and the impacts they are actually having as much as they actually do”.* (SWT Community Engagement Coordinator)

Perceived benefits play a crucial role in generating satisfaction, therefore increasing retention and, potentially, volunteer productivity (Appendix 6). The benefits that people derive from volunteering are related to initial motivations and expectations; nonetheless, they are likely to evolve during volunteer participation. Accordingly, expectations can be exceeded by the unforeseen benefits, enhancing level of satisfaction and wellbeing of volunteers, which increases the likelihood of higher productivity.

Testing and validating a psychometric tool to assess satisfaction of citizen scientists is an important achievement of this study, as the vast majority of literature on volunteer satisfaction lies within the social services sector (Clary et al. 1998; Finkelstein 2008; Galindo-Kuhn & Guzley 2001). This study lays a foundation role to build a stronger tool for evaluating that moves beyond simply examining the quality of data produced by volunteers towards a more holistic understanding of both the technical and human dimensions of volunteer programmes. This approach could assist programme managers in monitoring volunteer satisfaction with a view to strengthen commitment and, potentially, enhance productivity.

However, there is no doubt that further research is required to develop a framework for assessing satisfaction and its alignment with other variables that impact volunteer productivity (i.e., the quantity and quality of the data gathered) and the length of time volunteers are retained in a programme. Factors that relate to programme organisation, including support, supervision and training received could be usefully included. A programme-specific survey may also elucidate the finer scale motivations differing across citizen science programmes.

### *4.3. Volunteer productivity*

Identifying factors driving motivation and satisfaction allows investigation into whether these factors influenced volunteers’ productivity (Finkelstein 2008a; 2008b; Ryan 2001). Results from this study demonstrate that factors defining motivation and satisfaction are significant predictors of volunteer productivity. Connection with Nature, followed by Personal Development, again emerged

as the most significant components of volunteer psychology and behaviour predicting productivity. Increasing Connection with Nature and Personal Development suggests a related increase in time spent volunteering. This finding contrasts previous work where nature-related motivation had only a minor influence on volunteer commitment compared to other factors (Asah & Blahna 2012; Ryan et al. 2001). It is possible that this inconsistency may be explained by the different nuances in the measures of commitment adopted by these different studies.

A number of significant relationships were identified between volunteer satisfaction and productivity and this represents the strength of the present work for furthering understanding of human dimensions of conservation volunteerism. Time dedicated to volunteering showed a positive association with sense of Individual Fulfilment. This result is consistent with previous research; Finkelstein (2008) found motives fulfilment positively correlated to time spent volunteering. The perception of multiple benefits strongly influenced the number of volunteering sites visited by citizens, producing evidence of the critical role that satisfaction played in determining the effort that volunteers dedicated to programmes. The satisfaction derived from Individual Fulfilment and Perceived Benefits influences productivity: satisfied volunteers were more spurred to get involved in a greater number of different activities within the same organisation. Although the majority of volunteers were engaged in monitoring activities (81.16%), most of them reported involvement in other habitat restoration, campaigning, fund-raising, administration work as well as writing newsletters. An eloquent description of conservation volunteerism emerged during a focus group discussion reinforcing the idea that engaging in volunteering has the potential to change citizens' behaviour; as they start valuing nature, they want to get increasingly involved:

*“Conservation volunteerism can be a long process comparable to a jigsaw puzzle of activities carried out and achievements, the result of which is public understanding of what conservation is. Nature protection is therefore accomplished through the joint effort of the community”* (SWT staff member).

#### *4.4. Advocacy of citizen scientists*

Project coordinators of all groups involved in this research referred to the difficulty in recruiting sufficient numbers of volunteers. Measuring the advocacy of volunteers allowed further investigation into the Connection with Nature factor as it characterises citizen scientists. Volunteers



seeking a Connection with Nature tended to advocate for conservation on a broad scale. Of secondary importance was the ability to act as an advocate for the programme specifically, suggesting that current volunteers may not be the most effective mechanism for recruiting new volunteers. This is valuable in order to examine the linkages between volunteers' motivation, factors of satisfaction and productivity. Validating the psychometric scale for advocacy ability has important practical implications for programme managers, since it provides tools to identify potential advocates for the programme, facilitating recruitment of new volunteers and greater public outreach. Further research could assess what factor(s) of motivation and satisfaction have an influence, whether positive or negative, on volunteers' advocacy, so as to understand how conservation and programme advocacy ability can be developed.

If "motivation is the reason for a behaviour" (Wilkie 1990), this study suggests that a sense of Connection with Nature can drive human decisions towards engaging in conservation volunteerism. Should that connection be undervalued, volunteer programmes may suffer decreasing membership, productivity and advocacy. In a country that faces ever-increasing urbanisation, further understanding Connection – and its role in motivating citizen science can help to reverse a growing estrangement to nature.

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## **List of Appendix**

**Appendix 1. Citizen Science Programmes**

**Appendix 2. Workshop report**

**Appendix 3. Qualitative methods**

**Appendix 4. Psychometric scales**

**Appendix 5. Consulted literature**

**Appendix 6. Conservation volunteers process**



## Appendix 1. Citizen science programmes surveyed in this study.

Organisation	Description
<p><i>Surrey Wildlife Trust (SWT)</i></p>	<p>Currently manage 5% of the county in collaboration with landowners, communities and local volunteer groups.</p> <ul style="list-style-type: none"> <li>• <b>RiverSearch</b> is focused in building a network of trained volunteers for monitoring river health and providing evidence for management strategies.</li> <li>• <b>Surrey Dormouse Group</b> lead monitoring activities of dormice population; data are submitted to the NDMP. Volunteers are given the opportunity to apply for the Licence Training, necessary to handle this endangered species.</li> <li>• <b>Surrey Biological Information Centre (SBIC)</b> collect and manage records of flora, fauna and habitats of Surrey thanks to the contribution of a wide network of volunteers.</li> <li>• <b>Surrey Amphibian and Reptile Group:</b> volunteers engage in a number of activities such as wildlife surveys, habitat management, training courses, and photography workshops.</li> <li>• <b>BioBlitz</b> is an annual event during which members of the public and scientists come together for surveying and monitoring local wildlife and green spaces.</li> </ul>
<p><i>People's Trust for Endangered Species (PTES)</i></p>	<p>Investing in scientific research aims to protect endangered species in Britain. The PTES lead the National Dormouse Monitoring Programme. Volunteers engage in monitoring dormice and entry records to the national database. The dormouse is a protected species in Britain regarded as priority for conservation action.</p>
<p><i>British Trust for Ornithology (BTO) Surrey regional Network</i></p>	<p>Has established a Regional Network of local volunteer groups involved in different bird survey programmes such as Breeding Bird Survey, Garden Birdwatch and Wetland Bird Survey.</p> <ul style="list-style-type: none"> <li>• <b>Surrey Bird Club</b> is affiliated to the BTO</li> </ul>
<p><i>Riverfly Partnership</i></p>	<p>Has established a network of conservationists, anglers, entomologists, scientists and watercourse managers to collaborate for the enhancement of river health, protection of riverfly populations and habitat conservation.</p> <ul style="list-style-type: none"> <li>• The <b>Anglers' Riverfly Monitoring Initiative (ARMI)</b> engages volunteers across the UK. Records are submitted to the online database and used to inform local environmental agencies.</li> </ul>
<p><i>The Mammal</i></p>	<p>Volunteers take part in surveys of a number of mammals' species and submit</p>

<i>Society</i>	records to the National Mammal Atlas Project (NMAP).
<i>Tower Hamlets</i>	Volunteers engaged in bee survey in London. Records are sent to Greenspace Information for Greater London (GIGL).
<i>Amateur Entomologist Society</i>	Volunteer with an interest in entomology engage in local groups and benefit from expert support for species identification. Bi-monthly journal, magazine, newsletter and annual meeting encourage amateurs to share interest and material on insects and other invertebrates.
<i>LWT</i>	Volunteers engage in different activities ranging from wildlife monitoring, habitat management and administration work.

## Appendix 2

### WORKSHOP REPORT

“Mainstreaming monitoring and evaluation of wellbeing and productivity of citizen scientists”

23rd June 2014

Silwood Park Campus, Imperial College London

Funded by NERC Impact

#### 1. Introduction

This report presents a summary of the full-day workshop “Mainstreaming monitoring and evaluation of wellbeing and productivity of citizen scientists”. This workshop was conducted at Silwood Park Campus as part of a Masters project under Imperial College London. The purpose of the workshop was to bring together expertise from different conservation organisations in the UK and tackle the major issues related to the management of ongoing programmes. The workshop, together with a focus group and interviews with project managers and volunteers, has been the preliminary work for the refinement of a questionnaire which target environmental volunteers in the UK.

#### 2. Objectives of the workshop

The workshop had several objectives:

- Organisation’s priorities, needs and goals,
- motivations, expectations and benefits of volunteers,
- factors defining a satisfied, efficient and committed volunteers,
- strategies for targeting recruitment and increasing retentions of volunteers,
- drivers and constraints of volunteers productivity,
- and challenges of managing data collected by volunteers.

#### 3. Description of the methodology

##### *3.1 About the participants*

Participants at the workshop represented a wide range of positions from different organisations, all of them involved in citizen science programmes. The list of participants is in Appendix 2. During the first segment of the workshop, participants introduced themselves and described their jobs by elucidating their main roles and responsibilities within their affiliation. In the context of understanding organisation’s priorities, needs and goals, participants were given a questionnaire. The questionnaire was aimed to survey stakeholders’ expectations, motivations and major costs for being involved in citizen science programmes, as well as understanding how they perceive motivations, expectations and outcomes from the point of view of volunteers. To lead to better discussion and pinpoint main priorities, participants were asked to express their individual reasons for attending the workshop. Primary objectives were:

- To understand loyalty,
- understand how to engage with all user groups,
- find effective strategies to recruit new volunteers,
- learn how to improve wellbeing and efficiency of volunteers,
- learn how to reward volunteers and illustrate achievements adequately,
- learn how to make volunteers contribute more scientifically,
- and improve quality and quantity of data through improving citizen scientists wellbeing.

##### *3.2 Introduction to the background*

To support workshop objectives, the background of the proposed research project as well as methods and aims have been introduced by the Masters student with a PowerPoint presentation. The presentation has effectively stimulated participants, whom interacted with the speaker during the presentation. Interesting new topics emerged from this, and as a result, were discussed throughout the day. The PowerPoint slides are in Appendix 2.

### ***3.3 Group discussion***

The group discussed the Masters project goals and objectives. Participants engaged in a brainstorming sessions and further discussion were stimulated by drawing tables and writing key concepts and ideas on a board.

### ***3.4 Activities carried out***

The working session was held in a lecture room, which provided a hospitable environment and was equipped with necessary tools to facilitate the workshop. Different moments of socialisation were scheduled throughout the day, including a tour of Silwood Park Campus. Dr. Helen Hipperson, a research associate at Imperial College, had guided participants for a visit of the campus. The tour took place in mid-day and participants were presented with a historical background, the current and previous research conducted on campus, as well as an overview of the biodiversity that inhabits Silwood Park.

## **4. Workshop discussion outcomes**

The following discussion points are the result of group discussions and brainstorming sessions that were held during the workshop.

### ***4.1 How do organisations sell the importance of conserving nature?***

Key point – Expressing that every kind of information is important to an organisation - do not preclude people to contribute

- Untapped groups are unaware of how they can help the organisations
- Informing the public on the utility of collecting data – any data are useful, not only for protected species, which require more expertise to be collected and validated
- Communicating the importance of “absent” information from an area
- Randomly selected area surveys are important

Key point – Protected species take priority – do volunteers focus their interest in protected species?

- Conservation programmes can be very focused on target with highest importance - volunteers may be frustrated when submitting records of less protected species which do not attract the attention of researchers
- Protected species may not interest everybody - volunteers may be frustrated when they are generally keen on conserving nature

Key point – Explaining that the goal is conserving not just species, but ecosystems and the wider landscapes

- Communicating Living Landscape
- Encouraging the “ists” (specialists) to contribute to the bigger picture
- Understanding the need of a balance between “ists” and a broader goal of managing landscapes
- Explaining the importance of reconnection with nature and science

### ***4.2 Understanding motivations, expectations and benefits of volunteers***

People decide to join volunteer programmes for different reasons. These reasons may be determined by simple, mix or complex motivations. The expectations of volunteers depend significantly on the context of the programme, as well as on the individual reasons for getting involved. The benefits that people derive from volunteering are related to initial motivations and expectations; nonetheless, they are likely to evolve during volunteer participation. Accordingly, benefits can also exceed the initial expectations, enhancing the level of satisfaction and well-being of volunteers, which increases the likelihood of retention.

The table in Appendix 3 summarises examples of motivations, expectations and benefits identified and shared by participants during the workshop.

#### ***4.3 What could influence motivation in volunteers?***

Key point – Using social media

- Social networks – potential in motivating the public
- Contributing in knowledge building processes
- Incentive for competitive collectors
- Speeding up data collection and submission – reducing volunteers fatigue and effort

Key point – Role of policy and marketing

- Public awareness is determined by government channels
- Politics and campaign - advertising of economic concerns

Key point – Reputation of the programme

- Age of the programme
- Methodology
- Recruitment strategy

Key point – Influence from fashion, culture and TV

- Women becoming more involved
- Up until 10 years ago may have been male dominated

#### ***4.4 Challenges associated with different volunteer characteristics***

A major challenge of managing volunteers has been identified in complying with individual personality traits, values, emotions and fields of interest. These aspects determine different needs of people; therefore they have to be considered for recruitment and management of human resources. There is a relationship between the chosen field of interest and a general profile of volunteers. As an example, depending on the target species or type of volunteer work, people show preference for working solitarily rather than collectively. This association depends on the requirements of survey techniques, health and safety, gender, time availability, purpose and methods of the volunteer work. In addition, personality traits of individuals (such as being introvert or extrovert), as well as their values, might also have an influence in their preference. Values define what is important for an individual and they can be influenced by several external factors such as culture, society, religion and politics. However, values can be also a function of personality, and together they drive attitude and behaviour of individuals. Because different specialists may have different motivations for volunteering and therefore different expectations, the identification of general profiles of citizen scientists may lead to understanding how volunteers' needs can be met, so as to increase their satisfaction and therefore productivity. Further research on these aspects is needed in order

to better understand how needs and expectations of volunteers might be fulfilled. General profiles of different specialists' categories are in Appendix 4.

Key point – Solitary activities vs collective activities – what are the factors determining volunteer's preference?

- Requirements of the survey techniques – safety, site and equipment
- Purpose of the study – depend on the ecology and behaviour of the species of interest
- Personality traits
- Time
- Gender
- Level of competition and pride of the volunteer
- Benefits of being in a group

#### ***4.5 What discourages volunteers from initially entering into programmes?***

Key point - Distinction between “skilled” and “non skilled” volunteers - requiring skilled volunteers may discourage people, as many of them may not have required skills (qualifications/certifications)

- Common perception is that skills are more important than experience - perhaps they are equivalent.
- “Skill Level” may not be the correct phrasing
- Eliminating the requirement of volunteers with knowledge and experience - these aspects are built up through volunteering
- People need to know that species identification can be made by non-skilled volunteers
- Skills are more important when reporting “rarity” - it requires additional details that may require more skilled individuals

Key point - Complex and effort intensive - if people are recruited for something that should be paid for, it can discourage volunteers from registering

- It is important to let volunteers know that they can make a difference doing something interesting, feasible and achievable through volunteering
- It is difficult to justify seeking the public to pay for species conservation - volunteers may feel it should be the government's responsibility to pay for it

#### ***4.6 Reasons people might leave a programme – Causes of Burnout***

Key point – Challenges with living up to volunteer expectations - misled by media and TV

- The role of media is essential for public engagement
- From a conservation perspective it can be criticized - media may have been controlled for viewers and influence expectations
- E.g. Pro and Cons of Spring watch

Key point – Data management efficiency can demotivate volunteers

- “Data flow” is an issue - delay in data distribution can create frustration on volunteers
- Volunteers can get annoyed if data they have collected have not been shared and processed efficiently - potential “motivation sapper”

Key point – Volunteers may be frustrated when their contribution is affected by another stakeholder

- Collaboration is needed at different scales
- All different stakeholders have to be involved and engaged with volunteers, programmes and organisations
- Example: farmers involved in pollution of rivers

Key point – Challenges for retaining younger audience - cultivating initial enthusiasm

- Younger volunteers are very passionate and engaged - they stop volunteering once they acquire jobs and families
- They may only desire short-term involvement
- Too much age difference within a group
- Organising events to mix up different age groups

#### ***4.7 Factors inhibiting or affecting productivity of volunteer programmes***

Key point – Organisation may be too sensitive for data quality – need to create a common understanding of data quality for both volunteers and managers

- Data quality is function of its use – different programmes have different goals
- Importance of data quality depends on how the data will be used
- A constructive feedback has to be provided by the organisation
- Volunteers need to be corrected without demotivating or offending them
- A false presence recording and other inaccurate recordings have to be encouraged when submitted

Key point – Volunteers want to feel as though they are contributing to something

- Seeing the effects of conscientious and effective usage of data
- Seeing data being utilized – if not, the effort for collecting data might be affected
- Volunteers expect any information they provide is important
- Efficiency in data submission
- Being thanked

Key point – Can organisations prevent the sharing of “rare” species from the public? Need to establish appropriate level of transparency

- Recorders of rare species may want to get recognised for their work
- Volunteers may be frustrated if they do not know why their work has been restricted
- Organisations must realize: “who are we conserving nature for”?
- Knowledge of the location of rare species needs to be protected – is it morally responsible?

Key point – Lack of survey strategy and effort can result in inefficient data collection - organisations have to explain how to survey effectively

- Accuracy of data may be biased by survey strategy and distribution of survey effort
- Quality of data can be inhibited by different interests of volunteers
- Organisation cannot restrict the different interests

#### ***4.8 Challenges of data collection and management***

Key point – Including volunteers in the planning stages of the programme

- It might help volunteers in collecting data of good quality
- Difficulties in managing human resources
- Potential scarce interest
- Limited resources available

Key point – Emotional possession of the environment and ownership of data - restrictions on data collection and sharing

- Some volunteers are motivated by collecting data in their patch - often the use of these data is limited by indicating just the distribution of where people live
- Some volunteers accumulate their records and prefer not to share with organisations
- Willingness to share is competitive
- Anonymity appear to be important for some recorders
- Volunteers are hostile to private companies claiming ownership of public collected data – signing agreement to restrict sharing of the data

Key point – Limitations of technology

- Using Apps for data collection – effective for engagement but data can be lost
- Technological knowledge understanding – not everyone know how to use smart phones and computers
- Apps are useful because geo referenced – but restricted if no smartphone/internet

Key point - Design of data collection and online submission forms - important for a priori data quality management

- Too many forms to fill in – need to be replaced with simple records forms
- Great variation in survey completion – related to volunteers fatigue
- Targeting types of volunteers to do surveys
- Taking into account different abilities, age groups and societal responsibilities

#### ***4.9 How do we recruit and retain volunteers?***

Key point – Understanding in targeting age groups/social groups

- Different social groups/age groups are interested in different types of volunteering opportunities – casual involvement vs programme involvement
- Targeting different audiences in different venues

Key point - Creating experiences that are life transforming - opportunities with social engagement, events and games.

- Making tasks enjoyable – important for recruitment and retention
- Effective strategy especially for those less motivated by altruistic and intrinsic interests
- Children observed to cherish the experience
- Providing adults the opportunity to rediscover the excitement of being in touch with nature
- E.g. Nightjar walk; moth survey; river survey

Key point – Need to identify the drivers for making volunteers step up



- Understanding if a volunteer needs to feel they are contributing for the greater good of conservation
- Understanding if a volunteer needs to assist in planning stages of a programme

Key point - Measuring what will make people satisfied and retain large number of volunteers

- Understanding how to reward and encourage different types of people
- Giving adequate recognition publicizing achievements on the website or other sources
- People do not respond well to being told how to act – if told of the conservation concern (i.e. dog walkers)

Key point – Volunteers creating their own communities – motivation of a group might be different from the individual

- Volunteers getting together and forming a voice
- Potentially key to efficiency, motivation and retention of data collectors

#### ***4.10 How can the organisation improve volunteer’s wellbeing and efficiency?***

Key point - Natural resources provide societal benefits - understanding the relationships between mental and physical health with volunteer engagement

- Cultivating the benefits associated to mental and physical health
- Understanding the benefits from the natural environment
- Often people with mental illness, antisocial or competitive characteristics are the most passionate, knowledgeable and driven

Key point – Promoting sharing of data and providing easier access to databases to wider audience

- Competitive collectors might be incentivised
- Volunteers can compare themselves
- Long-term effect of improving data quality

Key point – Training and education - giving volunteers a status of becoming a “local expert”

- Fulfilling the expectation to learn - volunteers are keen to improve and get involved
- Getting involved provides them with a “status”
- Giving them title of “expert” of certain areas appear to motivate and recognize volunteers
- Becoming a citizen “expert” gives them a voice, recognition and equal value to scientists
- E.g. Becoming a local expert of a stretch of river

Key point - Transparency on project objectives

- Increasing sense of responsibility of volunteers
- Potentially linked to volunteers effort efficacy

### **5. Measuring productivity of volunteers – the effort index:**

Productivity of volunteers may be defined as ecosystem specific. Some conservation targets can be more rich in biodiversity (e.g. heathland surveys may obtain no birds records, whilst wetlands will obtain

many), but also some taxa are more easy to detect than others (insects vs mammals). The level of commitment, effort and efficiency of a volunteer can be measured looking at different factors. The following criteria have been identified during the workshop for measuring the effort index of volunteers involved in citizen science programmes:

- Number of records/visits per time,
- records description enthusiasm – records sent with additional information and details,
- regularity of surveillance,
- quantity of data,
- time spent on data entry,
- and uploading digital photographs.

## **6. Considerations for programmes planning and development:**

- Understanding motivations and expectations of volunteers may help steer them in the right group/programme.
- Different specialists have different motivations – need to identify and accommodate each type of person.
- Specialist groups are easier to start with, compared to rarity recording groups which need a lot of information for validation.
- Cultivating life experience (spiritual, educational, cultural) to recruit and retain different audience.
- Trying to engage with new audiences – those less engaged with conservation rather than those are already engaged and supporting.
- Using social media a wider range of people can get involved and with different levels of commitment, reducing costs and optimising time, and enabling trust between individuals in a citizen science community provides a measure of reliability of data collected.
- Making public volunteers achievement on the website - important for both introverted and extroverted volunteers.
- Making public data collected through visual presentation on the website – using data motivate volunteers to improve the quality.
- Providing easier access to the database.
- Providing feedback to volunteers – showing their improvements and that data are properly checked.
- Volunteers expect to see outcomes from the first year – provides encouragement, motivation and satisfaction.
- Transparency with project objectives - involving volunteers in planning make them informed of the standard of data required and survey strategy.
- Need to address the sources of errors in data collection and submission – might be resulting from volunteers and protocols.
- Defining dimensions of data quality with volunteers.

**Appendix 3.** Qualitative methods used at the initial stage of the research as preliminary work for the refinement of the psychometric instruments and design of the questionnaire.

<b>Methodology</b>	<b>Description</b>	<b>Participants</b>
<i>Participant observation and informal interviews<sup>a</sup></i>	<i>RiverSearch Training Course</i>	
	A full day course held at Norbury Park included a classroom session and a riverwalk survey.	<ul style="list-style-type: none"> <li>• Project Coordinator</li> <li>• 6 volunteers</li> </ul>
	<i>Tree Warden Conference</i>	
	Volunteer groups from Surrey and East Sussex met for a full day event of case studies presentations and discussions.	<ul style="list-style-type: none"> <li>• Key stakeholders</li> <li>• Several volunteers</li> </ul>
	<i>Surrey Wildlife Trust BioBlitz</i>	
	A 24-hour event held at Newlands Corner in which teams of scientists, citizens and families carried out several monitoring activities.	<ul style="list-style-type: none"> <li>• SWT staff</li> <li>• Local-led groups</li> <li>• SWT volunteers</li> <li>• General public</li> </ul>
<i>Focus Group<sup>b</sup></i>	Pre-arranged group interview facilitated by the researcher for understanding CSP staff perspective.	<ul style="list-style-type: none"> <li>• 6 key representatives from SWT</li> </ul>
<i>Semi-structured interviews</i>	Pre-arranged interviews based on a prepared interview guide to refine the EVFI and understand volunteer perspective.	<ul style="list-style-type: none"> <li>• 2 volunteers</li> </ul>
<i>Workshop<sup>c</sup></i>	A pre-arranged full-day event held at Silwood Park Campus to develop a common understanding of the research project and to lay the groundwork for collaboration between the researcher and the various stakeholders.	<ul style="list-style-type: none"> <li>• 8 key informants from different conservation organisations and institutions</li> </ul>

<sup>a</sup> Volunteers and other key stakeholders interviewed were recruited onsite during volunteer events.

<sup>c</sup> Workshop Report is in Appendix 2.

#### **Appendix 4.** Psychometric scale for assessing motivation and satisfaction.

1. It is important for people to volunteer their time to a worthy cause.
2. I enjoy being outdoors.
3. I want to learn more about nature.
4. I am concerned about the impacts of global climate change and degradation on ecosystems.
5. Volunteering allows me to indulge in my true passion(s).
6. I want to actively contribute towards improving society.
7. I prefer volunteering in group rather than alone.
8. Volunteering provides an opportunity to explore new places.
9. Volunteering allows me to introduce others to science.
10. I enjoy sharing new knowledge with others in the volunteering community.
11. Participation in volunteer programmes allows for personal development.
12. I enjoy the challenges of learning new skills.
13. I am interested in the planning stages of the programme.
14. Volunteering provides me with an opportunity for meeting people with similar interests.
15. I regularly consult the programmes managers to see the impacts of my contribution.
16. Nature is a never-ending source of fascination for me.
17. I feel a strong connection with nature.
18. The programme I volunteer for is well-organized.
19. I strive to meet the challenges set by the programme managers.
20. Volunteering for conservation organizations provides me with opportunities to network with professionals.
21. My volunteer experience has been positive.
22. I receive adequate recognition for my work as a volunteer.
23. My role(s) and responsibilities for the programme meet my motives for volunteering.
24. This programme allows me to actively contribute information to the scientific community.
25. My overall experience as a volunteer has been personally fulfilling.
26. Volunteering allows me to break away from my normal routine.
27. My network of fellow volunteers has grown as a result of participating in the programme.
28. Through my involvement I am able to actively contribute to the conservation of nature and wildlife.

29. My learned skills from volunteering have improved throughout involvement in this programme.

30. I enjoy volunteering because of the social time it provides.

31. I enjoy working under the supervision provided by the staff.

32. Volunteering provides a great opportunity for recreation.

33. The website of the organization is user friendly.

34. I volunteer because it helps my physical fitness.

35. Volunteering increases my self-esteem.

36. My volunteer experience may help me in changing career.

37. Volunteering is an important activity for people I know best.

### **Psychometric scale for assessing advocacy ability.**

1. I have taken practical measures to reduce my impact on the environment.

2. I have formally shared my volunteering experiences with others through public speeches, presentations or the media.

3. I encourage friends and family to join the programme.

4. I discuss conservation and environmental issues with non-volunteering friends and acquaintances.

5. I often informally share my volunteering experiences with others.

6. I make annual donations to other conservation organizations.

7. I try to encourage people to join the programme by facilitating logistics, such as providing transport.

8. It is important for me to explain the impacts of human actions on the environment to friends and acquaintances.

**Appendix 5.** Motivations identified in previous studies on conservation volunteers.

<b>Study</b>	<b>Motivations of conservation volunteers</b>					
<b>Ryan et al. 2001</b>	Learning	Helping the Environment	Social	Project Organisation	Reflective	Fascination with Nature
<b>Bruyere &amp; Rappe 2007</b>	Learning	Helping the Environment	Social	Project Organisation and Career	Values and Esteem	Get Outside
<b>Measham &amp; Barnett 2008</b>	Learning about the Environment	Helping a Cause	Social	Improving Skills	Desire to Care about the Environment	Career
<b>Weston et al. 2003</b>	Self Education	Helping Birds and their Habitat		Personal Experience	Conservation	Research
<b>Raddick et al. 2010</b>	Learning	Contribute	Community	Fun	Teaching	Discovery
<b>Asah &amp; Blahna 2012</b>	Learning	Help the Environment	Community Building	Escape and Exercise	Teaching	Discovery
<b>Miles et al. 1998</b>	Personal Growth	Meaningful Action	Participation	Physical Activity	Chance to be away	Fascination with Nature

Appendix 6. Conservation Volunteer Process

# Conservation Volunteerism Process

