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Conservation and human behaviour: lessons from social psychology

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Abstract. Despite increased effort from non-governmental organisations, academics and governments over recent decades, several threats continue to cause species declines and even extinctions. Resource use by a growing human population is a significant driver of biodiversity loss, so conservation scientists need to be interested in the factors that motivate human behaviour. Economic models have been applied to human decision making for many years; however, humans are not financially rational beings and other characteristics of the decision maker (including attitude) and the pressure that people perceive to behave in a certain way (subjective norms) may influence decision making; these are characteristics considered by social psychologists interested in human decision making. We review social-psychology theories of behaviour and how they have been used in the context of conservation and natural-resource management. Many studies focus on general attitudes towards conservation rather than attitudes towards specific behaviours of relevance to conservation and thus have limited value in designing interventions to change specific behaviours (e.g. reduce hunting of a threatened species). By more specifically defining the behaviour of interest, and investigating attitude in the context of other social-psychological predictors of behaviour (e.g. subjective norms, the presence of facilitating factors and moral obligation), behaviours that have an impact on conservation goals will be better understood, allowing for the improved design of interventions to influence them.

Additional keywords: attitude, behaviour, decision making, parks, poaching, hunting, social norms, taboo.

Introduction

Over the past decades, biodiversity conservation has received increasing attention: protected area coverage has increased (Chape *et al*. 2005), and 193 nations have signed the United Nation's Convention on Biological Diversity (UNEP 2010). Despite this increased profile, funding shortfalls remain (James *et al*. 1999) and overexploitation (Rosser and Mainka 2002), habitat loss (Brooks *et al*. 2002), invasive species (Blackburn *et al*. 2004; Clavero and García-Berthou 2005) and increasingly, climate change (Parmesan 2006; Carpenter *et al*. 2008), continue to cause species extinctions (Schipper *et al*. 2008; Sodhi *et al*. 2008). The ultimate driver of much of the loss in biodiversity is the increasing human population and the associated consumption (van Vuuren and Bouwman 2005). Although population growth is a critical issue, it is beyond the scope of most conservation projects which are generally concerned with the more proximate drivers of biodiversity loss such as resource use. Conservation projects will often seek to alter human behaviour, for example, by encouraging the adoption of agri-environment schemes (Hounsome *et al*. 2006), reducing poaching within protected areas (Jachmann 2008) or limiting resource extraction (Gelcich *et al*. 2005; Blank and Gavin 2009). However, successfully influencing behaviour depends on the predictors of human behaviour being diagnosed correctly (Vlek and Steg 2007). Conservation scientists therefore need to be interested in the factors that motivate human behaviour. However, many of us working within natural-resource management and conservation have trained as biological scientists (Adams 2007). In understanding the complexities involved in researching, interpreting and influencing human behaviours we therefore have a lot to learn from other disciplines.

Several disciplines have offered models of the human decision-making process. Institutional analysis offers one way of identifying how the behaviour of a group, or individual, is influenced by rules governed by either formal, or informal institutions (Agrawal and Gibson 1999). Economic models based on expected utility theory have been applied within natural-resource management for many years (Rae 1971; Clark 1973; May *et al*. 1979; Just and Zilberman 1983). A well known example is the seminal work by Hardin (1968) which, on the basis of the assumption that humans seek to maximise their utility, explains elegantly why open-access resources tend to be overexploited. However, humans are not *Homo economicus* (Persky 1995), i.e. purely rational beings weighing up the costs and benefits of each and every decision in an economic framework. Social-psychological characteristics of the decision maker (e.g. their personal attitudes), and the pressure that they perceive to behave in a certain way (subjective norms)

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also influence decision making, particularly when considering broader decisions such as livelihoods and land use (Willock *et al*. 1999; Rounsevell *et al*. 2003). Such considerations are the realm of social psychologists. In the present paper, we review theories of human decision making from social psychology and consider how they have been used in the context of conservation and natural-resource management, highlighting where they could be particularly useful to conservation in the future.

Social-psychological models used to understand human behaviour

The theory of reasoned action and its extension, the theory of planned behaviour (Fishbein and Ajzen 1975; Ajzen and Madden 1986; Ajzen 1991) are the models most commonly used by social psychologists interested in understanding human behaviour. Many studies, where the ultimate objective has been to understand and influence behaviour, e.g. condom use (Albarracín *et al*. 2001), illicit drug use (Conner and McMillan 1999) and drivers' speeding behaviour (Parker *et al*. 1996), have used these theories. The assumption underlying such studies is that an understanding of the predictors of behaviour allow interventions that aim to change behaviour to be better designed (Parker 2002). Indeed, a systematic review of cases that have applied interventions designed around the findings of the theory of planned behaviour studies reported that two-thirds of the case studies recorded some behavioural change in the desired direction after the intervention (Hardeman *et al*. 2002).

Both the theory of reasoned action and the theory of planned behaviour are based on the following two assumptions: (1) that people evaluate the implications of performing a behaviour before deciding to engage, or not engage in it and (2) that people make quite rational decisions on the basis of a systematic evaluation of information available to them (be it correct or not) (Ajzen and Fishbein 1980). These assumptions are similar to those made in economic models (Blume and Easley 2008), except that social-psychological models use quite different predictors of behaviour. Within the theory of reasoned action, both an individual's attitude towards the behaviour and subjective norms influence whether an individual is likely to carry out that behaviour (Fig. 1). Attitude is a function of beliefs about the behaviour, and an outcome evaluation of performing the behaviour. For example, in a typical survey, respondents may be asked to score (e.g. on a six-point semantic scale; Ajzen and Fishbein 1980) a 'behavioural belief' statement 'poaching a duiker will provide meat for my family'. This score is multiplied by the respondents' score to an 'outcome evaluation' statement 'eating duiker meat is good for my family'. A subjective norm is what we think other people will think of us if we do (or do not do) the behaviour. It is a function of normative beliefs and the motivation to comply with what a significant person (e.g. village elder, father or religious leader) thinks is appropriate behaviour. For example, respondents score a 'normative belief' statement 'the village elder approves of me poaching duiker'. This score is multiplied by the respondents' score to a 'motivation to comply' statement 'behaving how the village elder expects me to, is important to me'.

For behaviours that are completely under an individual's control (i.e. depend on conscious personal choice rather than external forces) this theory has been proven to predict behavioural intention (where an individual is asked whether they plan to carry

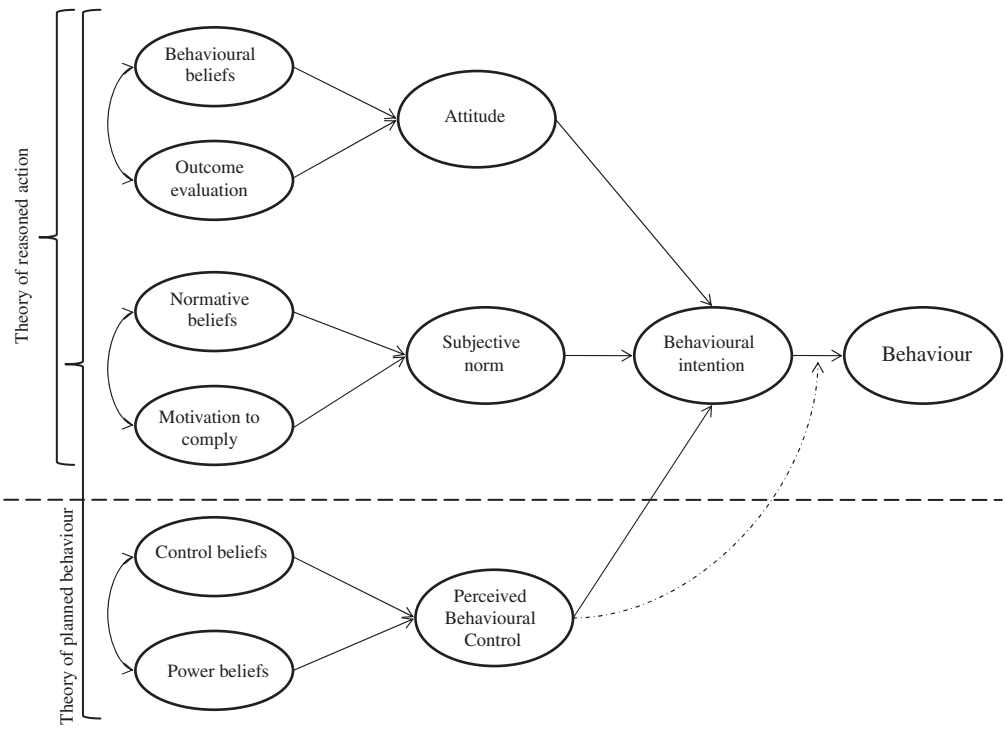

Fig. 1. The theory of reasoned action and the theory of planned behaviour. All things held equal, the more positive a persons' attitude, subjective norm and perceived behavioural control are, the greater their behavioural intention and, thus, the likelihood that they perform the behaviour (adapted from Vallerand *et al*. 1992).

out the behaviour), which has in turn been demonstrated to predict the actual behaviour (Ajzen and Fishbein 1980; Albarracín *et al*. 2001).

The theory of planned behaviour extends this model to include a measure of the perceived control over performance of a behaviour; this is known as perceived behavioural control (Ajzen 2002). Perceived behavioural control is a function of the presence (or absence) of resources (including skills and material items) that facilitate performing the behaviour, and the perceived power that each resource has to facilitate the behaviour. For example respondents score a 'control belief' statement 'it is easy for me to get wire to make snares for poaching duiker'. This score is multiplied by the respondents' score to a power-belief statement 'having access to wire makes it likely that I will poach a duiker'. This extension improves the predictive power of the model for behaviours that are not completely under an individual's control (Ajzen 1991) (Fig. 1). The theory of planned behaviour is now the most extensively used social-psychological model (Hardeman *et al*. 2002). The relative importance of the three predictors (attitudes, subjective norms and perceived behavioural control) tends to differ from one behaviour to another (Ajzen 1991). By using this model to investigate why people make specific decisions about a behaviour, it is possible to learn which predictor is the most important with respect to the behaviour of interest (e.g. turning a non-tree-planting farmer into a tree-planting farmer; Zubair and Garforth 2006) and, therefore, which predictor should be the target of behaviour-change interventions.

Some researchers have added other variables to the theory of planned behaviour in an attempt to improve the predictive power of the model. Variables that have improved the theory of planned behaviour include anticipated regret (Sheeran and Orbell 1999), descriptive norms (how other people actually behave, rather than what we perceive others will think of us) (Rivis and Sheeran 2003), self-efficacy (Armitage *et al*. 1999) and moral obligation (Beck and Ajzen 1991; Conner and Armitage 1998). Moral obligation is a person's own perception of the moral correctness or incorrectness of performing a behaviour (Ajzen 1991; Manstead 2000) and so reflects another form of social pressure in addition to subjective norms (Conner and Armitage 1998). Empirical studies that have found moral obligation to be an important predictor of behaviours include studies of reckless driving (Manstead and Parker 1995; Parker *et al*. 1996), lying (Beck and Ajzen 1991) and cannabis use (Conner and McMillan 1999). Moral obligation was also an important predictor of positive pro-environment behaviours (Bamberg and Möser 2007), including engaging in a recycling scheme (Tonglet *et al*. 2004) and water conservation (Lam 1999).

How have models of behaviour been used in the context of conservation?

There are very few examples where social-psychological models have been used within conservation science. The few examples that exist (Beedell and Rehman 2000; Seeland *et al*. 2002; Aipanjiguly *et al*. 2003; Zubair and Garforth 2006) have highlighted how information about attitude alone reveals a limited picture concerning the predictors of pro-conservation behaviours. For example, farmers who had already planted trees on their land, and those who had not, both had a positive attitude towards farm forestry, suggesting that other factors must influence farmer's decisions to engage in farm forestry (Zubair and Garforth 2006). Subjective norms were important in predicting pro-conservation behaviours such as on-farm forestry (Zubair and Garforth 2006), on-farm conservation behaviours (including hedgerow management and tree planting) (Beedell and Rehman 2000), obeying boating speed limits in manatee (*Trichechus manatus*) areas (Aipanjiguly *et al*. 2003) and the intention to abide by proposed nature reserve rules (Seeland *et al*. 2002). As a result of this theory-based research, the authors cited above could specifically identify which person or groups of people (e.g. village elders, family members and friends) play a significant role in influencing whether an individual will engage in pro-conservation behaviours or not. Such information can be exploited for the benefit of conservation, allowing interventions aimed at changing behaviour to be better targeted.

Perceived behavioural control was also found to be an important predictor in pro-conservation decision making. For example, Zubair and Garforth (2006) identified factors that inhibited people from engaging in on-farm forestry and were then able to recommend facilitating factors, such as improved communication about markets, establishment of village nurseries, and information about appropriate species, which would increase adoption of this pro-conservation behaviour (Zubair and Garforth 2006).

Although social-psychological models have received relatively little attention from conservation scientists, some of the predictors of behaviour used in the models have been considered independently in several conservation studies.

Attitude studies

'Attitude is the psychological tendency of an individual to evaluate an entity (person, place, behaviour or thing) with a degree of favour or disfavour' (Albarracín *et al*. 2005). Within conservation, there has been a general perception that positive conservation attitudes, or a positive attitude towards a protected area, are likely to be linked to pro-conservation behaviours, and several studies have therefore investigated attitudes towards conservation (see Holmes 2003 for a review). There are very few studies that have put attitudes in the context of other possible influences as suggested by the social-psychological theories highlighted above, although some have linked conservation attitudes to socio-demographic variables, or to behaviours that relate to conservation (Table 1).

Studies that have explored the relationships between general attitudes towards conservation (or protected areas) and socio-demographic and livelihood variables have done so to identify which variables determine positive, as opposed to negative, attitudes (Nepal and Weber 1995; Mehta and Heinen 2001; Arjunan *et al*. 2006). Investigating local attitudes towards conservation near Kalakad–Mundanthurai Tiger Reserve in India Arjunan *et al*. (2006) found that women had more positive attitudes towards tiger and forest conservation than did men. Further, wealthy residents who stood to lose crops to crop-raiding animals, the hunting of which is prohibited, had a more negative attitude towards tiger conservation than did poorer residents who did not stand to face such a loss (Arjunan *et al*.

2006). However, knowing how general attitudes are distributed does not necessarily help in the design of interventions to change a specific behaviour because a person may have a positive attitude to conservation, and yet still perform behaviours that contradict that attitude (e.g. poach species that are of conservation concern). Several studies have collected data on attitudes towards a protected area or species and concluded that respondents hold positive attitudes, yet either do not engage in pro-conservation behaviours, or continue to perform behaviours that have negative consequences to conservation goals. These findings are largely a result of a mismatch in the information collected on attitude and behaviour (see Table 1).

Such mismatches (e.g. measuring attitude towards conservation, but linking it to a specific behaviour such as trespassing in a protected area) limit how useful the information can be in informing the design of conservation interventions aimed at changing behaviour. For example, knowing that crop raiding by wildlife is the cause of negative attitudes towards a protected area (de Boer and Baquete 1998) is useful, because it may spur a project towards designing ways of deterring crop-raiding animals. However, such an intervention may be a waste of conservation investment if peoples' negative attitudes towards the protected area never trigger negative behaviours towards the protected area (e.g. in the form of retaliation behaviours). Equally, positive attitudes towards a protected area related to perceived benefits and good relationships with protected area staff (Fiallo and Jacobson 1995) may not mean that people abide by the rules of the protected area. If ensuring local people benefit from a protected area improves attitudes but does not increase compliance with protected area rules, increasing benefit flows to local people, although important, may alone not be the appropriate way of tackling illegal resource extraction.

Infield and Namara (2001) found that although communities around Lake Mburo National Park in Uganda that had been subject to a 7-year-long community conservation programme had a more positive attitude towards the park and wildlife than did communities that had not been included in the programme, behaviour remained largely unchanged, with high levels of poaching and illegal grazing continuing. Infield and Namara (2001), therefore, concluded that attitude alone is not an adequate predictor of behaviour. Waylen *et al*. (2009), in their study of attitudes towards two critically endangered species, the leatherback turtle (*Dermochelys coriacea*) and the Trinidad piping-guan (*Pipile pipile*), also reported that attitudes towards conservation did not necessarily predict behaviour. Hunting remained a popular pastime even among respondents who had a positive attitude towards conservation and recognised that hunting threatened conservation (Waylen *et al*. 2009). However, in both of these studies, there is a mismatch between the attitude and the behaviour investigated; for example, Waylen *et al*. (2009) measured general attitudes towards conservation rather than the specific behaviour they were interested in (hunting).

Investigating general attitudes towards a subject (e.g. conservation) are likely to be of limited use in identifying the predictors of specific behaviours (e.g. poaching) (Ajzen 1991). If the aim is to influence poaching behaviour occurring in a park, then studies of attitudes need to be clearly focused on attitudes towards poaching behaviour, rather than general attitudes towards conservation, or other related topics. Conner and Sparks (2008) suggested that one should consider the target, action, context and time scale of a behaviour. For example, by using the theory of planned behaviour, we may wish to understand the beliefs underlying the intention to poach (action) an elephant (target) from within the protected area (context) in the next 12 months (time). Armed only with information on general attitude as currently gathered in much conservation research we are lacking behaviour-specific beliefs and vital information about social pressure, internalised moral beliefs, and the perceived control that people feel they have to engage (or not) in a given behaviour, and the relative importance of each of these predictors on actual behaviour. This missing knowledge limits our ability to target interventions effectively. Critically, in the absence of such knowledge, we may threaten locally existing subjective norms that also influence human decision making and behaviour.

Subjective norms: social norms and taboo

Social psychology emphasises that a person's behaviour will be influenced by subjective norms, namely the perceived expectations of valued others (Fishbein and Ajzen 1975). 'Social norms' is a general term for the shared understanding about what actions are obligatory, acceptable or forbidden (Ostrom 2000) and includes general societal expectations of behaviour (Cialdini and Trost 1998) and standards that develop out of observing how others behave (descriptive norms; Cialdini *et al*. 1990). Social norms are enforced through informal institutions, not dependent on government juridical laws (North 1994); for example, someone breaking a social norm may suffer shame and social rejection (Posner and Rasmusen 1999). Behaviours that are particularly unacceptable, perhaps invoking not only the displeasure of the community but also of religious entities, may be referred to as a taboo (Freud 1950).

Social norms and taboos help govern traditional systems of natural-resource management that exist in many non-industrial societies (Berkes *et al*. 2000). Traditional natural-resource management has been important in many parts of the world for centuries. For example, a system of traditional rules known as *sasi* has controlled spatial and temporal patterns of fishing and forest-product harvesting in Maluku, Indonesia, since the 16th century (Harkes and Novaczek 2002). Sami reindeer herders of Norway have similarly well established traditional institutions to control reindeer stocking density on communal lands (Bjørklund 1990). Social norms can contribute considerably to the successful management of common-pool resources, such as farmer-managed irrigation schemes (Ostrom *et al*. 1999), pasture management by nomadic pastoralists (Fernandez-Gimenez 2000) and near-shore fisheries of the tropical Pacific islands (Johannes 1982). For example, temporal grazing norms control where and when herders in Mongolia can graze their stock, and a norm of reciprocity safeguards access between neighbouring herders' pasture in the event of climatic disaster (Fernandez-Gimenez 2000).

More recently, social norms have been shown to be important in predicting re-enrolment to a payment for ecosystem services

Table 1. Attitude studies and the use of social psychological frameworks in conservation research

Authors	Attitude towards	Social psychological framework applied?	Remarks of the authors	Link made between attitude and behaviour?	Authors able to suggest behaviour-specific interventions?[A]
Zubair and Garforth (2006)	Farm-level tree planting, Pakistan	Yes. Theory of planned behaviour.	'. . .in addition to attitudes and perceptions farmers also feel social pressure while considering the decision to grow trees on their farms'.	Yes. Relative importance of attitude, subjective norm and perceived behavioural control with respect to on-farm tree planting quantified.	Yes. Programmes promoting farm forestry should seek to intensify indentified favourable attitudes towards tree planting. Village elders influential and thus instrumental in information dissemination.
Aipanjiguly *et al*. (2003)	Behaviour of boaters in Tampa Bay, Florida	Yes. Theory of reasoned action.	'. . .the normative component has a strong influence on the intention to follow [comply with] speed zones'.	Yes. Relative importance of attitude and subjective norms with respect to exceeding speed limits quantified.	Yes. Authors suggest the use of normative messages highlighting the opinions of specified 'important others'.
Beedell and Rehman (2000)	Farmer's conservation-related behaviours, UK	Yes. Theory of planned behaviour.	'. . .differences do emerge between the farmers and FWAG farmers [members of the Farming Wildlife Advisory Group] in terms of the beliefs that they hold. . . .FWAG farmers were largely influenced by conservation-related beliefs. . . .The farmer group were more influenced by farm management beliefs. . .'	Yes. Relative importance of attitude, subjective norm and perceived behavioural control with respect to farmer's conservation-related behaviours quantified.	Yes. Farmers not implementing conservation behaviours unlikely to seek outside help because less influenced by subjective norms.
Seeland *et al*. (2002)	Restrictions on recreational use of Sihlwald peri-urban Nature Reserve, Switzerland	Yes. Theory of planned behaviour.	'Eighty-eight percent of the variance of behaviour intention was explained by the three determinants attitude, subjective norms, and perceived behavioural control'	Yes. Relative importance of attitude, subjective norm and perceived behavioural control with respect to obeying reserve restrictions quantified.	Yes. Subjective norm most influential predictor of behavioural intention. Recreation clubs to promote collective self-obligation to obey rules.
Arjunan *et al*. (2006)	Protection of tigers; Kalakad–Mundanthurai Tiger Reserve; and the Forest Department, India	No	'Positive attitudes might not necessarily translate into sustainable practices. . .'.	Yes, but mismatch between attitude (towards tiger conservation) and behaviour (use of forest products).	No
Mehta and Heinen (2001)	Annapurna and Makalu–Barun Conservation Areas, Nepal	No	'The results indicated that the overwhelming majority of respondents held favourable attitudes towards both Annapurna and Makalu-Barun Conservation Areas. . . .local people liked the conservation areas mainly because of community development and community forestry programs'.	No. Study investigated socioeconomic and demographic characteristics influencing attitudes. Behaviour within the conservation areas not investigated.	No

Nepal and Weber (1995)	Wildlife conservation; Royal Chitwan National Park, Nepal	No	'. . .loss of crops and domestic livestock, and threats to human life from wild animals from the park resulted in local people's antagonistic behaviour towards the park and negative attitude towards wildlife conservation'.	Yes, but mismatch between attitude (towards conservation) and behaviour (trespassing in park).	No
de Boer and Baquete (1998)	Maputo Elephant Reserve, Mozambique	No	'The attitude towards the Reserve was correlated with crop damage experiences; people with crop damage caused by elephants, hippos or bushpigs, were more negative'.	Yes, but mismatch between attitude (reasons for liking Reserve) and behaviours (resource exploitation).	No
Fiallo and Jacobson (1995)	Machalilla National Park, Ecuador	No	'. . .residents living either within or adjacent to [the park] hold a variety of negative attitudes towards the Park. Positive attitudes tended to increase with respondents' level of education and knowledge about conservation issues.	No. Positive and negative attitudes quantified, whereas the link to conservation related behaviours or compliance was not.	No
Infield and Namara (2001)	Lake Mburo National Park; and conservation, Uganda	No	'Surveys of attitudes show that communities that benefited from the [community conservation] programme were significantly more positive towards the park and wildlife than communities that did not. . . .Their behaviour was not greatly changed, and high levels of poaching and illegal grazing continued'.	Yes, but mismatch between attitude (towards the park and conservation) and behaviour (poaching; illegal grazing).	No
Waylen *et al*. (2009)	Attitude towards the environment; turtles; and the Trinidad piping-guan, Trinidad	No	'Hunting was seen as the main threat to wildlife but was also a popular pastime, illustrating the potential for mismatch between attitudes and conservation behaviours'.	Yes, but mismatch between attitude (general support for conservation) and behaviour (hunting).	No

[A]Where authors were unable to recommend behaviour-specific interventions it was generally because the attitude statements did not correspond to a specific behaviour, or the attitude statements were too general.

scheme (grain-to-green programme, in China's Wolong Nature Reserve; Chen *et al*. 2009). In a study that used stated-choice methods to investigate the relative importance of social norms and conservation payments, social norms were found to be most important when conservation payments were intermediate, and least important at both the lowest and highest levels of conservation payment, where none or all of the respondents would re-enrol. When offered an intermediate conservation payment, farmers based their decisions on what other local farmers were doing: if others were planting trees, then they would chose to plant trees, and *vice versa* (Chen *et al*. 2009).

In a systematic review of taboos held by traditional societies, Colding and Folke (2001) identified six categories of taboos (which they refer to as resource and habitat taboos) that influence conservation. Taboos that may have developed for reasons unconnected to natural-resource management may play an important role in conservation (Colding and Folke 1997). For example, taboos have had a role in protecting several threatened species in Madagascar, including lemurs of the Indiridae family, thought to embody dead ancestors, and the carnivorous fosa (*Cryptoprocta ferox*), believed to scavenge from the bodies of dead ancestors buried in the forest (Jones *et al*. 2008). In both of these cases, the taboos have their origin in respect for the ancestors, rather than in attempts to manage natural resources; however, they play an important conservation role. Sacred groves are another example where conservation is a happy consequence of taboo, and not the result of an innate desire to conserve biodiversity (Gadgil and Vartak 1976). Initially protected for religious or cultural purposes, sacred groves are now increasingly important to biodiversity conservation and ecosystem services, including pollination and seed dispersal (Bodin *et al*. 2006). Of course, other taboos can have a negative conservation impact; e.g. spotted eagle owls (*Bubo africanus*) (Kideghesho 2008) and the aye-aye (*Daubentonia madagascariensis*) (Simons and Meyers 2001) are associated with negative beliefs in parts of Tanzania and Madagascar, respectively, which can result in their persecution.

Conservation interventions (e.g. establishment of a protected area with associated rules) may erode social norms or taboos and the institutions that enforce them (Anoliefo *et al*. 2003; Jones *et al*. 2008). For example, Jones *et al*. (2008) found that the designation of Ranomafana National Park in Madagascar had resulted in the breakdown of traditional management of pandans (*Pandanus* spp.), a plant used for weaving. Because the resource became the property of the park, the social norm that had prevailed (to be careful not to damage the growing tip when harvesting) became widely disregarded. Newly introduced religions and the drive to modernisation have also contributed to the erosion of locally held social norms that traditionally protected sacred groves and streams in Nigeria and Tanzania (Anoliefo *et al*. 2003; Kideghesho 2008). Where there is limited capacity for enforcement, conservationists must take great care when introducing new rules that may inadvertently result in the breakdown of social norms that provide some positive management (Gelcich *et al*. 2006; Jones *et al*. 2008).

Perceived behavioural control

We do not know of any studies in conservation that have quantified the influence of the presence or absence of facilitating factors on decision making in the way that perceived behavioural control does in the theory of planned behaviour (Ajzen 1991). When social psychologists measure perceived behaviour control they are quantifying to what extent people feel that they have the ability to perform the behaviour being investigated. It measures the perceived presence (or absence) of required skills, resources and other prerequisites required, and how much power people perceive each of these factors to have in making the behaviour easy or hard to do (Ajzen 1991). Such factors are important in decision making because people who believe that they have all the necessary resources, and perceive that the opportunity to perform the behaviour exists (with limited obstacles) are ultimately more likely to engage in the behaviour (Conner and Sparks 2008). Although this terminology has not been used in the conservation literature, studies have looked at factors (e.g. available resources and skill) that influence the success of enterprise interventions such as producing essential oils from wild plants or setting up ecotourism ventures (Salafsky *et al*. 2001), and factors such as product suitability that can influence uptake of project interventions such as installing a fuel-efficient stove (Wallmo and Jacobson 1998).

Discussion

In the field of conservation and natural-resource management, we are generally good at getting the biology right; identifying new and threatened species and modelling the limits of ecosystems (Mascia *et al*. 2003). However, slowing biodiversity loss requires that we understand and influence the decision-making processes that result in behaviours that drive the loss. There has been some excellent work using simple economic models to investigate decisions that have an impact on conservation success; for example, the decision made by a poacher to engage in poaching involves weighing up of costs (risk of detection and likely sanctions) and benefits (potential profit) (Mesterton-Gibbons and Milner-Gulland 1998). However, there are other influences that we know much less about but that are important in decision making. Some work has been carried out on attitudes towards conservation, and there is a considerable wealth of knowledge concerning social norms that govern natural-resource extraction. Yet only a few studies have investigated predictors of behaviour in a coherent holistic way. In particular, rarely has human behaviour that has an impact on the success of conservation interventions been studied using existing social-psychological models. These models have been tried and tested in other areas, including health, illicit drug abuse and tax compliance. They have made a significant contribution to understanding the beliefs that underlie peoples' decisions to engage in specific behaviours and this information has been used to design interventions that have been successful in influencing behaviour.

In recent years, there have been several studies in conservation that considered attitudes towards conservation. However, they have been of limited use in designing conservation interventions aimed at changing behaviour, largely because of the mismatch between the attitude studied, and the behaviour of interest. The trend has been to investigate general attitudes towards conservation, rather than attitudes towards specific, clearly

defined behaviours that conservationists are interested in promoting or reducing. Some studies have noted that positive conservation attitudes do not translate to pro-conservation behaviours (Infield and Namara 2001; Waylen, McGowan *et al*. 2009). This is supported by the social psychological literature, which emphasises that general attitudes do not successfully predict specific behaviours (Conner and Sparks 2008). By more specifically defining the behaviour of interest in terms of target, action, context and time scale, and by collecting quantitative data not only on attitude, but also on subjective norms, the presence of facilitating factors and moral obligation, the predictors of specific behaviours will be better understood.

Biodiversity loss is, in a large part, the result of human behaviours. Because these behaviours (e.g. over-exploitation, habitat conversion, introducing species and burning of fossil fuels which lead to climate change) continue to be the major drivers of loss, so influencing behaviour must form a major part of the conservation solution. As such, we must expand our knowledge and skills in understanding and influencing human behaviour. So that we do not waste valuable time we should refrain from re-inventing the wheel and ensure that we learn from the wealth of knowledge held by other disciplines.

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